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.

FOREWORD

This SUPPLEMENTARY SERVICE MANUAL is a supplement to SF SERIES SERVICE MANUALS mentioned in next page and has been prepared exclusively for the following applicable model.

Applicable model: SF310/SF413 of and after the vehicle identification numbers below.

Vehicle Identification Number (Vehicle Specification)
ⓧ TSMMAA44S00600001ⓧ (SF310 3 door H/B 2WD)
ⓧ TSMMAB44S00600001ⓧ (SF310 5 door H/B 2WD)
ⓧ TSMMAA35S00600001ⓧ (SF413 3 door H/B 2WD)
ⓧ TSMMAB35S00600001ⓧ (SF413 5 door H/B 2WD)
ⓧ TSMMAB35S10600001ⓧ (SF413 5 door H/B 2WD)
ⓧ TSMMSF35S00600001ⓧ (SF413 3 door H/B 4WD)
ⓧ TSMMSG35S00600001ⓧ (SF413 5 door H/B 4WD)
ⓧ TSMMAH35S00600001ⓧ (SF413 4 door N/B 2WD)
ⓧ TSMMAH35S10600001ⓧ (SF413 4 door N/B 2WD)

When servicing the above applicable models, refer to this SUPPLEMENTARY SERVICE MANUAL first. If necessary information is not found in this SUPPLEMENTARY SERVICE MANUAL, refer to RELATED MANUALS specified next page.

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.

SUZUKI MOTOR CORPORATION
OVERSEAS SERVICE DEPARTMENT

RELATED MANUALS

Related manuals listed below are in the chronological order with the latest one at the top. For the efficient use of manuals, start with one at the top of the list (i.e., the latest one). If desired section, item or description is not found in it, try next one in the list and do the same one by one till what is being searched is found.

MODEL	NO.	RELATED SERVICE MANUAL	APPLICABILITY
SF310/ SF413	1	SF310/SF413 WIRING DIAGRAM MANUAL (99512-80E10-019)	This manual is prepared exclusively for the applicable model mentioned in FOREWORD of this supplementary service manual.
SF SERIES	1	SF SERIES SUPPLEMENTARY SERVICE MANUAL (99501-80E00-xxx)	This manual describes the updated information from the SF310 and SF413 Service Manuals below.
SF310 (1,000 cc)	1	SF310 SUPPLEMENTARY SERVICE MANUAL (99501-60B00-xxx)	This manual describes the items that are updated (modified and added) from the Service Manual (99500-60B01).
	2	SF310 SERVICE MANUAL (99500-60B01-xxx)	This manual is the base manual for the above manual.
SF413 (1,300 cc)	1	SF413 SUPPLEMENTARY SERVICE MANUAL (99501-63B30-xxx) [Pub. No. G4203GE]	This manual describes the items that are updated (modified and added) from the Service Manual (99500-63B01).
	2	SF413 SUPPLEMENTARY SERVICE MANUAL (99501-63B20-xxx) [Pub. No. G4202GE]	This manual describes the items for 4WD model that are updated (modified and added) from the Service Manual (99500-63B01).
	2	SF413 SUPPLEMENTARY SERVICE MANUAL (99501-63B10-xxx)	This manual describes the items for SEDAN model that are updated (modified and added) from the Service Manual (99500-63B01).
	3	SF413 SERVICE MANUAL (99500-63B01-xxx) [Pub. No. G4200GE]	This manual is the base manual for the above manuals.
SF SERIES (A/C)	1	AIR CONDITIONING BASIC MANUAL (99520-02130-xxx)	This manual is the base manual of A/C system.

NOTE:
The screen toned Section 8A is contained in WIRING DIAGRAM MANUAL mentioned in RELATED MANUALS.

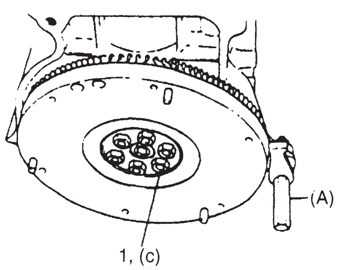
SECTION 0A

GENERAL INFORMATION

CONTENTS

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 TIGHTENING TORQUE SPECIFICATION are given as shown in figure below.



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

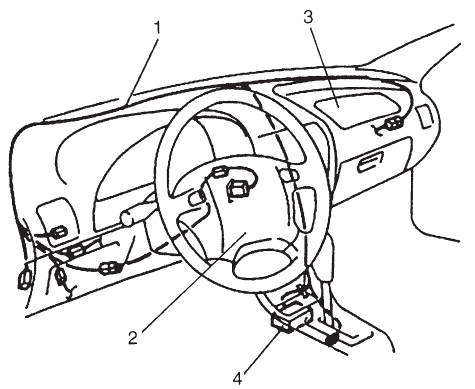
6) Install oil pump. Refer to “Oil pump”.
7) Install flywheel (for M/T vehicle) or drive plate (for A/T vehicle).
Using special tool, lock flywheel or drive plate, and tighten flywheel or drive plate bolts to specified torque.

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 AND SYMBOLS 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.

PRECAUTIONS

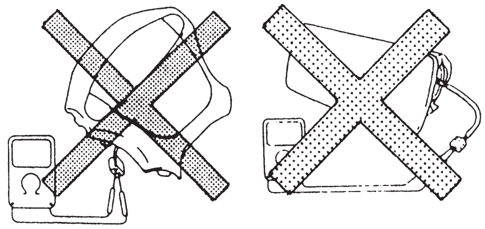
PRECAUTION FOR VEHICLES EQUIPPED WITH A SUPPLEMENTAL RESTRAINT (AIR BAG) SYSTEM



1. Air bag wire harness
2. Driver air bag (inflator) module
3. Passenger air bag (inflator) module
4. SDM

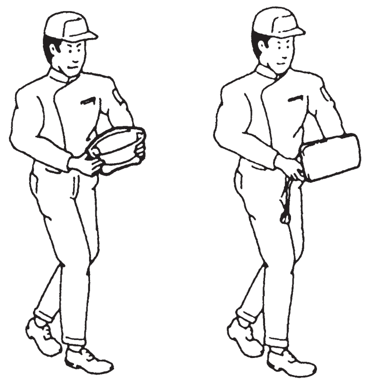
WARNING:
- **The configuration of air bag system parts are as shown in the figure. When it is necessary to service (remove, reinstall and inspect) these parts, be sure to follow procedures described in Section 9J. Failure to follow proper procedures could result in possible air bag deployment, personal injury, damage to parts or air bag being unable to deploy 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 deployment.**
- **Do not modify the steering wheel, dashboard, or any other air bag system component. 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) modules, sensing and diagnostic module) beforehand to avoid component damage or unintended deployment.**

DIAGNOSIS
- When troubleshooting air bag system, be sure to follow "DIAGNOSIS" in Section 9J. 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.

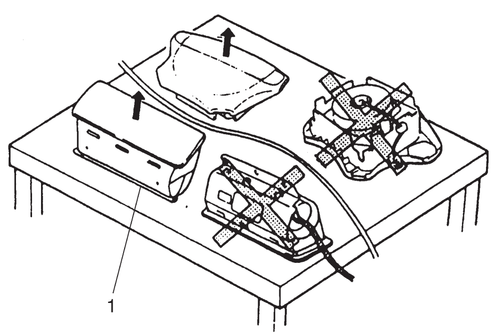


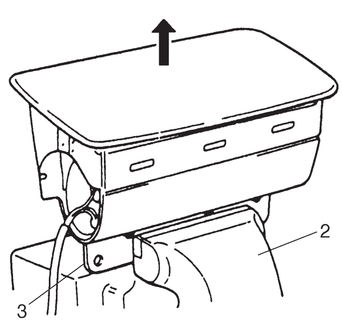
WARNING:
Never attempt to measure the resistance of the air bag (inflator) modules (driver and passenger). It is very dangerous as the electric current from the tester may deploy the air bag.

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

HANDLING AND SERVICING

WARNING:

- **Many of service procedures require disconnection of "AIR BAG" fuse and air bag (inflator) modules (driver and passenger) from deployment loop 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 9J 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.**

SDM

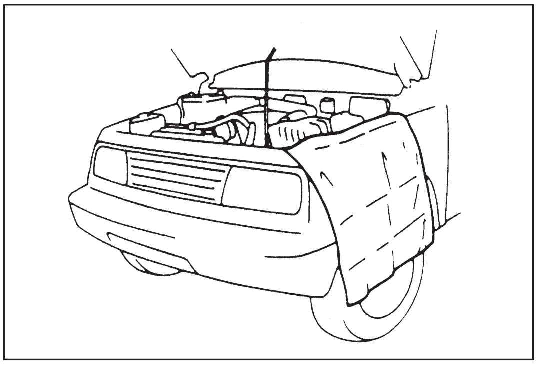
- **During service procedures, be very careful when handling a Sensing and Diagnostic Module (SDM). Never strike or jar the SDM. Never power up the air bag system when the SDM is not rigidly attached to the vehicle. All SDM and mounting bracket fasteners must be carefully torqued and the arrow must be 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.**

CAUTION:
- **Even when the accident was light enough not to cause air bags to deploy, be sure to inspect system parts and other related parts according to instructions under “Repair and Inspection Required after an Accident” in Section 9J.**
- **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) 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), 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” under “Service Precaution” in Section 9J.**
- **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 9J.**

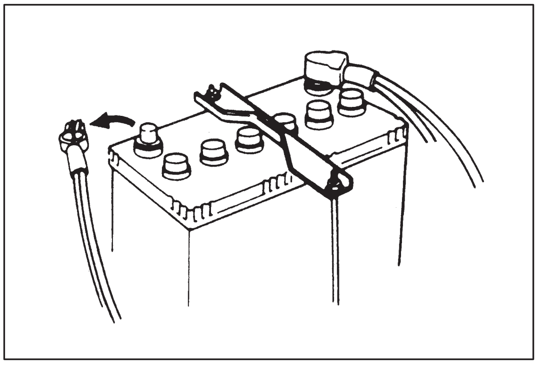
GENERAL PRECAUTIONS

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.

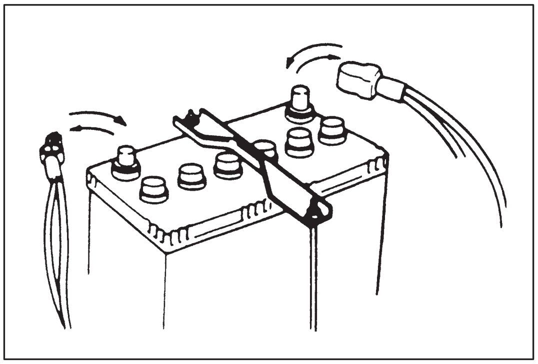
WARNING:
- **Whenever raising a vehicle for service, be sure to follow the instructions under "VEHICLE LIFTING POINTS" on SECTION 0A.**
- **When it is necessary to do service work with the engine running, make sure that the parking brake is set fully and the transmission is in Neutral (for manual transmission 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 dish washing gloves) when changing engine oil. If engine oil contacts your skin, wash thoroughly with soap and water. Launder any clothing or rags if wet with oil, recycle or properly dispose of used oil and filters.**
- **Make sure the bonnet is fully closed and latched before driving. If it is not, it can fly up unexpectedly during driving, obstructing your view and resulting in an accident.**



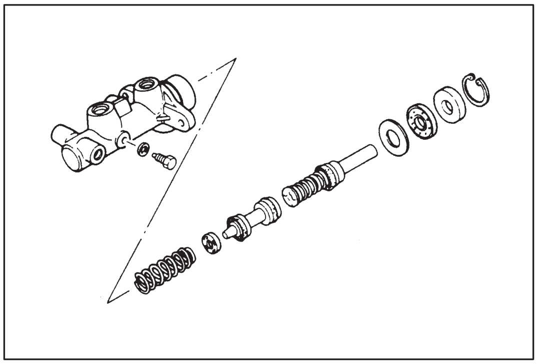
CAUTION:
- **Before staring any service work, cover fenders, seats and any other parts that are likely to get scratched or stained during servicing. Also, be aware that what you wear (e.g. buttons) may cause damage to the vehicle's finish.**



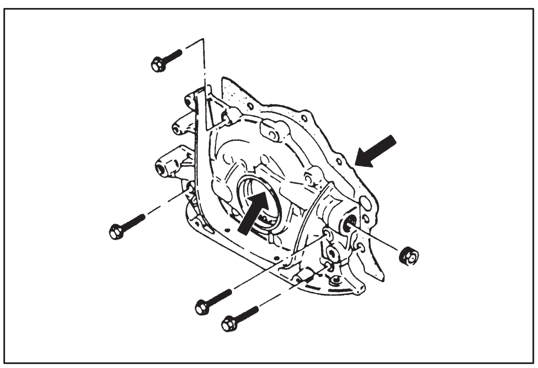
- **When performing service to electrical parts that does not require use of battery power, disconnect the negative cable of the battery.**



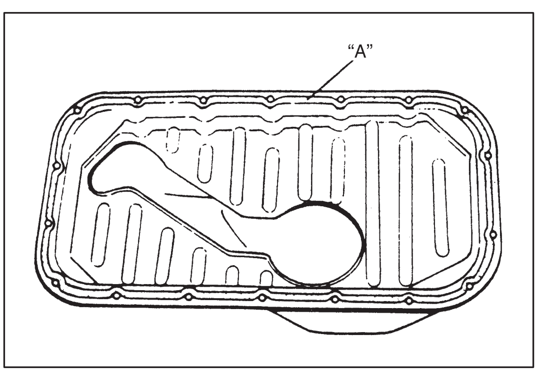
- **When removing the battery, be sure to disconnect the negative cable first and then the positive cable. When reconnecting the battery, connect the positive cable first and then the negative cable, and replace the terminal cover.**



- **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.**

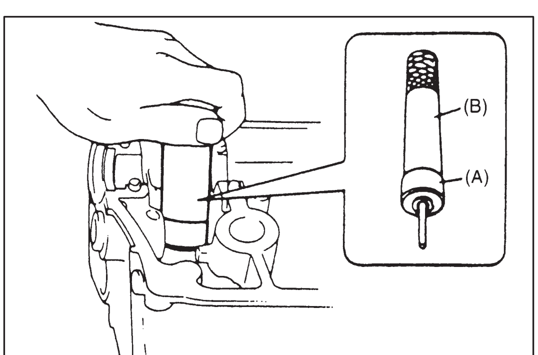


- **Whenever you use oil seals, gaskets, packing, O-rings, locking washers, split pins, self-locking nuts, and certain other parts as specified, be sure to use new ones. Also, before installing new gaskets, packing, etc., be sure to remove any residual material from the mating surfaces.**



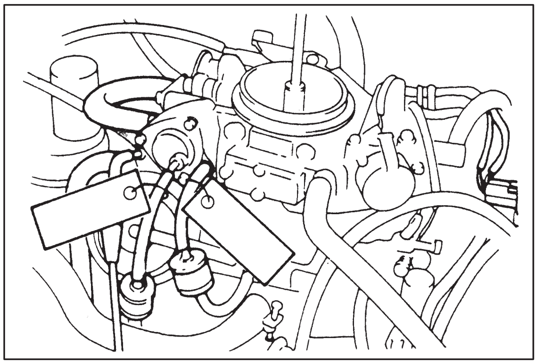
- **Make sure that all parts used in reassembly are perfectly clean.**
- **When use of a certain type of lubricant, bond or sealant is specified, be sure to use the specified type.**

"A": Sealant 99000-31150

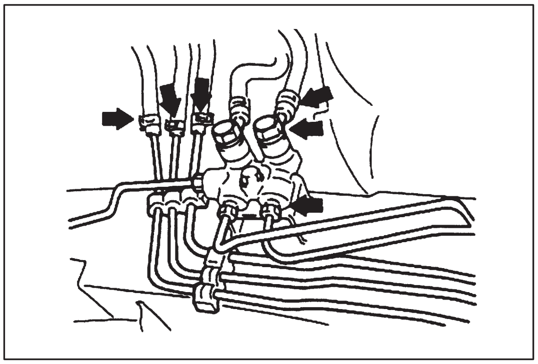


- **Be sure to use special tools when instructed.**

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

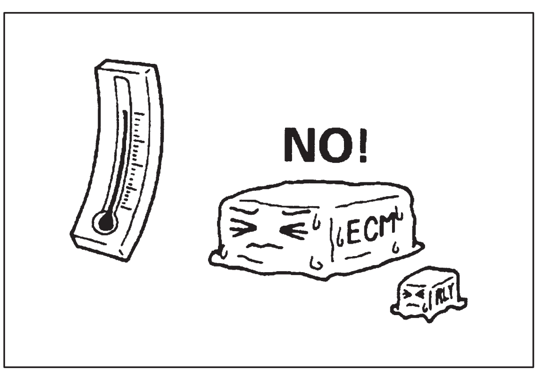


- **When disconnecting vacuum hoses, attach a tag describing the correct installation positions so that the hoses can be re-installed correctly.**

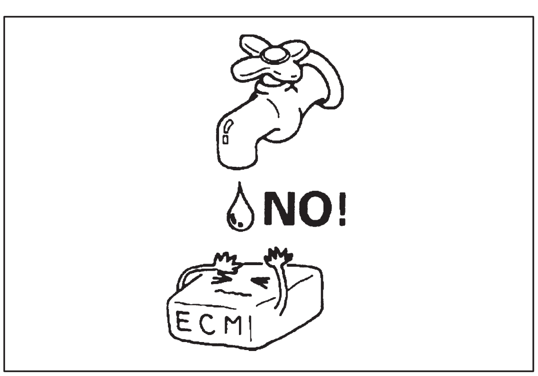


- **After servicing fuel, oil, coolant, vacuum, exhaust or brake systems, check all lines related to the system for leaks.**

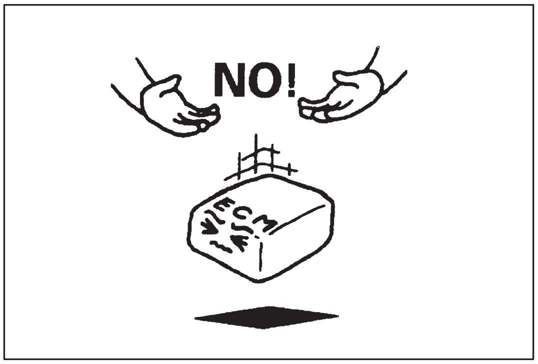
- **For vehicles equipped with fuel injection systems, never disconnect the fuel line between the fuel pump and injector without first releasing the fuel pressure, or fuel can be sprayed out under pressure.**



- **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.**

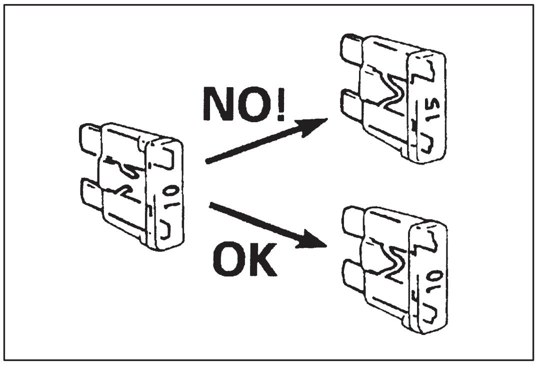


- Always be careful not to handle electrical parts (computer, relay, etc.) in a rough manner or drop them.

PRECAUTIONS FOR CATALYTIC CONVERTER

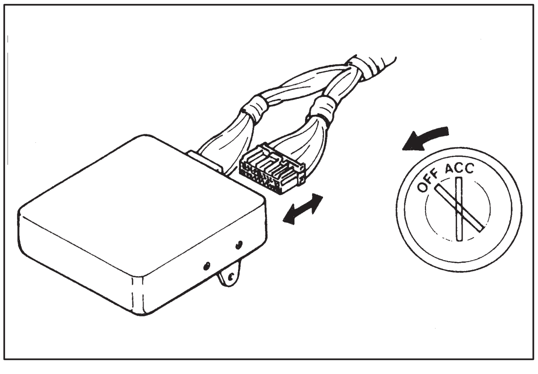
For vehicles equipped with a catalytic converter, use only unleaded gasoline and be careful not to let a large amount of unburned gasoline enter the converter or it can be damaged.

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

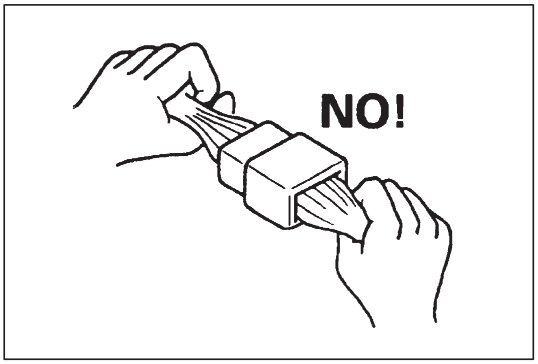


PRECAUTIONS FOR ELECTRICAL CIRCUIT SERVICE

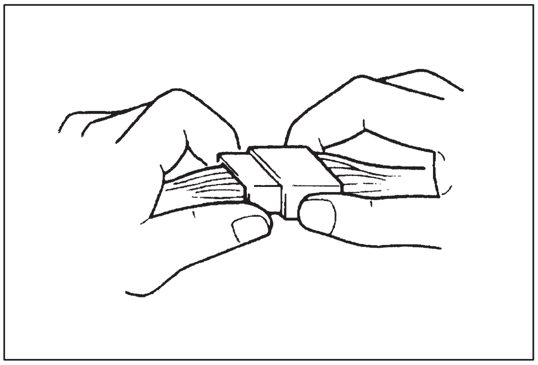
- When replacing a fuse, make sure to use a fuse of the specified capacity. Use of a fuse with a larger capacity will cause a damage to the electrical parts and a fire.



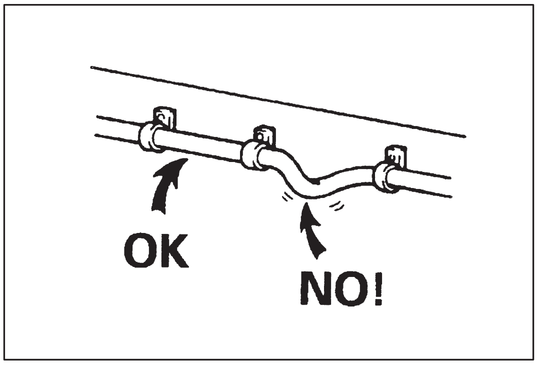
- When disconnecting and connecting coupler, make sure to turn ignition switch OFF, or electronic parts may get damaged.



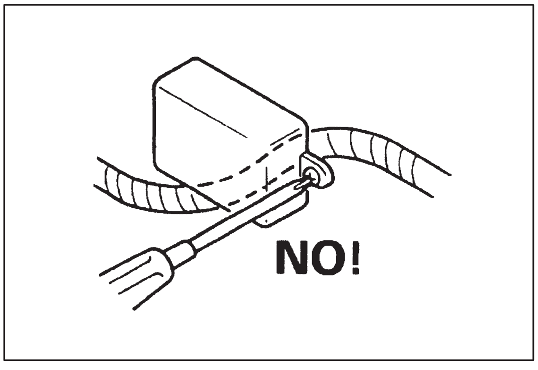
- **When disconnecting connectors, never pull the wiring harness. Unlock the connector lock first and then pull them apart by holding connectors themselves.**



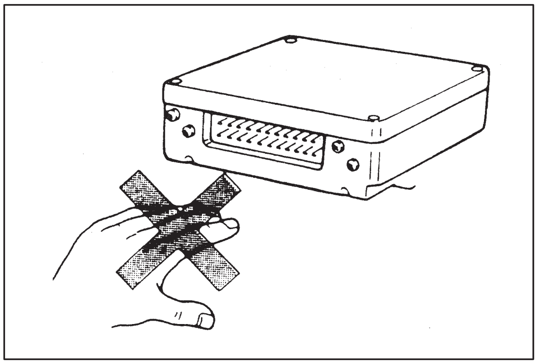
- **When connecting connectors, also hold connectors and put them together until they lock securely (a click is heard).**



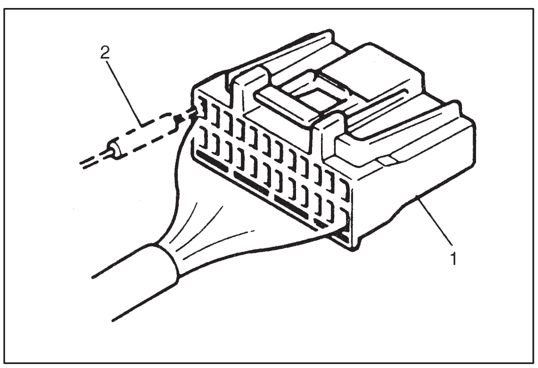
- **When installing the wiring harness, fix it with clamps so that no slack is left.**



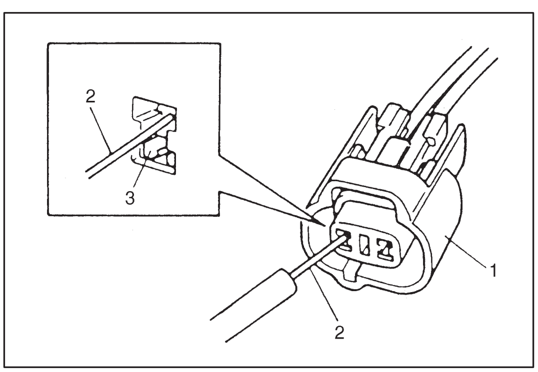
- **When installing vehicle parts, be careful so that the wiring harness is not interfered with or caught by any other part.**



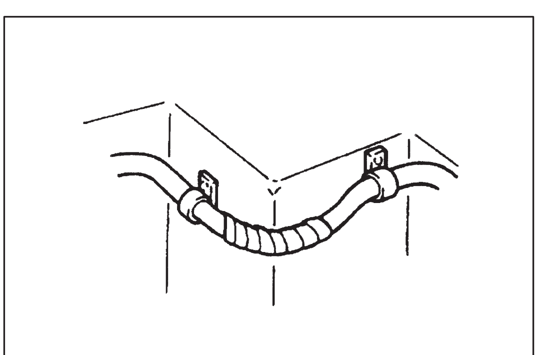
- Be careful not to touch the electrical terminals of parts which use microcomputers (e.g. electronic control unit like as ECM, PCM, P/S controller, etc.). The static electricity from your body can damage these parts.
- Never connect any tester (voltmeter, ohmmeter, or whatever) to electronic control unit when its coupler is disconnected. Attempt to do it may cause damage to it.
- Never connect an ohmmeter to electronic control unit with its coupler connected to it. Attempt to do it may cause damage to electronic control unit and sensors.
- Be sure to use a specified voltmeter/ohmmeter. Otherwise, accurate measurements may not be obtained or personal injury may result. If not specified, use a voltmeter with high-impedance (MΩ/V minimum) or a digital type voltmeter.



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

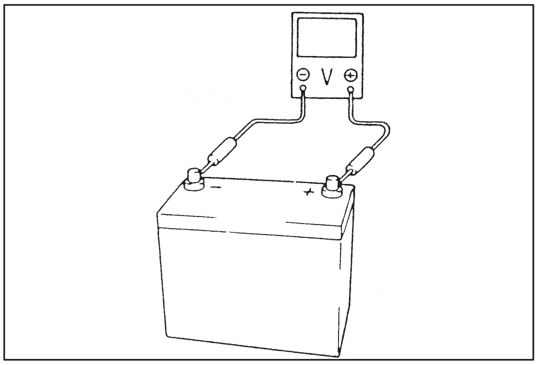


- When connecting meter probe (2) from terminal side of coupler (1) because it can't be connected from harness side, use extra care not to bend male terminal of coupler of force its female terminal open for connection.
  In case of such coupler as shown connect probe as shown to avoid opening female terminal.
  Never connect probe where (3) male terminal is supposed to fit.



- 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 checking connection of terminals, check its male half for bend and female half for excessive opening and both for locking (looseness), corrosion, dust, etc.**



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

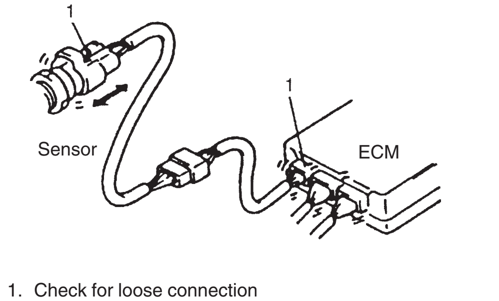
ELECTRICAL CIRCUIT INSPECTION PROCEDURE

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

OPEN CIRCUIT CHECK

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

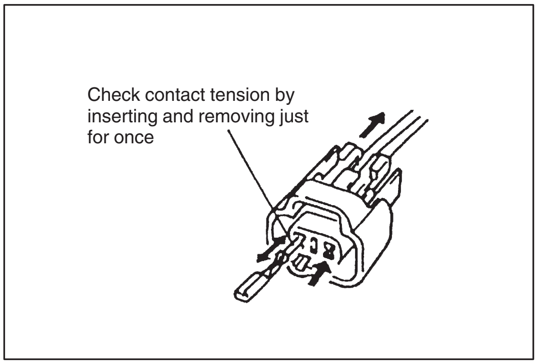
- Loose connection of connector.
- Poor contact of terminal (due to dirt, corrosion or rust on it, poor contact tension, entry of foreign object etc.).
- Wire harness being open.



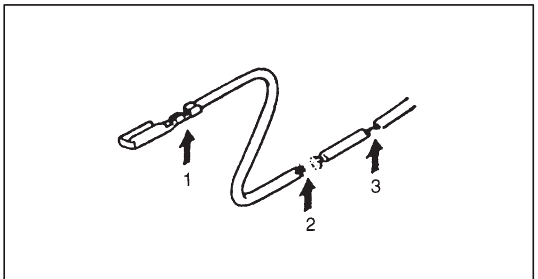
1. Check for loose connection

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.

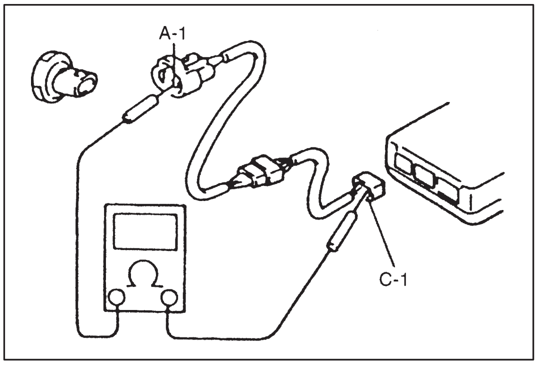


3) Using a test male terminal, check both terminals of the circuit being checked for contact tension of its female terminal.
   Check each terminal visually for poor contact (possibly caused by dirt, corrosion, rust, entry of foreign object, etc.).
   At the same time, check to make sure that each terminal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



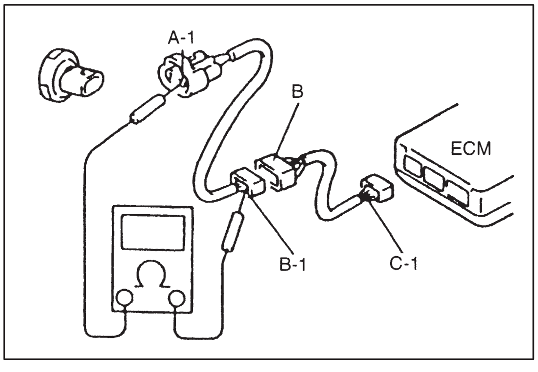
1. Looseness of crimping
2. Open
3. Thin wire (single strand of wire)

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.

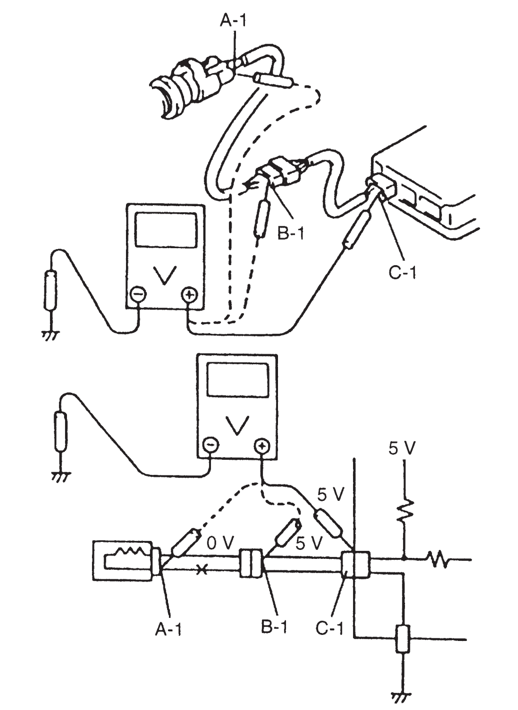


2) Disconnect the connector included in the circuit (connector-B in the figure) and measure resistance between terminals A-1 and B-1.
   If no continuity is indicated, that means that the circuit is open between terminals A-1 and B-1. If continuity is indicated, there is an open circuit between terminals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



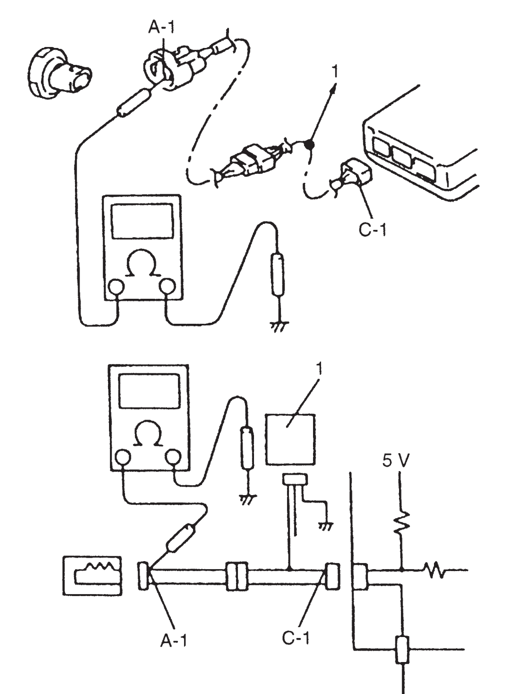
If measurements were taken as shown in the figure at the left and results were as listed below, it means that the circuit is open between terminals B-1 and A-1.

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

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

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

2 V voltage drop



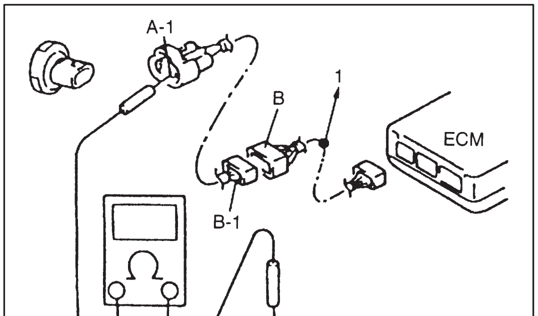
1. Other parts

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.

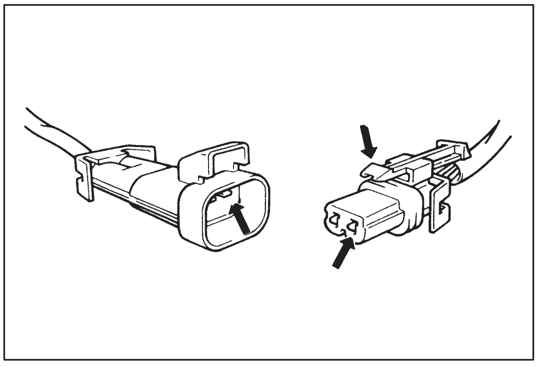


1. To other parts

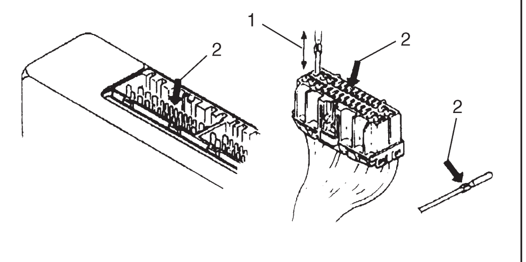
4) Disconnect the connector included in circuit (connector B) and measure resistance between A-1 and body ground.
If continuity is indicated, it means that the circuit is shorted to the ground between terminals A-1 and B-1.

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:

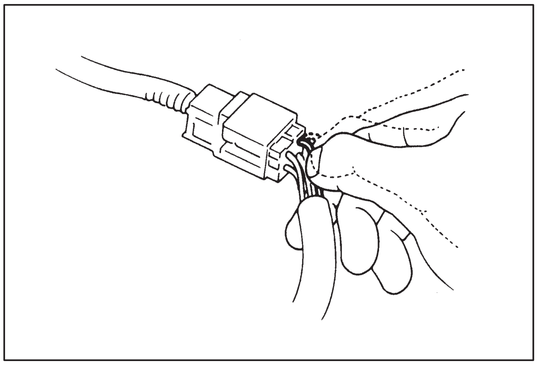


- Poor mating of connector halves, or terminals not fully seated in the connector body (backed out).
- Dirt or corrosion on the terminals. The terminals must be clean and free of any foreign material which could impede proper terminal contact. However, cleaning the terminal with a sand paper or the like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

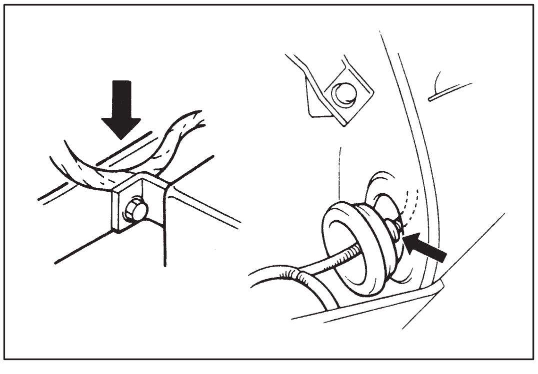


1. Check contact tension by inserting and removing just once
2. Check each terminal for bend and proper alignment

- 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

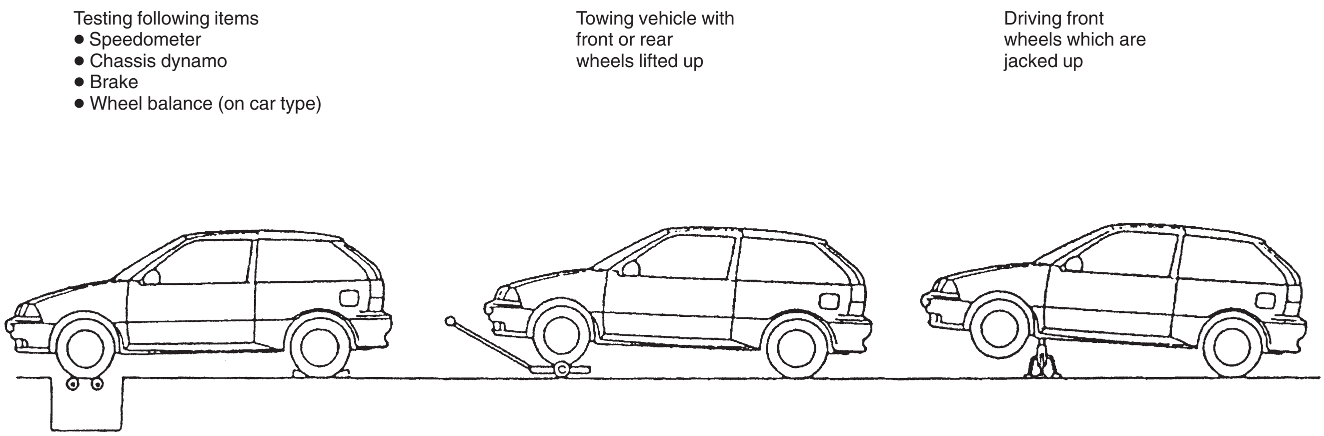
When installing mobile communication equipment such as CB (Citizens-Band)-radio or cellular-telephone, be sure to observe the following precautions.

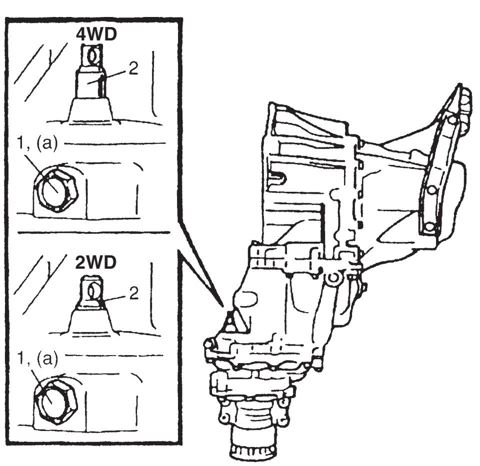
Failure to follow cautions may adversely affect electronic control system.

- 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.

PRECAUTION IN SERVICING FULL-TIME 4WD VEHICLE

When performing any of the following types of work, be sure to make the vehicle as front wheel drive by cutting transmission of driving force to the rear wheels. Otherwise, rear wheels are driven and vehicle accidents, damage and personal injury may result.





1. Transfer lock bolt
2. Shift fork shaft

SWITCHING FROM 4WD TO 2WD

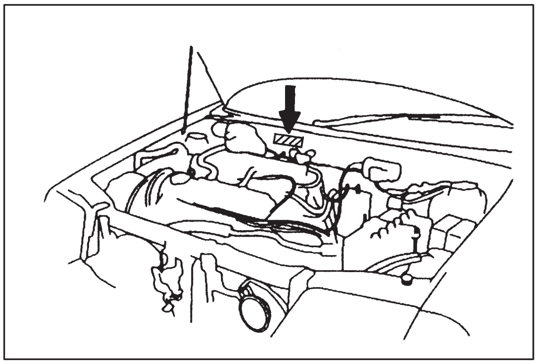
Set 4WD/2WD select lever located at lower side of transfer driven case to 2WD as follows.

1) Loosen transfer lock bolt.
2) Push in shift fork shaft fully.
3) With shift fork shaft pushed in, tighten transfer lock bolt.

Tightening Torque
(a): 19 N·m (1.9 kg-m, 14.0 lb-ft)

NOTE:

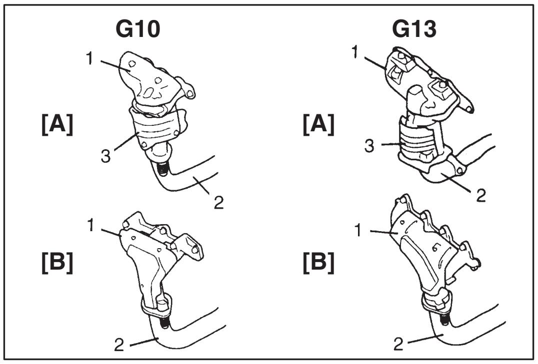
- **If shift fork shaft is hard to move, try to move it while turning it to the right and left little by little. Do the same when setting back to 4WD after servicing vehicle.**
- **Upon completion of servicing, always set shift fork shaft back to 4WD.**



IDENTIFICATION INFORMATION

VEHICLE IDENTIFICATION NUMBER

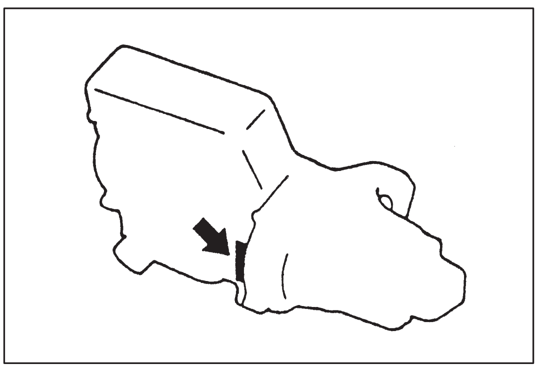
The number is punched on the front dash panel in the engine room.



IDENTIFICATION WHETHER VEHICLE EQUIPPED WITH WU-TWC OR NOT

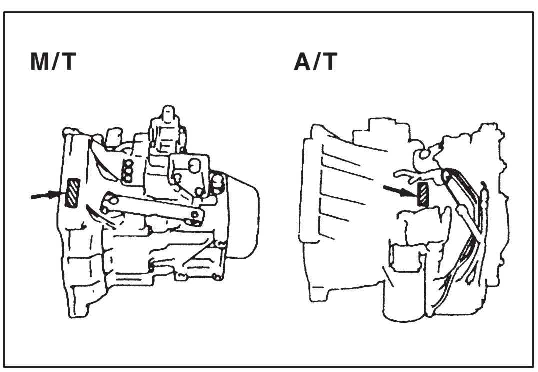
It can be identified by the shape of exhaust manifold (1) and exhaust pipe (2).

[A]: Vehicle equipped with WU-TWC (3)
[B]: Vehicle not equipped with WU-TWC



ENGINE IDENTIFICATION NUMBER

The number is punched on the cylinder block.



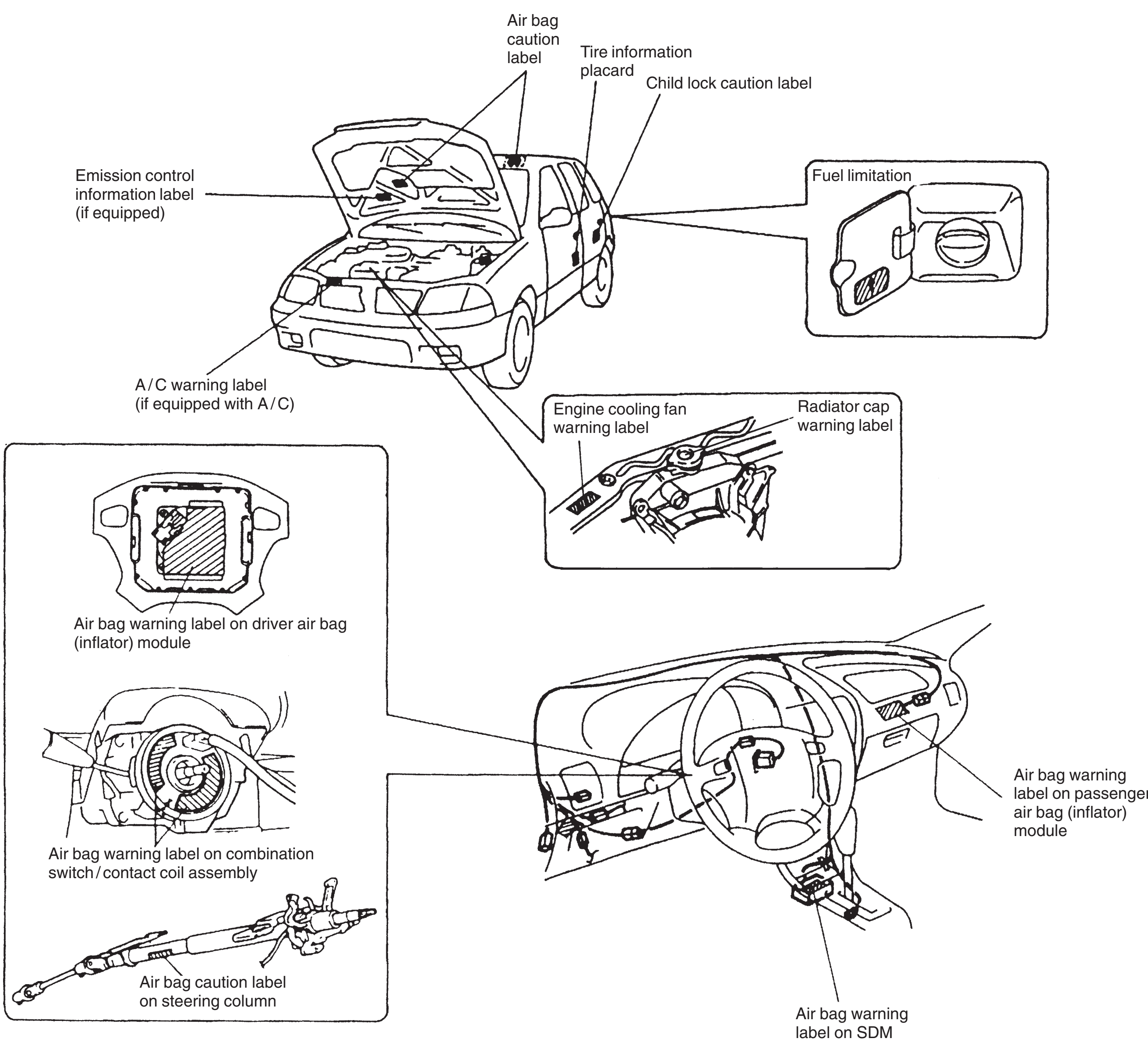
TRANSMISSION IDENTIFICATION NUMBER

The number is punched 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.

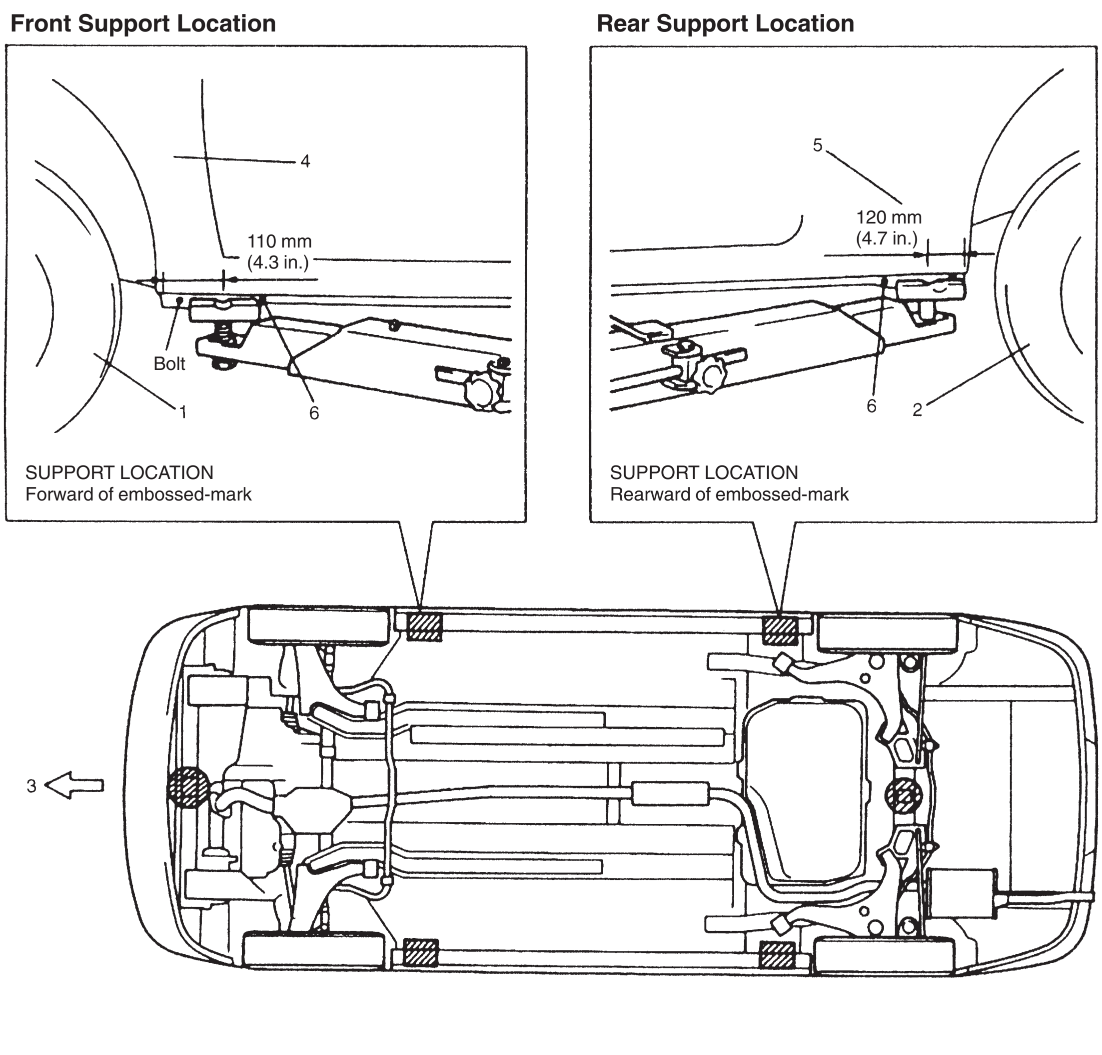


VEHICLE LIFTING POINTS

WARNING:

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

When using frame contact hoist:

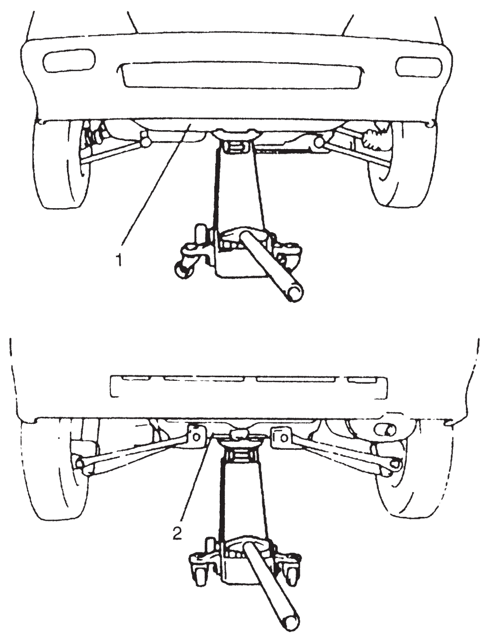


1. Front left tire
2. Rear left tire
3. Front
4. Front fender left panel
5. Rear left panel
6. Embossed-mark

: Support position for frame contact hoist and safety stand

: Floor jack position

When using floor jack:



In raising front or rear vehicle end off the floor by jacking, be sure to put the jack against the center portion of front cross member (1) or rear cross member (2).

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.

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

ABBREVIATIONS AND SYMBOLS MAY BE USED IN THIS MANUAL

ABBREVIATIONS

A

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

B

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

C

CKT	:	Circuit
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
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
M/T	: Manual Transmission

N

NOx	: Nitrogen Oxides

O

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

P

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

R

RH	: Right Hand

S

SAE	: Society of Automotive Engineers
SDM	: Sensing and Diagnostic Module (Air Bag Controller, Air Bag Control Module)
SFI	: Sequential Multiport Fuel Injection
SOHC	: Single Over Head Camshaft

T

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

V

VIN	: Vehicle Identification Number
VSS	: Vehicle Speed Sensor

W

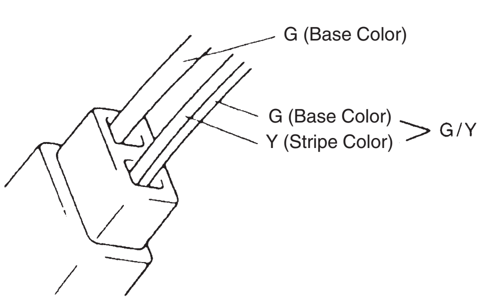
WU-OC	: Warm Up Oxidation Catalytic Converter
WU-TWC	: Warm Up Three-Way Catalytic Converter

SYMBOLS

SYMBOL	DEFINITION	SYMBOL	DEFINITION
	Tightening torque		Apply SUZUKI BOND NO. 1216 99000-31160
	Apply oil (Engine, transmission, transfer, differential)		Apply SILICONE SEALANT 99000-31120
	Apply fluid (Brake, power steering or automatic transmission fluid)		Apply SEALING COMPOUND 366E 99000-31090
	Apply SUZUKI SUPER GREASE A 99000-25010		
	Apply SUZUKI SUPER GREASE C 99000-25030		Apply THREAD LOCK 1322 99000-32110
	Apply SUZUKI SUPER GREASE E 99000-25050		Apply THREAD LOCK 1333B 99000-32020
	Apply SUZUKI SUPER GREASE H 99000-25120		Apply THREAD LOCK 1342 99000-32050
	Apply SUZUKI SUPER GREASE I 99000-25210		
	Apply SUZUKI BOND NO. 1215 99000-31110		Do not reuse
	Apply SUZUKI BOND NO. 1207C 99000-31150		Note on reassembly

WIRE COLOR SYMBOLS

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

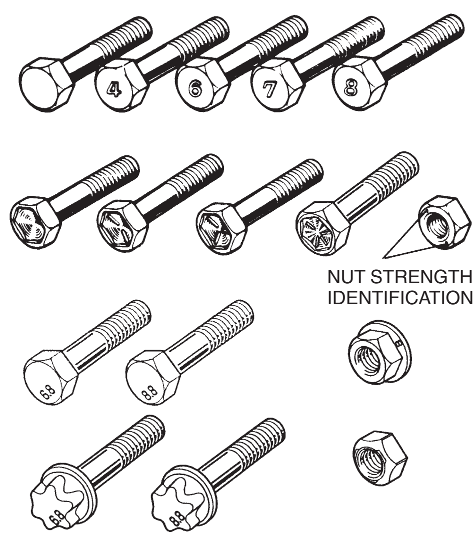


There are two kinds of colored wire used in this vehicle. One is single-colored wire and the other is dual-colored (striped) wire.
The single-colored wire uses only one color symbol (i.e. “G”).
The dual-colored wire uses two color symbols (i.e. “G/Y”). The first symbol represents the base color of the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

FASTENERS INFORMATION

METRIC FASTENERS

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



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.

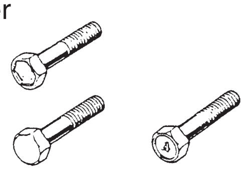
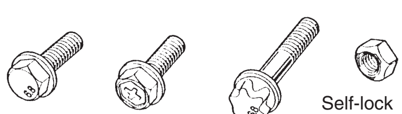
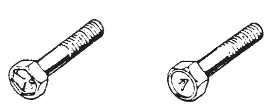
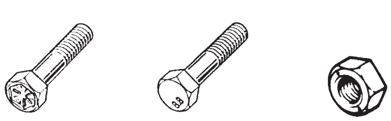
When replacing metric fasteners, be careful to use bolts and nuts of the same strength or greater than the original fasteners (the same number marking or higher). It is likewise important to select replacement fasteners of the correct diameter and thread pitch. Correct replacement bolts and nuts are 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	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
Self-lock nut	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

NORMAL CONDITION SCHEDULE

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 (× 1,000)	15	30	45	60	75	90
		Miles (× 1,000)	9	18	27	36	45	54
		Months	12	24	36	48	60	72
1. ENGINE								
1-1. Drive belt (tension, damage)		V-belt	I	R	I	R	I	R
		V-rib belt (Flat type)	–	–	I	–	–	R
1-2. Camshaft timing belt			Replace every 100,000 km (60,000 miles).					
1-3. Valve lash (1.3 liter engine)			–	I	–	I	–	I
1-4. Engine oil and oil filter	Vehicle with O2S (SG, SH, SJ)		R	R	R	R	R	R
	Vehicle with O2S (SE, SF) Vehicle without O2S		Replace every 10,000 km (6,000 miles) or 8 months					
1-5. Engine coolant			–	R	–	R	–	R
1-6. Exhaust system (leakage, damage, tightness)			–	I	–	I	–	I
2. IGNITION SYSTEM								
2-1. Spark plugs	When unleaded fuel is used	Vehicle without O2S	–	R	–	R	–	R
		Vehicle with O2S	–	–	R	–	–	R
	When leaded fuel is used		Refer to “Severe Driving Condition” schedule.					
2-2. Distributor cap and rotor (if equipped)			–	–	I	–	–	I
3. FUEL SYSTEM								
3-1. Air cleaner filter		Paved-road	I	I	R	I	I	R
		Dusty condition	Refer to “Severe Driving Condition” schedule.					
3-2. Fuel lines (deterioration, leakage, damage)			–	I	–	I	–	I
3-3. Fuel tank			–	–	I	–	–	I

NOTES:
- **For Item 2-1 “spark plugs”, replace every 50,000 km if the local law requires.**
- **For Sweden, Item 2-1, 4-1 and 4-2 should be performed by odometer reading only.**
- **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.**

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 (× 1,000)	15	30	45	60	75	90
	Miles (× 1,000)	9	18	27	36	45	54
	Months	12	24	36	48	60	72
4. EMISSION CONTROL SYSTEM							
4-1. PCV (Positive Crankcase Ventilation) Valve	Vehicle without O2S	–	–	I	–	–	I
	Vehicle with O2S	–	–	–	–	–	I
4-2. Fuel evaporative emission control system		–	–	–	–	–	I
5. BRAKE							
5-1. Brake discs and pads		I	I	I	I	I	I
Brake drums and shoes		–	I	–	I	–	I
5-2. Brake hoses and pipes		–	I	–	I	–	I
5-3. Brake fluid		–	R	–	R	–	R
5-4. Brake lever and cable		Inspect at first 15,000 km (9,000 miles) only.					
6. CHASSIS AND BODY							
6-1. Clutch pedal (for manual transmission)		–	I	–	I	–	I
6-2. Tires/wheel discs		I	I	I	I	I	I
6-3. Propeller shaft (4WD) and drive shafts		–	–	I	–	–	I
6-4. Suspension system		–	I	–	I	–	I
6-5. Steering system		–	I	–	I	–	I
6-6. Power steering (if equipped)		I	I	I	I	I	I
6-7. Manual transmission oil		I	–	R	–	–	R
6-8. Automatic transmission	Fluid level	–	I	–	I	–	I
	Fluid change	Replace every 165,000 km (99,000 miles).					
	Fluid hose	–	–	–	R	–	–
6-9. Rear differential oil (4WD)	(R: 1st 15,000 km only)	R or I	–	I	–	I	–
6-10. All latches, hinges and locks		–	I	–	I	–	I

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

MAINTENANCE RECOMMENDED UNDER SEVERE DRIVING CONDITIONS

If the vehicle is usually used under the conditions corresponding to any severe condition code given below, it is recommended that applicable maintenance operation be performed at the particular interval as 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 – (For Diesel engine) Town use/Towing a trailer/ Sustained high speed driving/ Hot climates above 30°C (86°F)/ Low quality lubricants or fuel**
- **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 filter	R	Every 5,000 km (3,000 miles) or 4 months
A B C – E F – H	ITEM 2-1 Spark plugs	R	Every 10,000 km (6,000 miles) or 8 months
– – C – – – – –	ITEM 3-1 Air cleaner filter *1	I	Every 2,500 km (1,500 miles)
		R	Every 30,000 km (18,000 miles) or 24 months
– B C D – – – H	ITEM 6-2 Wheel bearings	I	Every 15,000 km (9,000 miles) or 12 months
– B – D E – – H	ITEM 6-3 Propeller shaft (4WD) and drive shafts	I	Every 15,000 km (9,000 miles) or 12 months
– B – – E – – H	ITEM 6-7/6-8 Manual transmission oil and differential oil (4WD)	R	Every 30,000 km (18,000 miles) or 24 months
– B – – E – – H	ITEM 6-9 Automatic transmission fluid	R	Every 30,000 km (18,000 miles) or 24 months

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

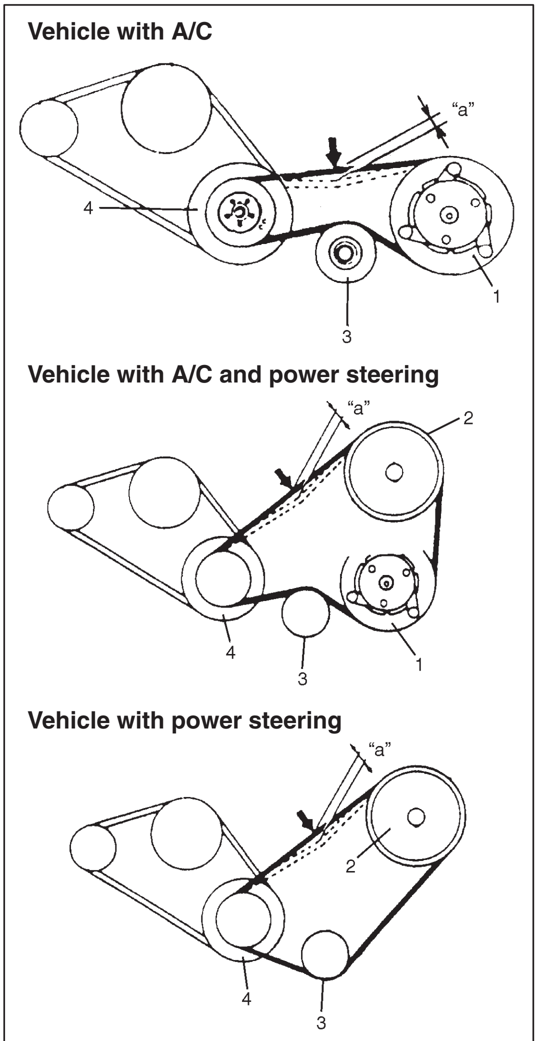
MAINTENANCE SERVICE

ENGINE

ITEM 1-1

Drive Belt Inspection and Replacement

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



1. A/C compressor pulley
2. Power steering pump pulley
3. Tension pulley
4. Crankshaft pulley

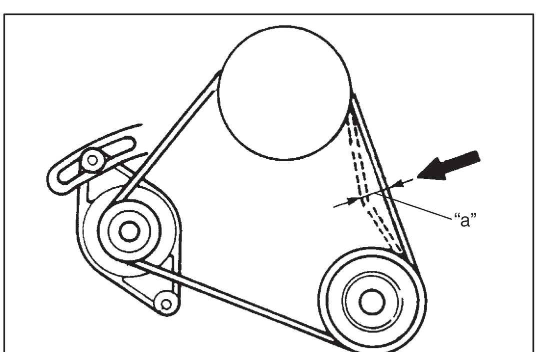
A/C Compressor and/or Power Steering Pump Drive Belt Inspection (If equipped)

1) Detach air cleaner assembly from vehicle body and shift its position.
2) Inspect belt for wear, deterioration and tension.
   Replace or adjust, if necessary.

   A/C compressor and/or power steering pump drive belt tension "a":
   7 – 9 mm (0.28 – 0.35 in.) deflection under 10 kg or 22 lb pressure

A/C Compressor and/or Power Steering Pump Drive Belt Replacement

1) Disconnect negative cable from battery.
2) Remove engine under cover of right side.
3) Loosen belt tension and replace belt with new one.
4) Adjust belt tension to specification referring to SECTION 1B or SECTION 3B1.
5) Install engine under cover and connect negative cable to battery.



Water Pump Belt Inspection

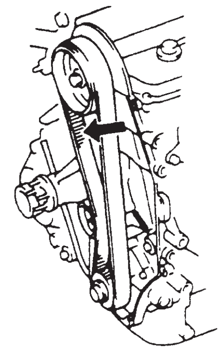
1) Inspect belt for cracks, cuts, deformation, wear and cleanliness.
   Replace, if necessary.
2) Check pump belt for tension and adjust it as necessary.

   Water pump belt tension "a":
   6 – 8 mm (0.24 – 0.32 in.) deflection under 10 kg or 22 lb pressure

Water Pump Belt Replacement

Replace belt with a new one. Refer to SECTION 6B for replacement procedure of pump belt.

NOTE:
When replacing belt with a new one, adjust belt tension to 5 – 7 mm (0.20 – 0.27 in.).

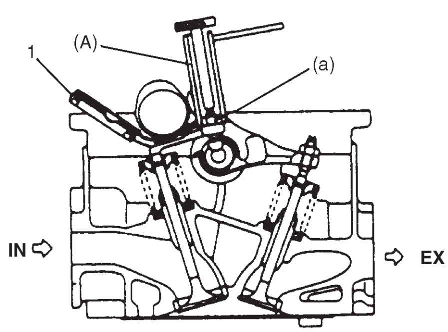


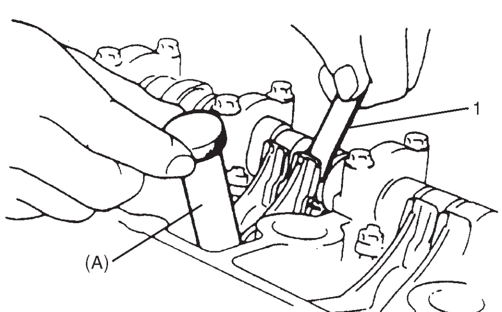
ITEM 1-2

Camshaft Timing Belt Replacement

Replace belt with new one. Refer to SECTION 6A or 6A1 for replacement procedure.

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





1. Thickness gauge

ITEM 1-3

Valve Lash Inspection (1.3 liter 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.

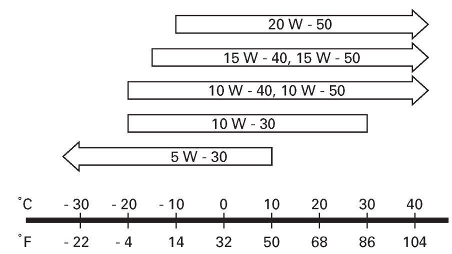
Valve lash (gap) specification		When cold (Coolant temperature is 15 – 25°C or 59 – 77°F)	When hot (Coolant temperature is 60 – 68°C or 140 – 154°F)
	Intake	0.13 – 0.17 mm (0.005 – 0.007 in.)	0.17 – 0.21 mm (0.007 – 0.008 in.)
	Exhaust	0.23 – 0.27 mm (0.009 – 0.011 in.)	0.28 – 0.32 mm (0.011 – 0.013 in.)

Special Tool
(A): 09917-18211

Tightening Torque
(a): 12 N·m (1.2 kg-m, 8.5 lb-ft)

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

Proper Engine Oil Viscosity Chart

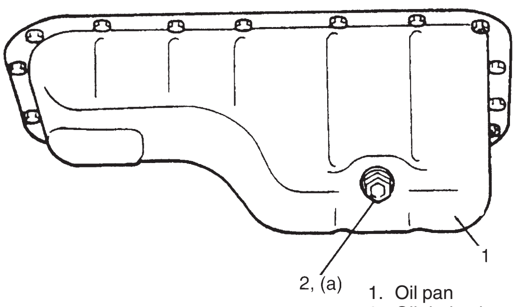


ITEM 1-4

Engine Oil and Filter Change

WARNING:
New and used engine oil can be hazardous.
Be sure to read "WARNING" in General Precaution in SECTION 0A and observe what in written there.

Use engine oil of SE, SF, SG, SH or SJ grade.
Select the appropriate oil viscosity according to the left chart.

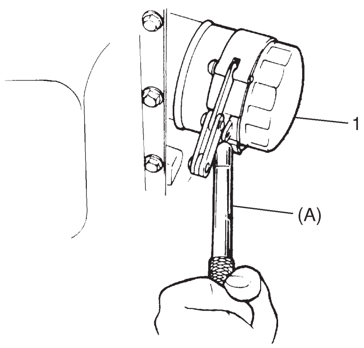


1. Oil pan
2. Oil drain plug

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 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.

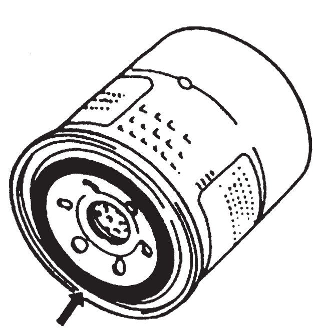
   Tightening Torque
   (a): 35 N·m (3.5 kg-m, 25.5 lb-ft)



1. Oil filter

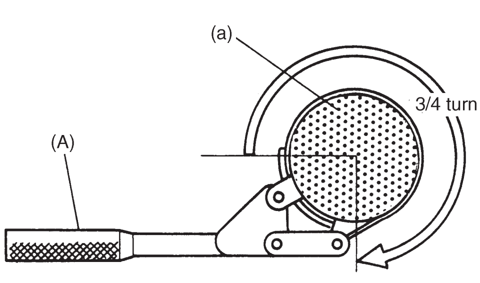
3) Loosen oil filter by using oil filter wrench (Special tool).

   Special Tool
   (A): 09915-47330



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

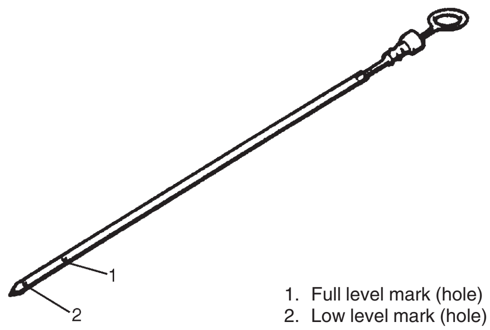
CAUTION:
To tighten oil filter properly, it is important to accurately identify the position at which filter O-ring first contacts mounting surface.



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

   Special Tool
   (A): 09915-47330

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



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

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

Engine Oil Capacity

	1.0 L and 1.3 L Engine
Oil pan capacity	About 3.1 liters (6.5/5.5 US/Imp pt.)
Oil filter capacity	About 0.2 liter (0.4/0.3 US/Imp pt.)
Others	About 0.3 liter (0.6/0.5 US/Imp pt.)
Total	About 3.6 liters (7.5/6.3 US/Imp pt.)

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

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

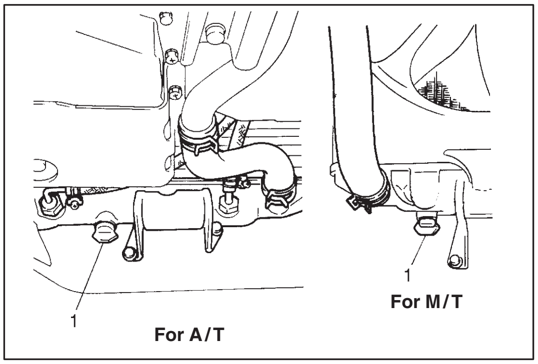
ITEM 1-5

Engine Coolant Change

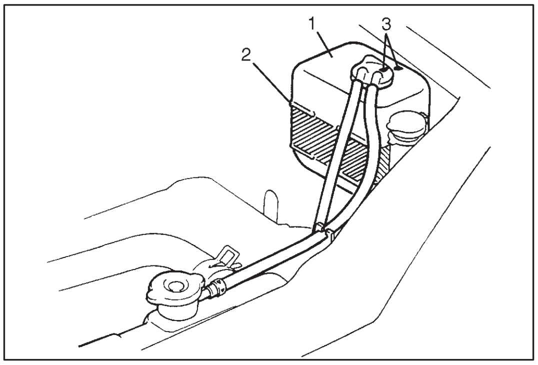
WARNING:
To help avoid danger of being burned, do not remove radiator cap while engine and radiator are still hot. Scalding fluid and steam can be blown out under pressure if cap is taken off too soon.

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

Refer to SECTION 6B for COOLANT CAPACITY.



1) Remove radiator cap when engine is cool.
2) Loosen radiator drain plug (1) to drain coolant.
3) Remove reservoir and drain.
4) Tighten drain plug securely. Also install reservoir.
5) Slowly pour specified amount of coolant to the base of radiator filler neck, and run engine, with radiator cap removed, until radiator upper hose is hot. This drives out any air which may still be trapped within cooling system. Add coolant as necessary until coolant level reaches filler throat of radiator. Reinstall radiator cap.

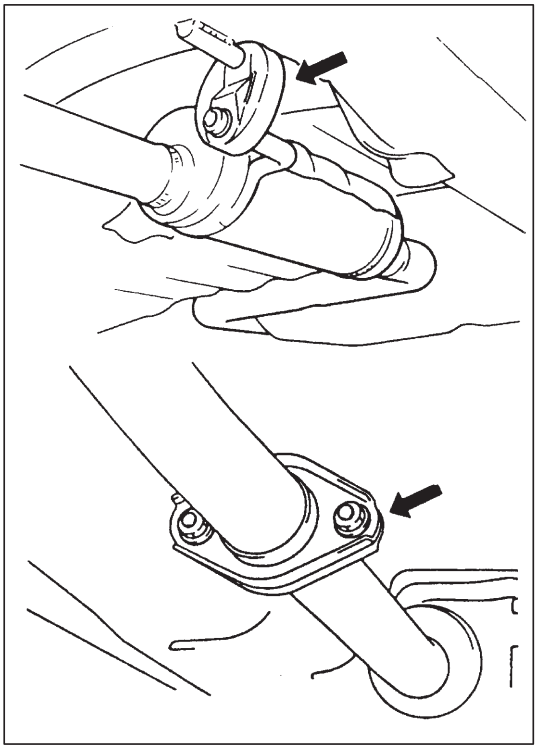


6) Add coolant to reservoir (1) so that its level aligns with Full mark (2). Then, reinstall cap to reservoir aligning match marks (3) on reservoir and cap.

ITEM 1-6

Exhaust System Inspection

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



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

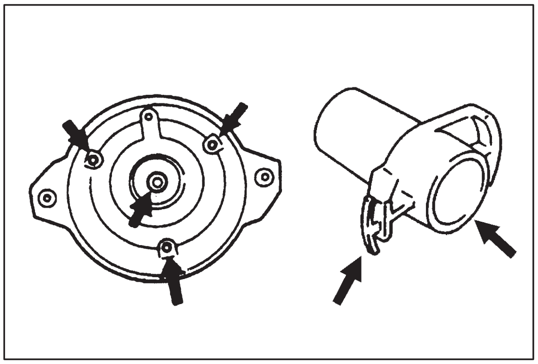
- Check rubber mountings for damage and deterioration.
- Check exhaust system for leakage, loose connections, dents, and damages.
  If bolts or nuts are loose, tighten them to specification. Refer to SECTION 6K for torque specification of bolts and nuts.
- Check nearby body areas for damaged, missing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

IGNITION SYSTEM

ITEM 2-1

Spark Plugs Replacement

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



ITEM 2-2

Distributor Cap and Rotor Inspection (if equipped)

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

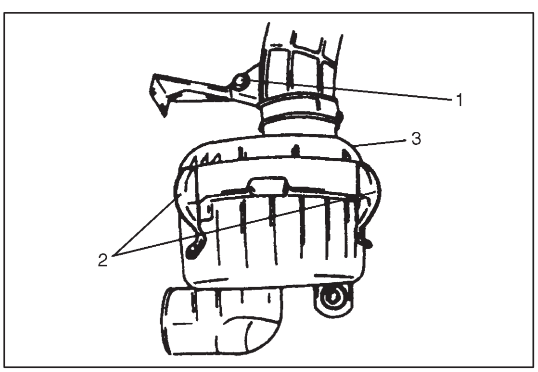
Repair or replace any component which is found to be in malcondition.

FUEL SYSTEM

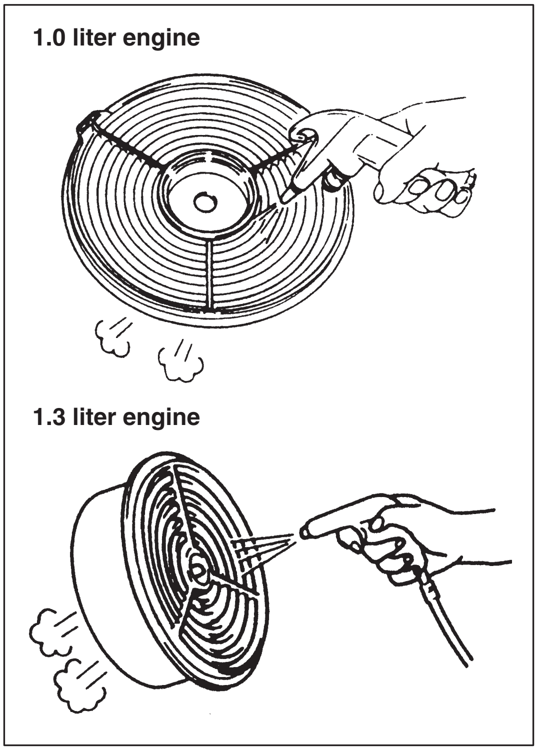
ITEM 3-1

Air Cleaner Filter Inspection

1) Take out air cleaner filter as follows.
   For 1.0 liter engine:
   i) Remove air cleaner upper case after removing case nut and clamps.
   ii) Remove air cleaner filter.



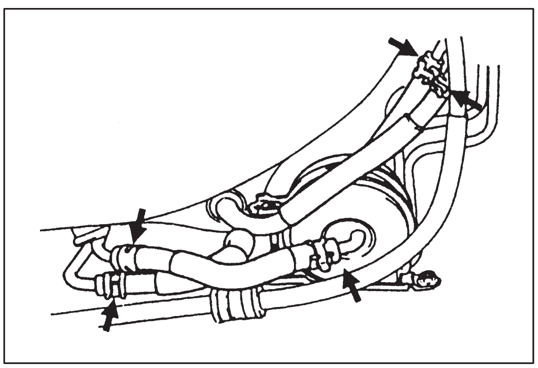
   For 1.3 liter engine:
   i) Disconnect air cleaner outlet hose from case after loosening its clamp and removing bolt (1) shown in figure.
   ii) Remove air cleaner case cap (3) from case by unhooking its clamps (2), then take out air cleaner filter.



2) Visually check that air cleaner filter is not excessively dirty, damaged or oily.
3) Clean filter with compressed air from air outlet side of filter.
4) Install air cleaner filter into case.
5) Clamp case cap securely and install hose to case and bracket if removed.

Air Cleaner Filter Replacement

Replace air cleaner filter with new one according to steps 1), 4) and 5) of Air Cleaner Filter Inspection.



ITEM 3-2

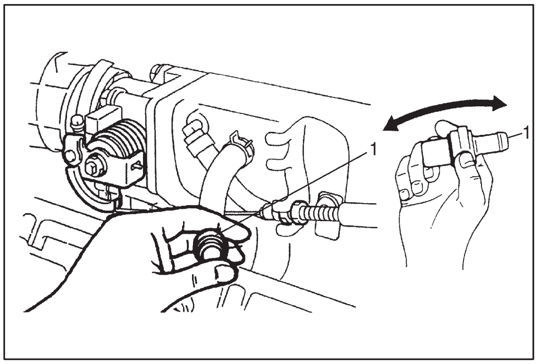
Fuel Lines Inspection

- Check fuel lines for loose connection, deterioration or damage which could cause leakage.
  Make sure all clamps are secure.
- Replace any damaged or deteriorate parts.
  There should be no sign of fuel leakage or moisture at any fuel connection.

ITEM 3-3

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

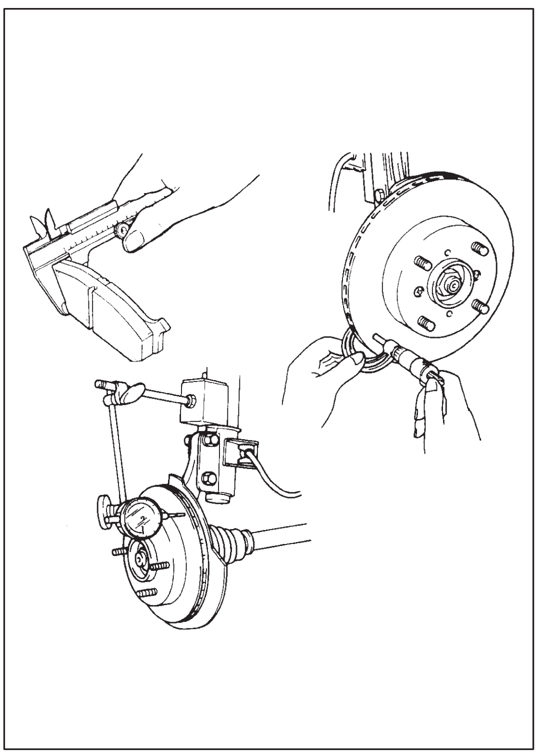
PCV (Positive Crankcase Ventilation) Valve Inspection

Check crankcase ventilation hoses and PCV hoses for leaks, cracks or clog, and PCV valve (1) for stick or clog. Refer to ON-VEHICLE SERVICE of SECTION 6E1 or 6E2 for PCV valve checking procedure.

ITEM 4-2

Fuel Evaporative Emission Control System Inspection

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



BRAKE

ITEM 5-1

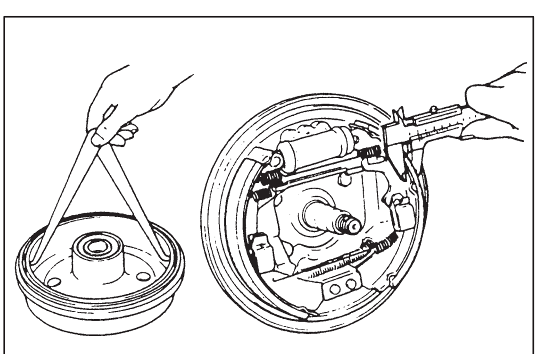
Brake Discs, Pads, Drums and Shoes Inspection

Brake discs and pads

NOTE:

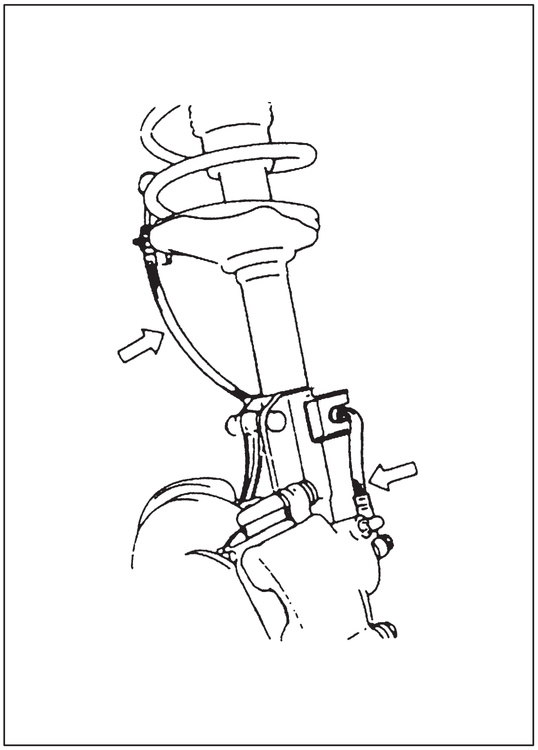
If noise is heard from brake when brake pedal is depressed, check brake pad lining for wear. If it is worn, both right and left brake pads should be replaced with new ones.

1) Remove wheel and caliper but don't disconnect brake hose from caliper.
2) Check disc brake pads and discs for excessive wear, damage and deflection. Replace parts as necessary. For the details, refer to SECTION 5.
3) Install caliper and wheel.



Brake drums and shoes

1) Remove wheel and brake drum.
2) Check rear brake drums and brake linings for excessive wear and damage.
   At the same time, check wheel cylinders for leakage.
   Replace as necessary.
   For the details, refer to SECTION 5.
3) Install brake drum and wheel.



ITEM 5-2

Brake Hoses and Pipes Inspection

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

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

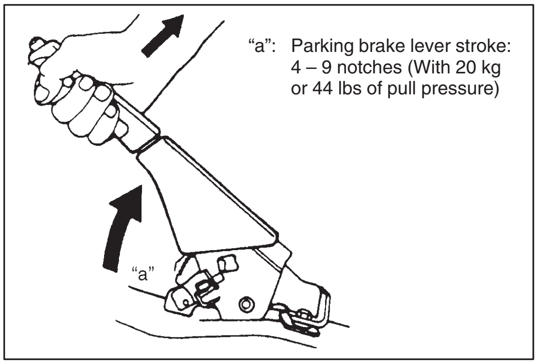
> **CAUTION:**
> **After replacing any brake pipe or hose, be sure to carry out air purge operation.**

ITEM 5-3

Brake Fluid Change

> **CAUTION:**
> **Since brake system of this vehicle is factory-filled with brake fluid indicated on reservoir cap, do not use or mix different type of fluid when refilling; otherwise serious damage will occur.**
> **Do not use old or used brake fluid, or any fluid from a unsealed container.**

Change brake fluid as follows.
Drain existing fluid from brake system completely, fill system with specified fluid and carry out air purge operation.
For air purging procedure, refer to SECTION 5.

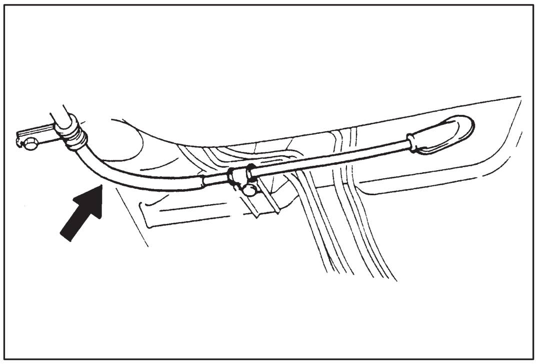


ITEM 5-4

Brake Lever and Cable Inspection

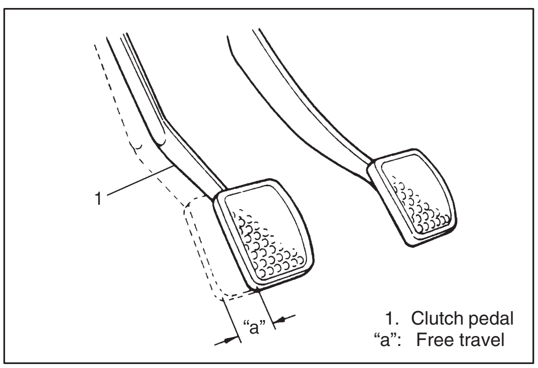
Parking brake lever

- Check tooth tip of each notch for damage or wear. If any damage or wear is found, replace parking lever.
- Check parking brake lever for proper operation and stroke, and adjust it if necessary.
  For checking and adjusting procedures, refer to PARKING BRAKE INSPECTION AND ADJUSTMENT of SECTION 5.



Parking brake cable

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

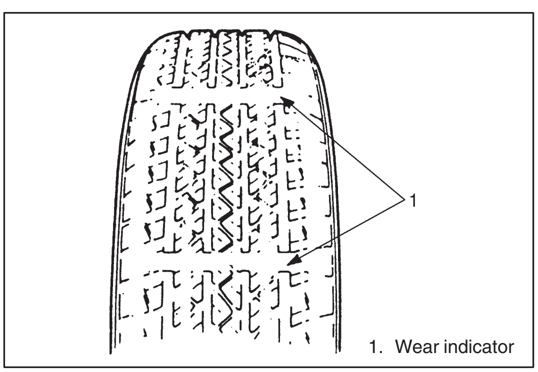


CHASSIS AND BODY

ITEM 6-1

Clutch Pedal Free Travel Inspection

Check clutch pedal free travel. Refer to SECTION 7C for procedure to check and adjust it.



ITEM 6-2

Tire and Wheel Disc Inspection

[Tire inspection]

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

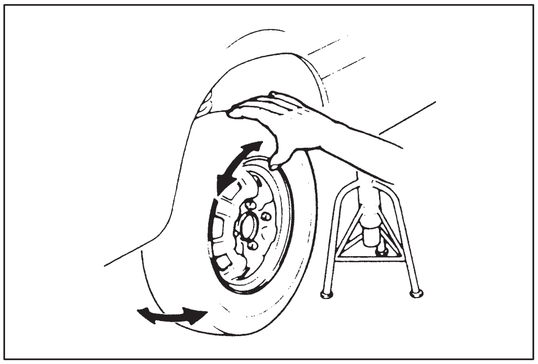
2) Check inflating pressure of each tire and adjust pressure to specification as necessary.

NOTE:

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

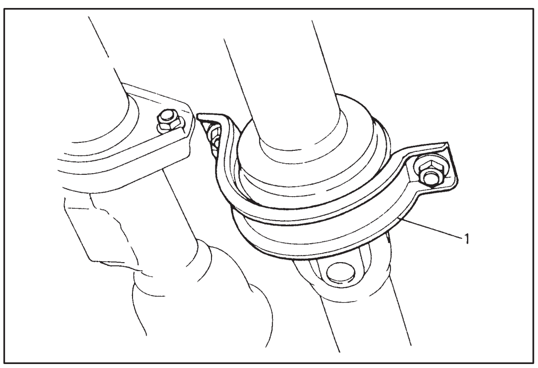
[Wheel disc inspection]
Inspect each wheel disc for dents, distortion and cracks. A disc in badly damaged condition must be replaced.

[Tire rotation]
Rotate tires referring to SECTION 3F.



Wheel Bearing Inspection

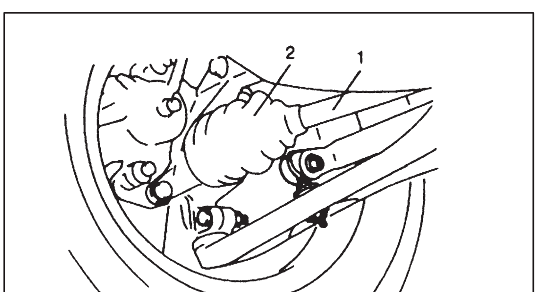
1) Check front wheel bearing for wear, damage, abnormal noise or rattles. For details, refer to SECTION 3D.
2) Check rear wheel bearing for wear, damage abnormal noise or rattle. For details, refer to SECTION 3E.



ITEM 6-3

Propeller Shaft Inspection (4WD vehicle only)

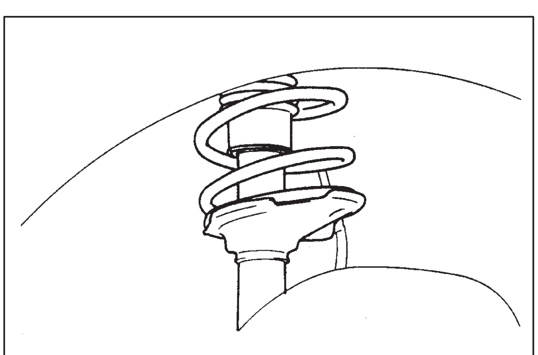
1) Check propeller shaft connecting bolts for looseness. If looseness is found, tighten to specified torque.
2) Check propeller shaft joints for wear, play and damage.
   If any defect is found, replace.
3) Check propeller shaft center support (1) for biting of foreign matter, crack, abnormal noise and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



1. Drive shaft
2. Boot

Drive Shaft Boot Inspction

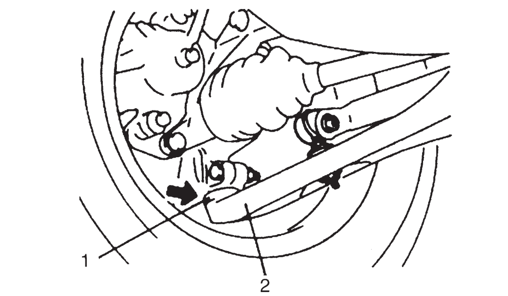
Check drive shaft boots (wheel side and differential side) for leakage, detachment, tear or any other damage.
Replace boot as necessary.



ITEM 6-4

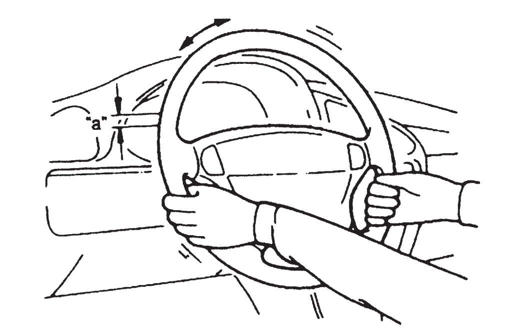
Suspension System Inspection

- Inspect front & rear struts for evidence of oil leakage, dents or any other damage on sleeves; and inspect anchor ends for deterioration.
  Replace defective parts, if any.



1. Ball joint stud dust seal (boot)
2. Suspension arm

- Check front and rear suspension systems for damaged, loose or missing parts; also for parts showing signs of wear or lack of lubrication.
  Repair or replace defective parts, if any.
- Check front suspension arm ball joint stud dust seals for leakage, detachment, tear or any other damage.
  Replace defective boot, if any.

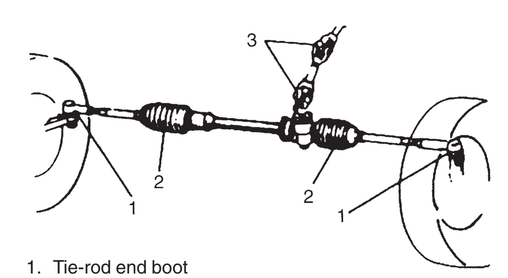


ITEM 6-5

Steering System Inspection

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

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



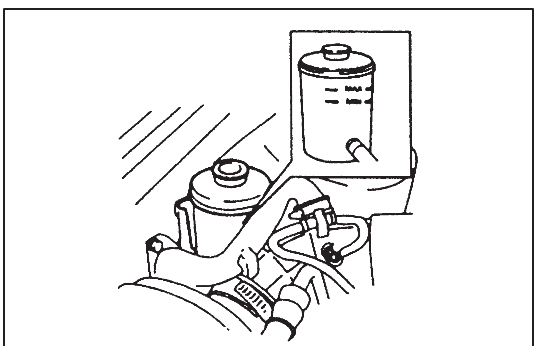
1. Tie-rod end boot
2. Steering gear case boot
3. Universal joint

2) Check steering linkage for looseness and damage. Repair or replace defective parts, if any.
3) Check boots of steering linkage and steering gear case for damage (leaks, detachment, tear, etc.). If damage is found, replace defective boot with new one.
4) Check universal joints of steering shaft for rattle and damage. If rattle or damage is found, replace defective part with a new one.

ITEM 6-6

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.

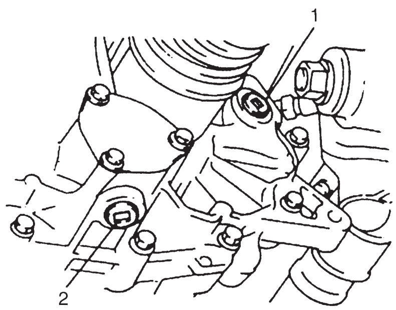


2) With engine stopped, check fluid level indicated on fluid tank, which should be between MAX and MIN marks. If it is lower than MIN, fill fluid up to MAX mark.

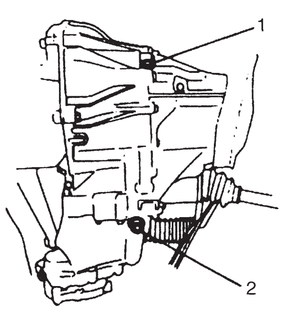
   NOTE
   - **Be sure to use specified P/S fluid.**
   - **Fluid level should be checked when fluid is cool.**

3) Visually check pump drive belt for cracks and wear.
4) Check belt for tension, referring to item 1-1 in this section.
   If necessary, adjust or replace.

2WD



4WD



1. Oil filler / level plug
2. Oil drain plug

ITEM 6-7

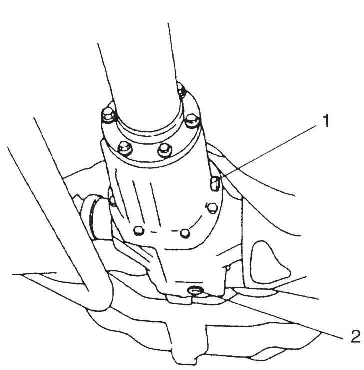
Manual Transmission Oil Inspection and Change

[Inspection]

1) Inspect transmission case for evidence of oil leakage.
   Repair leaky point if any.
2) Make sure that vehicle is placed level for oil level check.
3) Remove oil level plug of transmission.
4) Check oil level.
   Oil level can be checked roughly by means of filler/level plug hole. That is, if oil flows out of level plug hole or if oil level is found up to hole when level plug is removed, oil is properly filled.
   If oil is found insufficient, pour specified oil up to level hole.
   For specified oil, refer to description of oil change under ON-VEHICLE SERVICE in SECTION 7A or 7A1.
5) Tighten level plug to specified torque.

[Change]

1) Place the vehicle level and drain oil by removing drain plug.
2) Apply sealant to drain plug and tighten drain plug to specified torque.
3) Pour specified oil up to level hole.
4) Tighten filler plug to specified torque.
   For recommended oil, its amount and tightening torque data, refer to ON-VEHICLE SERVICE of SECTION 7A or 7A1.



ITEM 6-8

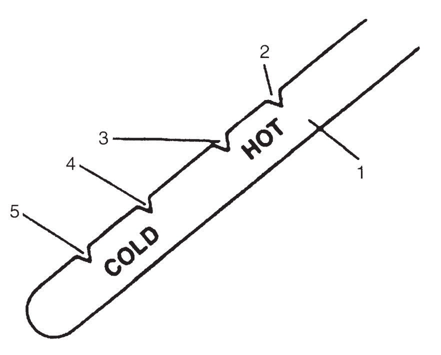
Rear Differential Oil Inspection and Change (4WD vehicle only)

[Inspection]

1) Inspect rear differential case for evidence of oil leakage.
   Repair leaky point, if any.
2) Make sure that the vehicle is placed level for oil level check.
3) Remove level plug (1) of differential. 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 as given in SECTION 7E.
4) Tighten it to specified torque.

[Change]

Place the vehicle level and drain oil by removing drain plug (2). Pour specified amount of specified oil, tighten drain plug and filler plug to specified torque, referring to ON-VEHICLE SERVICE in SECTION 7E.



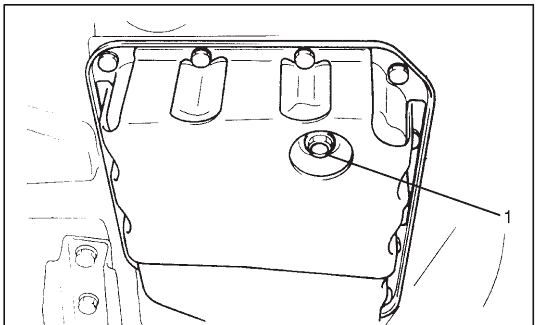
1. Oil level gauge
2. FULL HOT mark
3. LOW HOT mark
4. FULL COLD mark
5. LOW COLD mark

ITEM 6-9

Automatic Transmission

[Fluid level inspection]

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

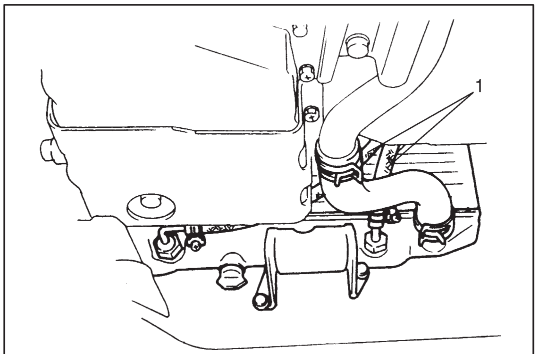


1. Drain plug

[Fluid change]

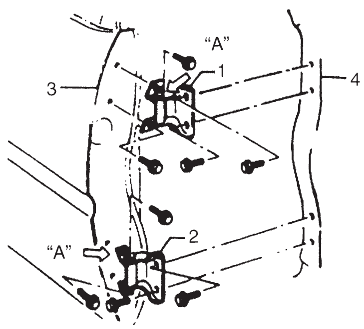
1) Perform steps 1) and 2) of above Fluid Level Inspection.
2) Change fluid. For its procedure, refer to ON-VEHICLE SERVICE in SECTION 7B.

> **CAUTION:**
> **Use of specified fluid is absolutely necessary.**



[Fluid cooler hose change]

Replace inlet and outlet hoses (1) of cooler hose and their clamps. For replacement procedure, refer to ON-VEHICLE SERVICE in SECTION 7B.



"A": Oil point
1. Upper hinge
2. Lower hinge
3. Door
4. Body

ITEM 6-10

All Latches, Hinges and Locks Inspection

Doors

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

Engine hood

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

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 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 car could move without warning and possibly cause personal injury or property damage.**

On automatic transmission vehicles, try to start the engine in each gear. The starter 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.

> **CAUTION:**
> **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 vehicle does not pull to one side when brake is applied,
- and that brake does 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 and mode lever to defroster position for this check.

RECOMMENDED FLUIDS AND LUBRICANTS

Engine oil	SE, SF, 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	DOT3
Manual transmission oil	See SECTION 7A
Rear differential oil	See SECTION 7E
Automatic transmission fluid	An equivalent of DEXRON®-IIE or DEXRON®-III
Power steering fluid	See material table on SECTION 3B1
Door hinges	Engine oil
Engine hood latch	Engine oil
Key lock cylinder	Spray lubricant

SECTION 6

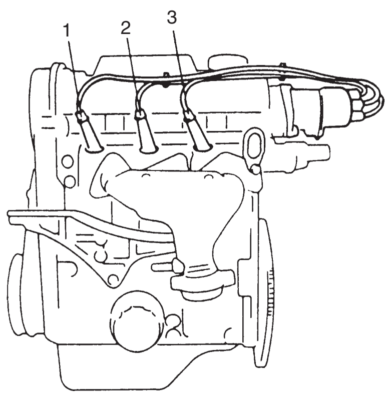
ENGINE GENERAL INFORMATION AND DIAGNOSIS (TBI FOR G10)

6

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

NOTE:
For the descriptions for vehicle without warm up three way catalytic converter (WUTWC), refer to Section 6 and 6E1 of the Service Manual mentioned in the FOREWORD of this manual.

CONTENTS



1. No.1 cylinder
2. No.2 cylinder
3. No.3 cylinder

GENERAL INFORMATION

STATEMENT ON CLEANLINESS AND CARE

An automobile engine is a combination of many machined, honed, polished and lapped surfaces with tolerances that are measured in the thousands of an millimeter (ten thousands of an inch).
Accordingly, when any internal engine parts are serviced, care and cleanliness are important.
Throughout this section, it should be understood that proper cleaning and protection of machined surfaces and friction areas is part of the repair procedure. This is considered standard shop practice even if not specifically stated.

- A liberal coating of engine oil should be applied to friction areas during assembly to protect and lubricate the surfaces on initial operation.
- Whenever valve train components, pistons, piston rings, connecting rods, rod bearings, and crankshaft journal bearings are removed for service, they should be retained in order.
  At the time of installation, they should be installed in the same locations and with the same mating surfaces as when removed.
- Battery cables should be disconnected before any major work is performed on the engine.
  Failure to disconnect cables may result in damage to wire harness or other electrical parts.
- Throughout this manual, the four cylinders of the engine are identified by numbers; No.1 (1), No.2 (2) and No.3 (3) counted from crankshaft pulley side to flywheel side.

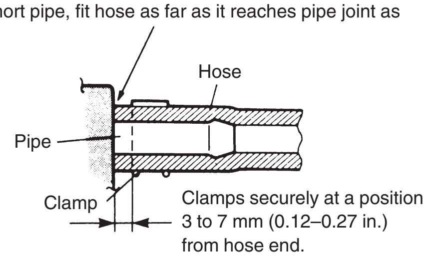
GENERAL INFORMATION ON ENGINE SERVICE

THE FOLLOWING INFORMATION ON ENGINE SERVICE SHOULD BE NOTED CAREFULLY, AS IT IS IMPORTANT IN PREVENTING DAMAGE, AND IN CONTRIBUTING TO RELIABLE ENGINE PERFORMANCE.

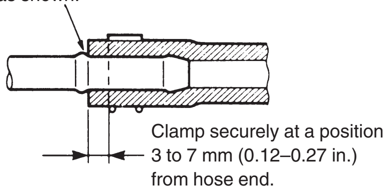
- When raising or supporting engine for any reason, do not use a jack under oil pan. Due to small clearance between oil pan and oil pump strainer, jacking against oil pan may cause it to be bent against strainer resulting in damaged oil pick-up unit.
- It should be kept in mind, while working on engine, that 12-volt electrical system is capable of violent and damaging short circuits.
  When performing any work where electrical terminals can be grounded, ground cable of the battery should be disconnected at battery.
- Any time the air cleaner, throttle body or intake manifold is removed, the intake opening should be covered. This will protect against accidental entrance of foreign material which could follow intake passage into cylinder and cause extensive damage when engine is started.

HOSE CONNECTION

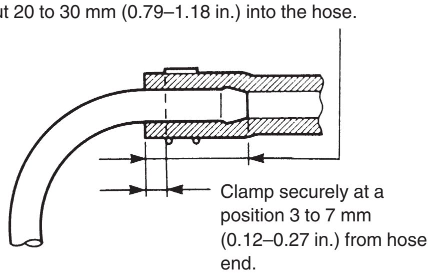
With short pipe, fit hose as far as it reaches pipe joint as shown.



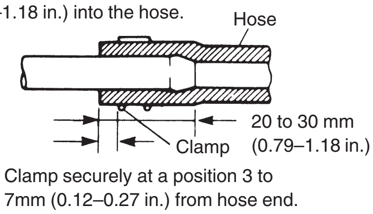
With following type pipe, fit hose as far as its peripheral projection as shown.



With bent pipe, fit hose as its bent part as shown or till pipe is about 20 to 30 mm (0.79–1.18 in.) into the hose.

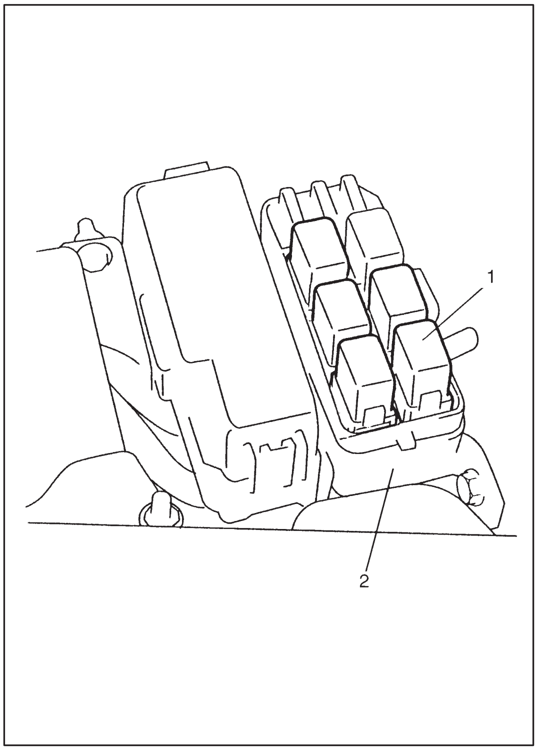


With straight pipe, fit hose till pipe is, about 20 to 30 mm (0.79–1.18 in.) into the hose.



PRECAUTION ON FUEL SYSTEM SERVICE

- Work must be done with no smoking, in a well-ventilated area and away from any open flames.
- As fuel feed line (between fuel pump and fuel delivery pipe) is still under high fuel pressure even after engine was stopped, loosening or disconnecting fuel feed line directly may cause dangerous spout of fuel to occur where loosened or disconnected.
  Before loosening or disconnecting fuel feed line, make sure to release fuel pressure according to "FUEL PRESSURE RELIEF PROCEDURE". A small amount of fuel may be released after the fuel line is disconnected. In order to reduce the chance of personal injury, cover the fitting to be disconnected with a shop cloth. Put that cloth in an approved container when disconnection is completed.
- Never run engine with fuel pump relay disconnected when engine and exhaust system are hot.
- Fuel or fuel vapor hose connection varies with each type of pipe. When reconnecting fuel or fuel vapor hose, be sure to connect and clamp each hose correctly referring to left figure Hose Connection.
  After connecting, make sure that it has no twist or kink.
- When installing injector or fuel delivery pipe, lubricate its O-ring with spindle oil or gasoline.
- When connecting fuel pipe flare nut, first tighten flare nut by hand and then tighten it to specified torque.



FUEL PRESSURE RELIEF PROCEDURE

CAUTION:
This work must not be done when engine is hot. If done so, it may cause adverse effect to catalyst.

After making sure that engine is cold, release fuel pressure as follows.

1) Place transmission gear shift lever in "Neutral" (Shift selector lever to "P" range for A/T model), set parking brake, and block drive wheels.
2) Remove relay box cover.
3) Disconnect fuel pump relay (1) from relay box (2).
4) Remove fuel filler cap to release fuel vapor pressure in fuel tank and then reinstall it.
5) Start engine and run it till it stops for lack of fuel. Repeat cranking engine 2-3 times for about 3 seconds each time to dissipate fuel pressure in lines. Fuel connections are now safe for servicing.
6) Upon completion of servicing, connect fuel pump relay to relay box and install relay box cover.

FUEL LEAKAGE CHECK PROCEDURE

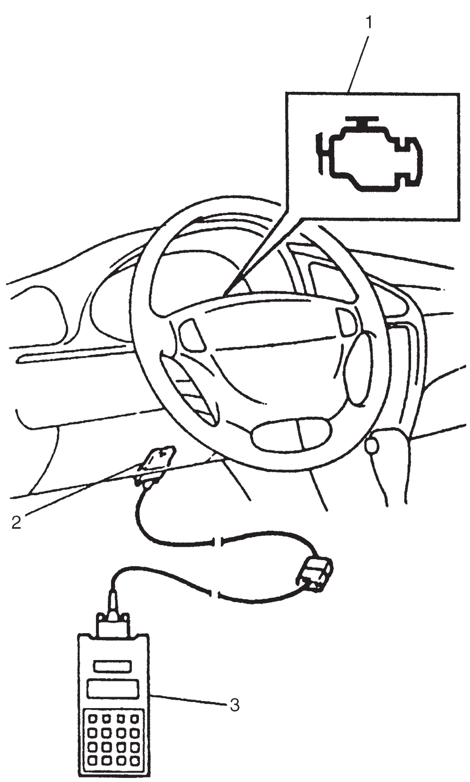
After performing any service on fuel system, check to make sure that there are no fuel leakages as follows.

1) Turn ON ignition switch for 2 seconds (to operate fuel pump) and then turn it OFF.
   Repeat this (ON and OFF) 3 or 4 times and apply fuel pressure to fuel line. (till fuel pressure is felt by hand placed on fuel feed hose.)
2) In this state, check to see that there are no fuel leakages from any part of fuel system.

ENGINE DIAGNOSIS

GENERAL DESCRIPTION

This vehicle is equipped with an engine and emission control system which are under control of ECM (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) doesn’t turn ON, it should be diagnosed according to this flow table.



ON-BOARD DIAGNOSTIC SYSTEM

ECM (PCM) in this vehicle has following functions.

- When the ignition switch is turned ON with the engine at a stop, malfunction indicator lamp (MIL) (1) turns ON to check the bulb of the malfunction indicator lamp (1).
- When ECM (PCM) detects a malfunction which gives an adverse effect to vehicle emission while the engine is running, it makes the malfunction indicator lamp (1) in the meter cluster of the instrument panel turn ON or flash (flashing only when detecting a misfire which can cause damage to the catalyst) and stores the malfunction area in its memory.
  (If it detects that continuously 3 driving cycles are normal after detecting a malfunction, however, it makes MIL (1) turn OFF although DTC stored in its memory will remain.)
- As a condition for detecting a malfunction in some areas in the system being monitored by ECM (PCM) and turning ON the malfunction indicator lamp (1) due to that malfunction, 2 driving cycle detection logic is adopted to prevent erroneous detection.
- When a malfunction is detected, engine and driving conditions then are stored in ECM (PCM) memory as freeze frame data. (For the details, refer to description on Freeze frame data.)
- It is possible to communicate by using not only SUZUKI scan tool (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, driving mode where a malfunction would be detected if present and engine shutoff.

2 Driving Cycles Detection Logic

The malfunction detected in the first driving cycle is stored in ECM (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.	Engine Speed	782 RPM
3.	Eng Cool Tmp.	80°C
4.	Vehicle Spd.	0 km/h
5.	MAP Sensor	39 kPa
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 from 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:

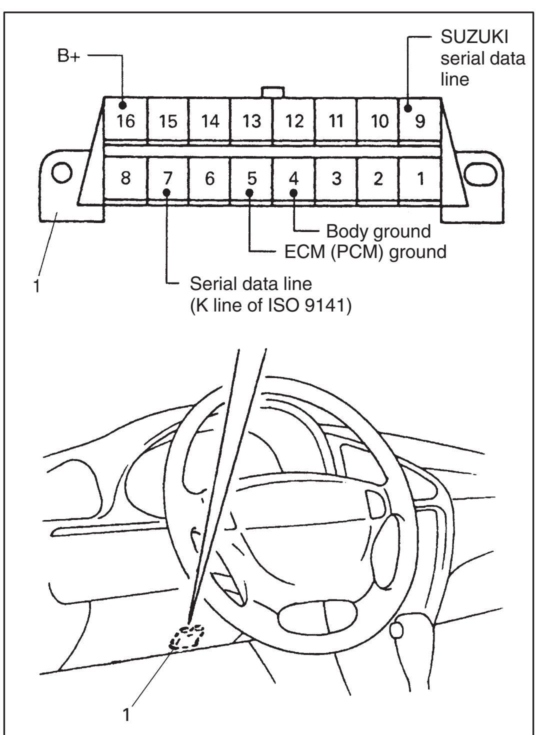
ECM (PCM) has 4 frames where the freeze frame data can be stored. The first frame stores the freeze frame data of the malfunction which was detected first. However, the freeze frame data stored in this frame is updated according to the priority described below. (If malfunction as described in the upper 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-P0303), 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.

MALFUNCTION 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			
1	P0400 (EGR) detected	Data at P0400 detection	Data at P0400 detection	–	–
2	P0171 (Fuel system) detected	Data at P0171 detection	Data at P0400 detection	Data at P0171 detection	–
3	P0300 (Misfire) detected	Data at P0171 detection	Data at P0400 detection	Data at P0171 detection	Data at P0300 detection
4	P0301 (Misfire) detected	Data at P0171 detection	Data at P0400 detection	Data at P0171 detection	Data at P0300 detection

Freeze frame data clearance:
The freeze frame data is cleared at the same time as clearance of diagnostic trouble code (DTC).



Data Link Connector (DLC)
DLC (1) is in compliance with SAEJ1962 in its installation position, the shape of connector and pin assignment.

Serial data line (K line of ISO 9141) is used for SUZUKI scan tool (Tech-1) or generic scan tool to communicate with ECM (PCM). SUZUKI serial data line is used for SUZUKI scan tool (Tech-1) to communicate with ABS control module and air bay SDM.

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.
  If two or more 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 (DTCs) other than DTC P0171/P0172 (Fuel system too lean/too rich) and DTC P0300/P0301/P0302/P0303 (Misfire detected)
  2. DTC P0171/P0172 (Fuel system too lean/too rich)
  3. DTC P0300/P0301/P0302/P0303 (Misfire detected)
- Be sure to read "Precautions for Electrical Circuit Service" in Section 0A before inspection and observe what is written there.
- ECM (PCM) Replacement
  When substituting a known-good ECM (PCM), check for following conditions. Neglecting this check may cause damage to 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 the following pages for the details of each step.

<table>
<tr><th>STEP</th><th>ACTION</th><th>YES</th><th>NO</th></tr>
<tr><td>1</td><td>Customer Complaint Analysis
1) Perform customer complaint analysis referring to the next page.
Was customer complaint analysis performed?</td><td>Go to Step 2.</td><td>Perform customer complaint analysis.</td></tr>
<tr><td>2</td><td>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)?</td><td>1) Print DTC and freeze frame data or write them down and clear them by referring to “DTC Clearance” section.
2) Go to Step 3.</td><td>Go to Step 4.</td></tr>
<tr><td>3</td><td>Visual Inspection
1) Perform visual inspection referring to the next page.
Is there any faulty condition?</td><td rowspan="2">1) Repair or replace malfunction part.
2) Go to Step 11.</td><td>Go to Step 5.</td></tr>
<tr><td>4</td><td>Visual Inspection
1) Perform visual inspection referring to the next page.
Is there any faulty condition?</td><td>Go to Step 8.</td></tr>
<tr><td>5</td><td>Trouble Symptom Confirmation
1) Confirm trouble symptom referring to the next page.
Is trouble symptom identified?</td><td>Go to Step 6.</td><td>Go to Step 7.</td></tr>
<tr><td>6</td><td>Rechecking and Record of DTC/Freeze Frame Data
1) Recheck for DTC and freeze frame data referring to “DTC Check” section.
Is there any DTC(s)?</td><td rowspan="2">Go to Step 9.</td><td>Go to Step 8.</td></tr>
<tr><td>7</td><td>Rechecking and Record of DTC/Freeze Frame Data
1) Recheck for DTC and freeze frame data referring to “DTC Check” section.
Is there any DTC(s)?</td><td>Go to Step 10.</td></tr>
<tr><td>8</td><td>Engine Basic Inspection and Engine Diag. Table
1) Check and repair according to “Engine Basic Check” and “Engine Diag. Table” section.
Are check and repair complete?</td><td rowspan="2">Go to Step 11.</td><td rowspan="2">1) Check and repair malfunction part(s).
2) Go to Step 11.</td></tr>
<tr><td>9</td><td>Trouble shooting for DTC
1) Check and repair according to applicable DTC diag. flow table.
Are check and repair complete?</td></tr>
<tr><td>10</td><td>Check for Intermittent Problems
1) Check for intermittent problems referring to the next page.
Is there any faulty condition?</td><td>1) Repair or replace malfunction part(s).
2) Go to Step 11.</td><td>Go to Step 11.</td></tr>
<tr><td>11</td><td>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?</td><td>Go to Step 6.</td><td>End.</td></tr>
</table>

1. **CUSTOMER COMPLAINT ANALYSIS**
   Record details of the problem (failure, complaint) and how it occurred as described by the customer. For this purpose, use of such an inspection form will facilitate collecting information to the point required for proper analysis and diagnosis.

2. **DIAGNOSTIC TROUBLE CODE (DTC)/FREEZE FRAME DATA CHECK, RECORD AND CLEARANCE**
   First, check DTC (including pending DTC), referring to "DTC check" section. If DTC is indicated, print it and freeze frame data or write them down and then clear them by referring to "DTC clearance" section. DTC indicates malfunction that occurred in the system but does not indicate whether it exists now or it occurred in the past and the normal condition has been restored now. To check which case applies, check the symptom in question according to Step 4 and recheck DTC according to Step 5.
   Attempt to diagnose a trouble based on DTC in this step only or failure to clear the DTC in this step will lead to incorrect diagnosis, trouble diagnosis of a normal circuit or difficulty in troubleshooting.

   NOTE:
   If only Automatic transmission DTCs (P0705/P0720/P0753/P0758/P0751/P0756) or Immobilizer DTCs (P1620 – P1623) are indicated in this step, perform trouble diagnosis according to "Diagnosis" in Section 7B or Section 8G.

3. **and 4. VISUAL INSPECTION**
   As a preliminary step, be sure to perform visual check of the items that support proper function of the engine referring to "Visual Inspection" section.

5. **TROUBLE SYMPTOM CONFIRMATION**
   Based on information obtained in Step 1 Customer complaint analysis and Step 2 DTC/freeze frame data check, confirm trouble symptoms. Also, reconfirm DTC according to "DTC Confirmation Procedure" described in each DTC Diagnosis section.

6. **and 7. RECHECKING AND RECORD OF DTC/FREEZE FRAME DATA**
   Refer to "DTC check" section for checking procedure.

8. **ENGINE BASIC INSPECTION AND ENGINE DIAGNOSIS TABLE**
   Perform basic engine check according to the "Engine Basic Inspection 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 FLOW TABLE and based on symptoms appearing on the vehicle (symptoms obtained through steps of customer complaint analysis, trouble symptom confirmation and/or basic engine check) and repair or replace faulty parts, if any.

9. **TROUBLESHOOTING FOR DTC (See each DTC Diag. Flow Table)**
   Based on the DTC indicated in Step 5 and referring to the applicable DTC diag. flow table in this section, locate the cause of the trouble, namely in a sensor, switch, wire harness, connector, actuator, ECM (PCM) or other part and repair or replace faulty parts.

10. **CHECK FOR INTERMITTENT PROBLEM**
    Check parts where an intermittent trouble is easy to occur (e.g., wire harness, connector, etc.), referring to "INTERMITTENT AND POOR CONNECTION" in Section 0A and related circuit of DTC recorded in Step 2.

11. **FINAL CONFIRMATION TEST**
    Confirm that the problem symptom has gone and the engine is free from any abnormal conditions. If what has been repaired is related to the DTC, clear the DTC once, perform DTC confirmation procedure and confirm that no DTC is indicated.

CUSTOMER PROBLEM INSPECTION FORM (EXAMPLE)

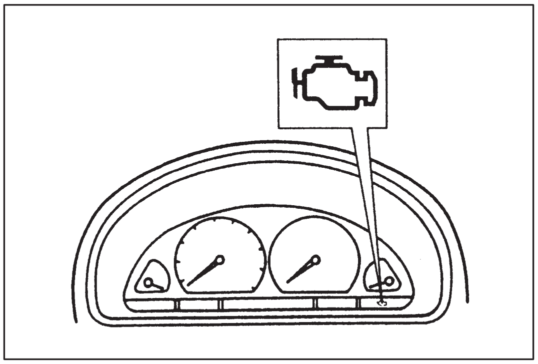
User name:	Model:	VIN:	
Date of issue:	Date Reg.	Date of problem:	Mileage:

PROBLEM SYMPTOMS	
☐ **Difficult Starting** ☐ No cranking ☐ No initial combustion ☐ No combustion ☐ Poor starting at (☐cold ☐warm ☐always) ☐ Other___________	☐ **Poor Driveability** ☐ Hesitation on acceleration ☐ Back fire/☐After fire ☐ Lack of power ☐ Surging ☐ abnormal knocking ☐ Other___________
☐ **Poor Idling** ☐ Poor fast idle ☐ Abnormal idling speed (☐High ☐Low) (r/min.) ☐ Unstable ☐ Hunting (r/min. to r/min.) ☐ Other___________	☐ **Engine Stall when** ☐ Immediately after start ☐ Accel. pedal is depressed ☐ Accel. pedal is released ☐ Load is applied ☐ A/C ☐Electric load ☐P/S ☐ Other___________ ☐ Other___________
☐ OTHERS:	

VEHICLE/ENVIRONMENTAL CONDITION WHEN PROBLEM OCCURS	
Environmental Condition	
Weather	☐Fair ☐Cloudy ☐Rain ☐Snow ☐Always ☐Other___________
Temperature	☐Hot ☐Warm ☐Cool ☐Cold (°F/ °C) ☐Always
Frequency	☐Always ☐Sometimes (times/ day, month) ☐Only once ☐Under certain condition
Road	☐Urban ☐Suburb ☐Highway ☐Mountainous (☐Uphill ☐Downhill) ☐Tarmacadam ☐Gravel ☐Other___________
Vehicle Condition	
Engine condition	☐Cold ☐Warming up phase ☐Warmed up ☐Always ☐Other at starting ☐Immediately after start ☐Racing without load ☐Engine speed (r/min.)
Vehicle condition	During driving: ☐Constant speed ☐Accelerating ☐Decelerating ☐Right hand corner ☐Left hand corner ☐When shifting (Lever position) ☐At stop ☐Vehicle speed when problem occurs (km/h, Mile/h) ☐Other___________

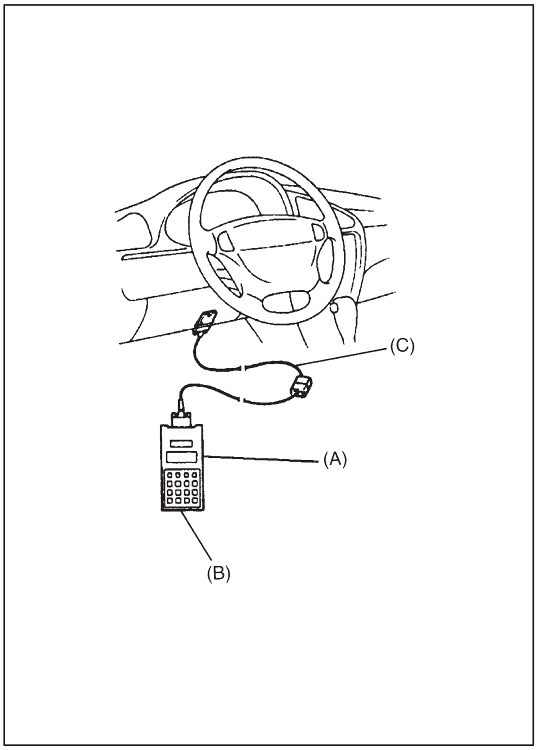
Malfunction indicator lamp condition	☐Always ON ☐Sometimes ON ☐Always OFF ☐Good condition	
Diagnostic trouble code	First check:	☐No code ☐Malfunction code ( )
	Second check:	☐No code ☐Malfunction code ( )

NOTE:
The above form is a standard sample. It should be modified according to conditions characteristic of each market.



MALFUNCTION INDICATOR LAMP (MIL) CHECK

1) Turn ON ignition switch (but the engine at stop) and check that MIL lights.
   If MIL does not light up (or MIL dims), go to “Diagnostic Flow Table A-1” for troubleshooting.
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

1) Prepare SUZUKI scan tool (Tech-1) or generic scan tool.
2) With ignition switch OFF, connect it to data link connector (DLC) (1) located on underside of instrument panel at driver’s seat side.

   Special Tool:
   (A): SUZUKI scan tool
   (B): Mass storage cartridge
   (C): 16/14 pin DLC 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 it or write it 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 in good condition. Then check data link connector and serial data line (circuit) in the vehicle with which communication was not possible.
5) After completing the check, turn ignition switch off and disconnect scan tool from data link connector.

DIAGNOSTIC TROUBLE CODE (DTC) CLEARANCE

1) Connect SUZUKI scan tool (Tech-1) or generic scan tool to data link connector in the same manner as when making this connection for DTC check.
2) Turn ignition switch ON.
3) Erase DTC and pending DTC according to instructions displayed on scan tool. Refer to scan tool operator's manual for further details.
4) After completing the clearance, turn ignition switch off and disconnect scan tool from data link connector.

NOTE:
DTC and freeze frame data stored in ECM (PCM) memory are also cleared in following cases. Be careful not to clear them before keeping their record.
- **When power to ECM (PCM) is cut off (by disconnecting battery cable, removing fuse or disconnecting ECM (PCM) connectors for 30 sec. or longer)**
- **When the same malfunction (DTC) is not detected again during 40 engine warm-up cycles.**

DIAGNOSTIC TROUBLE CODE (DTC) TABLE

DTC NO.	DETECTING ITEM	DETECTING CONDITION (DTC will set when detecting:)	MIL
P0105	Manifold absolute pressure circuit malfunction	Low pressure-high vacuum-low voltage (or MAP sensor circuit shorted to ground) High pressure-low vacuum-high voltage (or MAP sensor circuit open)	1 driving cycle
P0110	Intake air temp. circuit malfunction	Intake air temp. circuit low input Intake air temp. circuit high input	1 driving cycle
P0115	Engine coolant temp. circuit malfunction	Engine coolant temp. circuit low input Engine coolant temp. circuit high input	1 driving cycle
P0120	Throttle position circuit malfunction	Throttle position circuit low input Throttle position circuit high input	1 driving cycle
P0121	Throttle position circuit performance problem	Poor performance of TP sensor	2 driving cycles
P0130	HO2S circuit malfunction (Sensor-1)	Min. output voltage of HO2S-higher than specification Max. output voltage of HO2S-lower than specification	2 driving cycles
P0133	HO2S circuit slow response (Sensor-1)	Response time of HO2S-1 output voltage between rich and lean is longer than specification.	2 driving cycles
P0135	HO2S heater circuit malfunction (Sensor-1)	Terminal voltage is lower than specification at heater OFF or it is higher at heater ON.	2 driving cycles
P0136	HO2S circuit malfunction (Sensor-2)	Max. voltage of HO2S-2 is lower than specification or its min. voltage is higher than specification	2 driving cycles
P0141	HO2S heater circuit malfunction (Sensor-2)	Terminal voltage is lower than specification at heater OFF or it is higher at heater ON. (or heater circuit or short)	2 driving cycles
P0171	Fuel system too lean	Short term fuel trim or total fuel trim (short and long terms added) is larger than specification for specified time or longer. (fuel trim toward rich side is large.)	2 driving cycles
P0172	Fuel system too rich	Short term fuel trim or total fuel trim (short and long term added) is smaller than specification for specified time or longer. (fuel trim toward lean side is large.)	2 driving cycles
P0300 P0301 P0302 P0303	Random misfire detected Cylinder 1 misfire detected Cylinder 2 misfire detected Cylinder 3 misfire detected	Misfire of such level as to cause damage to three way catalyst	MIL flashing during misfire detection
		Misfire of such level as to deteriorate emission but not to cause damage to three way catalyst	2 driving cycles

DTC NO.	DETECTING ITEM	DETECTING CONDITION (DTC will set when detecting:)	MIL
P0335	Crankshaft position sensor circuit malfunction	No signal during engine running	1 driving cycle
P0340	Camshaft position sensor circuit malfunction	No signal for 2 sec. during engine cranking	1 driving cycle
P0420	Catalyst system efficiency below threshold	Output waveforms of HO2S-1 and HO2S-2 are similar. (Time from output voltage change of HO2S-1 to that of HO2S-2 is shorter than specification.)	2 driving cycles
P0443	EVAP Purge control valve circuit malfunction	Purge control valve circuit is open or shorted to ground	2 driving cycles
P0480	Radiator fan control circuit malfunction	Radiator cooling fan relay terminal voltage is low when cooling temp. is lower than specification	2 driving cycles
P0500	Vehicle speed sensor malfunction	No signal while running in “D” range or during fuel cut at decelerating	2 driving cycles
P0505	Idle control system malfunction	Throttle opening change is small as compared with electrically live time. Throttle valve opening is not within its target range with CTP switch ON or drive voltage exists though ECM (PCM) is not outputting ISC drive command.	1 driving cycle
P0510	Closed throttle position switch malfunction	Switch does not change from ON to OFF (or from OFF to ON) even when vehicle speed reaches over (or below) specification.	2 driving cycle
P1250	Early Fuel Evaporation Heater Circuit Malfunction	Heater monitor terminal voltage is higher than specified value when EFE OFF or it is lower than specified value when EFE ON.	2 driving cycles
P1450	Barometric pressure sensor circuit malfunction	Barometric pressure is lower or higher than specification. (or sensor malfunction)	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
P1500	Starter signal circuit malfunction	Starter signal is not inputted from engine cranking till its start and after or it is always inputted	2 driving cycles
P1510	ECM (PCM) backup power source malfunction	No backup power after starting engine	1 driving cycle

DTC NO.	DETECTING ITEM	DETECTING CONDITION (DTC will set when detecting:)	MIL
P0705	Transmission range sensor (switch) circuit malfunction (A/T)	No signal or multiple signals inputted with shifted in "D" range	1 driving cycle
P0720	Output speed sensor circuit malfunction (A/T)	No signal while running vehicle with "D" or "2" range.	1 driving cycle
P0751	Shift solenoid A (#1) performance or stuck off	While running in "D" range, engine speed as compared to vehicle speed is higher or lower than specified value.	2 driving cycles
P0756	Shift solenoid B (#2) performance or stuck off		
P0753	Shift solenoid A (#1) electrical (A/T)	Output command from PCM and output voltage do not agree. (solenoid circuit shorted to ground or open)	1 driving cycle
P0758	Shift solenoid B (#2) electrical (A/T)		
P1620	ECU code not registered	Refer to Section 8A.	
P1621	No ECU code transmitted from Immobilizer Control Module		
P1622	Fault in ECM (PCM)		
P1623	ECU code not matched		

FAIL-SAFE TABLE

When any of the following DTCs is detected, ECM (PCM) enters fail-safe mode as long as malfunction continues to exist but that mode is canceled when ECM (PCM) detects normal condition after that.

DTC NO.	DETECTED ITEM	FAIL-SAFE OPERATION
P0105	Manifold absolute pressure circuit malfunction	● ECM (PCM) uses value determined by throttle opening and engine speed. ● ECM (PCM) stops EVAP purge control.
P0110	Intake air temp. circuit malfunction	ECM (PCM) controls actuators assuming that intake air temperature is 20°C (68°F).
P0115	Engine coolant temp. circuit malfunction	● ECM (PCM) controls actuators assuming that engine coolant temperature is 80°C (176°F). ● ECM (PCM) operates radiator fan. ● ECM (PCM) stops A/C and idle speed control.
P0120	Throttle position circuit malfunction	● ECM (PCM) controls actuators assuming that throttle opening is 20°. ● ECM (PCM) stops idle speed control.
P0500	Vehicle speed sensor malfunction	ECM (PCM) stops idle air control.
P1450	Barometric pressure sensor low/ high input	ECM (PCM) controls actuators assuming that barometric pressure is 100 kPa (760 mmHg).

VISUAL INSPECTION

Visually check following parts and systems.

INSPECTION ITEM	REFERRING SECTION
● Engine oil – – – – – level, leakage	Section 0B
● Engine coolant – – – – – level, leakage	Section 0B
● Fuel – – – – – level, leakage	Section 0B
● A/T fluid – – – – – level, leakage	Section 0B
● Air cleaner element – – – – – dirt, clogging	Section 0B
● Battery – – – – – fluid level, corrosion of terminal	
● Water pump belt – – – – – tension, damage	Section 0B
● Throttle cable – – – – – play, installation	Section 6E1
● Vacuum hoses of air intake system – – – – – disconnection, looseness, deterioration, bend	
● Connectors of electric wire harness – – – – – disconnection, friction	
● Fuses – – – – – burning	Section 8
● Parts – – – – – installation, bolt – – – – – looseness	
● Parts – – – – – deformation	
● Other parts that can be checked visually	
Also check following items at engine start, if possible	
● Malfunction indicator lamp	Section 6
● Charge warning lamp	Section 6H
● Engine oil pressure warning lamp Operation	Section 8 (section 6 for pressure check)
● Engine coolant temp. meter	Section 8
● Fuel level meter	Section 8
● Tachometer, if equipped	
● Abnormal air being inhaled from air intake system	
● Exhaust system – – – – – leakage of exhaust gas, noise	
● Other parts that can be checked visually	

ENGINE BASIC INSPECTION

This check is very important for troubleshooting when ECM (PCM) has detected no DTC and no abnormality has been found in visual inspection.
Follow the flow table carefully.

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Check battery voltage. Is it 11 V or more?	Go to Step 3.	Charge or replace battery.
3	Is engine cranked?	Go to Step 4.	Go to "DIAGNOSIS" in Section 6G.
4	Does engine start?	Go to Step 5.	Go to Step 7.
5	Check idle speed as follows. 1) Warm up engine to normal operating temp. 2) Shift transmission to neutral position for M/T ("P" position for A/T). 3) All of electrical loads are switched off. 4) Check engine idle speed with scan tool. See Fig. 1. Is it 800 – 900 r/min.?	Go to Step 6.	Go to "ENGINE DIAGNOSIS TABLE".
6	Check ignition timing as follows. 1) Select "MISC" mode on SUZUKI scan tool and fix ignition timing to initial one. See Fig. 2. 2) Using timing light (1), check initial ignition timing. See Fig. 3. Is it 5° ± 3° BTDC at specified idle speed?	Go to "ENGINE DIAGNOSIS TABLE".	Check ignition control related parts referring to Section 6F.
7	Check immobilizer system malfunction as follows. 1) Check immobilizer indicator lamp for flashing. Is it flashing when ignition switch is turned to ON position?	Go to "DIAGNOSIS" in Section 8A.	Go to Step 8.
8	Check fuel supply as follows. 1) Check to make sure that enough fuel is filled in fuel tank. 2) Turn ON ignition switch for 2 seconds and then OFF. See Fig. 4. Is fuel return pressure (returning sounds) felt from fuel feed hose (1) when ignition switch is turned ON?	Go to Step 10.	Go to Step 9.
9	Check fuel pump for operating. 1) Was fuel pump operating sound heard from fuel filler for about 2 seconds after ignition switch ON and stop?	Go to "DIAG. FLOW TABLE B-3".	Go to "DIAG. FLOW TABLE B-2".
10	Check ignition spark as follows. 1) Disconnect injector coupler. 2) Remove spark plugs and connect them to high tension cords. 3) Ground spark plugs. 4) Crank engine and check if each spark plug sparks. Is it in good condition?	Go to Step 11.	Go to "DIAGNOSIS" in Section 6F.
11	Check fuel injector for operation as follows. 1) Install spark plugs and connect injector connectors. 2) Check that fuel is injected out in conical shape from fuel injector when cranking. Is it in good condition?	Go to "ENGINE DIAGNOSIS TABLE".	Go to "DIAG. FLOW TABLE B-1".

Fig. 1 for Step 5

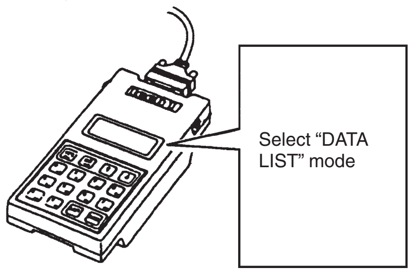


Fig. 2 for Step 6

Fig. 3 for Step 6

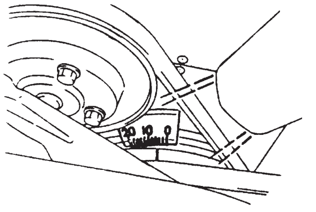


Fig. 4 for Step 8

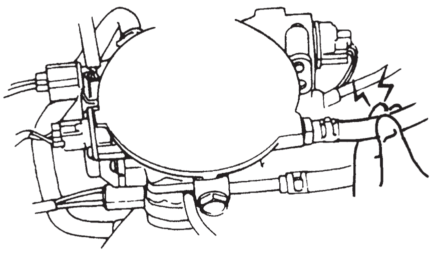
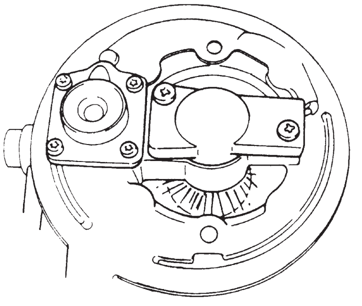


Fig. 5 for Step 11



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	Referring Item
Hard Starting (Engine cranks OK)	**Ignition system out of order**	
	● Faulty spark plug	Spark plugs in Section 6F
	● Leaky high-tension cord	High-tension cords in Section 6F
	● Loose connection or disconnection of high-tension cords or lead wires	High-tension cords in Section 6F
	● Faulty ignition coil	Ignition coil in Section 6F
	Fuel system out of order	
	● Dirty or clogged fuel hose or pipe	Diagnostic Flow Table B-3
	● Malfunctioning fuel pump	Diagnostic Flow Table B-3
	● Air inhaling from intake manifold gasket or throttle body gasket	
	● Fuel injector resistor malfunction	Fuel injector resistor in Section 6E1
	Engine and emission control system out of order	
	● Faulty idle control system	Diagnostic Flow Table P0505
	● Faulty ECT sensor or MAP sensor	ECT sensor or MAP sensor in Section 6E1
	● Faulty ECM (PCM)	
	Low compression	Compression check in Section 6A
	● Poor spark plug tightening or faulty gasket	Spark plugs in Section 6F
	● Compression leak from valve seat	Valves inspection in Section 6A
	● Sticky valve stem	Valves inspection in Section 6A
	● Weak or damaged valve springs	Valve springs inspection in Section 6A
	● Compression leak at cylinder head gasket	Cylinder head inspection in Section 6A
	● Sticking or damaged piston ring	Cylinders, pistons and piston rings inspection in Section 6A
	● Worn piston, ring or cylinder	Cylinders, pistons and piston rings inspection in Section 6A
	Others	
	● Malfunctioning PCV valve	PCV system in Section 6E1

Condition	Possible Cause	Referring Item
Low oil pressure	• Improper oil viscosity	Engine oil and oil filter change in Section 0B
	• Malfunctioning oil pressure switch	Oil pressure switch inspection in Section 8
	• Clogged oil strainer	Oil pan and oil pump strainer cleaning in Section 6A
	• Functional deterioration of oil pump	Oil pump in Section 6A
	• Worn oil pump relief valve	Oil pump in Section 6A
	• Excessive clearance in various sliding parts	
Engine noise Note: Before checking mechanical noise, make sure that: • Specified spark plug in used. • Specified fuel is used.	**Valve noise**	
	• Improper valve lash	Valve lash in Section 6A
	• Worn valve stem and guide	Valves inspection in Section 6A
	• Weak or broken valve spring	Valve springs inspection in Section 6A
	• Warped or bent valve	Valves inspection in Section 6A
	Piston, ring and cylinder noise	
	• Worn piston, ring and cylinder bore	Pistons and cylinders inspection in Section 6A
	Connecting rod noise	
	• Worn rod bearing	Crank pin and connecting rod bearing inspection in Section 6A
	• Worn crank pin	Crank pin and connecting rod bearing inspection in Section 6A
	• Loose connecting rod nuts	Connecting rod installation in Section 6A
	• Low oil pressure	Previously outlined
	Crankshaft noise	
	• Low oil pressure	Previously outlined
	• Worn bearing	Crankshaft and bearing inspection in Section 6A
	• Worn crankshaft journal	Crankshaft and bearing inspection in Section 6A
	• Loose bearing cap bolts	Crankshaft inspection in Section 6A
	• Excessive crankshaft thrust play	Crankshaft thrust play inspection in Section 6A

Condition	Possible Cause	Referring Item
Overheating	● Inoperative thermostat	Thermostat in Section 6B
	● Poor water pump performance	Water pump in Section 6B
	● Clogged or leaky radiator	Radiator in Section 6B
	● Improper engine oil grade	Engine oil and oil filter change in Section 0B
	● Clogged oil filter or oil strainer	Oil pressure check in Section 6A
	● Poor oil pump performance	Oil pressure check in Section 6A
	● Faulty radiator fan control system	Radiator fan control system in Section 6E1
	● Dragging brakes	Trouble diagnosis in Section 5
	● Slipping clutch	Trouble diagnosis in Section 7C
	● Blown cylinder head gasket	Cylinder head in Section 6A
Poor gasoline mileage	**Ignition system out of order**	
	● Leaks or loose connection of high-tension cord	High-tension cords in Section 6F
	● Faulty spark plug (improper gap, heavy deposits and burned electrodes, etc.)	Spark plugs in Section 6F
	Engine and emission control system out of order	
	● High idle speed	Refer to item "Improper engine idle speed" previously outlined
	● Poor performance of TP sensor, ECT sensor or MAP sensor	TP sensor, ECT sensor or MAP sensor in Section 6E1
	● Faulty fuel injector	Diagnostic Flow Table B-1
	● Faulty fuel injector resistor	Fuel injector resistor in Section 6E1
	● Faulty ECM (PCM)	
	Low compression	Previously outlined
	Others	
	● Poor valve seating	Valves inspection in Section 6A
	● Dragging brakes	Trouble diagnosis in Section 5
	● Slipping clutch	Trouble diagnosis in Section 7C
	● Thermostat out of order	Thermostat in Section 6B
	● Improper tire pressure	Refer to Section 3F
Excessive engine oil consumption	**Oil leakage**	
	● Blown cylinder head gasket	Cylinder head in Section 6A
	● Leaky camshaft oil seals	Camshaft in Section 6A
	Oil entering combustion chamber	
	● Sticky piston ring	Piston cleaning in Section 6A
	● Worn piston and cylinder	Pistons and cylinders inspection in Section 6A
	● Worn piston ring groove and ring	Pistons inspection in Section 6A
	● Improper location of piston ring gap	Pistons assembly in Section 6A
	● Worn or damaged valve stem seal	Valves removal and installation in Section 6A
	● Worn valve stem	Valves inspection in Section 6A

Condition	Possible Cause	Referring Item
Engine hesitates (Momentary lack of response as accelerator is depressed. Can occur at all vehicle speeds. Usually most severe when first trying to make vehicle move, as from a stop sign.)	**Ignition system out of order** ● Spark plug faulty or plug gap out of adjustment ● Leaky high-tension cord **Fuel system out of order** ● Fuel pressure out of specification **Engine and emission control system out of order** ● Poor performance of TP sensor, ECT sensor or MAP sensor ● Faulty fuel injector ● Faulty ECM (PCM) **Engine overheating** **Low compression**	 Spark plugs in Section 6F High-tension cords in Section 6F Diagnostic Flow Table B-3 Trouble diagnosis in Section 6 TP sensor, ECT sensor or MAP sensor in Section 6E1 Diagnostic Flow Table B-1 Refer to “Overheating” section Previously outlined
Surge (Engine power variation under steady throttle or cruise. Feels like vehicle speeds up and down with no change in accelerator pedal.)	**Ignition system out of order** ● Leaky or loosely connected high-tension cord ● Faulty spark plug (excess carbon deposits, improper gap, and burned electrodes, etc.) **Fuel system out of order** ● Variable fuel pressure ● Kinky or damaged fuel hose and lines ● Faulty fuel pump (clogged fuel filter) **Engine and emission control system out of order** ● Poor performance of MAP sensor ● Faulty fuel injector ● Faulty ECM (PCM)	 High-tension cords in Section 6F Spark plugs in Section 6F Diagnostic Flow Table B-3 MAP sensor in Section 6E1 Diagnostic Flow Table B-1
Excessive detonation (Engine makes continuously sharp metallic knocks that change with throttle opening. Sounds like pop corn popping.)	**Engine overheating** **Ignition system out of order** ● Faulty spark plug ● Loose connection of high-tension cord **Fuel system out of order** ● Clogged fuel filter (faulty fuel pump) or fuel lines ● Air inhaling from intake manifold or throttle body gasket **Engine and emission control system out of order** ● Poor performance of ECT sensor or MAP sensor ● Faulty fuel injector ● Faulty ECM (PCM) ● Excessive combustion chamber deposits	Refer to “Overheating” section Spark plugs in Section 6F High-tension cords in Section 6F Diagnostic Flow Table B-1 or B-2 Trouble diagnosis in Section 6 ECT sensor or MAP sensor in Section 6E1 Diagnostic Flow Table B-1 Piston and cylinder head cleaning in Section 6A

Condition	Possible Cause	Referring Item
Engine has no power	**Ignition system out of order**	
	● Faulty spark plug	Spark plugs in Section 6F
	● Faulty ignition coil with ignitor	Ignition coil in Section 6F
	● Leaks, loose connection or disconnection of high-tension cord	High-tension cords in Section 6F
	Engine overheating	Refer to “Overheating” section
	Fuel system out of order	
	● Clogged fuel hose or pipe	Diagnostic Flow Table B-3 in Section 6
	● Malfunctioning fuel pump	Diagnostic Flow Table B-2
	● Air inhaling from intake manifold gasket or throttle body gasket	
	Engine and emission control system out of order	
	● Maladjusted accelerator cable play	Accelerator cable play in Section 6E1
	● Poor performance of TP sensor, ECT sensor or MAP sensor	TP sensor, ECT sensor or MAP sensor in Section 6E1
	● Faulty fuel injector	Diagnostic Flow Table B-1
	● Faulty ECM (PCM)	
	Low compression	Previously outlined
	Others	
	● Dragging brakes	Trouble diagnosis in Section 5
	● Slipping clutch	Trouble diagnosis in Section 7C

Condition	Possible Cause	Referring Item
Improper engine idling or engine fails to idle	**Ignition system out of order**	
	● Faulty spark plug	Spark plugs in Section 6F
	● Leaky or disconnected high-tension cord	High-tension cords in Section 6F
	● Faulty ignition coil with ignitor	Ignition coil in Section 6F
	Fuel system out of order	
	● Fuel pressure out of specification	Diagnostic Flow Table B-3 in Section 6
	● Leaky manifold, throttle body, or cylinder head gasket	
	Engine and emission control system out of order	
	● Faulty idle control system	Diagnostic Flow Table P0505
	● Faulty evaporative emission control system	EVAP control system in Section 6E
	● Faulty fuel injector	Diagnostic Flow Table B-1
	● Faulty fuel injector resistor	Fuel injector resistor in Section 6E1
	● Poor performance of ECT sensor, TP sensor or MAP sensor	ECT sensor, TP sensor or MAP sensor in Section 6E1
	● Faulty ECM (PCM)	
	Engine overheating	Refer to “Overheating” section
	Low compression	Previously outlined
	Others	
	● Loose connection or disconnection of vacuum hoses	
	● Malfunctioning PCV valve	PCV system in Section 6E1

Condition	Possible Cause	Referring Item
Excessive hydrocarbon (HC) emission or carbon monoxide (CO)	**Ignition system out of order** ● Faulty spark plug ● Leaky or disconnected high-tension cord ● Faulty ignition coil with ignitor **Low compression** **Engine and emission control system out of order** ● Lead contamination of three way catalytic converter ● Faulty evaporative emission control system ● Fuel pressure out of specification ● Closed loop system (A/F feed back compensation) fails – Faulty TP sensor – Poor performance of ECT sensor or MAP sensor ● Faulty injector ● Faulty fuel injector resistor ● Faulty ECM (PCM) **Others** ● Engine not at normal operating temperature ● Clogged air cleaner ● Vacuum leaks	 Spark plugs in Section 6F High-tension cords in Section 6F Ignition coil assembly in Section 6F Refer to “Low compression” section Check for absence of filler neck restrictor EVAP control system in Section 6E1 Diagnostic Flow Table B-3 TP sensor in Section 6E1 ECT sensor or MAP sensor in Section 6E1 Diagnostic Flow Table B-1 Fuel injector resistor in Section 6E1
Excessive nitrogen oxides (NOx) emission	**Ignition system out of order** ● Improper ignition timing **Engine and emission control system out of order** ● Lead contamination of catalytic converter ● Fuel pressure out of specification ● Closed loop system (A/F feed back compensation) fails – Faulty TP sensor – Poor performance of ECT sensor or MAP sensor ● Faulty injector ● Faulty fuel injector resistor ● Faulty ECM (PCM)	 See section 6F1 Check for absence of filler neck restrictor. Diagnostic Flow Table B-3 TP sensor in Section 6E1 ECT sensor or MAP sensor in Section 6E1 Diagnostic Flow Table B-1 Fuel injector resistor in Section 6E1

SCAN TOOL DATA

As the data values given below are standard values estimated on the basis of values obtained from the normally operating vehicles by using a scan tool, use them as reference values. Even when the vehicle is in good condition, there may be cases where the checked value does not fall within each specified data range. Therefore, judgment as abnormal should not be made by checking with these data alone.
Also, conditions in the below table that can be checked by the scan tool are those detected by ECM (PCM) and output from ECM (PCM) as commands and there may be cases where the engine or actuator is not operating (in the condition) as indicated by the scan tool. Be sure to use the timing light to check the ignition timing.

NOTE:
- **With the generic scan tool, only star (☆) marked data in the table below can be read.**
- **When checking the data with the engine running at idle or racing, be sure to shift M/T gear to the neutral gear position and A/T gear to the “Park” position and pull the parking brake fully. Also, if nothing or “no load” is indicated, turn OFF A/C, all electric loads, P/S and all the other necessary switches.**

	SCAN TOOL DATA	VEHICLE CONDITION		NORMAL CONDITION/ REFERENCE VALUES
☆	FUEL SYSTEM B1 (FUEL SYSTEM STATUS)	At specified idle speed after warming up		CLOSED (closed loop)
☆	CALC LOAD (CALCULATED LOAD VALUE)	At specified idle speed with no load after warming up		3 – 5%
		At 2500 r/min with no load after warming up		10 – 18%
☆	COOLANT TEMP. (ENGINE COOLANT TEMP.)	At specified idle speed after warming up		85 – 95°C, 185 – 203°F
☆	SHORT FT BI (SHORT TERM FUEL TRIM)	At specified idle speed after warming up		–20 – +20%
☆	LONG FT BI (LONG TERM FUEL TRIM)	At specified idle speed after warming up		–15 – +15%
☆	MAP (INTAKE MANIFOLD ABSOLUTE PRESSURE)	At specified idle speed with no load after warming up		29 – 48 kPa, 220 – 360 mmHg
☆	ENGINE SPEED	At idling with no load after warming up		Desired idle speed ± 50 r/min
☆	VEHICLE SPEED	At stop		0 km/h, 0 MPH
☆	IGNITION ADVANCE (IGNITION TIMING ADVANCE FOR NO.1 CYLINDER)	At specified idle speed with no load after warming up		–1 – 18° BTDC
☆	INTAKE AIR TEMP.	At specified idle speed after warming up		Ambient temp. +35°C (+63°F) –5°C (–9°F)
☆	MAF (MASS AIR FLOW RATE)	At specified idle speed with no load after warming up		1.0 – 3.0 gm/sec
		At 2500 r/min with no load after warming up		3.0 – 6.0 gm/sec
☆	THROTTLE POS (ABSOLUTE THROTTLE POSITION)	Ignition switch ON/ engine stopped	Throttle valve fully closed	7 – 18%
			Throttle valve fully open	70 – 90%
☆	O2S B1 S1 (HEATED OXYGEN SENSOR-1)	At specified idle speed after warming up		0.05 – 0.95 V
☆	O2S B1 S2 (HEATED OXYGEN SENSOR-2)	When engine is running at 2000 r/min. for 3 min. or longer after warming up.		0 – 0.95 V
☆	O2S FT B1 S1	At specified idle speed after warning up		–20 – +20%
☆	DIS. WITH MIL ON	——		——

	SCAN TOOL DATA	CONDITION		NORMAL CONDITION/ REFERENCE VALUES	
	DESIRED IDLE (DESIRED IDLE SPEED)	At idling with no load after warming up, M/T at neutral, A/T at "P" range		850 r/min	
	TP SENSOR VOLT (THROTTLE POSITION SENSOR OUTPUT VOLTAGE)	Ignition switch ON/engine stopped	Throttle valve fully closed	More than 0.2 V	
			Throttle valve fully open	Less than 4.8 V	
	INJ PULSE WIDTH (FUEL INJECTION PULSE WIDTH)	At specified idle speed with no load after warming up		0.8 – 2.3 msec.	
		At 2500 r/min with no load after warming up		0.8 – 2.3 msec.	
	IAC FLOW DUTY (IDLE AIR CONTROL FLOW DUTY)	At idling with no load after warming up		20 – 40%	
	TOTAL FUEL TRIM	At specified idle speed after warming up		–35 – +35%	
	BATTERY VOLTAGE	Ignition switch ON/engine stop		10 – 14 V	
	CANIST PRG DUTY (EVAP CANISTER PURGE FLOW DUTY)	At specified idle speed after warming up		0 – 100%	
	CLOSED THROT POS (CLOSED THROTTLE POSITION)	Throttle valve at idle position		ON	
		Throttle valve opens larger than idle position		OFF	
	FUEL CUT	When engine is at fuel cut condition		ON	
		Other than fuel cut condition		OFF	
	RAD FAN (RADIATOR FAN CONTROL RELAY)	Ignition switch ON	Engine coolant temp.: Lower than 92.5°C (199°F)	OFF	
			Engine coolant temp.: 97.5°C (208°F) or higher	ON	
	ELECTRIC LOAD	Ignition switch ON/Headlight, small light, heater fan and rear window defogger all turned OFF		OFF	
		Ignition switch ON/Headlight, small light, heater fan or rear window defogger turned ON		ON	
	A/C SWITCH	Engine running after warming up, A/C not operating		OFF	
		Engine running after warming up, A/C operating		ON	
	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	
	FUEL TANK LEVEL	————		0 – 100%	
	BAROMETRIC PRESS	————		Display the barometric pressure	
	FUEL PUMP	Within 3 seconds after ignition switch ON or engine running		ON	
		Engine stop at ignition switch ON.		OFF	

	SCAN TOOL DATA	CONDITION	NORMAL CONDITION/ REFERENCE VALUES
	VSS (for 4-A/T) (Vehicle Speed Sensor)	At stop.	0 km/h 0 MPH
	SHIFT SOL1 CON (Command Signal) MON (Monitor Signal) SHIFT SOL2 CON (Command Signal) MON (Monitor Signal)	Ignition switch ON, selector lever is shifted at P, R or N range	OFF
		Ignition switch ON, selector lever is shifted at D range and vehicle stops	ON
	THROT POS LEVEL (THROTTLE POSITION LEVER FOR A/T)	"0" (about idle position), "1", "2", "3", "4", "5", "6" or "7" (about full open) appears according to throttle valve opening.	
	TRANS. RANGE (TRANSMISSION RANGE SENSOR)	"P", "R", "N", "D", "2" or "L" appears according tho selector lever position.	
	GEAR POSITION	Select lever at D, 2 or L range	1
		Select lever at P, N or R range	–

SCAN TOOL DATA DEFINITIONS

FUEL SYSTEM (FUEL SYSTEM STATUS)

Air/fuel ratio feedback loop status displayed as either open or closed loop. Open indicates that ECM (PCM) ignores feedback from the exhaust oxygen sensor. Closed indicates final injection duration is corrected for oxygen sensor feedback.

CALC LOAD (CALCULATED LOAD VALUE, %)

Engine load displayed as a percentage of maximum possible load. Value is calculated mathematically using the formula: actual (current) intake air volume ÷ maximum possible intake air volume x 100%.

COOLANT TEMP. (ENGINE COOLANT TEMPERATURE, °C, °F)

It is detected by engine coolant temp. sensor

SHORT FT B1 (SHORT TERM FUEL TRIM, %)

Short term fuel trim value represents short term corrections to the air/fuel mixture computation. A value of 0 indicates no correction, a value greater than 0 means an enrichment correction, and a value less than 0 implies an enleanment correction.

LONG FT B1 (LONG TERM FUEL TRIM, %)

Long term fuel trim Value represents long term corrections to the air/fuel mixture computation. A value of 0 indicates no correction, a value greater than 0 means an enrichment correction, and a value less than 0 implies an enleanment correction.

MAP (INTAKE MANIFOLD ABSOLUTE PRESSURE, kPa, inHg)

It is detected by manifold absolute pressure sensor and used (among other things) to compute engine load.

ENGINE SPEED (rpm)

It is computed by reference pulses from crankshaft position sensor.

VEHICLE SPEED (km/h, MPH)

It is computed based on pulse signals from vehicle speed sensor.

IGNITION ADVANCE (IGNITION TIMING ADVANCE FOR NO.1 CYLINDER, °)

Ignition timing of NO.1 cylinder is commanded by ECM (PCM). The actual ignition timing should be checked by using the timing light.

INTAKE AIR TEMP. (°C, °F)

It is detected by intake air temp. sensor and used to determine the amount of air passing into the intake manifold as air density varies with temperature.

MAF (MASS AIR FLOW RATE, gm/s, lb/min)

It represents total mass of air entering intake manifold which is computed based on signals from MAP sensor, IAT sensor, TP sensor, etc.

THROTTLE POS (ABSOLUTE THROTTLE POSITION, %)

When throttle position sensor is fully closed position, throttle opening is indicated as 0% and 100% full open position.

OXYGEN SENSOR B1 S1 (HEATED OXYGEN SENSOR-1, V)

It indicates output voltage of HO2S-1 installed on exhaust manifold (pre-catalyst).

OXYGEN SENSOR B1 S2 (HEATED OXYGEN SENSOR-2, V)

It indicates output voltage of HO2S-2 installed on exhaust pipe (post-catalyst). It is used to detect catalyst deterioration.

DESIRED IDLE (DESIRED IDLE SPEED, rpm)

The Desired Idle Speed is an ECM (PCM) internal parameter which indicates the ECM (PCM) requested idle. If the engine is not running, this number is not valid.

TP SENSOR VOLT (THROTTLE POSITION SENSOR OUTPUT VOLTAGE, V)

The Throttle Position Sensor reading provides throttle valve opening information in the form of voltage.

INJ PULSE WIDTH (FUEL INJECTION PULSE WIDTH, msec.)

This parameter indicates time of the injector drive (valve opening) pulse which is output from ECM (PCM) (but injector drive time of NO.1 cylinder for multiport fuel injection).

IAC FLOW DUTY (IDLE AIR (SPEED) CONTROL DUTY, %)

This parameter indicates opening of the throttle valve in terms of percentage to opening controllable by the ISC actuator.

TOTAL FUEL TRIM (%)

The value of Total Fuel Trim is obtained by putting values of short Term Fuel Trim and Long Term Fuel Trim together. This value indicates how much correction is necessary to keep the air/fuel mixture stoichiometrical.

BATTERY VOLTAGE (V)

This parameter indicates battery positive voltage inputted from main relay to ECM (PCM).

CANIST PURGE DUTY (EVAP CANISTER PURGE FLOW DUTY, %)

This parameter indicates valve ON (valve open) time rate within a certain set cycle of EVAP purge solenoid valve which controls the amount of EVAP purge.
0% means that the purge valve is completely closed while 100% is a fully open valve.

CLOSED THROTTLE POSITION (ON/OFF)

This parameter will read ON when throttle valve is fully closed, or OFF when the throttle is not fully closed.

FUEL CUT (ON/OFF)

ON : Fuel being cut (output signal to injector is stopped)
OFF : Fuel not being cut

RAD FAN (RADIATOR FAN CONTROL RELAY, ON/OFF)

ON : Command for radiator fan control relay operation being output.
OFF : Command for relay operation not being output.

ELECTRIC LOAD (ON/OFF)

ON : Headlight, small light, heater fan or rear window defogger ON signal inputted.
OFF : Above electric loads all turned OFF.

A/C SWITCH (ON/OFF)

ON : Command for A/C operation being output from ECM (PCM) to A/C amplifier.
OFF : Command for A/C operation not being output.

FUEL TANK LEVEL (%)

This parameter indicates approximate fuel level in the fuel tank. As the detectable range of the fuel level sensor is set as 0 to 100%, however, with some models whose fuel tank capacity is smaller, the indicated fuel level may be only 70% even when the fuel tank is full.

PSP SWITCH (ON/OFF)

ON : PSP switch detects P/S operation (high PS pressure).
OFF : PSP switch not detects P/S operation.

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 ISC actuator control.

FUEL PUMP (ON/OFF)

ON is displayed when the ECM (or PCM) activates the fuel pump via the fuel pump relay switch.

VSS (A/T) (km/h, MPH)

If is computed by using pulse signals from vehicle (output) speed sensor on automatic transmission.

TRANS RANGE (TRANSMISSION RANGE SENSOR, P, R, N, D, 2 OR L)

It is indicated transmission range detected by transmission range sensor.

SHIFT SOL 1-CON (SHIFT SOLENOID-1, ON/OFF)

ON : ON command being output to shift solenoid-1
OFF : ON command not being output.

SHIFT SOL 2-CON (SHIFT SOLENOID-2, ON/OFF)

ON : ON command being output to shift solenoid-2
OFF : ON command not being output.

SHIFT SOL 1-MON (SHIFT SOLENOID-1, ON/OFF)

The monitor result of the shift solenoid-1 circuit is displayed.
ON : Electricity being passed to shift solenoid-1 or circuit open.
OFF : Electricity not being passed or circuit short.

SHIFT SOL 2-MON (SHIFT SOLENOID-2, ON/OFF)

The monitor result of the shift solenoid-2 circuit is displayed.
ON : Electricity being passed to shift solenoid-2 or circuit open.
OFF : Electricity not being passed or circuit short.

THROT POS LEVEL (THROTTLE POSITION LEVEL FOR A/T, "0", "1", "2", "3", "4", "5", "6" or "7")

This parameter indicates which level (zone) the throttle valve opening is in. The throttle opening is divided into 8 levels (zones) from "0" (about idle position) to "7" (about full open) and signals are assigned to each opening level (zone). ECM (PCM) control the automatic gear change of the automatic transmission by using these signals according to the signal from the TP sensor.

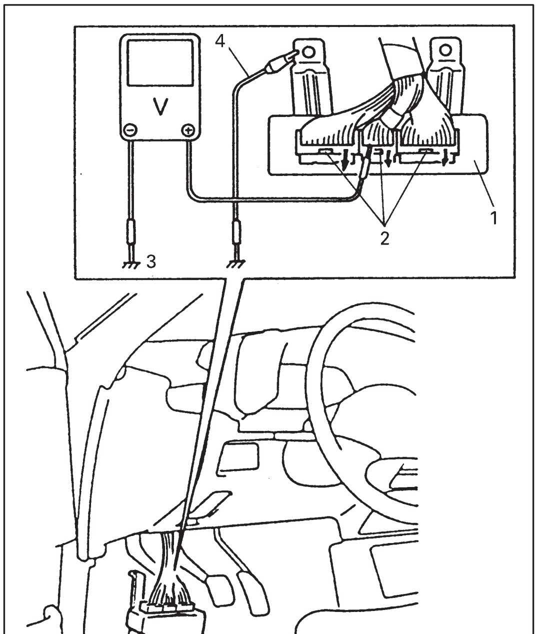
GEAR POSITION

This parameter indicates the A/T gear position which is computed on signals from the Transmission Range Switch, VSS, TP Sensor, and so forth.

INSPECTION OF ECM (PCM) AND ITS CIRCUITS

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

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

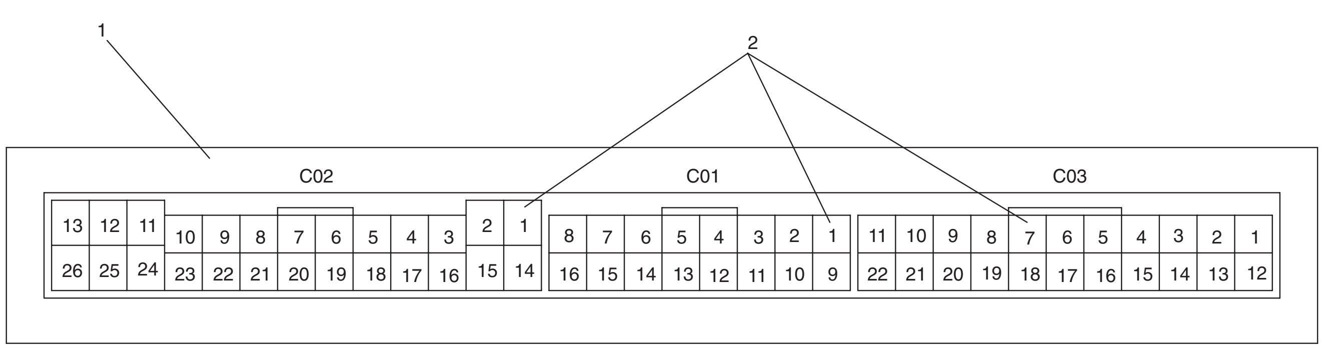


1. ECM (PCM)
2. Couplers
3. Body ground
4. Service wire

Voltage Check

1) Remove ECM (PCM) (1) from body referring to Section 6E.
2) Check voltage at each terminal of couplers (2) 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.

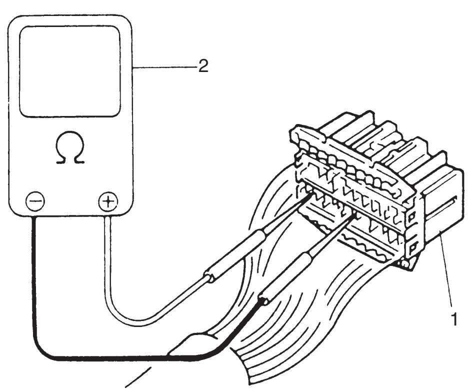


1. ECM (PCM)
2. ECM (PCM) couplers (Viewed from harness side)

	TER-MINAL	WIRE COLOR	CIRCUIT	STANDARD VOLTAGE	CONDITION
CONNECTOR "C02"	1	B	ECM (PCM) ground	–	–
	2	W/Bl	Power source	10 – 14 V	Ignition switch ON
	3	—	Blank	—	—
	4	—	Blank	—	—
	5	—	Blank	—	—
	6	—	Blank	—	—
	7	R/G	EVAP canister purge valve	10 – 14 V	Ignition switch ON
	8	G/Or	Shift solenoid-B (A/T)	0 V	Ignition switch ON, selector lever at "P" range
				10 – 14 V	Ignition switch ON, selector lever at "D" range
	9	G/W	Shift solenoid-A (A/T)	0 V	Ignition switch ON, selector lever at "P" range
				10 – 14 V	Ignition switch ON, selector lever at "D" range
	10	Or	Igniter (IGT)	—	—
	11	Gr/Y	ISC actuator	—	—
	12	Y/B	Fuel injector	10 – 14 V	Ignition switch ON
	13	B/Bl	Ground for injector	—	—
	14	W	Power source for back-up	10 – 14 V	Ignition switch ON and OFF
	15	W/Bl	Power source	10 – 14 V	Ignition switch ON
	16	Gr/B	ISC actuator relay	0.3 – 1.0 V	Ignition switch ON
	17	V/Y	Malfunction indicator lamp	0.2 – 2.0 V	Ignition switch ON
				10 – 14 V	When engine running
	18	V/G	Immobilizer indicator lamp	0.2 – 2.0 V	Ignition switch ON
				10 – 14 V	When engine running at idle
	19	Lg/B	Heater of H02S-2	10 – 14 V	Ignition switch ON
	20	Bl	Radiator fan control relay	10 – 14 V	Ignition switch ON, Engine coolant temp: Below 91.5°C (197°F)
				0.3 – 1.0 V	Ignition switch ON, Engine coolant temp: 96.0°C (205°F) or higher
	21	P/W	Fuel pump relay	0.3 – 1.3 V	For 2 seconds after ignition switch ON
				10 – 14 V	After the above time
	22	Bl/B	Main relay	0.4 – 1.5 V	Ignition switch ON
	23	–	Blank	—	—
	24	Gr/R	ISC actuator	—	—
	25	Y/R	EFE heater relay	10 – 14 V	Ignition switch ON
	26	B/R	Ground for injector	—	—

	TER-MINAL	WIRE COLOR	CIRCUIT	STANDARD VOLTAGE	CONDITION
CONNECTOR "C01"	1	Lg	Power source for sensor	4.75 – 5.25 V	Ignition switch ON
	2	Or	Camshaft position sensor (+)	—	—
	3	W/B	Crankshaft position sensor (+)	—	—
	4	Gr/G	Closed throttle position switch (In ISC actuator)	0 – 1 V	Ignition switch ON, ISC actuator plunger is in contact with throttle lever screw
				4 – 6 V	Ignition switch ON Plunger is apart from throttle lever screw
	5	Lg/R	Manifold absolute pressure sensor	3.3 – 4.0 V	Ignition switch ON Barometric pressure: 100 kPa, 760 mmHg
	6	Lg/W	Throttle position sensor	0.2 – 1.0 V	Ignition switch ON, when clearance between throttle lever and throttle stop screw is less than 0.35 mm (0.014 in.)
				2.8 – 4.8 V	Ignition switch ON Throttle valve at full open position
	7	Gr/W	Engine coolant temp. sensor	0.55 – 0.95 V	Ignition switch ON Engine coolant temp.: 80°C (176°F)
	8	P/B	Heater of H02S-1	10 – 14 V	Ignition switch ON
	9	G	Ground for sensors	—	—
	10	W	Camshaft position sensor (–)	—	—
	11	W/R	Crankshaft position sensor (+)	—	—
	12	W/B	EFE heater monitor	0 – 1 V	Heater relay OFF
				10 – 14 V	Heater relay ON
	13	R	Heated oxygen sensor-1	Refer to DTC flow chart	
	14	Gr	Intake air temp. sensor	2.0 – 2.7 V	Ignition switch ON Sensor ambient temp. (Intake air temp): 20°C (68°F)
	15	Bl/W	Power steering pressure switch (If equipped)	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, repeating it a few times
	16	B/Y	Engine start switch (Engine start signal)	6 – 12 V	While engine cranking
				0 – 1 V	Other than above

	TER-MINAL	WIRE COLOR	CIRCUIT		STANDARD VOLTAGE	CONDITION	
CONNECTOR “C03”	1	V/W	Data link connector (SUZUKI serial data line)		4 – 6 V	Ignition switch ON	
	2	Bl	Vehicle speed sensor (+) (A/T)		0.4 – 0.8 V	Ignition switch ON	
		Y/G	Vehicle speed sensor (M/T)		Indicator deflection repeated 0 V and 4 – 6 V	Ignition switch ON Front left tire turned slowly with front right tire locked	
	3	G	Transmis-sion range sensor (switch) (A/T only).	“2” range	10 – 14 V	Ignition switch ON, Selector lever at “2” range	
	4	Or/Y		“N” range		Ignition switch ON, Selector lever at “N” range	
	5	Or/B		“P” range		Ignition switch ON, Selector lever at “P” range	
	6	—	Blank		–	—	
	7	—	Blank		–	—	
	8	R	Heated oxygen sensor-2		Refer to DTC flow chart		
	9	—	—		—	—	
	10	Y/R	Fuel level sensor (gauge)		0 – 1.5 V	Ignition switch ON, fuel tank fully filled	
					3 – 5.5 V	Ignition switch ON, fuel tank emptied	
	11	—	Blank		—	—	
	12	R/G	Data link connector (OBD serial data line)		10 – 14 V	Ignition switch ON	
	13	P	Vehicle speed sensor (–) (A/T)		0.4 – 0.8 V	Ignition switch ON	
	14	G/Bl	Transmis-sion range sensor (switch) (A/T)	“L” range	10 – 14 V	Ignition switch ON	Selector lever at “L” range
	15	G/R		“D” range			Selector lever at “D” range
	16	R		“R” range			Selector lever at “R” range
	17	Lg/R	A/C ON (output) signal for A/C controller (if equipped)		0 – 1 V	While engine running and A/C not operating	
					10 – 14 V	While engine running and A/C operating	
	18	Br/Y	Electric load signal		0 –1 V	Ignition switch ON Headlight, small light, heater fan and rear window defogger turned OFF	
					10 – 14 V	Ignition switch ON Headlight, small light, heater fan and rear window defogger turned ON	
	19	Bl/R	A/C (input) signal for A/C amplifier		10 – 14 V	While engine running and A/C not operating	
					0 – 0.6 V	While engine running and A/C operating	
	20	B/W	Ignition switch		10 – 14 V	Ignition switch ON	
	21	—	Blank		—	—	
	22	—	Blank		—	—	



1. ECM (PCM) coupler disconnected
2. Ohmmeter

RESISTANCE CHECK

1) Disconnect ECM (PCM) couplers from ECM (PCM) with ignition switch OFF.

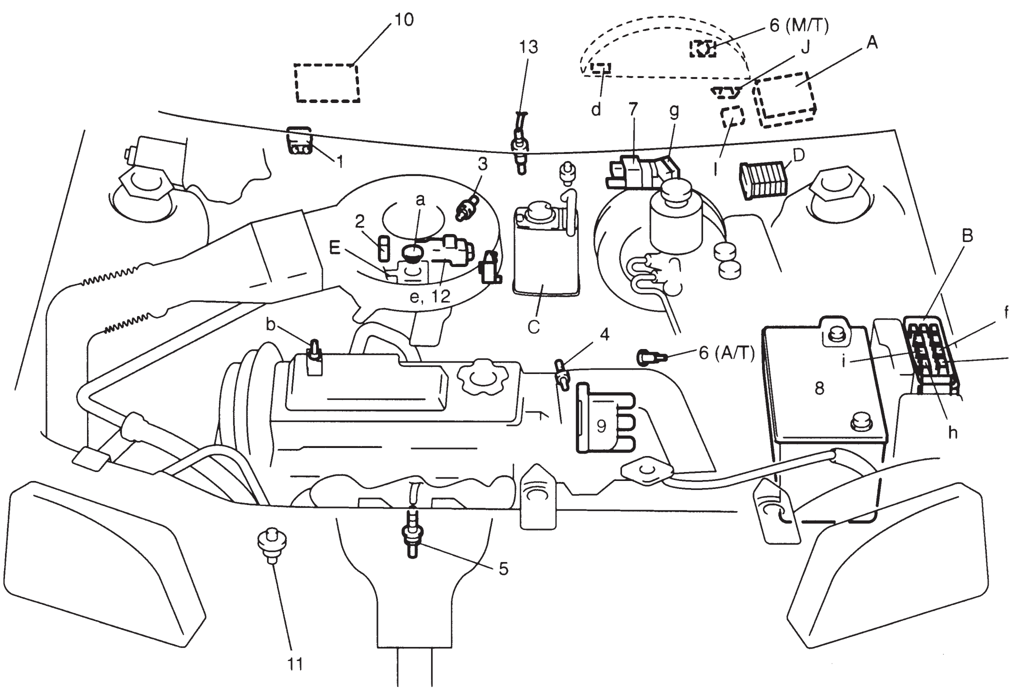
CAUTION:
Never touch terminals of ECM (PCM) itself or connect voltmeter or ohmmeter.

2) Check resistance between each terminal of couplers disconnected.

CAUTION:
- **Be sure to connect ohmmeter probe from wire harness side of coupler.**
- **Be sure to turn OFF ignition switch for this check.**
- **Resistance in table below represents that when parts temperature is 20°C (68°F).**

TERMINALS	CIRCUIT	STANDARD RESISTANCE
C01-8 to C03-20	H02S-1 heater	11.7 – 14.3 Ω
C02-19 to C03-20	H02S-2 heater	11.7 – 14.3 Ω
C02-12 to C02-2/15	Fuel injector	2.4 – 3.6 Ω
C02-7 to C02-2/15	EVAP canister purge valve	30 – 34 Ω
C02-21 to C03-20	Fuel pump relay	100 – 120 Ω
C02-16 to C02-2/15	ISC actuator relay	100 – 120 Ω
C02-25 to C02-2/15	EFE heater relay	100 – 120 Ω
C02-8 to Body ground	Shift solenoid-B	8 – 20 Ω
C02-9 to Body ground	Shift solenoid-A	8 – 20 Ω
C02-20 to C02-2/15	Radiator fan control relay	100 – 120 Ω
C02-22 to C02-14	Main relay	100 – 120 Ω
C02-1 to Body ground	Ground	Continuity
C02-13 to Body ground	Ground	Continuity
C02-26 to Body ground	Ground	Continuity

COMPONENT LOCATION



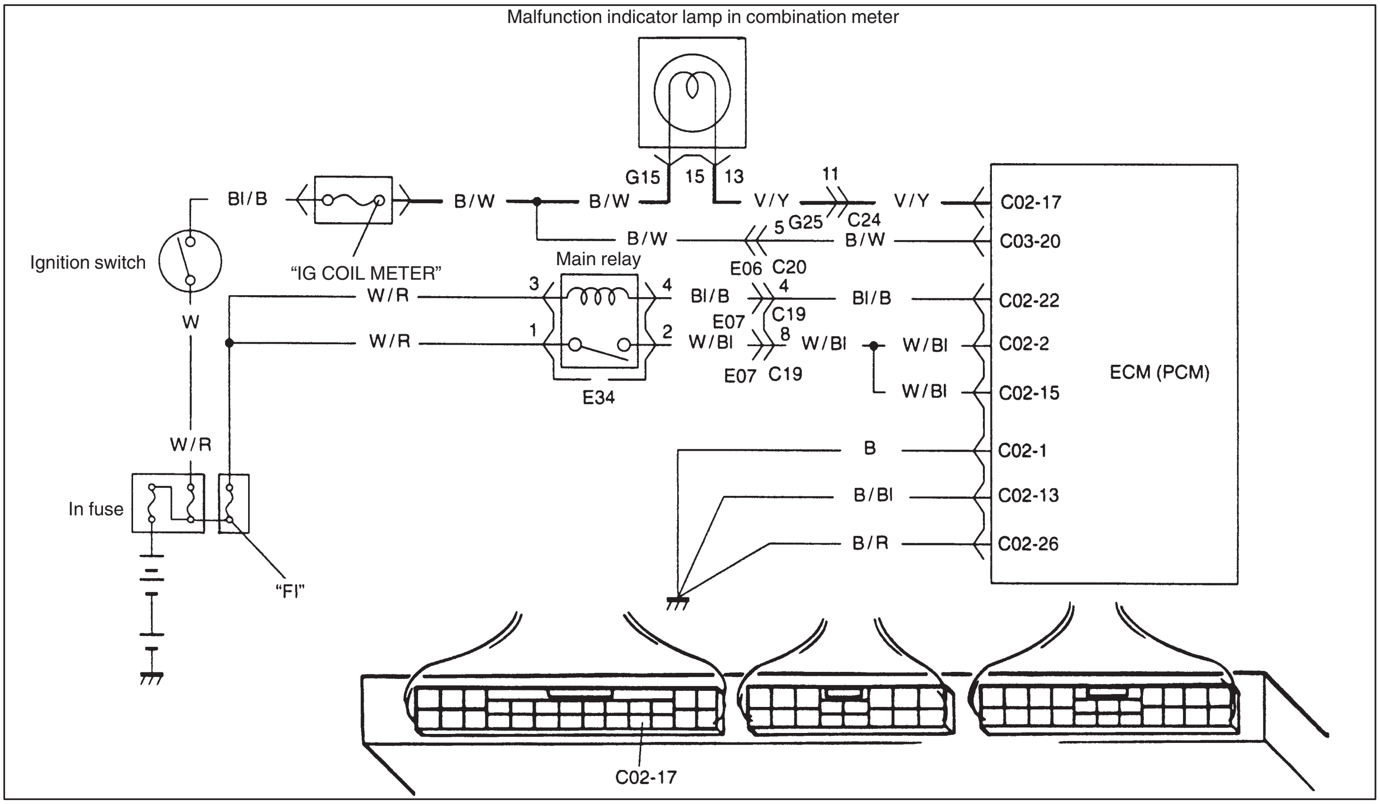
INFORMATION SENSORS
1. MAP sensor
2. TP sensor
3. IAT sensor
4. ECT sensor
5. Heated oxygen sensor-1
6. VSS
7. Ignition coil
8. Battery
9. CMP sensor (in Distributor)
10. A/C contoller (if equipped)
11. CKP sensor
12. CTP switch (in ISC actuator)
13. Heated oxygen sensor-2

CONTROL DEVICES
- a: Fuel injector
- b: EVAP canister purge valve
- c: Fuel pump relay
- d: Malfunction indicator lamp
- e: ISC actuator
- f: Radiator fan control relay
- g: Igniter
- h: EFE heater relay
- i: ISC actuator relay

OTHERS
- A: ECM (PCM)
- B: Main relay
- C: EVAP canister
- D: Injector resistor
- E: EFE heater
- F: Electric load diode

TABLE A-1 MALFUNCTION INDICATOR LAMP CIRCUIT CHECK – LAMP DOES NOT COME "ON" AT IGNITION SWITCH ON (BUT ENGINE AT STOP)

CIRCUIT DESCRIPTION



When the ignition switch is turned ON, ECM (PCM) causes the main relay to turn ON (close the contact point). Then, ECM (PCM) being supplied with the main power, turns ON the malfunction indicator lamp (MIL). When the engine starts to run and no malfunction is detected in the system, MIL goes OFF but if a malfunction was or is detected, MIL remains ON even when the engine is running.

INSPECTION

STEP	ACTION	YES	NO
1	MIL Power Supply Check 1) Turn ignition switch ON. Do other indicator/warning lights in combination meter comes ON?	Go to Step 2.	"IG COIL METER" fuse blown, main fuse blown, ignition switch malfunction, "B/W" circuit between "IG COIL METER" fuse and combination meter or poor coupler connection at combination meter.
2	ECM (PCM) Power and Ground Circuit Check Does engine start?	Go to Step 3.	Go to TABLE A-3 ECM (PCM) POWER AND GROUND CIRCUIT CHECK. If engine is not cranked, go to DIAGNOSIS in SECTION 8A.
3	MIL Circuit Check 1) Turn ignition switch OFF and disconnect connectors from ECM (PCM). 2) Check for proper connection to ECM (PCM) at terminal C02-17. 3) If OK, then using service wire, ground terminal C02-17 in connector disconnected. Does MIL turn on at ignition switch ON?	Substitute a known-good ECM (PCM) and recheck.	Bulb burned out or "V/Y" wire circuit open.

TABLE A-2 MALFUNCTION INDICATOR LAMP CIRCUIT CHECK – LAMP REMAINS “ON” AFTER ENGINE STARTS

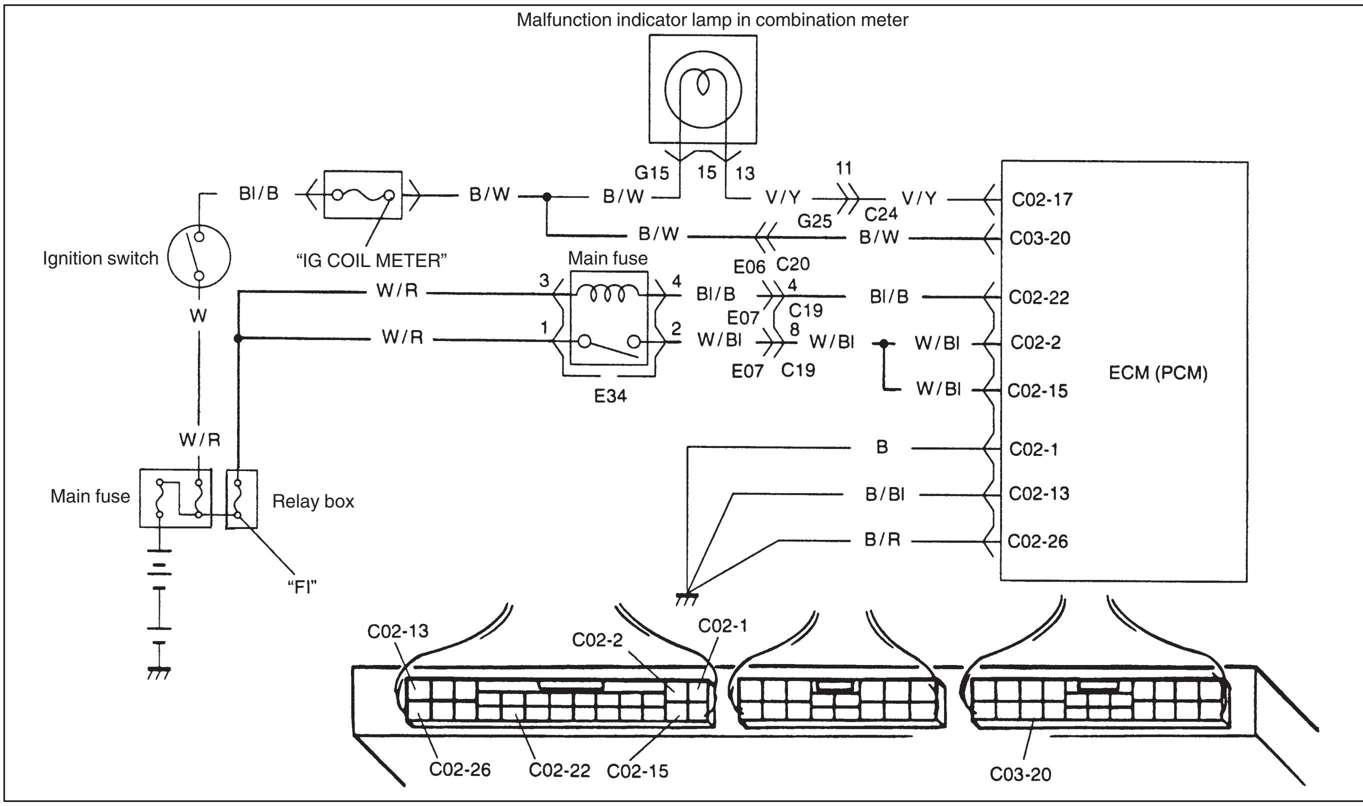
WIRING DIAGRAM/CIRCUIT DESCRIPTION – Refer to table A-1.

INSPECTION

<table>
<tr><th>STEP</th><th>ACTION</th><th>YES</th><th>NO</th></tr>
<tr><td>1</td><td>Diagnostic Trouble Code (DTC) check
1) Check DTC referring to DTC CHECK section.
Is there any DTC(s)?</td><td rowspan="2">Go to Step 2 of ENGINE DIAG. FLOW TABLE.</td><td>Go to Step 2.</td></tr>
<tr><td>2</td><td>DTC check
Start engine and recheck DTC while engine running.
Is there any DTC(s)?</td><td>Go to Step 3.</td></tr>
<tr><td>3</td><td>MIL Circuit check
1) Turn OFF ignition switch.
2) Disconnect connectors from ECM (PCM).
Does MIL turn ON at ignition switch ON?</td><td>“V/Y” wire circuit shorted to ground.</td><td>Substitute a known-good ECM (PCM) and recheck.</td></tr>
</table>

TABLE A-3 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

CIRCUIT DESCRIPTION



When the ignition switch tuned ON, the main relay turns ON (the contact point closes) and the main power is supplied to ECM (PCM).

INSPECTION

STEP	ACTION	YES	NO
1	Main Relay Operating Sound Check Is operating sound of main relay heard at ignition switch ON?	Go to Step 5.	Go to Step 2.
2	Main Relay Check 1) Turn OFF ignition switch and remove main relay (1). 2) Check for proper connection to main relay (1) at terminal 3 and 4. 3) Check resistance between each two terminals. See Fig. 1 and 2. Between terminals 1 and 2: Infinity Between terminals 3 and 4: 100 – 120 Ω 4) Check that there is continuity between terminals 1 and 2 when battery is connected to terminals 3 and 4. See Fig. 3. Is main relay in good condition?	Go to Step 3.	Replace main relay.
3	Fuse Check Is main "FI" fuse in good condition?	Go to Step 4.	Check for short in circuits connected to this fuse.
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 C03-20, C02-2, C02-15 and C02-22. 3) If OK, then measure voltage between terminal C03-20 and ground, C02-22 and ground with ignition switch ON. Is each voltage 10 – 14 V?	Go to Step 5.	"B/W", "W/R" or "Bl/B" circuit open.

STEP	ACTION	YES	NO
5	ECM (PCM) Power Circuit Check 1) Using service wire, ground terminal C02-22 and measure voltage between terminal C02-2 and ground at ignition switch ON. Is it 10 – 14 V?	Check ground circuits “Bl/B” and “W/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.	“W/R” or “W/Bl” wire open.
7	Main Relay Check 1) Check main relay according to procedure in Step 2. Is main relay in good condition?	“W/R” or “W/Bl” wire open.	Replace main relay.

Fig. 1 for Step 2

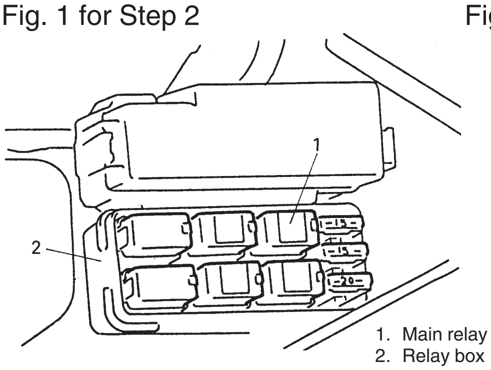


Fig. 2 for Step 2

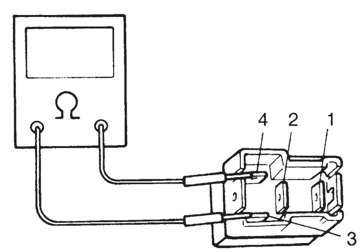
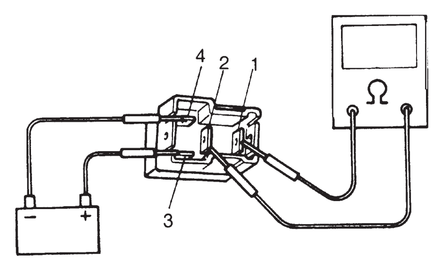
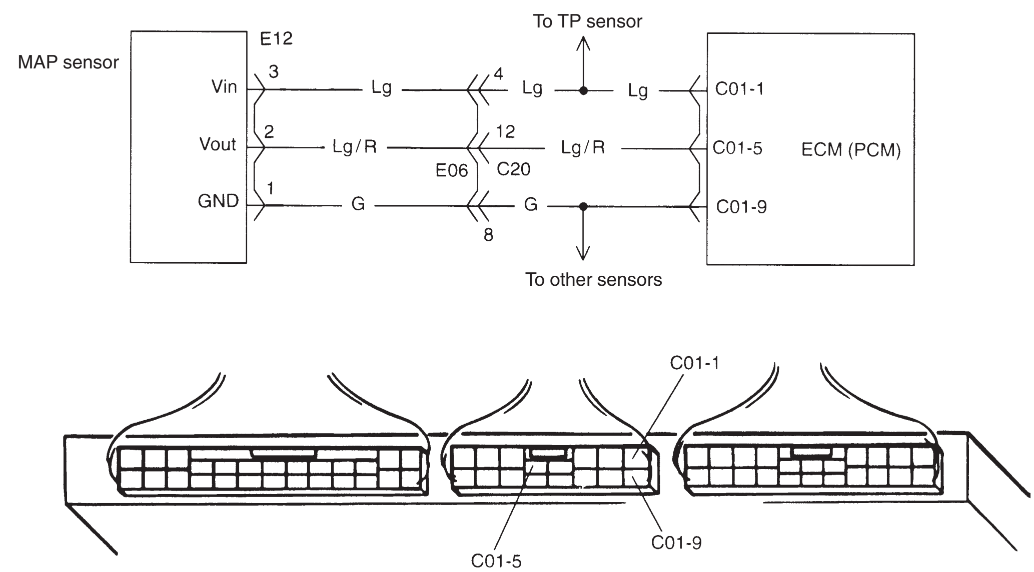


Fig. 3 for Step 2



DTC P0105 MANIFOLD ABSOLUTE PRESSURE (MAP) CIRCUIT MALFUNCTION

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
• MAP: 5 kPa, 37.5 mmHg or less (Low pressure – High vacuums – Low voltage) or • MAP: 130 kPa, 975 mmHg or more (High pressure – Low vacuums – High voltage)	• “G” circuit open • “Lg” circuit open or shorted to ground • “Lg/R” circuit open or shorted to ground • MAP sensor malfunction • ECM (PCM) malfunction

NOTE:
- **When DTC P0105, and/or P0120, P0510 are indicated together, it is possible that “Lg” circuit is open.**
- **When DTC P0105, P0110, P0115 and/or P0120 are indicated together, it is possible that “G” circuit is open.**

DTC CONFIRMATION PROCEDURE

1) Clear DTC, start engine and keep it at idle for 1 min.
2) Select “DTC” mode on scan tool and check DTC.

INSPECTION

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Check MAP Sensor and Its Circuit. 1) Connect scan tool to DLC with ignition switch OFF. 2) Turn ignition switch ON. 3) Check intake manifold pressure. See Fig. 1. Is it 130 kPa or more or 5 kPa or less?	Go to Step 3.	Intermittent trouble. Check for intermittent referring to "INTERMITTENT AND POOR CONNECTION" in Section 0A.
3	Check Wire Harness. 1) Disconnect MAP sensor connector with ignition switch OFF. 2) Check for proper connection of MAP sensor at "Lg/R" and "G" wire terminals. 3) If OK, then with ignition switch ON, check voltage at each of "Lg" and "Lg/R" wire terminals. See Fig. 2. Is voltage about 4 – 6 V at each terminal?	Go to Step 4.	"Lg" wire open or shorted to ground circuit or shorted to power circuit, "Lg/R" wire open or shorted to ground, poor C01-5 connection or C01-1 connection. If wire and connection are OK, confirm that MAP sensor is normal and then substitute a known-good ECM (PCM) and recheck. **NOTE: When battery voltage is applied to "Lg" wire, it is possible that MAP sensor is also faulty.**
4	Check MAP sensor according to "MAP Sensor Individual Check" in Section 6E1. Is it in good condition?	"Lg" wire shorted to "Lg/R" wire, "G" wire open, poor C01-9 connection. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.	Replace MAP sensor.

Fig. 1 for Step 2

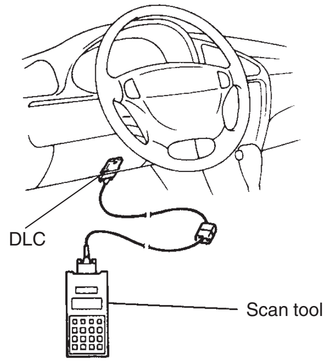
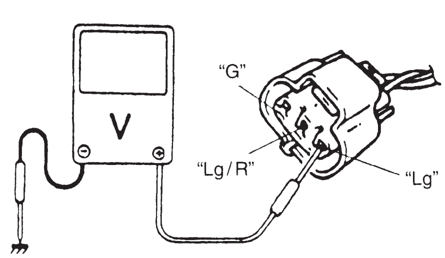
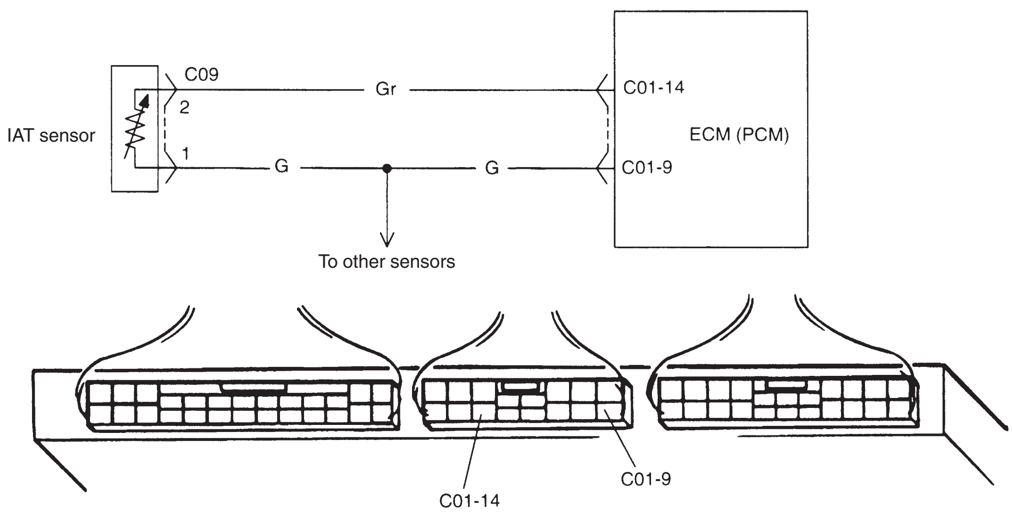


Fig. 2 for Step 3



DTC P0110 INTAKE AIR TEMP. (IAT) CIRCUIT MALFUNCTION

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
● Low intake air temperature (High voltage-High resistance) or ● High intake air temperature (Low voltage-Low resistance)	● "Gr" circuit open or shorted to power ● "G" circuit open ● IAT sensor malfunction ● ECM (PCM) malfunction

NOTE:

- **When DTC P0105, P0110, P0115 and P0120 are indicated together, it is possible that "G" circuit is open.**
- **Before inspecting, be sure to check that ambient temperature is higher than –40°C (–40°F).**

DTC CONFIRMATION PROCEDURE

1) Clear DTC, start engine and keep it at idle for 1 min.
2) Select "DTC" mode no scan tool and check DTC.

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Check IAT Sensor and Its Circuit. 1) Connect scan tool to DLC with ignition switch OFF. 2) Turn ignition switch ON. 3) Check intake air temp. displayed on scan tool. See Fig. 1. Is –40°C (–40°F) or 119°C (246°F) indicated?	Go to Step 3.	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.
3	Check Wire Harness. 1) Disconnect IAT sensor connector with ignition switch OFF. 2) Check for proper connection to IAT sensor at “Gr” and “G” wire terminals. 3) If OK, then with ignition switch ON, is voltage applied to “Gr” wire terminal about 4 – 6 V? See Fig. 2.	Go to Step 5.	“Gr” wire open or shorted to power, or poor C01-14 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) Check intake air temp. displayed on scan tool with ignition switch ON. Is –40°C (–40°F) indicated?	Replace IAT sensor.	“Gr” 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) Check intake air temp. displayed on scan tool with ignition switch ON. See Fig. 3. Is 119°C (246°F) indicated?	Replace IAT sensor.	“Gr” wire open or poor C01-9 connection. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.

Fig. 1 for Step 2

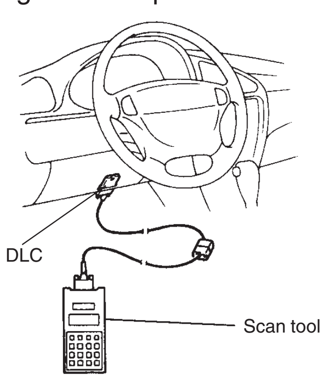


Fig. 2 for Step 3

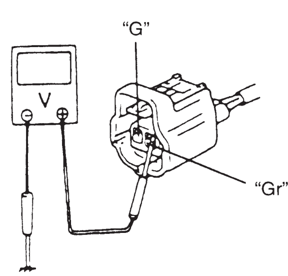
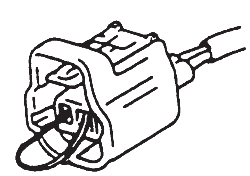
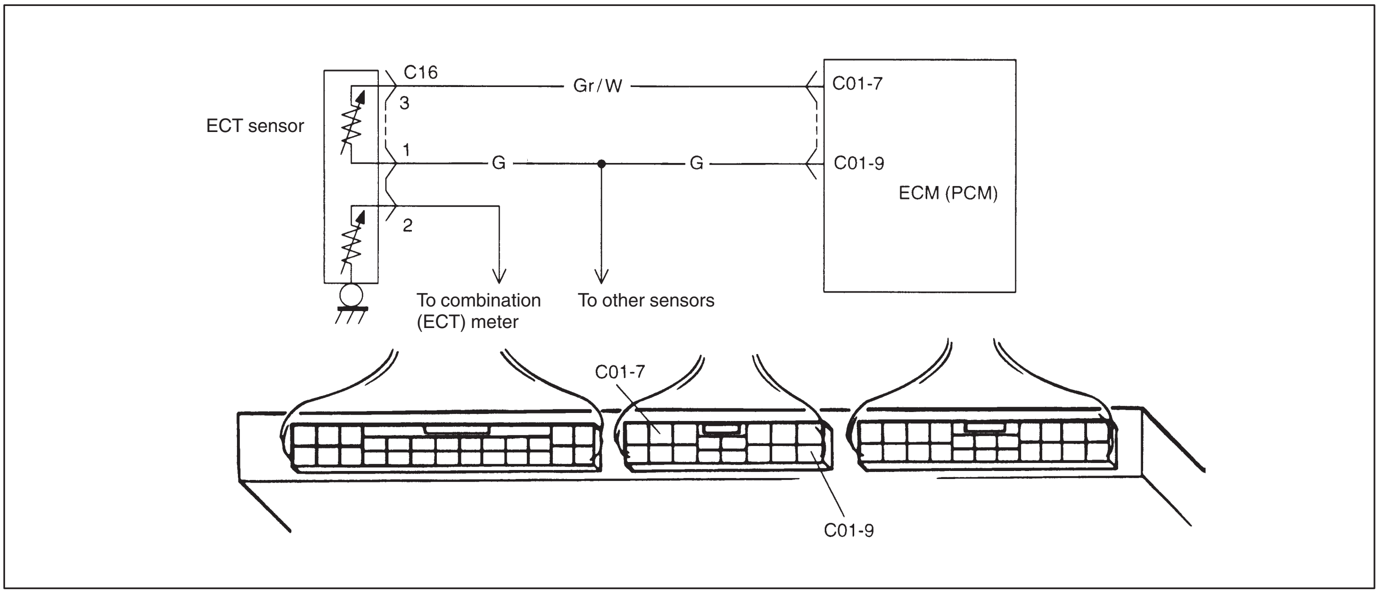


Fig. 3 for Step 4



DTC P0115 ENGINE COOLANT TEMPERATURE (ECT) CIRCUIT MALFUNCTION

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
● Low engine coolant temperature (High voltage-High resistance) or ● High engine coolant temperature (Low voltage-Low resistance)	● "Gr/W" circuit open or shorted to power ● "G" circuit open ● ECT sensor malfunction ● ECM (PCM) malfunction

NOTE:
Before inspecting, be sure to check that coolant temp. meter in combination meter indicates normal operating temperature (Engine is not overheating).

DTC CONFIRMATION PROCEDURE

1) Clear DTC, start engine and keep it at idle for 1 min.
2) Select "DTC" mode on scan tool and check DTC.

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Check ECT Sensor and Its Circuit. 1) Connect scan tool with ignition switch OFF. 2) Turn ignition switch ON. 3) Check engine coolant temp. displayed on scan tool. See Fig. 1. Is –40°C (–40°F) or 119°C (246°F) indicated?	Go to Step 3.	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection” in Section 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.	“Gr/W” wire shorted to ground. If wire is 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 with ignition switch OFF. 2) Check for proper connection to ECT sensor at “G” and “Gr/W” wire terminals. 3) If OK, then with ignition switch ON, is voltage applied to “G” wire terminal about 4 – 6 V? See Fig. 2.	Go to Step 4.	“Gr/W” wire open or shorted to power, or poor C01-7 connection. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.
6	Check Wire Harness. 1) Using service wire, connect ECT sensor connector terminals. See Fig. 3. 2) Turn ignition switch ON and check engine coolant temp. displayed on scan tool. Is 119°C (246°F) indicated?	Replace ECT sensor.	“G” wire open or poor C01-9 connection. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.

Fig. 1 for Step 2

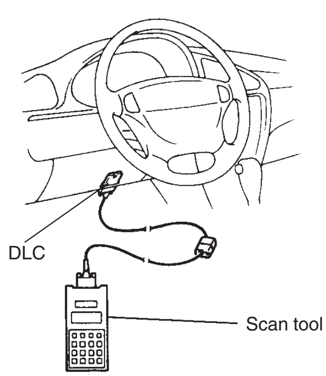


Fig. 2 for Step 3

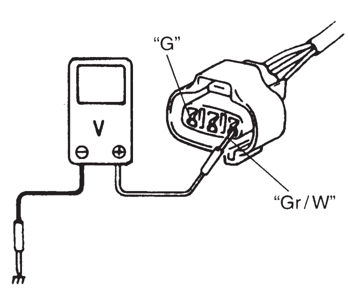
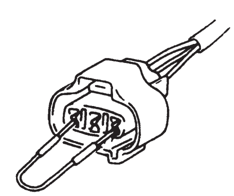
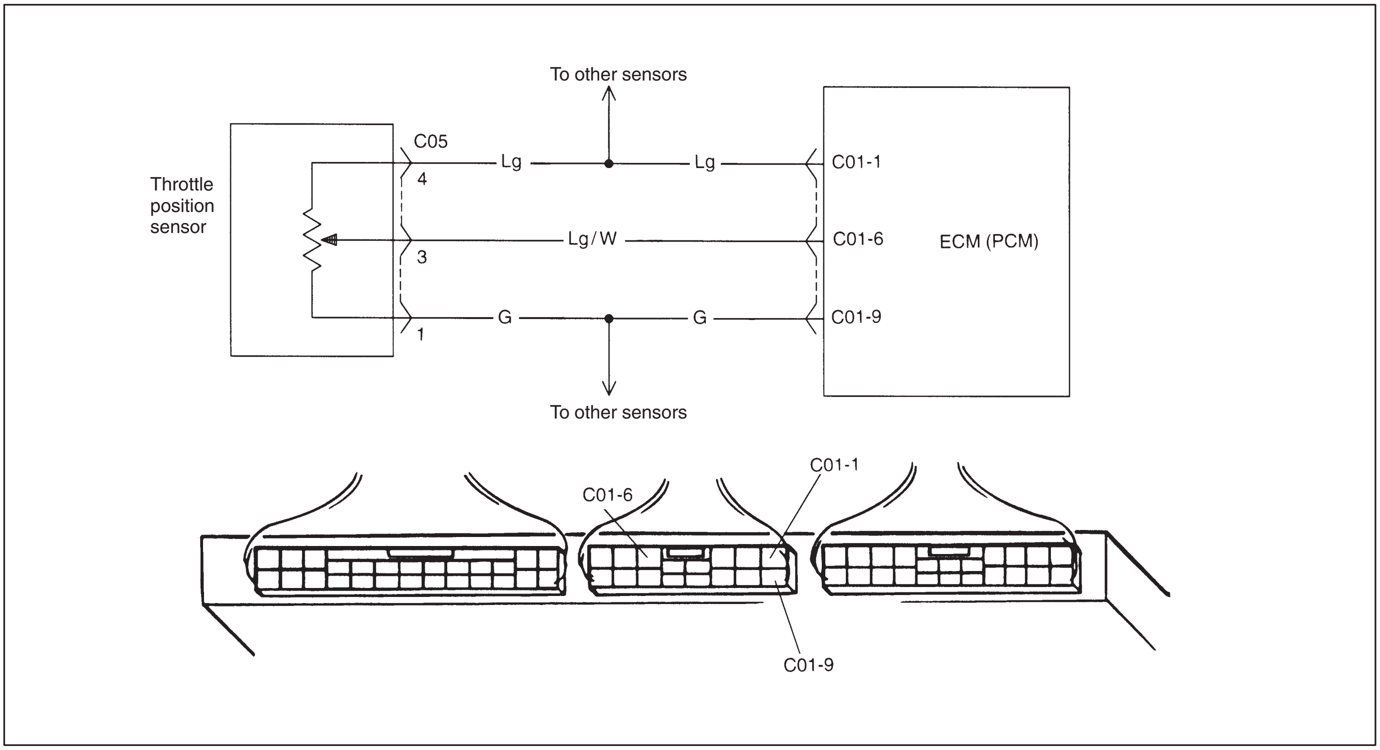


Fig. 3 for Step 4



DTC P0120 THROTTLE POSITION CIRCUIT MALFUNCTION

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
● Signal voltage high or ● Signal voltage low	● “G” circuit open ● “Lg/W” circuit open or shorted to ground ● “Lg” circuit open or shorted to power or ground ● TP sensor malfunction ● ECM (PCM) malfunction

NOTE:
- **When DTC P0105, P0110, P0115 and/or P0120 are indicated together, it is possible that “G” circuit is open.**
- **When DTC P0105, P0120 and/or P0510 are indicated together it is possible that “Lg” circuit is open.**

DTC CONFIRMATION PROCEDURE

1) Clear DTC, start engine and keep it at idle for 1 min.
2) Select “DTC” mode on scan tool and check DTC.

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Check 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. See Fig. 1. Is it displayed 2% or less? 3) Check throttle valve opening percentage displayed on scan tool while opening throttle valve from idle position to full open position. See Fig. 1. Is it displayed 96% or higher?	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 connector from TP sensor with ignition switch OFF. 2) Check for proper connection to TP sensor at “Lg”, “Lg/W” and “G” wire terminal. 3) If OK, then with ignition switch ON, check voltage at each of “Lg” and “Lg/W” wire terminals. See Fig. 2. Is voltage about 4 – 6 V at each terminal?	Go to Step 4.	“Lg” wire open, “Lg” wire shorted to ground circuit or power circuit or “G” wire, “Lg/W” wire open or shorted to ground circuit or poor C01-1 or C01-6 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. See Fig. 3. Between 1 and 4: 2.87 – 5.33 kΩ Between 1 and 3: 100 Ω – 20 kΩ, varying according to throttle valve opening. Are measured values within specifications?	“G” wire open or poor C01–9 connection. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.	Replace TP sensor.

Fig. 1 for Step 2

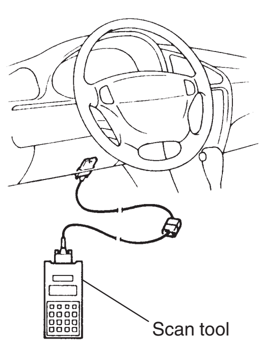


Fig. 2 for Step 3

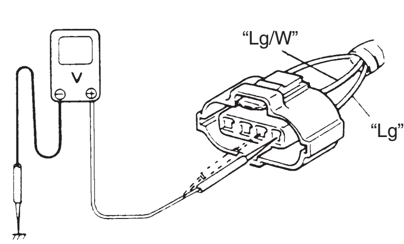
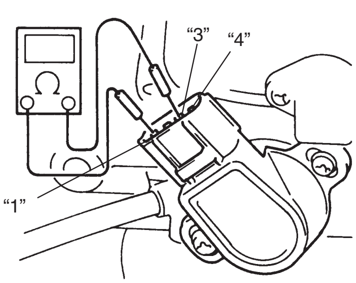
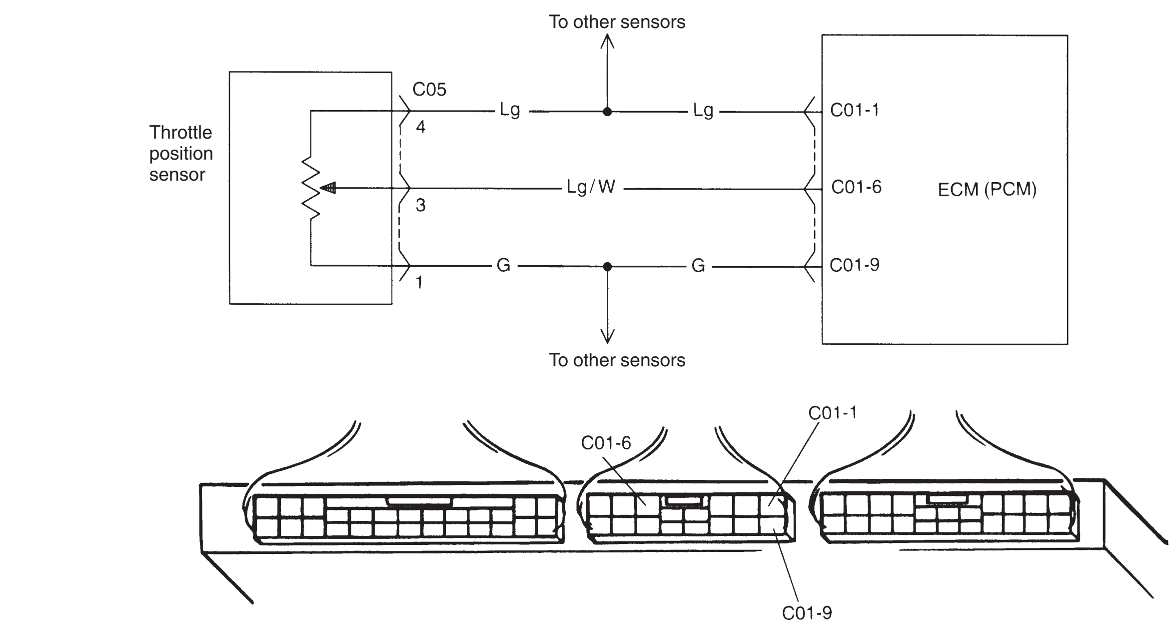


Fig. 3 for Step 4



DTC P0121 THROTTLE POSITION CIRCUIT RANGE/PERFORMANCE PROBLEM

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
● After engine warmed up. ● While vehicle running at specified engine speed. ● No change in intake manifold pressure (constant throttle opening) ● Difference between actual throttle opening (detected from TP sensor) and opening calculated by ECM (PCM) (Obtained on the basis of engine speed and intake manifold pressure) in larger than specified value. ✻ 2 driving cycle detection logic, continuous monitoring	● TP sensor malfunction ● High resistance in the circuit ● ECM (PCM) malfunction

DTC CONFIRMATION PROCEDURE

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester, on a level road.**

1) Turn ignition switch OFF. Clear DTC with ignition switch ON, check vehicle and environmental condition for:
   – Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)
   – Ambient temp.: –10°C, 14°F or higher
   – Intake air temp.: 70°C, 158°F or lower
   – Engine coolant temp.: 70 – 110°C, 158 – 230°F
2) Warm up engine to normal operating temperature.
3) Increase vehicle speed to 30 – 40 mph, 50 – 60 km/h in 3rd gear or “D” range and hold throttle valve at that opening position for 1 min.
4) Stop vehicle.
5) Check DTC in “DTC” mode and pending DTC in “ON BOARD TEST” or “PENDING DTC” mode.

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Check TP Sensor and Its Circuit. 1) Turn ignition switch OFF and connect SUZUKI scan tool to DLC. 2) Turn ignition switch ON and check TP sensor output voltage when throttle valve is at idle position and fully opened. See Fig. 1 and 2. Dose voltage vary within specified value linearly as shown in figure?	If voltmeter was used, check terminal C01-6 for poor connection. If OK, substitute a known-good ECM (PCM) and recheck.	Go to Step 3.
3	Check TP Sensor. 1) Turn ignition switch OFF. 2) Disconnect TP sensor connector. 3) Check for proper connection to TP sensor at each terminal. 4) If OK, then measure resistance between terminals and check if each measured value is as specified below. See Fig. 3. Between 1 and 4: 2.87 – 5.33 kΩ Between 1 and 3: 100 Ω – 20 kΩ, varying according to throttle valve opening. Are measured values as specified?	High resistance in “Lg”, “Lg/W” or “G” circuit. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.	Replace TP sensor.

Fig. 1 for Step 2

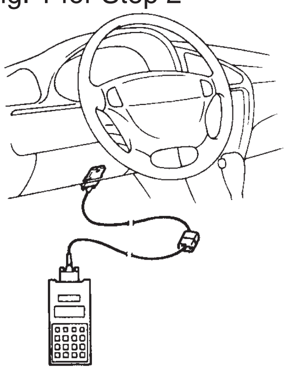


Fig. 2 for Step 2

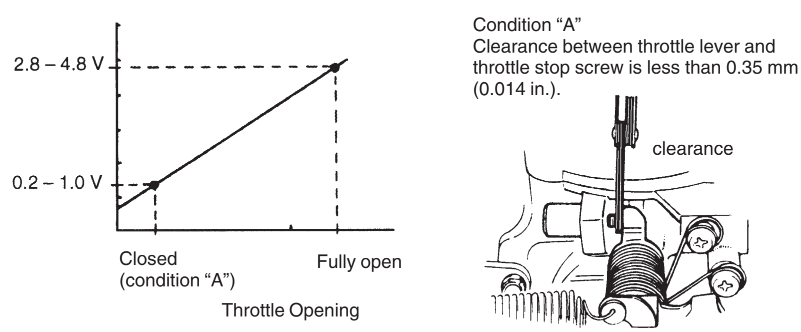
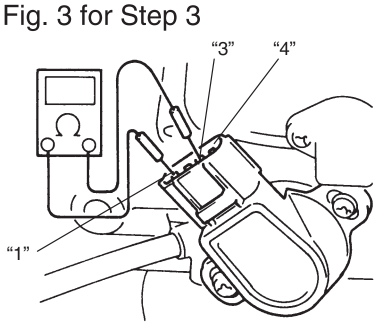
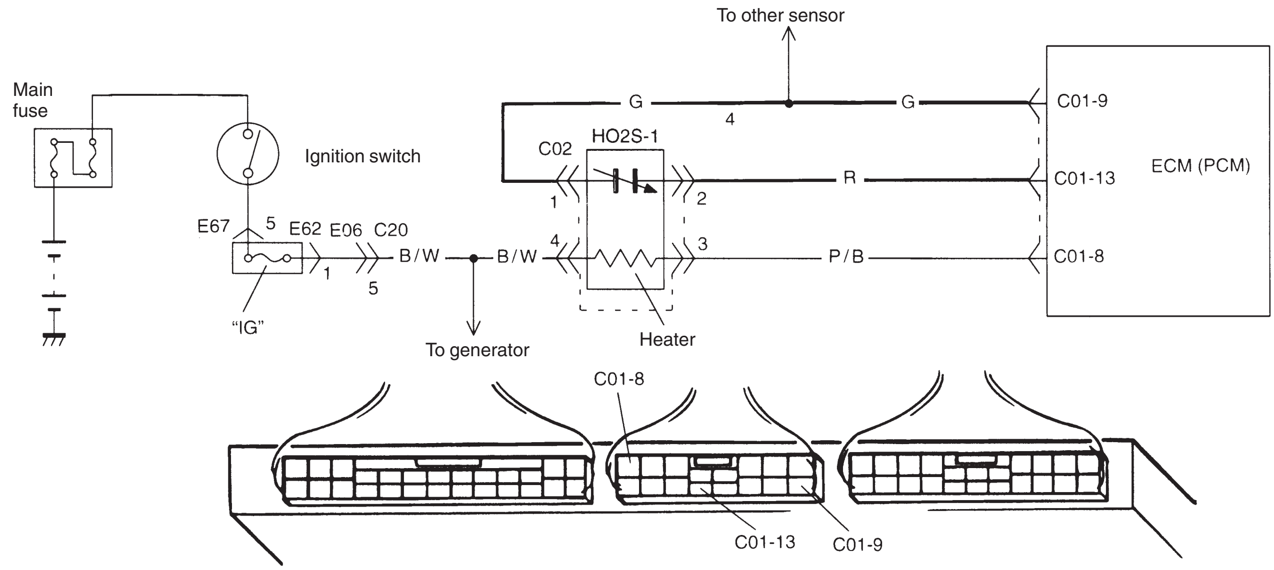


Fig. 3 for Step 3



DTC P0130 HEATED OXYGEN SENSOR (HO2S) CIRCUIT MALFUNCTION (SENSOR-1)

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
● When running at idle speed after engine warmed up and running at specified vehicle speed, HO2S-1 output voltage does not go below 0.3 V or over 0.6 V. ✻ 2 driving cycle detection logic, Monitoring once/1 driving.	● Heated oxygen sensor-1 malfunction ● "G" or "R" circuit open (poor connection) or short

DTC CONFIRMATION PROCEDURE

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester.**

1) Turn ignition switch OFF. Clear DTC with ignition switch ON, check vehicle and environmental condition for:
   – Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)
   – Ambient temp.: –10°C, 14°F or higher
   – Intake air temp.: 70°C, 158°F or lower
2) Warm up engine to normal operating temperature.
3) Drive vehicle at 30 – 40 mph, 50 – 60 km/h for 2 min.
4) Stop vehicle and run engine at idle for 2 min.
5) Check DTC in "DTC" mode and pending DTC in "ON BOARD TEST" or "PENDING DTC" mode.

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Is there DTC(s) other than HO2S-1 (DTC P0130)?	Go to applicable DTC Diag. Flow Table.	Go to Step 3.
3	1) Connect scan tool to DLC with ignition switch OFF. 2) Warm up engine to normal operating temperature and keep it at 2000 r/min. for 60 sec. 3) Repeat racing engine (Repeat depressing accelerator pedal 5 to 6 times continuously and take foot off from pedal to enrich and enlean A/F mixture). See Fig. 1 and 2. Does HO2S-1 output voltage deflect between 0.3 V and over 0.6 V repeatedly?	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Check “R” and “G” wires for open and short, and connections for poor connection. If wires and connections are OK, replace HO2S-1.

Fig. 1 for Step 3

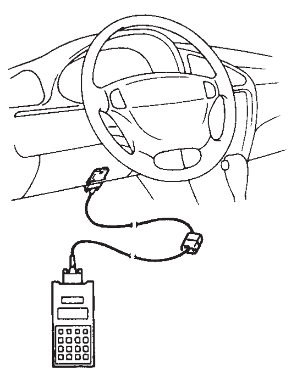
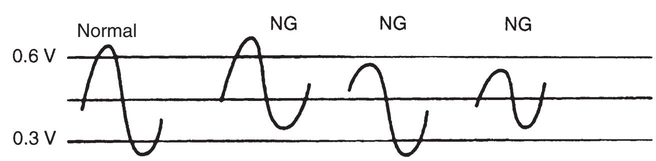


Fig. 2 for Step 3

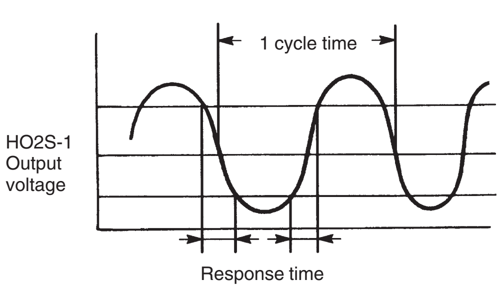


DTC P0133 HEATED OXYGEN SENSOR (HO2S) CIRCUIT SLOW RESPONSE (SENSOR-1)

WIRING DIAGRAM/CIRCUIT DESCRIPTION – Refer to DTC P0130 section.

DTC DETECTING CONDITION	POSSIBLE CAUSE
● When running at specified idle speed after engine warmed up and running at specified vehicle speed, response time (time to change from lean to rich or from rich to lean) of HO2S-1 output voltage is about 1 sec. at minimum or average time of 1 cycle is 5 sec. at minimum. See. Fig. 1 ✳ 2 driving cycle detection logic, Monitoring once/1 driving.	● Heated oxygen sensor-1 malfunction

Fig. 1



DTC CONFIRMATION PROCEDURE – Refer to DTC P0130 section.

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Is there DTC(s) other than HO2S-1 (DTC P0133)?	Go to applicable DTC Diag. Flow Table.	Replace HO2S-1.

DTC P0134 HEATED OXYGEN SENSOR (HO2S) CIRCUIT NO ACTIVITY DETECTED (SENSOR-1)

WIRING DIAGRAM/CIRCUIT DESCRIPTION – Refer to DTC P0130 section.

DTC DETECTING CONDITION	POSSIBLE CAUSE
● Engine warmed up. ● While running under other than high load and high engine speed conditions or at specified idle speed (engine is in closed loop condition), HO2S-1 output voltage is high or low continuously. ✻ 2 driving cycle detection logic, Continuous monitoring.	● “G” or “R” circuit open or short ● Heated oxygen sensor malfunction ● Fuel system malfunction ● Exhaust gas leakage

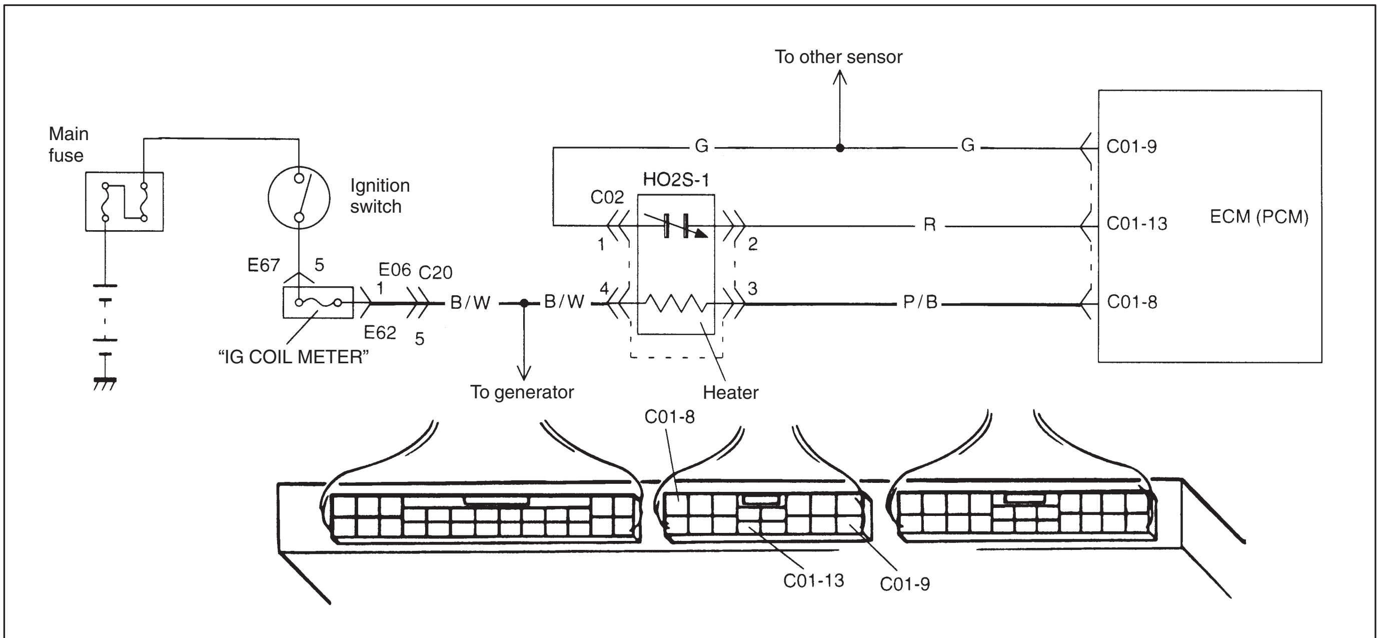
DTC CONFIRMATION PROCEDURE – Refer to DTC P0130 section.

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Is there DTC(s) other than Fuel system (DTC P0171/P0172) and HO2S-1 (DTC P0134)?	Go to applicable DTC Diag. Flow Table.	Go to Step 3.
3	Check HO2S-1 and Its Circuit. 1) Connect scan tool to DLC with ignition switch OFF. 2) Warm up engine to normal operating temperature and keep it at 2000 r/min. for 60 sec. 3) Repeat racing engine (Repeat depressing accelerator pedal 5 to 6 times continuously and take foot off from pedal to enrich and enlean A/F mixture). Does HO2S-1 output voltage deflect between 0.3 V and over 0.6 V repeatedly?	Go to DTC P0171 and P0172 Diag. Flow Table (Fuel System Check).	Check “R” and “G” wires for open and short, and connections for poor connection. If wires and connections are OK, replace HO2S-1.

DTC P0135 HEATED OXYGEN SENSOR (HO2S) HEATER CIRCUIT MALFUNCTION (SENSOR-1)

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
DTC will set when A or B condition is met. A: ● Low voltage at terminal C01-8 when engine is running at high load. B: ● High voltage at terminal C01-8 when engine is running under condition other than above. ✳ 2 driving cycle detection logic, Continuous monitoring.	● HO2S-1 heater circuit open or shorted to ground ● ECM (PCM) malfunction

DTC CONFIRMATION PROCEDURE

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester.**

1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON, start engine and keep it at idle for 1 min.
3) Start vehicle and depress accelerator pedal fully for 5 sec. or longer.
4) Stop vehicle.
5) Check DTC in "DTC" mode and pending DTC in "ON BOARD TEST" or "PENDING DTC" mode.

INSPECTION

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Check Heater for Operation. 1) Check voltage at terminal C01-8. See Fig. 1. 2) Warm up engine to normal operating temperature. 3) Stop engine. 4) Turn ignition switch ON and Check voltage at terminal C01-8. See Fig. 1. Voltage should be over 10 V. 5) Start engine, run it at idle and check voltage at the same terminal. Voltage should be below 1.9 V. Are check results are specified?	Intermittent trouble Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A.	Go to Step 3.
3	Check Heater of Sensor-1. 1) Disconnect HO2S-1 coupler with ignition switch OFF. 2) Check for proper connection to HO2S-1 at "B/W" and "P/B" wire terminals. 3) If OK, then check heater resistance. See Fig. 2. Is it 11.7 – 14.3 Ω at 20°C, 68°F?	"P/B" wire open or shorted to ground or poor connection at C01-8. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.	Replace HO2S-1.

Fig. 1 for Step 2

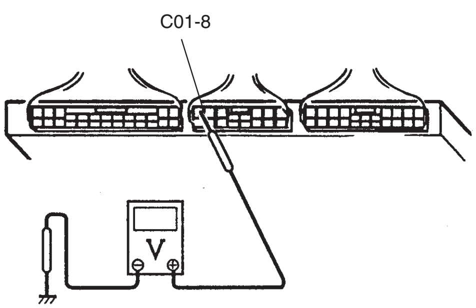
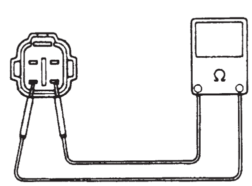
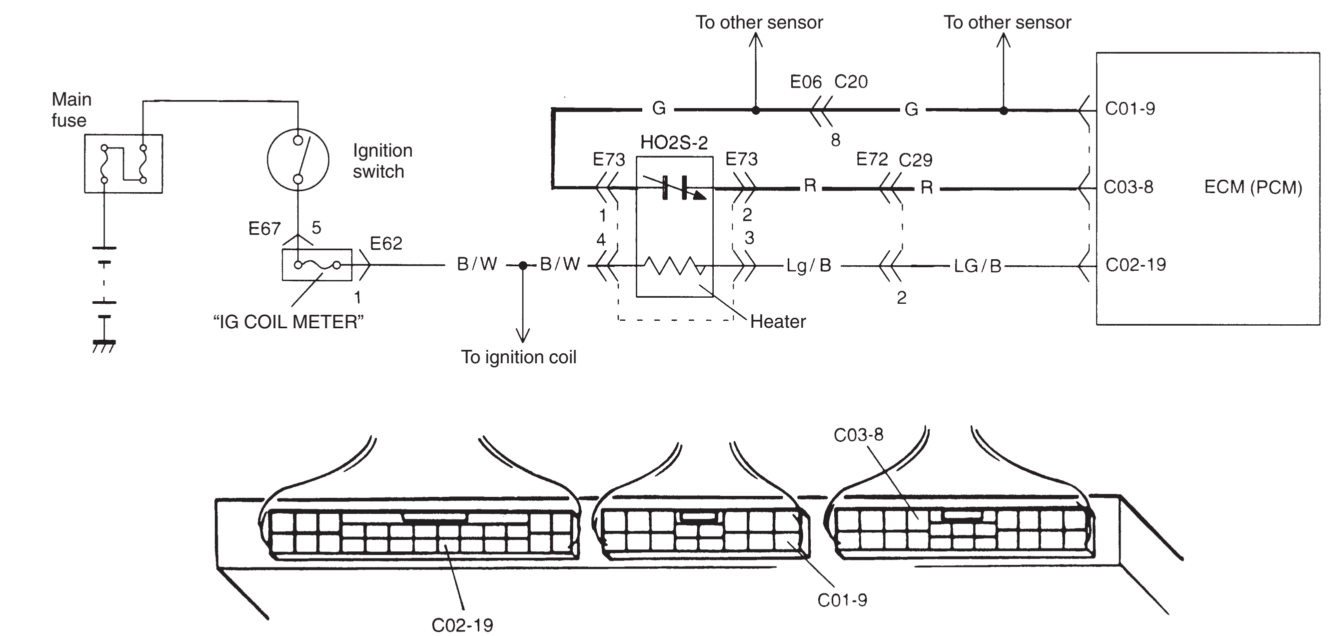


Fig. 2 for Step 3



DTC P0136 HEATED OXYGEN SENSOR (HO2S) CIRCUIT MALFUNCTION (SENSOR-2)

CIRCUIT DESCRIPTION

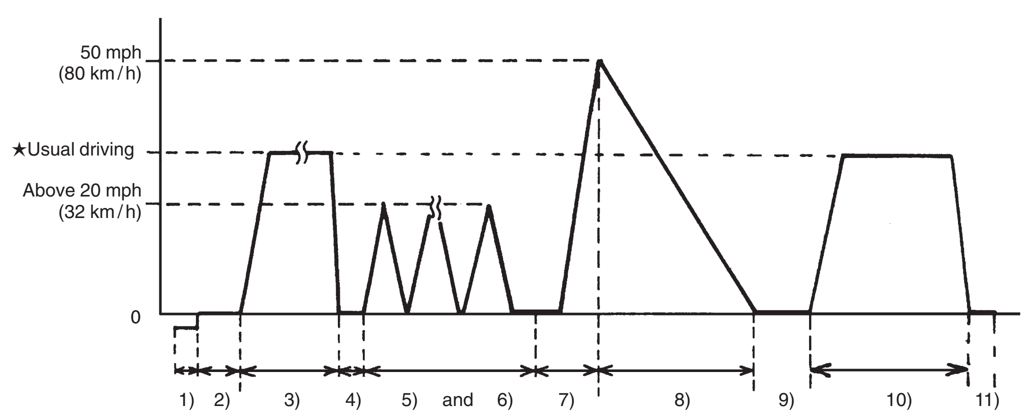


DTC DETECTING CONDITION	POSSIBLE CAUSE
DTC will set when A or B condition is detected. A. Max. output voltage of HO2S-2 is lower than specified value or Min. output voltage is higher than specified value while vehicle driving. B. Engine is warmed up and HO2S-2 voltage is 4.5 V or more. (circuit open) ✳ 2 driving cycle detection logic, monitoring once/1 driving.	● Exhaust gas leakage ● "G" or "R" circuit open or short ● Heated oxygen sensor-2 malfunction ● Fuel system malfunction

DTC CONFIRMATION PROCEDURE

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester, on a level road.**

1) Turn ignition switch OFF.
   Clear DTC with ignition switch ON, check vehicle and environmental condition for:
   – Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)
   – Ambient temp.: –10°C, 14°F or higher
   – Intake air temp.: 70°C, 158°F or lower
   – No exhaust gas leakage and loose connection
2) Warm up engine to normal operating temperature.
3) Drive vehicle under usual driving condition for 5 min. and check HO2S-2 output voltage and "short term fuel trim" with "Data List" mode on scan tool, and write it down.
4) Stop vehicle (don't turn ignition switch OFF).
5) Increase vehicle speed to higher than 20 mph, 32 km/h and then stop vehicle.
6) Repeat above steps 5) 4 times.
7) Increase vehicle speed to about 50 mph (80 km/h) in 3rd gear or 2 range.
8) Release accelerator pedal and with engine brake applied, keep vehicle coasting (fuel cut condition) for 10sec. or more.
9) Stop vehicle (don't turn ignition switch OFF) and run engine at idle for 2 min.
   After this step 9), if "Oxygen Sensor Monitoring TEST COMPLETED" is displayed in "READINESS TESTS" mode and DTC is not displayed in "DTC" mode, confirmation test is completed.
   If "TEST NOT COMPLTD" is still being displayed, proceed to next step 10).
10) Drive vehicle under usual driving condition for 10 min. (or vehicle is at a stop and run engine at idle for 10 min. or longer)
11) Stop vehicle (don't turn ignition switch OFF). Confirm test results according to "Test Result Confirmation Flow Table" in "DTC CONFIRMATION PROCEDURE" of DTC P0420.



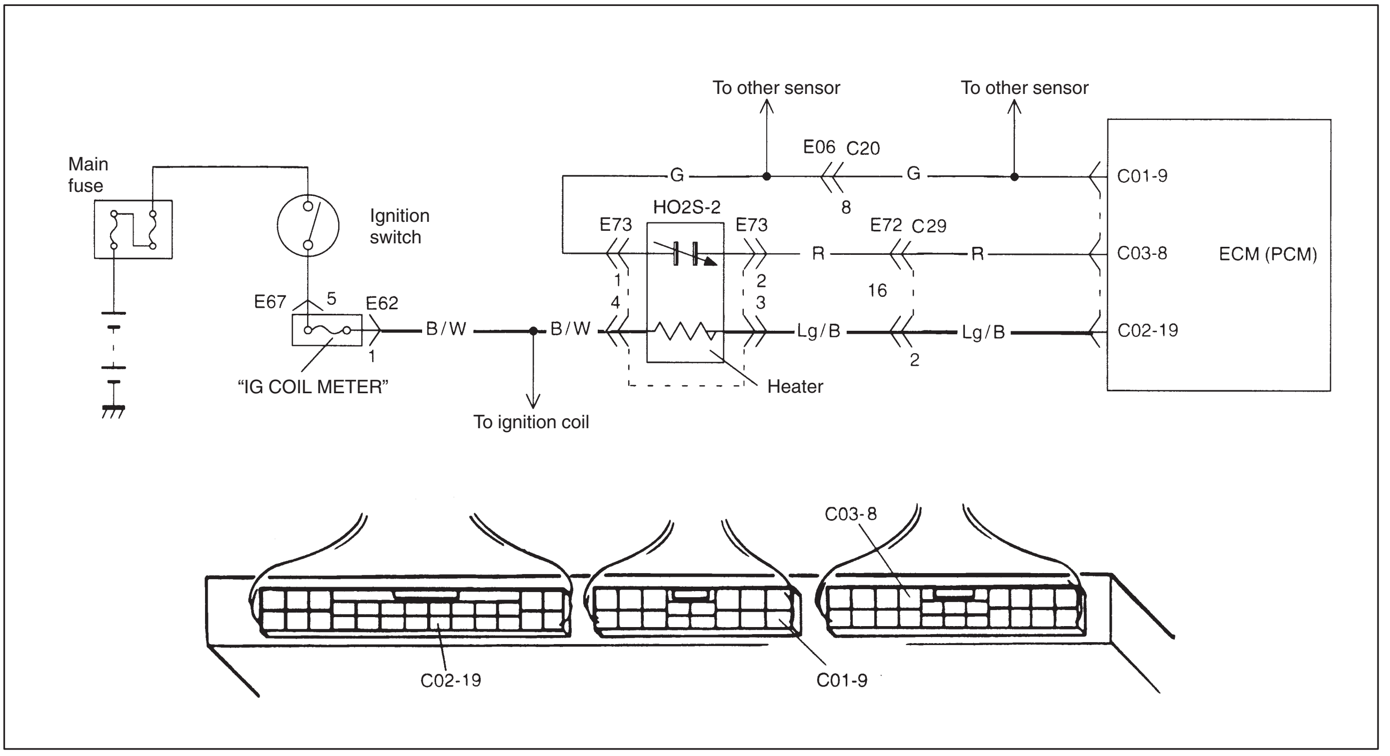
★Usual driving: Driving at 30 – 40 mph, 50 – 60 km/h including short stop according to traffic signal. (under driving condition other than high-load, high-engine speed, rapid accelerating and decelerating)

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Check exhaust system for leakage, loose connection and damage. Is it good condition?	Go to Step 3.	Repair or replace.
3	Check HO2S-2 and Its Circuit. Was HO2S-2 output voltage indicated on scan tool in step 3) of DTC confirmation test less than 1.275 V?	Go to Step 4.	“Lg/B” or “R” circuit open or HO2S-2 malfunction.
4	Check Short Term Fuel Trim. Did short term fuel trim very within –20 – +20% range in step 3) of DTC confirmation test?	Check “R” and “Lg/B” wire for open and short, and connection for poor connection. If wire and connection are OK, replace HO2S-2.	Check fuel system. Go to DTC P0171/P0172 Diag. Flow Table.

DTC P0141 HEATED OXYGEN SENSOR (HO2S) HEATER CIRCUIT MALFUNCTION (SENSOR-2)

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
DTC will set when A or B condition it met. A. Low voltage at terminal C02-19 for specified time after engine start or while engine running at high load. B. High voltage at terminal C02-19 while engine running under other than above condition. ✻ 2 driving cycle detection logic, continuous monitoring.	● HO2S-2 heater circuit open or shorted to ground ● ECM (PCM) malfunction

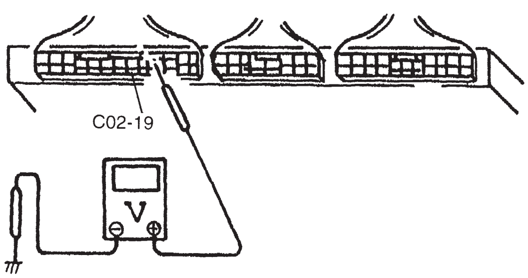
DTC CONFIRMATION PROCEDURE

1) Turn ignition switch OFF once and then ON.
2) Clear DTC, start engine and warm up engine to normal operating temperature.
3) Keep it at 2000 r/min for 2 min.
4) Check pending DTC in "ON BOARD TEST" or "PENDING DTC" mode and DTC in "DTC" mode.

INSPECTION

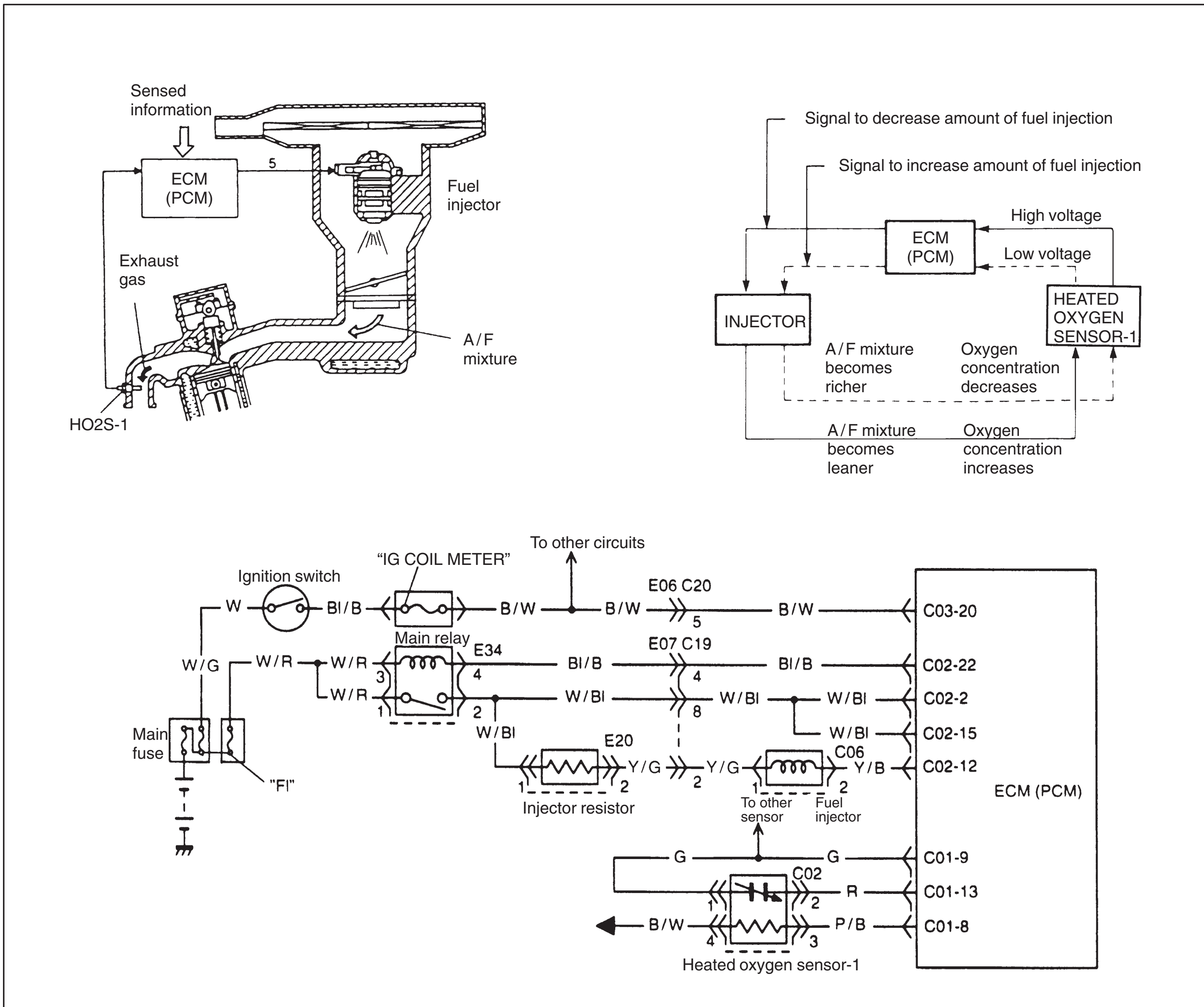
STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Check HO2S-2 Heater and Its Circuit. 1) Warm up engine to normal operating temperature. 2) Stop engine. 3) Turn ignition switch ON and check voltage at terminal C02-19 See Fig. 1. Voltage should be over 10 V. 4) Start engine, run it at idle and check voltage at the same terminal after 1 min. from engine start. Voltage should be below 1.9 V. Are check result as specified?	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Go to Step 3.
3	Check Heater or Sensor-2. 1) Disconnect HO2S-2 coupler with ignition switch OFF. 2) Check for proper connection to HO2S-2 at “B/W” and “Lg/B” wire terminals. 3) If OK, then check heater resistance. Is it 11.7 – 14.3 Ω at 20°C, 68°F?	“Lg/B” wire open or shorted to ground or poor connection at C02-19. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.	Replace HO2S-2.

Fig. 1 for Step 2



DTC P0171 FUEL SYSTEM TOO LEAN
DTC P0172 FUEL SYSTEM TOO RICH

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
• When following condition occurs while engine running under closed loop condition. – Air/fuel ratio too lean (Total fuel trim (short and long terms added) is more than 30%) or – Air/fuel ratio too rich (Total fuel trim is less than –30%) ✳ 2 driving cycle detection logic, continuous monitoring.	• Vacuum leaks (air drawn in). • Exhaust gas leakage. • Heated oxygen sensor-1 circuit malfunction. • Fuel pressure out of specification. • Fuel injector malfunction (clogged or leakage). • MAP sensor poor performance. • ECT sensor poor performance. • IAT sensor poor performance. • TP sensor poor performance. • EVAP control system malfunction. • PCV valve malfunction.

DTC CONFIRMATION PROCEDURE

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester on a level road.**

1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON.
3) Check vehicle and environmental condition for:
   – Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)
   – Ambient temp.: –10°C, 14°F or higher
   – Intake air temp.: 70°C, 158°F or lower
4) Start engine and drive vehicle under usual driving condition (described in DTC confirmation procedure of DTC P0136) for 5 min. or longer and until engine is warmed up to normal operating temperature.
5) Keep vehicle speed at 30 – 40 mph, 50 – 60 km/h in 5th gear or “D” range for 5 min. or more.
6) Stop vehicle (do not turn ignition switch OFF).
7) Check pending DTC in “ON BOARD TEST” or “PENDING DTC” mode and DTC in “DTC” mode.

INSPECTION

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Is there DTC(s) other than fuel system (DTC P0171/P0172)?	Go to applicable DTC Diag. Flow Table.	Go to Step 3.
3	Check HO2S-1 Output Voltage. 1) Connect scan tool to DLC with ignition switch OFF. 2) Warm up engine to normal operating temperature and keep it at 2000 r/min. for 60 sec. 3) Repeat racing engine (Repeat depressing accelerator pedal 5 to 6 times continuously and take foot off from pedal to enrich and enlean A/F mixture). See Fig. 1. Does HO2S-1 output voltage deflect between below 0.3 V and over 0.6 V repeatedly?	Go to Step 4.	Go to DTC P0130 Diag. Flow Table (HO2S-1 circuit check).
4	Check Fuel Pressure (Refer to section 6E1 for details). 1) Release fuel pressure from fuel feed line. 2) Install fuel pressure gauge. 3) Check fuel pressure. See Fig. 2. With fuel pump operating and engine at stop : 160 – 210 kPa, 1.6 – 2.1 kg/cm^2, 22.7 – 29.9 psi. At specified idle speed : 90 – 140 kPa, 0.9 – 1.4 kg/cm^2, 12.8 – 20.0 psi. Is measured value as specified?	Go to Step 5.	Go to Diag. Flow Table B-3 Fuel Pressure Check.
5	Check Fuel Injectors and Circuit. 1) Turn ignition switch OFF and disconnect fuel injector connector. 2) Check for proper connection to fuel injector at each terminals. 3) If OK, then check injector resistance. See Fig. 3. **Injector resistance: 0.5 – 1.5 Ω at 20°C (68°F)** 4) Connect injector, connector. 5) Check that fuel is injected out in conical shape from fuel injector when running engine. 6) Check injector for fuel leakage after engine stop. **Fuel leakage: Less than 1 drop/min.** Is check result satisfactory?	Go to Step 6.	Check injector circuit or replace fuel injector.
6	Check EVAP Canister Purge Valve. 1) Disconnect purge hose (1) from EVAP canister. 2) Place finger against the end of disconnected hose. 3) Check that vacuum is not felt there when engine is cool and running at idle. See Fig. 4. Is vacuum felt?	Check EVAP control system (See Section 6E1).	Go to Step 7.
7	Check intake manifold absolute pressure sensor for performance (See DTC P0105 Diag. Flow Table). Is it in good condition?	Go to Step 8.	Repair or replace.

STEP	ACTION	YES	NO
8	Check engine coolant temp. sensor for performance (See Section 6E1). Is it in good condition?	Go to Step 9.	Replace engine coolant temp. sensor.
9	Check intake air temp. sensor for performance (See Section 6E1). Is it in good condition?	Go to Step 10.	Replace intake air temp. sensor.
10	Check throttle position sensor for performance (See Step 4 of DTC P0121 Diag. Flow Table). Is it in good condition?	Go to Step 11.	Replace throttle position sensor.
11	Check PCV valve for valve clogging (See Section 6E1). Is it good condition?	Substitute a known-good ECM (PCM) and recheck.	Replace PCV valve.

Fig. 1 for Step 3

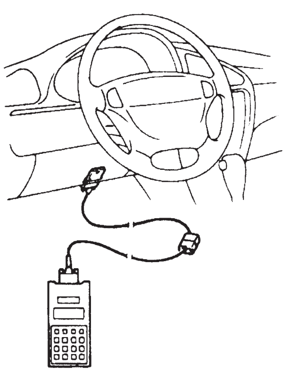
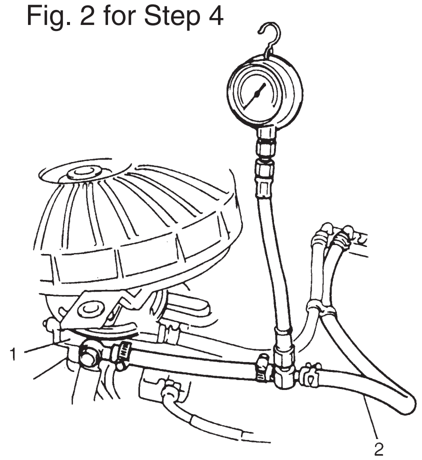


Fig. 2 for Step 4



1. Throttle body
2. Fuel feed hose

Fig. 3 for Step 5

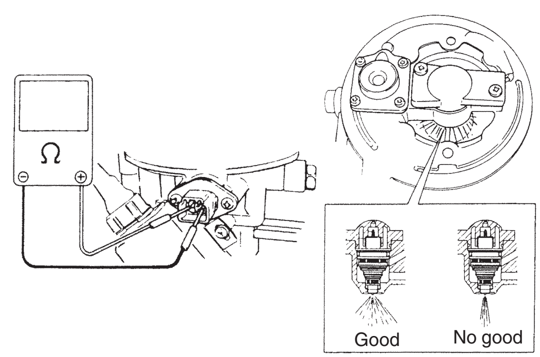
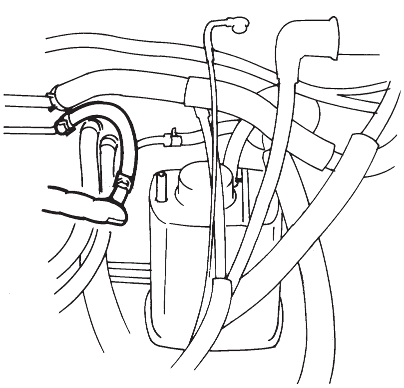
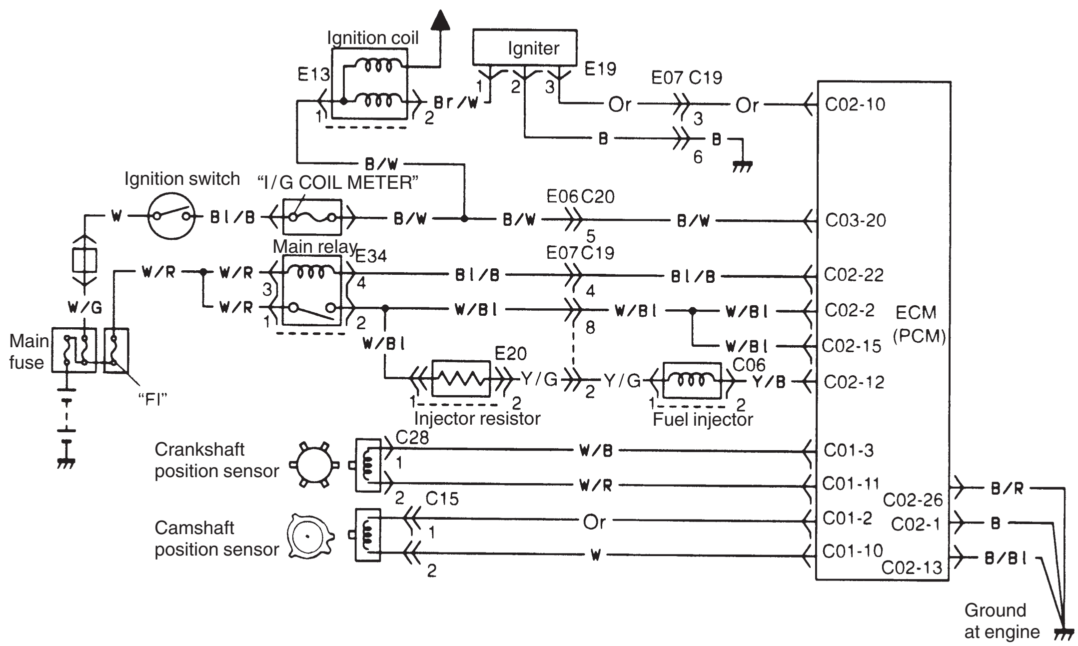


Fig. 4 for Step 6



DTC P0300 RANDOM MISFIRE DETECTED (Misfire detected at 2 or more cylinders)
DTC P0301 CYLINDER 1 MISFIRE DETECTED
DTC P0302 CYLINDER 2 MISFIRE DETECTED
DTC P0303 CYLINDER 3 MISFIRE DETECTED



CIRCUIT DESCRIPTION

ECM (PCM) monitors crankshaft revolution speed and engine speed via the crankshaft position sensor and cylinder No. via the camshaft position sensor. Then it calculates the change in the crankshaft revolution speed and from how many times such change occurred in every 200 or 1000 engine revolutions, it detects occurrence of misfire.
When ECM (PCM) detects a misfire (misfire rate per 200 revolutions) which can cause overheat and damage to the three way catalytic converter, it makes the malfunction indicator lamp (MIL) flash as long as misfire occurs at that rate.
After that, however, when the misfire rate drops, MIL remains ON until it has been judged as normal 3 times under the same driving conditions.
Also, when ECM (PCM) detects a misfire (misfire rate per 1000 revolutions) which will not cause damage to three way catalytic converter but can cause exhaust emission to be deteriorated, it makes MIL light according to the 2 driving cycle detection logic.

DTC DETECTING CONDITION	POSSIBLE CAUSE
• Engine under other than high revolution condition • Not on rough road • Engine speed changing rate • Manifold absolute pressure changing rate • Throttle opening changing rate (Below specified value) • Misfire rate per 200 or 1000 engine revolutions (how much and how often crankshaft revolution speed changes) is higher than specified value	• Engine overheating • Vacuum leaks (air inhaling) from air intake system • Ignition system malfunction (spark plug(s), high-tension cord(s), ignition coil assembly) • Fuel pressure out of specification • Fuel injector malfunction (clogged or leakage) • Engine compression out of specification • Valve lash (clearance) out of specification • Manifold absolute pressure sensor malfunction • Engine coolant temp. sensor malfunction • PCV valve malfunction • EVAP control system malfunction

DTC CONFIRMATION PROCEDURE

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester.**

1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON.
3) Check vehicle and environmental condition for:
   – Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)
   – Ambient temp.: –10°C, 14°F or higher
   – Intake air temp.: 70°C, 158°F or lower
   – Engine coolant temp.: –10 – 110°C, 14 – 230°F
4) Start engine and keep it at idle for 2 min. or more.
5) Check DTC in “DTC” mode and pending DTC in “ON BOARD TEST” or “PENDING DTC” mode.
6) If DTC is not detected at idle, consult usual driving based on information obtained in “Customer complaint analysis” and “Freeze frame data check”.

INSPECTION

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Is there DTC other than Fuel system (DTC P0171/P0172) and misfire (DTC P0300-P0303)?	Go to applicable DTC Diag. Flow Table.	Go to Step 3.
3	Check Ignition System. 1) Remove spark plugs and check them for; ● Air gap: 1.0 – 1.1 mm (0.040 – 0.043 in.) See Fig. 1. ● Carbon deposits ● Insulator damage ● Plug type If abnormality is found, adjust, clean or replace. 2) Disconnect injector connector. See Fig. 2. 3) Connect spark plugs to high tension cords and then ground spark plugs. 4) Crank engine and check that each spark plug sparks. Are above check results satisfactory?	Go to Step 4.	Check ignition system parts (Refer to Section 6F).
4	Check Fuel Pressure (Refer to Section 6E1 for details). 1) Release fuel pressure from fuel feed line. 2) Install fuel pressure gauge. See Fig. 3. 3) Check fuel pressure. With fuel pump operating and engine at stop : 160 – 210 kPa, 1.6 – 2.1 kg/cm^2, 22.7 – 29.9 psi. At specified idle speed : 90 – 140 kPa, 0.9 – 1.4 kg/cm^2, 12.8 – 20.0 psi. Is measured value as specified?	Go to Step 5.	Go to Diag. Flow Table B-3 fuel pressure check.
5	Check Fuel Injector and Circuit. 1) Turn ignition switch OFF and disconnect fuel injector connector. 2) Check for proper connection to fuel injector at each terminal. 3) If OK, then check injector resistance. See Fig. 4. Injector resistance: 0.5 – 1.5 Ω at 20°C (68°F). 4) Connect injector connector. 5) Check that fuel is injected out in conical shape from fuel injector when running engine. 6) Check injector for fuel leakage after engine stop. Fuel leakage: Less than 1 drop/min. Is check result satisfactory?	Go to Step 6.	Check injector circuit or replace fuel injector.

STEP	ACTION	YES	NO
6	Check PCV valve for clogging (See Section 6E1). Is it in good condition?	Go to Step 7.	Replace PCV valve.
7	Check EVAP Canister Purge Valve for Closing. 1) Disconnect purge hose (1) from EVAP canister. 2) Place finger against the end of disconnected hose. 3) Check that vacuum is not felt there, when engine is cool and running at idle. See Fig. 5. Is vacuum felt?	Check EVAP control system (See Section 6E1).	Go to Step 8.
8	Check intake manifold pressure sensor for performance (See Section 6E1). Is it in good condition?	Go to Step 9.	Repair or replace.
9	Check engine coolant temp. sensor for performance (See Section 6E1). Is it in good condition?	Go to Step 10.	Replace engine coolant temp. sensor.
10	Check parts or system which can cause engine rough idle or poor performance. – Engine compression (See Section 6A). – Valve lash (See Section 6A). – Valve timing (Timing belt installation. See Section 6A). 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.

Fig. 1 for Step 3

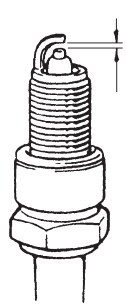
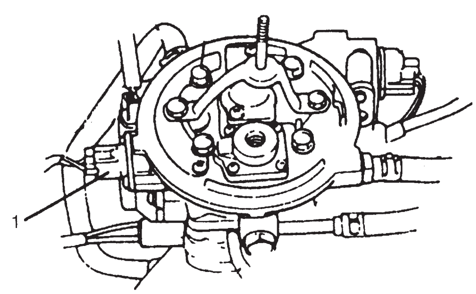
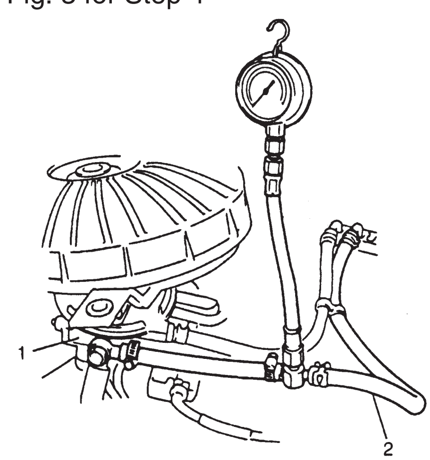


Fig. 2 for Step 3



1. Injector connector

Fig. 3 for Step 4



1. Throttle body
2. Fuel feed hose

Fig. 4 for Step 5

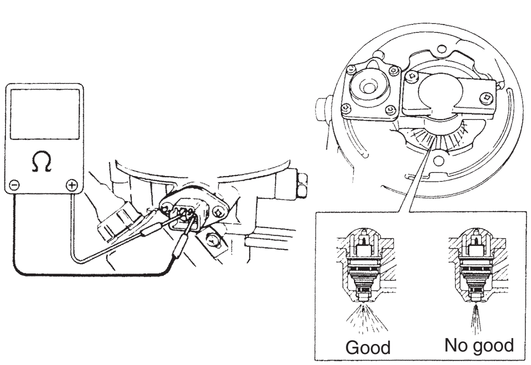
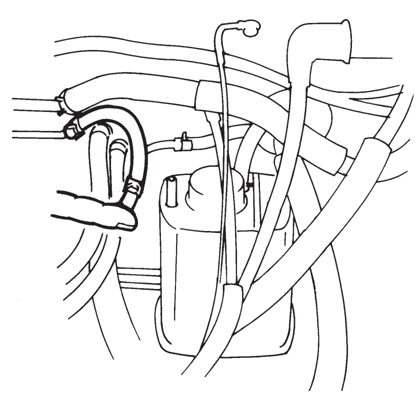
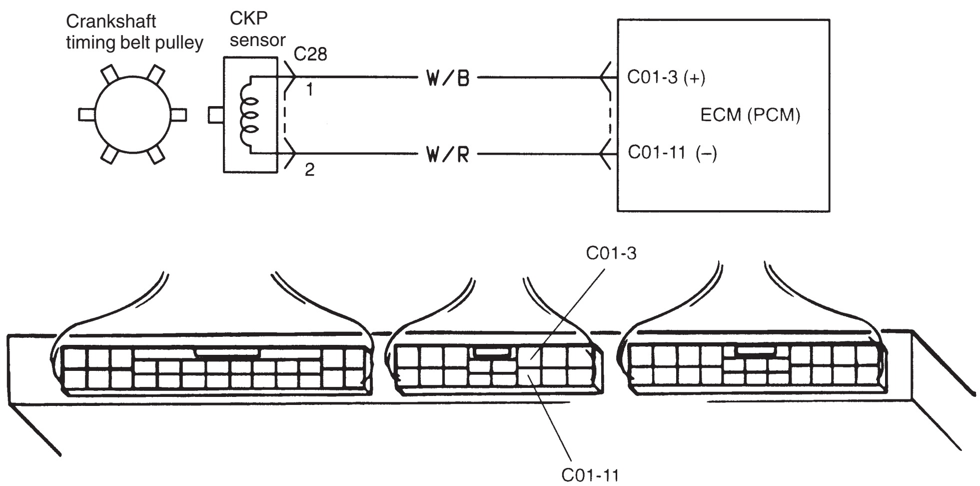


Fig. 5 for Step 7



DTC P0335 CRANKSHAFT POSITION (CKP) SENSOR CIRCUIT MALFUNCTION

CIRCUIT DESCRIPTION

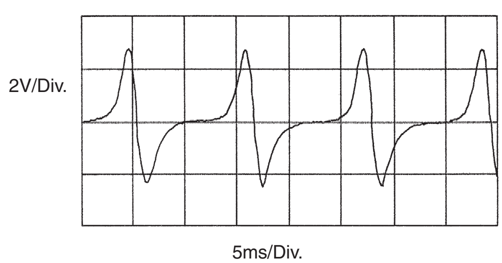


DTC DETECTING CONDITION	POSSIBLE CAUSE
● No CKP sensor signal during 1 revolution of camshaft.	● CKP sensor circuit open or short. ● Crankshaft timing belt pulley teeth damaged. ● CKP sensor malfunction, foreign material being attached or improper installation. ● ECM (PCM) malfunction.

Reference

Connect oscilloscope between terminals C01-3 (+) and C01-11 (–) of ECM (PCM) connector connected to ECM (PCM) and check CKP sensor signal.

Oscilloscope Waveforms



Waveforms at specified idle speed

DTC CONFIRMATION PROCEDURE

1) Clear DTC, start engine and keep it at idle for 1 min.
2) Select “DTC” mode on scan tool and check DTC.

INSPECTION

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Check CKP Sensor for Resistance. 1) Disconnect CKP sensor connector with ignition switch OFF. 2) Then check for proper connection to CKP sensor at "W/B" and "W/R" wire terminals. 3) If OK, measure sensor resistance between terminals. See Fig. 1. **CKP sensor resistance: 360 – 460 Ω at 20°C, (68°F)** 4) Measure resistance between each terminal and ground. **Insulation resistance: 1 MΩ or more.** Were measured resistance valves in step 3) and 4) as specified?	Go to Step 3.	Replace CKP sensor.
3	Check visually CKP sensor and pulley for the following. See Fig. 2. ● Damage ● No foreign material attached. ● Correct installation. Are they in good condition?	"W/B" or "W/R" wire open or shorted to ground, or poor connection at C01-3 or C01-11. If wire and connection are OK, intermittent trouble or faulty ECM (PCM). Recheck for intermittent referring to "Intermittent and Poor Connection" in Section 0A.	Clean, repair or replace.

Fig. 1 for Step 2

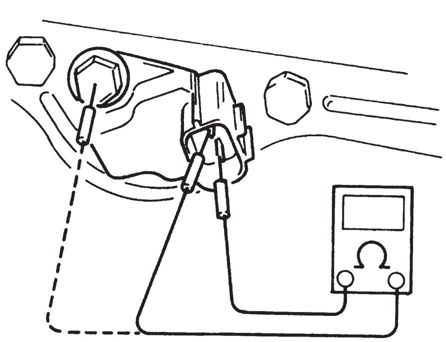
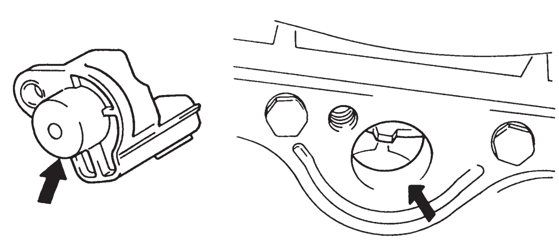
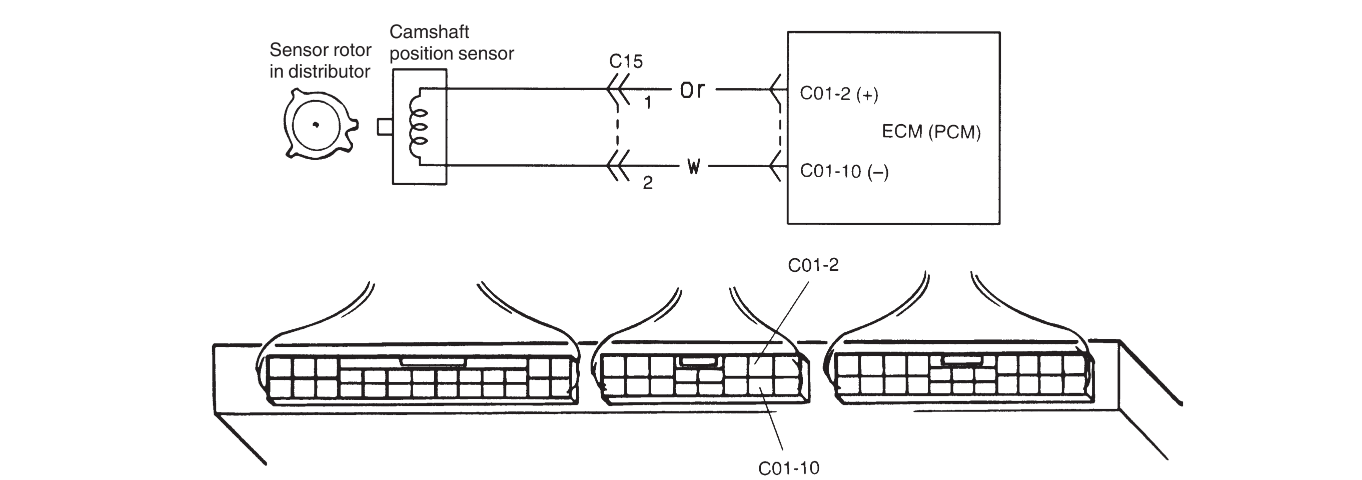


Fig. 2 for Step 3



DTC P0340 CAMSHAFT POSITION (CMP) SENSOR CIRCUIT MALFUNCTION

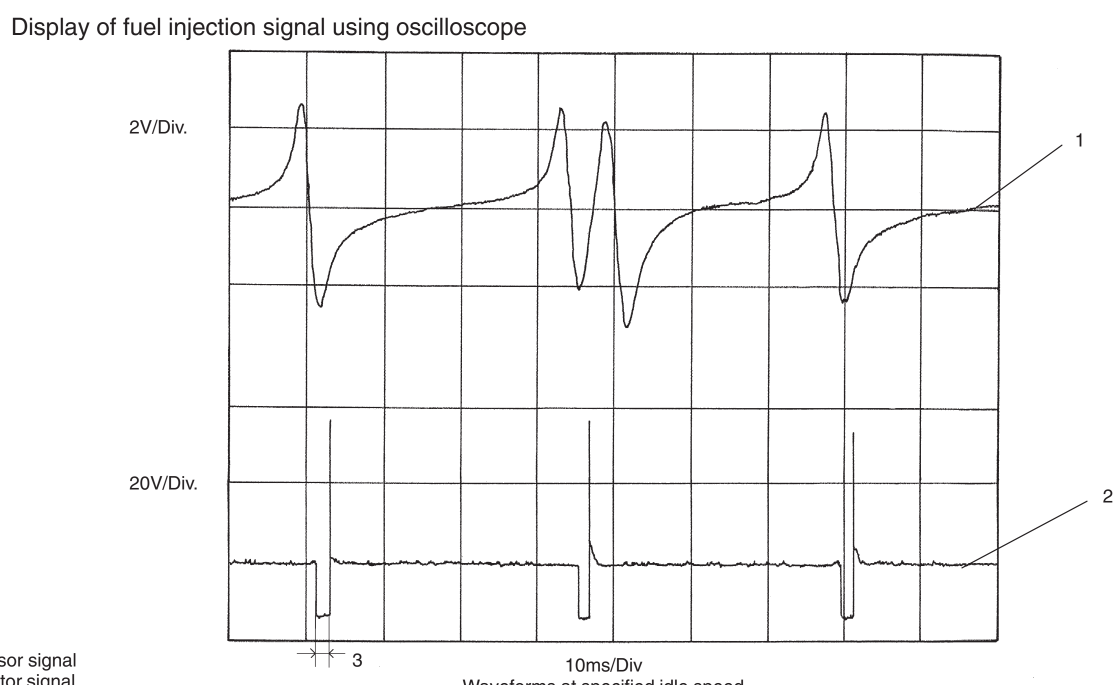
CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
● No CMP sensor signal for 2 seconds at engine cranking (CKP sensor signal is inputted).	● CMP sensor circuit open or short. ● Signal rotor teeth damaged. ● CMP sensor malfunction, foreign material being attached or improper installation. ● ECM (PCM) malfunction.

Reference

Connect oscilloscope between terminals C01-2 and C01-10 of ECM (PCM) connector connected to ECM (PCM) and check CMP sensor signal.



1. CMP sensor signal
2. Fuel injector signal
3. Fuel injection time

DTC CONFIRMATION PROCEDURE

1) Clear DTC.
2) Start engine and keep it at idle for 1 min.
3) Select “DTC” mode on scan tool and check DTC.

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Is DTC P1500 (Engine starter signal circuit malfunction) detected?	Go to DTC P1500 Diag. Flow Table.	Go to Step 3.
3	Check CMP Sensor for Resistance. 1) Measure resistance of CMP sensor by referring to “CMP SENSOR (PICK UP COIL) RESISTANCE” in SECTION 6F. Is resistance within specified value?	Go to Step 4.	Faulty CMP sensor.
4	Check Wire Harness. 1) With ignition switch at OFF position, disconnect ECM (PCM) electrical connectors. 2) Measure resistance from terminal “C01-2” to “C01-10” of ECM (PCM) connector. See Fig. 1. Is resistance within 185 – 275 Ω at 20°C (68°F)?	Go to Step 5.	“W” or “Or” wire open or short. Poor connection of CMP sensor connector terminal.
5	Check Air Gap Between Rotor Tooth and Sensor. See Fig. 2. 1) Remove Distributor cap. 2) Visually inspect CMP sensor signal rotor for damage. 3) Measure air gap by referring “SIGNAL ROTOR AIR GAP” in Section 6F. Was any damage found?	Faulty CMP sensor signal rotor.	Poor connection of ECM (PCM) connector terminal. If OK, substitute a known-good ECM (PCM) and recheck CMP.

Fig. 1 for Step 3

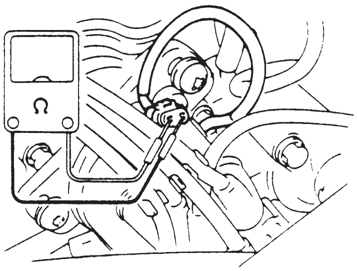
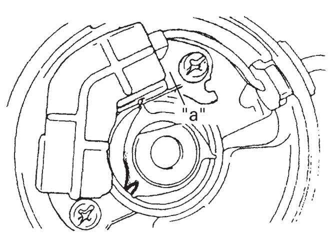


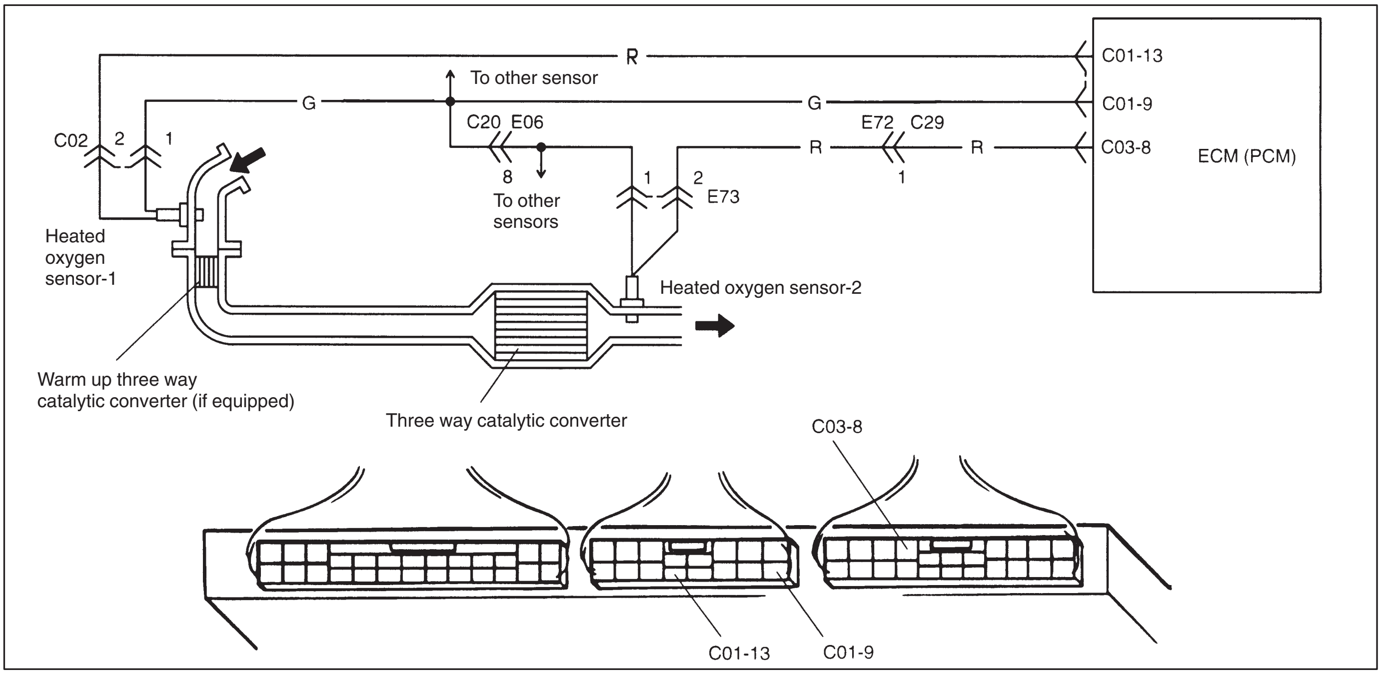
Fig. 2 for Step 5



“a”: Air gap

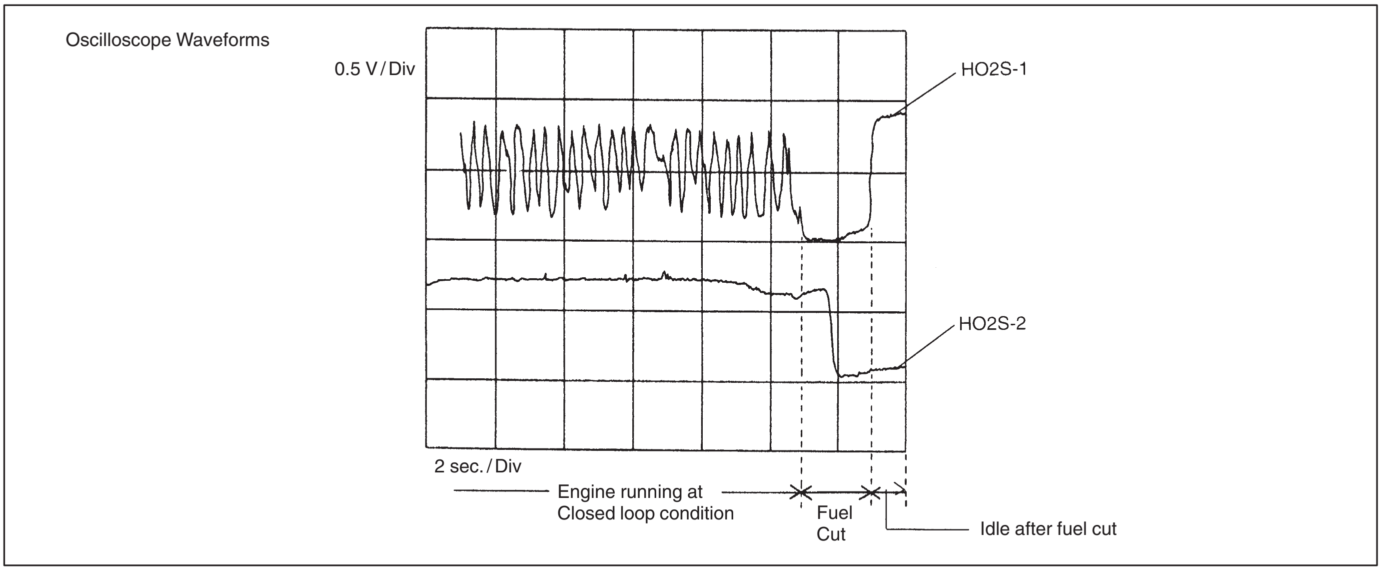
DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD

CIRCUIT DESCRIPTION



ECM (PCM) monitors oxygen concentration in the exhaust gas which has passed the three way catalytic converter by HO2S-2.
When the catalyst is functioning properly, the variation cycle of HO2S-2 output voltage (oxygen concentration) is slower than that of HO2S-1 output voltage because of the amount of oxygen in the exhaust gas which has been stored in the catalyst.

Reference

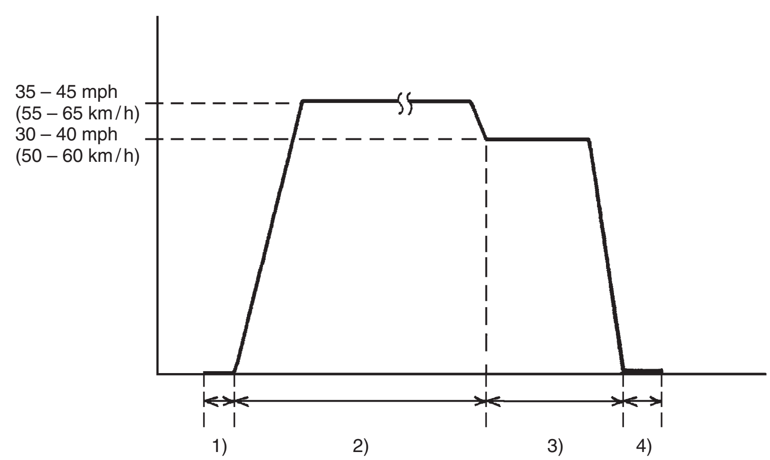


DTC DETECTING CONDITION	POSSIBLE CAUSE
● While vehicle running at constant speed under other than high load. ● Time from rich or lean switching command is output till HO2S-2 output voltage crosses 0.45 V is less than specified value. ✱ 2 driving cycle detection logic, monitoring once/1 driving.	● Exhaust gas leak ● Three way catalytic converter malfunction ● Fuel system malfunction ● HO2S-2 malfunction ● HO2S-1 malfunction

DTC CONFIRMATION PROCEDURE

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and tester, on a level road.**

1) Turn ignition switch OFF.
   Clear DTC with ignition switch ON, check vehicle and environmental condition for:
   – Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)
   – Ambient temp.: –10°C, 14°F or higher
   – Intake air temp.: 70°C, 158°F or lower
   – Engine coolant temp.: 70 – 110°C, 158 – 230°F
2) Start engine and drive vehicle at 40 – 47 mph, 65 – 75 km/h for 15 min. or longer.
   While this driving, if "Catalyst Monitoring TEST COMPLETED" is displayed in "READINESS TESTS" mode and DTC is not displayed in "DTC" mode, confirmation test is completed.
   If "TEST NOT COMPLTD" is still being displayed, continue test driving.
3) Decrease vehicle speed at 28 – 34 mph, 45 – 55 km/h, and hold throttle valve at that opening position for 2 min. and confirm that short term fuel trim vary within –20% –+20% range.
4) Stop vehicle (do not turn ignition switch OFF) and confirm test results according to following "Test Result Confirmation Flow Table".



Test Result Confirmation Flow Table

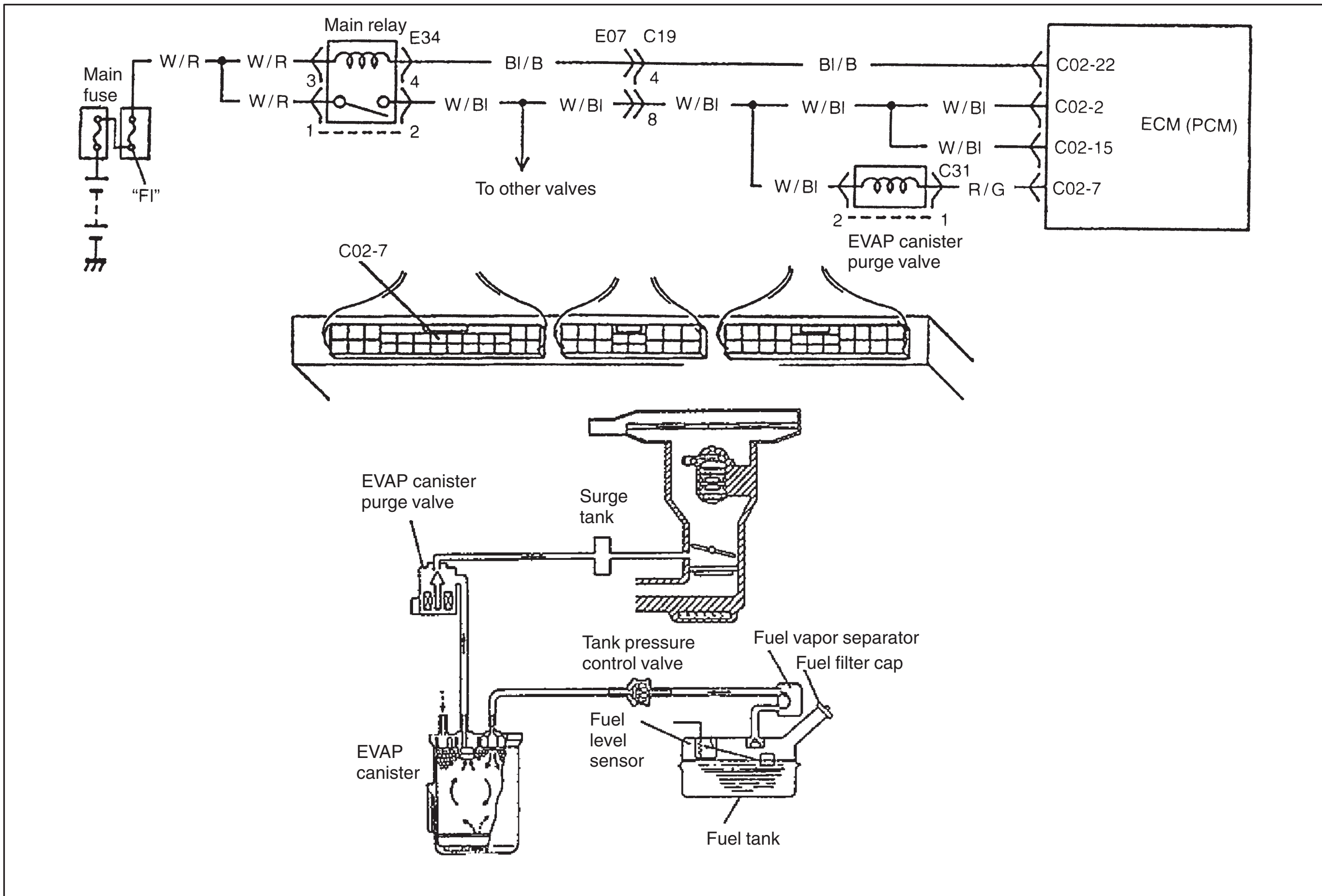
STEP	ACTION	YES	NO
1	Check DTC in "DTC" mode and pending DTC in "ON BOARD TEST" or "PENDING DTC" mode. Is DTC or pending DTC displayed?	Proceed to applicable DTC Diag. Flow Table.	Go to Step 2.
2	Set scan tool to "READINESS TESTS" mode and check if testing has been completed. Is test completed?	No DTC is detected (confirmation test is completed).	Repeat DTC confirmation procedure.

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Check Short Term Fuel Trim. Did short term fuel trim vary within –20% –+20% range in step 3) of DTC confirmation test?	Go to Step 3.	Check fuel system. Go to DTC P0171/P0172 Diag. Flow Table.
3	Check HO2S-2 for Output Voltage. Perform steps 1) through 9) of DTC confirmation procedure for DTC P0136 (HO2S-2 malfunction) and check output voltage of HO2S-2 then. Is over 0.6 V and below 0.3 V indicated?	Replace three way catalytic converter.	Check “G” and “R” wires for open and short, and connections for poor connection. If wires and connections are OK, replace HO2S-2.

DTC P0443 PURGE CONTROL VALVE CIRCUIT MALFUNCTION

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
Canister Purge control valve circuit is opened or shorted.	● "R/G" circuit open or short ● "W/BI" circuit open ● Canister purge valve malfunction

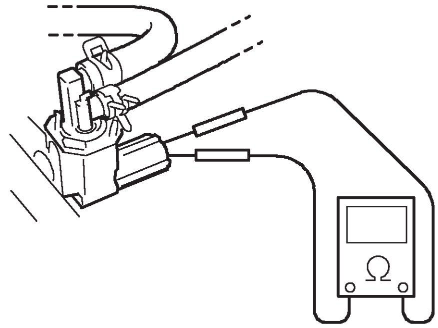
DTC CONFIRMATION PROCEDURE

1) Clear DTC with ignition switch ON.
2) Select "DTC" mode on scan tool and check DTC.

INSPECTION

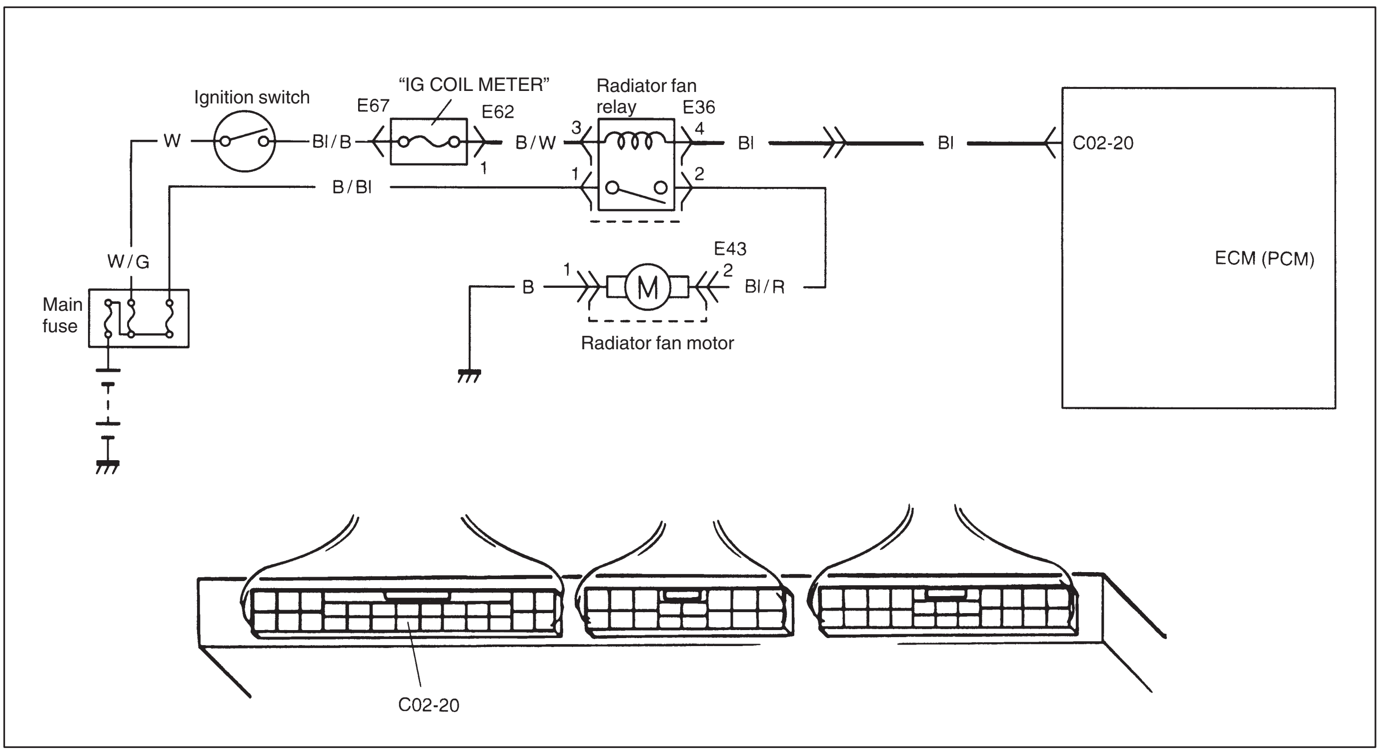
STEP	ACTION	YES	NO
1	Check EVAP canister purge valve operation 1) With ignition switch OFF, disconnect coupler from canister purge valve. 2) Check resistance of EVAP canister purge valve. See Fig. 1. Resistance between two terminals : 30 – 34 Ω at 20°C (68°F) Resistance between terminal and body : 1M Ω or higher Is it as specified?	"R/G" circuit open or short.	Replace EVAP canister purge valve.

Fig. 1 for Step 1



DTC P0480 RADIATOR FAN CONTROL SYSTEM MALFUNCTION

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
● Low voltage at terminal C02-20 when engine coolant temp. is below 91°C, 195°F. ✳ 2 driving cycle detection logic, continuous monitoring.	● "B/W" or "Bl" circuit open or short ● Radiator fan relay malfunction ● ECM (PCM) malfunction

DTC CONFIRMATION PROCEDURE

1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON.
3) Warm up engine until radiator cooling fan starts to operate.
4) Check pending DTC in "ON BOARD TEST" or "PENDING DTC" mode and DTC in "DTC" mode.

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Check Radiator Cooling Fan Relay and Its Circuit. 1) Turn ignition switch ON. 2) Check for voltage at terminal C02-20 of ECM (PCM) connector connected, under following condition. See Fig. 1. When engine coolant temp. is lower than 96°C, 205°F and A/C switch turns OFF: 10 – 14 V Is voltage 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	Check Radiator Fan Control Relay. 1) Turn ignition switch OFF and remove radiator fan relay. 2) Check for proper connection to the relay at “B/W” and “Bl” wire terminals. 3) If OK, then measure resistance between terminals a and b. See Fig. 2. Is it 100 – 120 Ω?	“B/W” or “Bl” circuit open or short. If wires and connections are OK, substitute a known-good ECM (PCM) and recheck.	Replace radiator fan relay.

Fig. 1 for Step 2

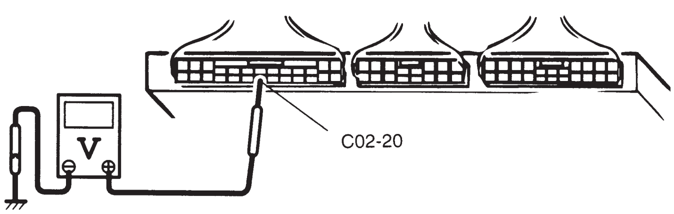
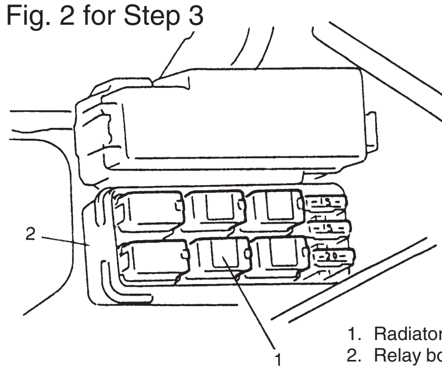


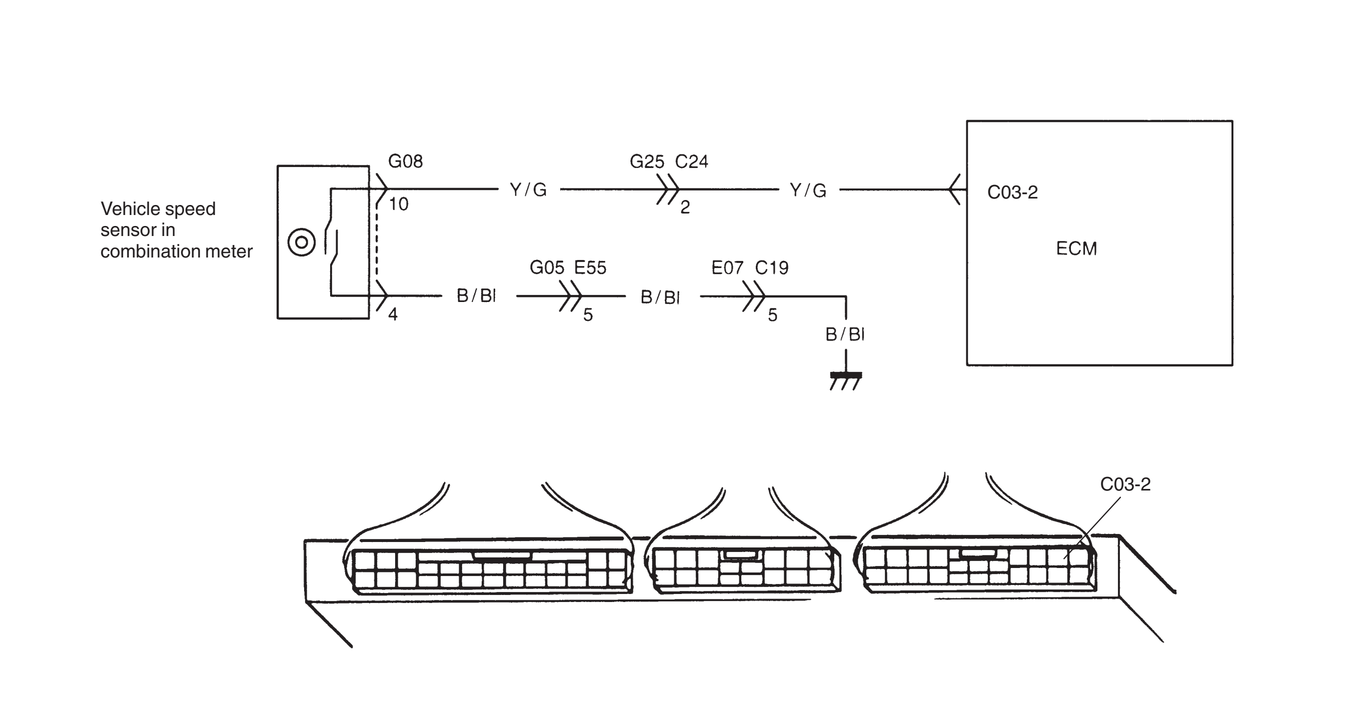
Fig. 2 for Step 3



1. Radiator fan relay
2. Relay box

DTC P0500 VEHICLE SPEED SENSOR (VSS) MALFUNCTION (M/T)

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
• VSS signal not inputted while vehicle running in “D” range or during fuel cut at deceleration. ✳ 2 driving cycle detection logic, continuous monitoring	• “B/Bl” circuit open • “Y/G” circuit open or short • VSS malfunction • ECM malfunction • Speedometer cable malfunction

DTC CONFIRMATION PROCEDURE

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester.**

1) Clear DTC and warm up engine to normal operating temperature.
2) Increase vehicle speed to 50 mph, 80 km/h in 3rd gear or “2” range while observing vehicle speed displayed on scan tool.
3) Release accelerator pedal and with engine brake applied, keep vehicle coasting (fuel cut condition) for 4 sec. or more.
4) Check pending DTC and DTC.

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Does speedometer indicate vehicle speed?	Go to Step 3.	Speedometer cable disconnected or broken.
3	Check VSS and Its Circuit. 1) Disconnect ECM connector with ignition switch OFF. 2) Check for proper connection to ECM at terminal C03-2. 3) If OK, then connect ohmmeter between terminal C03-2 of ECM connector and body ground. See Fig. 1. 4) Hoist front end of vehicle and lock front right tire. 5) Turn front left tire slowly. Does ohmmeter indicator deflect between 0 and ∞ a few times while tire is turned one revolution?	Intermittent trouble or faulty ECM. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Go to Step 4.
4	Check VSS. 1) Remove combination meter. 2) Connect ohmmeter between “VSS” terminal (No.10) and “GND” (No.4) terminal of combination meter and turn cable joint of speedometer with a screwdriver. Ohmmeter indicator should move back and forth between 0 (zero) and ∞ (infinity) 4 times while cable joint is turned one full revolution. See Fig. 2. Is it in good condition?	“Y/G” or “B/Bl” wire open or short, or poor connector connection.	Replace VSS.

Fig. 1 for Step 3

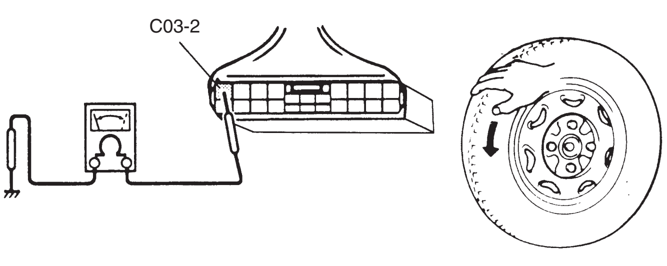
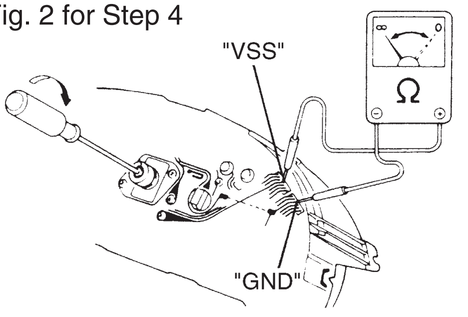
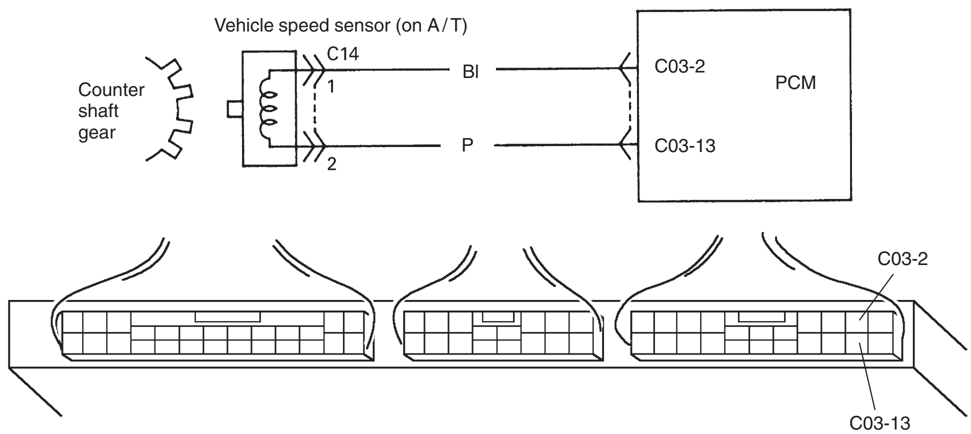


Fig. 2 for Step 4



DTC P0500 VEHICLE SPEED SENSOR (VSS) MALFUNCTION FOR A/T VEHICLE (A/T)



CIRCUIT DESCRIPTION – Refer to Section 6E1 for VSS operation.

DTC DETECTING CONDITION	POSSIBLE CAUSE
● While fuel is kept cut at lower than 4000 r/min for longer than 4 sec. ● VSS signal not inputted. ⁎ 2 driving cycle detection logic, continuous monitoring.	● "Bl" or "P" circuit open or short. ● Vehicle speed sensor malfunction. ● Foreign material being attached or sensor installed improperly. ● Gear damaged.

DTC CONFIRMATION PROCEDURE

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester, on a level road.**

1) Turn ignition switch OFF and then ON.
2) Clear DTC and warm up engine to normal operating temperature.
3) Increase vehicle speed to 50 mph, 80 km/h in "2" range.
4) Release accelerator pedal and with engine brake applied, keep vehicle coasting (fuel cut condition) for 4 sec. or more.
5) Stop vehicle and check DTC and pending DTC.

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Check VSS for Resistance. 1) Disconnect VSS connection with ignition switch OFF. 2) Check for proper connection to VSS at “Bl” and “P” wire terminals. 3) If OK, then check resistance of VSS. See Fig. 1. Resistance between terminals : 100 – 300 Ω Resistance between terminal and transmission : 1 MΩ or more Are check result satisfactory?	Go to Step 3.	Replace VSS.
3	Check Visually VSS and Counter Shaft Gear for the Following. See Fig. 2. ● No damage ● No foreign material attached ● Correct installation Are they in good condition?	“Bl” or “P” wire open or shorted to ground or poor C03-2 or C03-13 connection. If wires and connections are OK, intermittent trouble or faulty PCM. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Clean, repair or replace.

Fig. 1 for Step 2

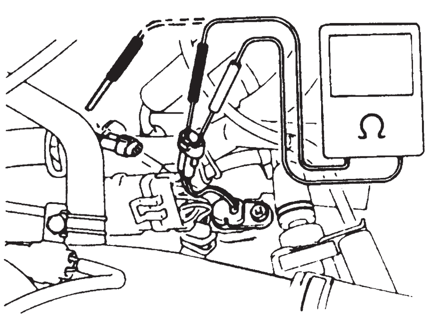
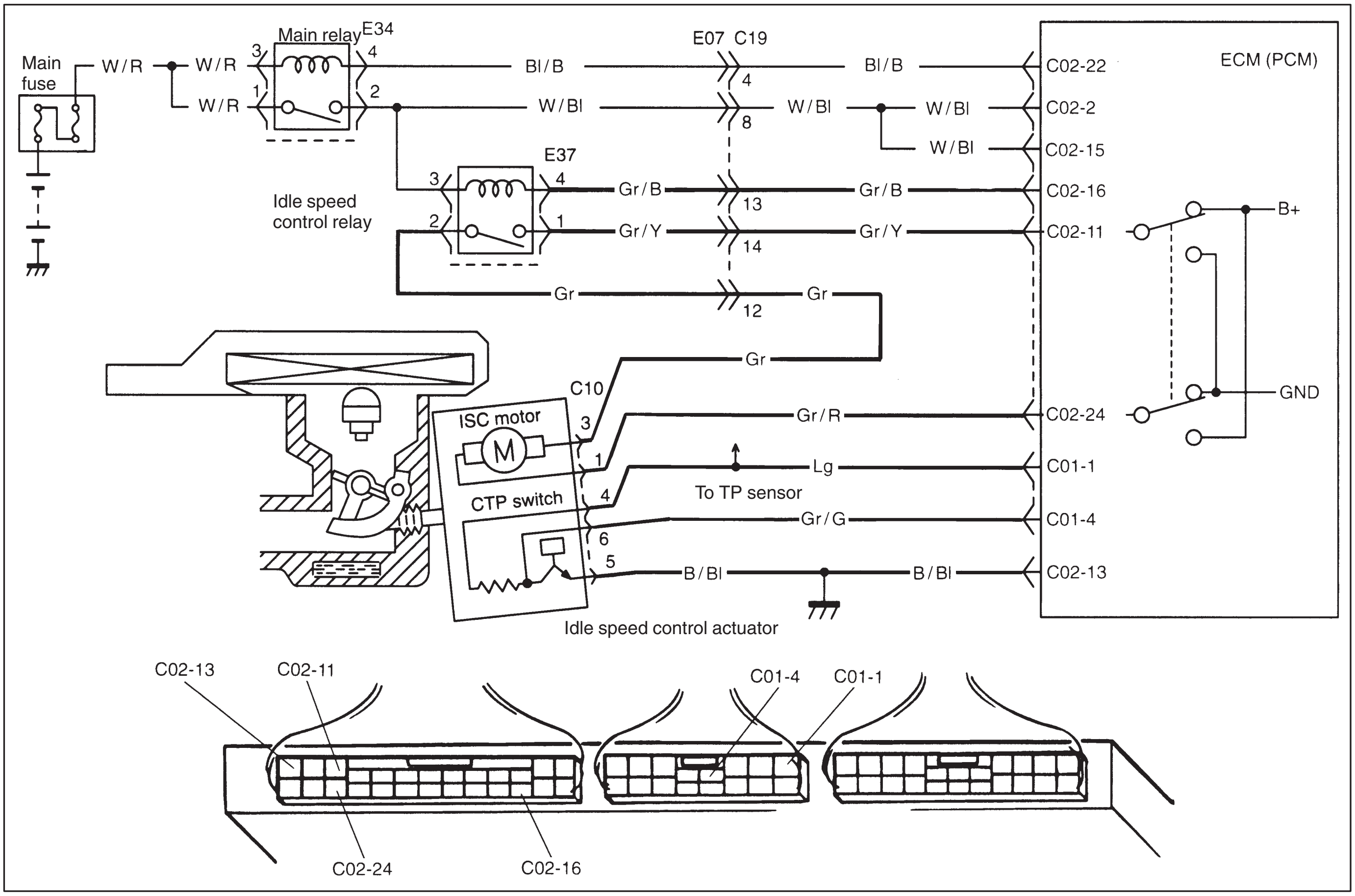


Fig. 2 for Step 3

DTC P0505 IDLE CONTROL SYSTEM MALFUNCTION

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
DTC will set when A, B or C condition is met. A: Throttle opening change is small as compared with electrically live time. B: Throttle valve opening is not within its target range with CTP switch ON. C: Drive voltage exists though ECM (PCM) is not outputting ISC drive command.	• Malajusted accelerater cable • Poor movement of throttle valve • Closed throttle position switch malfunction • Idle speed control actuator malfunction • Idle speed control relay malfunction • “Gr/B”, “Gr/Y”, “Gr”, “Gr/R”, “Gr/G”, “Lg” or “B/Bl” circuit open or short • Throttle position sensor malfunction • ECM (PCM) malfunction

DTC CONFIRMATION PROCEDURE

1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON.
3) Start cold engine.
4) Run it idle for 5 min.
5) Select “DTC” mode on scan tool and check DTC.

NOTE:
If engine speed changes up and down when engine speed is increased by opening throttle valve more than half but not changing its opening, it is possible that closed throttle position switch is malfunctioning.

DTC P0505

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Check Idle Control System. 1) Connect SUZUKI scan tool to DLC with ignition switch OFF, set parking brake and block drive wheels. 2) Warm up engine to normal operating temperature. 3) Clear DTC and select “MISC TEST” mode on SUZUKI scan tool. Is it possible to control (increase and reduce) engine idle speed by using SUZUKI scan tool?	Check TP sensor (Go to DTC P0121 Flow Table) If TP sensor is OK, intermittent trouble or faulty ECM (PCM). Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Go to Step 3.
3	Check ISC Relay. 1) Ignition switch OFF and remove ISC relay (“ISCA”). 2) Check for proper connection to ISC relay at terminals 3 and 4. 3) Check resistance between each two terminals. Between terminals 1 and 2: Infinity Between terminals 3 and 4: 100 – 120 Ω 4) Check that there is continuity between terminals 1 and 2 when battery is connected to terminals 3 and 4. Is ISC relay in good condition?	Go to Step 4.	Replace ISC relay.
4	Check Idle Speed Control Actuator. 1) Check ISC actuator operation by referring to ISC ACTUATOR INSPECTION in Section 6. Is it good condition?	Check “Gr/B”, “Gr/Y”, “Gr” and “Gr/R” circuit for open and short. If wires and connections are OK, substitute a known-good ECM (PCM) and recheck.	Replace throttle lower body with ISC actuator.

Fig. 1 for Step 3

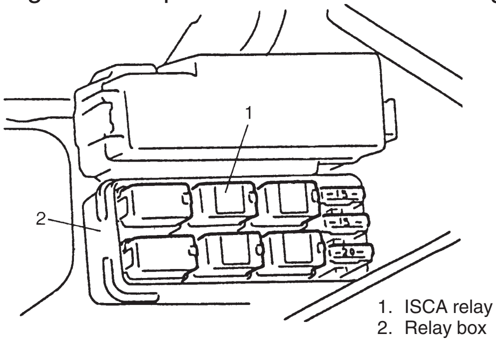


Fig. 2 for Step 3

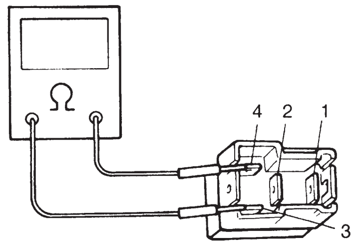
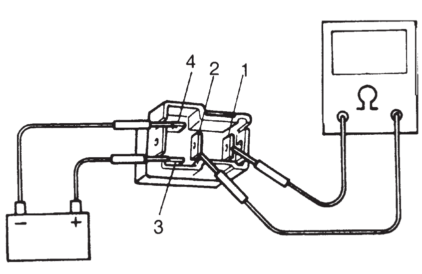


Fig. 3 for Step 3



DTC P0510 CLOSED THROTTLE POSITION (CTP) SWITCH MALFUNCTION

CIRCUIT DESCRIPTION – Refer to DTC P0505 section.

DTC DETECTING CONDITION	POSSIBLE CAUSE
● Even when vehicle is started from stop and accelerated to specified vehicle speed, CTP switch does not turn from ON to OFF (or from OFF to ON). ✳ 2 driving cycle detection logic, continuous monitoring	● "Lg", "Gr/G" or "B/Bl" circuit open or short ● CTP switch malfunction ● ECM (PCM) malfunction

NOTE:
When DTC P0105, P0120 and/or P0510 are indicated together, it is possible that "Lg" circuit is open.

DTC CONFIRMATION PROCEDURE

1) Turn ignition switch OFF, clear DTC with ignition switch ON and start engine.
2) Increase vehicle speed to 20 mph, 32 km/h and then stop vehicle.
3) Repeat above step 2) 15 times.
4) Check pending DTC in "ON BOARD TEST" or "PENDING DTC" mode and DTC in "DTC" mode.

INSPECTION

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Check CTP Switch Operation. 1) Connect SUZUKI scan tool to DLC with ignition switch OFF. 2) Turn ignition switch ON. Does CTP switch operate properly under following conditions respectively? Condition "A": ON displayed on scan tool Condition "B": OFF displayed on scan tool Is test result satisfactory?	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection in Section 0A.	Go to Step 3.
3	Check CTP switch. 1) Arrange 3 new 1.5 V batteries in series (4.5 V in total). 2) Connect these batteries to CTP switch terminals "4" and "5". 3) Under following each condition, check voltage between CTP switch terminals "6" and "5". Condition "A": 0 – 1 V Condition "B": 3.5 – 5.5 V Is measured voltage as specified?	Check "Lg", "Gr/G" and "B/Bl" wires and connections for open or short. If wires and connections are OK, substitute a known-good ECM (PCM) and recheck.	Replace ISC motor set (throttle lower body with ISC actuator).

Fig. 1 for Step 2

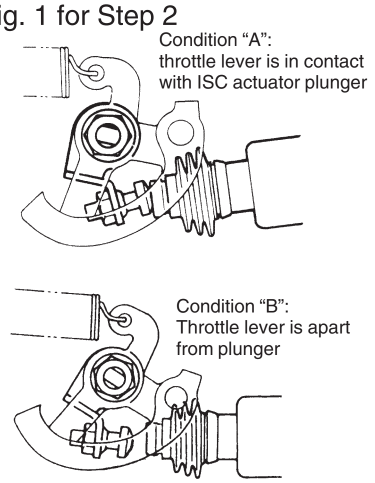
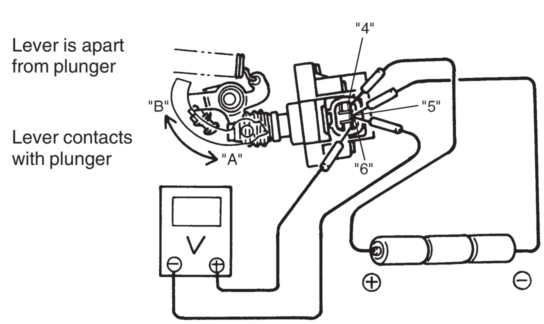


Fig. 2 for Step 3



DTC P0601 INTERNAL CONTROL MODULE MEMORY CHECK SUM ERROR

DTC DETECTING CONDITION	POSSIBLE CAUSE
DTC P0601: Data write error (or check sum error) when written into ECM (PCM) ✻ 2 driving cycle detection logic, continuous monitoring.	ECM (PCM)

DTC CONFIRMATION PROCEDURE

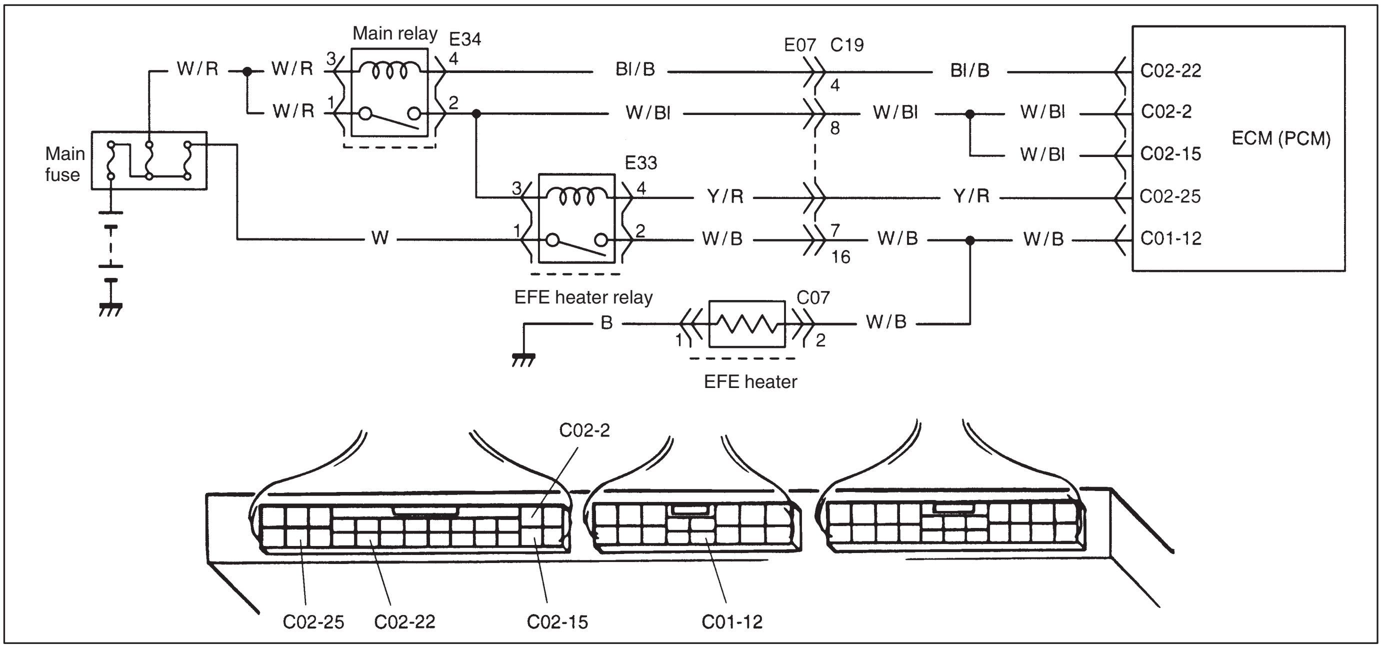
1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON and then turn ignition switch OFF.
3) Start engine and run it at idle if possible.
4) Check pending DTC in “ON BOARD TEST” or “PENDING DTC” mode and DTC in “DTC” mode.

INSPECTION

Substitute a known-good ECM (PCM) and recheck.

DTC P1250 EARLY FUEL EVAPORATION (EFE) HEATER CIRCUIT MALFUNCTION

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
● Voltage low at terminal C01-12 during engine warming up or ● Voltage high at terminal C01-12 after engine warming up ✻ 2 driving cycle detection logic, continuous monitoring	● "Y/R", "W" or "W/B" circuit open or short ● EFE heater relay malfunction ● EFE heater malfunction ● ECM (PCM) malfunction

DTC CONFIRMATION PROCEDURE

1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON.
3) Check vehicle and environmental condition for:
   – Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)
   – Ambient temp: –10°C, 14°F or higher
   – Intake air temp: 70°C, 158°F or lower
4) Start cool engine and warm it up to normal operating temperature.
5) Check pending DTC in "ON BOARD TEST" or "PENDING DTC" mode and DTC in "DTC" mode.

INSPECTION

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Check EFE Heater and Its Circuit. Check for voltage at terminal C01-12 of ECM (PCM) connector connected, under following each condition. During engine warming up (Coolant temp.: Below 80°C, 176°F, Engine speed: Over 750 r/min): Over 1.0 V After warming up: Below 1.0 V Is each voltage as specified?	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A.	Go to Step 3.
3	Check EFE Heater Relay. 1) Turn OFF ignition switch and remove EFE heater relay ("PTC"). See Fig. 2. 2) Check for proper connection to relay at terminal 3 and 4. See Fig. 3. 3) Check resistance between each two terminals. Between terminals 1 and 2: Infinity Between terminals 3 and 4: 100 – 120 Ω 4) Check that there is continuity between terminals 1 and 2 when battery is connected to terminals 3 and 4. See Fig. 4. Is EFE heater relay in good condition?	Go to Step 4.	Replace EFE heater relay.
4	Check EFE Heater and Its Circuit. 1) Turn ignition switch OFF and disconnect ECM (PCM) connectors. 2) Check for proper connection to ECM (PCM) at terminals C02-25 and C01-12. 3) If OK, then measure resistance between terminal C01-12 and ground. Is it 0.5 – 30 Ω at 20°C (68°F)?	"W", "Y/R" or "W/B" circuit open or short. If wire and connections are OK, substitute a known-good ECM (PCM) and recheck.	"W/B" circuit open or short. If wire and connections are OK, replace EFE heater.

Fig 1. for Step 4

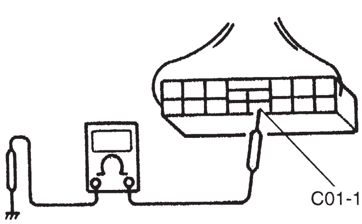


Fig. 2 for Step 3

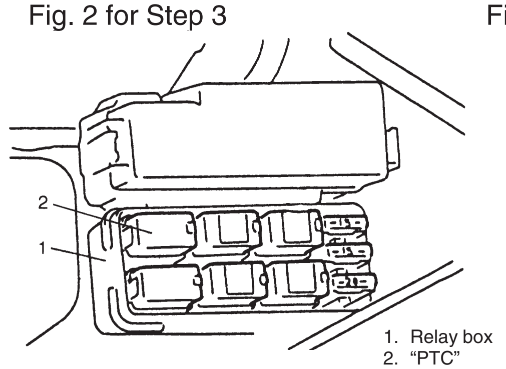


Fig. 3 for Step 3

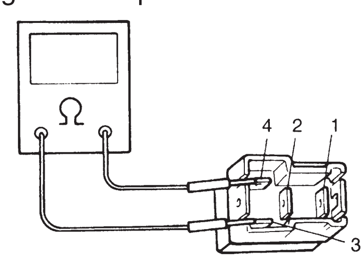
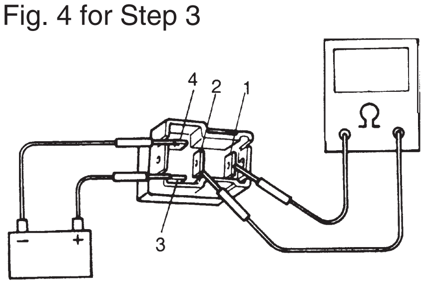


Fig. 4 for Step 3



DTC P1450 BAROMETRIC PRESSURE SENSOR LOW/HIGH INPUT
DTC P1451 BAROMETRIC PRESSURE SENSOR PERFORMANCE PROBLEM

WIRING DIAGRAM/CIRCUIT DESCRIPTION

Barometric pressure sensor is installed in ECM (PCM).

DTC DETECTING CONDITION	POSSIBLE CAUSE
DTC P1450: ● Barometric pressure: 136 kPa 1025 mmHg or higher, or 33 kPa 250 mmHg or lower	● ECM (PCM) (barometric pressure sensor) malfunction
DTC P1451: ● Vehicle stopped. ● Engine cranking. ● Difference between barometric pressure and intake manifold absolute pressure is 26 kPa, 200 mmHg or more. ✳ 2 driving cycle detection logic, monitoring once/1 driving.	● Manifold absolute pressure sensor and its circuit malfunction ● ECM (PCM) (barometric pressure sensor) malfunction

DTC CONFIRMATION PROCEDURE

1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON.
3) Turn ignition switch ON for 2 sec., crank engine for 2 sec. and run it at idle for 1 min.
4) Check pending DTC in “ON BOARD TEST” or “PENDING DTC” mode and DTC in “DTC” mode.

INSPECTION

DTC P1450:

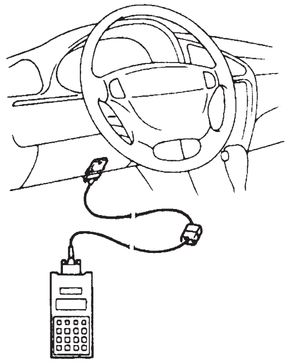
Substitute a known-good ECM (PCM) and recheck.

DTC P1451:

NOTE:
Note that atmospheric pressure varies depending on weather conditions as well as altitude.
Take that into consideration when performing these check.

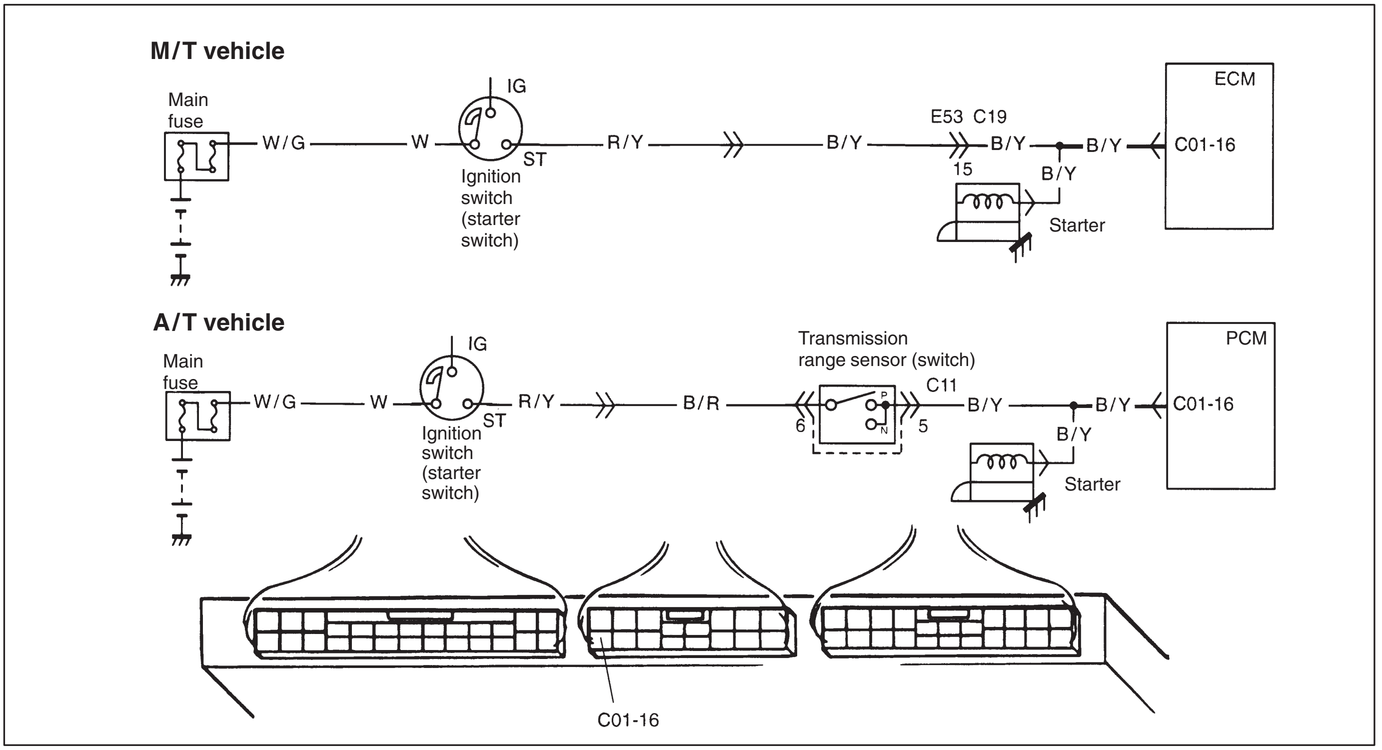
STEP	ACTION	YES	NO
1	1) Connect scan tool to DLC with ignition switch OFF. 2) Turn ignition switch ON and select “DATA LIST” mode on scan tool. 3) Check manifold absolute pressure. See Fig. 1. Is it barometric pressure (approx. 100 kPa, 760 mmHg) at sea level?	Substitute a known-good ECM (PCM) and recheck.	Check intake manifold pressure sensor and its circuit. Go to P0105 DIAG. FLOW TABLE.

Fig. 1 for Step 1



DTC P1500 ENGINE STARTER SIGNAL CIRCUIT MALFUNCTION

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
● High voltage at terminal C01-16 for 3 min. after engine start. ● Low voltage at terminal C01-16 during starting engine. ✳ 2 driving cycle detection logic, continuous monitoring.	● "B/Y" circuit open ● ECM (PCM) malfunction

DTC CONFIRMATION PROCEDURE

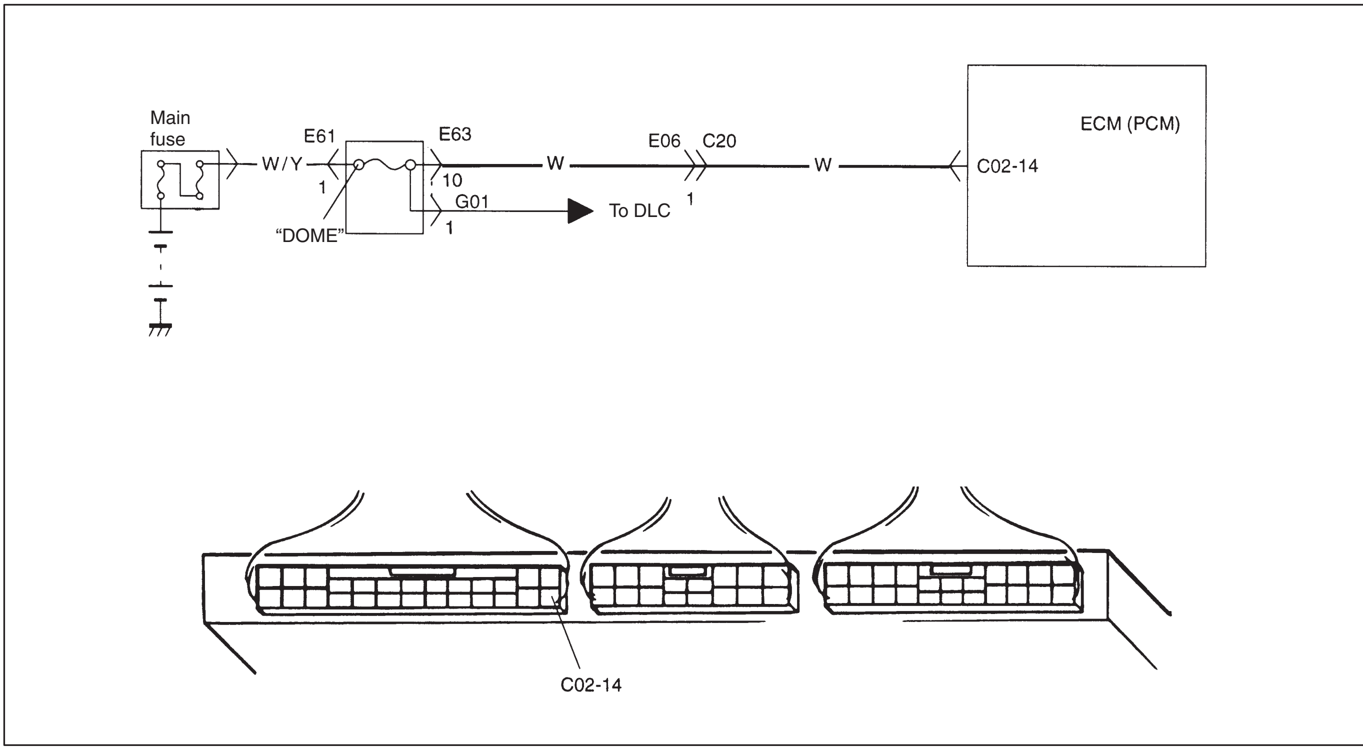
1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON, crank engine and run it at idle for 3 min.
3) Check pending DTC in "ON BOARD TEST" or "PENDING DTC" mode and DTC in "DTC" mode.

INSPECTION

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Check for voltage at terminal C01-16 of ECM (PCM) connector connected, under following condition. While engine cranking : 6 – 10 V After starting engine : 0 V Is voltage as specified?	Poor C01-16 connection or intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A. If wire and connections are OK, substitute a known-good ECM (PCM) and recheck.	"B/Y" circuit open.

DTC P1510 ECM (PCM) BACK-UP POWER SUPPLY MALFUNCTION

CIRCUIT DESCRIPTION



Battery voltage is supplied so that diagnostic trouble code memory, values for engine control learned by ECM (PCM), etc. are kept in ECM (PCM) even when the ignition switch is turned OFF.

DTC DETECTING CONDITION	POSSIBLE CAUSE
● Low voltage at terminal C02-14 after starting engine.	● "W" circuit open ● ECM (PCM) malfunction

DTC CONFIRMATION PROCEDURE

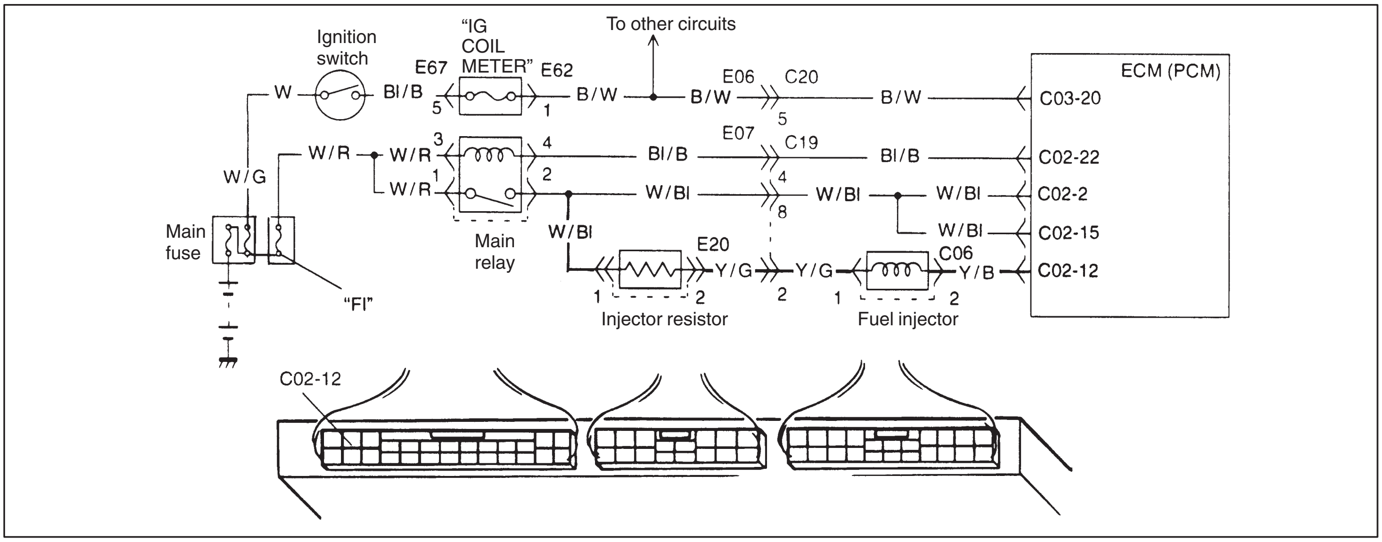
1) Clear DTC, start engine and run it at idle for 1 min.
2) Select "DTC" mode on scan tool and check DTC.

INSPECTION

STEP	ACTION	YES	NO
1	Check for voltage at terminal C02-14 of ECM (PCM) connector connected, under each condition, ignition switch OFF and engine running. Is it 10 – 14 V at each condition?	Poor C02-14 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.

BLANK

TABLE B-1 FUEL INJECTOR CIRCUIT CHECK

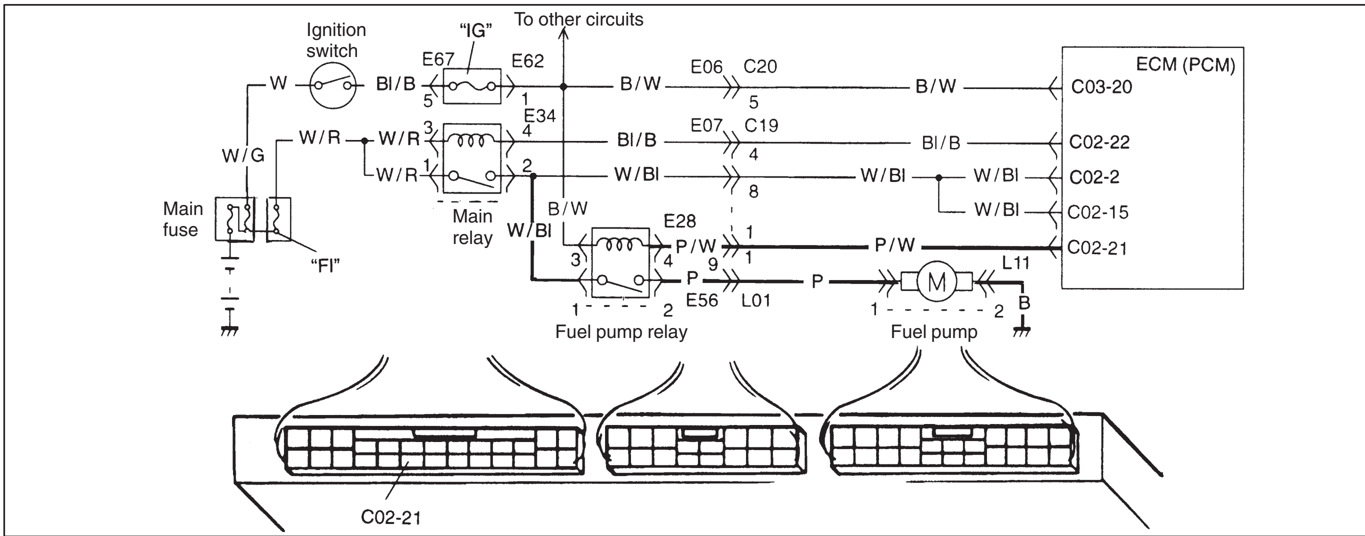


INSPECTION

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Injector Circuit Check 1) Check injector circuit for short. Is fuel injected from injector at ignition switch ON?	"Y/B" wire shorted to ground or faulty injector. If wire and injector is as specified respectively and then substitute known-good ECM (PCM) and recheck.	Go to Step 3.
3	Injector Check 1) Check injector for fuel Injection referring to FUEL INJECTOR ON-VEHICLE INSPECTION in Section 6E1. Is fuel injected from injector at engine cranking?	Go to Step 4.	Go to Step 5.
4	Injector Leakage Check 1) Check injector for leaks referring to FUEL INJECTOR ON-VEHICLE INSPECTION in Section 6E1. Is it in good condition?	Injector and its circuit are in good condition.	Faulty fuel injector.
5	Check Injector for Operating Sound. 1) Using sound scope, check injector for operating sound at engine cranking. Is it detected?	Proceed to DIAG. FLOW TABLE B-2 and B-3.	Go to Step 6.

STEP	ACTION	YES	NO
6	Check Injector Resistor for Resistance. 1) Disconnect resistor connector with ignition switch OFF. 2) Check for proper connection to resistor at each terminals. 3) If connection is OK, check resistance. Is resistance 1.9 – 2.1 Ω (at 20°C, 68°F)?	"W/Bl", "Y/G" or "Y/B" wire open or poor C02-12 connection. If wires and connections are OK, substitute a known-good ECM (PCM) and recheck.	Replace resistor.

TABLE B-2 FUEL PUMP AND ITS CIRCUIT CHECK



INSPECTION

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Check Fuel Pump Control System for Operation. See Fig. 1. Is fuel pump heard to operate for 2 sec. after ignition switch ON?	Fuel pump circuit is in good condition.	Go to Step 3.
3	Check Fuel Pump for Operation. 1) Remove fuel pump relay from relay box with ignition switch OFF. 2) Check for proper connection to relay at each terminals. 3) If OK, using service wire, connect terminals E28-1 and E28-2 of relay connector. See Fig. 2. **CAUTION: Check to make sure that connection is made between correct terminals. Wrong connection can cause damage to ECM (PCM), wire harness, etc.** Is fuel pump heard to operate at ignition switch ON?	Go to Step 4.	"P", "B" or "W/Bl" circuit open or fuel pump malfunction.
4	Check Fuel Pump Relay for Operation. 1) Check resistance between each two terminals of fuel pump relay. See Fig.3. Between terminals "1" and "2": Infinity Between terminals "3" and "4": 100 – 120 Ω 2) Check that there is continuity between terminals "1" and "2" when battery is connected to terminals "3" and "4". See Fig. 4. Is fuel pump relay in good condition?	"P/W" circuit open or poor C02-21 connection. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.	Replace fuel pump relay.

Fig. 1 for Step 2

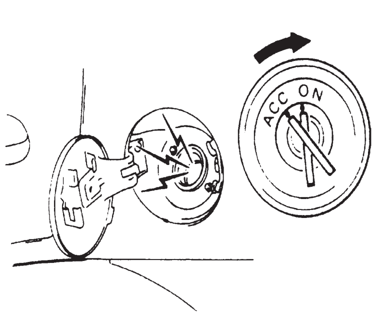
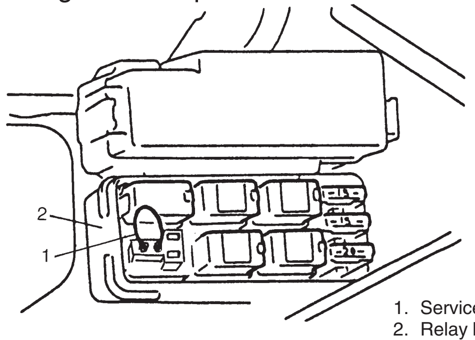


Fig. 2 for Step 3



1. Service wire
2. Relay box

Fig. 3 for Step 4

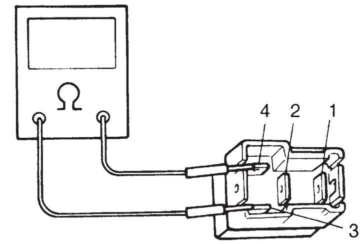


Fig. 4 for Step 4

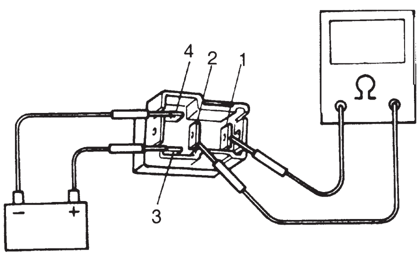
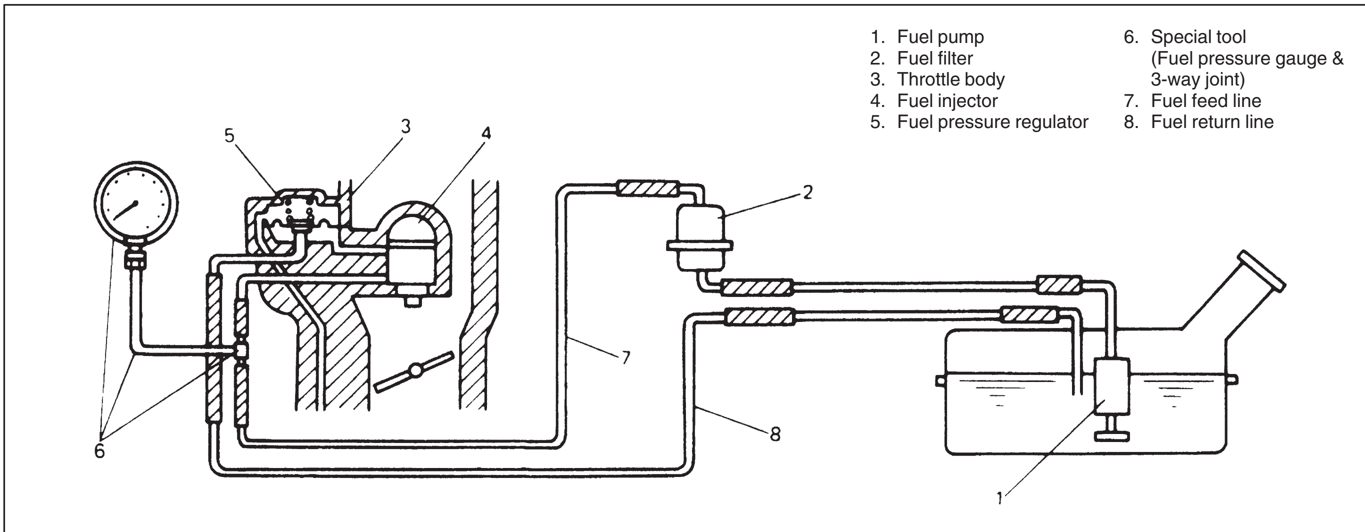


TABLE B-3 FUEL PRESSURE CHECK

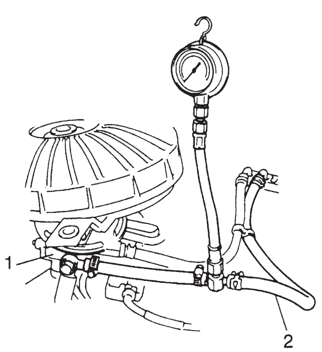


INSPECTION

STEP	ACTION	YES	NO
1	Check Fuel Pressure (Refer to Section 6E1 for details). 1) Release fuel pressure from fuel feed line. 2) Install fuel pressure gauge. 3) Check fuel pressure by repeating ignition switch ON and OFF. See Fig. 1. Is fuel pressure then 160 – 210 kPa (1.6 – 2.1 kg/cm^2, 22.7 – 29.9 psi)?	Go to Step 2.	Go to Step 4.
2	Is 90 kPa (0.9 kg/cm^2, 12.8 psi) or higher fuel pressure retained for 1 minute after fuel pump is stopped at Step 1?	Normal fuel pressure.	Go to Step 3.
3	1) Start engine and warm it up to normal operating temperature. 2) Keep it running at specified idle speed. Is fuel pressure then within 90 – 140 kPa (0.9 – 1.4 kg/cm^2, 12.8 – 20.0 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 their joint?	Fuel leakage from hose, pipe or joint.	Go to Step 10.
5	Was fuel pressure higher than specification in Step 1?	Go to Step 6.	Go to Step 7.
6	1) Disconnect fuel return hose from throttle body and connect new return hose to it. 2) Insert 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 supplied in Step 1?	Go to Step 8.	Go to Step 9.

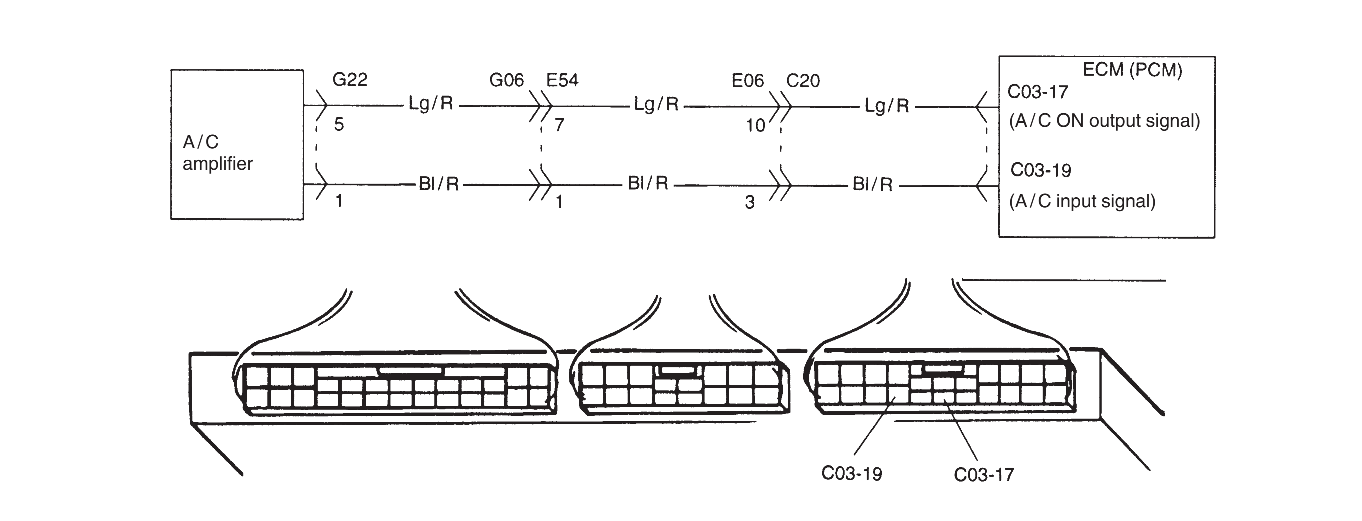
STEP	ACTION	YES	NO
8	With fuel pump operated and fuel return hose blocked by pinching it, is fuel pressure applied?	Faulty fuel pressure regulator.	Shortage of fuel or fuel pump or its circuit defective (refer to B-2 FUEL PUMP ANDITS CIRCUIT CHECK).
9	1) Operate fuel pump. 2) With fuel return hose blocked by pinching it, check fuel pressure. Is it 450 kPa (4.5 kg/cm^2, 63.9 psi) or more?	Faulty fuel pressure regulator.	● Clogged fuel filter, ● Restricted fuel feed hose or pipe, ● Faulty fuel pump or ● Fuel leakage from hose connection in fuel tank.
10	1) Disconnect fuel return hose from throttle body and connect new return hose to it. 2) Insert the other end of new return hose into approved gasoline container. 3) Check again if specified pressure is retained. While doing so, does fuel come out of return hose?	Faulty fuel pressure regulator.	● Fuel leakage from injector, ● Fuel leakage from between injector and throttle body, ● Faulty fuel pump (faulty check valve in fuel pump) or ● Fuel leakage from fuel pressure regulator diaphragm.

Fig. 1 for Step 1



1. Fuel pressure gauge & 3way joint

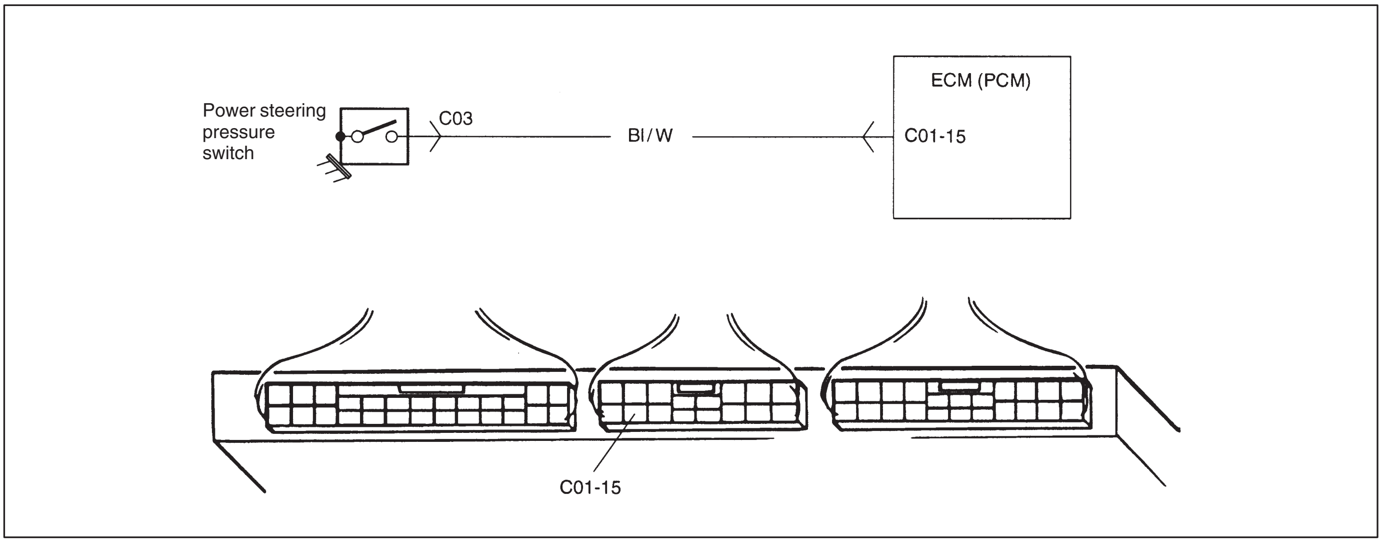
TABLE B-4 A/C SIGNAL CIRCUITS CHECK (VEHICLE WITH A/C)



INSPECTION

STEP	ACTION	YES	NO
1	Check A/C (Input) Signal Circuit. 1) Check voltage at terminal C03-19. While engine running and A/C switch and/or heater blower switch OFF (A/C is not operating) : 10 – 14 V While engine running and both A/C switch and heater blower switch ON (A/C is operating) : About 0 V Are check results as specified?	Go to Step 2.	● "Bl/R" wire open or short. ● Poor C03-19 connection. ● Poor A/C amplifier coupler connection or faulty A/C system.
2	Check A/C ON (Output) Signal Circuit. 1) Check voltage at terminal C03-17. While engine running and A/C switch and/or heater blower switch OFF (A/C is not operating) : About 0 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 results as specified?	A/C control signal circuits are in good condition.	● "Lg/R" wire open or short. ● Poor performance of ECT sensor, TP sensor. ● Engine start signal inputted or ● Poor C03-17 connection. If none of the above exists, substitute a known-good ECM (PCM) and recheck.

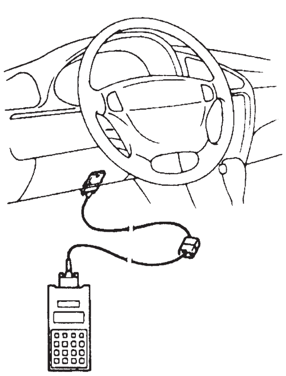
TABLE B-5 POWER STEERING PRESSURE (PSP) SWITCH SIGNAL CIRCUIT CHECK (IF EQUIPPED)



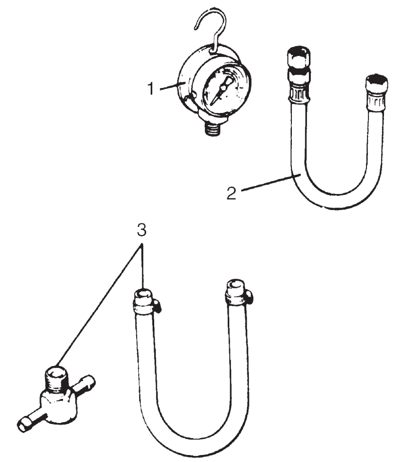
INSPECTION

STEP	ACTION	YES	NO
1	Check PSP Switch Signal Circuit. 1) Connect SUZUKI scan tool to DLC with ignition switch OFF. 2) Start engine and select "DATA LIST" mode on scan tool. 3) Check PSP switch signal under following each condition. See Fig. 1. Engine running and steering wheel at straight-ahead position : OFF Engine running and steering wheel turned to the right on left as far as it stops : ON Is check result satisfactory?	PSP switch signal circuit is in good condition.	"Bl/W" circuit open or short, PSP switch malfunction or power steering system malfunction.

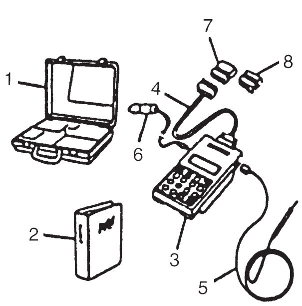
Fig. 1 for Step 1



SPECIAL TOOL

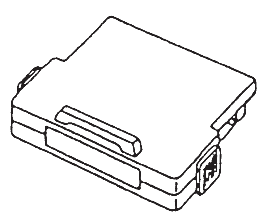


1. Pressure gauge
   09912-58441
2. Pressure hose
   09912-58431
3. 3-way joint & hose
   09912-58490

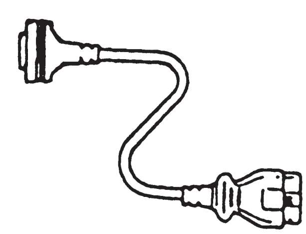


1. Storage case
2. Operator's manual
3. Tech 1 A
4. DLC cable (14/26 pin, 09931-76040)
5. Test lead/probe
6. Power source cable
7. DLC cable adaptor
8. Self-test adaptor

09931-76011
SUZUKI scan tool (Tech 1 A) kit



Mass storage cartridge



09931-76030
16/14 pin DLC cable

SECTION 6

ENGINE GENERAL INFORMATION AND DIAGNOSIS

(TBI FOR G13)

NOTE:
For the details of this section, refer to same section of the Service Manual mentioned in the FOREWORD of this manual.

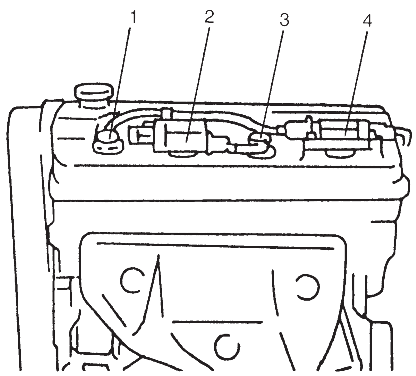
SECTION 6-1

ENGINE GENERAL INFORMATION AND DIAGNOSIS

(SFI FOR G13)

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 INFORMATION

STATEMENT ON CLEANLINESS AND CARE

An automobile engine is a combination of many machined, honed, polished and lapped surfaces with tolerances that are measured in the thousands of an millimeter (ten thousands of an inch).
Accordingly, when any internal engine parts are serviced, care and cleanliness are important.
Throughout this section, it should be understood that proper cleaning and protection of machined surfaces and friction areas is part of the repair procedure. This is considered standard shop practice even if not specifically stated.

- A liberal coating of engine oil should be applied to friction areas during assembly to protect and lubricate the surfaces on initial operation.
- Whenever valve train components, pistons, piston rings, connecting rods, rod bearings, and crankshaft journal bearings are removed for service, they should be retained in order.
  At the time of installation, they should be installed in the same locations and with the same mating surfaces as when removed.
- Battery cables should be disconnected before any major work is performed on the engine.
  Failure to disconnect cables may result in damage to wire harness or other electrical parts.
- Throughout this manual, the four cylinders of the engine are identified by numbers; No.1 (1), No.2 (2), No.3 (3) and No.4 (4) counted from crankshaft pulley side to flywheel side.

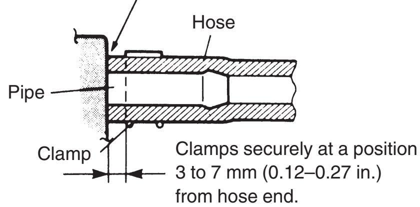
GENERAL INFORMATION ON ENGINE SERVICE

THE FOLLOWING INFORMATION ON ENGINE SERVICE SHOULD BE NOTED CAREFULLY, AS IT IS IMPORTANT IN PREVENTING DAMAGE, AND IN CONTRIBUTING TO RELIABLE ENGINE PERFORMANCE.

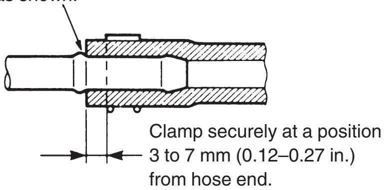
- When raising or supporting engine for any reason, do not use a jack under oil pan. Due to small clearance between oil pan and oil pump strainer, jacking against oil pan may cause it to be bent against strainer resulting in damaged oil pick-up unit.
- It should be kept in mind, while working on engine, that 12-volt electrical system is capable of violent and damaging short circuits.
  When performing any work where electrical terminals can be grounded, ground cable of the battery should be disconnected at battery.
- Any time the air cleaner, throttle body or intake manifold is removed, the intake opening should be covered. This will protect against accidental entrance of foreign material which could follow intake passage into cylinder and cause extensive damage when engine is started.

HOSE CONNECTION

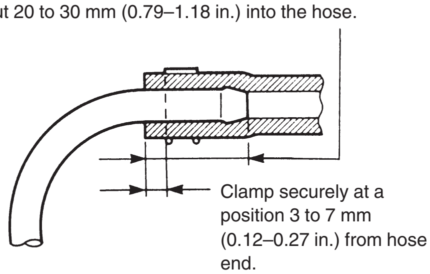
With short pipe, fit hose as far as it reaches pipe joint as shown.



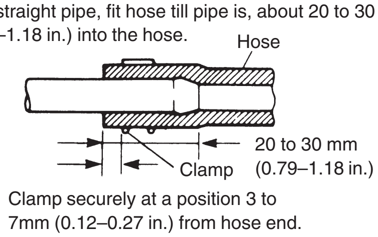
With following type pipe, fit hose as far as its peripheral projection as shown.



With bent pipe, fit hose as its bent part as shown or till pipe is about 20 to 30 mm (0.79–1.18 in.) into the hose.

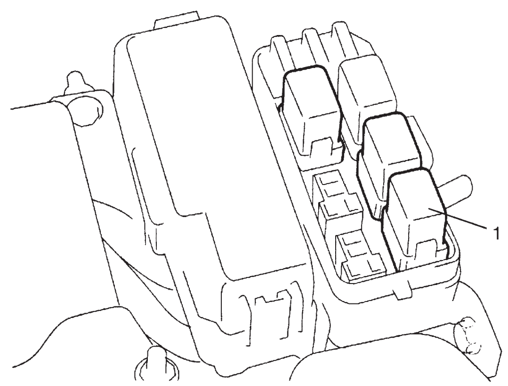


With straight pipe, fit hose till pipe is, about 20 to 30 mm (0.79–1.18 in.) into the hose.



PRECAUTION ON FUEL SYSTEM SERVICE

- Work must be done with no smoking, in a well-ventilated area and away from any open flames.
- As fuel feed line (between fuel pump and fuel delivery pipe) is still under high fuel pressure even after engine was stopped, loosening or disconnecting fuel feed line directly may cause dangerous spout of fuel to occur where loosened or disconnected.
  Before loosening or disconnecting fuel feed line, make sure to release fuel pressure according to “FUEL PRESSURE RELIEF PROCEDURE”. A small amount of fuel may be released after the fuel line is disconnected. In order to reduce the chance of personal injury, cover the fitting to be disconnected with a shop cloth. Put that cloth in an approved container when disconnection is completed.
- Never run engine with fuel pump relay disconnected when engine and exhaust system are hot.
- Fuel or fuel vapor hose connection varies with each type of pipe. When reconnecting fuel or fuel vapor hose, be sure to connect and clamp each hose correctly referring to left figure Hose Connection.
  After connecting, make sure that it has no twist or kink.
- When installing injector or fuel delivery pipe, lubricate its O-ring with spindle oil or gasoline.
- When connecting fuel pipe flare nut, first tighten flare nut by hand and then tighten it to specified torque.



FUEL PRESSURE RELIEF PROCEDURE

CAUTION:
This work must not be done when engine is hot. If done so, it may cause adverse effect to catalyst.

After making sure that engine is cold, release fuel pressure as follows.

1) Place transmission gear shift lever in “Neutral” (Shift selector lever to “P” range for A/T model), set parking brake, and block drive wheels.
2) Remove relay box cover.
3) Disconnect fuel pump relay (1) from relay box.
4) Remove fuel filler cap to release fuel vapor pressure in fuel tank and then reinstall it.
5) Start engine and run it till it stops for lack of fuel. Repeat cranking engine 2-3 times for about 3 seconds each time to dissipate fuel pressure in lines. Fuel connections are now safe for servicing.
6) Upon completion of servicing, connect fuel pump relay (1) to relay box and install relay box cover.

FUEL LEAKAGE CHECK PROCEDURE

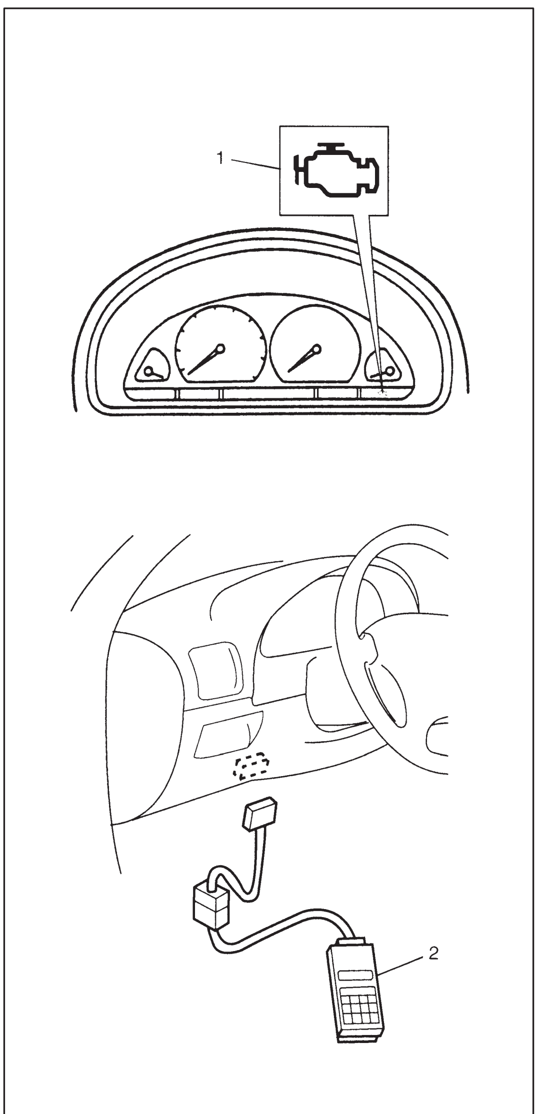
After performing any service on fuel system, check to make sure that there are no fuel leakages as follows.

1) Turn ON ignition switch for 3 seconds (to operate fuel pump) and then turn it OFF.
   Repeat this (ON and OFF) 3 or 4 times and apply fuel pressure to fuel line. (till fuel pressure is felt by hand placed on fuel feed hose.)
2) In this state, check to see that there are no fuel leakages from any part of fuel system.

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) doesn’t turn ON, it should be diagnosed according to this flow table.



ON-BOARD DIAGNOSTIC SYSTEM

ECM (PCM) in this vehicle has following functions.

- When the ignition switch is turned ON with the engine at a stop, malfunction indicator lamp (MIL) (1) turns ON to check the bulb of the malfunction indicator lamp (1).
- When ECM (PCM) detects a malfunction which gives an adverse effect to vehicle emission while the engine is running, it makes the malfunction indicator lamp (1) in the meter cluster of the instrument panel turn ON or flash (flashing only when detecting a misfire which can cause damage to the catalyst) and stores the malfunction area in its memory.
  (If it detects that continuously 3 driving cycles are normal after detecting a malfunction, however, it makes MIL (1) turn OFF although DTC stored in its memory will remain.)
- As a condition for detecting a malfunction in some areas in the system being monitored by ECM (PCM) and turning ON the malfunction indicator lamp (1) due to that malfunction, 2 driving cycle detection logic is adopted to prevent erroneous detection.
- When a malfunction is detected, engine and driving conditions then are stored in ECM (PCM) memory as freeze frame data. (For the details, refer to description on Freeze frame data.)
- It is possible to communicate by using not only SUZUKI scan tool (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 Cycle 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 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	39 kPa
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 from 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:

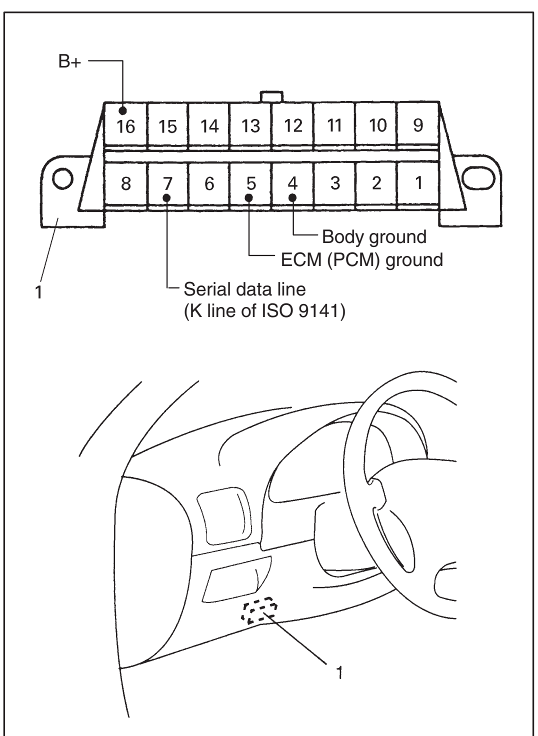
ECM (PCM) has 4 frames where the freeze frame data can be stored. The first frame stores the freeze frame data of the malfunction which was detected first. However, the freeze frame data stored in this frame is updated according to the priority described below. (If malfunction as described in the upper 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.

MALFUNCTION DETECTED ORDER \ FRAME		FRAME 1 FREEZE FRAME DATA to be updated	FRAME 2 1st FREEZE FRAME DATA	FRAME 3 2nd FREEZE FRAME DATA	FRAME 4 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 (1) is in compliance with ISO 15031-3 (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) to communicate with ECM (PCM).

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
  If two or more 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 DTCs according to the following priorities.
  1. Diagnostic trouble codes (DTCs) other than DTC P0171/P0172 (Fuel system too lean/too rich), DTC P0300/P0301/P0302/P0303/P0304 (Misfire detected) and DTC P0400 (EGR flow malfunction)
  2. DTC P0171/P0172 (Fuel system too lean/too rich) and DTC P0400 (EGR flow malfunction)
  3. DTC P0300/P0301/P0302/P0303/P0304 (Misfire detected)
- Be sure to read "Precautions for Electrical Circuit Service" in Section 0A before inspection and observe what is written there.
- ECM (PCM) Replacement
  When substituting a known-good ECM (PCM), check for following conditions. Neglecting this check may cause damage to 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 the following pages for the details of each step.

<table>
<tr><th>STEP</th><th>ACTION</th><th>YES</th><th>NO</th></tr>
<tr><td>1</td><td>Customer Complaint Analysis
1) Perform customer complaint analysis referring to the next page.
Was customer complaint analysis performed?</td><td>Go to Step 2.</td><td>Perform customer complaint analysis.</td></tr>
<tr><td>2</td><td>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)?</td><td>1) Print DTC and freeze frame data or write them down and clear them by referring to “DTC Clearance” section.
2) Go to Step 3.</td><td>Go to Step 4.</td></tr>
<tr><td>3</td><td>Visual Inspection
1) Perform visual inspection referring to the next page.
Is there any faulty condition?</td><td rowspan="2">1) Repair or replace malfunction part.
2) Go to Step 11.</td><td>Go to Step 5.</td></tr>
<tr><td>4</td><td>Visual Inspection
1) Perform visual inspection referring to the next page.
Is there any faulty condition?</td><td>Go to Step 8.</td></tr>
<tr><td>5</td><td>Trouble Symptom Confirmation
1) Confirm trouble symptom referring to the next page.
Is trouble symptom identified?</td><td>Go to Step 6.</td><td>Go to Step 7.</td></tr>
<tr><td>6</td><td>Rechecking and Record of DTC/Freeze Frame Data
1) Recheck for DTC and freeze frame data referring to “DTC Check” section.
Is there any DTC(s)?</td><td rowspan="2">Go to Step 9.</td><td>Go to Step 8.</td></tr>
<tr><td>7</td><td>Rechecking and Record of DTC/Freeze Frame Data
1) Recheck for DTC and freeze frame data referring to “DTC Check” section.
Is there any DTC(s)?</td><td>Go to Step 10.</td></tr>
<tr><td>8</td><td>Engine Basic Inspection and Symptoms-To-Diagnosis Matrix Table
1) Check and repair according to “Engine Basic Check” and “Symptom-To-Diagnosis Matrix Table” section.
Are check and repair complete?</td><td rowspan="2">Go to Step 11.</td><td rowspan="2">1) Check and repair malfunction part(s).
2) Go to Step 11.</td></tr>
<tr><td>9</td><td>Trouble shooting for DTC
1) Check and repair according to applicable DTC diag. flow table.
Are check and repair complete?</td></tr>
<tr><td>10</td><td>Check for Intermittent Problems
1) Check for intermittent problems referring to the next page.
Is there any faulty condition?</td><td>1) Repair or replace malfunction part(s).
2) Go to Step 11.</td><td>Go to Step 11.</td></tr>
<tr><td>11</td><td>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?</td><td>Go to Step 6.</td><td>End.</td></tr>
</table>

1. CUSTOMER COMPLAINT ANALYSIS

Record details of the problem (failure, complaint) and how it occurred as described by the customer. For this purpose, use of such an inspection form will facilitate collecting information to the point required for proper analysis and diagnosis.

2. DIAGNOSTIC TROUBLE CODE (DTC)/FREEZE FRAME DATA CHECK, RECORD AND CLEARANCE

First, check DTC (including pending DTC), referring to "DTC check" section. If DTC is indicated, print it and freeze frame data or write them down and then clear them by referring to "DTC clearance" section. DTC indicates malfunction that occurred in the system but does not indicate whether it exists now or it occurred in the past and the normal condition has been restored now. To check which case applies, check the symptom in question according to Step 4 and recheck DTC according to Step 5.
Attempt to diagnose a trouble based on DTC in this step only or failure to clear the DTC in this step will lead to incorrect diagnosis, trouble diagnosis of a normal circuit or difficulty in troubleshooting.

NOTE:
If only Automatic transmission DTCs (P0705-P0758) or Immobilizer DTCs (P1610-P1614) are indicated in this step, perform trouble diagnosis according to "Diagnosis" in Section 7B or Section 8G.

3. and 4. VISUAL INSPECTION

As a preliminary step, be sure to perform visual check of the items that support proper function of the engine referring to "Visual Inspection" section.

5. TROUBLE SYMPTOM CONFIRMATION

Based on information obtained in Step 1 Customer complaint analysis and Step 2 DTC/freeze frame data check, confirm trouble symptoms. Also, reconfirm DTC according to "DTC Confirmation Procedure" described in each DTC Diagnosis section.

6. and 7. RECHECKING AND RECORD OF DTC/FREEZE FRAME DATA

Refer to "DTC check" section for checking procedure.

8. ENGINE BASIC INSPECTION AND ENGINE DIAGNOSIS TABLE

Perform basic engine check according to the "Engine Basic Inspection 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 SYMPTOMS-TO-DIAGNOSIS MATRIX TABLE and based on symptoms appearing on the vehicle (symptoms obtained through steps of customer complaint analysis, trouble symptom confirmation and/or basic engine check) and repair or replace faulty parts, if any.

9. TROUBLESHOOTING FOR DTC (See each DTC Diag. Flow Table)

Based on the DTC indicated in Step 5 and referring to the applicable DTC diag. flow table in this section, locate the cause of the trouble, namely in a sensor, switch, wire harness, connector, actuator, ECM (PCM) or other part and repair or replace faulty parts.

10. CHECK FOR INTERMITTENT PROBLEM

Check parts where an intermittent trouble is easy to occur (e.g., wire harness, connector, etc.), referring to "INTERMITTENT AND POOR CONNECTION" in Section 0A and related circuit of DTC recorded in Step 2.

11. FINAL CONFIRMATION TEST

Confirm that the problem symptom has gone and the engine is free from any abnormal conditions. If what has been repaired is related to the DTC, clear the DTC once, perform DTC confirmation procedure and confirm that no DTC is indicated.

CUSTOMER PROBLEM INSPECTION FORM (EXAMPLE)

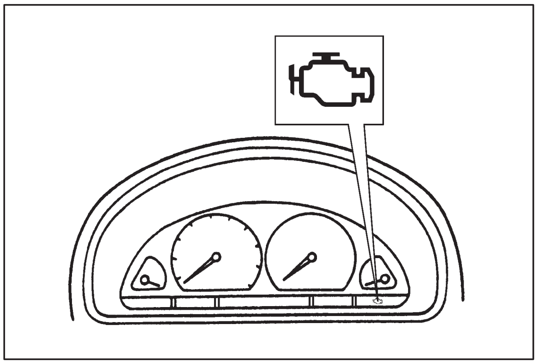
User name:	Model:	VIN:	
Date of issue:	Date of Reg.	Date of problem:	Mileage:

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	☐Fair ☐Cloudy ☐Rain ☐Snow ☐Always ☐Other___________
Temperature	☐Hot ☐Warm ☐Cool ☐Cold (°F/ °C) ☐Always
Frequency	☐Always ☐Sometimes (times/ day, month) ☐Only once ☐Under certain condition
Road	☐Urban ☐Suburb ☐Highway ☐Mountainous (☐Uphill ☐Downhill) ☐Tarmacadam ☐Gravel ☐Other___________
Vehicle Condition	
Engine condition	☐Cold ☐Warming up phase ☐Warmed up ☐Always ☐Other at starting ☐Immediately after start ☐Racing without load ☐Engine speed (r/min)
Vehicle condition	During driving: ☐Constant speed ☐Accelerating ☐Decelerating ☐Right hand corner ☐Left hand corner ☐When shifting (Lever position) ☐At stop ☐Vehicle speed when problem occurs (km/h, Mile/h) ☐Other___________

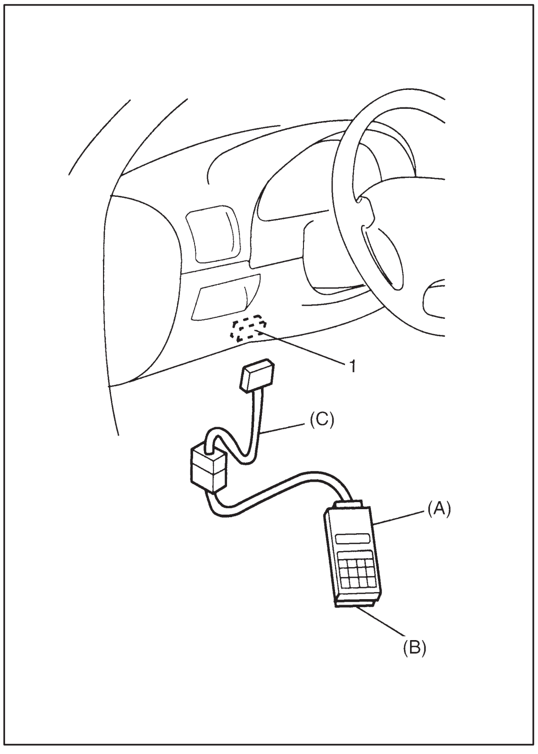
Malfunction indicator lamp condition	☐Always ON ☐Sometimes ON ☐Always OFF ☐Good condition
Diagnostic trouble code	First check: ☐No code ☐Malfunction code ( )
	Second check: ☐No code ☐Malfunction code ( )

NOTE:
The above form is a standard sample. It should be modified according to conditions characteristic of each market.



MALFUNCTION INDICATOR LAMP (MIL) CHECK

1) Turn ON ignition switch (but the engine at stop) and check that MIL lights.
   If MIL does not light up (or MIL dims), go to “Diagnostic Flow Table A-1” for troubleshooting.
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

1) Prepare SUZUKI scan tool (Tech-1).
2) With ignition switch OFF, connect it to data link connector (DLC) (1) located on underside of instrument panel at driver’s seat side.

   Special Tool:
   (A): SUZUKI scan tool
   (B): Mass storage cartridge
   (C): 16/14 pin DLC 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 it or write it 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 in good condition. Then check data link connector and serial data line (circuit) in the vehicle with which communication was not possible.
5) After completing the check, turn ignition switch off and disconnect scan tool from data link connector.

DIAGNOSTIC TROUBLE CODE (DTC) CLEARANCE

[Using SUZUKI scan tool]

1) Connect 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 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 (PCM) connectors)**
- **When the same malfunction (DTC) is not detected again during 40 engine warm-up cycles.**

[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 (PCM) memory and reconnect it.

Time required to erase DTC:

Ambient temperature	Time to cut power to ECM (PCM)
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

NOTE:
1 driving cycle: MIL lights up when DTC is detected in the first driving cycle.
2 driving cycles: MIL lights up when the same DTC is detected also in the next driving cycle after DTC is detected and stored temporarily in the first driving cycle.

DTC NO.	DETECTING ITEM	DETECTING CONDITION (DTC will set when detecting:)	MIL
P0105	Manifold absolute pressure circuit malfunction	Low pressure-high vacuum-low voltage (or MAP sensor circuit shorted to ground) High pressure-low vacuum-high voltage (or MAP sensor circuit open)	1 driving cycle
P0110	Intake air temp. circuit malfunction	Intake air temp. circuit low input Intake air temp. circuit high input	1 driving cycle
P0115	Engine coolant temp. circuit malfunction	Engine coolant temp. circuit low input Engine coolant temp. circuit high input	1 driving cycle
P0120	Throttle position circuit malfunction	Throttle position circuit low input Throttle position circuit high input	1 driving cycle
P0121	Throttle position circuit performance problem	Poor performance of TP sensor	2 driving cycles
P0130	HO2S circuit malfunction (Sensor-1)	Min. output voltage of HO2S-higher than specification Max. output voltage of HO2S-lower than specification	2 driving cycles
P0133	HO2S circuit slow response (Sensor-1)	Response time of HO2S-1 output voltage between rich and lean is longer than specification.	2 driving cycles
P0134	HO2S circuit no activity detected (Sensor-1)	Output voltage of HO2S-1 fails to go specification. (or HO2S-1 circuit open or short)	2 driving cycles
P0135	HO2S heater circuit malfunction (Sensor-1)	Terminal voltage is lower than specification at heater OFF or it is higher at heater ON.	2 driving cycles
P0136	HO2S circuit malfunction (Sensor-2)	Max. voltage of HO2S-2 is lower than specification or its min. voltage is higher than specification	2 driving cycles
P0141	HO2S heater circuit malfunction (Sensor-2)	Terminal voltage is lower than specification at heater OFF or it is higher at heater ON. (or heater circuit or short)	2 driving cycles
P0171	Fuel system too lean	Short term fuel trim or total fuel trim (short and long terms added) is larger than specification for specified time or longer. (fuel trim toward rich side is large.)	2 driving cycles
P0172	Fuel system too rich	Short term fuel trim or total fuel trim (short and long term added) is smaller than specification for specified time or longer. (fuel trim toward lean side is large.)	2 driving cycles
P0300 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
		Misfire of such level as to deteriorate emission but not to cause damage to three way catalyst	2 driving cycles

DTC NO.	DETECTING ITEM	DETECTING CONDITION (DTC will set when detecting:)	MIL
P0335	Crankshaft position sensor circuit malfunction	No signal for 2 sec. During engine cranking	1 driving cycle
P0340	Camshaft position sensor circuit malfunction	No signal during engine running	1 driving cycle
P0400	Exhaust gas recirculation flow malfunction detected	Excessive or insufficient EGR flow	2 driving cycles
P0420	Catalyst system efficiency below threshold	Output waveforms of HO2S-1 and HO2S-2 are similar. (Time from output voltage change of HO2S-1 to that of HO2S-2 is shorter than specification.)	2 driving cycles
P0443	Purge control valve circuit malfunction	Purge control valve circuit is open or shorted to ground	2 driving cycles
P0480	Radiator fan control circuit malfunction	Radiator cooling fan relay terminal voltage is low when cooling temp. is lower than specification	2 driving cycles
P0500	Vehicle speed sensor malfunction	No signal while running in "D" range or during fuel cut at decelerating	2 driving cycles
P0505	Idle control system malfunction	No closed signal to IAC valve is detected	2 driving cycles
P0601	Internal control module memory check sum error	Data write error (or check sum error) when written into ECM (PCM)	1 driving cycle
P1450	Barometric pressure sensor circuit malfunction	Barometric pressure is lower or higher than specification. (or sensor malfunction)	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
P1500	Starter signal circuit malfunction	Starter signal is not inputted from engine cranking till its start and after or it is always inputted	2 driving cycles
P1510	ECM (PCM) backup power source malfunction	No backup power after starting engine	1 driving cycle

DTC NO.	DETECTING ITEM	DETECTING CONDITION (DTC will set when detecting:)	MIL
P0705	Transmission Range Sensor Circuit Malfunction	Refer to Section 7B	
P0720	Output Speed Sensor Circuit Malfunction		
P0751	Shift Solenoid A Performance or Stuck Off		
P0753	Shift Solenoid A Circuit		
P0756	Shift Solenoid B Performance or Stuck Off		
P0758	Shift Solenoid B 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:
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 (PCM) enters fail-safe mode as long as malfunction continues to exist but that mode is canceled when ECM (PCM) detects normal condition after that.

DTC NO.	DETECTED ITEM	FAIL-SAFE OPERATION
P0105	Manifold absolute pressure circuit malfunction	● ECM (PCM) uses value determined by throttle opening and engine speed. ● ECM (PCM) stops EGR, EVAP purge and idle air control.
P0110	Intake air temp. circuit malfunction	ECM (PCM) controls actuators assuming that intake air temperature is 20°C (68°F).
P0115	Engine coolant temp. circuit malfunction	ECM (PCM) controls actuators assuming that engine coolant temperature is 80°C (176°F).
P0120	Throttle position circuit malfunction	ECM (PCM) controls actuators assuming that throttle opening is 20°.
P0340	Camshaft position sensor circuit malfunction	ECM (PCM) controls injection system sequential injection to synchronous injection.
P0500	Vehicle speed sensor malfunction	ECM (PCM) stops idle air control.
P1450	Barometric pressure sensor low/ high input	ECM (PCM) controls actuators assuming that barometric pressure is 100 kPa (760 mmHg).

VISUAL INSPECTION

Visually check following parts and systems.

INSPECTION ITEM	REFERRING SECTION
● Engine oil – – – – – level, leakage	Section 0B
● Engine coolant – – – – – level, leakage	Section 0B
● Fuel – – – – – level, leakage	Section 0B
● A/T fluid – – – – – level, leakage	Section 0B
● Air cleaner element – – – – – dirt, clogging	Section 0B
● Battery – – – – – fluid level, corrosion of terminal	
● Water pump belt – – – – – tension, damage	Section 0B
● Throttle cable – – – – – play, installation	Section 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 check following items at engine start, if possible	
● Malfunction indicator lamp – Operation	Section 6
● Charge warning lamp – Operation	Section 6H
● Engine oil pressure warning lamp – Operation	Section 8 (Section 6 for pressure check)
● Engine coolant temp. meter – Operation	Section 8
● Fuel level meter – Operation	Section 8
● Tachometer, if equipped – Operation	
● Abnormal air being inhaled from air intake system	
● Exhaust system – – – – – leakage of exhaust gas, noise	
● Other parts that can be checked visually	

ENGINE BASIC INSPECTION

This check is very important for troubleshooting when ECM (PCM) has detected no DTC and no abnormality has been found in visual inspection.
Follow the flow table carefully.

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Check battery voltage. Is it 11 V or more?	Go to Step 3.	Charge or replace battery.
3	Is engine cranked?	Go to Step 4.	Go to “DIAGNOSIS” in Section 6G.
4	Does engine start?	Go to Step 5.	Go to Step 7.
5	Check idle speed as follows: 1) Warm up engine to normal operating temp. 2) Shift transmission to neutral position for M/T (“P” position for A/T). 3) All of electrical loads are switched off. 4) Check engine idle speed with scan tool. See Fig. 1. Is it 700 – 800 r/min?	Go to Step 6.	“ENGINE DIAGNOSIS TABLE” in this section.
6	Check ignition timing as follows: 1) Using SUZUKI scan tool, select “MISC” mode on SUZUKI scan tool and fix ignition timing to initial one. See Fig. 2. 2) Remove air cleaner bolt and shift air cleaner position to observe ignition timing. 3) Using timing light (1), check initial ignition timing. See Fig. 3. Is it $5° \pm 3°$ BTDC at specified idle speed?	“ENGINE DIAGNOSIS TABLE” in this section.	Check ignition control related parts referring to Section 6F1.
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 2 seconds and then OFF. See Fig. 4. Is fuel return pressure (returning sounds) felt from fuel feed hose (1) 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 2 seconds after ignition switch ON and stop?	Go to “DIAG. FLOW TABLE B-3”.	Go to “DIAG. FLOW TABLE B-2”.
9	Check ignition spark as follows: 1) Disconnect injector couplers. 2) Remove spark plugs and connect them to high tension cords. 3) Ground spark plugs. 4) Crank engine and check if each spark plug sparks. Is it in good condition?	Go to Step 10.	Go to “DIAGNOSIS” in Section 6F1.
10	Check fuel injector for operation as follows: 1) Install spark plugs and connect injector connectors. 2) Using sound scope (1), check operating sound of each injector (2) when cranking engine. See Fig. 5. Was injector operating sound heard from all injectors?	“ENGINE DIAGNOSIS TABLE” in this section.	Go to “DIAG. FLOW TABLE B-1”.

Fig. 1 for Step 5

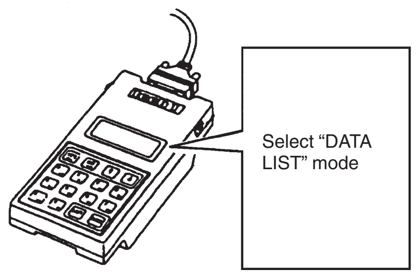


Fig. 2 for Step 6

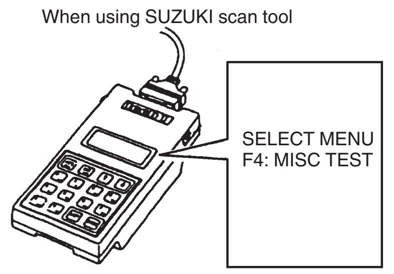


Fig. 3 for Step 6

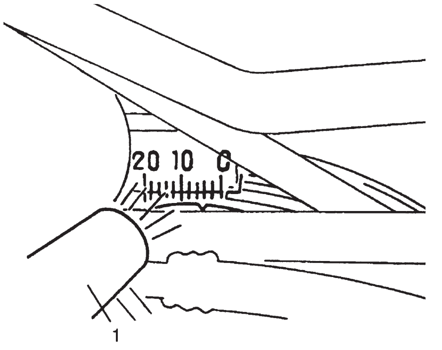


Fig. 4 for Step 7

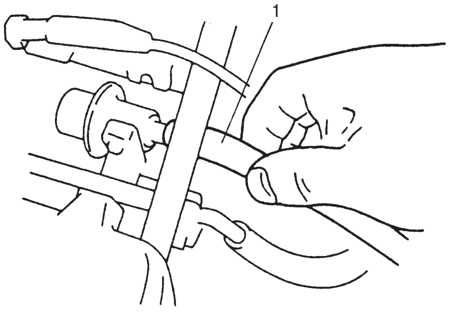
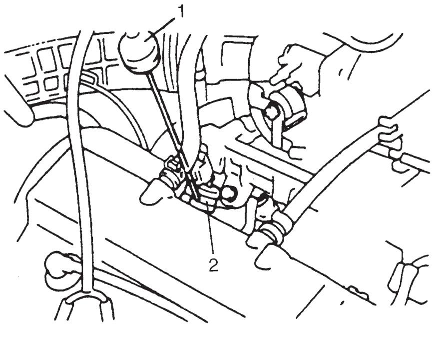


Fig. 5 for Step 10



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	Referring Item
Hard Starting (Engine cranks OK)	**Ignition system out of order**	
	● Faulty spark plug	Spark plugs in Section 6F1
	● Leaky high-tension cord	High-tension cords in Section 6F1
	● Loose connection or disconnection of high-tension cords or lead wires	High-tension cords in Section 6F1
	● Faulty ignition coil	Ignition coil in Section 6F1
	Fuel system out of order	
	● Dirty or clogged fuel hose or pipe	Diagnostic Flow Table B-3
	● Malfunctioning fuel pump	Diagnostic Flow Table B-3
	● Air inhaling from intake manifold gasket or throttle body gasket	
	Engine and emission control system out of order	
	● Faulty idle air control system	Diagnostic Flow Table B-4
	● Faulty ECT sensor or MAP sensor	ECT sensor or MAP sensor in Section 6E2
	● Faulty ECM (PCM)	
	Low compression	Compression check in Section 6A1
	● Poor spark plug tightening or faulty gasket	Spark plugs in Section 6F1
	● Compression leak from valve seat	Valves inspection in Section 6A1
	● Sticky valve stem	Valves inspection in Section 6A1
	● Weak or damaged valve springs	Valve springs inspection in Section 6A1
	● Compression leak at cylinder head gasket	Cylinder head inspection in Section 6A1
	● Sticking or damaged piston ring	Cylinders, pistons and piston rings inspection in Section 6A1
	● Worn piston, ring or cylinder	Cylinders, pistons and piston rings inspection in Section 6A1
	Others	
	● Malfunctioning PCV valve	PCV system in Section 6E2

Condition	Possible Cause]	Referring Item
Low oil pressure	● Improper oil viscosity ● Malfunctioning oil pressure switch ● Clogged oil strainer ● Functional deterioration of oil pump ● Worn oil pump relief valve ● Excessive clearance in various sliding parts	Engine oil and oil filter change in Section 0B Oil pressure switch inspection in Section 8 Oil pan and oil pump strainer cleaning in Section 6A1 Oil pump in Section 6A1 Oil pump in Section 6A1
Engine noise Note: Before checking mechanical noise, make sure that: ● Specified spark plug in used. ● Specified fuel is used.	**Valve noise** ● Improper valve lash ● Worn valve stem and guide ● Weak or broken valve spring ● Warped or bent valve **Piston, ring and cylinder noise** ● Worn piston, ring and cylinder bore **Connecting rod noise** ● Worn rod bearing ● Worn crank pin ● Loose connecting rod nuts ● Low oil pressure **Crankshaft noise** ● Low oil pressure ● Worn bearing ● Worn crankshaft journal ● Loose bearing cap bolts ● Excessive crankshaft thrust play	 Valve lash in Section 6A1 Valves inspection in Section 6A1 Valve springs inspection in Section 6A1 Valves inspection in Section 6A1 Pistons and cylinders inspection in Section 6A1 Crank pin and connecting rod bearing inspection in Section 6A1 Crank pin and connecting rod bearing inspection in Section 6A1 Connecting rod installation in Section 6A1 Previously outlined Previously outlined Crankshaft and bearing inspection in Section 6A1 Crankshaft and bearing inspection in Section 6A1 Crankshaft inspection in Section 6A1 Crankshaft thrust play inspection in Section 6A1

Condition	Possible Cause	Referring Item
Overheating	● Inoperative thermostat	Thermostat in Section 6B
	● Poor water pump performance	Water pump in Section 6B
	● Clogged or leaky radiator	Radiator in Section 6B
	● Improper engine oil grade	Engine oil and oil filter change in Section 0B
	● Clogged oil filter or oil strainer	Oil pressure check in Section 6A1
	● Poor oil pump performance	Oil pressure check in Section 6A1
	● Faulty radiator fan control system	Radiator fan control system in Section 6E2
	● Dragging brakes	Trouble diagnosis in Section 5
	● Slipping clutch	Trouble diagnosis in Section 7C
	● Blown cylinder head gasket	Cylinder head in Section 6A1
Poor gasoline mileage	**Ignition system out of order**	
	● Leaks or loose connection of high-tension cord	High-tension cords in Section 6F1
	● Faulty spark plug (improper gap, heavy deposits and burned electrodes, etc.)	Spark plugs in Section 6F1
	Engine and emission control system out of order	
	● Malfunctioning EGR valve	EGR system in Section 6E2
	● High idle speed	Refer to item “Improper engine idle speed” previously outlined
	● Poor performance of TP sensor, ECT sensor or MAP sensor	TP sensor, ECT sensor or MAP sensor in Section 6E2
	● Faulty EGR valve	EGR system in Section 6E2
	● Faulty fuel injector(s)	Diagnostic Flow Table B-1
	● Faulty ECM (PCM)	
	Low compression	Previously outlined
	Others	
	● Poor valve seating	Valves inspection in Section 6A1
	● Dragging brakes	Trouble diagnosis in Section 5
	● Slipping clutch	Trouble diagnosis in Section 7C
	● Thermostat out of order	Thermostat in Section 6B
	● Improper tire pressure	Refer to Section 3F
Excessive engine oil consumption	**Oil leakage**	
	● Blown cylinder head gasket	Cylinder head in Section 6A1
	● Leaky camshaft oil seals	Camshaft in Section 6A1
	Oil entering combustion chamber	
	● Sticky piston ring	Piston cleaning in Section 6A1
	● Worn piston and cylinder	Pistons and cylinders inspection in Section 6A1
	● Worn piston ring groove and ring	Pistons inspection in Section 6A1
	● Improper location of piston ring gap	Pistons assembly in Section 6A1
	● Worn or damaged valve stem seal	Valves removal and installation in Section 6A1
	● Worn valve stem	Valves inspection in Section 6A1

Condition	Possible Cause	Referring Item
Engine hesitates (Momentary lack of response as accelerator is depressed. Can occur at all vehicle speeds. Usually most severe when first trying to make vehicle move, as from a stop sign.)	**Ignition system out of order** ● Spark plug faulty or plug gap out of adjustment ● Leaky high-tension cord **Fuel system out of order** ● Fuel pressure out of specification **Engine and emission control system out of order** ● Malfunctioning EGR valve ● Poor performance of TP sensor, ECT sensor or MAP sensor ● Faulty fuel injector ● Faulty ECM (PCM) **Engine overheating** **Low compression**	 Spark plugs in Section 6F1 High-tension cords in Section 6F1 Diagnostic Flow Table B-3 EGR system in section 6E2 TP sensor, ECT sensor or MAP sensor in Section 6E2 Diagnostic Flow Table B-1 Refer to “Overheating” section Previously outlined
Surge (Engine power variation under steady throttle or cruise. Feels like vehicle speeds up and down with no change in accelerator pedal.)	**Ignition system out of order** ● Leaky or loosely connected high-tension cord ● Faulty spark plug (excess carbon deposits, improper gap, and burned electrodes, etc.) **Fuel system out of order** ● Variable fuel pressure – Kinky or damaged fuel hose and lines – Faulty fuel pump (clogged fuel filter) **Engine and emission control system out of order** ● Malfunctioning EGR valve ● Poor performance of MAP sensor ● Faulty fuel injector ● Faulty ECM (PCM)	 High-tension cords in Section 6F1 Spark plugs in Section 6F1 Diagnostic Flow Table B-3 EGR system in Section 6E2 MAP sensor in Section 6E2 Diagnostic Flow Table B-1
Excessive detonation (Engine makes continuously sharp metallic knocks that change with throttle opening. Sounds like pop corn popping.)	**Engine overheating** **Ignition system out of order** ● Faulty spark plug ● Loose connection of high-tension cord **Fuel system out of order** ● Clogged fuel filter (faulty fuel pump) or fuel lines ● Air inhaling from intake manifold or throttle body gasket **Engine and emission control system out of order** ● Malfunctioning EGR valve ● Poor performance of ECT sensor or MAP sensor ● Faulty fuel injector(s). ● Faulty ECM (PCM) ● Excessive combustion chamber deposits	Refer to “Overheating” section Spark plugs in Section 6F1 High-tension cords in Section 6F1 Diagnostic Flow Table B-1 or B-2 EGR system in Section 6E2 ECT sensor or MAP sensor in Section 6E2 Diagnostic Flow Table B-1 Piston and cylinder head cleaning in Section 6A1

Condition	Possible Cause	Referring Item
Engine has no power	**Ignition system out of order**	
	● Faulty spark plug	Spark plugs in Section 6F1
	● Faulty ignition coil with ignitor	Ignition coil in Section 6F1
	● Leaks, loose connection or disconnection of high-tension cord	High-tension cords in Section 6F1
	Engine overheating	Refer to “Overheating” section
	Fuel system out of order	
	● Clogged fuel hose or pipe	Diagnostic Flow Table B-3
	● Malfunctioning fuel pump	Diagnostic Flow Table B-2
	● Air inhaling from intake manifold gasket or throttle body gasket	
	Engine and emission control system out of order	
	● Malfunctioning EGR valve	EGR system inspection in Section 6E2
	● Maladjusted accelerator cable play	Accelerator cable play in Section 6E2
	● Poor performance of TP sensor, ECT sensor or MAP sensor	TP sensor, ECT sensor or MAP sensor in Section 6E2
	● Faulty fuel injector(s)	Diagnostic Flow Table B-1
	● Faulty ECM (PCM)	
	Low compression	Previously outlined
	Others	
	● Dragging brakes	Trouble diagnosis in Section 5
	● Slipping clutch	Trouble diagnosis in Section 7C

Condition	Possible Cause	Referring Item
Improper engine idling or engine fails to idle	**Ignition system out of order**	
	● Faulty spark plug	Spark plugs in Section 6F
	● Leaky or disconnected high-tension cord	High-tension cords in Section 6F
	● Faulty ignition coil with ignitor	Ignition coil in Section 6F
	Fuel system out of order	
	● Fuel pressure out of specification	Diagnostic Flow Table B-3
	● Leaky manifold, throttle body, or cylinder head gasket	
	Engine and emission control system out of order	
	● Malfunctioning EGR valve	EGR system in Section 6E2
	● Faulty idle air control system	Diagnostic Flow Table B-4
	● Faulty evaporative emission control system	EVAP control system in Section 6E2
	● Faulty EGR system	EGR system in Section 6E2
	● Faulty fuel injector(s)	Diagnostic Flow Table B-1
	● Poor performance of ECT sensor, TP sensor or MAP sensor	ECT sensor, TP sensor or MAP sensor in Section 6E2
	● Faulty ECM (PCM)	
	Engine overheating	Refer to "Overheating" section
	Low compression	Previously outlined
	Others	
	● Loose connection or disconnection of vacuum hoses	
	● Malfunctioning PCV valve	PCV system in Section 6E2

Condition	Possible Cause	Referring Item
Excessive hydrocarbon (HC) emission or carbon monoxide (CO)	**Ignition system out of order** ● Faulty spark plug ● Leaky or disconnected high-tension cord ● Faulty ignition coil with ignitor **Low compression** **Engine and emission control system out of order** ● Lead contamination of three way catalytic converter ● Faulty evaporative emission control system ● Fuel pressure out of specification ● Closed loop system (A/F feed back compensation) fails – Faulty TP sensor – Poor performance of ECT sensor or MAP sensor ● Faulty injector(s) ● Faulty ECM (PCM) **Others** ● Engine not at normal operating temperature ● Clogged air cleaner ● Vacuum leaks	 Spark plugs in Section 6F1 High-tension cords in Section 6F1 Ignition coil assembly in Section 6F1 Refer to “Low compression” section Check for absence of filler neck restrictor EVAP control system in Section 6E2 Diagnostic Flow Table B-3 TP sensor in Section 6E2 ECT sensor or MAP sensor in Section 6E2 Diagnostic Flow Table B-1
Excessive nitrogen oxides (NOx) emission	**Ignition system out of order** ● Improper ignition timing **Engine and emission control system out of order** ● Lead contamination of catalytic converter ● Faulty EGR system ● Fuel pressure out of specification ● Closed loop system (A/F feed back compensation) fails – Faulty TP sensor – Poor performance of ECT sensor or MAP sensor ● Faulty injector(s) ● Faulty ECM (PCM)	 See section 6F1 Check for absence of filler neck restrictor. EGR system in Section 6E2 Diagnostic Flow Table B-3 TP sensor in Section 6E2 ECT sensor or MAP sensor in Section 6E2 Diagnostic Flow Table B-1

SCAN TOOL DATA

As the data values given below are standard values estimated on the basis of values obtained from the normally operating vehicles by using a scan tool, use them as reference values. Even when the vehicle is in good condition, there may be cases where the checked value does not fall within each specified data range. Therefore, judgment as abnormal should not be made by checking with these data alone.
Also, conditions in the below table that can be checked by the scan tool are those detected by ECM (PCM) and output from ECM (PCM) as commands and there may be cases where the engine or actuator is not operating (in the condition) as indicated by the scan tool. Be sure to use the timing light to check the ignition timing.

NOTE:
- **With the generic scan tool, only star (☆) marked data in the table below can be read.**
- **When checking the data with the engine running at idle or racing, be sure to shift M/T gear to the neutral gear position and A/T gear to the "Park" position and pull the parking brake fully. Also, if nothing or "no load" is indicated, turn OFF A/C, all electric loads, P/S and all the other necessary switches.**

	SCAN TOOL DATA	VEHICLE CONDITION		NORMAL CONDITION/ REFERENCE VALUES
☆	FUEL SYSTEM B1 (FUEL SYSTEM STATUS)	At specified idle speed after warming up		CLOSED (closed loop)
☆	CALC LOAD (CALCULATED LOAD VALUE)	At specified idle speed with no load after warming up		3 – 9%
		At 2500 r/min with no load after warming up		12 – 17%
☆	COOLANT TEMP. (ENGINE COOLANT TEMP.)	At specified idle speed after warming up		85 – 100°C, 185 – 212°F
☆	SHORT FT BI (SHORT TERM FUEL TRIM)	At specified idle speed after warming up		–20 – +20%
☆	LONG FT BI (LONG TERM FUEL TRIM)	At specified idle speed after warming up		–15 – +15%
☆	MAP (INTAKE MANIFOLD ABSOLUTE PRESSURE)	At specified idle speed with no load after warming up		24 – 37 kPa, 180 – 280 mmHg
☆	ENGINE SPEED	At idling with no load after warming up		Desired idle speed ± 50 r/min
☆	VEHICLE SPEED	At stop		0 km/h, 0 MPH
☆	IGNITION ADVANCE (IGNITION TIMING ADVANCE FOR NO.1 CYLINDER)	At specified idle speed with no load after warming up		9 – 15° BTDC
☆	INTAKE AIR TEMP.	At specified idle speed after warming up		Ambient temp. +35°C (95°F) –5°C (23°F)
☆	MAF (MASS AIR FLOW RATE)	At specified idle speed with no load after warming up		0 – 4 gm/sec
		At 2500 r/min with no load after warming up		4 – 9 gm/sec
☆	THROTTLE POS (ABSOLUTE THROTTLE POSITION)	Ignition switch ON/engine stopped	Throttle valve fully closed	7 – 18%
			Throttle valve fully open	70 – 100%
☆	O2S B1 S1 (HEATED OXYGEN SENSOR-1)	At specified idle speed after warming up		0.05 – 0.95 V
☆	O2S B1 S2 (HEATED OXYGEN SENSOR-2)	When engine is running at 2000 r/min. for 3 min or longer after warming up.		0 – 0.95 V
☆	O2S FT B1 S1	At specified idle speed after warning up		–20 – +20%
☆	DIS. WITH MIL ON	——		——

	SCAN TOOL DATA	CONDITION		NORMAL CONDITION/ REFERENCE VALUES
	DESIRED IDLE (DESIRED IDLE SPEED)	At idling with no load after warming up, M/T at neutral, A/T at “P” range		750 r/min
	TP SENSOR VOLT (THROTTLE POSITION SENSOR OUTPUT VOLTAGE)	Ignition switch ON/engine stopped	Throttle valve fully closed	More than 0.2 V
			Throttle valve fully open	Less than 4.8 V
	INJ PULSE WIDTH (FUEL INJECTION PULSE WIDTH)	At specified idle speed with no load after warming up		2.0 – 3.6 msec.
		At 2500 r/min with no load after warming up		2.0 – 3.6 msec.
	IAC FLOW DUTY (IDLE AIR CONTROL FLOW DUTY)	At idling with no load after warming up		5 – 25%
	TOTAL FUEL TRIM	At specified idle speed after warming up		–35 – +35%
	BATTERY VOLTAGE	Ignition switch ON/engine stop		10 – 14 V
	CANIST PRG DUTY (EVAP CANISTER PURGE FLOW DUTY)	———		0 – 100%
	CLOSED THROT POS (CLOSED THROTTLE POSITION)	Throttle valve at idle position		ON
		Throttle valve opens larger than idle position		OFF
	FUEL CUT	When engine is at fuel cut condition		ON
		Other than fuel cut condition		OFF
	RADIATOR FAN (RADIATOR FAN CONTROL RELAY)	Ignition switch ON	Engine coolant temp.: Lower than 92.5°C (199°F)	OFF
			Engine coolant temp.: 97.5°C (208°F) or higher	ON
	ELECTRIC LOAD	Ignition switch ON/Headlight, small light, heater fan and rear window defogger all turned OFF		OFF
		Ignition switch ON/Headlight, small light, heater fan or rear window defogger turned ON		ON
	A/C SWITCH	Engine running after warming up, A/C not operating		OFF
		Engine running after warming up, A/C operating		ON
	PNP SIGNAL (PARK/ NEUTRAL POSITION SIGNAL) A/T only	Ignition switch ON	Selector lever in “P” or “N” position	P/N Range
			Selector lever in “R”, “D”, “2” or “L” position	D Range
	EGR VALVE	At specified idle speed after warming up		0%
	FUEL TANK LEVEL	———		0 – 100%
	BAROMETRIC PRESS	———		Display the barometric pressure
	FUEL PUMP	Within 3 seconds after ignition switch ON or engine running		ON
		Engine stop at ignition switch ON.		OFF
	BRAKE SW	Ignition switch ON	Brake pedal is depressing	ON
			Brake pedal is releasing	OFF
	BLOWER FAN	Ignition switch ON	Blower fan switch ON	ON
			Blower fan switch OFF	OFF
	A/C MAG CLUTCH	Ignition switch ON	A/C switch ON	ON
			A/C switch OFF	OFF

SCAN TOOL DATA DEFINITIONS

FUEL SYSTEM (FUEL SYSTEM STATUS)
Air/fuel ratio feedback loop status displayed as either open or closed loop. Open indicates that ECM (PCM) ignores feedback from the exhaust oxygen sensor. Closed indicates final injection duration is corrected for oxygen sensor feedback.

CALC LOAD (CALCULATED LOAD VALUE, %)
Engine load displayed as a percentage of maximum possible load. Value is calculated mathematically using the formula: actual (current) intake air volume ÷ maximum possible intake air volume x 100%.

COOLANT TEMP. (ENGINE COOLANT TEMPERATURE, °C, °F)
It is detected by engine coolant temp. sensor

SHORT FT B1 (SHORT TERM FUEL TRIM, %)
Short term fuel trim value represents short term corrections to the air/fuel mixture computation. A value of 0 indicates no correction, a value greater than 0 means an enrichment correction, and a value less than 0 implies an enleanment correction.

LONG FT B1 (LONG TERM FUEL TRIM, %)
Long term fuel trim Value represents long term corrections to the air/fuel mixture computation. A value of 0 indicates no correction, a value greater than 0 means an enrichment correction, and a value less than 0 implies an enleanment correction.

MAP (INTAKE MANIFOLD ABSOLUTE PRESSURE, kPa, inHg)
It is detected by manifold absolute pressure sensor and used (among other things) to compute engine load.

ENGINE SPEED (rpm)
It is computed by reference pulses from crankshaft position sensor.

VEHICLE SPEED (km/h, MPH)
It is computed based on pulse signals from vehicle speed sensor.

IGNITION ADVANCE (IGNITION TIMING ADVANCE FOR NO.1 CYLINDER, °)
Ignition timing of NO.1 cylinder is commanded by ECM (PCM). The actual ignition timing should be checked by using the timing light.

INTAKE AIR TEMP. (°C, °F)
It is detected by intake air temp. sensor and used to determine the amount of air passing into the intake manifold as air density varies with temperature.

MAF (MASS AIR FLOW RATE, gm/s, lb/min)
It represents total mass of air entering intake manifold which is computed based on signals from MAP sensor, IAT sensor, TP sensor, etc.

THROTTLE POS (ABSOLUTE THROTTLE POSITION, %)
When throttle position sensor is fully closed position, throttle opening is indicated as 0% and 100% full open position.

OXYGEN SENSOR B1 S1 (HEATED OXYGEN SENSOR-1, V)
It indicates output voltage of HO2S-1 installed on exhaust manifold (pre-catalyst).

OXYGEN SENSOR B1 S2 (HEATED OXYGEN SENSOR-2, V)
It indicates output voltage of HO2S-2 installed on exhaust pipe (post-catalyst). It is used to detect catalyst deterioration.

DESIRED IDLE (DESIRED IDLE SPEED, rpm)
The Desired Idle Speed is an ECM (PCM) internal parameter which indicates the ECM (PCM) requested idle. If the engine is not running, this number is not valid.

TP SENSOR VOLT (THROTTLE POSITION SENSOR OUTPUT VOLTAGE, V)
The Throttle Position Sensor reading provides throttle valve opening information in the form of voltage.

INJ PULSE WIDTH (FUEL INJECTION PULSE WIDTH, msec.)
This parameter indicates time of the injector drive (valve opening) pulse which is output from ECM (PCM) (but injector drive time of NO.1 cylinder for multiport fuel injection).

IAC FLOW DUTY (IDLE AIR (SPEED) CONTROL DUTY, %)
This parameter indicates current flow time rate within a certain set cycle of IAC valve (valve opening rate) which controls the amount of bypass air (idle speed).

TOTAL FUEL TRIM (%)
The value of Total Fuel Trim is obtained by putting values of short Term Fuel Trim and Long Term Fuel Trim together. This value indicates how much correction is necessary to keep the air/fuel mixture stoichiometrical.

BATTERY VOLTAGE (V)
This parameter indicates battery positive voltage inputted from main relay to ECM (PCM).

CANIST PURGE DUTY (EVAP CANISTER PURGE FLOW DUTY, %)

This parameter indicates valve ON (valve open) time rate within a certain set cycle of EVAP purge solenoid valve which controls the amount of EVAP purge.
0% means that the purge valve is completely closed while 100% is a fully open valve.

CLOSED THROTTLE POSITION (ON/OFF)

This parameter will read ON when throttle valve is fully closed, or OFF when the throttle is not fully closed.

FUEL CUT (ON/OFF)

ON : Fuel being cut (output signal to injector is stopped)
OFF : Fuel not being cut

RADIATOR FAN (RADIATOR FAN CONTROL RELAY, ON/OFF)

ON : Command for radiator fan control relay operation being output.
OFF : Command for relay operation not being output.

ELECTRIC LOAD (ON/OFF)

ON : Headlight, small light, heater fan or rear window defogger ON signal inputted.
OFF : Above electric loads all turned OFF.

A/C SWITCH (ON/OFF)

ON : Command for A/C operation being output from ECM (PCM) to A/C amplifier.
OFF : Command for A/C operation not being output.

FUEL TANK LEVEL (%)

This parameter indicates approximate fuel level in the fuel tank. As the detectable range of the fuel level sensor is set as 0 to 100%, however, with some models whose fuel tank capacity is smaller, the indicated fuel level may be only 70% even when the fuel tank is full.

PNP SIGNAL (PARK/NEUTRAL POSITION SIGNAL, P/N RANGE or D RANGE)

It is detected by signal from TCM.
D range : A/T is in “R”, “D”, “2” or “L” range.
P/N range : A/T is in “P” or “N” range or the above signal is not inputted from TCM.

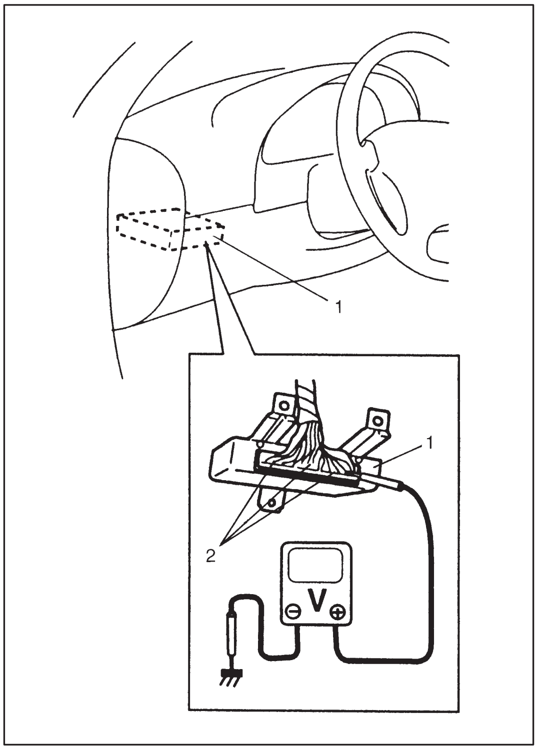
EGR VALVE (%)

This parameter indicates opening rate of EGR valve which controls the amount of EGR flow.

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.

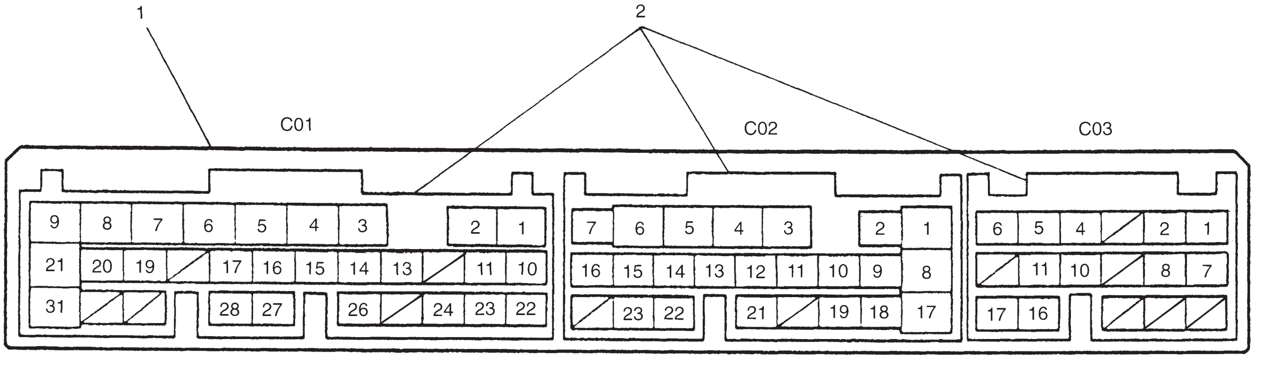
CAUTION:
ECM (PCM) cannot be checked by itself. It is strictly prohibited to connect voltmeter or ohmmeter to ECM (PCM) with coupler disconnected from it.



Voltage Check

1) Remove ECM (PCM) (1) from body referring to Section 6E2.
2) Check voltage at each terminal of couplers (2) 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.

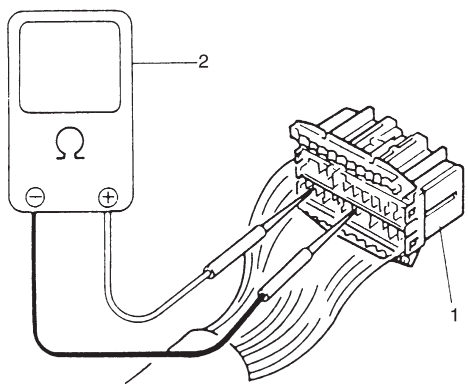


1. ECM (PCM)
2. ECM (PCM) couplers (Viewed from harness side)

	TERMINAL NO.	CIRCUIT	NORMAL VOLTAGE	CONDITION
CONNECTOR "C01"	1	Ground	—	—
	2	Ground	—	—
	3	Ground	—	—
	4	EVAP canister purge valve	10 – 14 V	Ignition switch ON
	5	Power steering switch	Indication deflection repeated 0 V and 10 – 14 V	Ignition switch ON
	6	Idle air control valve	0 – 13 V	At specified idle speed after engine warmed up
	7	Heater of HO2S-1	10 – 14 V	Ignition switch ON
	8	Fuel injector NO.4	10 – 14 V	Ignition switch ON
	9	Fuel injector NO.1	10 – 14 V	Ignition switch ON
	10	Sensor ground	—	—
	11	Camshaft position sensor	0 – 0.8 V and 4 – 6 V	Ignition switch ON
	12	Blank	—	—
	13	Heater oxygen sensor-1	Refer to DTC P0130 diag. flow table	
	14	Engine coolant temp. sensor	0.55 – 0.95 V	Ignition switch ON Engine coolant temp.: 80°C (176°F)
	15	Intake air temp. sensor	2.0 – 2.7 V	Ignition switch ON Intake air temp.: 20°C (68°F)
	16	Blank	—	—
	17	Electric load signal (+)	0 – 1 V	Ignition switch ON Small light and rear defogger OFF
			10 – 14 V	Ignition switch ON Small light and rear defogger ON
	18	Blank	—	—
	19	Ignition coil #2	—	—
	20	Ignition coil #1	—	—
	21	Fuel injector NO.2	10 – 14 V	Ignition switch ON
	22	Power source for sensor	4.75 – 5.25 V	Ignition switch ON
	23	Crankshaft position sensor (+)	—	—
	24	Crankshaft position sensor (–)	—	—
	25	Blank	—	—
	26	Manifold absolute pressure sensor	3.3 – 4.0 V	Ignition switch ON Barometric pressure: 100 kPa (760 mmHg)
	27	Blank	—	—
	28	Immobilizer indicator lamp	0 – 2 V	Ignition switch ON
			10 – 14 V	When engine running
	29	Blank	—	—
	30	Blank	—	—
	31	Fuel injector NO.3	10 – 14 V	Ignition switch ON

	TERMINAL NO.	CIRCUIT	NORMAL VOLTAGE	CONDITION
CONNECTOR "C02"	1	A/C ON output signal	0 V	Ignition switch ON
	2	EGR valve (stepper motor coil 1)	10 – 14 V	Ignition switch ON
			0 – 1 V	Engine running at idle speed
	3	Data link connector	10 – 14 V	Ignition switch ON
	4	Heater of HO2S-2	10 – 14 V	Ignition switch ON
	5	Power source	10 – 14 V	Ignition switch ON
	6	Power source	10 – 14 V	Ignition switch ON
	7	Power source for buck-up	10 – 14 V	Ignition switch ON and OFF
	8	EGR valve (stepper motor coil 3)	10 – 14 V	Ignition switch ON
			10 – 14 V	Engine running at idle speed
	9	EGR valve (stepper motor coil 2)	10 – 14 V	Ignition switch ON
			10 – 14 V	Engine running at idle speed
	10	Main relay	10 – 14 V	Ignition switch OFF
			0.4 – 1.5 V	Ignition switch ON
	11	2-range signal (A/T)	10 – 14 V	Ignition switch ON, Select lever at 2-range
	12	N-range signal (A/T)	10 – 14 V	Ignition switch ON, Select lever at N-range
	13	Heated oxygen sensor-2	Refer to DTC P0130 diag. flow table	
	14	D-range signal (A/T)	10 – 14 V	Ignition switch ON, Select lever at D-range
	15	R-range signal (A/T)	10 – 14 V	Ignition switch ON, Select lever at R-range
	16	A/C input signal	10 – 14 V	Ignition switch ON A/C switch OFF
			0 – 2 V	Ignition switch ON A/C switch ON
	17	EGR valve (stepper motor coil 4)	10 – 14 V	Ignition switch ON
			0 – 1 V	Engine running at idle speed
	18	Radiator fan control relay	10 – 14 V	Ignition switch ON Engine coolant temp.: Below 92.5°C (199°F)
			0 – 1 V	Ignition switch ON Engine coolant temp.: Below 97.5°C (208°F) or higher
	19	Fuel pump relay	0 – 1 V	For 2 seconds after ignition switch ON
			10 – 14 V	After the above time
	20	Blank	—	—
	21	P-range signal (A/T)	Indication deflection repeated 0 V and 10 – 14 V	Ignition switch ON
	22	Fuel level sensor (gauge)	0 – 2 V	Ignition switch ON Fuel tank fully filled
			4.5 – 7.5 V	Ignition switch ON Fuel tank emptied
	23	L-range signal (A/T)	10 – 14 V	Ignition switch ON, Select lever at L-range
	24	Blank	—	—

CONNECTOR	TERMINAL NO.	CIRCUIT	NORMAL VOLTAGE	CONDITION
CONNECTOR "C03"	1	Malfunction indicator lamp	0 – 1 V	Ignition switch ON
			10 – 14 V	When engine running
	2	Vehicle speed sensor (M/T)	Indicator deflection repeated 0 V and 4 – 6 V	Ignition switch ON Front left tire turned slowly with front right tire locked
		Output shaft speed sensor (+) (A/T)	0.4 – 0.8 V	Ignition switch ON
	3	Blank	—	—
	4	Shift solenoid – A (A/T)	0 V	Ignition switch ON, Select lever at P-range
			10 – 14 V	Ignition switch ON, Select lever at D-range
	5	Throttle position sensor	0.2 – 1.0 V	Ignition switch ON Throttle valve at idle position
			2.8 – 4.8 V	Ignition switch ON Throttle valve at full open position
	6	Ignition switch	10 – 14 V	Ignition switch ON
	7	Data link connector	—	Ignition switch ON
	8	Output shaft speed sensor (–) (A/T)	0.4 – 0.8 V	Ignition switch ON
	9	Blank	—	—
	10	Sensor ground	—	—
	11	Shift solenoid – B (A/T)	0 V	Ignition switch ON, Select lever at P-range
			10 – 14 V	Ignition switch ON, Select lever at D-range
	12	Blank	—	—
	13	Blank	—	—
	14	Blank	—	—
	15	Blank	—	—
	16	Tachometer (if equipped)	0 – 1 V	Ignition switch ON
	17	Engine start switch (Engine start signal)	6 – 12 V	While engine cranking
			0 – 1 V	Other than above



1. ECM (PCM) coupler disconnected
2. Ohmmeter

Resistance Check

1) Disconnect ECM (PCM) couplers from ECM (PCM) with ignition switch OFF.

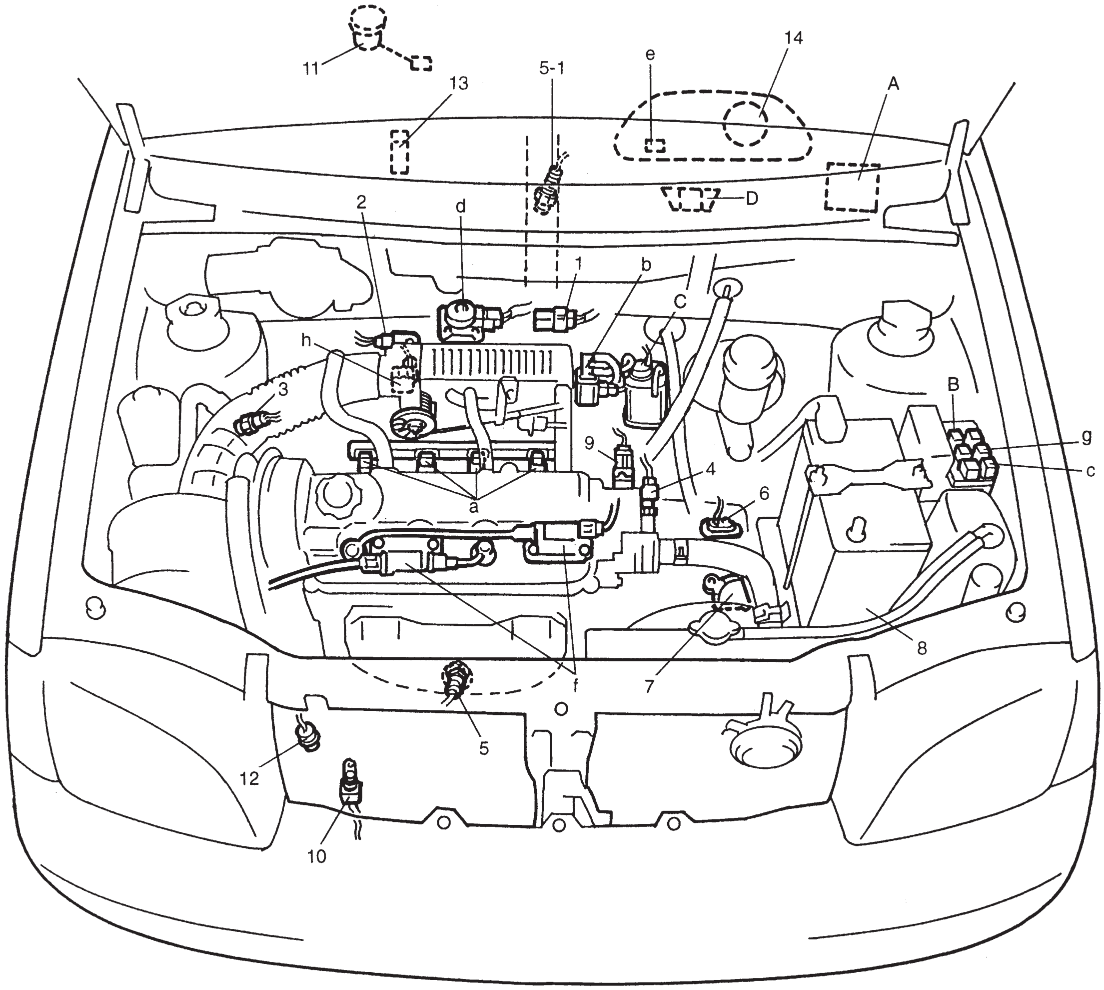
> **CAUTION:**
> **Never touch terminals of ECM (PCM) itself or connect voltmeter or ohmmeter.**

2) Check resistance between each terminal of couplers disconnected.

> **CAUTION:**
> - **Be sure to connect ohmmeter probe from wire harness side of coupler.**
> - **Be sure to turn OFF ignition switch for this check.**
> - **Resistance in table below represents that when parts temperature is 20°C (68°F).**

TERMINALS	CIRCUIT	STANDARD RESISTANCE
C01-7 to C03-6	HO2S-1 heater	11.7 – 15.6 Ω
C02-4 to C03-6	HO2S-2 heater	11.7 – 15.6 Ω
C01-9 to C02-5/6	No.1 injector	12.0 – 13.0 Ω
C01-21 to C02-5/6	No.2 injector	12.0 – 13.0 Ω
C01-31 to C02-5/6	No.3 injector	12.0 – 13.0 Ω
C01-8 to C02-5/6	No.4 injector	12.0 – 13.0 Ω
C02-2 to C02-5/6	EGR valve (stepper motor coil 4)	20 – 24 Ω
C02-9 to C02-5/6	EGR valve (stepper motor coil 3)	20 – 24 Ω
C02-8 to C02-5/6	EGR valve (stepper motor coil 2)	20 – 24 Ω
C02-17 to C02-5/6	EGR valve (stepper motor coil 1)	20 – 24 Ω
C01-4 to C02-5/6	EVAP canister purge valve	30 – 34 Ω
C02-19 to C03-6	Fuel pump relay	70 – 110 Ω
C02-1 to Body ground	A/C control module	No continuity
C02-18 to C02-5/6	Radiator fan control relay	70 – 110 Ω
C02-10 to C02-7	Main relay	70 – 110 Ω
C01-1 to Body ground	Ground	Continuity
C01-2 to Body ground	Ground	Continuity
C01-3 to Body ground	Ground	Continuity

COMPONENT LOCATION



INFORMATION SENSORS
1. MAP sensor
2. TP sensor
3. IAT sensor
4. ECT sensor
5. Heated oxygen sensor-1

5-1. Heated oxygen sensor-2

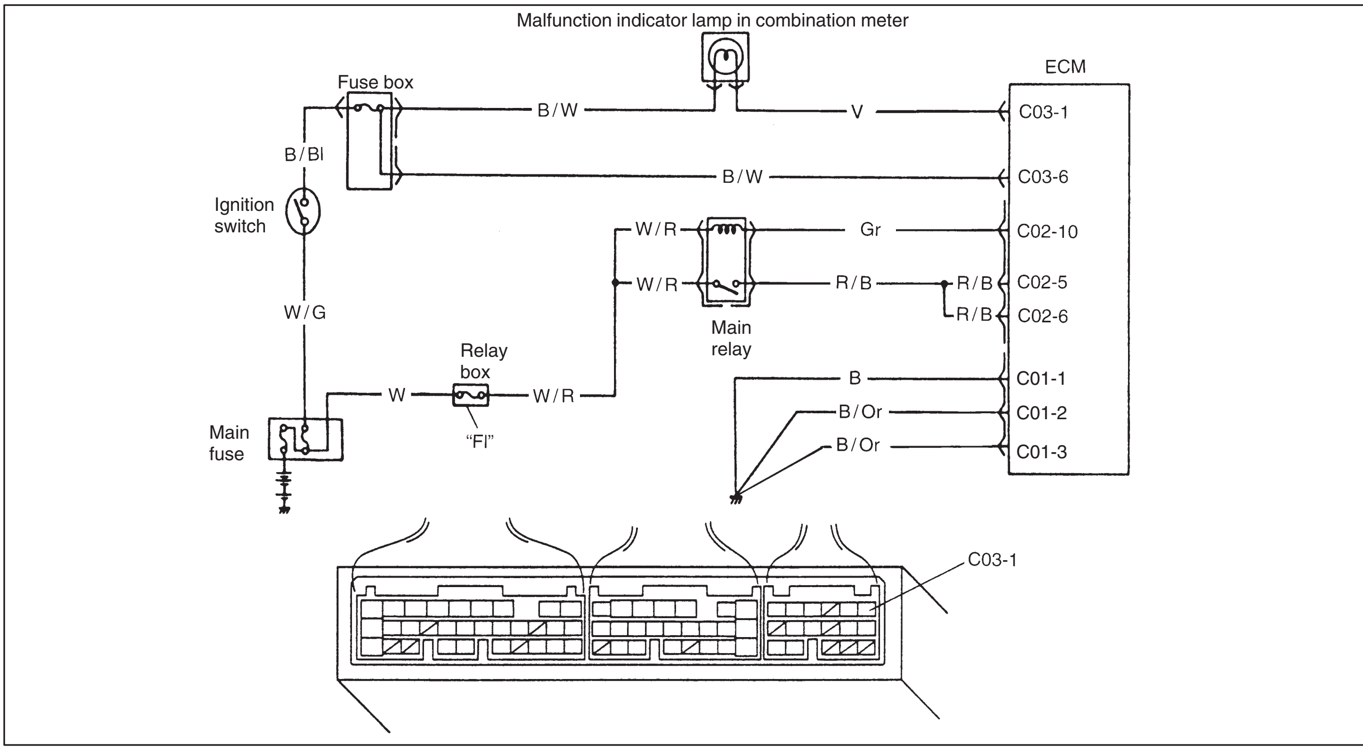
6. VSS (A/T)
7. Transmission range switch (A/T)
8. Battery
9. CMP sensor
10. CKP sensor
11. Fuel level sensor (gauge) (in fuel tank)
12. PSP switch
13. A/C control module (if equipped)
14. VSS (speedometer) (M/T)

CONTROL DEVICES
- a: Fuel injector
- b: EVAP canister purge valve
- c: Fuel pump relay
- d: EGR valve (step motor)
- e: Malfunction indicator lamp
- f: Ignition coil assembly
- g: Radiator fan control relay
- h: IAC valve

OTHERS
- A: ECM (PCM)
- B: Main relay
- C: EVAP canister
- D: Data link connector

TABLE A-1 MALFUNCTION INDICATOR LAMP CIRCUIT CHECK – LAMP DOES NOT COME "ON" AT IGNITION SWITCH ON (BUT ENGINE AT STOP)

CIRCUIT DESCRIPTION



When the ignition switch is turned ON, ECM (PCM) causes the main relay to turn ON (close the contact point). Then, ECM (PCM) being supplied with the main power, turns ON the malfunction indicator lamp (MIL). When the engine starts to run and no malfunction is detected in the system, MIL goes OFF but if a malfunction was or is detected, MIL remains ON even when the engine is running.

INSPECTION

STEP	ACTION	YES	NO
1	MIL Power Supply Check 1) Turn ignition switch ON. Do other indicator/warning lights in combination meter 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 (PCM) Power and Ground Circuit Check Does engine start?	Go to Step 3.	Go to TABLE A-3 ECM (PCM) POWER AND GROUND CIRCUIT CHECK. If engine is not cranked, go to DIAGNOSIS in SECTION 6G.
3	MIL Circuit Check 1) Turn ignition switch OFF and disconnect connectors from ECM (PCM). 2) Check for proper connection to ECM (PCM) at terminal C03-1. 3) If OK, then using service wire, ground terminal C03-1 in connector disconnected. Does MIL turn on at ignition switch ON?	Substitute a known-good ECM (PCM) and recheck.	Bulb burned out or "V" wire circuit open.

TABLE A-2 MALFUNCTION INDICATOR LAMP CIRCUIT CHECK – LAMP REMAINS "ON" AFTER ENGINE STARTS

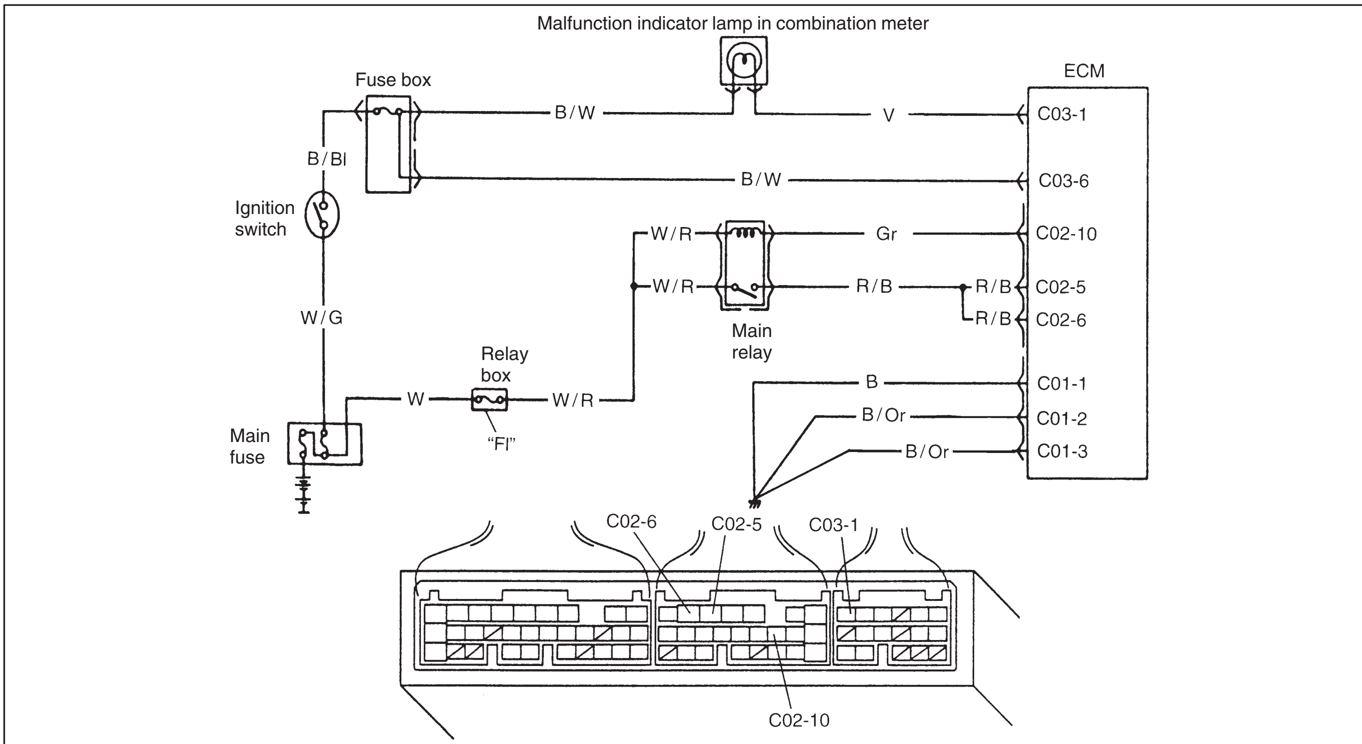
WIRING DIAGRAM/CIRCUIT DESCRIPTION – Refer to table A-1.

INSPECTION

STEP	ACTION	YES	NO
1	Diagnostic Trouble Code (DTC) check 1) Check DTC referring to DTC CHECK section. Is there any DTC(s)?	Go to Step 2 of ENGINE DIAG. FLOW TABLE.	Go to Step 2.
2	DTC check Start engine and recheck DTC while engine running. Is there any DTC(s)?		Go to Step 3.
3	MIL Circuit check 1) Turn OFF ignition switch. 2) Disconnect connectors from ECM (PCM). Does MIL turn ON at ignition switch ON?	"V" wire circuit shorted to ground.	Substitute a known-good ECM (PCM) and recheck.

TABLE A-3 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

CIRCUIT DESCRIPTION



When the ignition switch tuned ON, the main relay turns ON (the contact point closes) and the main power is supplied to ECM (PCM).

INSPECTION

STEP	ACTION	YES	NO
1	Main Relay Operating Sound Check Is operating sound of main relay heard at ignition switch ON?	Go to Step 5.	Go to Step 2.
2	Main Relay Check 1) Turn OFF ignition switch and remove main relay (1). 2) Check for proper connection to main relay (1) at terminal 3 and 4. 3) Check resistance between each two terminals. See Fig. 1 and 2. Between terminals 1 and 2: Infinity Between terminals 3 and 4: 100 – 150 Ω 4) Check that there is continuity between terminals 1 and 2 when battery is connected to terminals 3 and 4. See Fig. 3. Is main relay in good condition?	Go to Step 3.	Replace main relay.
3	Fuse Check Is main "FI" fuse in good condition?	Go to Step 4.	Check for short in circuits connected to this fuse.
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 C03-6, C02-10, C02-5 and C02-6. 3) If OK, then measure voltage between terminal C03-6 and ground, C02-10 and ground with ignition switch ON. Is each voltage 10 – 14 V?	Go to Step 5.	"B/W", "W/R" or "Gr" circuit open.

STEP	ACTION	YES	NO
5	ECM (PCM) Power Circuit Check 1) Using service wire, ground terminal C02-10 and measure voltage between terminal C02-5/6 and ground at ignition switch ON. Is it 10 – 14 V?	Check ground circuits "B/Y" and "B" for open. If OK, then substitute a known-good ECM (PCM) and recheck.	Go to Step 6.
6	Is operating sound of main relay heard in Step 1?	Go to Step 7.	"W/R" or "R/B" wire open.
7	Main Relay Check 1) Check main relay according to procedure in Step 2. Is main relay in good condition?	"W/R" or "R/B" wire open.	Replace main relay.

Fig. 1 for Step 2

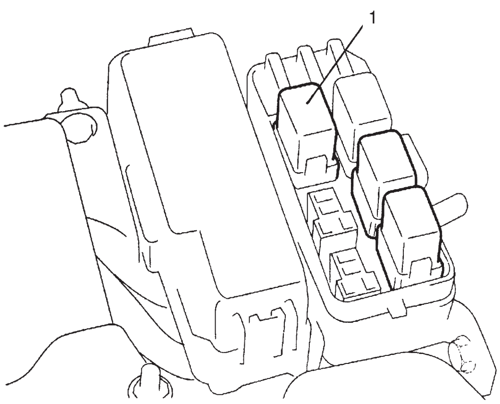


Fig. 2 for Step 2

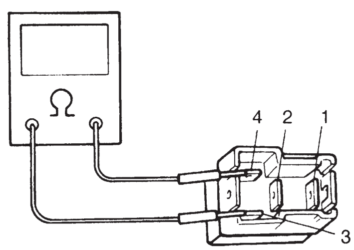
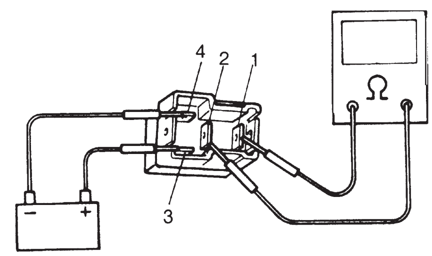
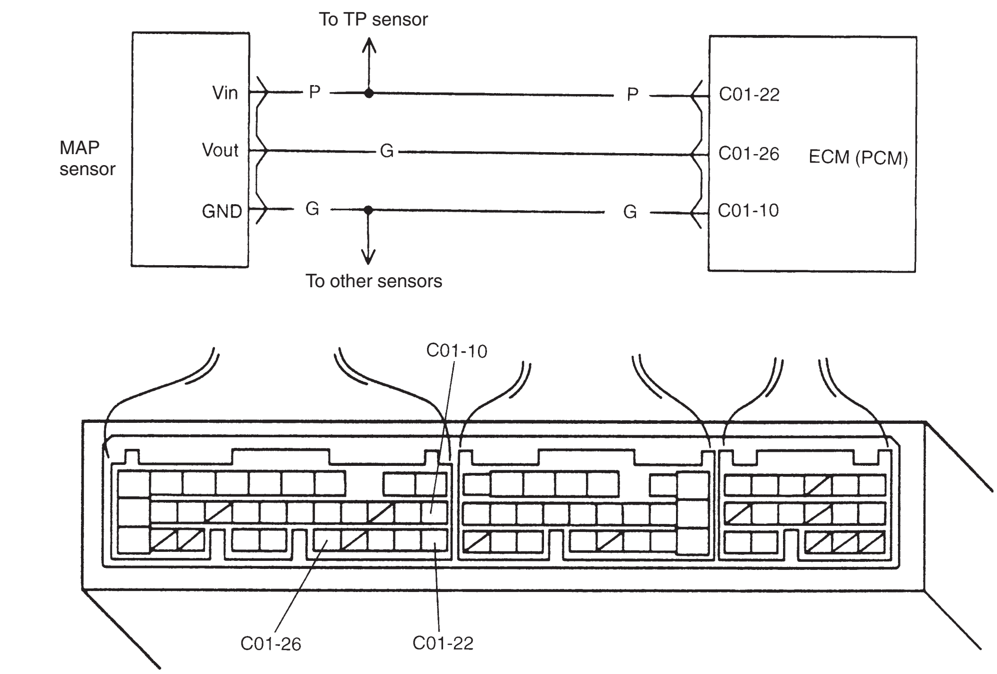


Fig. 3 for Step 2



DTC P0105 MANIFOLD ABSOLUTE PRESSURE (MAP) CIRCUIT MALFUNCTION

CIRCUIT DESCRIPTION

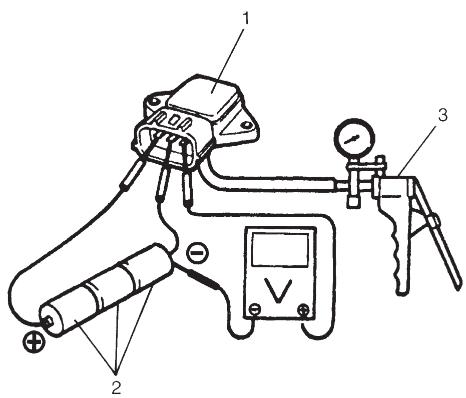


DTC DETECTING CONDITION	POSSIBLE CAUSE
● MAP: 4.9 kpa, 37 mmHg or less (Low pressure – High vacuums – Low voltage) ● MAP: 114.7 kpa, 860 mmHg or more (High pressure – Low vacuums – High voltage)	● “G” circuit open ● “P” circuit open or shorted to ground ● “G” circuit open or shorted to ground ● MAP sensor malfunction ● ECM (PCM) malfunction

NOTE:
When DTC P0120 is indicated together, it is possible that “P” circuit is open.

DTC CONFIRMATION PROCEDURE

1) Clear DTC, start engine and keep it at idle for 1 min.
2) Select “DTC” mode on scan tool and check DTC.



MAP Sensor Individual Check

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).

   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

   If check result is not satisfactory, replace MAP sensor (1).

4) Install MAP sensor (1) securely.
5) Connect MAP sensor (1) coupler securely.

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Check MAP Sensor and Its Circuit. 1) Connect scan tool to DLC with ignition switch OFF. 2) Turn ignition switch ON. 3) Check intake manifold pressure. See Fig. 1. Is it 114.7 kPa or more or 4.9 kPa or less?	Go to Step 3.	Intermittent trouble. Check for intermittent referring to “INTERMITTENT AND POOR CONNECTION” in Section 0A.
3	Check Wire Harness. 1) Disconnect MAP sensor connector with ignition switch OFF. 2) Check for proper connection of MAP sensor at “Gr” and “G” wire terminals. 3) If OK, then with ignition switch ON, check voltage at each of “P” and “Gr” wire terminals. See Fig. 2. Is voltage about 4 – 6 V at each terminal?	Go to Step 4.	“P” wire open or shorted to ground circuit or shorted to power circuit, “Gr” wire open or shorted to ground, poor C03-5 connection or C01-22 connection. If wire and connection are OK, confirm that MAP sensor is normal and then substitute a known-good ECM (PCM) and recheck. **NOTE: When battery voltage is applied to “P” wire, it is possible that MAP sensor is also faulty.**
4	Check MAP sensor according to “MAP Sensor Individual Check” below. Is it in good condition?	“P” wire shorted to “Gr” wire, “G” wire open, poor C01-10 connection. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.	Replace MAP sensor.

Fig. 1 for Step 2

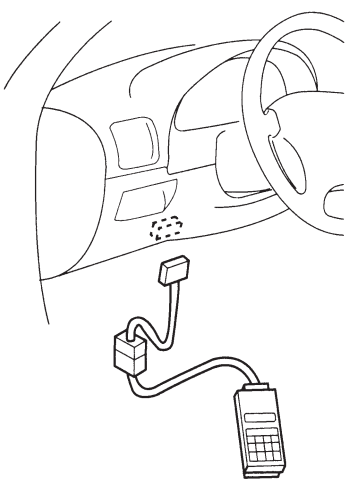
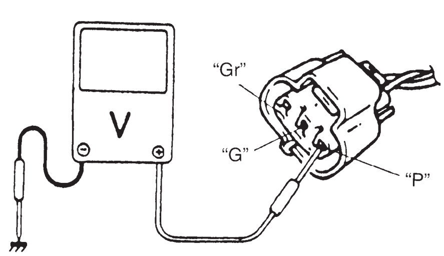
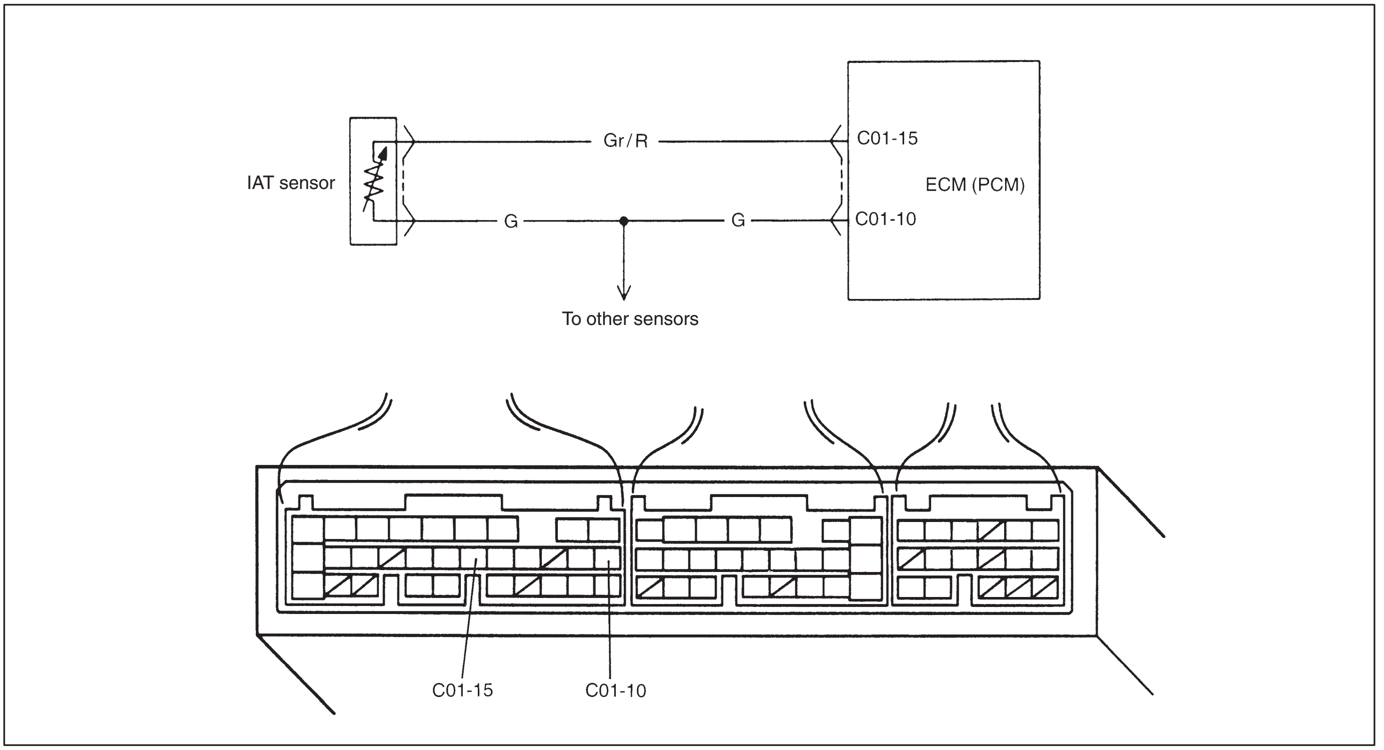


Fig. 2 for Step 3



DTC P0110 INTAKE AIR TEMP. (IAT) CIRCUIT MALFUNCTION

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
● Low intake air temperature (High voltage-High resistance) ● High intake air temperature (Low voltage-Low resistance)	● "Gr/R" circuit open or shorted to power ● "G" circuit open ● IAT sensor malfunction ● ECM (PCM) malfunction

NOTE:

- **When DTC P0115 and P0120 are indicated together, it is possible that "G" circuit is open.**
- **Before inspecting, be sure to check that ambient temperature is higher than –40°C (–40°F).**

DTC CONFIRMATION PROCEDURE

1) Clear DTC, start engine and keep it at idle for 1 min.
2) Select "DTC" mode no scan tool and check DTC.

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Check IAT Sensor and Its Circuit. 1) Connect scan tool to DLC with ignition switch OFF. 2) Turn ignition switch ON. 3) Check intake air temp. displayed on scan tool. See Fig. 1. Is –40°C (–40°F) or 119°C (246°F) indicated?	Go to Step 3.	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.
3	Check Wire Harness. 1) Disconnect IAT sensor connector with ignition switch OFF. 2) Check for proper connection to IAT sensor at “Gr/R” and “G” wire terminals. 3) If OK, then with ignition switch ON, is voltage applied to “Gr/R” wire terminal about 4 – 6 V? See Fig. 2.	Go to Step 5.	“Gr/R” wire open or shorted to power, or poor C01-15 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) Check intake air temp. displayed on scan tool with ignition switch ON. Is –40°C (–40°F) indicated?	Replace IAT sensor.	“Gr/R” 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) Check intake air temp. displayed on scan tool with ignition switch ON. See Fig. 3. Is 119°C (246°F) indicated?	Replace IAT sensor.	“Gr/R” wire open or poor C01-10 connection. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.

Fig. 1 for Step 2

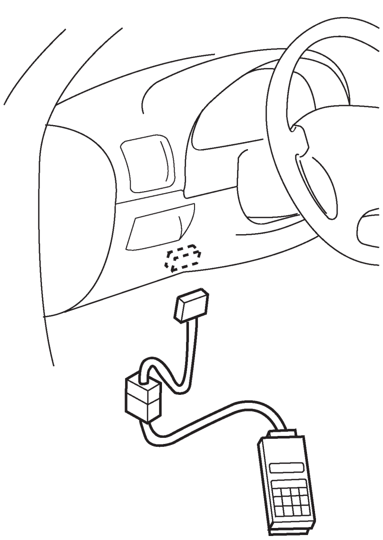


Fig. 2 for Step 3

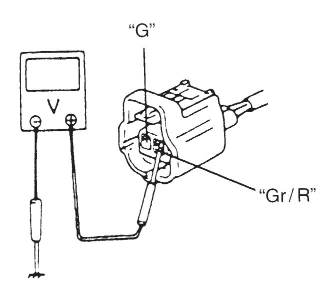
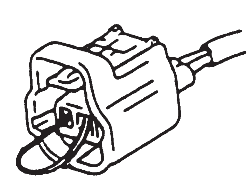
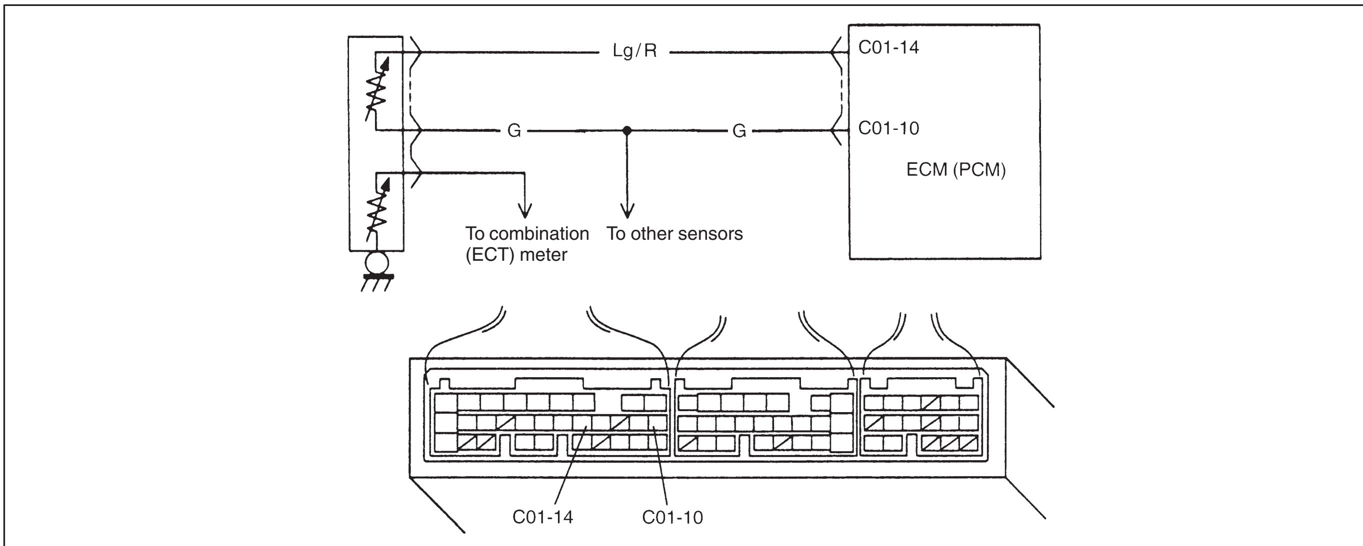


Fig. 3 for Step 4



DTC P0115 ENGINE COOLANT TEMPERATURE (ECT) CIRCUIT MALFUNCTION

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
● Low engine coolant temperature (High voltage-High resistance) ● High engine coolant temperature (Low voltage-Low resistance)	● “Lg/R” circuit open or shorted to power ● “G” circuit open ● ECT sensor malfunction ● ECM (PCM) malfunction

DTC CONFIRMATION PROCEDURE

1) Clear DTC, start engine and keep it at idle for 1 min.
2) Select “DTC” mode on scan tool and check DTC.

NOTE:
Before inspecting, be sure to check that coolant temp. meter in combination meter indicates normal operating temperature (Engine is not overheating).

INSPECTION

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Check ECT Sensor and Its Circuit. 1) Connect scan tool with ignition switch OFF. 2) Turn ignition switch ON. 3) Check engine coolant temp. displayed on scan tool. See Fig. 1. Is –40°C (–40°F) or 119°C (246°F) indicated?	Go to Step 3.	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection" in Section 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.	"Lg/R" wire shorted to ground. If wire is 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 with ignition switch OFF. 2) Check for proper connection to ECT sensor at "G" and "Lg/R" wire terminals. 3) If OK, then with ignition switch ON, is voltage applied to "G" wire terminal about 4 – 6 V? See Fig. 2.	Go to Step 4.	"Lg/R" wire open or shorted to power, or poor C01-14 connection. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.
6	Check Wire Harness. 1) Using service wire, connect ECT sensor connector terminals. See Fig. 3. 2) Turn ignition switch ON and check engine coolant temp. displayed on scan tool. Is 119°C (246°F) indicated?	Replace ECT sensor.	"G" wire open or poor C01-10 connection. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.

Fig. 1 for Step 2

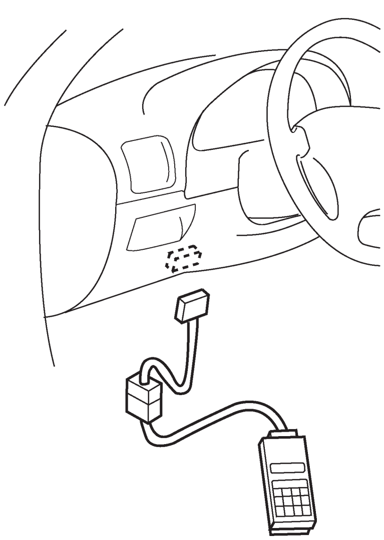


Fig. 2 for Step 5

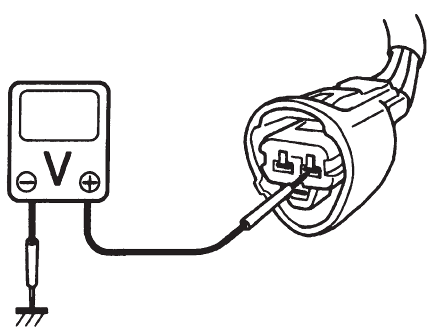
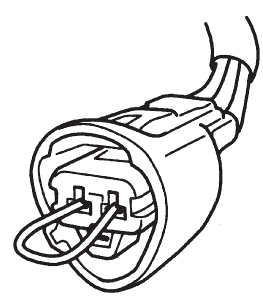
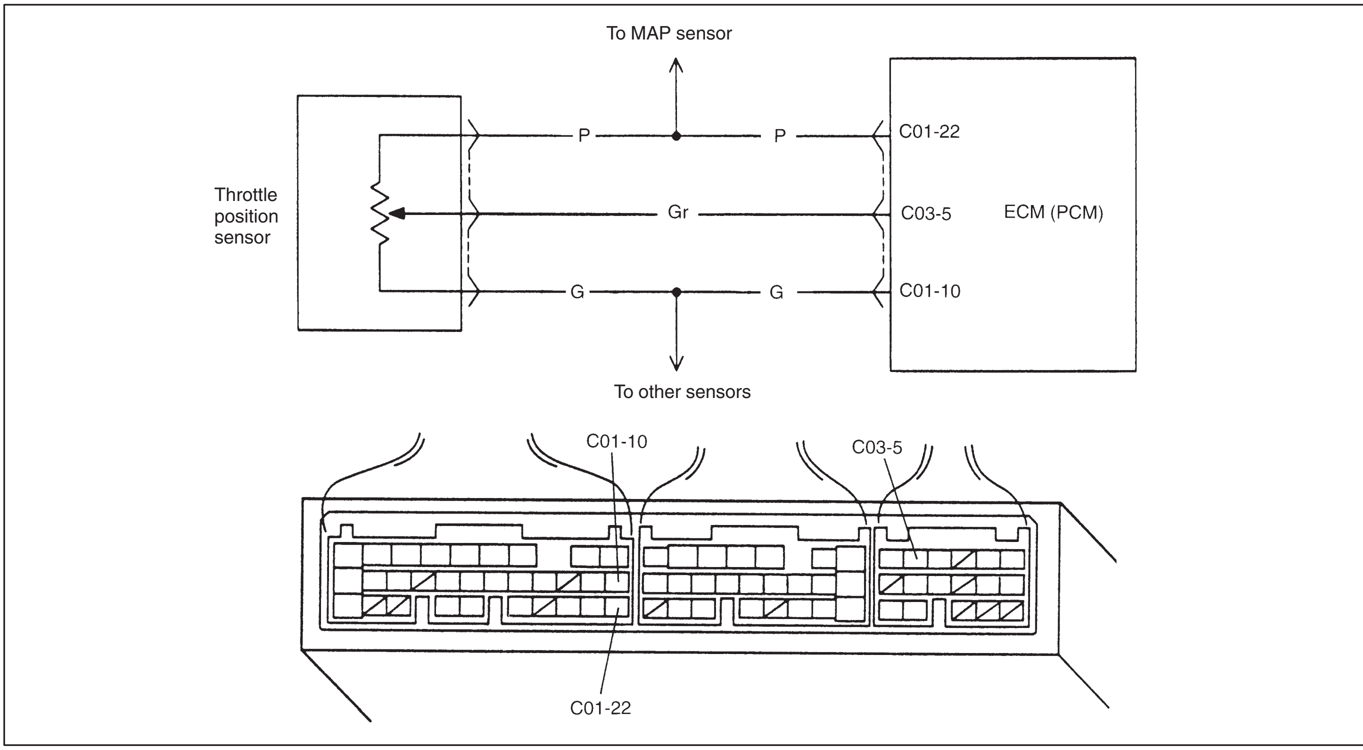


Fig. 3 for Step 6



DTC P0120 THROTTLE POSITION CIRCUIT MALFUNCTION

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
● Signal voltage high ● Signal voltage low	● “G” circuit open ● “Gr” circuit open or shorted to ground ● “P” circuit open or shorted to power or ground ● TP sensor malfunction ● ECM (PCM) malfunction

NOTE:

- **When DTC P0105, P0110, P0115 and/or P0120 are/is indicated together, it is possible that “G” circuit is open.**
- **When DTC P0105 and/or P0120 are/is indicated together, it is possible that “P” circuit is open.**

DTC CONFIRMATION PROCEDURE

1) Clear DTC, start engine and keep it at idle for 1 min.
2) Select “DTC” mode on scan tool and check DTC.

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Check 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. See Fig. 1. Is it displayed 2% or less? 3) Check throttle valve opening percentage displayed on scan tool while opening throttle valve from idle position to full open position. See Fig. 1. Is it displayed 96% or higher?	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 “P”, “Gr” and “G” wire terminal. 3) If OK, then with ignition switch ON, check voltage at each of “P” and “Gr” wire terminals. See Fig. 2. Is voltage about 4 – 6 V at each terminal?	Go to Step 4.	“P” wire open, “P” wire shorted to ground circuit or power circuit or “G” wire, “Gr” wire open or shorted to ground circuit or poor C01-22 or C03-5 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. See Fig. 3. Between 1 and 2: 2.5 – 6.0 kΩ Between 1 and 3: 170 Ω – 15.5 kΩ Are measured values within specifications?	“G” wire open or poor C01-10 connection. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.	Replace TP sensor.

Fig. 1 for Step 2

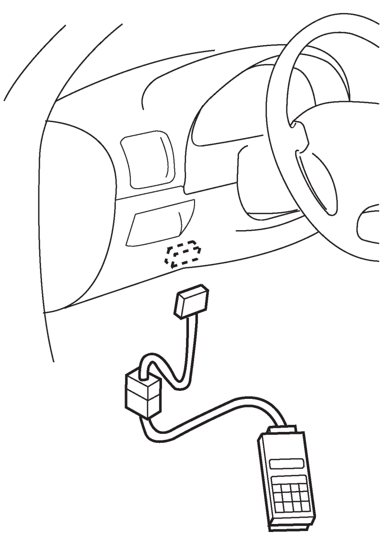


Fig. 2 for Step 3

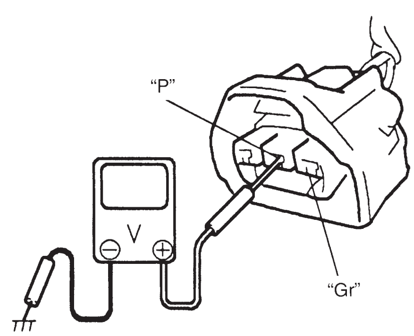
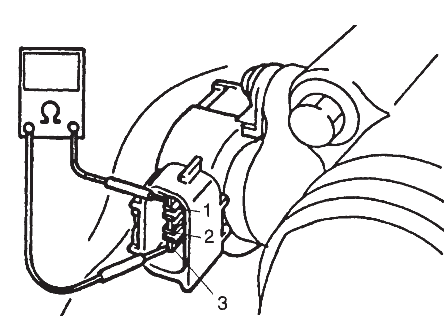
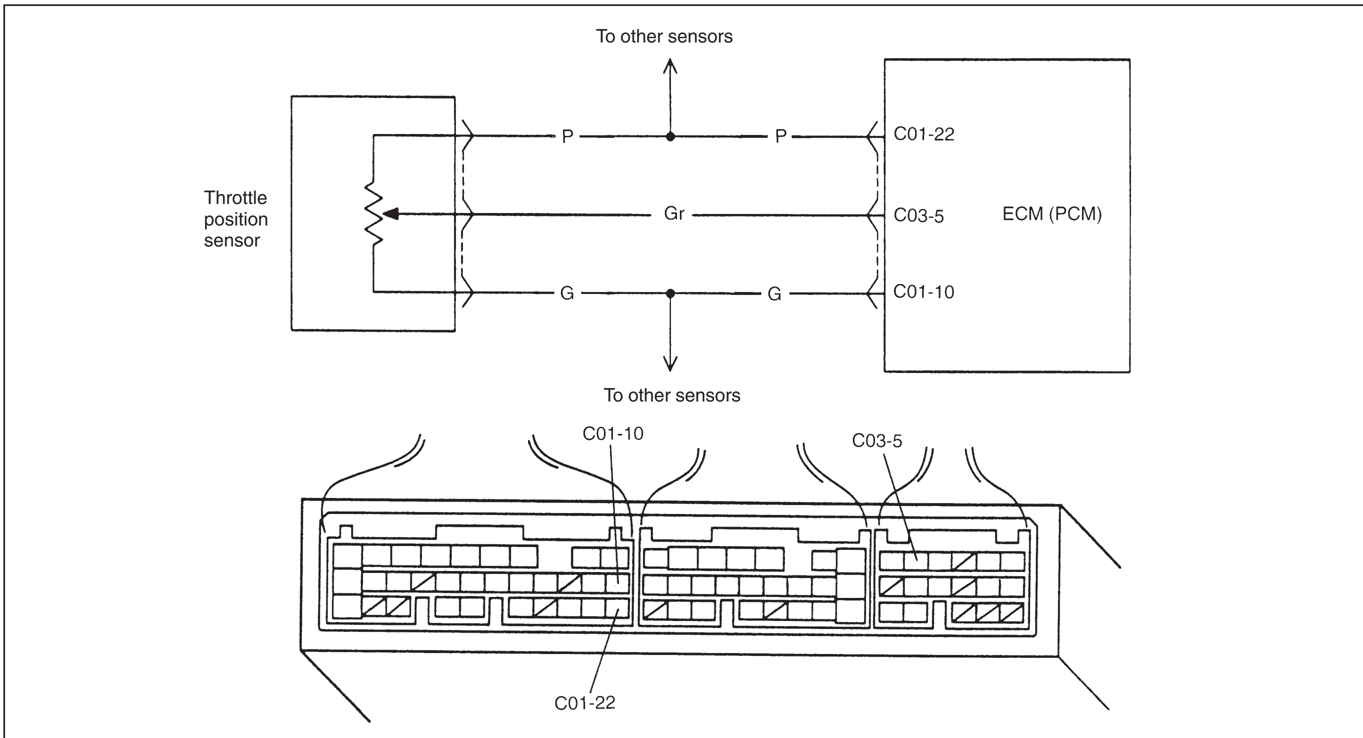


Fig. 3 for Step 4



DTC P0121 THROTTLE POSITION CIRCUIT RANGE/PERFORMANCE PROBLEM

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
● After engine warmed up. ● While vehicle running at specified engine speed. ● No change in intake manifold pressure (constant throttle opening) ● Difference between actual throttle opening (detected from TP sensor) and opening calculated by ECM (PCM) (Obtained on the basis of engine speed and intake manifold pressure) in larger than specified value. ✳ 2 driving cycle detection logic, continuous monitoring	● TP sensor malfunction ● High resistance in the circuit ● ECM (PCM) malfunction

DTC CONFIRMATION PROCEDURE

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester, on a level road.**

1) Turn ignition switch OFF. Clear DTC with ignition switch ON, check vehicle and environmental condition for:
   – Indication of fuel level meter in combination meter: 1/4 or more
   – Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)
   – Intake air temp.: between –10°C and 80°C (14°F and 176°F)
   – Engine coolant temp.: 70°C, 158°F or higher
2) Warm up engine to normal operating temperature.
3) Increase vehicle speed to 30 – 40 mph, 50 – 60 km/h in 3rd gear or “D” range and hold throttle valve at that opening position for 1 min.
4) Stop vehicle.
5) Check DTC in “DTC” mode and pending DTC in “ON BOARD TEST” or “PENDING DTC” mode.

INSPECTION

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	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. See Fig. 1 and 3. When not using SUZUKI scan tool: 1) Turn ignition switch ON. 2) Check voltage at terminal C03-5 of ECM (PCM) connector connected, when throttle valve is at idle position and fully opened. See Fig. 2 and 3. Dose voltage vary within specified value linearly as shown in figure?	If voltmeter was used, check terminal C03-5 for poor connection. If OK, substitute a known-good ECM (PCM) and recheck.	Go to Step 3.
3	Check TP Sensor. 1) Turn ignition switch OFF. 2) Disconnect TP sensor connector. 3) Check for proper connection to TP sensor at each terminal. 4) If OK, then measure resistance between terminals and check if each measured value is as specified below. See Fig. 4. Between 1 and 2: 2.5 – 6.0 kΩ Between 1 and 3: 170 Ω – 15.5 kΩ, varying according to throttle valve opening. Are measured values as specified?	High resistance in "P", "Gr" or "G" circuit. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.	Replace TP sensor.

Fig. 1 for Step 2

When using SUZUKI scan tool:

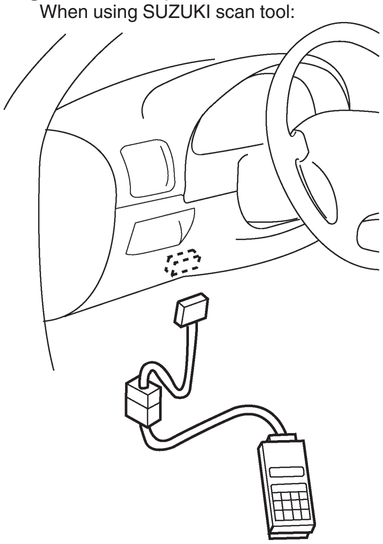


Fig. 2 for Step 2

When not using SUZUKI scan tool:

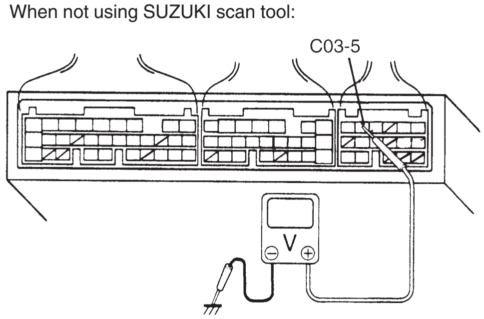


Fig. 3 for Step 2

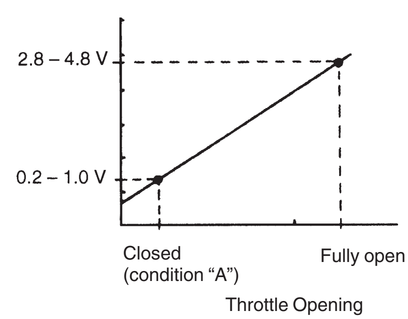
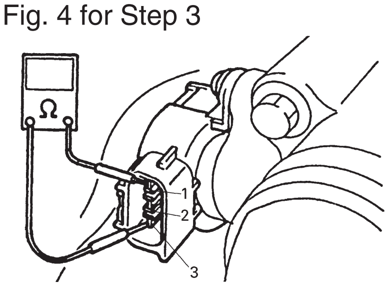
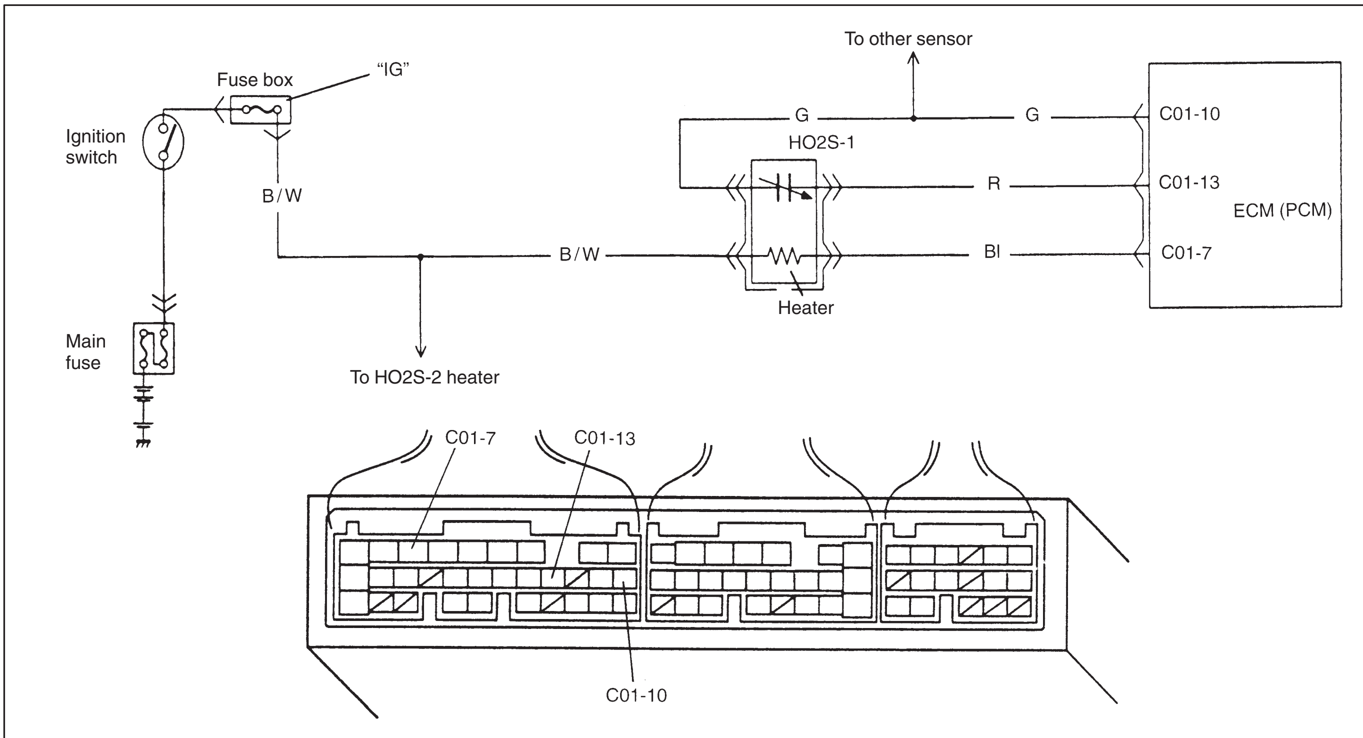


Fig. 4 for Step 3



DTC P0130 HEATED OXYGEN SENSOR (HO2S) CIRCUIT MALFUNCTION (SENSOR-1)

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
● When running at idle speed after engine warmed up and running at specified vehicle speed, HO2S-1 output voltage does not go 0.3 V below or over 0.6 V. ✻ 2 driving cycle detection logic, Monitoring once/1 driving.	● Heated oxygen sensor-1 malfunction ● "G" or "R" circuit open (poor connection) or short

DTC CONFIRMATION PROCEDURE

> **WARNING:**
> - **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
> - **Road test should be carried out with 2 persons, a driver and a tester.**

1) Turn ignition switch OFF. Clear DTC with ignition switch ON, check vehicle and environmental condition for:
   – Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)
   – Intake air temp.: between –10°C and 80°C (14°F and 176°F)
2) Warm up engine to normal operating temperature.
3) Drive vehicle at 38 – 50 mph, 60 – 80 km/h for 2 min.
4) Stop vehicle and run engine at idle for 2 min.
5) Check DTC in "DTC" mode and pending DTC in "ON BOARD TEST" or "PENDING DTC" mode.

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Is there DTC(s) other than HO2S-1 (DTC P0130)?	Go to applicable DTC Diag. Flow Table.	Go to Step 3.
3	1) Connect scan tool to DLC with ignition switch OFF. 2) Warm up engine to normal operating temperature and keep it at 2000 r/min. for 60 sec. 3) Repeat racing engine (Repeat depressing accelerator pedal 5 to 6 times continuously and take foot off from pedal to enrich and enlean A/F mixture). See Fig. 1 and 2. Does HO2S-1 output voltage deflect between 0.3 V and over 0.6 V repeatedly?	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Check “R” and “G” wires for open and short, and connections for poor connection. If wires and connections are OK, replace HO2S-1.

Fig. 1 for Step 3

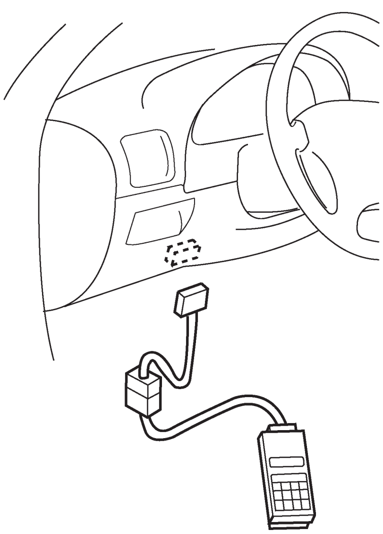
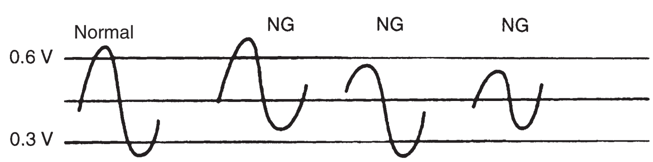


Fig. 2 for Step 3

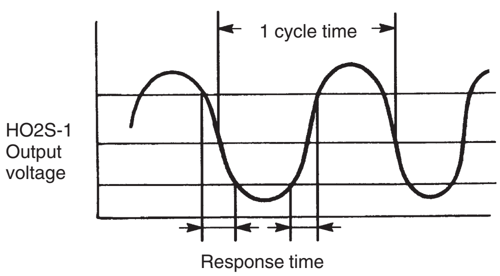


DTC P0133 HEATED OXYGEN SENSOR (HO2S) CIRCUIT SLOW RESPONSE (SENSOR-1)

WIRING DIAGRAM/CIRCUIT DESCRIPTION – Refer to DTC P0130 section.

DTC DETECTING CONDITION	POSSIBLE CAUSE
● When running at specified idle speed after engine warmed up and running at specified vehicle speed, response time (time to change from lean to rich or from rich to lean) of HO2S-1 output voltage is about 1 sec. at minimum or average time of 1 cycle is 5 sec. at minimum. See. Fig. 1 ✻ 2 driving cycle detection logic, Monitoring once/1 driving.	● Heated oxygen sensor-1 malfunction

Fig. 1



DTC CONFIRMATION PROCEDURE – Refer to DTC P0130 section.

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Is there DTC(s) other than HO2S-1 (DTC P0133)?	Go to applicable DTC Diag. Flow Table.	Replace HO2S-1.

DTC P0134 HEATED OXYGEN SENSOR (HO2S) CIRCUIT NO ACTIVITY DETECTED (SENSOR-1)

CIRCUIT DESCRIPTION – Refer to DTC P0130 section.

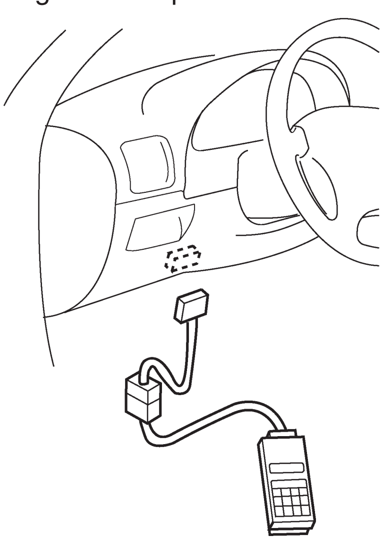
DTC DETECTING CONDITION	POSSIBLE CAUSE
● Engine warmed up. ● While running under other than high load and high engine speed conditions or at specified idle speed (engine is in closed loop condition), HO2S-1 output voltage is high or low continuously. ✻ 2 driving cycle detection logic, Continuous monitoring.	● “G” or “R” circuit open or short ● Heated oxygen sensor malfunction ● Fuel system malfunction ● Exhaust gas leakage

DTC CONFIRMATION PROCEDURE – Refer to DTC P0130 section.

INSPECTION

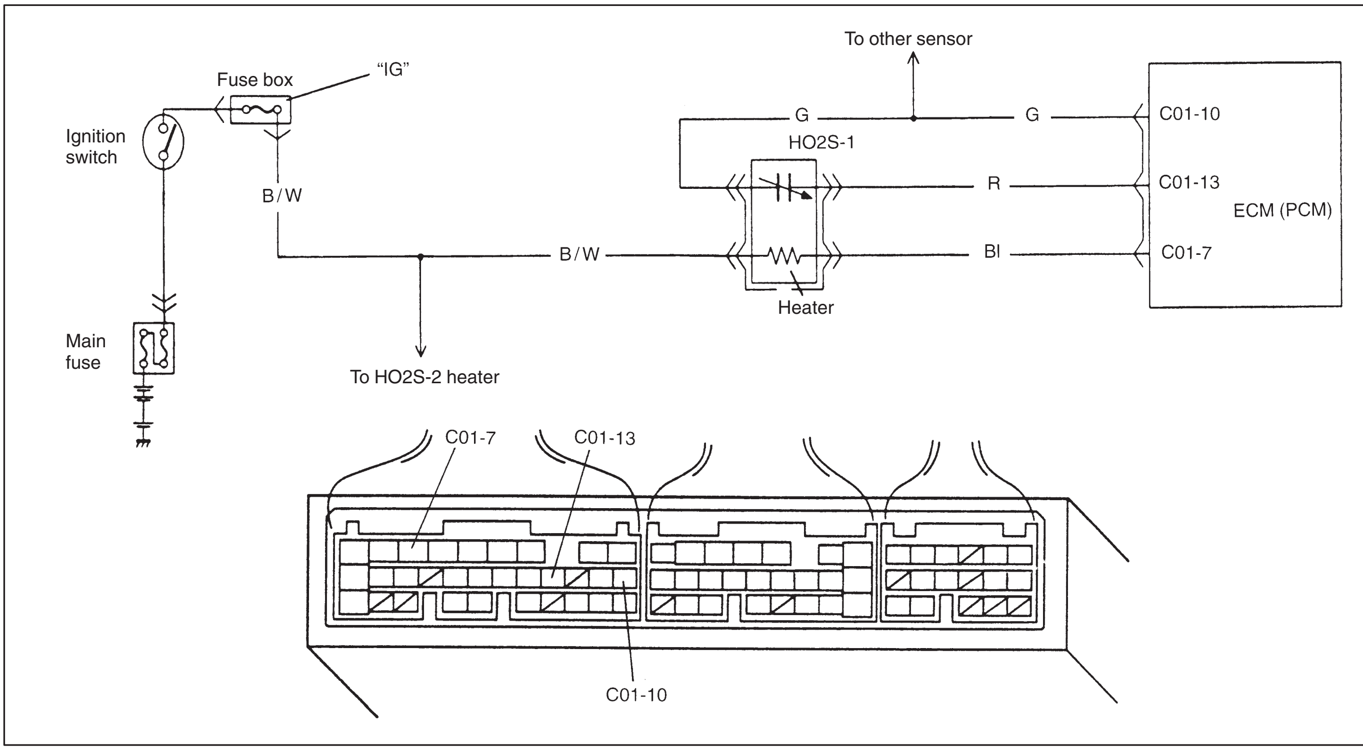
STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Is there DTC(s) other than Fuel system (DTC P0171/P0172) and HO2S-1 (DTC P0134)?	Go to applicable DTC Diag. Flow Table.	Go to Step 3.
3	Check HO2S-1 and Its Circuit. 1) Connect scan tool to DLC with ignition switch OFF. 2) Warm up engine to normal operating temperature and keep it at 2000 r/min. for 60 sec. 3) Repeat racing engine (Repeat depressing accelerator pedal 5 to 6 times continuously and take foot off from pedal to enrich and enlean A/F mixture). See Fig. 1. Does HO2S-1 output voltage deflect between 0.3 V and over 0.6 V repeatedly?	Go to DTC P0171 and P0172 Diag. Flow Table (Fuel System Check).	Check “R” and “G” wires for open and short, and connections for poor connection. If wires and connections are OK, replace HO2S-1.

Fig. 1 for Step 3



DTC P0135 HEATED OXYGEN SENSOR (HO2S) HEATER CIRCUIT MALFUNCTION (SENSOR-1)

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
DTC will set when A or B condition is met. A: ● Low voltage at terminal C01-7 when engine is running at high load. B: ● High voltage at terminal C01-7 when engine is running under condition other than above. ✳ 2 driving cycle detection logic, Continuous monitoring.	● HO2S-1 heater circuit open or shorted to ground ● ECM (PCM) malfunction

DTC CONFIRMATION PROCEDURE

> **WARNING:**
> - **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
> - **Road test should be carried out with 2 persons, a driver and a tester.**

1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON, start engine and keep it at idle for 1 min.
3) Start vehicle and depress accelerator pedal fully for 5 sec. or longer.
4) Stop vehicle.
5) Check DTC in "DTC" mode and pending DTC in "ON BOARD TEST" or "PENDING DTC" mode.

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go t o“ENGINE DIAG. FLOW TABLE”.
2	Check Heater for Operation. 1) Check voltage at terminal C01-7. See Fig. 1. 2) Warm up engine to normal operating temperature. 3) Stop engine. 4) Turn ignition switch ON and Check voltage at terminal C01-7. See Fig. 1. Voltage should be over 10 V. 5) Start engine, run it at idle and check voltage at the same terminal. Voltage should be below 1.9 V. Are check results are specified?	Intermittent trouble Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Go to Step 3.
3	Check Heater of Sensor-1. 1) Disconnect HO2S-1 coupler with ignition switch OFF. 2) Check for proper connection to HO2S-1 at “B/W” and “Bl” wire terminals. 3) If OK, then check heater resistance. See Fig. 2. Is it 11.7 – 14.3 Ω at 20°C, 68°F?	“Bl” wire open or shorted to ground or poor connection at C01-7. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.	Replace HO2S-1.

Fig. 1 for Step 2

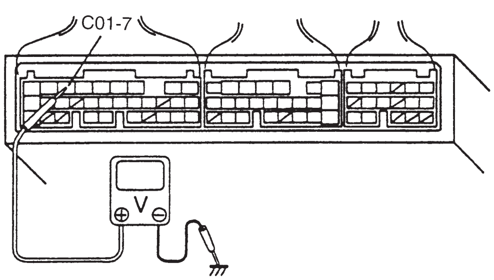
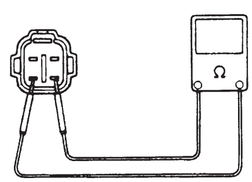
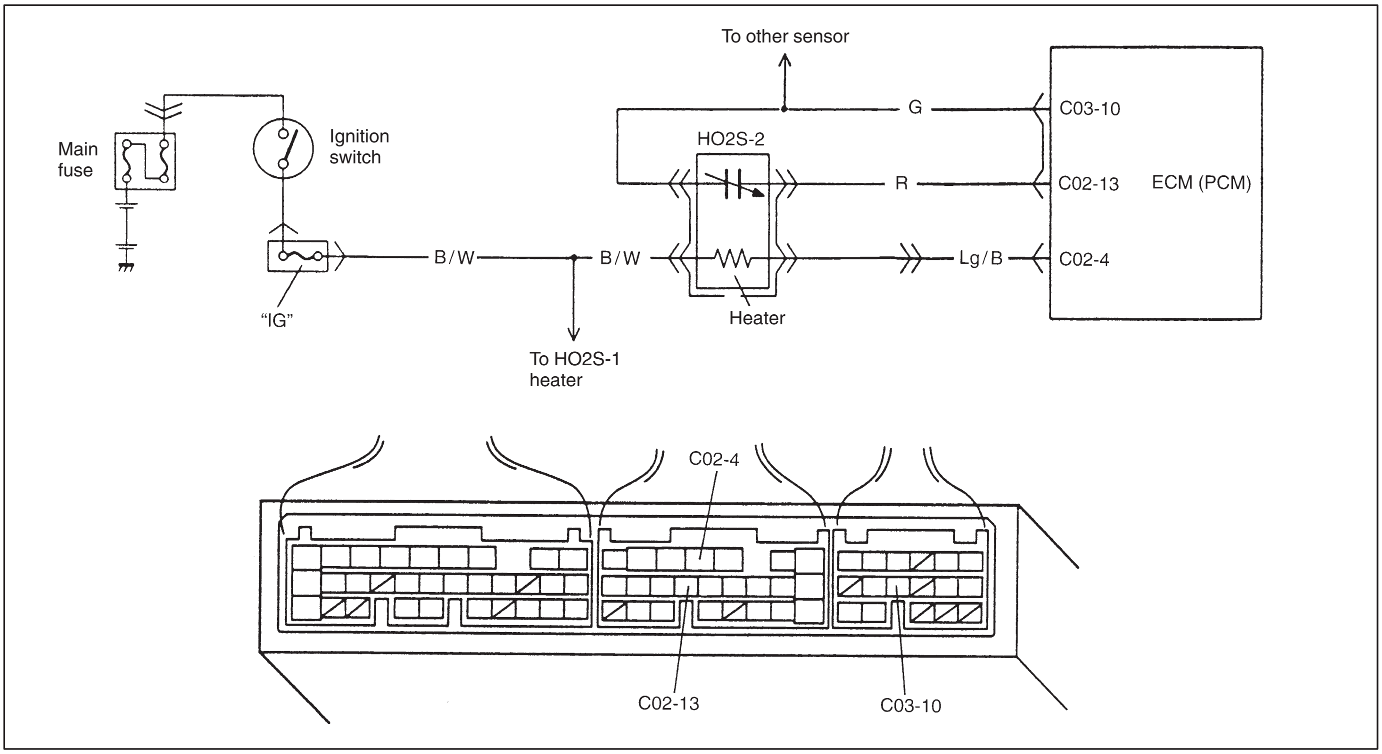


Fig. 2 for Step 3



DTC P0136 HEATED OXYGEN SENSOR (HO2S) CIRCUIT MALFUNCTION (SENSOR-2)

CIRCUIT DESCRIPTION

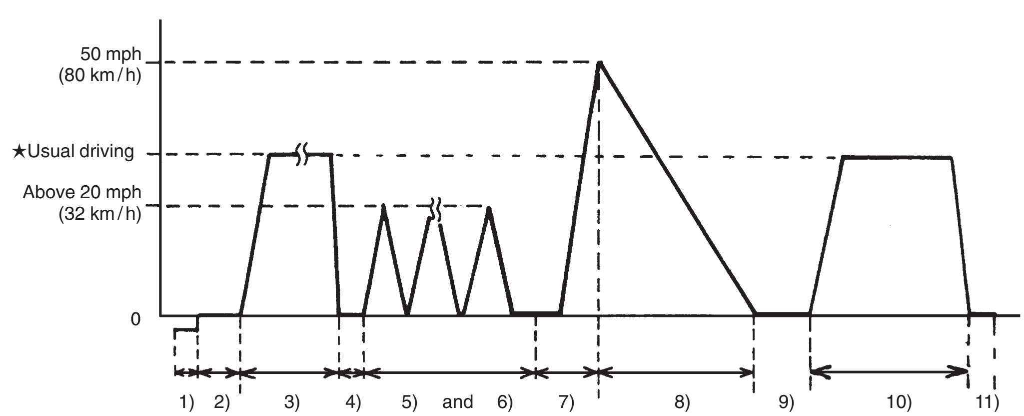


DTC DETECTING CONDITION	POSSIBLE CAUSE
DTC will set when A or B condition is detected. A. Max. output voltage of HO2S-2 is lower than specified value or Min. output voltage is higher than specified value while vehicle driving. B. Engine is warmed up and HO2S-2 voltage is 4.5 V or more. (circuit open) ✳ 2 driving cycle detection logic, monitoring once/1 driving.	● Exhaust gas leakage ● "G" or "R" circuit open or short ● Heated oxygen sensor-2 malfunction ● Fuel system malfunction

DTC CONFIRMATION PROCEDURE

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester, on a level road.**

1) Turn ignition switch OFF.
   Clear DTC with ignition switch ON, check vehicle and environmental condition for:
   – Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)
   – Intake air temp.: –10°C, 14°F or higher
   – No exhaust gas leakage and loose connection
2) Warm up engine to normal operating temperature.
3) Drive vehicle under usual driving condition for 5 min. and check HO2S-2 output voltage and "short term fuel trim" with "Data List" mode on scan tool, and write it down.
4) Stop vehicle (don't turn ignition switch OFF).
5) Increase vehicle speed to higher than 20 mph, 32 km/h and then stop vehicle.
6) Repeat above steps 5) 4 times.
7) Increase vehicle speed to about 50 mph (80 km/h) in 3rd gear or 2 range.
8) Release accelerator pedal and with engine brake applied, keep vehicle coasting (fuel cut condition) for 10sec. or more.
9) Stop vehicle (don't turn ignition switch OFF) and run engine at idle for 2 min.
   After this step 9), if "Oxygen Sensor Monitoring TEST COMPLETED" is displayed in "READINESS TESTS" mode and DTC is not displayed in "DTC" mode, confirmation test is completed.
   If "TEST NOT COMPLTD" is still being displayed, proceed to next step 10).
10) Drive vehicle under usual driving condition for 10 min. (or vehicle is at a stop and run engine at idle for 10 min. or longer)
11) Stop vehicle (don't turn ignition switch OFF). Confirm test results according to "Test Result Confirmation Flow Table" in "DTC CONFIRMATION PROCEDURE" of DTC P0420.



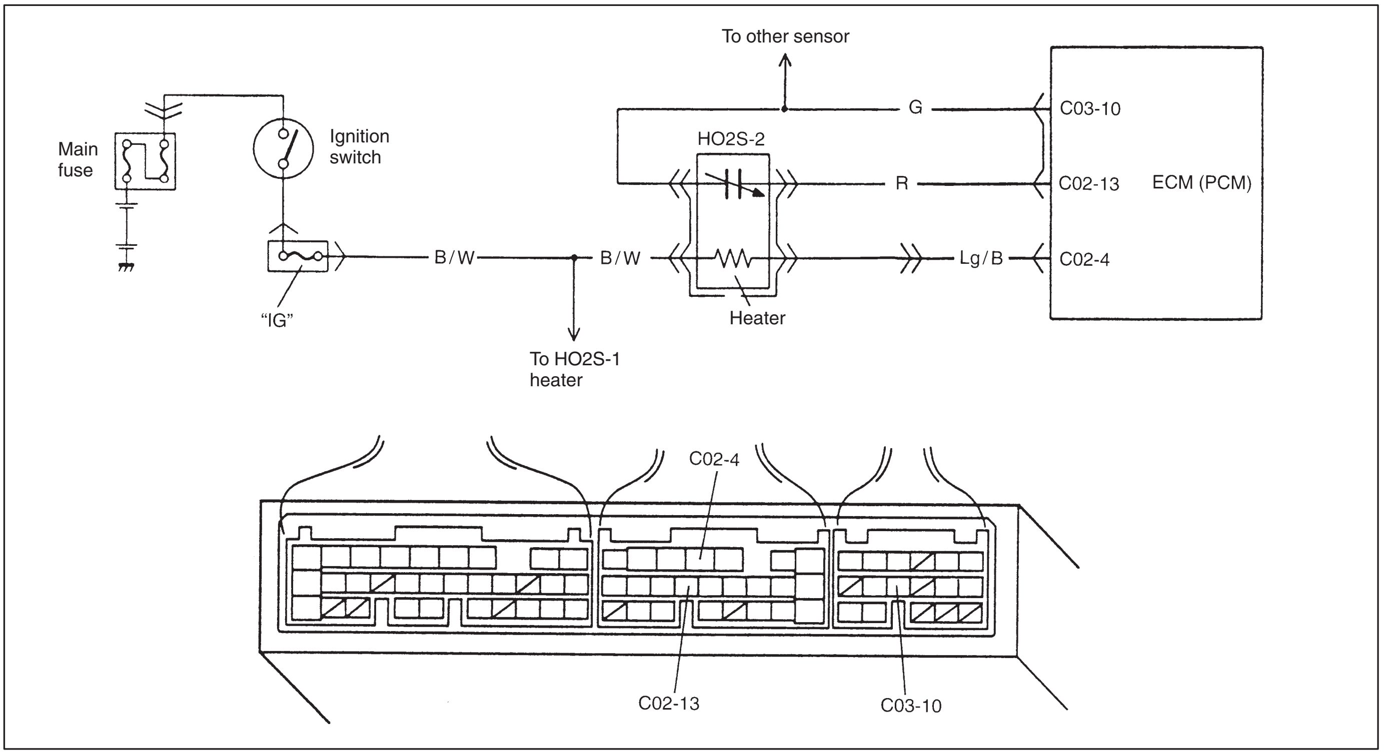
★Usual driving: Driving at 30 – 40 mph, 50 – 60 km/h including short stop according to traffic signal. (under driving condition other than high-load, high-engine speed, rapid accelerating and decelerating)

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Check exhaust system for leakage, loose connection and damage. Is it good condition?	Go to Step 3.	Repair or replace.
3	Check HO2S-2 and Its Circuit. Was HO2S-2 output voltage indicated on scan tool in step 3) of DTC confirmation test less than 1.275 V?	Go to Step 4.	“G” or “R” circuit open or HO2S-2 malfunction.
4	Check Short Term Fuel Trim. Did short term fuel trim very within –20 – +20% range in step 3) of DTC confirmation test?	Check “R” and “G” wire for open and short, and connection for poor connection. If wire and connection are OK, replace HO2S-2.	Check fuel system. Go to DTC P0171/P0172 Diag. Flow Table.

DTC P0141 HEATED OXYGEN SENSOR (HO2S) HEATER CIRCUIT MALFUNCTION (SENSOR-2)

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
DTC will set when A or B condition it met. A. Low voltage at terminal C02-4 for specified time after engine start or while engine running at high load. B. High voltage at terminal C02-4 while engine running under other than above condition. ✻ 2 driving cycle detection logic, continuous monitoring.	● HO2S-2 heater circuit open or shorted to ground ● ECM (PCM) malfunction

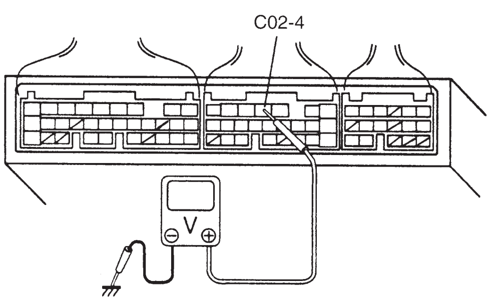
DTC CONFIRMATION PROCEDURE

1) Turn ignition switch OFF once and then ON.
2) Clear DTC, start engine and warm up engine to normal operating temperature.
3) Keep it at 2000 r/min for 2 min.
4) Check pending DTC in "ON BOARD TEST" or "PENDING DTC" mode and DTC in "DTC" mode.

INSPECTION

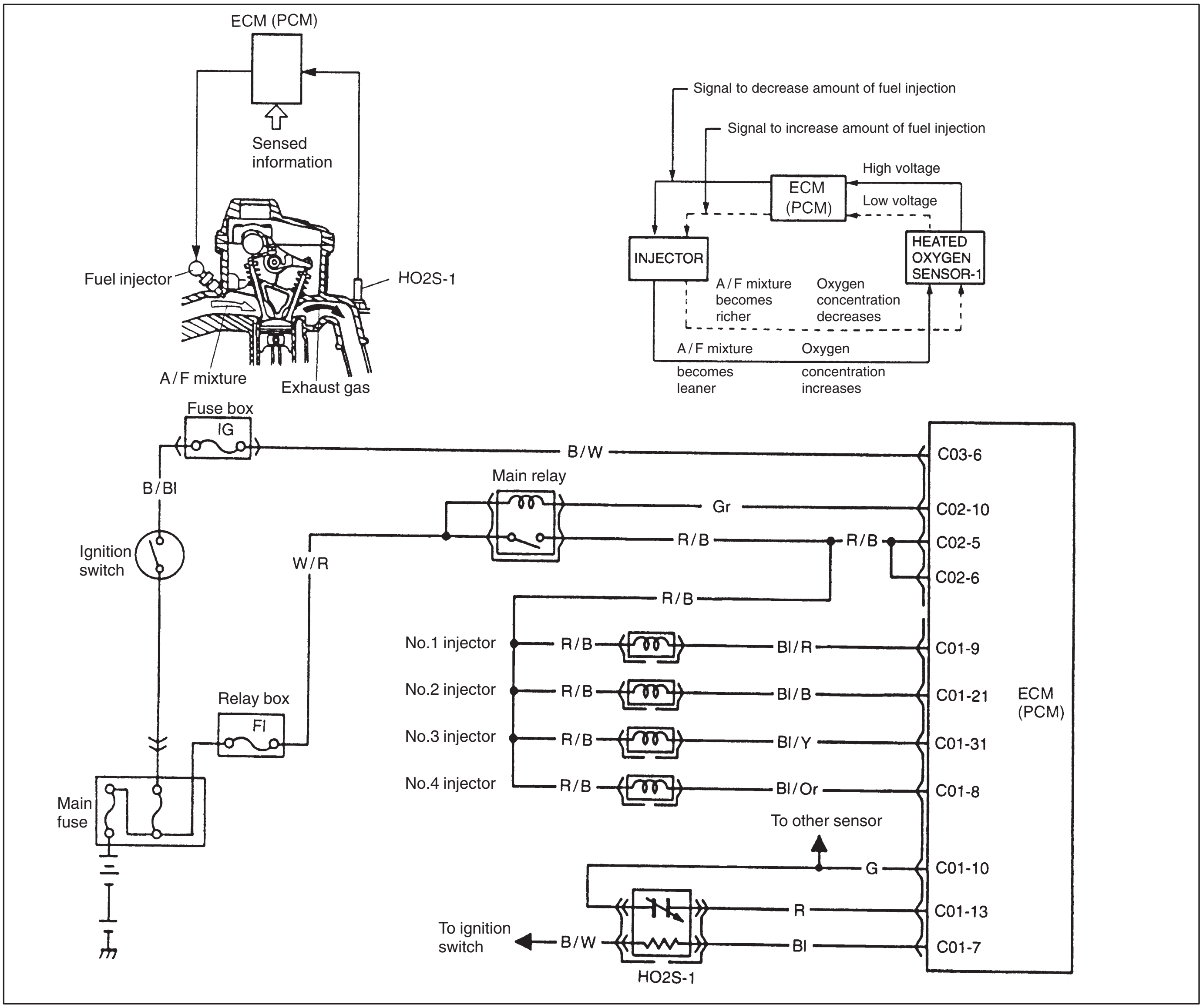
STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Check HO2S-2 Heater and Its Circuit. 1) Warm up engine to normal operating temperature. 2) Stop engine. 3) Turn ignition switch ON and check voltage at terminal C02-4 See Fig. 1. Voltage should be over 10 V. 4) Start engine, run it at idle and check voltage at the same terminal after 1 min. from engine start. Voltage should be below 1.9 V. Are check result as specified?	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A.	Go to Step 3.
3	Check Heater or Sensor-2. 1) Disconnect HO2S-2 coupler with ignition switch OFF. 2) Check for proper connection to HO2S-2 at "B/W" and "Lg/B" wire terminals. 3) If OK, then check heater resistance. Is it 11.7 – 14.3 Ω at 20°C, 68°F?	"Lg/B" wire open or shorted to ground or poor connection at C02-4. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.	Replace HO2S-2.

Fig. 1 for Step 2



DTC P0171 FUEL SYSTEM TOO LEAN
DTC P0172 FUEL SYSTEM TOO RICH

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
● When following condition occurs while engine running under closed loop condition. – Air/fuel ratio too lean (Total fuel trim (short and long terms added) is more than 30%) or – Air/fuel ratio too rich (Total fuel trim is less than –30%) ✻ 2 driving cycle detection logic, continuous monitoring.	● Vacuum leaks (air drawn in). ● Exhaust gas leakage. ● Heated oxygen sensor-1 circuit malfunction. ● Fuel pressure out of specification. ● Fuel injector malfunction (clogged or leakage). ● MAP sensor poor performance. ● ECT sensor poor performance. ● IAT sensor poor performance. ● TP sensor poor performance. ● EVAP control system malfunction. ● PCV valve malfunction.

DTC CONFIRMATION PROCEDURE

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester on a level road.**

1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON.
3) Check vehicle and environmental condition for:
   – Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)
   – Intake air temp.: between –10°C and 80°C (14°F and 176°F)
4) Start engine and drive vehicle under usual driving condition (described in DTC confirmation procedure of DTC P0136) for 5 min. or longer and until engine is warmed up to normal operating temperature.
5) Keep vehicle speed at 30 – 40 mph, 50 – 60 km/h in 5th gear or “D” range for 5 min. or more.
6) Stop vehicle (do not turn ignition switch OFF).
7) Check pending DTC in “ON BOARD TEST” or “PENDING DTC” mode and DTC in “DTC” mode.

INSPECTION

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Is there DTC(s) other than fuel system (DTC P0171/P0172)?	Go to applicable DTC Diag. Flow Table.	Go to Step 3.
3	Check HO2S-1 Output Voltage. 1) Connect scan tool to DLC with ignition switch OFF. 2) Warm up engine to normal operating temperature and keep it at 2000 r/min. for 60 sec. 3) Repeat racing engine (Repeat depressing accelerator pedal 5 to 6 times continuously and take foot off from pedal to enrich and enlean A/F mixture). See Fig. 1. Does HO2S-1 output voltage deflect between below 0.3 V and over 0.6 V repeatedly?	Go to Step 4.	Go to DTC P0130 Diag. Flow Table (HO2S-1 circuit check).
4	Check Fuel Pressure (Refer to section 6E2 for details). 1) Release fuel pressure from fuel feed line. 2) Install fuel pressure gauge. 3) Check fuel pressure. See Fig. 2. With fuel pump operating and engine at stop : 270 – 310 kPa, 2.7 – 3.1 kg/cm^2, 38.4 – 44.0 psi. At specified idle speed : 200 – 240 kPa, 2.0 – 2.4 kg/cm^2, 28.4 – 34.1 psi. Is measured value as specified?	Go to Step 5.	Go to Diag. Flow Table B-3 Fuel Pressure Check.
5	Check Fuel Injectors and Circuit. 1) Using sound scope (1) or such, check operating sound of each injector (2) when engine is running. Cycle of operating sound should vary according to engine speed. See Fig. 3. If no sound or an unusual sound is heard, check injector circuit (wire or coupler) or injector. 2) Turn ignition switch OFF and disconnect a fuel injector connector. 3) Check for proper connection to fuel injector at each terminal. See Fig. 4. 4) If OK, then check injector resistance. Injector Resistance: 12 – 13 ohm at 20°C (68°F) 5) Carry out steps 1) and 3) on each injector. 6) Check each injector for injected fuel volume referring to Section 6E2. See Fig. 5. Injected Fuel Volume: 38 – 48 cc/15 sec 1.28/ 1.34 – 1.62/1.69 US/Imp.oz/15 sec) 7) Check each injector for fuel leakage after injector closed. Fuel Leakage: Less than 1 drop/min. Is check result in step 1) and 3) to 7) satisfactory?	Go to Step 6.	Check injector circuit or replace fuel injector(s).
6	Check EVAP Canister Purge Valve. 1) Disconnect purge hose (1) from EVAP canister. 2) Place finger against the end of disconnected hose. 3) Check that vacuum is not felt there when engine is cool and running at idle. See Fig. 6. Is vacuum felt?	Check EVAP control system (See Section 6E2).	Go to Step 7.
7	Check intake manifold absolute pressure sensor for performance (See DTC P0105 Diag. Flow Table). Is it in good condition?	Go to Step 8.	Repair or replace.

STEP	ACTION	YES	NO
8	Check engine coolant temp. sensor for performance (See Section 6E2). Is it in good condition?	Go to Step 9.	Replace engine coolant temp. sensor.
9	Check intake air temp. sensor for performance (See Section 6E2). Is it in good condition?	Go to Step 10.	Replace intake air temp. sensor.
10	Check throttle position sensor for performance (See Step 3 of DTC P0121 Diag. Flow Table). Is it in good condition?	Go to Step 11.	Replace throttle position sensor.
11	Check PCV valve for valve clogging (See Section 6E2). Is it good condition?	Substitute a known-good ECM (PCM) and recheck.	Replace PCV valve.

Fig. 1 for Step 3

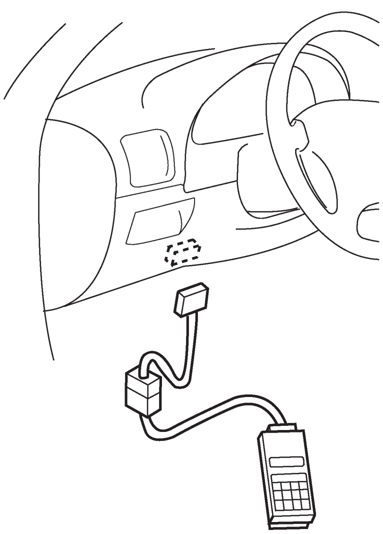
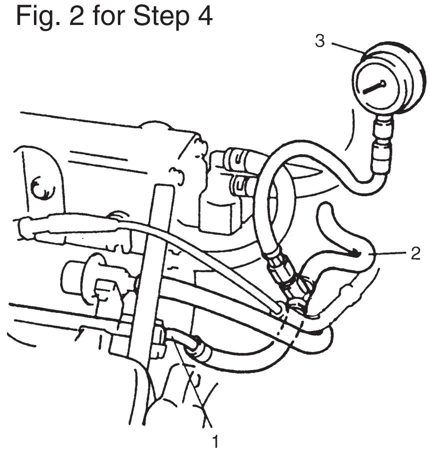


Fig. 2 for Step 4



1. Fuel delivery pipe
2. Fuel feed hose
3. Fuel pressure gauge & 3 way joint

Fig. 3 for Step 5

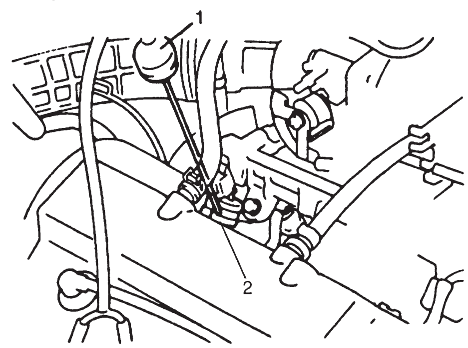


Fig. 4 for Step 5

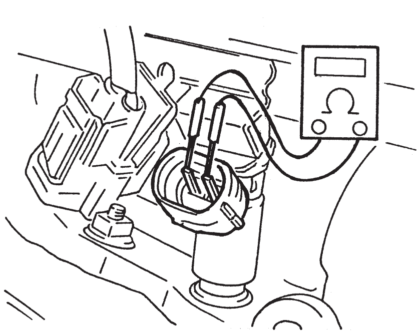


Fig. 5 for Step 5

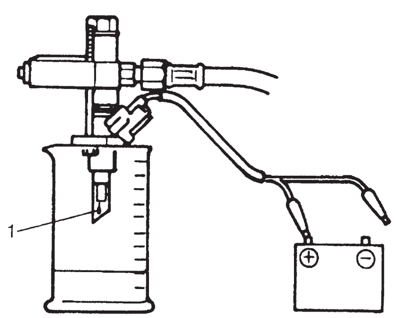
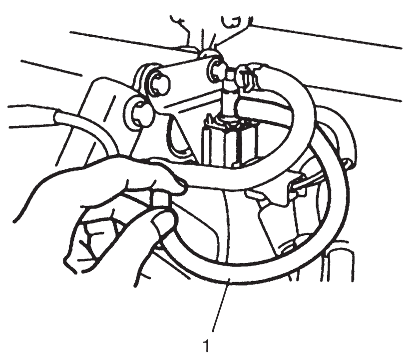
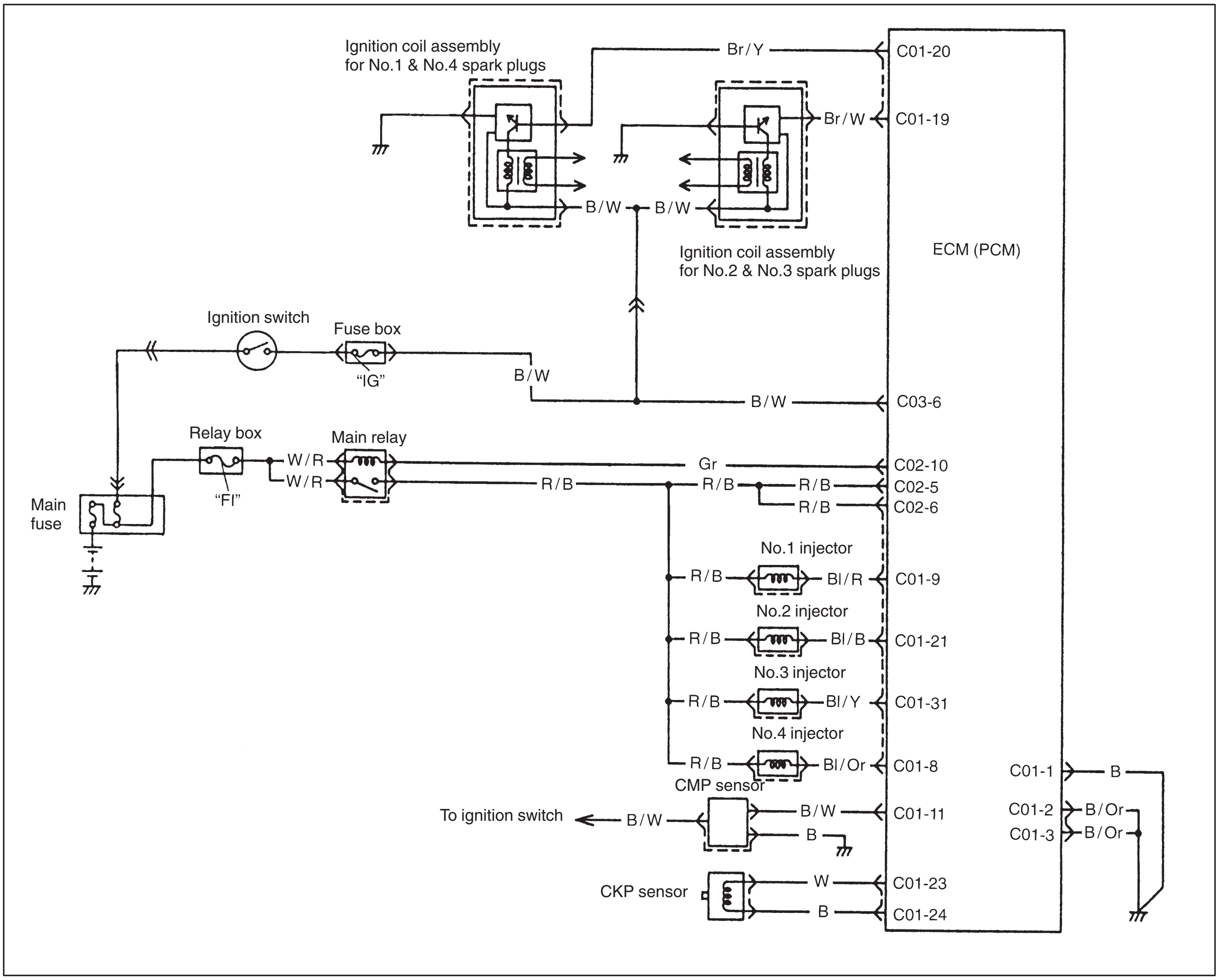


Fig. 6 for Step 6



DTC P0300 RANDOM MISFIRE DETECTED (Misfire detected at 2 or more cylinders)
DTC P0301 CYLINDER 1 MISFIRE DETECTED
DTC P0302 CYLINDER 2 MISFIRE DETECTED
DTC P0303 CYLINDER 3 MISFIRE DETECTED
DTC P0304 CYLINDER 4 MISFIRE DETECTED



CIRCUIT DESCRIPTION

ECM (PCM) monitors crankshaft revolution speed and engine speed via the crankshaft position sensor and cylinder No. via the camshaft position sensor. Then it calculates the change in the crankshaft revolution speed and from how many times such change occurred in every 200 or 1000 engine revolutions, it detects occurrence of misfire.

When ECM (PCM) detects a misfire (misfire rate per 200 revolutions) which can cause overheat and damage to the three way catalytic converter, it makes the malfunction indicator lamp (MIL) flash as long as misfire occurs at that rate.

After that, however, when the misfire rate drops, MIL remains ON until it has been judged as normal 3 times under the same driving conditions.

Also, when ECM (PCM) detects a misfire (misfire rate per 1000 revolutions) which will not cause damage to three way catalytic converter but can cause exhaust emission to be deteriorated, it makes MIL light according to the 2 driving cycle detection logic.

DTC DETECTING CONDITION	POSSIBLE CAUSE
● Engine under other than high revolution condition ● Not on rough road ● Engine speed changing rate ● Manifold absolute pressure changing rate ● Throttle opening changing rate (Below specified value) ● Misfire rate per 200 or 1000 engine revolutions (how much and how often crankshaft revolution speed changes) is higher than specified value	● Engine overheating ● Vacuum leaks (air inhaling) from air intake system ● Ignition system malfunction (spark plug(s), high-tension cord(s), ignition coil assembly) ● Fuel pressure out of specification ● Fuel injector malfunction (clogged or leakage) ● Engine compression out of specification ● Valve lash (clearance) out of specification ● Manifold absolute pressure sensor malfunction ● Engine coolant temp. sensor malfunction ● PCV valve malfunction ● EVAP control system malfunction ● EGR system malfunction

DTC CONFIRMATION PROCEDURE

NOTE:

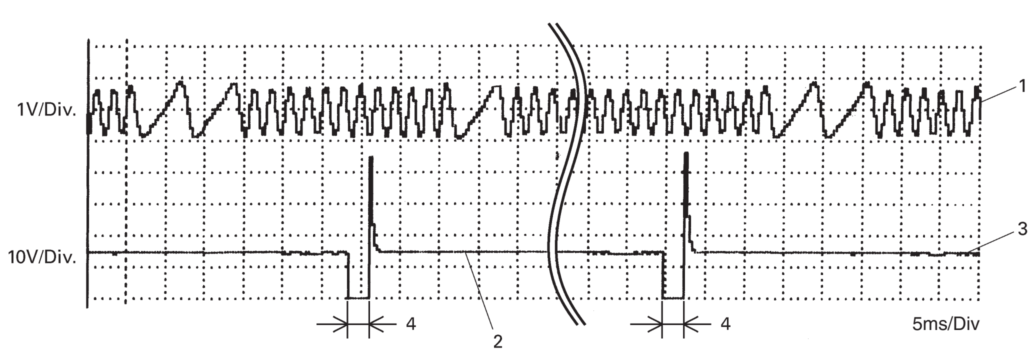
Among different types of random misfire, if misfire occurs at cylinders 1 and 4 or cylinders 3 and 2 simultaneously, it may not possible to reconfirm DTC by using the following DTC confirmation procedure. When diagnosing the trouble of DTC P0300 (Random misfire detected) of the engine which is apparently misfiring, even if DTC P0300 cannot be reconfirmed by using the following DTC confirmation procedure, proceed to the following Diag. Flow Table.

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester.**

1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON.
3) Check vehicle and environmental condition for:
   – Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)
   – Intake air temp.: between –10°C and 80°C (14°F and 176°F)
   – Engine coolant temp.: –10°C, 14°F or higher
4) Start engine and keep it at idle for 2 min. or more.
5) Check DTC in “DTC” mode and pending DTC in “ON BOARD TEST” or “PENDING DTC” mode.
6) If DTC is not detected at idle, consult usual driving based on information obtained in “Customer complaint analysis” and “Freeze frame data check”.

Reference

Display of fuel injection signal using oscilloscope



Waveforms at specified idle speed

1. CKP sensor signal
2. No.1 fuel injector signal
3. No.3 fuel injector signal
4. Fuel injection time

INSPECTION

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Is there DTC other than Fuel system (DTC P0171/P0172) and misfire (DTC P0300-P0304)?	Go to applicable DTC Diag. Flow Table.	Go to Step 3.
3	Check Ignition System. 1) Remove spark plugs and check them for; ● Air gap: 1.0 – 1.1 mm (0.040 – 0.043 in.) See Fig. 1. ● Carbon deposits ● Insulator damage ● Plug type If abnormality is found, adjust, clean or replace. 2) Disconnect all injector connectors. See Fig. 2. 3) Connect spark plugs to high tension cords and then ground spark plugs. 4) Crank engine and check that each spark plug sparks. Are above check results satisfactory?	Go to Step 4.	Check ignition system parts (Refer to Section 6F1).
4	Check Fuel Pressure (Refer to Section 6E2 for details). 1) Release fuel pressure from fuel feed line. 2) Install fuel pressure gauge. See Fig. 3. 3) Check fuel pressure. With fuel pump operating and engine at stop : 270 – 310 kPa, 2.7 – 3.1 kg/cm^2, 38.4 – 44.0 psi. At specified idle speed : 200 – 240 kPa, 2.0 – 2.4 kg/cm^2, 28.4 – 34.1 psi. Is measured value as specified?	Go to Step 5.	Go to Diag. Flow Table B-3 fuel pressure check.
5	Check Fuel Injectors and Circuit. 1) Using sound scope (1) or such, check operating sound of each injector (2) when engine is running. Cycle of operating sound should very according to engine speed. See Fig 4. If no sound or an unusual sound is heard, check injector circuit (wire or coupler) or injector. 2) Turn ignition switch OFF and disconnect a fuel injector connector. 3) Check for proper connection to fuel injector at each terminal. See Fig. 5. 4) If OK, then check injector resistance. Injector Resistance: 12 – 13 ohm at 20°C (68°F) 5) Carry out steps 1) and 3) on each injector. 6) Check each injector for injected fuel volume referring to Section 6E2. See Fig. 6. Injected Fuel Volume: 38 – 48 cc/15 sec (1.28/1.34 – 1.62/1.69 US/Imp. oz/15 sec) 7) Check each injector for fuel leakage after injector closed. Fuel Leakage: Less than 1 drop/min. Is check result in step 1) and 3) to 7) satisfactory?	Go to Step 6.	Check injector circuit or replace fuel injector(s).

STEP	ACTION	YES	NO
6	Check PCV valve for clogging (See Section 6E2). Is it in good condition?	Go to Step 7.	Replace PCV valve.
7	Check EVAP Canister Purge Valve for Closing. 1) Disconnect purge hose (1) from EVAP canister. 2) Place finger against the end of disconnected hose. 3) Check that vacuum is not felt there, when engine is cool and running at idle. See Fig. 7. Is vacuum felt?	Check EVAP control system (See Section 6E2).	Go to Step 8.
8	Check intake manifold pressure sensor for performance (See DTC P0105 Diag. Flow Table). Is it in good condition?	Go to Step 9.	Repair or replace.
9	Check engine coolant temp. sensor for performance (See Section 6E2). Is it in good condition?	Go to Step 10.	Replace engine coolant temp. sensor.
10	Check parts or system which can cause engine rough idle or poor performance. – Engine compression (See Section 6A1). – Valve lash (See Section 6A1). – Valve timing (Timing belt installation. See Section 6A1). Are they in good condition?	Check wire harness and connection of ECM (PCM) ground, ignition system and fuel injector for intermittent open and short.	Repair or replace.

Fig. 1 for Step 3

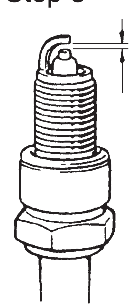
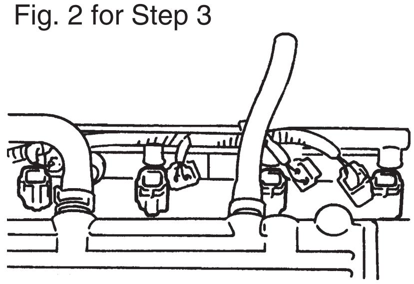
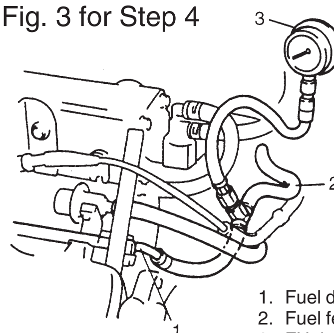


Fig. 2 for Step 3



Disconnect connectors when checking plugs for spark

Fig. 3 for Step 4



1. Fuel delivery pipe
2. Fuel feed hose
3. FUel pressure gauge & 3 way joint

Fig. 4 for Step 5

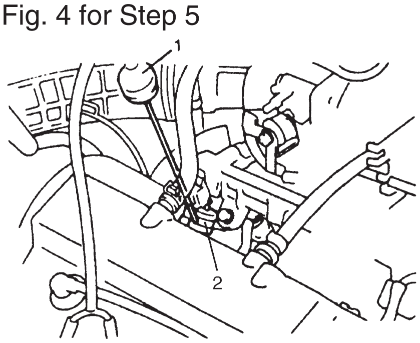


Fig. 5 for Step 4

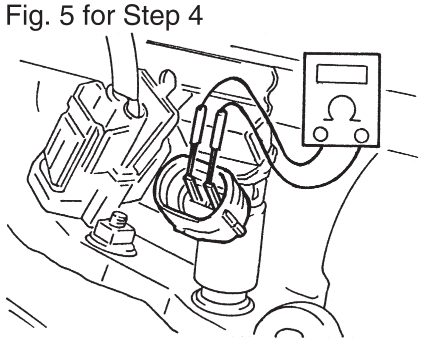


Fig. 6 for Step 5

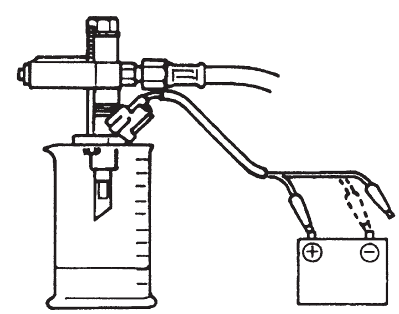
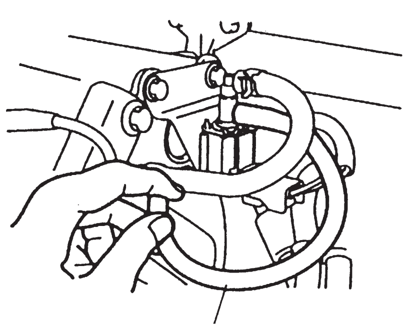
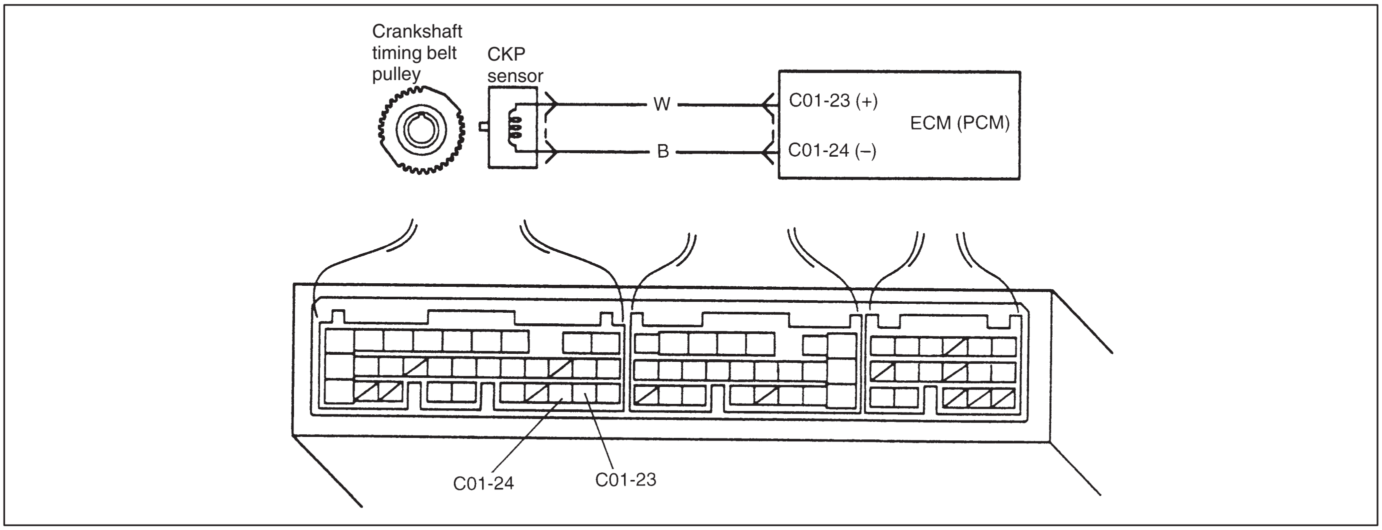


Fig. 7 for Step 7



DTC P0335 CRANKSHAFT POSITION (CKP) SENSOR CIRCUIT MALFUNCTION

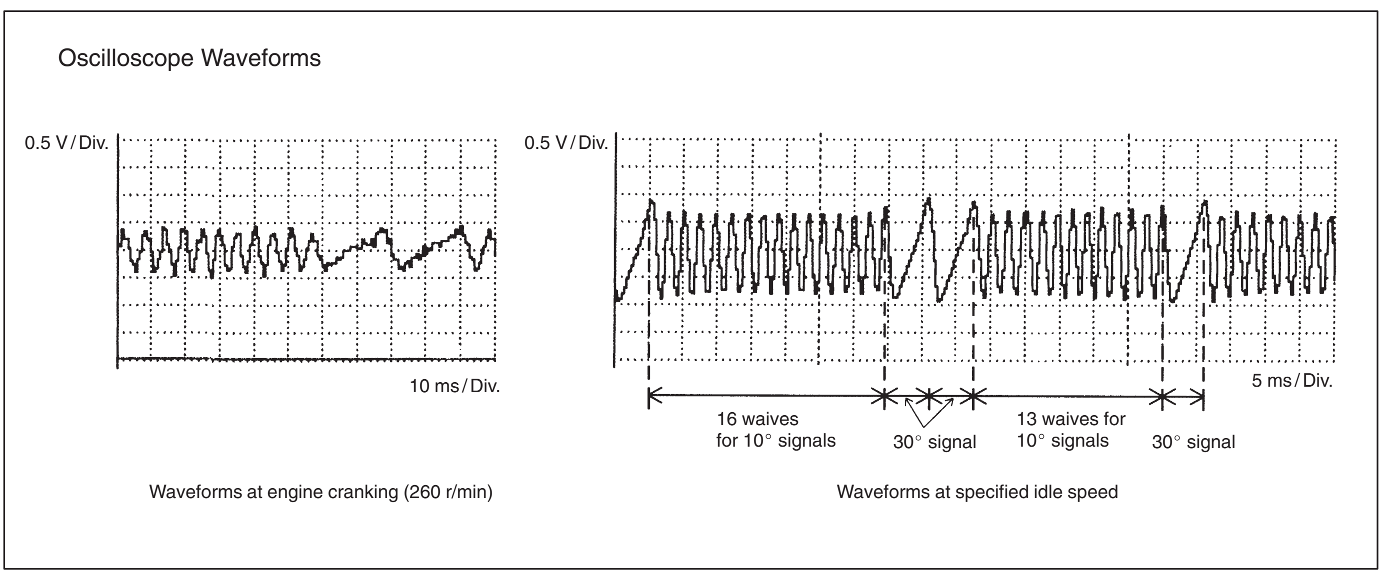
CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
• NO CKP sensor signal for 2 seconds at engine cranking.	• CKP sensor circuit open or short. • Crankshaft timing belt pulley teeth damaged. • CKP sensor malfunction, foreign material being attached or improper installation. • ECM (PCM) malfunction.

Reference

Connect oscilloscope between terminals C01-23 (+) and C01-24 (–) of ECM (PCM) connector connected to ECM (PCM) and check CKP sensor signal.



DTC CONFIRMATION PROCEDURE

1) Clear DTC and crank engine for 2 sec.
2) Select “DTC” mode on scan tool and check DTC.

INSPECTION

NOTE:

If starter circuit is open (i.e., start signal circuit is OK but starter fails to run), this DTC is stored in memory at starter switch ON, even though CKP sensor is in good condition.
When starter motor fails to run and this DTC appears, check starter circuit first.

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Is there DTC P1500 (Engine starter signal circuit)?	Go to DTC P1500 Diag. Flow Table.	Go to Step 3.
3	Check CKP Sensor for Resistance. 1) Disconnect CKP sensor connector with ignition switch OFF. 2) Then check for proper connection to CKP sensor at "W" and "B" wire terminals. 3) If OK, measure sensor resistance between terminals. See Fig. 1. CKP sensor resistance: 360 – 460 Ω at 20°C, 68°F 4) Measure resistance between each terminal and ground. Insulation resistance: 1 MΩ or more. Were measured resistance valves in step 3) and 4) as specified?	Go to Step 4.	Replace CKP sensor.
4	Check visually CKP sensor and pulley for the following. See Fig. 2. ● Damage ● No foreign material attached. ● Correct installation. Are they in good condition?	"W" or "B" wire open or shorted to ground, or poor connection at C01-23 or C01-24. If wire and connection are OK, intermittent trouble or faulty ECM (PCM). Recheck for intermittent referring to "Intermittent and Poor Connection" in Section 0A.	Clean, repair or replace.

Fig. 1 for Step 3

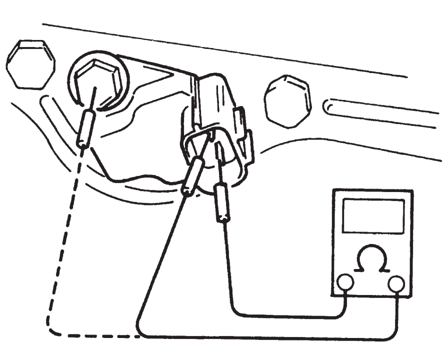
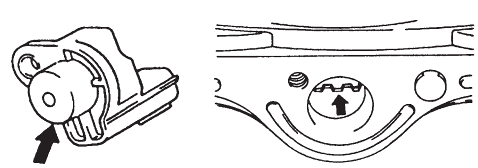
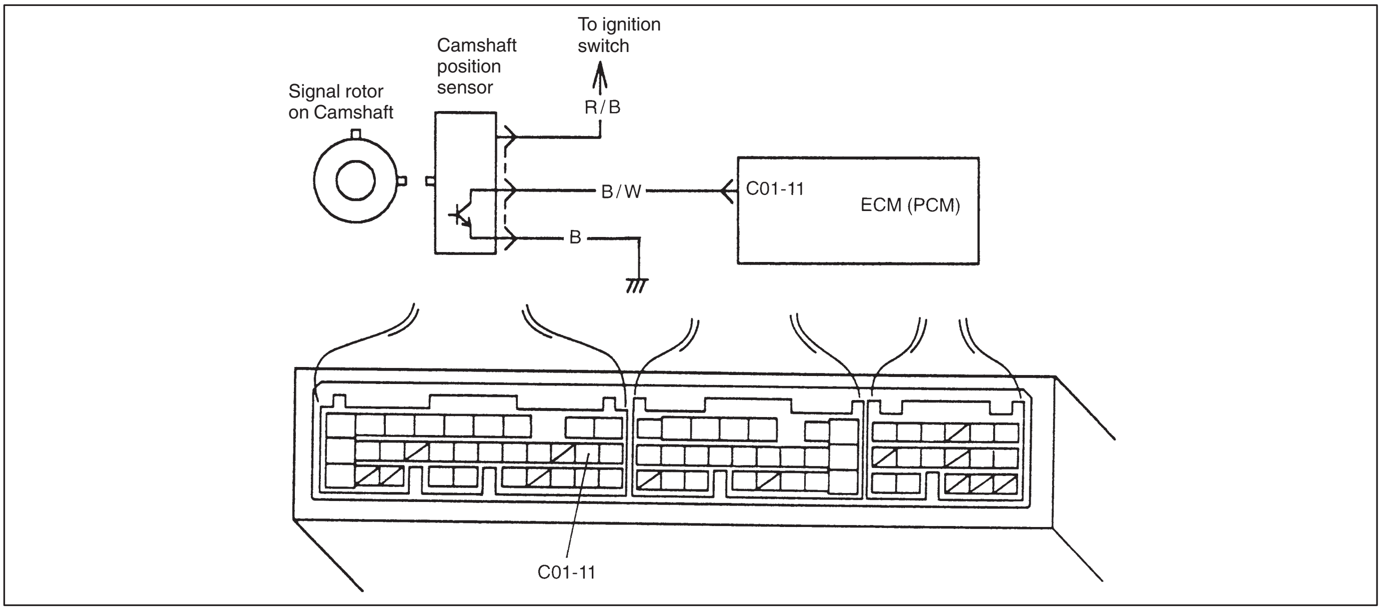


Fig. 2 for Step 4



DTC P0340 CAMSHAFT POSITION (CMP) SENSOR CIRCUIT MALFUNCTION

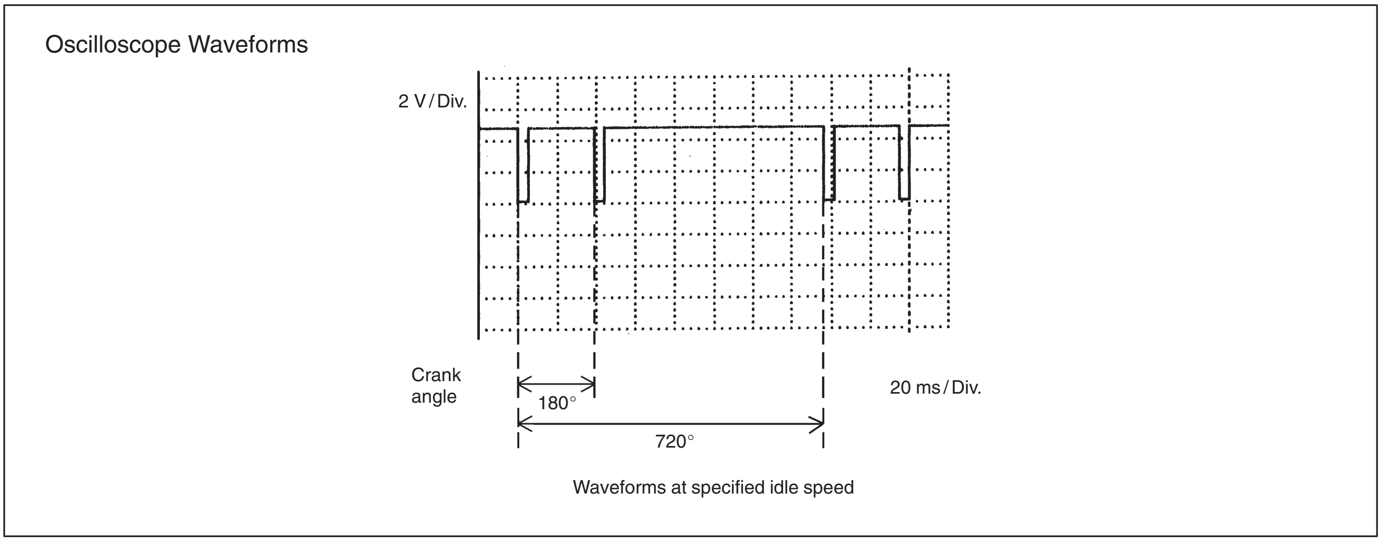
CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
● No CMP sensor signal during engine running (CKP sensor signal is inputted).	● CMP sensor circuit open or short. ● Signal rotor teeth damaged. ● CMP sensor malfunction, foreign material being attached or improper installation. ● ECM (PCM) malfunction.

Reference

Connect oscilloscope between terminals C01-11 of ECM (PCM) connector connected to ECM (PCM) and body ground and check CKP sensor signal.



DTC CONFIRMATION PROCEDURE

1) Clear DTC.
2) Start engine and keep it at idle for 1 min.
3) Select “DTC” mode on scan tool and check DTC.

INSPECTION

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Check CMP Sensor and connector for proper installation. Is CMP sensor installed properly and connector connected securely?	Go to Step 3.	Correct.
3	Check Wire Harness and Connection. 1) Disconnect connector from CMP sensor. 2) Check for proper connection to CMP sensor at each terminal. 3) If OK, turn ignition switch ON and check for voltage at each terminal of sensor connection disconnected. See Fig. 1. Terminal "B+" : 10 – 14 V Terminal "Vout" : 4 – 5 V Terminal "GND" : 0 V Is check result satisfactory?	Go to Step 5.	Go to Step 4.
4	Was terminal "Vout" voltage out of specification in Step 3 check?	"B/W" wire open, short or poor connection. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.	"B/W" or "B" wire open, short or poor connection.
5	Check Ground Circuit for Open. 1) Turn ignition switch OFF. 2) Check for continuity between "GND" terminal of CMP sensor connector and engine ground. Is continuity indicated?	Go to Step 6.	"B" wire open or poor ground connection.
6	Check CMP Sensor for Operation. 1) Remove CMP sensor from sensor case. 2) Remove metal particles on end face of CMP sensor, if any. 3) Connect each connector to ECM (PCM) and CMP sensor. 4) Turn ignition switch ON. 5) Check for voltage at terminal C01-11 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. See Fig. 2 and 3. Does voltage vary from low (0 – 1 V) to high (4 – 5 V) or from high to low?	Go to Step 7.	Replace CMP sensor.

STEP	ACTION	YES	NO
7	Check signal rotor for the following, using mirror. See Fig. 4. ● 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.	Clean rotor teeth or replace CMP sensor.

Fig. 1 for Step 3

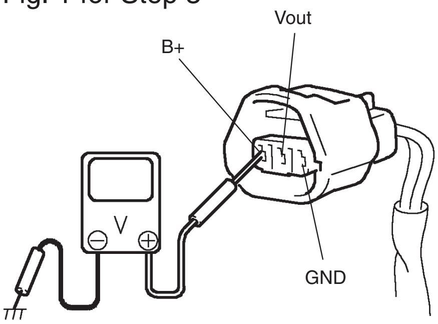


Fig. 2 for Step 4

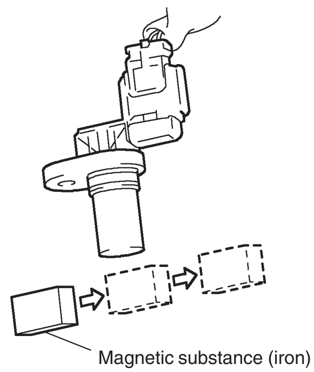


Fig. 3 for Step 6

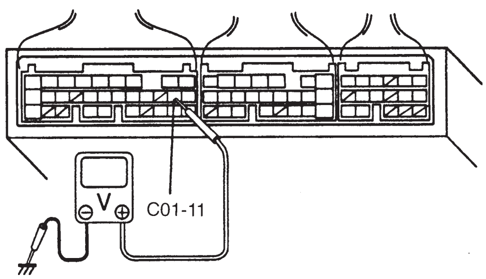
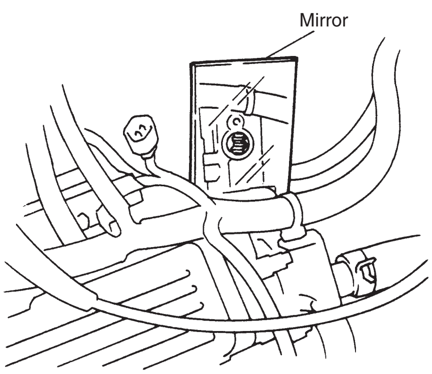
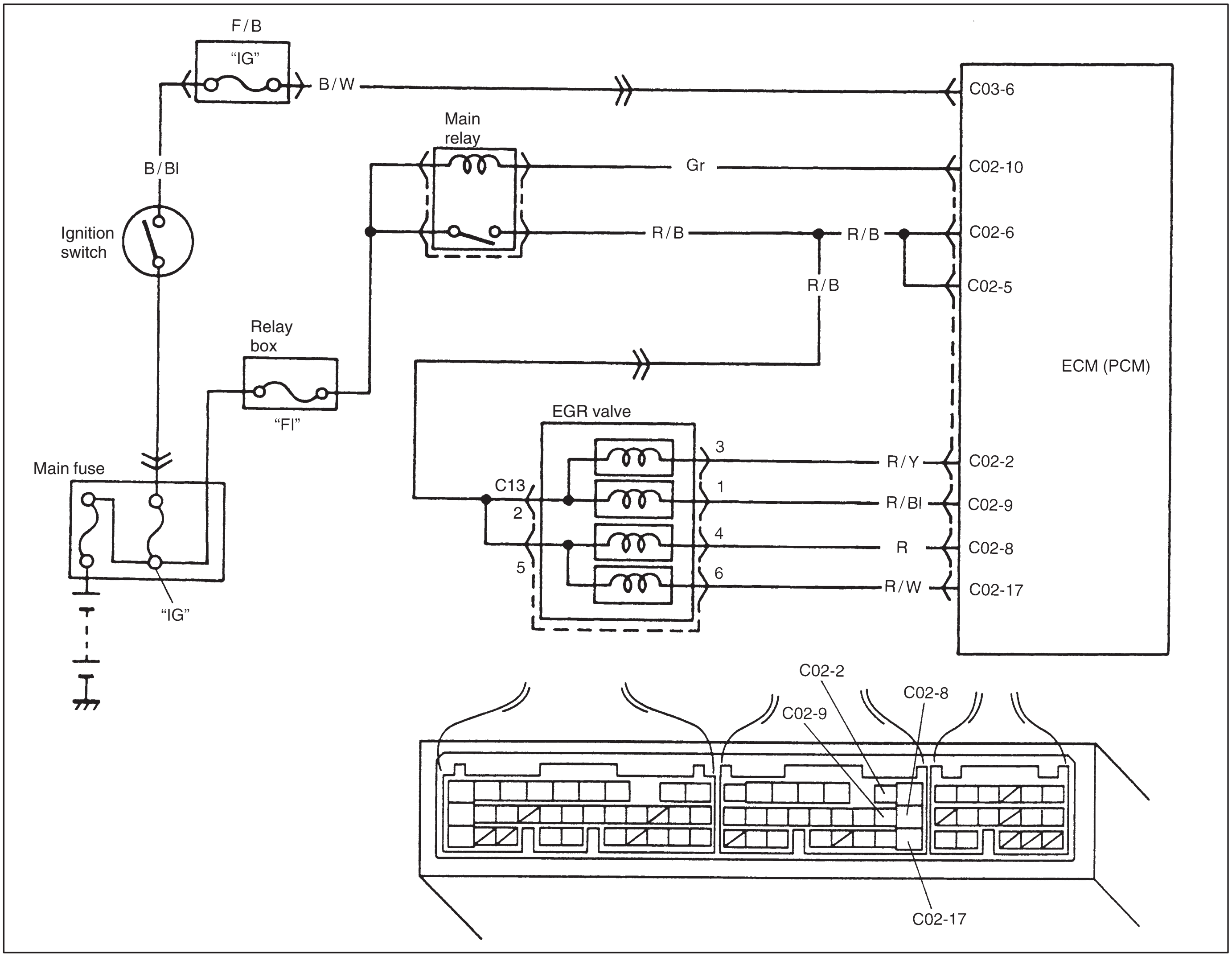


Fig. 4 for Step 7



DTC P0400 EXHAUST GAS RECIRCULATION FLOW MALFUNCTION

CIRCUIT DESCRIPTION

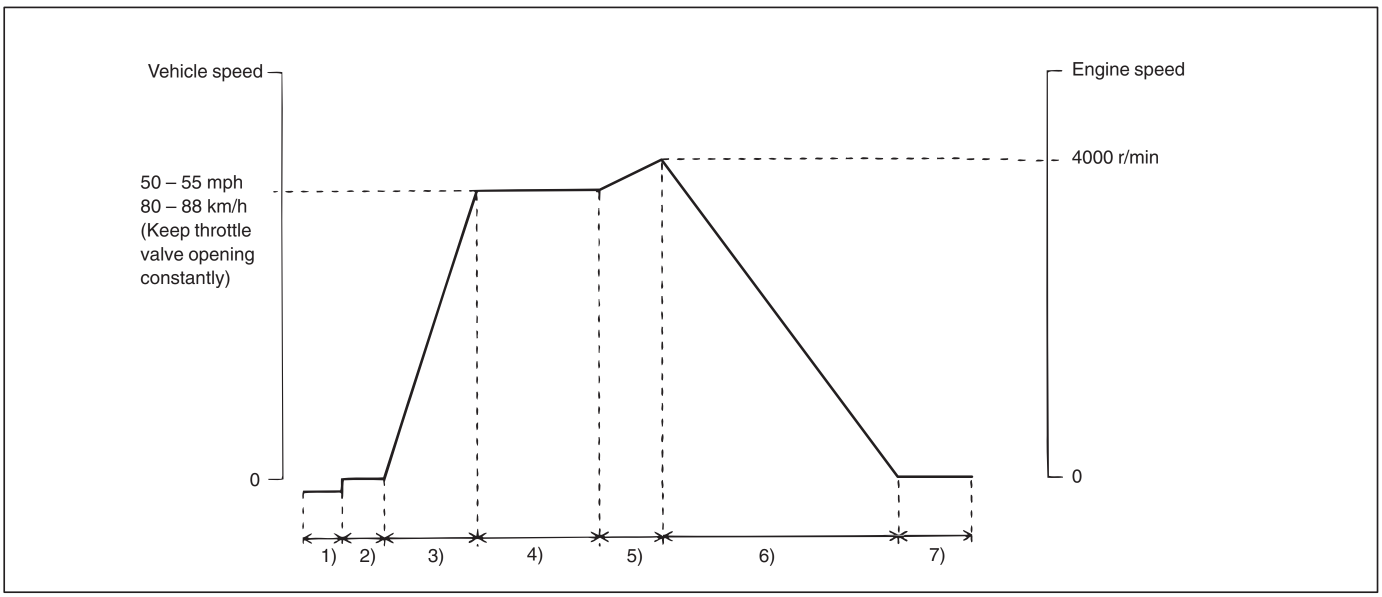


DTC DETECTING CONDITION	POSSIBLE CAUSE
● While running at specified vehicle speed after engine warm-up ● During deceleration (engine speed high with closed throttle position ON) in which fuel cut is involved, difference in intake manifold absolute pressure between when EGR valve is opened at specified value and when it is closed is larger or smaller than specified value. ✻ 2 driving cycle detection logic, monitoring once/1 driving	● EGR valve or its circuit ● EGR passage ● ECM (PCM)

DTC CONFIRMATION PROCEDURE

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester, on a level road.**

1) Turn ignition switch OFF.
   Clear DTC with ignition switch ON, check vehicle and environmental condition for:
   – Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)
   – Intake air temp.: between –10°C and 80°C (14°F and 158°F)
2) Start engine and warm it up to normal operating temperature (70 – 110°C, 158 – 230°F) and run it at idle for 5 min.
3) Increase vehicle speed to 50 – 55 mph, 80 – 88 km/h in 5th gear or in “D” range.
4) Hold throttle valve at that opening position for 2 min. or longer.
5) Increase engine speed to 4000 r/min. in 3rd gear or in “2” range.
6) Release accelerator pedal and with engine brake applied, keep vehicle coasting (fuel cut condition) till engine speed reaches 1500 r/min.
7) Stop vehicle (don’t turn ignition switch OFF) and confirm test results according to following “Test Result Confirmation Flow Table.”



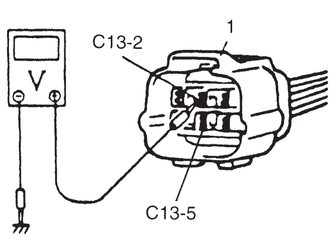
Test Result Confirmation Flow Table

STEP	ACTION	YES	NO
1	Check DTC in “DTC” mode and pending DTC in “ON BOARD TEST”. Is DTC or pending DTC displayed?	Proceed to applicable DTC flow table.	Go to Step 2.
2	Set scan tool to “READINESS TESTS” mode and check if testing has been completed. Is test completed?	No DTC is detected. (Confirmation test is completed)	Repeat DTC confirmation procedure.

INSPECTION

STEP	ACTION	YES	NO
1	Was ENGINE DIAG. FLOW TABLE performed?	Go to Step 2.	Go to ENGINE DIAG. FLOW TABLE.
2	Do you have SUZUKI scan tool?	Go to Step 3.	Go to Step 5.
3	EGR Valve Operation Check 1) With ignition switch OFF, install SUZUKI scan tool. 2) Check EGR system referring to section 6E2. Is it in good condition?	Go to Step 4.	Go to Step 5.
4	MAP Sensor Check 1) Check MAP sensor for performance referring to “MAP Sensor Check” in DTC P0105 Diag. Flow Table. 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.
5	EGR Valve Power Supply Circuit Check 1) With ignition switch OFF, disconnect EGR valve coupler. 2) With ignition switch ON, check voltage between C13-2 and ground, C13-5 and ground. See Fig. 1. Is each voltage 10 – 14 V?	Go to Step 6.	“R/B” wire.
6	EGR Valve Stepping Motor Coil Circuit Check 1) With ignition switch OFF, connect EGR valve coupler and disconnect ECM (PCM) couplers. 2) Check resistance between C02-6 and C02-2, C02-8, C02-9, C02-17. Is each resistance 20 – 24 Ω at 20°C, 68°F?	Go to Step 7.	Faulty “R/Y”, “R/Bl”, “R”, “R/W” wire or EGR valve.
7	MAP Sensor Check 1) Check MAP sensor for performance referring to “MAP Sensor Check” in DTC P0105 Diag. Flow Table. Is check result satisfactory?	EGR passage clogged or EGR valve malfunction. If all above are OK, intermittent trouble or faulty ECM. Check for intermittent referring to “Intermittent and Poor Connection” in section 0A.	Repair or replace.

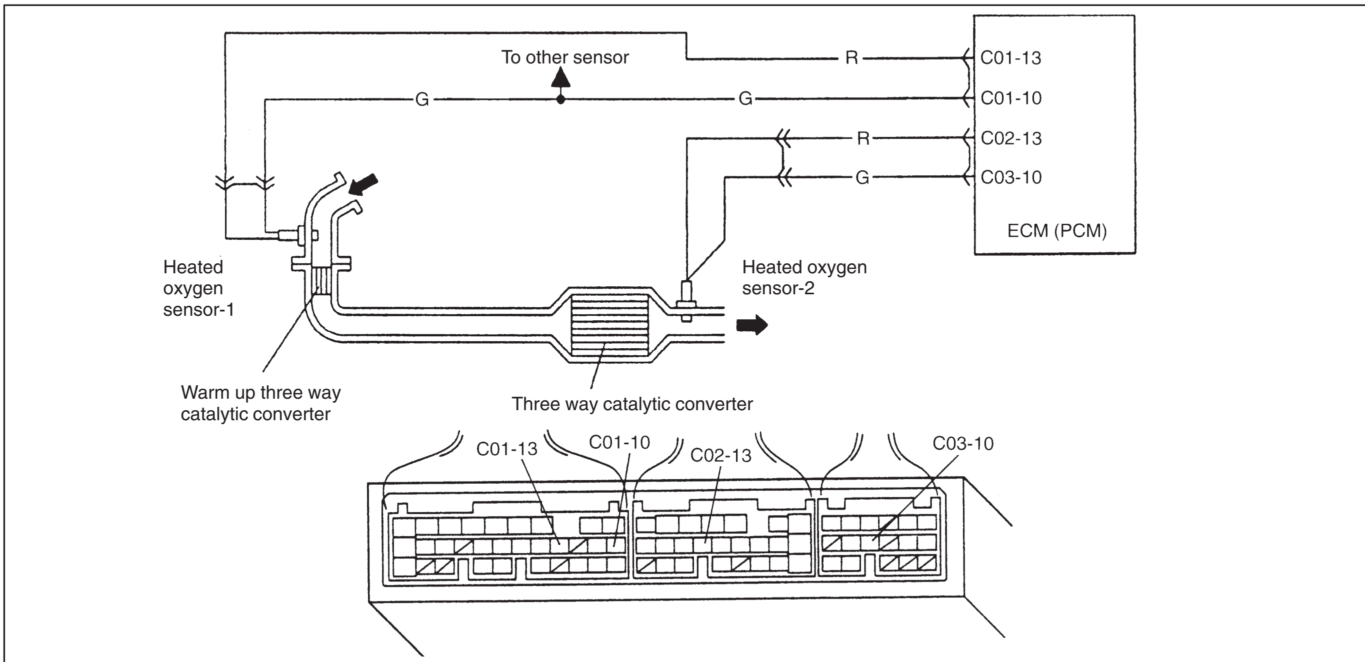
Fig. 1 for step 5



1. EGR valve coupler

DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD

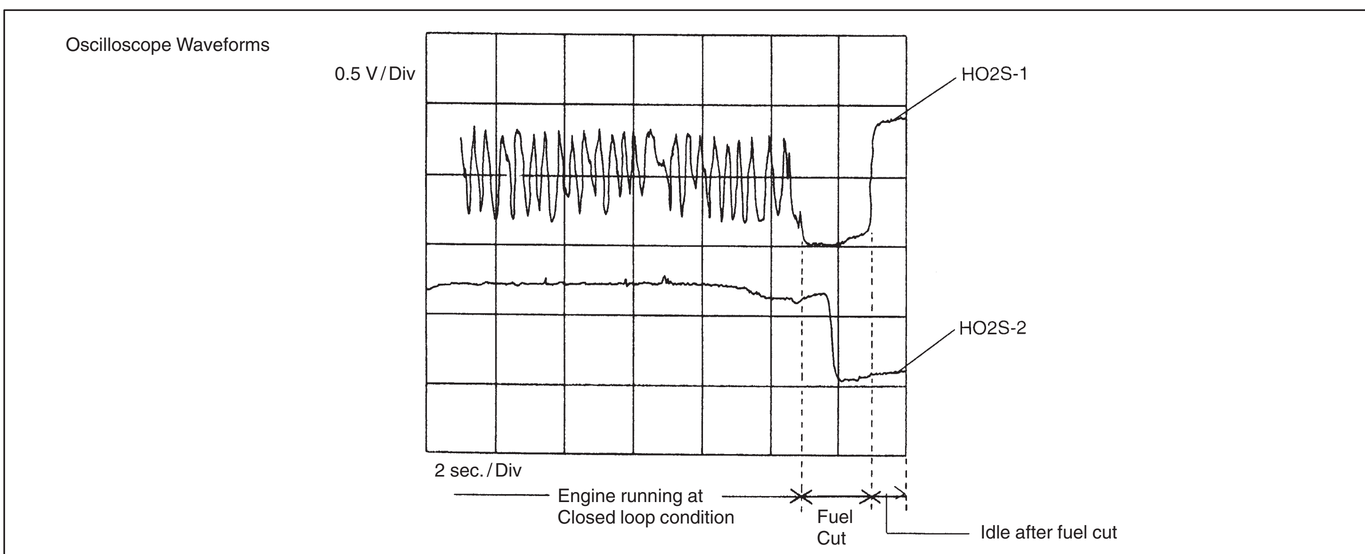
CIRCUIT DESCRIPTION



ECM (PCM) monitors oxygen concentration in the exhaust gas which has passed the three way catalytic converter by HO2S-2.

When the catalyst is functioning properly, the variation cycle of HO2S-2 output voltage (oxygen concentration) is slower than that of HO2S-1 output voltage because of the amount of oxygen in the exhaust gas which has been stored in the catalyst.

Reference

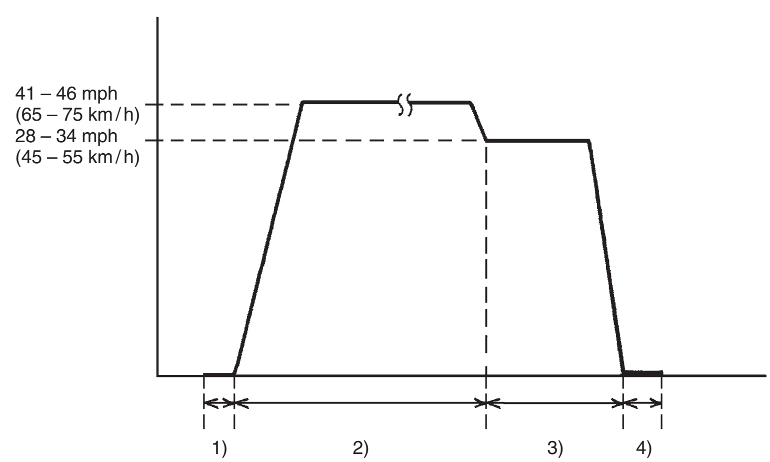


DTC DETECTING CONDITION	POSSIBLE CAUSE
● While vehicle running at constant speed under other than high load. ● Time from rich or lean switching command is output till HO2S-2 output voltage crosses 0.45 V is less than specified value. ✳ 2 driving cycle detection logic, monitoring once/1 driving.	● Exhaust gas leak ● Three way catalytic converter malfunction ● Fuel system malfunction ● HO2S-2 malfunction ● HO2S-1 malfunction

DTC CONFIRMATION PROCEDURE

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and tester, on a level road.**

1) Turn ignition switch OFF.
   Clear DTC with ignition switch ON, check vehicle and environmental condition for:
   – Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)
   – Intake air temp.: between –10°C and 80°C (14°F and 158°F)
   – Engine coolant temp.: 70°C, 230°F or higher
2) Start engine and drive vehicle at 41 – 46 mph, 65 – 75 km/h for 8 min. or longer.
   While this driving, if “Catalyst Monitoring TEST COMPLETED” is displayed in “READINESS TESTS” mode and DTC is not displayed in “DTC” mode, confirmation test is completed.
   If “TEST NOT COMPLTD” is still being displayed, continue test driving.
3) Decrease vehicle speed at 28 – 34 mph, 45 – 55 km/h, and hold throttle valve at that opening position for 2 min. and confirm that short term fuel trim vary within –20% –+20% range.
4) Stop vehicle (do not turn ignition switch OFF) and confirm test results according to following “Test Result Confirmation Flow Table”.



Test Result Confirmation Flow Table

STEP	ACTION	YES	NO
1	Check DTC in “DTC” mode and pending DTC in “ON BOARD TEST” or “PENDING DTC” mode. Is DTC or pending DTC displayed?	Proceed to applicable DTC Diag. Flow Table.	Go to Step 2.
2	Set scan tool to “READINESS TESTS” mode and check if testing has been completed. Is test completed?	No DTC is detected (confirmation test is completed).	Repeat DTC confirmation procedure.

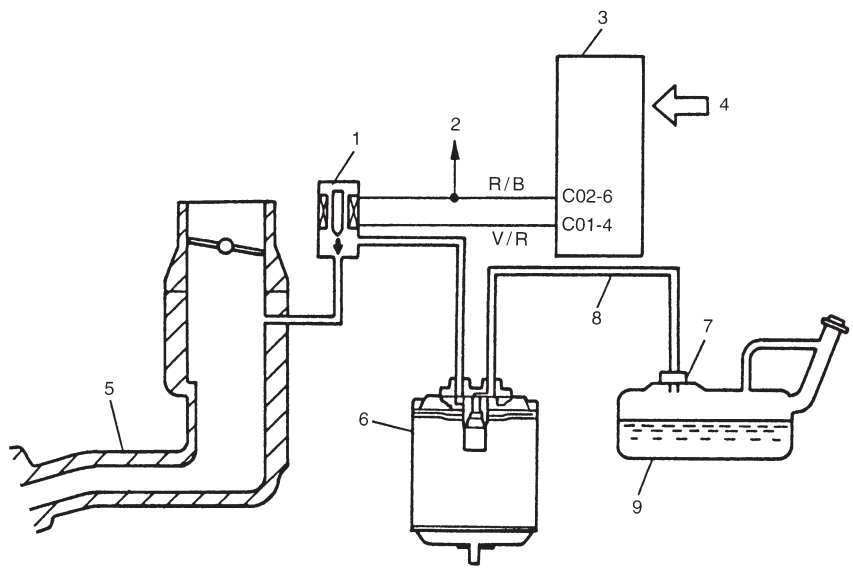
INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Check Short Term Fuel Trim. Did short term fuel trim vary within –20% –+20% range in step 3) of DTC confirmation test?	Go to Step 3.	Check fuel system. Go to DTC P0171/P0172 Diag. Flow Table.
3	Check HO2S-2 for Output Voltage. Perform steps 1) through 9) of DTC confirmation procedure for DTC P0136 (HO2S-2 malfunction) and check output voltage of HO2S-2 then. Is over 0.6 V and below 0.3 V indicated?	Replace three way catalytic converter.	Check “R” and “G” wires for open and short, and connections for poor connection. If wires and connections are OK, replace HO2S-2.

DTC P0443 EVAP PURGE CONTROL VALVE CIRCUIT MALFUNCTION

CIRCUIT DESCRIPTION

1. EVAP canister purge valve
2. To main relay
3. ECM (PCM)
4. Sensed information
5. Intake manifold
6. EVAP canister
7. Tank pressure control valve
8. Fuel vapor line
9. Fuel tank



DTC DETECTING CONDITION	POSSIBLE CAUSE
Canister Purge control valve circuit is opened or shorted.	● "V/R" circuit open or short ● "R/B" circuit open ● Canister purge valve malfunction

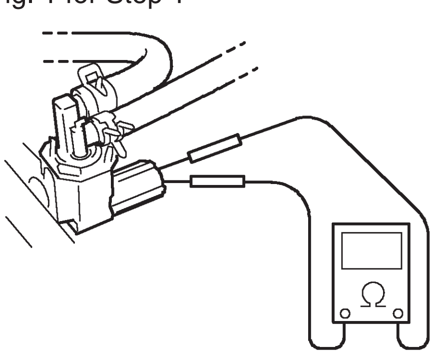
DTC CONFIRMATION PROCEDURE

1) Clear DTC with ignition switch ON.
2) Select "DTC" mode on scan tool and check DTC.

INSPECTION

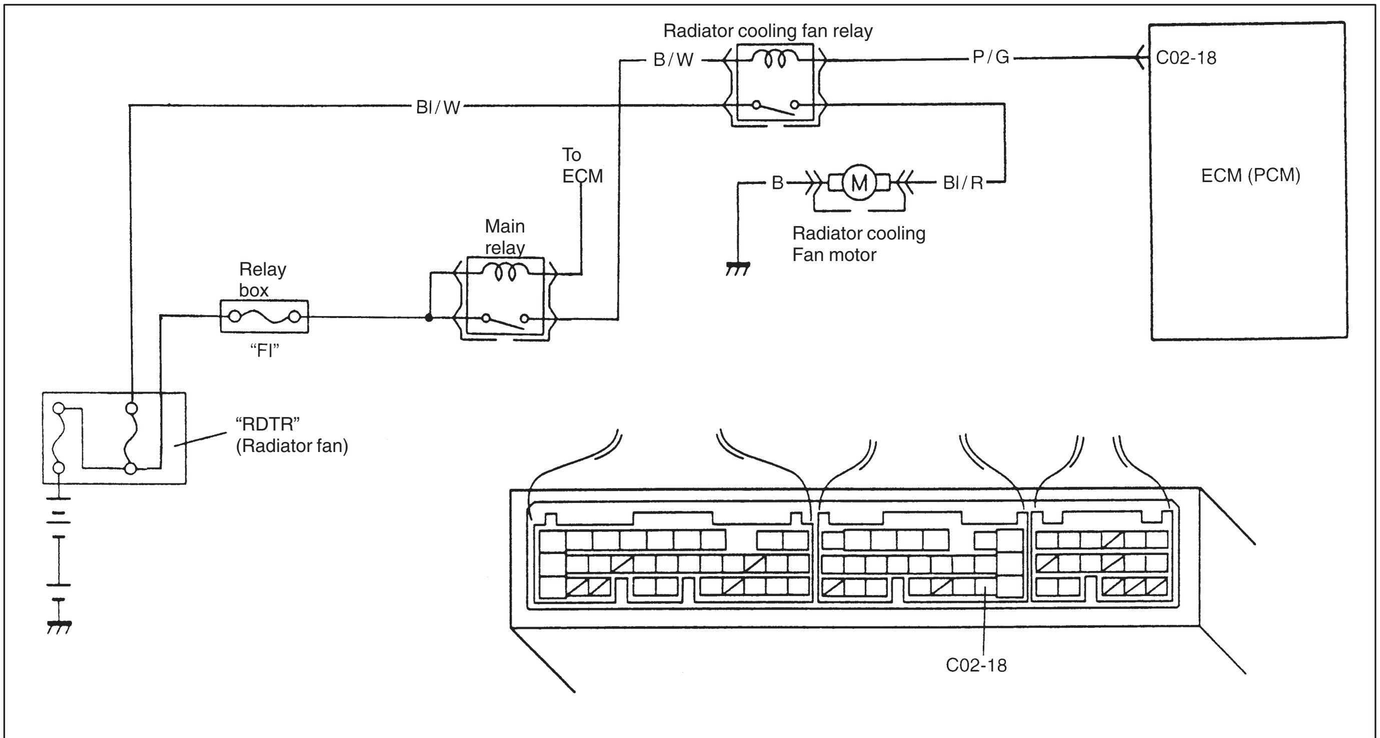
STEP	ACTION	YES	NO
1	Check EVAP canister purge valve operation 1) With ignition switch OFF, disconnect coupler from canister purge valve. 2) Check resistance of EVAP canister purge valve. Resistance between two terminals : 30 – 34 Ω at 20°C (68°F) Resistance between terminal and body : 1M Ω or higher Is it as specified?	"V/R" circuit open or short.	Replace EVAP canister purge valve.

Fig. 1 for Step 1



DTC P0480 RADIATOR COOLING FAN CONTROL SYSTEM MALFUNCTION

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
● Low voltage at terminal C02-18 when engine coolant temp. is 92°C, 197°F below. ✳ 2 driving cycle detection logic, continuous monitoring.	● "B/W" or "P/G" circuit open or short ● Radiator cooling fan relay malfunction ● ECM (PCM) malfunction

DTC CONFIRMATION PROCEDURE

1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON.
3) Warm up engine until radiator cooling fan starts to operate.
4) Check pending DTC in "ON BOARD TEST" or "PENDING DTC" mode and DTC in "DTC" mode.

INSPECTION

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Check Radiator Cooling Fan Relay and Its Circuit. 1) Turn ignition switch ON. 2) Check for voltage at terminal C02-18 of ECM (PCM) connector connected, under following condition. See Fig. 1. When engine coolant temp. is lower than 92°C, 197°F and A/C switch turns OFF: 10 – 14 V Is voltage 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	Check Radiator Cooling Fan Control Relay. 1) Turn ignition switch OFF and remove radiator cooling fan relay. 2) Check for proper connection to the relay at "B/W" and "P/G" wire terminals. 3) If OK, then measure resistance between terminals a and b. See Fig. 2 and 3. Is it 100 – 150 Ω?	"B/W" or "P/G" circuit open or short. If wires and connections are OK, substitute a known-good ECM (PCM) and recheck.	Replace radiator cooling fan relay.

Fig. 1 for Step 2

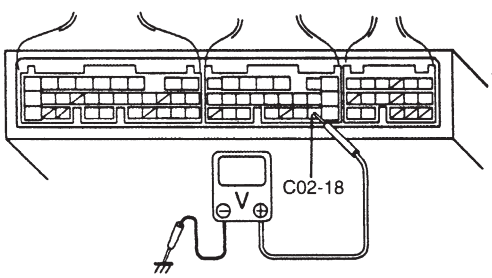


Fig. 2 for Step 3

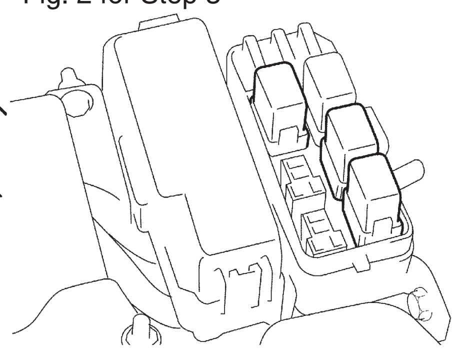
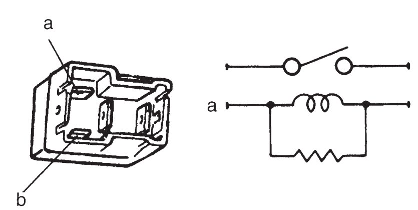
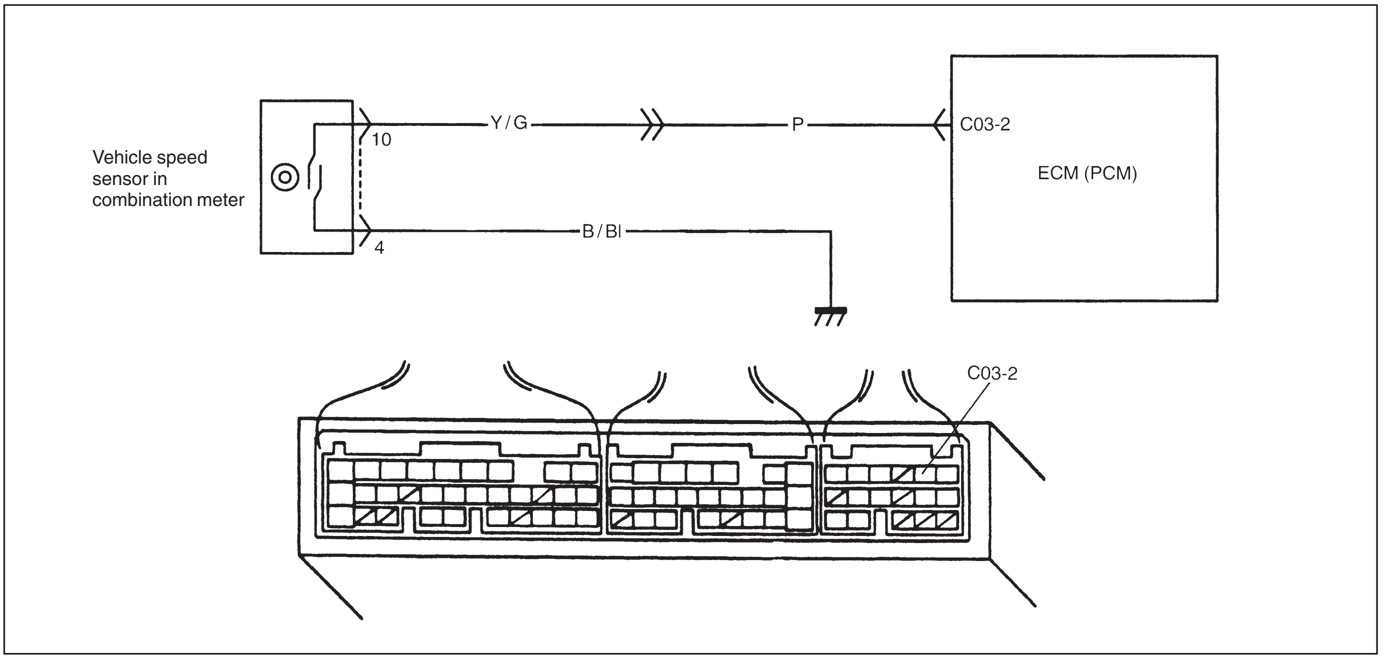


Fig. 3 for Step 3



DTC P0500 VEHICLE SPEED SENSOR (VSS) MALFUNCTION FOR M/T VEHICLE

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
● While fuel is kept cut at lower than 4000 r/min for longer than 4 sec. ● VSS signal not inputted. ✻ 2 driving cycle detection logic, continuous monitoring.	● Speedometer cable broken ● “P”, “Y/G” or “B/Bl” circuit open or short ● VSS malfunction ● ECM (PCM) malfunction

DTC CONFIRMATION PROCEDURE

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester.**

1) Clear DTC and warm up engine to normal operating temperature.
2) Increase vehicle speed to 50 mph, 80 km/h in 3rd gear.
3) Release accelerator pedal and with engine brake applied, keep vehicle coasting (fuel cut condition) for 4 sec. or more.
4) Check pending DTC and DTC.

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Does speedometer indicate vehicle speed?	Go to Step 3.	Speedometer cable disconnected or broken.
3	Check VSS and Its Circuit. 1) Disconnect ECM connector with ignition switch OFF. 2) Check for proper connection to ECM (PCM) at terminal C03-2. 3) If OK, then connect ohmmeter between terminal C03-2 of ECM (PCM) connector and body ground. 4) Hoist front end of vehicle and lock front right tire. 5) Turn front left tire slowly. Does ohmmeter indicator deflect between 0 and infinity a few times while tire is turned one revolution? See Fig. 1.	Intermittent trouble or faulty ECM. Check for intermittent referring to “Intermittent and Poor Connection” in section 0A.	Go to Step 4.
4	Check VSS. 1) Remove combination meter. 2) Connect ohmmeter between “VSS” terminal and “GND” terminal of combination meter and turn cable joint of speedometer with a screwdriver. Ohmmeter indicator should move back and forth between 0 and infinity 4 times while cable joint is turned one full revolution. See Fig. 2. Is it in good condition?	“P”, “Y/G” or “B/Bl” wire open or short, or poor connection.	Replace VSS.

Fig. 1 for Step 3

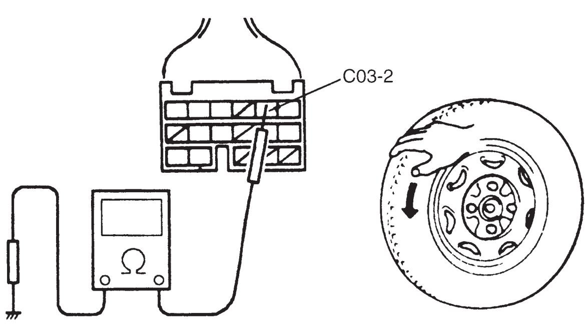
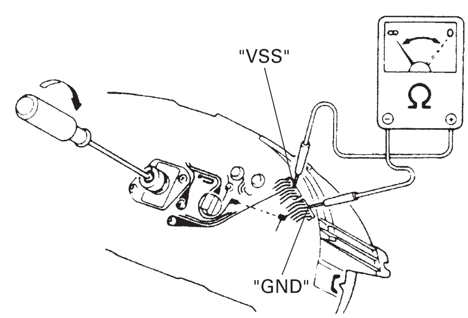
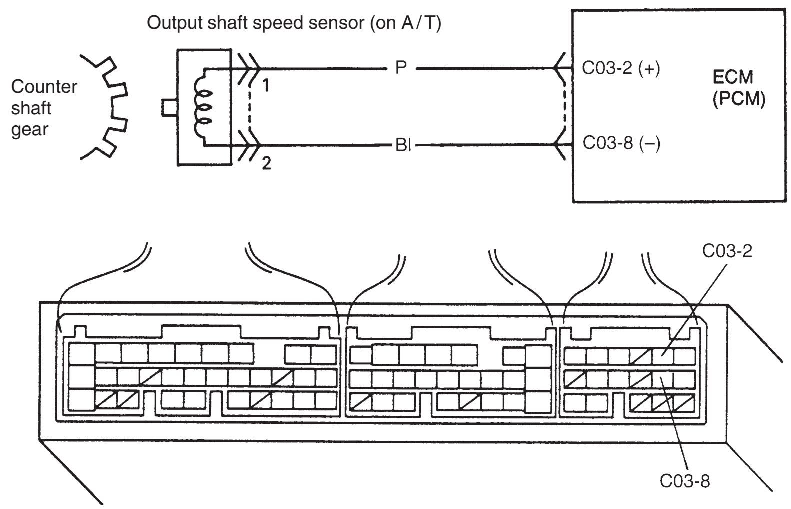


Fig. 2 for Step 4



DTC P0500 VEHICLE SPEED SENSOR (VSS) MALFUNCTION FOR A/T VEHICLE

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
• While fuel is kept cut at lower than 4000 r/min for longer than 4 sec. • VSS signal not inputted. ✻ 2 driving cycle detection logic, continuous monitoring.	• "P" or "Bl" circuit open or short. • Vehicle speed sensor malfunction. • Foreign material being attached or sensor installed improperly. • Gear damaged.

DTC CONFIRMATION PROCEDURE

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester, on a level road.**

1) Turn ignition switch OFF and then ON.
2) Clear DTC and warm up engine to normal operating temperature.
3) Increase vehicle speed to 50 mph, 80 km/h in "2" range.
4) Release accelerator pedal and with engine brake applied, keep vehicle coasting (fuel cut condition) for 4 sec. or more.
5) Stop vehicle and check DTC and pending DTC.

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Check VSS for Resistance. 1) Disconnect VSS connection with ignition switch OFF. 2) Check for proper connection to VSS at “P” and “Bl” wire terminals. 3) If OK, then check resistance of VSS. See Fig. 1. Resistance between terminals : 100 – 300 Ω Resistance between terminal and transmission : 1 MΩ or more Are check result satisfactory?	Go to Step 3.	Replace VSS.
3	Check Visually VSS and Counter Shaft Gear for the Following. See Fig. 2. ● No damage ● No foreign material attached ● Correct installation Are they in good condition?	“P” or “Bl” wire open or shorted to ground or poor C03-2 or C03-8 connection. If wires and connections are OK, intermittent trouble or faulty ECM (PCM). Check for intermittent referring to “Intermittent and Poor Connection” in section 0A.	Clean, repair or replace.

Fig. 1 for Step 2

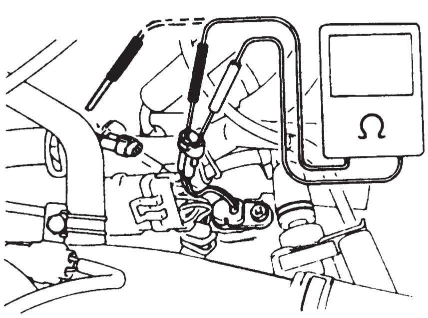
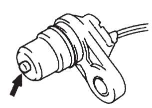
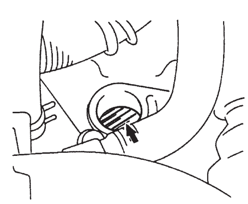


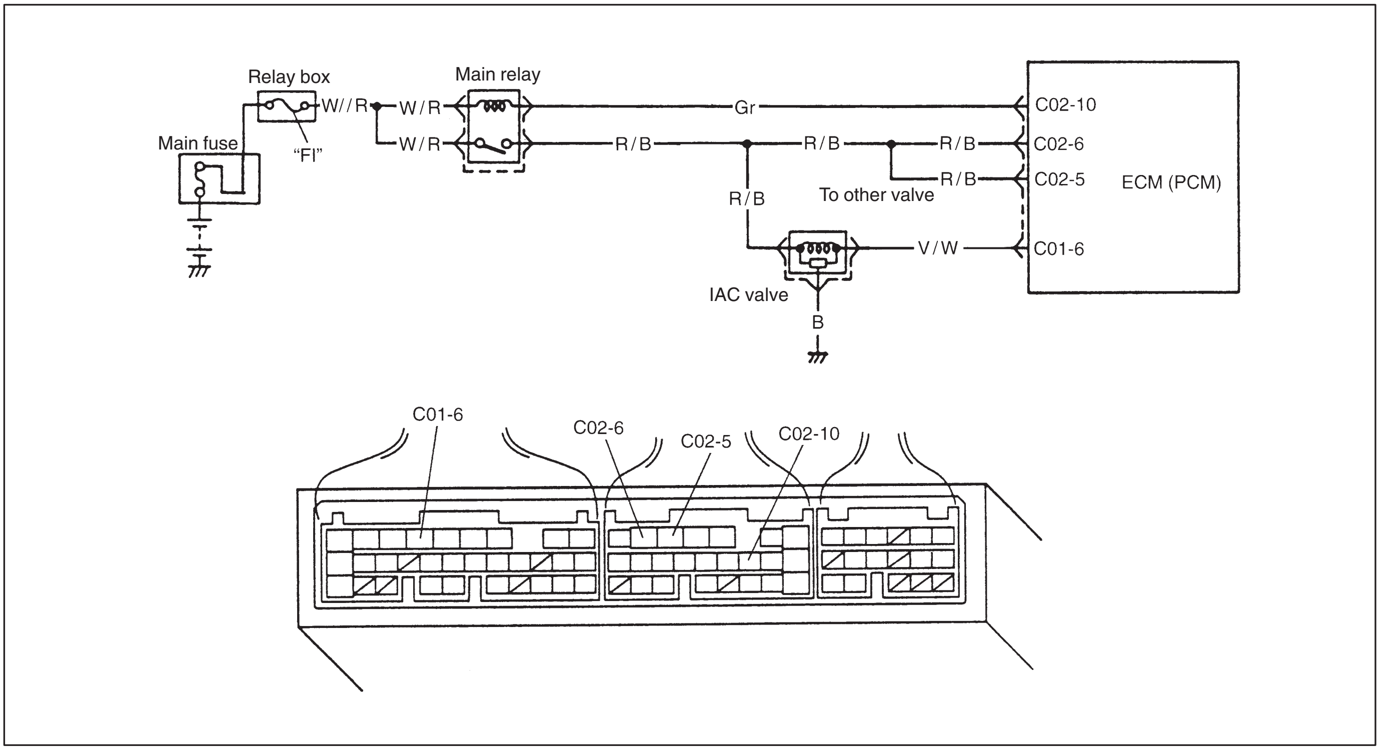
Fig. 2 for Step 3





DTC P0505 IDLE CONTROL SYSTEM MALFUNCTION

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
● No closed signal to IAC valve is detected after engine start. ✻ 2 driving cycle detection logic, continuous monitoring.	● "R/B", "V/W" or "B" circuit open or short ● IAC valve malfunction ● ECM (PCM) malfunction

DTC CONFIRMATION PROCEDURE

1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON.
3) Start engine and run it at idle for 1 min.
4) Check DTC and pending DTC.

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Check Idle Air Control System. When using SUZUKI scan too: 1) Connect SUZUKI scan tool to DLC with ignition switch OFF, set parking brake and block drive wheels. 2) Warm up engine to normal operating temperature. 3) Clear DTC and select “MISC TEST” mode on SUZUKI scan tool. See Fig. 1. Is it possible to control (increase and reduce) engine idle speed by using SUZUKI scan tool? When not using SUZUKI scan tool: 1) Remove IAC valve from throttle boy referring to “IAC Valve Removal” in Section 6E2. 2) Check IAC valve for operation referring to “IAC Valve Inspection” in Section 6E2. See Fig. 2. 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 Wire Harness for Open and Short. 1) Turn ignition switch OFF. 2) Disconnect IAC valve connector. 3) Check for proper connection to IAC valve at each terminals. 4) If OK, disconnect ECM (PCM) connector. 5) Check for proper connection to ECM (PCM) at C01-6 terminal. 6) If OK, check “R/B”, “V/W” and “B” circuit for open and short. Are they in good condition?	Replace IAC valve and recheck.	Repair or replace.

Fig. 1 for Step 1

When using SUZUKI scan tool:

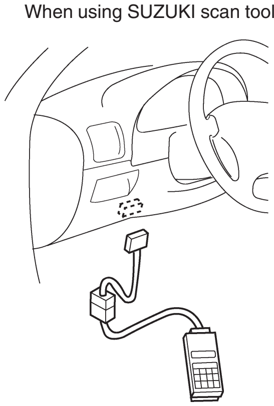
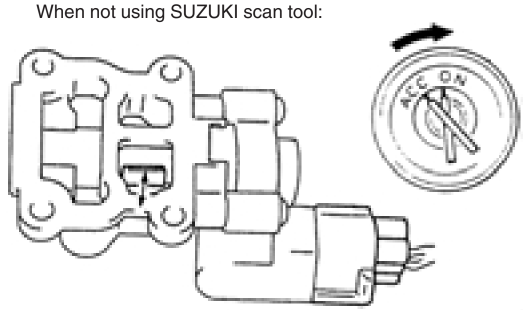


Fig. 2 for Step 2

When not using SUZUKI scan tool:



DTC P0601 INTERNAL CONTROL MODULE MEMORY CHECK SUM ERROR

DTC DETECTING CONDITION	POSSIBLE CAUSE
DTC P0601: Data write error (or check sum error) when written into ECM (PCM) ✳ 1 driving cycle detection logic, continuous monitoring.	ECM (PCM)

DTC CONFIRMATION PROCEDURE

1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON and then turn ignition switch OFF.
3) Start engine and run it at idle if possible.
4) Check pending DTC in “ON BOARD TEST” or “PENDING DTC” mode and DTC in “DTC” mode.

INSPECTION

Substitute a known-good ECM (PCM) and recheck.

DTC P1450 BAROMETRIC PRESSURE SENSOR LOW/HIGH INPUT

DTC P1451 BAROMETRIC PRESSURE SENSOR PERFORMANCE PROBLEM

WIRING DIAGRAM/CIRCUIT DESCRIPTION

Barometric pressure sensor is installed in ECM (PCM).

DTC DETECTING CONDITION	POSSIBLE CAUSE
DTC P1450: ● Barometric pressure: 136 kPa 1025 mmHg or higher, or 33 kPa 250 mmHg or lower	● ECM (PCM) (barometric pressure sensor) malfunction
DTC P1451: ● Vehicle stopped ● Engine cranking ● Difference between barometric pressure and intake manifold absolute pressure is 26 kPa, 200 mmHg or more ✳ 2 driving cycle detection logic, monitoring once/1 driving.	● Manifold absolute pressure sensor and its circuit malfunction ● ECM (PCM) (barometric pressure sensor) malfunction

DTC CONFIRMATION PROCEDURE

1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON.
3) Turn ignition switch ON for 2 sec., crank engine for 2 sec. and run it at idle for 1 min.
4) Check pending DTC in “ON BOARD TEST” or “PENDING DTC” mode and DTC in “DTC” mode.

INSPECTION

DTC P1450:

Substitute a known-good ECM (PCM) and recheck.

DTC P1451:

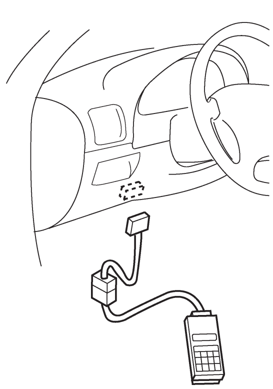
NOTE:

Note that atmospheric pressure varies depending on weather conditions as well as altitude. Take that into consideration when performing these check.

STEP	ACTION	YES	NO
1	1) Connect scan tool to DLC with ignition switch OFF. 2) Turn ignition switch ON and select “DATA LIST” mode on scan tool. 3) Check manifold absolute pressure. See Fig. 1. Is it barometric pressure (approx. 100 kPa, 760 mmHg) at sea level?	Substitute a known-good ECM (PCM) and recheck.	Go to Step 2.

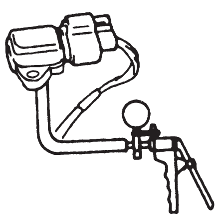
Fig. 1 for Step 1

When using SUZUKI scan tool:



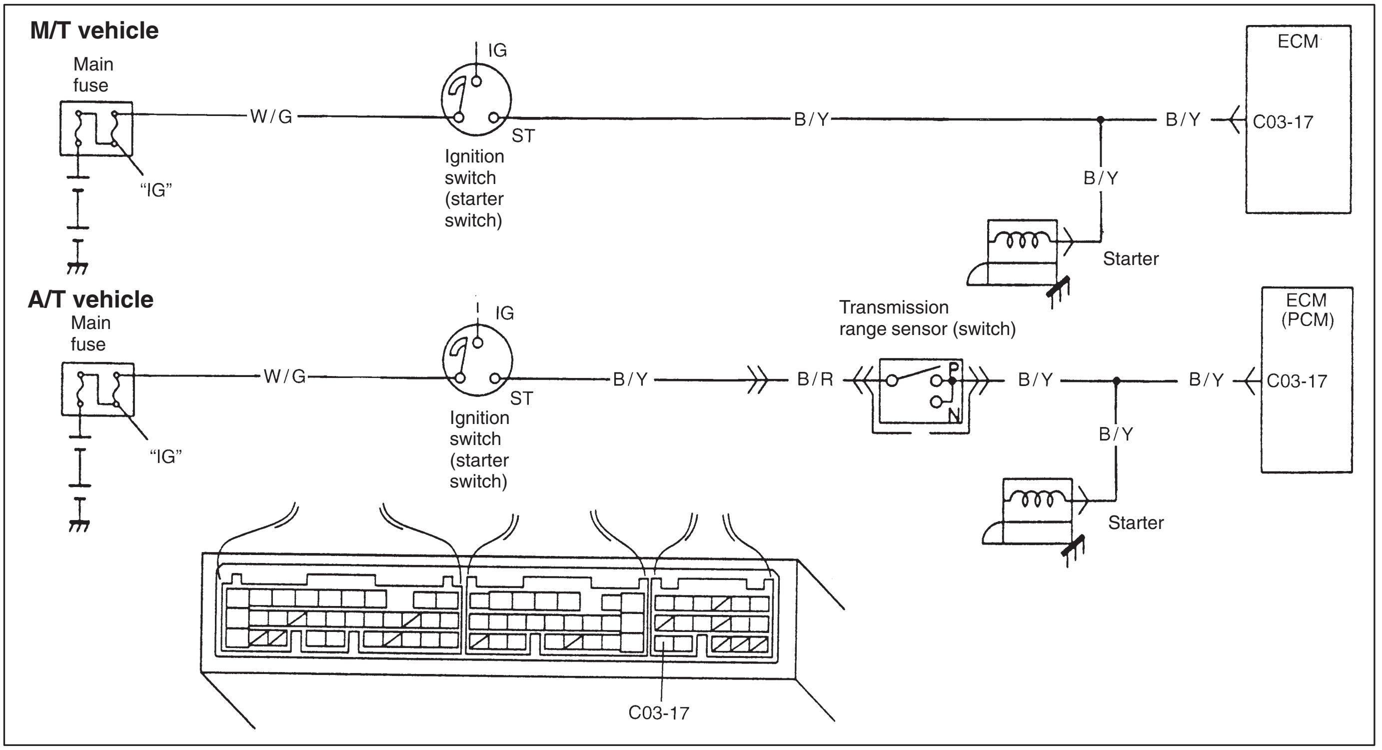
<table>
<tr><th>STEP</th><th>ACTION</th><th>YES</th><th>NO</th></tr>
<tr><td>2</td><td>Check MAP Sensor
1) Remove MAP sensor from intake manifold and connect vacuum pump gauge to MAP sensor. See Fig. 2.
2) Connect scan tool to DLC and turn ignition switch ON.
3) Check intake manifold absolute pressure displayed on scan tool 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 (PCM) and recheck.</td><td>Replace MAP sensor.</td></tr>
</table>

Fig. 2 for Step 2



DTC P1500 ENGINE STARTER SIGNAL CIRCUIT MALFUNCTION

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
● Low voltage at terminal C03-17 when cranking engine or ● High voltage at terminal C03-17 after starting engine. ✳ 2 driving cycle detection logic, continuous monitoring.	● "B/Y" circuit open ● ECM (PCM) malfunction

DTC CONFIRMATION PROCEDURE

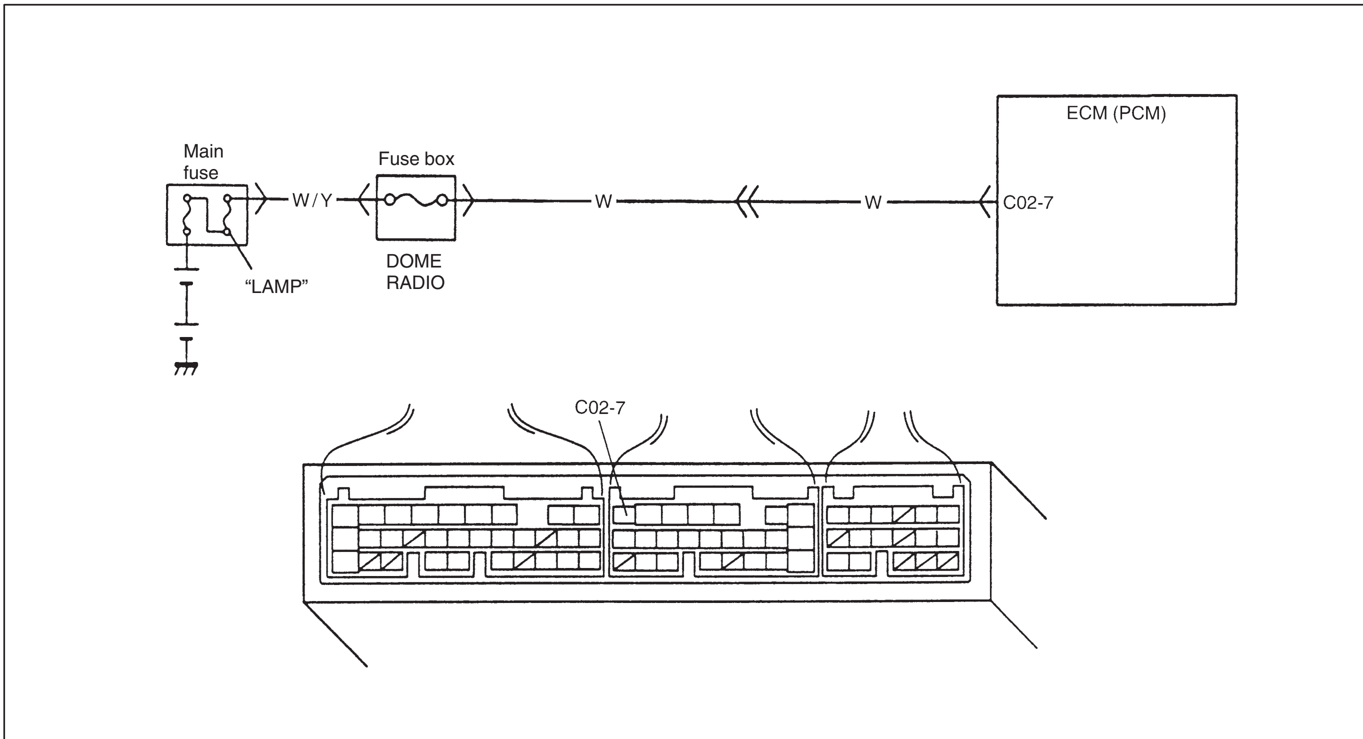
1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON, crank engine and run it at idle for 3 min.
3) Check pending DTC in "ON BOARD TEST" or "PENDING DTC" mode and DTC in "DTC" mode.

INSPECTION

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Check for voltage at terminal C03-17 of ECM (PCM) connector connected, under following condition. While engine cranking : 6 – 10 V After starting engine : 0 V Is voltage as specified?	Poor C03-17 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 (PCM) BACK-UP POWER SUPPLY MALFUNCTION

CIRCUIT DESCRIPTION



Battery voltage is supplied so that diagnostic trouble code memory, values for engine control learned by ECM (PCM), etc. are kept in ECM (PCM) even when the ignition switch is turned OFF.

DTC DETECTING CONDITION	POSSIBLE CAUSE
● Low voltage at terminal C02-7 after starting engine.	● "W" circuit open ● ECM (PCM) malfunction

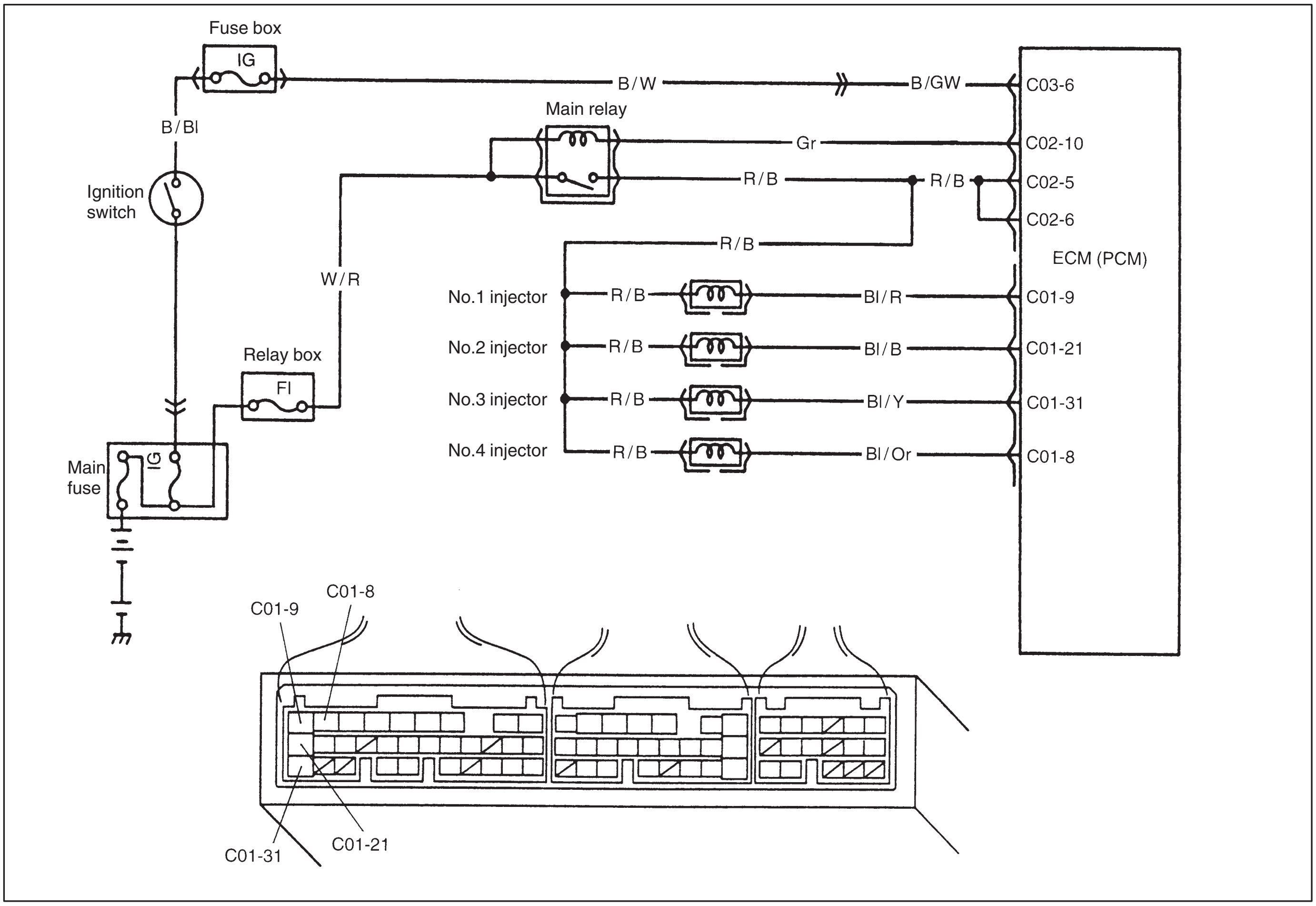
DTC CONFIRMATION PROCEDURE

1) Clear DTC, start engine and run it at idle for 1 min.
2) Select "DTC" mode on scan tool and check DTC.

INSPECTION

STEP	ACTION	YES	NO
1	Check for voltage at terminal C02-7 of ECM (PCM)connector connected, under each condition, ignition switch OFF and engine running. Is it 10 – 14 V at each condition?	Poor C02-7 connection or intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A. If wire and connections are OK, substitute a known- good ECM (PCM) and recheck.	"W" circuit open.

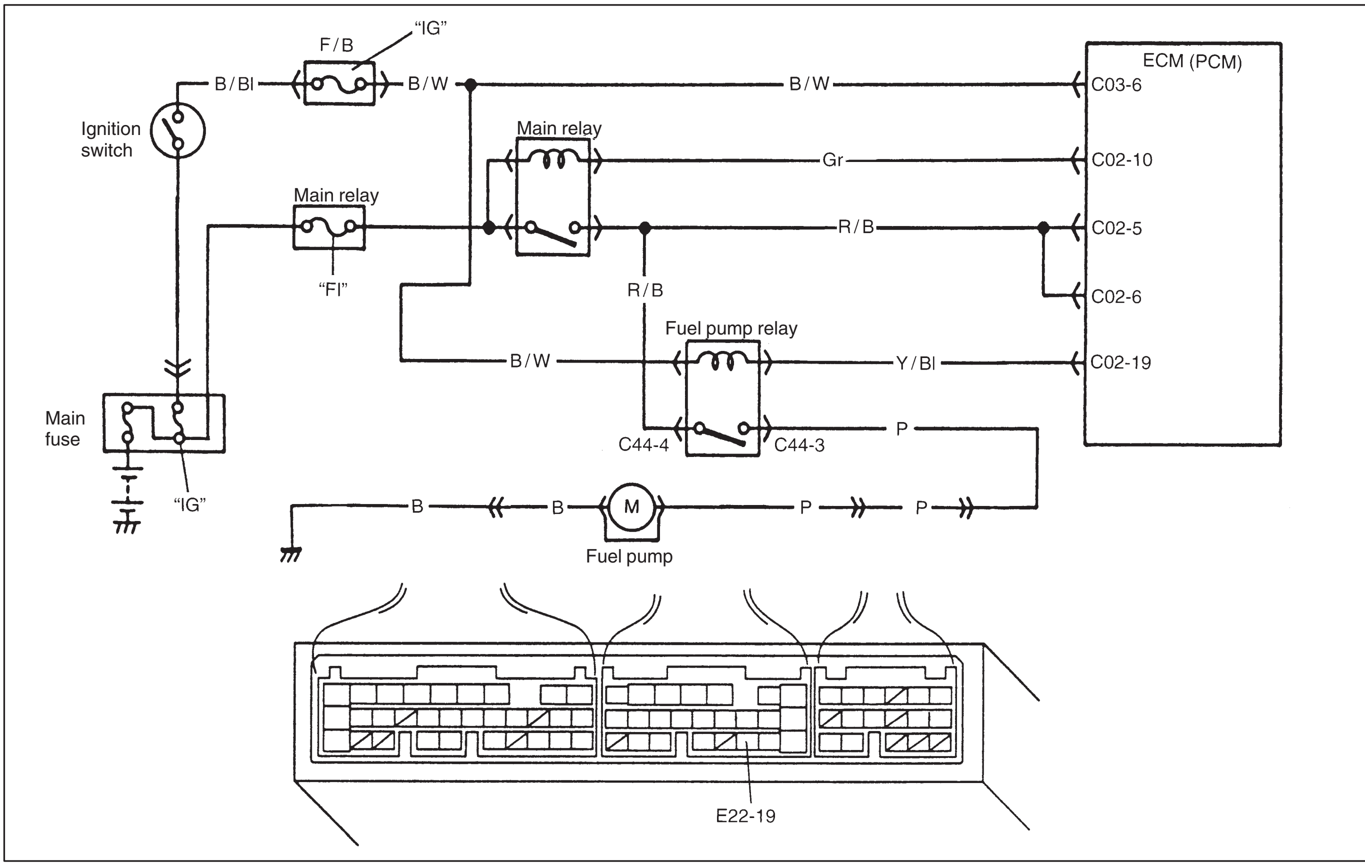
TABLE B-1 FUEL INJECTOR CIRCUIT CHECK



INSPECTION

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Check Injector for Operating Sound. Using sound scope, check each injector for operating sound at engine cranking. Do all 4 injector make operating sound?	Fuel injector circuit is in good condition.	Go to Step 3.
3	Dose none of 4 injectors make operating sound at Step 2?	Go to Step 4.	Check coupler connection and wire harness of injector not making operating sound and injector itself (Refer to Section 6E2).
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-2 FUEL PUMP AND ITS CIRCUIT CHECK



INSPECTION

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Check Fuel Pump Control System for Operation. See Fig. 1. Is fuel pump heard to operate for 2 sec. after ignition switch ON?	Fuel pump circuit is in good condition.	Go to Step 3.
3	Check Fuel Pump for Operation. 1) Remove fuel pump relay from relay box with ignition switch OFF. 2) Check for proper connection to relay at each terminals. 3) If OK, using service wire, connect terminals C44-3 and C44-4 of relay connector. See Fig. 2. **CAUTION: Check to make sure that connection is made between correct terminals. Wrong connection can cause damage to ECM (PCM), wire harness, etc.** Is fuel pump heard to operate at ignition switch ON?	Go to Step 4.	"P", "B" or "R/B" circuit open or fuel pump malfunction.
4	Check Fuel Pump Relay for Operation. 1) Check resistance between each two terminals of fuel pump relay. See Fig.3. Between terminals "c" and "d": Infinity Between terminals "a" and "b": 100 – 150 Ω 2) Check that there is continuity between terminals "c" and "d" when battery is connected to terminals "a" and "b". See Fig. 3. Is fuel pump relay in good condition?	"Y/Bl" circuit open or poor C02-19 connection. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.	Replace fuel pump relay.

Fig. 1 for Step 2

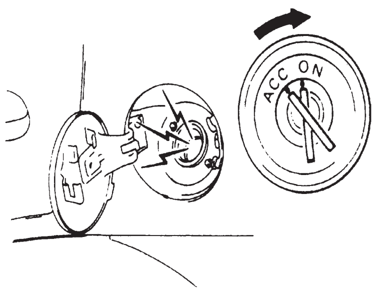


Fig. 2 for Step 3

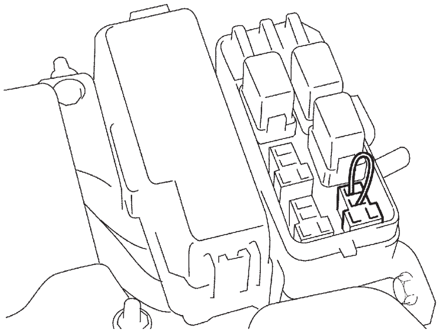


Fig. 3 for Step 4

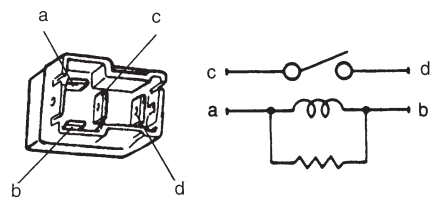
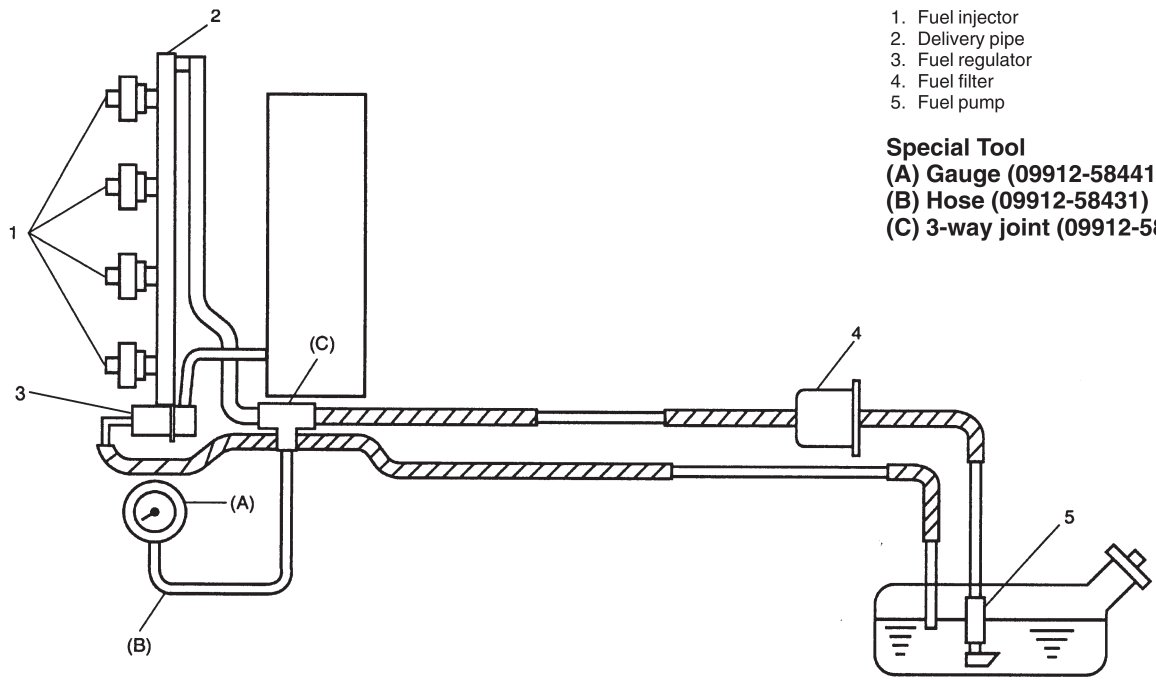


TABLE B-3 FUEL PRESSURE CHECK



1. Fuel injector
2. Delivery pipe
3. Fuel regulator
4. Fuel filter
5. Fuel pump

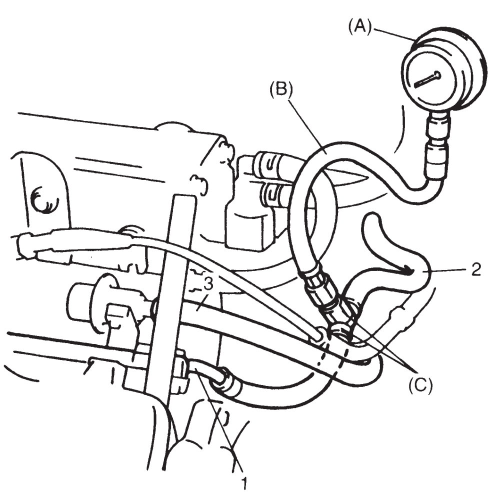
Special Tool
(A) Gauge (09912-58441)
(B) Hose (09912-58431)
(C) 3-way joint (09912-58490)

INSPECTION

STEP	ACTION	YES	ON
1	1) Release fuel pressure from fuel feed line. 2) Install fuel pressure gauge. 3) Check fuel pressure by repeating ignition switch ON and OFF. Is fuel pressure then 270 – 310 kPa (2.7 – 3.1 kg/cm^2, 38.4 – 44.0 psi)?	Go to Step 2.	Go to Step 5.
2	Is 200 kPa (2.0 kg/cm^2, 28.4 psi) or higher fuel pressure retained for 1 minute after fuel pump is stopped at step 1?	Go to Step 3.	Go to Step 4.
3	1) Start engine and warm it up to normal operating temperature. 2) Keep it running at specified idle speed. Is fuel pressure then within 200 – 240 kPa (2.0 – 2.4 kg/cm^2, 28.4 – 34.1 psi)?	Normal fuel pressure.	Clogged vacuum passage for fuel pressure regulator or faulty fuel pressure regulator.
4	Is there fuel leakage from fuel feed line hose, pipe or their joint?	Fuel leakage from hose, pipe or joint.	Go to Step 10.
5	Was fuel pressure higher than spec. in step 1?	Go to Step 6.	Go to Step 7.
6	1) Disconnect fuel return hose from fuel pressure regulator and connect new return hose to it. 2) Put the other end of new return hose into approved gasoline container. 3) Operate fuel pump. Is specified fuel pressure obtained then?	Restricted fuel return hose or pipe.	Faulty fuel pressure regulator.

STEP	ACTION	YES	ON
7	Was no fuel pressure applied in step 1?	Go to Step 8.	Go to Step 9.
8	With fuel pump operated and fuel return hose blocked by pinching it, is fuel pressure applied?	Faulty fuel pressure regulator.	Shortage of fuel or fuel pump or its circuit malfunction.
9	1) Operate fuel pump. 2) With fuel return hose blocked by pinching it, check fuel pressure. Is it 450 kPa (4.5 kg/cm^2, 63.9 psi) or more?	Faulty fuel pressure regulator.	Clogged fuel filter, restricted fuel feed hose or pipe, Faulty fuel pump or fuel leakage from hose connection in fuel tank.
10	1) Disconnect fuel return hose from pressure regulator and connect new return hose to it. 2) Insert the other end of new return hose into approved gasoline container. 3) Check again if specified pressure is obtained. While doing so, does fuel come out of return hose?	Faulty fuel pressure regulator.	Fuel leakage from injector, Fuel leakage from between injector and delivery pipe, Faulty fuel pump (faulty check valve in fuel pump) or Fuel leakage from fuel pressure regulator diaphragm.

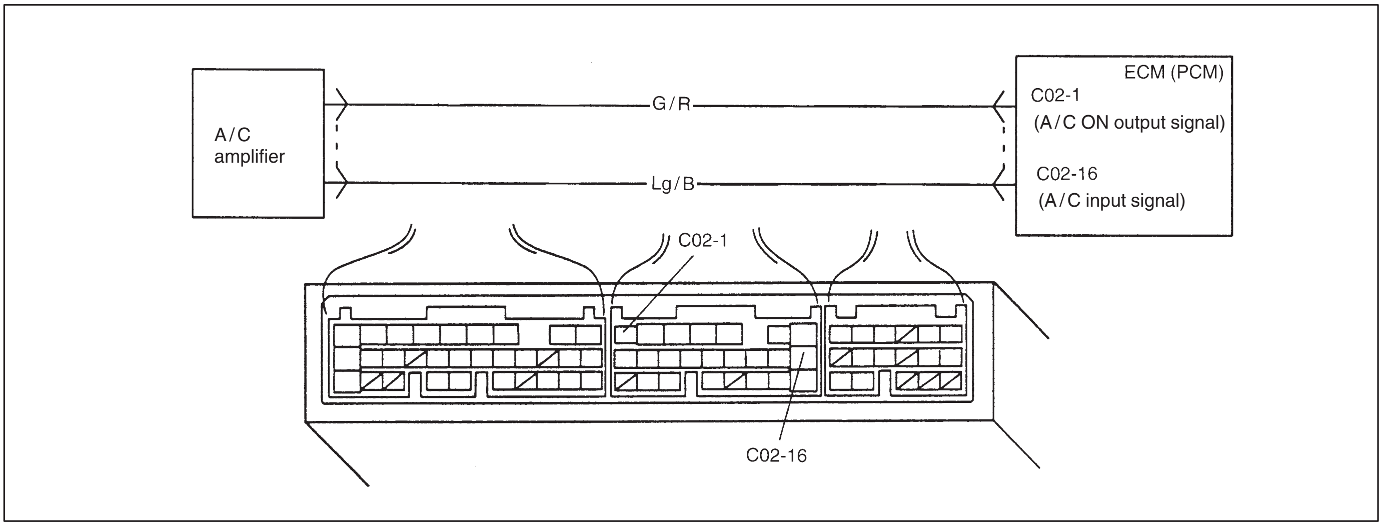
Fig. for STEP 1



1. Fuel delivery pipe
2. Fuel feed hose
3. Fuel return hose

Special Tool
(A) Gauge
(B) Hose
(C) 3-way joint

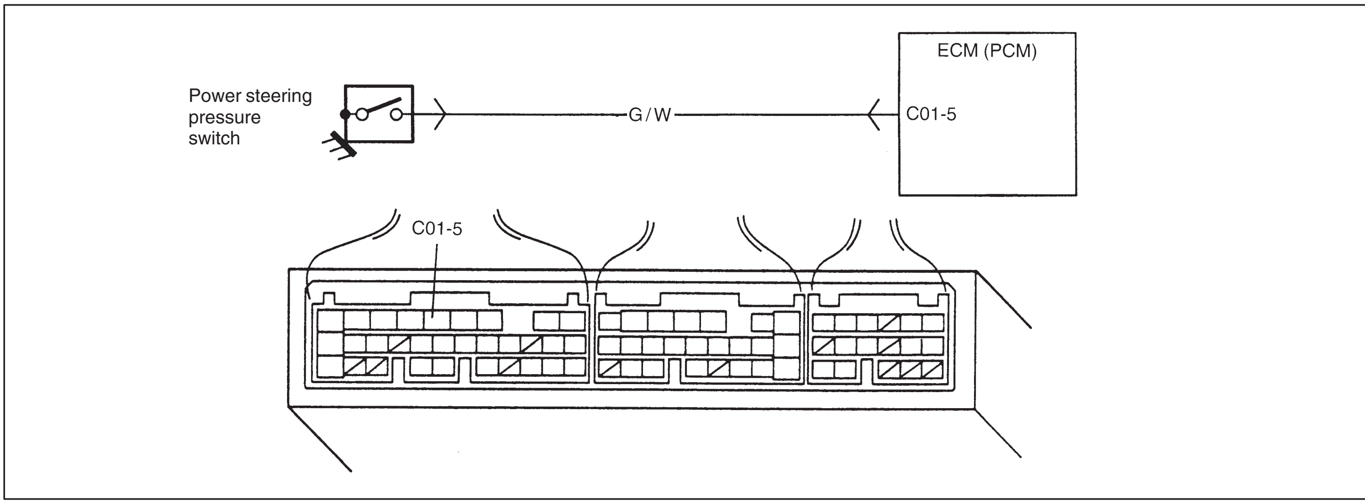
TABLE B-4 A/C SIGNAL CIRCUITS CHECK (VEHICLE WITH A/C)



INSPECTION

STEP	ACTION	YES	NO
1	Check A/C (input) Signal Circuit. 1) Check voltage at terminal C02-16. See Fig. 1. While engine running and A/C switch and/or heater blower switch OFF (A/C is not operating) : 10 – 14 V While engine running and both A/C switch and heater blower switch ON (A/C is operating) : About 0 V Are check result as specified?	Go to Step 2.	"Lg/B" circuit open or short, Evaporative temperature is 1°C (34°F) below or faulty A/C system.
2	Check A/C ON (Output) Signal Circuit. 1) Check voltage at terminal C02-1. See Fig. 2. While engine running and A/C switch and/or heater blower switch OFF (A/C is not operating) : About 0 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.	"G/R" 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 and recheck.

TABLE B-5 POWER STEERING PRESSURE (PSP) SWITCH SIGNAL CIRCUIT CHECK (If equipped)



INSPECTION

STEP	ACTION	YES	NO
1	Check PSP Switch Signal Circuit. When using SUZUKI scan tool: 1) Connect SUZUKI scan tool to DLC with ignition switch OFF. 2) Start engine and select “DATA LIST” mode on scan tool. 3) Check power steering pressure switch. See Fig. 1. Engine running and steering wheel at straight-ahead position : OFF, 10 – 14 V Engine running and steering wheel turned to the right or left as far as it stops : ON, 0 – 1 V Is it in good condition? When not using SUZUKI scan tool: 1) Turn ignition switch ON. 2) Check for voltage at terminal C01-5 of ECM connector connected, under above each condition. Is each voltage as specified?	Signal circuit is in good condition.	Go to Step 2.
2	Check Wire Harness. 1) Turn ignition switch OFF and disconnect PSP switch connector. 2) Check for proper connection to PSP switch. 3) If OK, then check voltage at PSP switch wire terminal with ignition switch ON. See Fig. 2. Is it 10 – 14V?	Power steering switch malfunction or power steering system malfunction.	“G/W” wire open or shorted to ground or poor C01-5 connection. If wire and connection are OK, substitute a known-good ECM and recheck.

Fig. 1 for Step 1

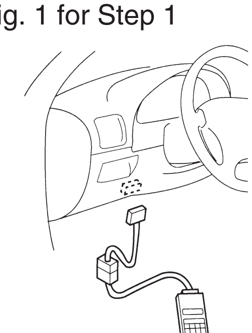


Fig. 2 for Step 2

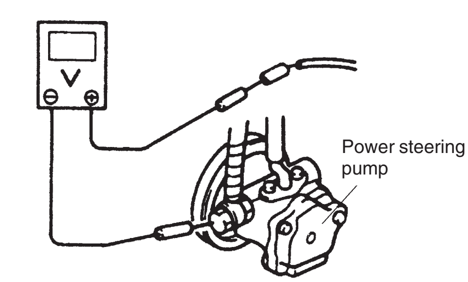
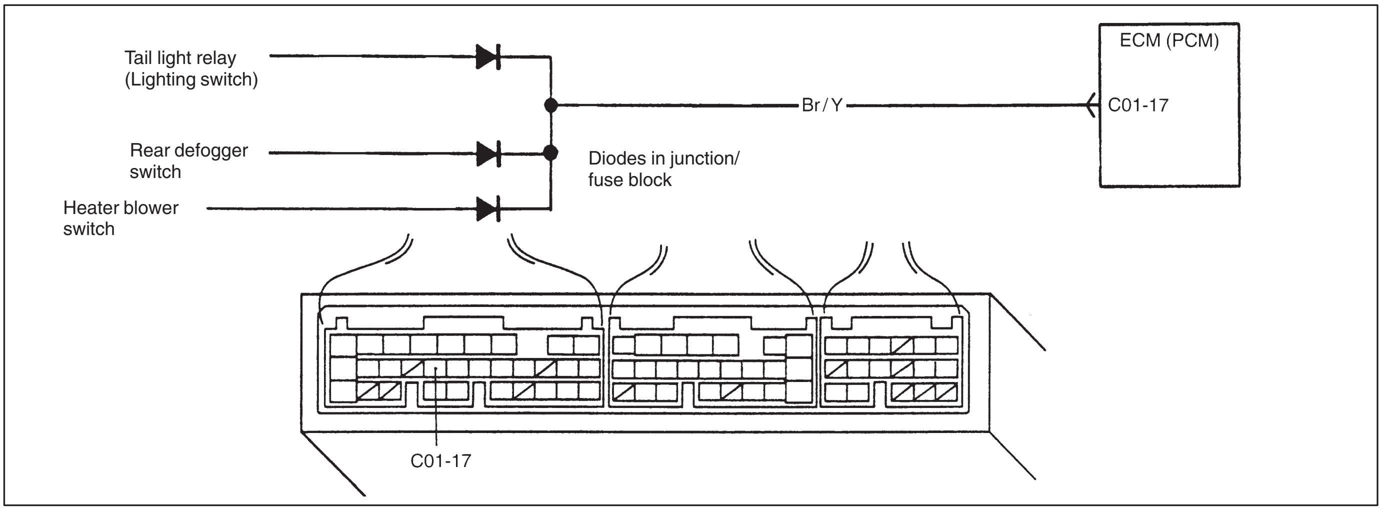


TABLE B-6 ELECTRIC LOAD SIGNAL CIRCUIT CHECK



INSPECTION

STEP	ACTION	YES	NO
1	Check Electric Load Signal Circuit. When using SUZUKI scan tool: 1) Connect SUZUKI scan tool to DLC with ignition switch OFF. 2) Start engine and select “DATA LIST” mode on scan tool. 3) Check electric load signal under following each condition. See Fig. 1. Ignition switch ON, Small light, heater blower fan and rear defogger all turned OFF : OFF 0 V (C01-17) Ignition switch ON, Small light, heater blower fan or rear defogger turned ON : ON 10 – 14 V (C01-17) Is check result satisfactory? When not using SUZUKI scan tool: 1) Turn ignition switch ON. 2) Check voltage at terminals C01-17 of ECM (PCM) connector connected, under above each condition. See Fig. 2. Is each voltage as specified?	Electric load signal circuit is in good condition.	“Br/Y” circuit open or short, Electric load diodes malfunction or Each electric load circuit malfunction.

Fig. 1 for Step 1

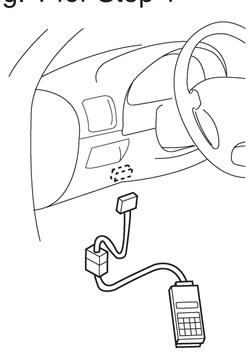


Fig. 2 for Step 1

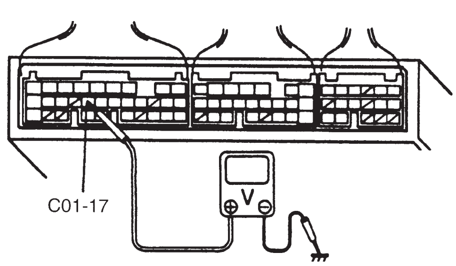
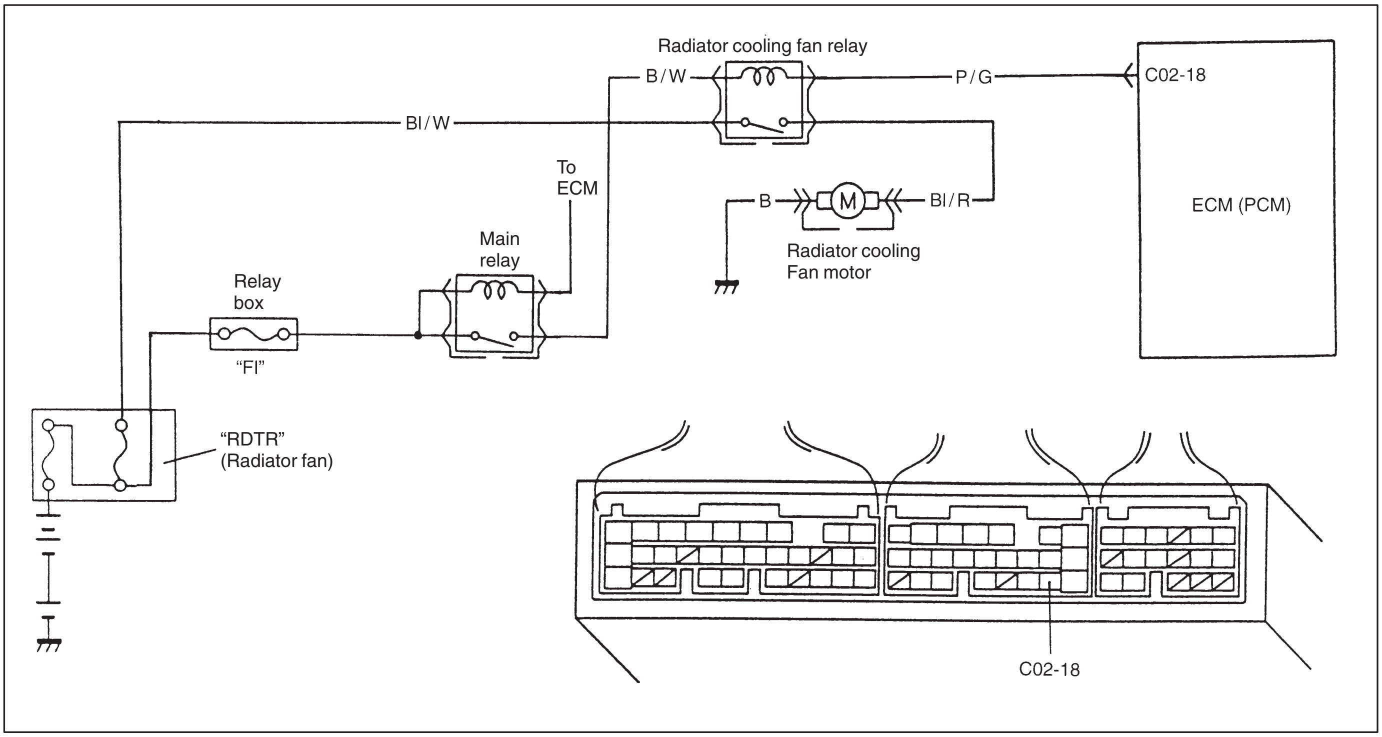


TABLE B-7 RADIATOR COOLING FAN CONTROL SYSTEM CHECK



INSPECTION

STEP	ACTION	YES	NO
1	Check Fan Control System. 1) Connect scan tool to DLC with ignition switch OFF. 2) Start engine and select "DATA LIST" mode on scan tool. 3) Warm up engine until coolant temp. is 97.5°C, 208°F or higher and A/C switch turn OFF. (If engine coolant temp. does not rise, check engine cooling system or ECT sensor.) See Fig. 1. Is radiator cooling fan started when engine coolant temp. reached above temp.?	Radiator cooling fan control system is in good condition.	Go to Step 2.
2	Check Radiator Cooling Fan Relay and Its Circuit. 1) Check DTC and pending DTC with scan tool. Is DTC P0480 displayed?	Go to DTC P0480 Diag. Flow Table.	Go to Step 3.
3	Check Radiator Cooling Fan Relay. 1) Turn ignition switch OFF and remove radiator cooling fan relay. 2) Check for proper connection to relay at terminals "c" and "d". 3) If OK, check that there is continuity between "c" and "d" when battery is connected to terminals "a" and "b". See Fig. 2. Is check result satisfactory?	Go to Step 4.	Replace radiator fan relay.
4	Check Radiator Cooling Fan. 1) Turn ignition switch OFF. 2) Disconnect cooling fan motor connector. 3) Check for proper connection to motor at "Bl/R" and "B" terminals. 4) If OK, connect battery to motor and check for operation. See Fig. 3. Is it in good condition?	"Bl/W", "Bl/R" or "B" circuit open.	Replace radiator cooling fan motor.

Fig. 1 for Step 1

When using SUZUKI scan tool:

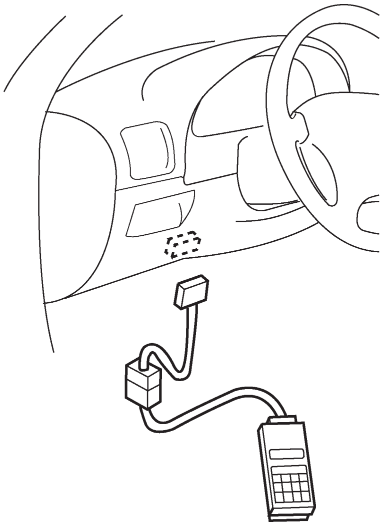
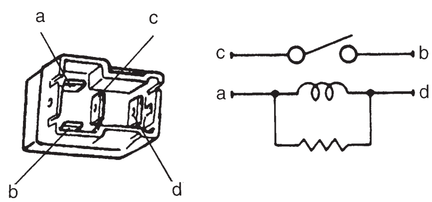
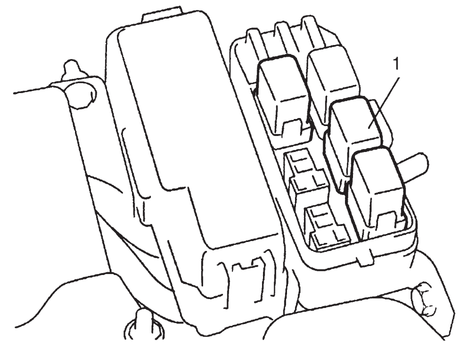


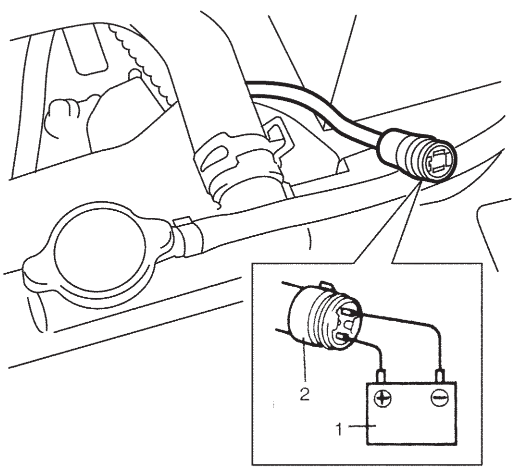
Fig. 2 for Step 3





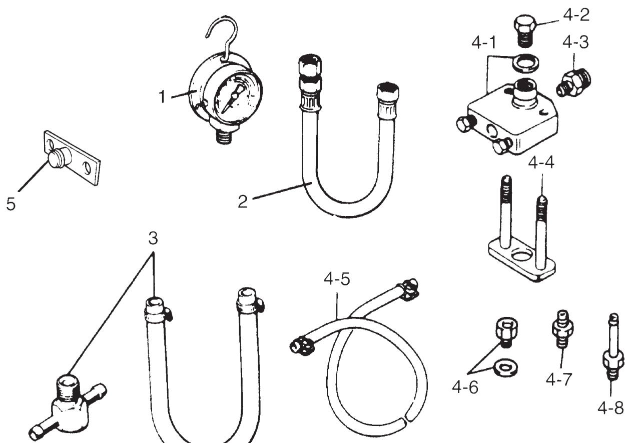
1. Radiator cooling fan relay

Fig. 3 for Step 4



1. Battery
2. Radiator fan motor coupler

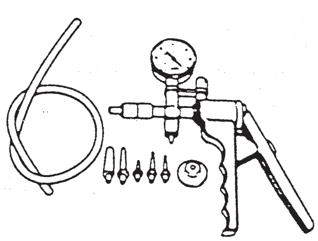
SPECIAL TOOLS



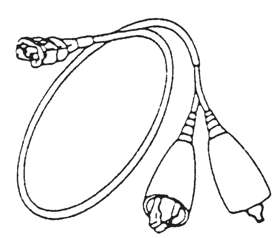
1. Pressure gauge
   09912-58441
2. Pressure hose
   09912-58431
3. 3-way joint & hose
   09912-58490
4. Checking tool set
   09912-58421

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

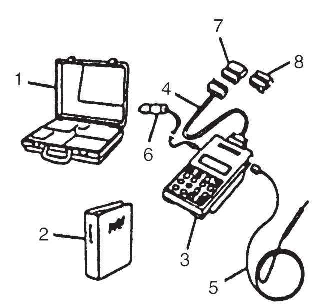
5. Checking tool plate
   09912-57610



09917-47910
Vacuum pump gauge

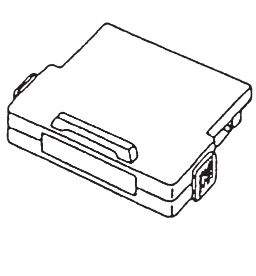


09930-88530
Injector test lead

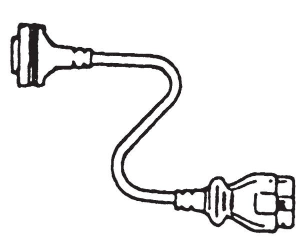


1. Storage case
2. Operator’s manual
3. Tech 1 A
4. DLC cable (14/26 pin, 09931-76040)
5. Test lead/probe
6. Power source cable
7. DLC cable adaptor
8. Self-test adaptor

09931-76011
SUZUKI scan tool (Tech 1 A) kit



Mass storage cartridge



09931-76030
16/14 pin DLC cable

SECTION 6A

ENGINE MECHANICAL
(G10, 1-CAM 6-VALVES 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:
For the descriptions (items) not found in this section, refer to the same section of Service Manual mentioned in FOREWORD of this manual.

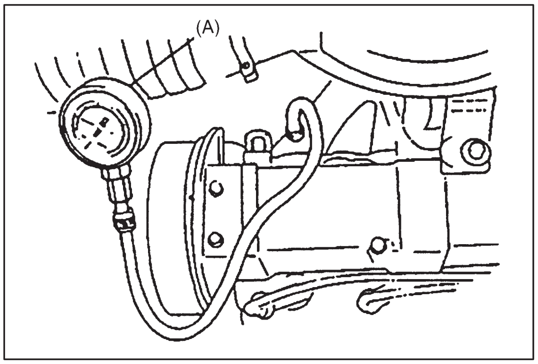
CONTENTS

ON-VEHICLE SERVICE

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.



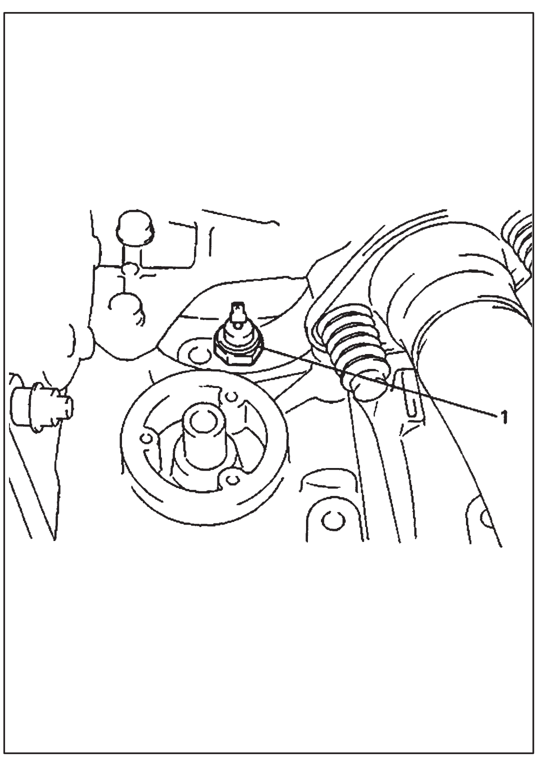
2) With engine stopped, remove blind plug hose from intake manifold and connect special tool (vacuum gauge and joint) to vacated threaded hole.

   Special Tool
   (A): 09915-67311

3) Run engine at specified idle speed (see Section 6E), and read vacuum gauge. Vacuum should be within the following specification.

   Vacuum specification: 52.6 – 65.8 kPa (40 – 50 cm·Hg, 15.7 – 19.7 in·Hg) at specified idling speed

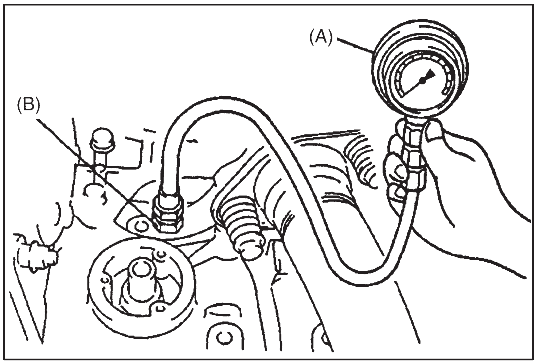
4) After checking, apply sealant to thread of blind plug and install it to intake manifold.



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 the table in Section 0B.
- **Oil leaks.**
  If leak is found, repair it.

1) Using special tool (Oil filter wrench), remove oil filter.
2) After removing oil filter, remove oil pressure switch (1) from cylinder block.



3) Install special tool (Oil pressure gauge) to vacated threaded hole.

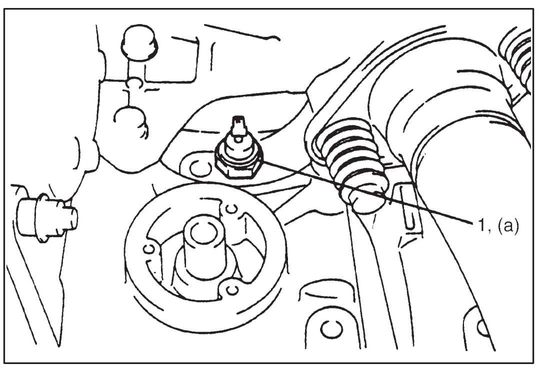
Special Tool
(A): 09915-77311
(B): 09915-78211

NOTE:
At this time, be very careful not to exert force to where heated oxygen sensor and its lead wire are connected.

4) Reinstall oil filter.
5) Start engine and warm it up to normal operating temperature.
6) After warming up, raise engine speed to 4,000 r/min and measure oil pressure.

Oil pressure specifications: 270 – 370 kPa (2.7 – 3.7 kg/cm^2, 38.4 – 52.6 psi) at 4,000 r/min (rpm)

7) After checking oil pressure, stop engine and remove oil filter and oil pressure gauge.



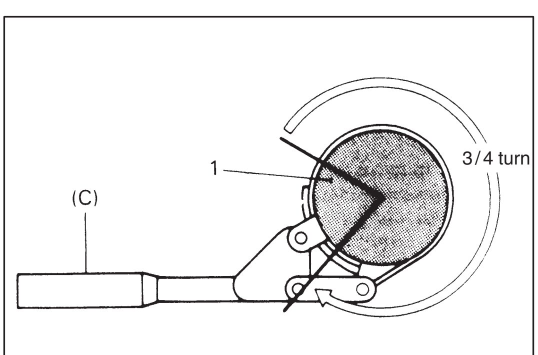
8) Before reinstalling oil pressure switch (1), be sure to wrap its screw threads with a sealing tape and tighten switch to specified torque.

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)

9) After oiling oil filter "O" ring (rubber gasket), screw oil filter on oil filter stand by hand until filter "O" ring contacts mounting surface.

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

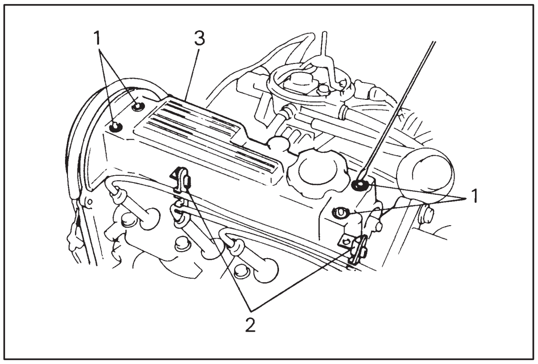


10) Tighten filter (1) 3/4 (270°) turn from the point of contact with mounting surface using an oil filter wrench.

Special Tool
(C): 09915-47310

CAUTION:
To prevent oil leakage, make sure that oil filter is tight, but do not overtighten it.

11) After installing oil filter, start engine and check oil filter for oil leakage.



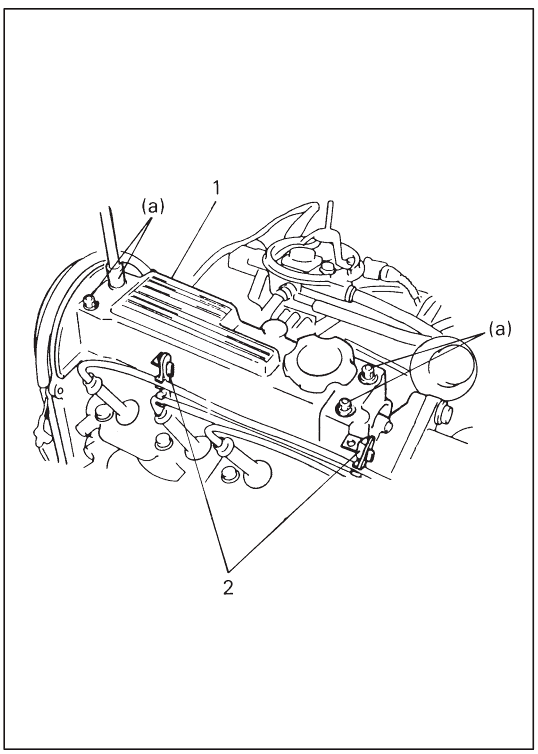
CYLINDER HEAD COVER

REMOVAL

1) Disconnect negative cable at battery.
2) Remove air cleaner assembly.
3) Remove high-tension cord clamps (2) from cylinder head cover.
4) Disconnect breather hose from cylinder head cover.
5) Remove cylinder head cover nuts and then seal washers (1).
6) Remove cylinder head cover (3) from cylinder head.

INSTALLATION

1) Install cylinder head cover gasket to head cover.
   Before installing gasket, check it for deterioration or damage, and replace as necessary.

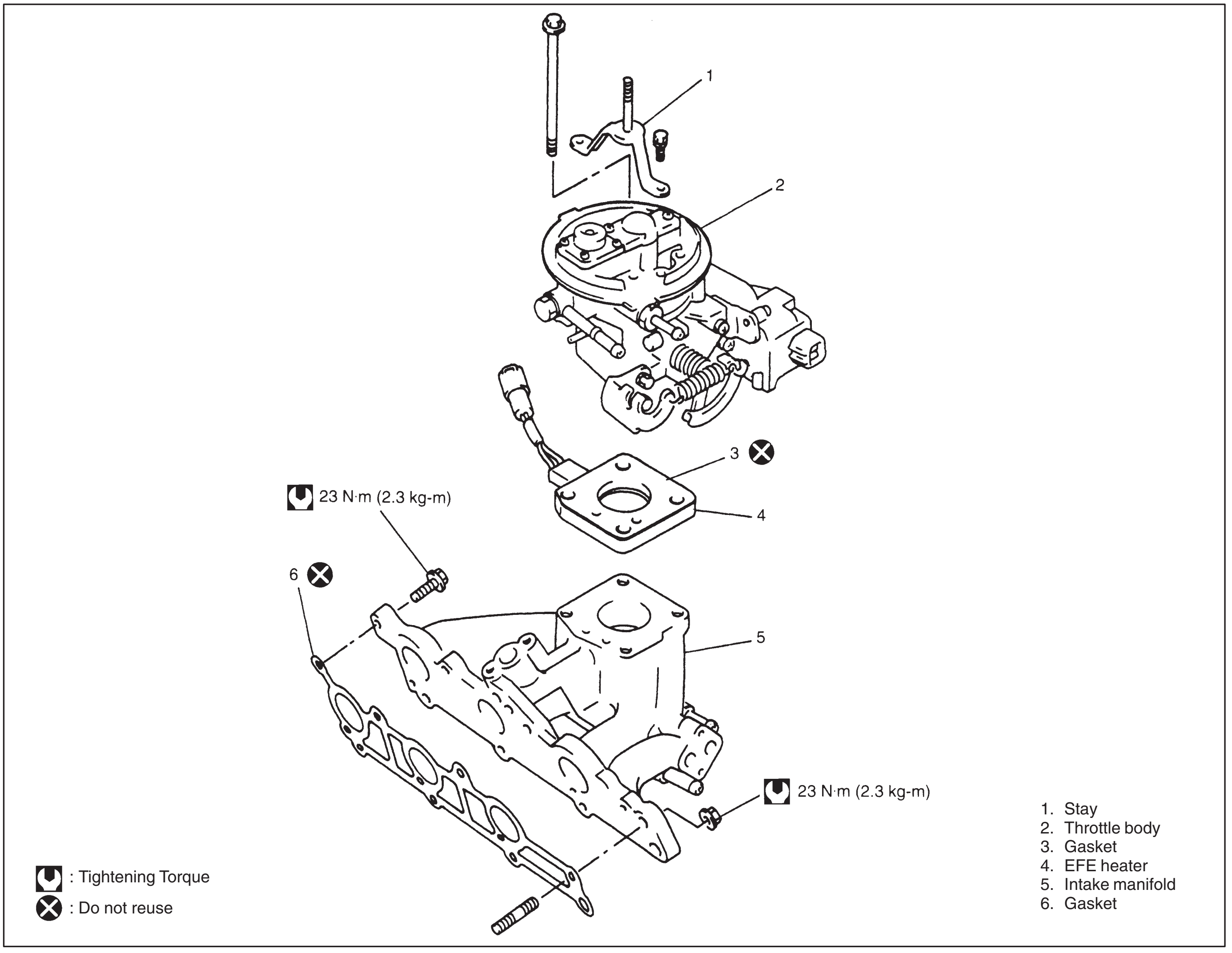


2) Install cylinder head cover (1).
   Before installing seal washers, check each one for deterioration or damage, and replace as necessary.
   Tighten cover nuts to specified torque.

   Tightening Torque
   (a): 4.5 N·m (0.45 kg-m, 3.5 lb-ft)

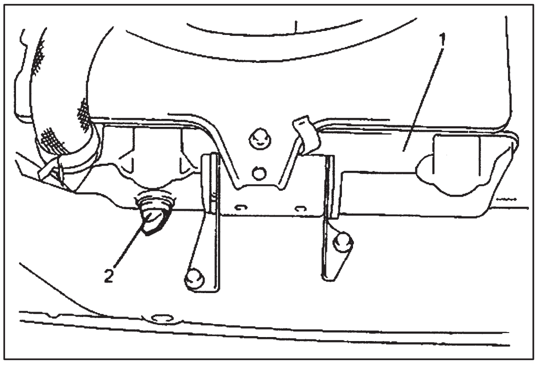
3) Install high-tension cord clamps (2) to cylinder head cover.
4) Connect breather hose to cylinder head cover.
5) Install air cleaner assembly.
6) Connect negative cable at battery.

THROTTLE BODY AND INTAKE MANIFOLD



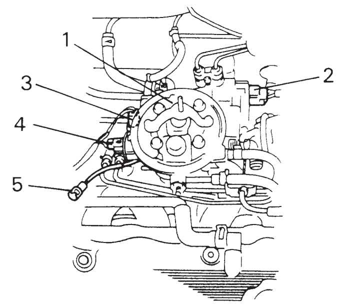
REMOVAL

1) Relieve fuel pressure according to procedure described in "FUEL PRESSURE RELIEF PROCEDURE" of Section 6.
2) Disconnect negative cable at battery.



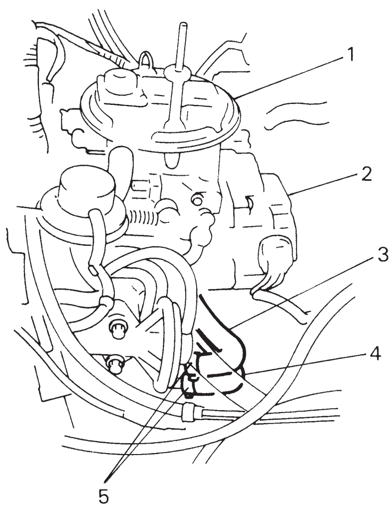
3) Drain cooling system.

> **WARNING:**
> **To help avoid danger of being burned, do not remove drain plug (2) and radiator cap while engine and radiator (1) are still hot. Scalding fluid and steam can be blown out under pressure if plug and cap are taken off too soon.**



1. Throttle body

4) Remove air cleaner assembly.
5) Disconnect the following electric lead wires:
   - EGR valve
   - ISC actuator (2)
   - Ground wires from intake manifold
   - Fuel injector (4)
   - TP sensor (3)
   - EFE heater (5)
   - Engine coolant temp. gauge

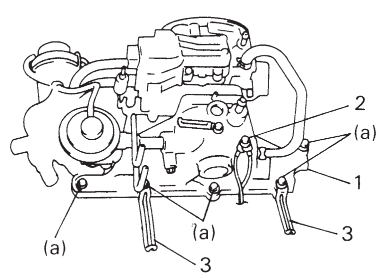


1. Throttle body
2. ISC actuator
5. Clamp

6) Disconnect fuel return (4) and feed hoses (3) from fuel pipes.
7) Disconnect coolant hoses from intake manifold.
8) Disconnect the following vacuum hoses.
   - Canister purge hose from intake manifold.
   - EGR pressure transducer hoses from EGR valve.
   - EGR valve hose from EGR valve.
   - Pressure sensor hose from intake manifold.
   - Brake booster hose from intake manifold.
9) Disconnect breather hose from PCV valve.
10) Disconnect accelerator cable from throttle body.
11) Disconnect other connected to throttle body and intake manifold, if any.
12) Remove intake manifold with throttle body from cylinder head.
13) Remove throttle body from intake manifold.

INSTALLATION

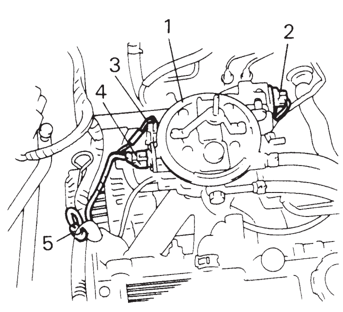
1) Install throttle body to intake manifold. (Refer to Section 6E.)
2) Install intake manifold gasket to cylinder head. Use a new gasket.



2. Ground

3) Install intake manifold (1) with throttle body to cylinder head.
   - Install clamps (3) as shown in figure, and tighten bolts and nuts to specification.

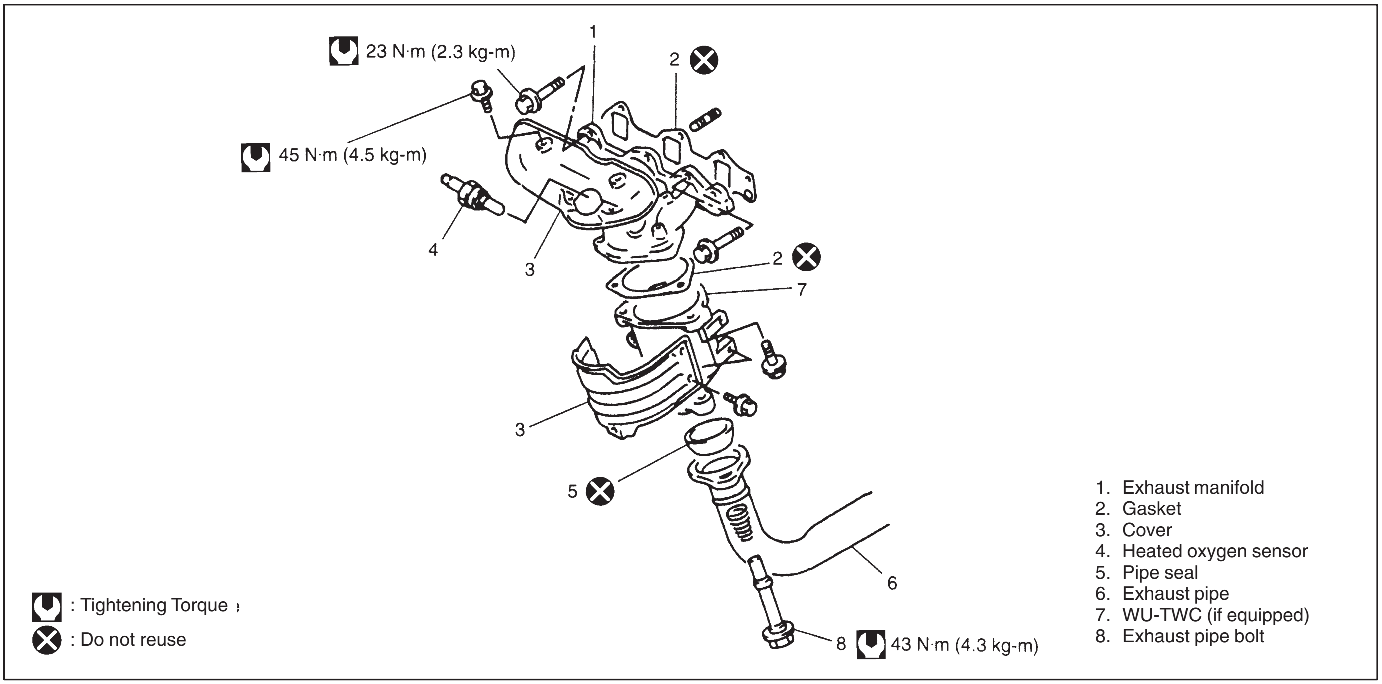
   Tightening Torque
   (a): 23 N·m (2.3 kg-m, 17.0 lb-ft)



1. Throttle body
2. ISC actuator coupler
3. TP sensor coupler
4. Fuel injector coupler
5. EFE heater coupler

4) Connect breather hose to PCV valve.
5) Connect vacuum hoses.
6) Connect coolant hoses.
7) Connect fuel return and feed hoses to throttle body.
8) Connect electric lead wire.
9) Connect accelerator cable to throttle body.
10) Install air cleaner assembly to throttle body.
11) Check to ensure that all removed parts are back in place. Reinstall any necessary parts which have not been reinstalled.
12) Refill cooling system.
13) Connect negative cable at battery.
14) Upon completion of installation, start engine and check for fuel leaks and engine coolant leaks.
    After warming up engine, adjust accelerator cable play to specification according to description in Section 6E.

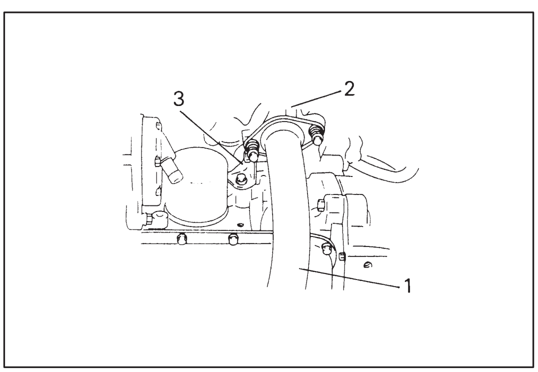
EXHAUST MANIFOLD



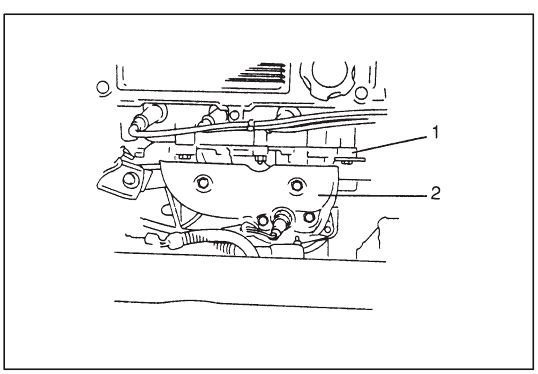
WARNING:
To avoid danger of being burned, do not service exhaust system while it is still hot.
Service should be performed after system cools down.

REMOVAL

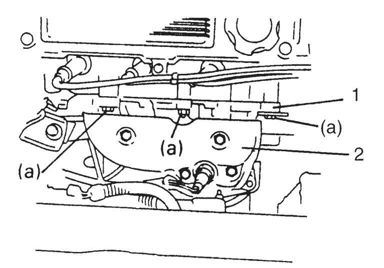
1) Disconnect negative cable at battery.
2) Disconnect heated oxygen sensor coupler.
   Release its wire from clamps.

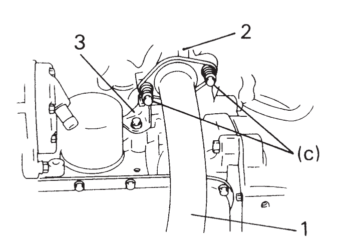


3) Disconnect exhaust pipe (1) from exhaust manifold (or WU-TWC (2)).
4) Remove WU-TWC stiffener (3). (if equipped)



5) Remove exhaust manifold cover (2). (for vehicle with WU-TWC)
6) Remove exhaust manifold (1) with WU-TWC (if equipped) and its gasket from cylinder head.





2. WU-TWC

INSTALLATION

1) Install manifold gasket to cylinder head.
   Before installing gasket, check it for deterioration or damage, and replace as necessary.
2) Install exhaust manifold (1).
   Tighten manifold bolts and nuts to specified torque.

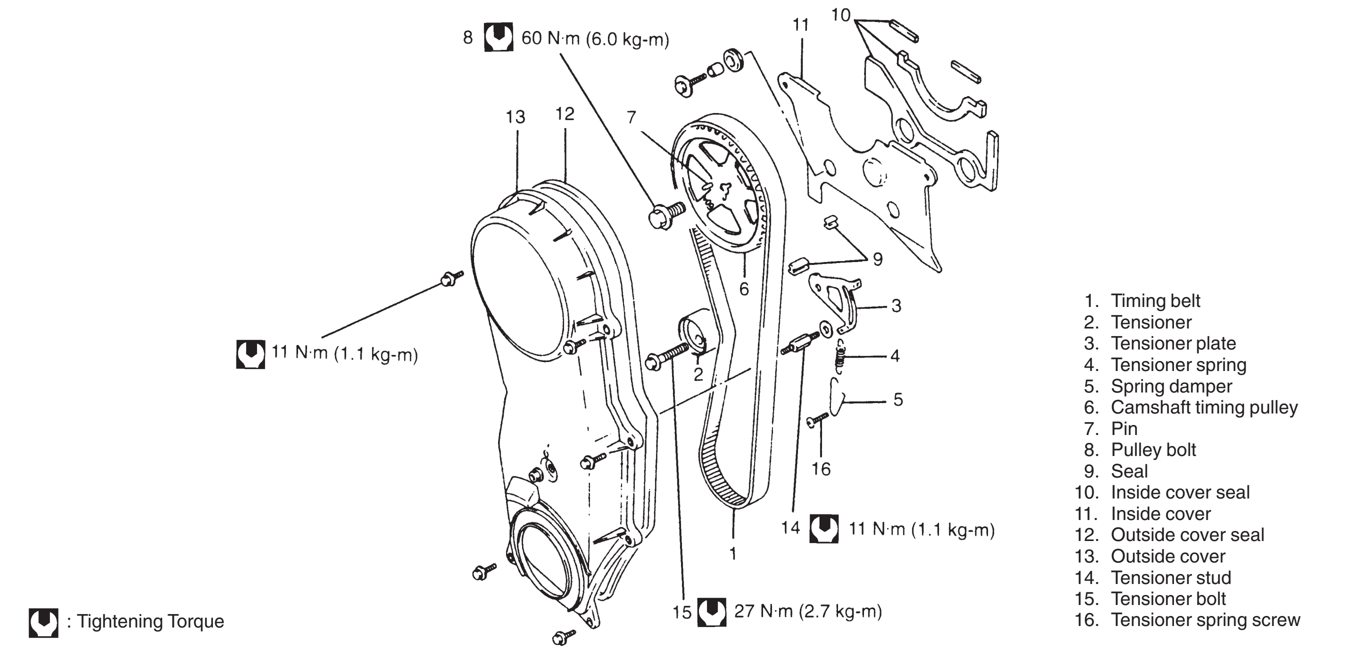
   Tightening Torque
   (a): 23 N·m (2.3 kg-m, 17.0 lb-ft)

3) Install exhaust manifold cover (2).
4) Install pipe seal, and then connect exhaust pipe (1).
   Before installing pipe seal, check it for deterioration or damage, and replace as necessary.
   Tighten pipe bolts to specified torque.

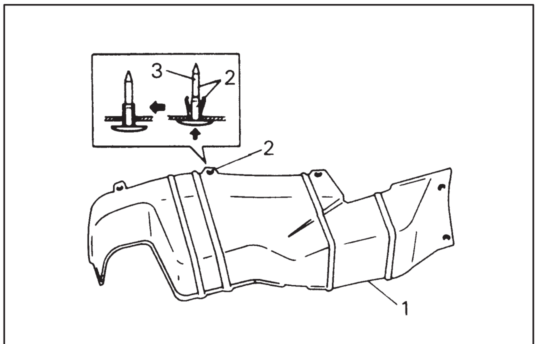
   Tightening Torque
   (c): 43 N·m (4.3 kg-m, 31.5 lb-ft)

5) Install WU-TWC stiffener (3). (if equipped)
6) Connect heated oxygen sensor coupler.
7) Clamp its wire securely.
8) Connect negative cable at battery.
9) Check exhaust system for exhaust gas leakage.

TIMING BELT AND BELT TENSIONER



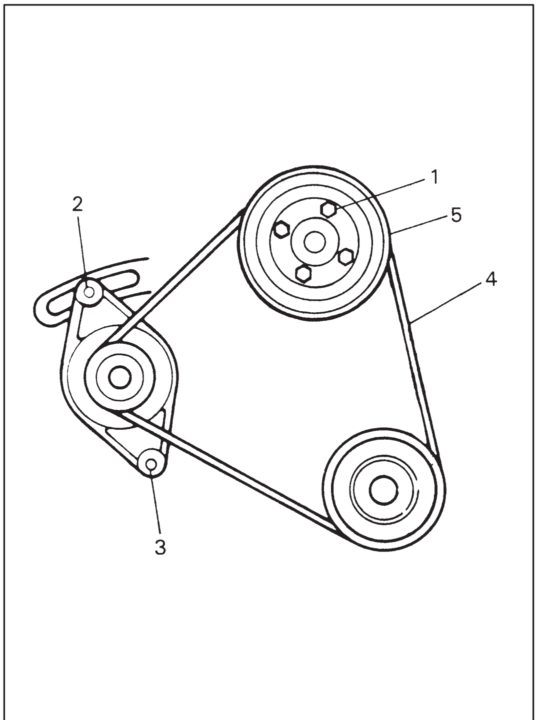
1. Timing belt
2. Tensioner
3. Tensioner plate
4. Tensioner spring
5. Spring damper
6. Camshaft timing pulley
7. Pin
8. Pulley bolt
9. Seal
10. Inside cover seal
11. Inside cover
12. Outside cover seal
13. Outside cover
14. Tensioner stud
15. Tensioner bolt
16. Tensioner spring screw



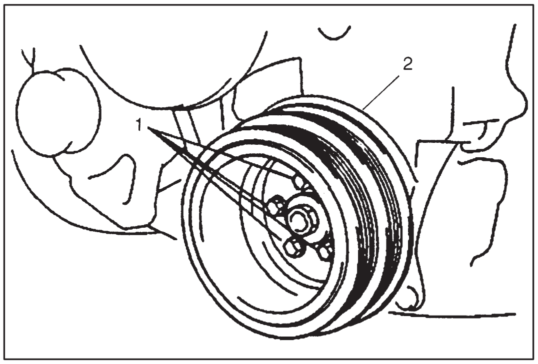
REMOVAL

1) Disconnect negative cable at battery.
2) Hoist vehicle.
3) Remove clip (2) after pushing center pin, and then remove fender apron extension (1) on right side.

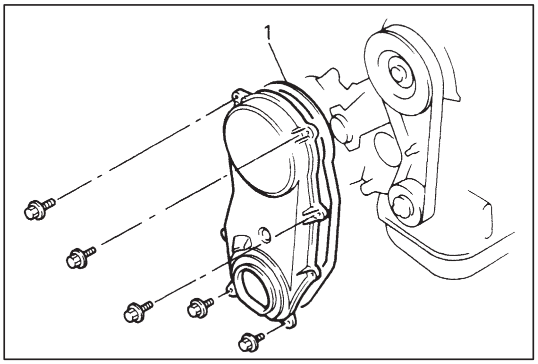
NOTE:
Do not push center pin (3) too far in, or it will fall off into fender.



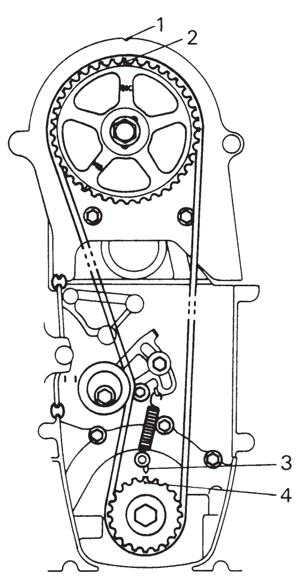
4) Remove air cleaner assembly as previously outlined.
5) Remove A/C compressor drive belt, if equipped.
6) Loosen water pump pulley bolts (1).
7) Loosen generator pivot bolts (3) and its adjusting bolt (2) and remove water pump belt (4) and its pulley (5).



8) Loosen crankshaft pulley bolts (1) and remove crankshaft pulley (2).

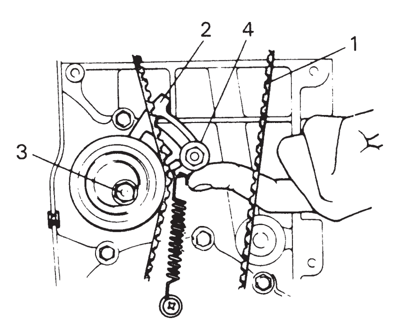


9) Remove timing belt outside cover (1).



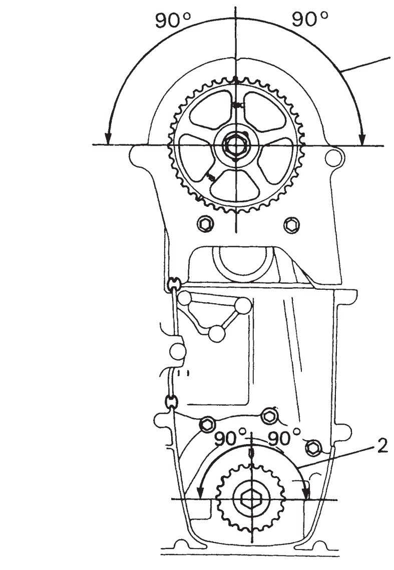
1. "V" mark on cylinder head cover
2. Timing mark on camshaft timing belt pulley
3. Arrow mark on oil pump case
4. Punch mark on crankshaft timing belt pulley

10) Align 4 timing marks as shown in figure to facilitate its installation.



11) Loosen tensioner bolt (3) and stud (4), and remove belt (1) from crankshaft timing belt pulley and camshaft timing belt pulley after pushing up the tensioner plate (2) fully by finger as shown figure.

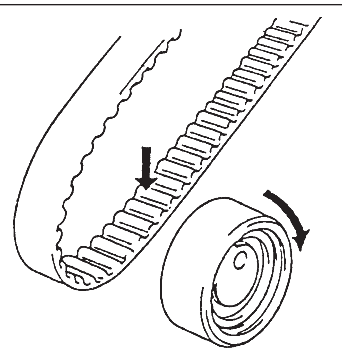
CAUTION:
Never bend timing belt.



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.

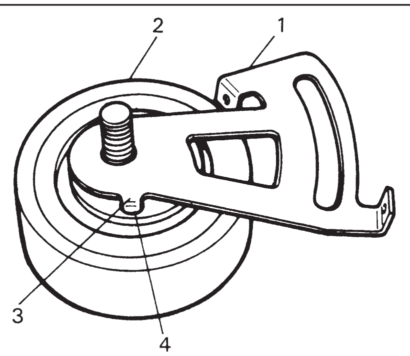
CAUTION:
After timing belt is removed, never turn camshaft and crankshaft independently more than such an extent as shown below. If turned, interference may occur among piston and valves, and parts related to piston and valves may be damaged.

12) Remove tensioner, tensioner plate, tensioner spring and spring damper.



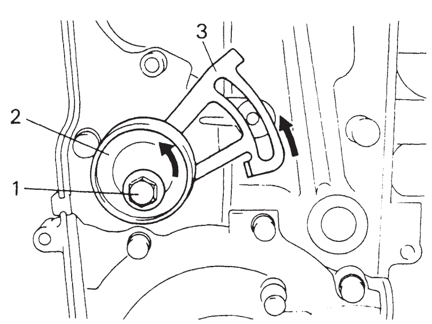
INSPECTION

- Check timing belt for wear or crack. Replace it as necessary.
- Check tensioner for smooth rotation and rattle.

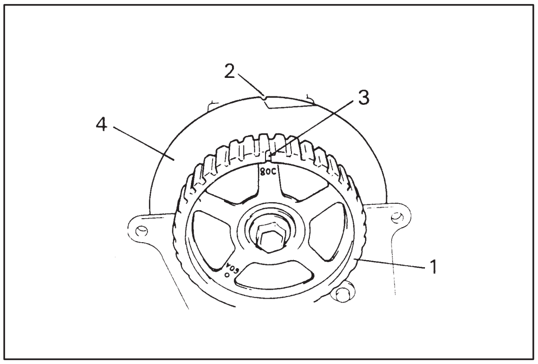


INSTALLATION

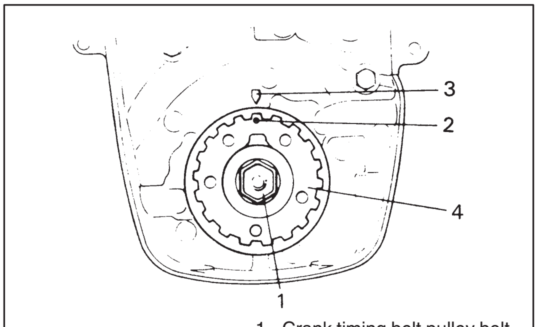
1) Install tensioner plate (1) to tensioner (2).
   Insert lug (3) of tensioner plate into hole (4) of tensioner.



2) Install tensioner (2) and tensioner plate (3).
   Do not tighten the tensioner bolt (1) and stud by 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 the plate lug into tensioner hole.

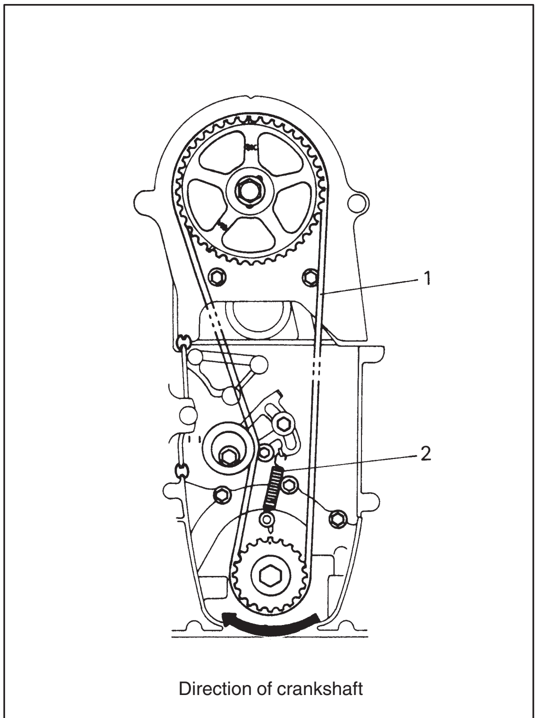


3) Check that timing mark (3) on camshaft timing belt pulley (1) is aligned with "V" mark (2) on cylinder head cover (4). If not, align two marks by turning camshaft but be careful not to turn it more than its allowable turning range which is described on previous page.



1. Crank timing belt pulley bolt

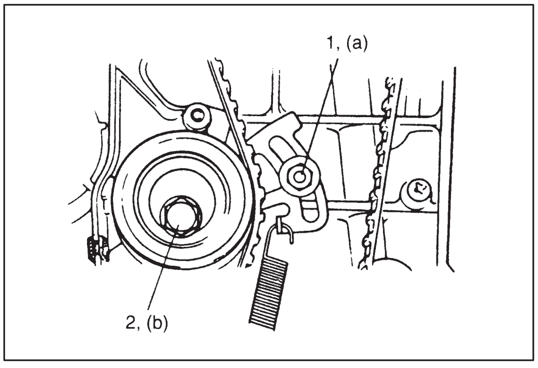
4) Check that punch mark (2) on crank timing belt pulley (4) is aligned with arrow mark (3) on oil pump case. If not, align two marks by turning crankshaft but be careful not to turn it more than its allowable turning range which is described on previous page.



Direction of crankshaft

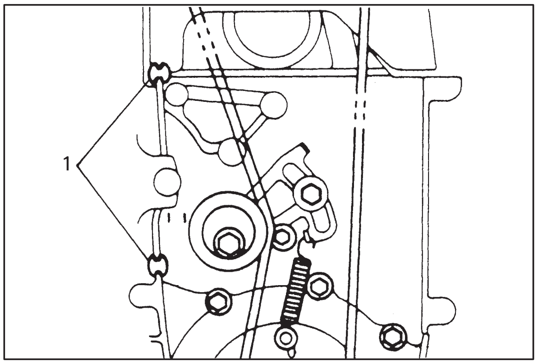
5) With two sets of marks aligned, install timing belt (1) on two pulleys in such a way that the drive side of belt is free of any slack, and with tensioner plate pushed up by finger.
   And then install tensioner spring and spring damper (2) as shown in figure, and handtighten tensioner stud.

   NOTE:
   - **When installing timing belt, match arrow mark (➡) on timing belt with rotating direction of crankshaft.**
   - **In this state, No.1 piston is at top dead center of compression stroke.**

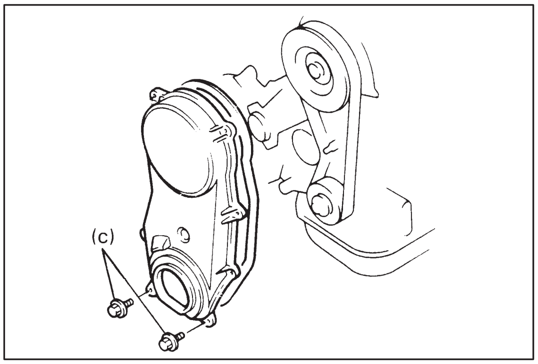


6) To take up slack of timing belt, turn crankshaft two rotations clockwise after installing it. After making sure that belt is free from slack, tighten tensioner stud (1) first and then tensioner bolt (2) to each specified torque.
   Then confirm again that two sets of marks are aligned respectively.

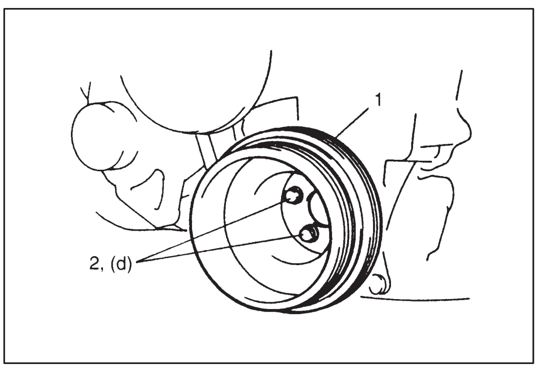
   Tightening Torque
   (a): 11 N·m (1.1 kg-m, 8.0 lb-ft)
   (b): 27 N·m (2.7 kg-m, 19.5 lb-ft)



7) Install timing belt outside cover.
   Before installing, make sure that rubber seal (1) is between water pump and oil pump case and another between water pump and cylinder head.



Tightening Torque
(c): 11 N·m (1.1 kg-m, 8.0 lb-ft)

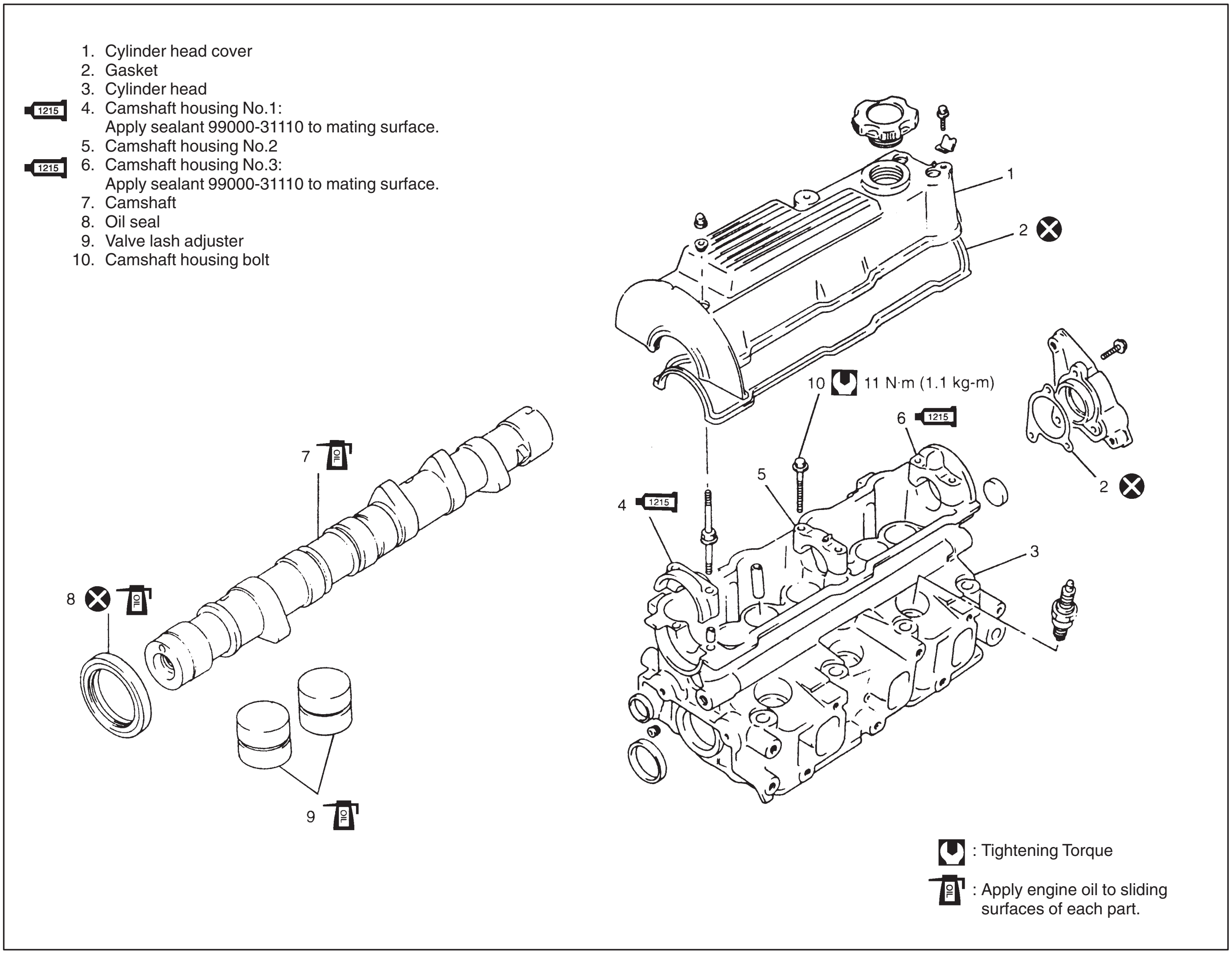


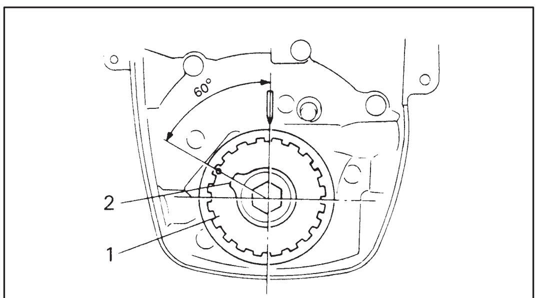
8) Install crankshaft pulley (2).
   Tighten crankshaft pulley bolts (1).

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

9) Install water pump pulley and water pump belt.
   Adjust the belt tension to the specification.
   Refer to Section 6B for procedure to adjust the belt tension.
10) Install air cleaner assembly.
11) Install fender apron extension of right side.
12) Connect negative cable at battery.

CAMSHAFT AND HYDRAULIC VALVE LASH ADJUSTER

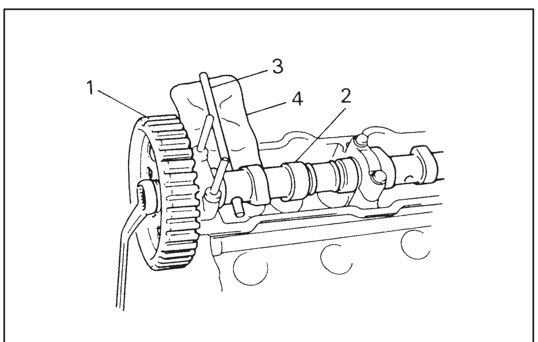




1. Crankshaft timing belt pulley

REMOVAL

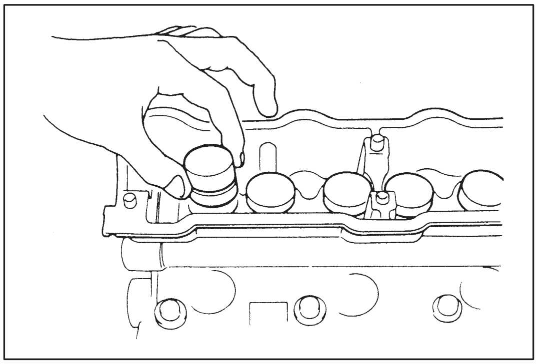
1) Disconnect negative cable at battery.
2) Remove cylinder head cover as previously outlined.
3) Remove distributor and then its case from cylinder head.
4) Remove crankshaft pulley, timing belt outside cover and timing belt as previously outlined.
   After removing timing belt, set key (2) on crankshaft in position as shown in figure by turning crankshaft. This is to prevent interference between valves and piston when reinstalling camshaft.



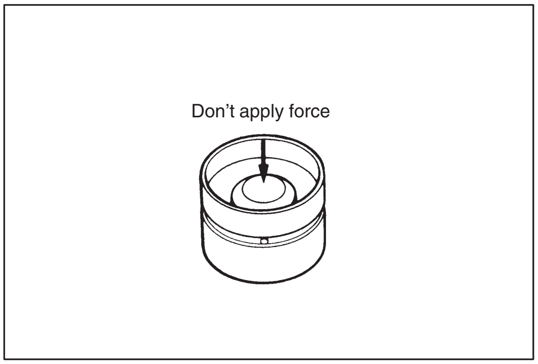
5) Remove camshaft timing belt pulley (1).
   Lock camshaft (2) with a proper size rod (3) inserted into hole (10 mm, 0.39 in.) in it as shown and then loosen camshaft timing belt pulley bolt.

NOTE:

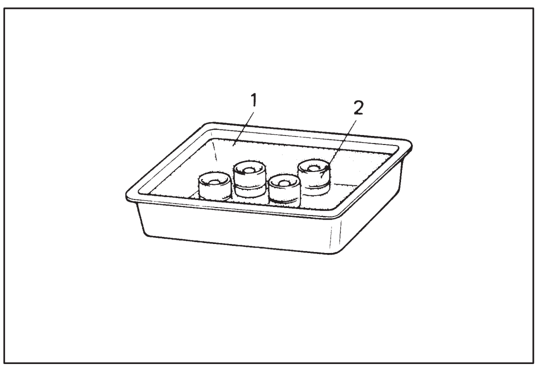
Mating surfaces of cylinder head and cover must not be damaged in this work. So, put clean shop cloth (4) between rod and mating surfaces, and use care not to bump rod against mating surfaces hard when loosening bolt.



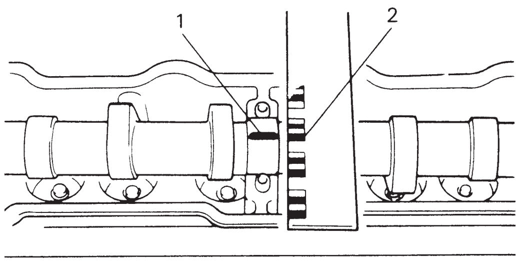
6) Remove camshaft housings from cylinder head.
7) Remove camshaft from cylinder head.
8) Remove valve lash adjuster from cylinder head.



NOTE:
- **Never disassemble hydraulic valve lash adjuster.**
- **Don’t apply force to body of adjuster, for oil in high pressure chamber in adjuster will leak.**



- **Immerse removed adjuster (2) in clean engine oil (1) 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

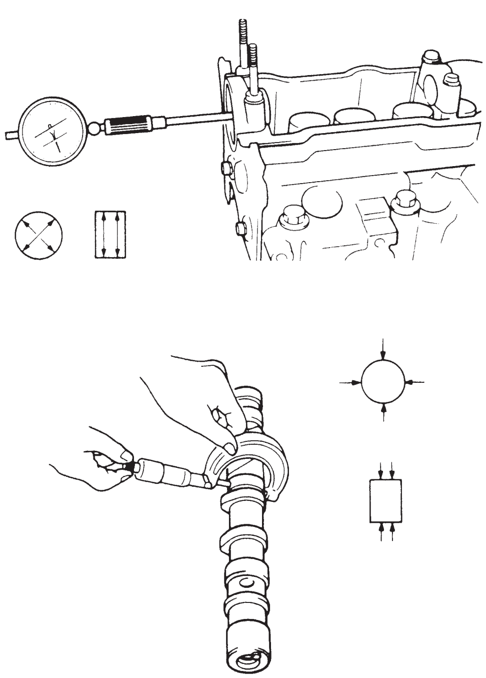
Camshaft journal wear:

- 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 (1). 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 housings as outlined on the following page and evenly torque housing bolts to specified torque. Housings MUST be torqued to specification in order to assure proper reading of camshaft journal clearance.

  NOTE:
  Do not rotate camshaft while gaging plastic is installed.

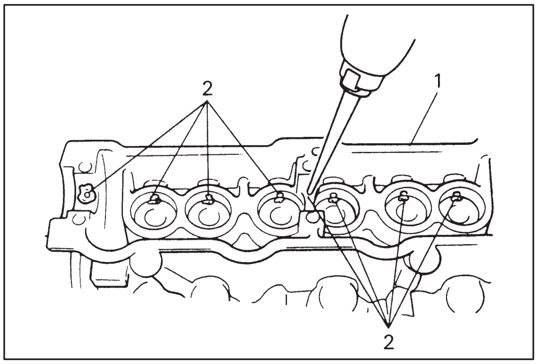
  5) Remove housing, and using scale (2) on gaging plastic envelop, measure gaging plastic width at its widest point.

	Standard	Limit
Journal clearance	0.040 – 0.082 mm (0.0016 – 0.0032 in.)	0.12 mm (0.0047 in.)



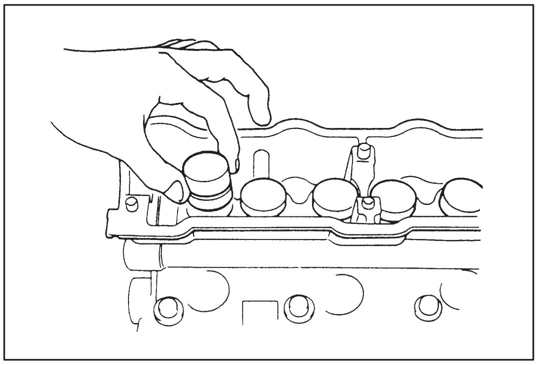
If measured camshaft journal clearance exceeds limit, measure journal (housing) bore and outside diameter of camshaft journal. Replace camshaft or cylinder head assembly whichever the difference from specification is greater.

Item		Standard
Camshaft journal bore dia.	No.1	26.000 – 26.021 mm (1.0236 – 1.0244 in.)
	No.2 & No.3	30.000 – 30.021 mm (1.1811 – 1.1819 in.)
Camshaft journal O.D.	No.1	25.939 – 25.960 mm (1.0212 – 1.0220 in.)
	No.2 & No.3	29.939 – 29.960 mm (1.1787 – 1.1795 in.)

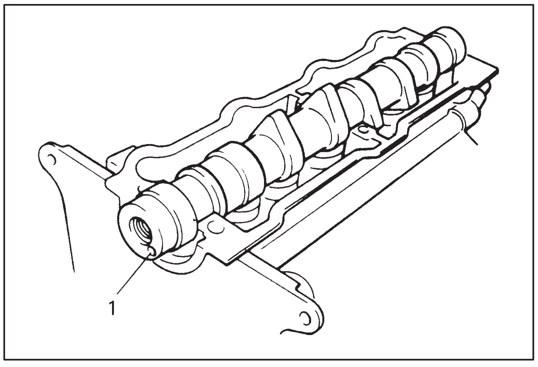


INSTALLATION

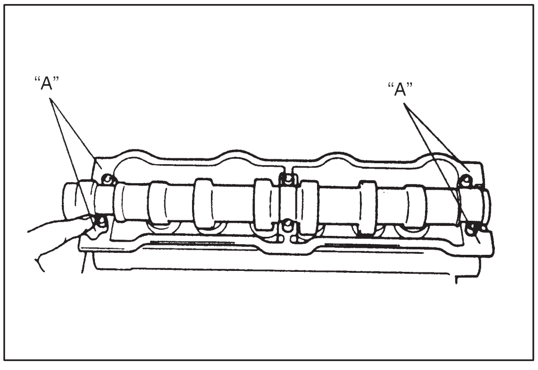
1) Before installing valve lash adjuster to cylinder head, fill oil passage of cylinder head (1) with engine oil according to the following procedure.
   Pour engine oil through camshaft journal oil holes (2) and check that oil comes out from oil holes in sliding part of valve lash adjuster.



2) Install lash adjuster to cylinder head.
   Apply engine oil around valve lash adjuster and then install it to cylinder head.

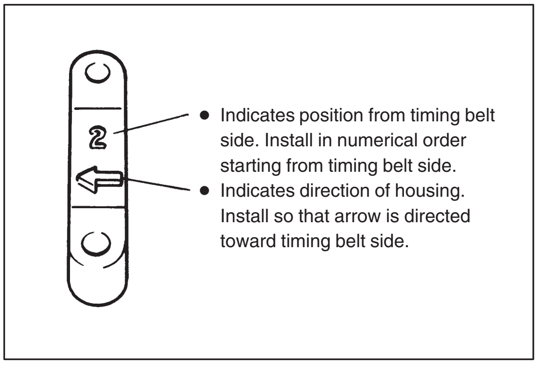


3) Install camshaft to cylinder head.
   After applying engine oil to camshaft journal and all around cam, set camshaft to cylinder head so that camshaft timing belt pulley pin hole (1) in camshaft is at lower position.

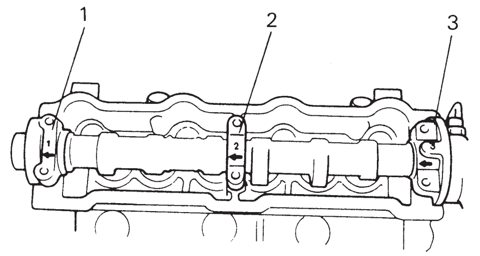


4) Install camshaft housing to camshaft and cylinder head.
   - Apply engine oil to sliding surface of each housing against camshaft journal.
   - Apply sealant to mating surface of No.1 and No.3 housings which will mate with cylinder head.

   "A": Sealant 99000-31110

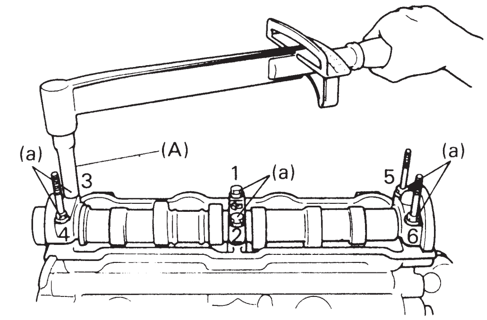


- Embossed marks are provided on each camshaft housing, indicating position and direction for installation.
  Install housing as indicated by these marks.



2. No.2 housing
3. No.3 housing

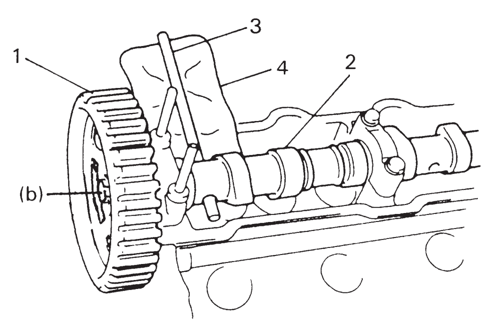
- As camshaft housing No.1 (1) retains camshaft in proper position as to thrust direction, make sure to first fit No.1 housing to No.1 journal of camshaft securely.



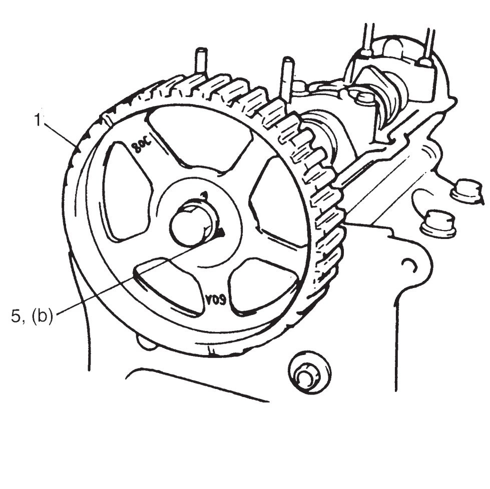
- After applying engine oil to housing bolts, tighten them temporarily first. Then tighten them by following sequence as shown in figure.
  Tighten a little at a time and evenly among bolts and repeat tightening sequence three to four times before they are tightened to specified torque.

  Special Tool
  (A): 09919-16010

  Tightening Torque
  (a): 11 N·m (1.1 kg-m, 8.0 lb-ft)



3. Rod
4. Shop cloth



5) 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.
6) Install camshaft timing belt pulley (1) to camshaft (2) after installing dwell pin to camshaft.
   With locking camshaft as shown in figure, tighten pulley bolt to specified torque.

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

7) Install cylinder head cover to cylinder head as previously outlined.
8) Install timing belt, timing belt outside cover, crankshaft pulley, water pump pulley and water pump belt as previously outlined.
9) Install distributor case and distributor.
   Refer to Section 6F for installation.
10) Install air cleaner assembly as previously outlined.
11) Connect negative cable at battery.
12) Adjust ignition timing.
    Refer to Section 6F for adjustment.

CAUTION:

- **Don't turn camshaft or start engine (i.e., valves should not be operated) for about half an hour after reinstalling hydraulic valve lash adjusters and camshaft. 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 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 should 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 6 of them, check as follows.
  1) **Stop engine and remove cylinder head cover.**
  2) **Push adjuster downward by hand (with less than 15 kg or 33 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

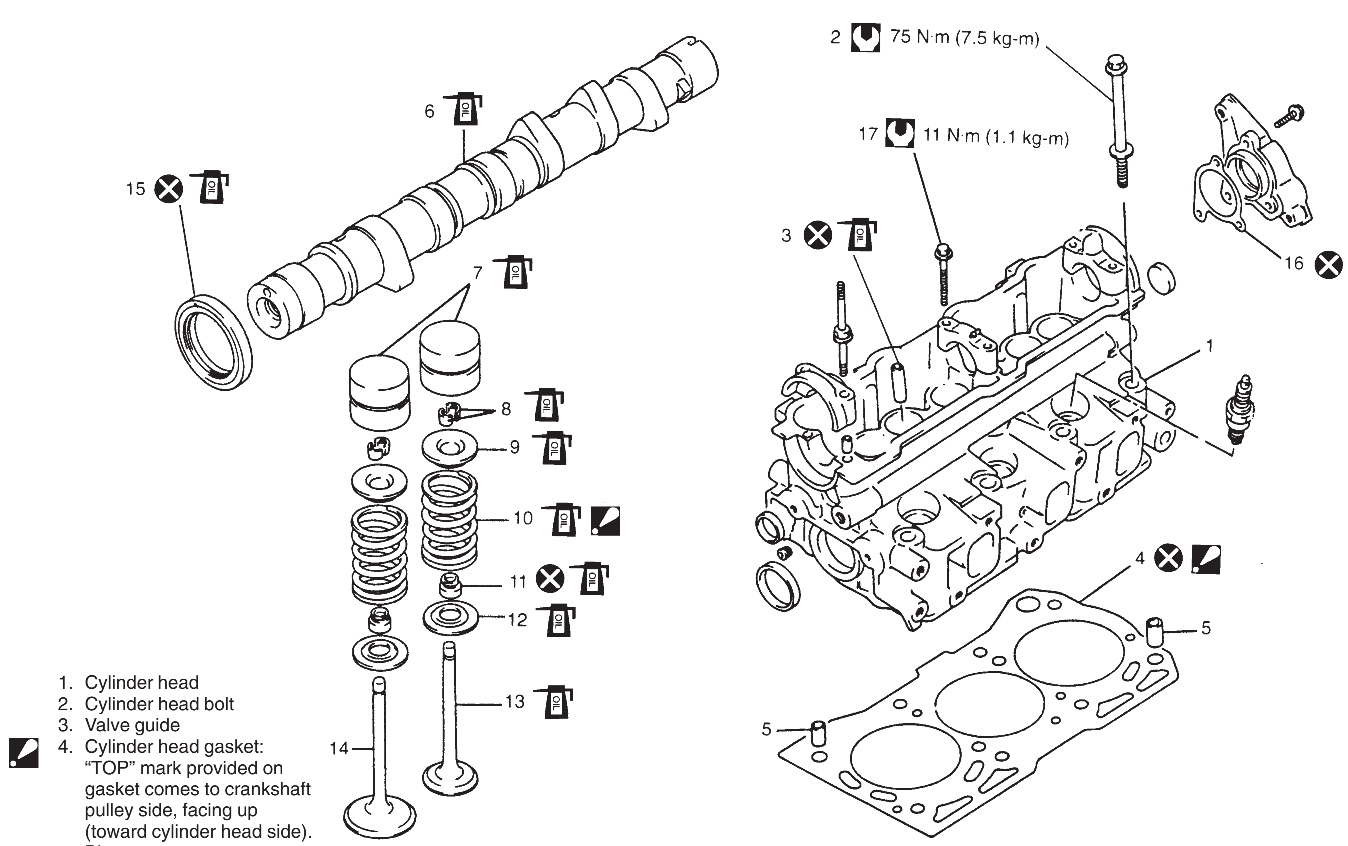
In case of the followings, valve lash adjuster noise may be caused by air trapped into valve lash adjusters.

- 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.

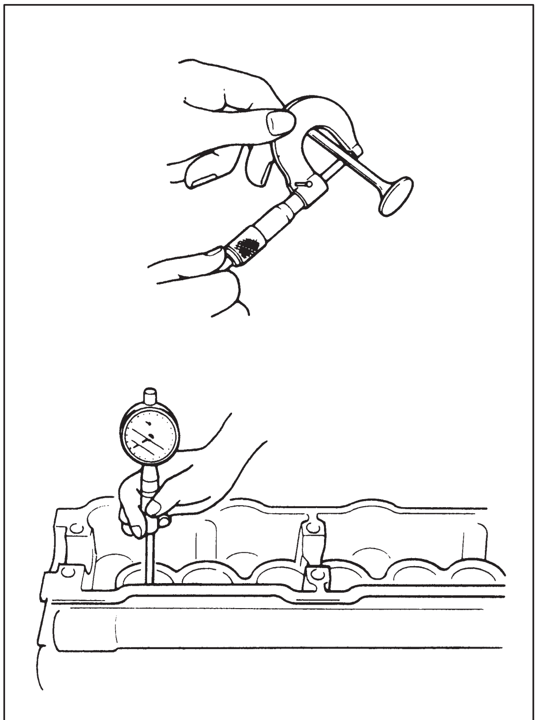
1) Check engine oil for the followings.
   - Oil level in oil pan
     If oil level is low, add oil up to Full level hole on oil level gauge.
   - Oil quality
     If oil is discolored, or deteriorated, change it.
     For particular oil to be used, refer to Section 0B.
   - Oil leaks
     If leak is 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 16 of them, check as follows.
   a) Stop engine and remove cylinder head cover.
   b) 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 head
2. Cylinder head bolt
3. Valve guide
4. Cylinder head gasket: "TOP" mark provided on gasket comes to crankshaft pulley side, facing up (toward cylinder head side).
5. Pin
6. Camshaft
7. Valve lash adjuster
8. Valve cotters
9. Valve spring retainer
10. Valve spring: Be sure to position spring in place with its bottom end (small-pitched) facing the bottom (valve spring seat side).
11. Valve stem seal
12. Valve spring seat
13. Exhaust valve
14. Intake valve
15. Oil seal
16. Gasket
17. Camshaft housing bolt

: Apply engine oil to sliding surfaces of each part.
: Tightening Torque
: Do not reuse

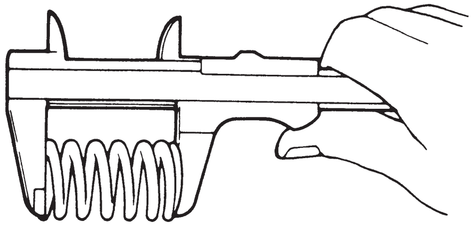


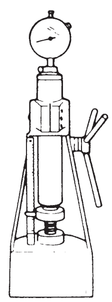
INSPECTION

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	5.457 – 5.480 mm (0.2148 – 0.2157 in.)	———
	Ex	5.440 – 5.455 mm (0.2142 – 0.2148 in.)	———
Valve guide I.D.	In & Ex	5.500 – 5.512 mm (0.2165 – 0.2170 in.)	———
Stem-to-guide clearance	In	0.020 – 0.055 mm (0.0008 – 0.0021 in.)	0.07 mm (0.0027 in.)
	Ex	0.045 – 0.072 mm (0.0018 – 0.0028 in.)	0.09 mm (0.0035 in.)

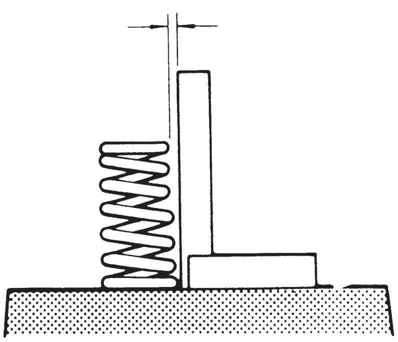




Valve Springs

- 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.

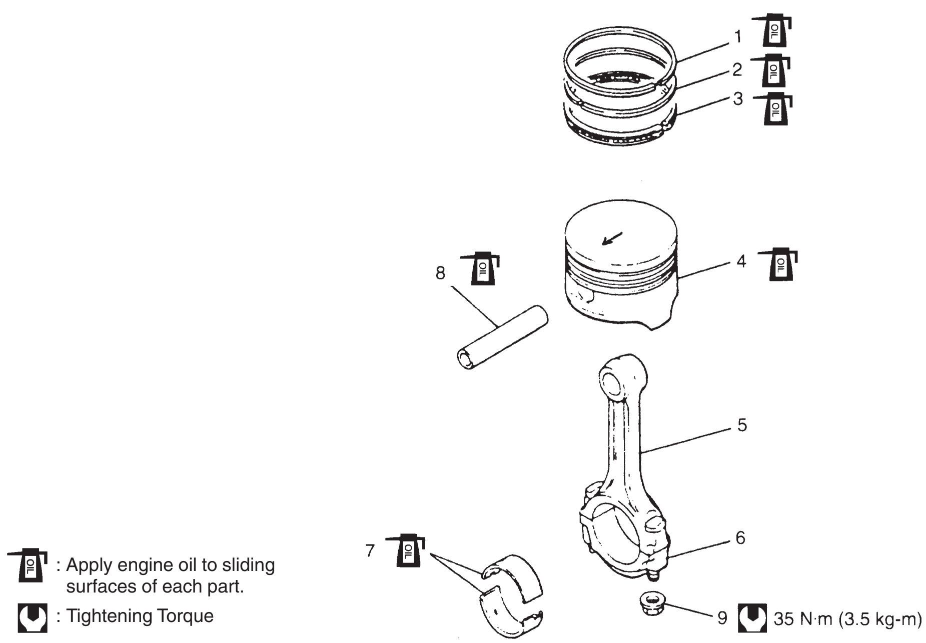
Item	Standard	Limit
Valve spring free length	42.29 mm (1.6649 in.)	41.0 mm 1.6142 in.)
Valve spring preload	209 – 235 N (20.9 – 23.5 kg) at 32.6 mm (46.1 – 51.8 lb at 1.28 in.)	187 N (18.7 kg) at 32.6 mm (41.2 lb at 1.28 in.)



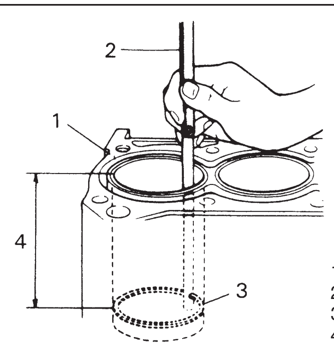
- Spring squareness:
  Use a square and surface plate to check each spring for squareness in terms of clearance between end of valve spring and square. Valve spring found to exhibit a larger clearance than limit must be replaced.

Valve spring squareness limit.	2.0 mm (0.079 in.)

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. Connecting rod nut



1. Cylinder block
2. Feeler gauge
3. Piston ring
4. 120 mm (4.72 in.)

INSPECTION

Piston Rings

To measure end gap, insert piston ring into cylinder bore as shown in figure and then measure gap by using thickness gauge.
If measured gap is out of specification, replace ring.

NOTE:
Decarbon and clean the top of cylinder bore before inserting piston ring.

Item		Standard	Limit
Piston ring end gap	Top ring	0.15 – 0.30 mm (0.0059 – 0.0118 in.)	0.7 mm (0.0275 in.)
	2nd ring	0.20 – 0.35 mm (0.0079 – 0.0138 in.)	0.7 mm (0.0275 in.)
	Oil ring	0.20 – 0.60 mm (0.0079 – 0.0236 in.)	1.8 mm (0.0708 in.)

UNIT REPAIR OVERHAUL

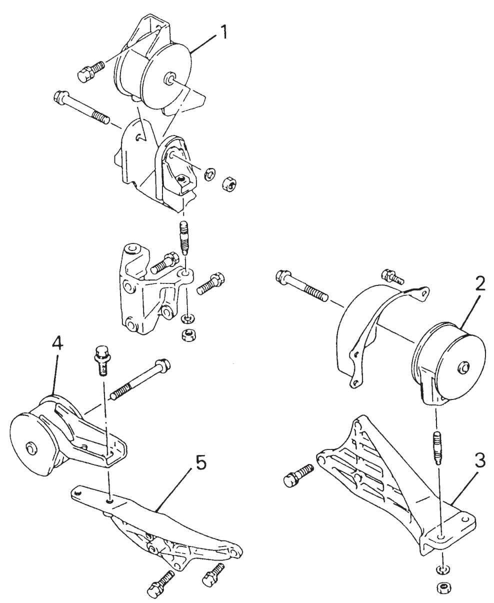
ENGINE ASSEMBLY

REMOVAL

1) Relieve fuel pressure according to procedure described in “FUEL PRESSURE RELIEF PROCEDURE” of Section 6.
2) Remove engine hood after disconnecting front window washer hose.
3) Disconnect battery cables at battery and remove battery and its tray.
4) Drain cooling system.
5) Remove air cleaner assembly.
6) Remove radiator with cooling fan. Refer to Section 6B for removal.
7) Disconnect the following electric wire harness.
   - High-tension cord from ignition coil
   - Distributor
   - EGR valve
   - ECT sensor
   - ISC actuator
   - Ground wire harness from intake manifold
   - TP sensor
   - Fuel injector
   - Oil pressure gauge
   - A/C compressor pressure switch (if equipped)
   - Heated oxygen sensor
   - Generator
   - Starter
   - Back-up light switch (For M/T model)
   - Battery negative cable from transmission
   - Shift switch of A/T (For A/T model)
   - Direct clutch and 2nd brake solenoids of A/T (For A/T model)
   - Vehicle speed sensor on A/T (For A/T model)

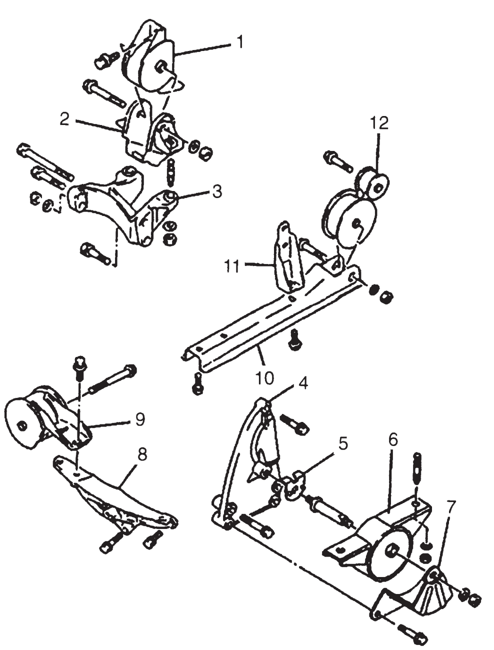
   And release above wire harness from clamps.
8) Disconnect the following vacuum hose.
   - Brake booster hose from intake manifold.
   - Canister purge hose from EVAP canister purge valve.
   - Pressure sensor hose from intake manifold.
9) Disconnect fuel return hose and fuel feed hose from fuel feed and return pipes.
10) Disconnect heater inlet and outlet hoses.

For M/T model



1. Rear mounting
2. Left mounting
3. Left mounting bracket
4. Right mounting
5. Right mounting bracket

For A/T model

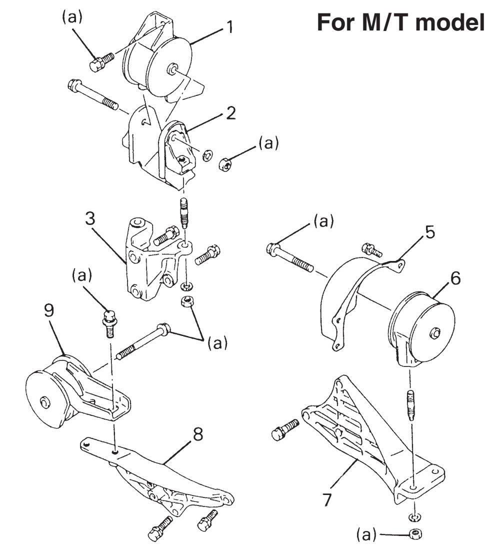


1. Rear mounting
2. Rear mounting No.2 bracket
3. Rear mounting No.1 bracket
4. Left mounting No.1 bracket
5. Stopper
6. Left mounting
7. Left mounting No.2 bracket
8. Right mounting bracket
9. Right mounting
10. Torque rod bracket
11. Stiffener
12. Torque rod

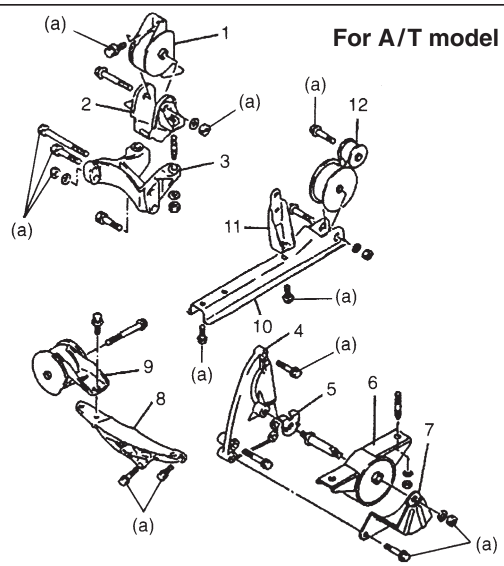
11) Disconnect the following cables.
    - Accelerator cable from throttle body.
    - Clutch cable from transmission. (For M/T model)
    - Gear select cable and oil pressure control cable from transmission. (For A/T model)
    - Speedometer cable from transmission.
12) Hoist vehicle.
13) Remove fender apron extensions.
14) Remove exhaust pipe from exhaust manifold (or WU-TWC).
15) Remove gear shift control shaft from transmission and remove extension rod. (For M/T model)
16) Drain engine oil and transmission oil.
17) Remove drive shaft joints from differential gears of transmission.
    Refer to Section 4 (DRIVE SHAFT) for procedure to disconnect drive shaft joints.
    For engine and transmission removal, it is not necessary to remove drive shafts from steering knuckle.
18) Remove A/C compressor (if equipped) from compressor bracket with hose still attached.

    NOTE:
    Suspend removed A/C compressor at a place where no damage will be caused during removal/installation of engine with transmission.

19) Remove engine rear torque rod bracket from transmission. (For A/T model)
20) Lower vehicle.
21) Install lifting device.
22) Remove rear mounting from body.
23) Remove left side engine mounting and bracket. (For M/T model)
    Remove left mounting from body. (For A/T model)
24) Remove right side engine mounting from its bracket.
25) Before removing engine with transmission, recheck to make sure all hoses, electric wires and cables are disconnected from engine and transmission.
26) Remove engine with transmission from body.



1. Rear mounting
2. Rear mounting No.2 bracket
3. Rear mounting No.1 bracket
4. Rear mounting bracket
5. Left mounting body bracket
6. Left mounting
7. Left mounting bracket
8. Right mounting bracket
9. Right mounting



1. Rear mounting
2. Rear mounting No.2 bracket
3. Rear mounting No.1 bracket
4. Left mounting No.1 bracket
5. Stopper
6. Left mounting
7. Left mounting No.2 bracket
8. Right mounting bracket
9. Right mounting
10. Torque rod bracket
11. Stiffener
12. Torque rod

INSTALLATION

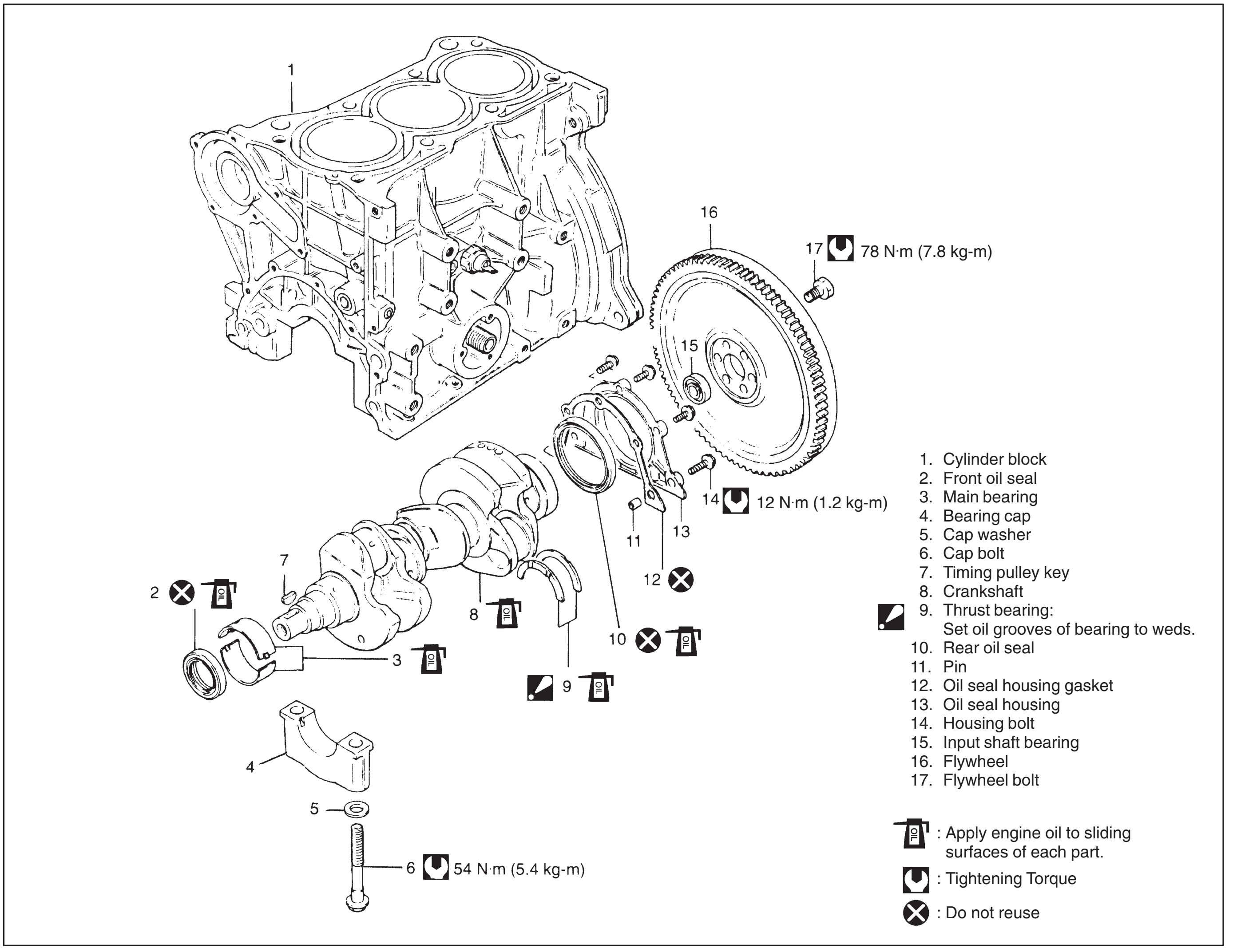
1) Lift engine with transmission into engine compartment, but do not remove lifting device.
2) Install right side engine mounting to its bracket.
3) Install left side engine mounting and its bracket.
4) Install rear mounting to body.
5) Tighten bolts and nuts of all parts installed in above steps 2), 3) and 4) to specified torque.

Tightening Torque
(a): 55 N·m (5.5 kg-m, 40.0 lb-ft)

Tightening Torque
(a): 55 N·m (5.5 kg-m, 40.0 lb-ft)

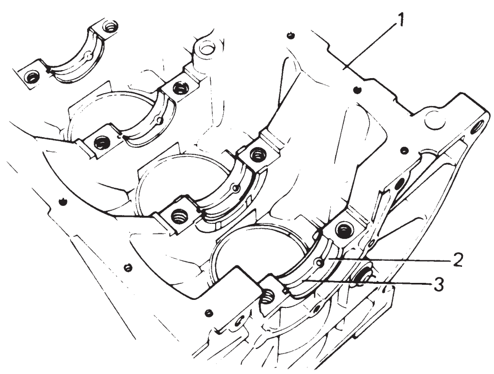
6) Remove lifting device.
7) Reverse removal procedures for installation of remainder.
   - Push in each drive shaft joint fully so that snap ring engages with differential gear or center bearing support.
     Use care not to damage oil seal lip when inserting.
   - Clamp electric wires securely.
8) Adjust clutch pedal free travel referring to Section 7C. (For M/T model)
   Adjust gear select cable and oil pressure control cable referring to Section 7B. (For A/T model)
9) Adjust gear shift control lever referring to Section 7A. (For M/T model)
10) Refill transmission with gear oil. (A/T fluid for A/T model) referring to Section 0B.
11) Refill engine with engine oil referring to Section 0B.
12) Refill cooling system referring to Section 6B.
13) Adjust A/C compressor drive belt referring to Section 0B. (if equipped)
14) Upon completion of installation, verify that there is no fuel leakage, coolant leakage, transmission oil leakage or exhaust gas leakage at each connection.
15) Adjust accelerator cable play referring to Section 6E.

MAIN BEARINGS, CRANKSHAFT AND CYLINDER BLOCK



REMOVAL

1) Remove engine with transmission from body as previously outlined.
2) Remove transmission from engine, and then remove clutch and flywheel (drive plate for A/T).
3) Remove water pump belt, generator bracket, crankshaft pulley, timing belt, and crankshaft timing belt pulley etc.
4) Remove cylinder head assembly.
5) Remove oil pan and oil pump strainer.
6) Remove pistons and connecting rods.
7) Remove oil pump and oil seal housing.
8) Remove main bearing caps and crankshaft.



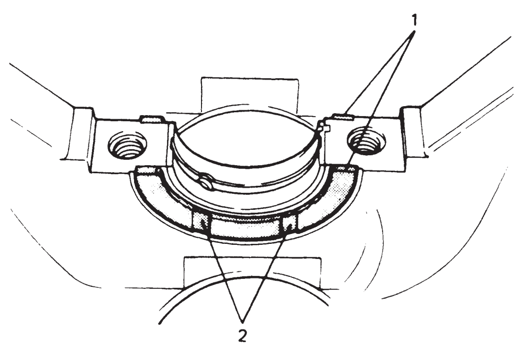
2.Upper half of bearing

INSTALLATION

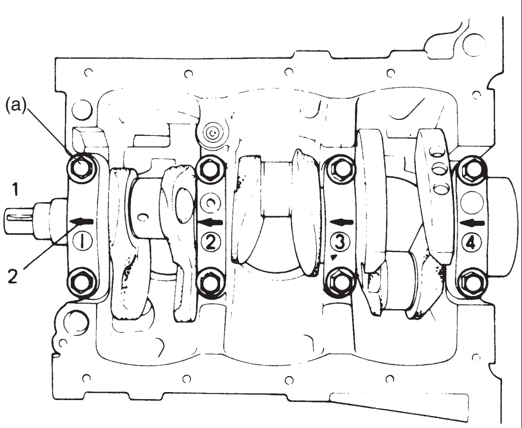
NOTE:

- **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 combination and try to see that each part goes back to where it came from, when installing.**

1) Fit main bearings to cylinder block (1).
   Among two halves of main bearing, one halt has oil groove (3). Install this half with oil groove to cylinder block, and another half without oil groove to bearing cap.
   Make sure that two halves are painted in the same color.



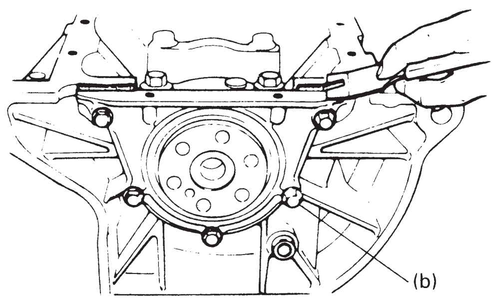
2) Fit thrust bearings (1) to cylinder block between No.2 and No.3 cylinders. Face oil groove (2) sides to crank webs.



3) Put crankshaft on cylinder block.
4) Fit bearing caps sequentially in ascending order, 1, 2, 3 and 4, starting from pulley side. Be sure to point arrow mark (2) (on each cap) to crankshaft pulley side (1).
   Gradual and uniform tightening is important for bearing cap bolts. Make sure that four caps become tight equally and progressively till specified torque is attained.

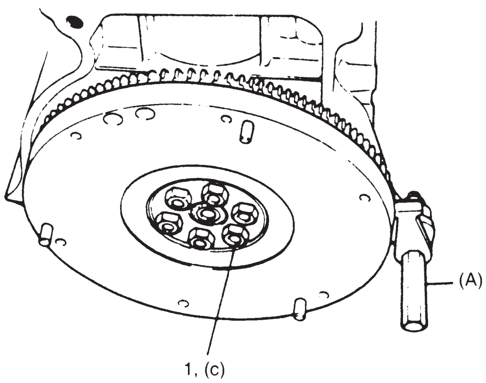
   Tightening Torque
   (a): 53 N·m (5.3 kg-m, 38.5 lb-ft)

   NOTE:
   After tightening cap bolts, check to be sure that crankshaft rotates smoothly when turned by hand.



5) Install oil seal housing and its gasket.
   Install new gasket. Do not reuse gasket removed in disassembly. Oil lip portion of oil seal before installing. Tighten housing bolts to specification.
   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.

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

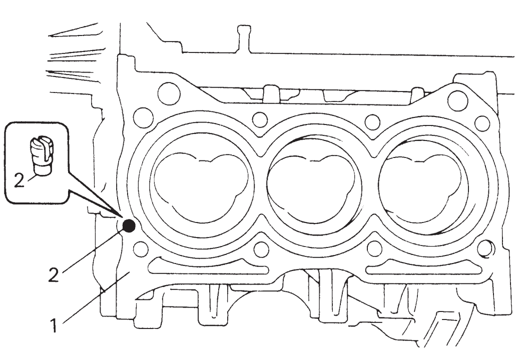


6) Install oil pump.
   Refer to item "Oil pump" for installation of oil pump.
7) Install flywheel (M/T model) or drive plate (A/T model).
   Using special tool, lock flywheel and torque its bolts (1) to specification.

   Special Tool
   (A): 09924-17810

   Tightening Torque
   (c): 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.

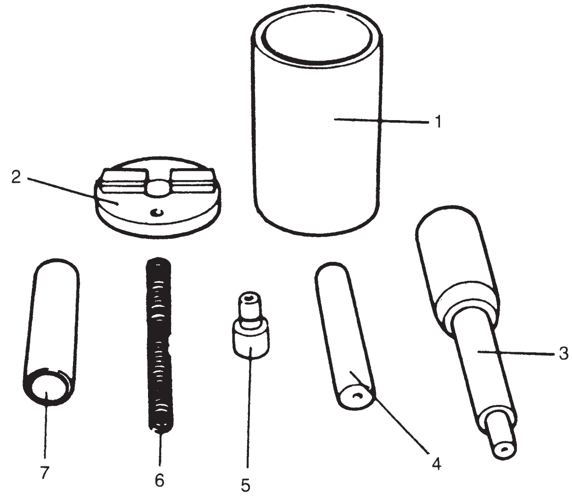


10) Install cylinder head assembly to cylinder block (1).
    Before installing cylinder head assembly to cylinder block, install check valve (2) into oil gallery in cylinder block, directing slit of valve toward top of cylinder block.

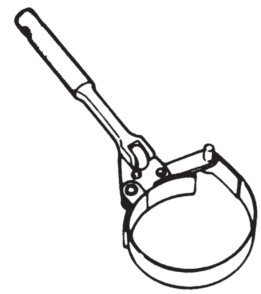
    NOTE:
    Tighten cylinder head bolts to specified torque as previously outlined.
    Whenever installing cylinder head to new cylinder block, use following procedure to tighten cylinder head bolts.
    - **Tighten cylinder head bolts to specified torque as previously outlined and loosen them once till tightening torque becomes "zero". And then torque them to specification again.**

11) Install crankshaft timing belt pulley, timing belt, crankshaft pulley, water pump pulley, etc., as previously outlined.
12) Install clutch to flywheel (M/T model).
    For clutch installation, refer to Section 7C.
13) Install engine with transmission to body as previously outlined.

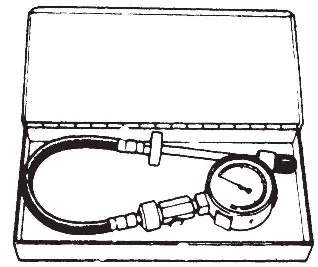
SPECIAL TOOLS



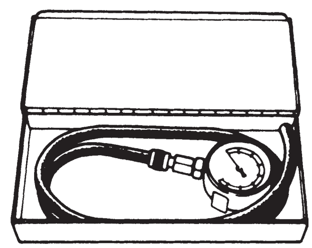
09910-38211
Piston pin remover and installer
1. Base
2. Base cap
3. Driver handle
4. Piston pin guide for installation
5. Piston pin guide for removal
6. Spring
7. Spring guide



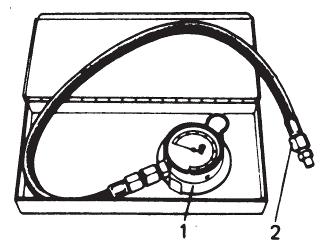
09915-47310
Oil filter wrench



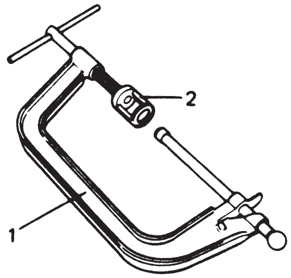
09915-64512
Compression gauge



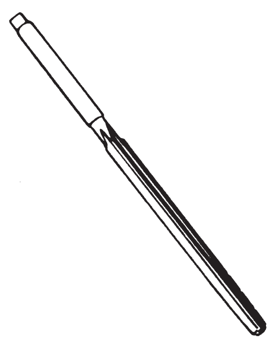
09915-67311
Vacuum gauge



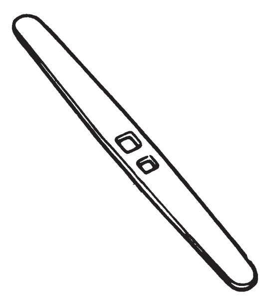
1. 09915-77311
   Oil pressure gauge
2. 09915-78211
   Oil pressure gauge attachment



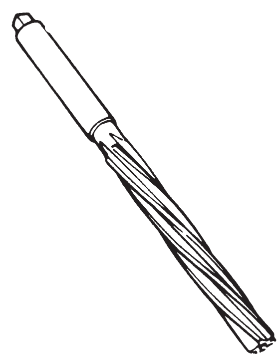
1. 09916-14510
   Valve lifter
2. 09916-14910
   Valve lifter attachment



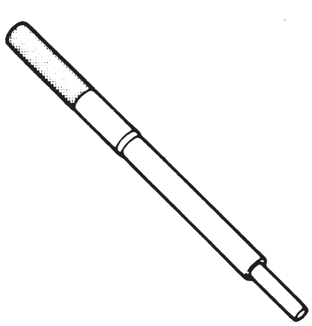
09916-34550
Reamer (5.5 mm)



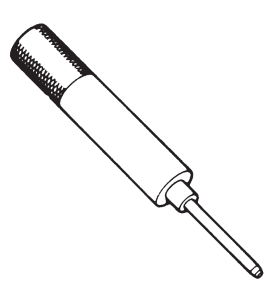
09916-34542
Reamer handle



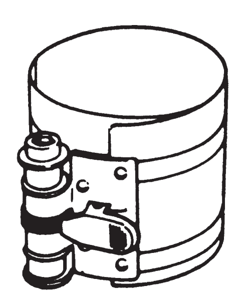
09916-38210
Reamer (11 mm)



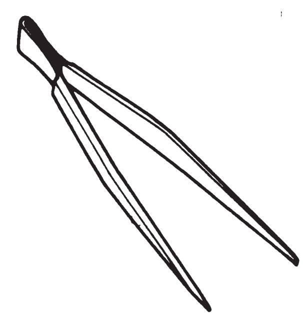
09916-44910
Valve guide remover



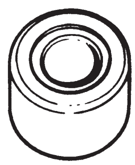
09916-58210
Valve guide installer handle



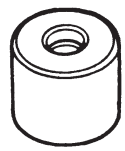
09916-77310
Piston ring compressor



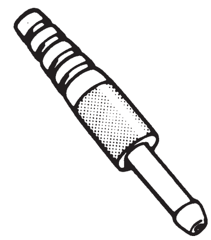
09916-84511
Forceps



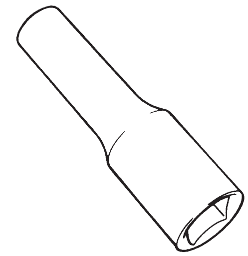
09916-56011
Valve guide installer



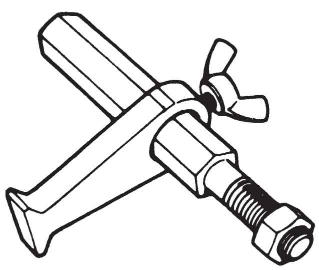
09917-98221
Valve stem seal installer



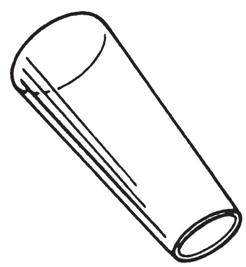
09918-08210
Vacuum gauge hose joint



09919-16010
Deep socket



09924-17810
Flywheel holder



09926-18210
Oil seal guide (Vinyl resin)

REQUIRED SERVICE MATERIALS

MATERIALS	RECOMMENDED SUZUKI PRODUCT	USE
Sealant	SUZUKI BOND NO. 1207C (99000-31150)	● Mating surfaces of cylinder block and oil pan.
	SUZUKI BOND NO. 1215 (99000-31110)	● Mating surfaces of camshaft housings (No.1 & No.3) and cylinder head.

SECTION 6A1

ENGINE MECHANICAL (G13B, 1-CAM 16-VALVES ENGINE)

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).**

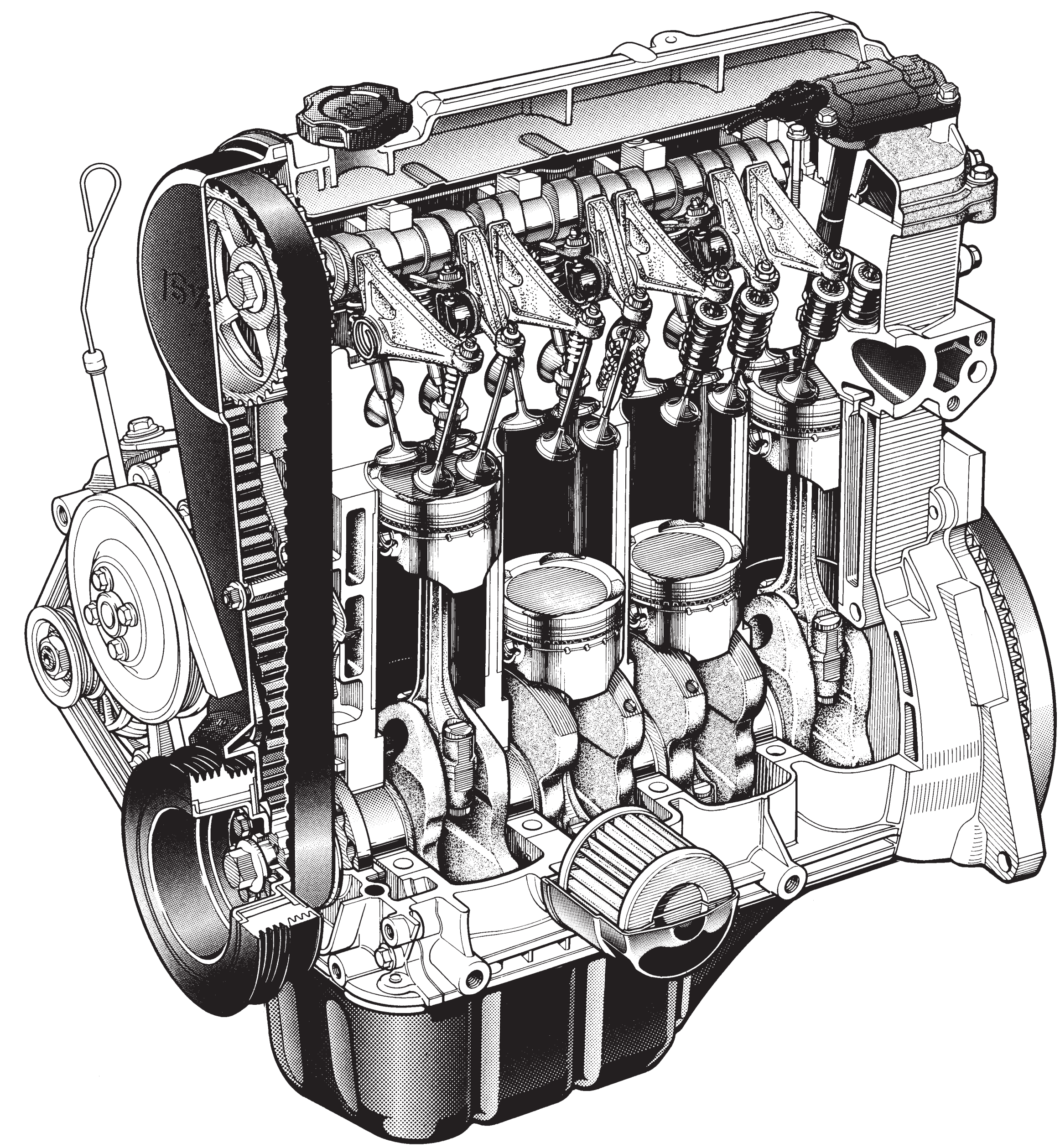
CONTENTS

NOTE:
For what each abbreviation stands for (i.e., full term), refer to SECTION 0A.

GENERAL DESCRIPTION

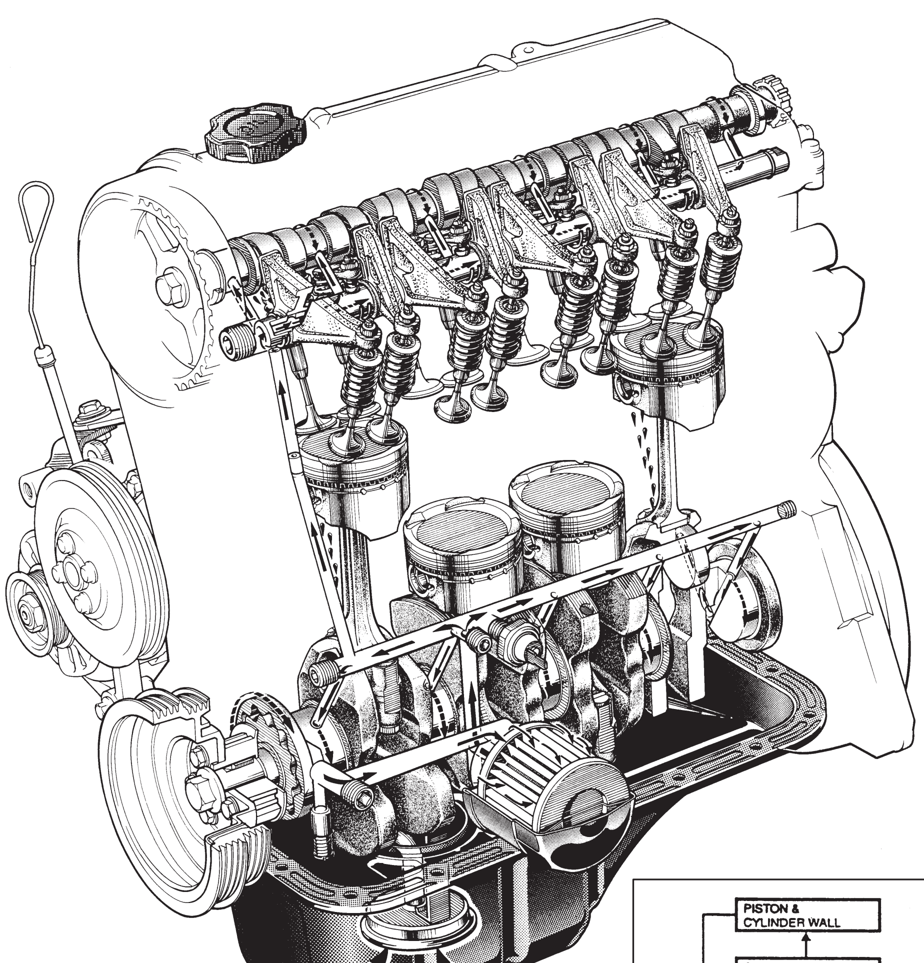
ENGINE

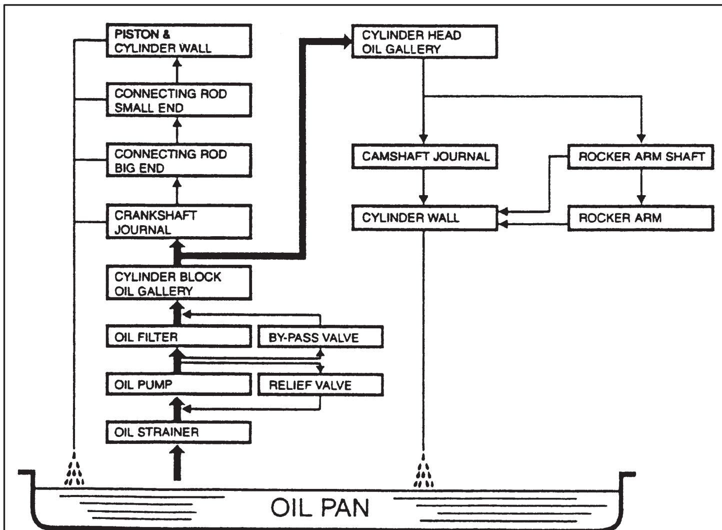
The engine is a water-cooled, in line 4 cylinders, 4 stroke cycle gasoline unit equipped with its S.O.H.C. (Single Overhead Camshaft) valve mechanism arranged for "V"-type valve configuration and 16 valves (IN 2 and EX 2/one cylinder).
The single overhead camshaft is mounted over the cylinder head: it 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/cm², 56.9 psi). Relieved oil drains back to oil pan.





CYLINDER BLOCK

The cylinder block is made of cast aluminum alloy and has 4 cylinders arranged “In-Line”. A cylindrical cast iron sleeve is installed in each cylinder.

CRANKSHAFT AND MAIN BEARINGS

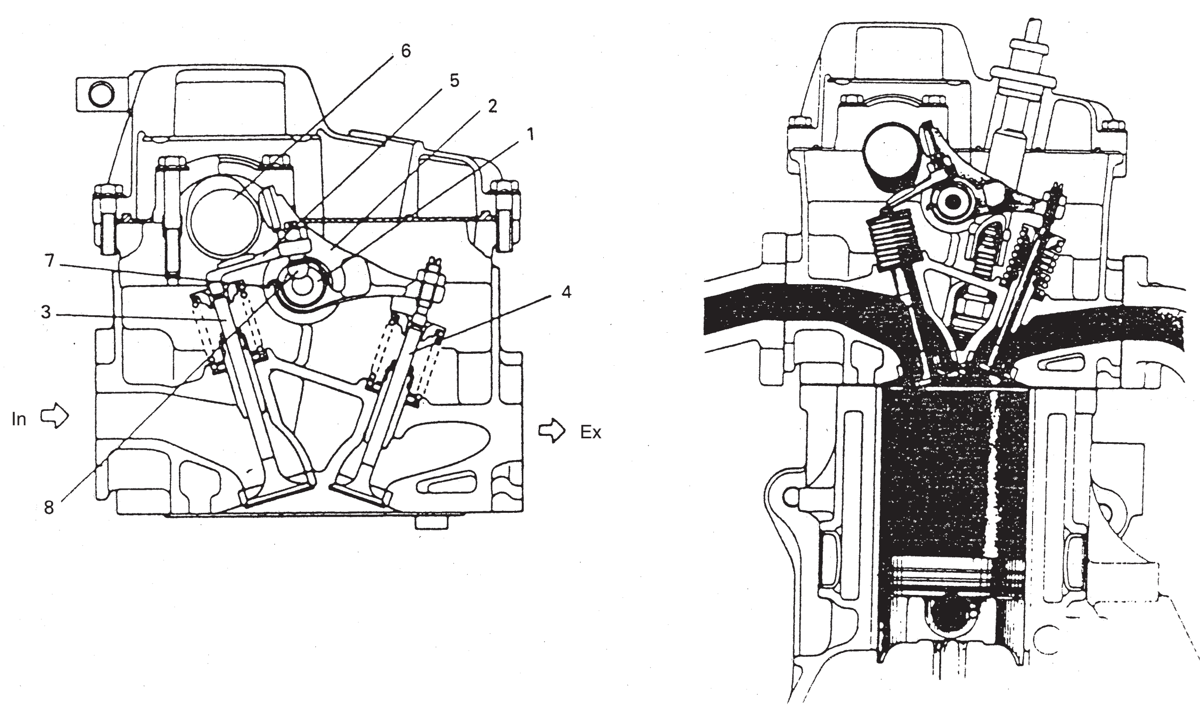
A monoblock casting crankshaft is supported by 5 main bearings which are of precision insert type. Four crank pins on the crankshaft are positioned 180° apart.

PISTONS, RINGS, PISTON PINS AND CONNECTING RODS

The piston is cast aluminum alloy, and has two compression rings and one oil ring.
Among two compression rings (top and 2nd rings), the outer surface of the top ring is treated with hard chromium for improvement in abrasion resistance.
The oil ring consists of two rails and one spacer. The piston pin is offset 0.5 mm towards the major thrust side.
This allows a gradual change in thrust pressure against the cylinder wall as the piston travels its path. Pins, made of chromium steel, have a floating fit in the pistons and in the connecting rods. The connecting rods are made of forged steel, and the rod bearings are of precision insert type.

CYLINDER HEAD AND VALVE TRAIN

The cylinder head is made of aluminum casting. The supporting part of the camshaft is an independent cap type. The combustion chamber has 4 valves and uses the center plug type pent roof shape for higher intake and exhaust efficiency.
As the intake side rocker arm is end pivot type, it swings according to the camshaft movement to open and close the intake valve.
On the other hand, the exhaust side rocker arm is seesaw type. It swings with the rocker arm shaft as its supporting point and according to the camshaft movement to open and close the exhaust valve.



1. Rocker arm shaft
2. Rocker arm (EX)
3. Intake valve
4. Exhaust valve
5. Rocker arm (IN)
6. Camshaft
7. Clip
8. Pivot

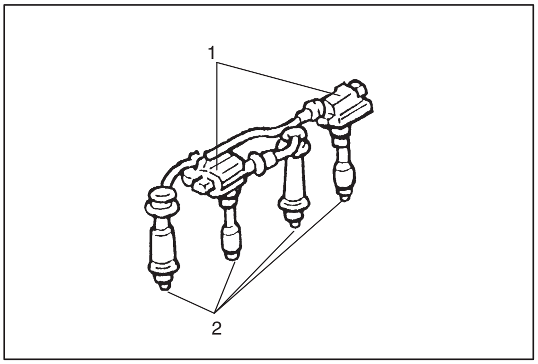
ON-VEHICLE SERVICE

COMPRESSION CHECK

Check compression pressure on all four cylinders as follows:

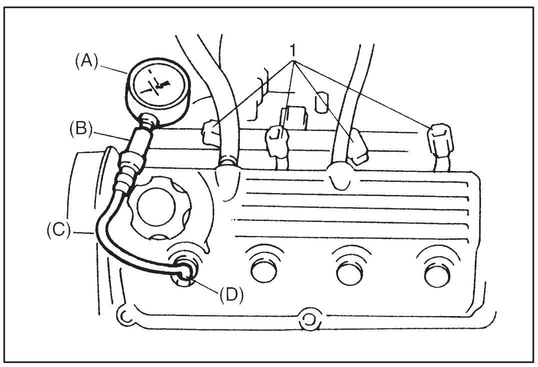
1) Warm up engine.
2) Stop engine after warming up.

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.



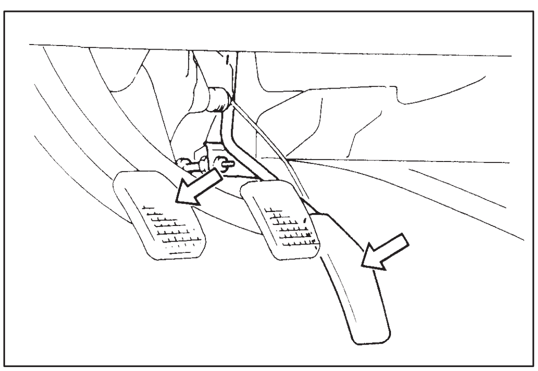
3) Remove ignition coil assemblies (1) and all spark plugs (2) referring to Section 6F.

WARNING:
Failure in disconnecting couplers from ignition coil assemblies can cause spark to occur in engine room possibly resulting in a dangerous explosion.



4) Disconnect fuel injector wire harness at couplers (2).
5) Install special tools (Compression gauge) into spark plug hole.

Special Tool
(A): 09915-64510-001
(B): 09915-64510-002
(C): 09915-64530
(D): 09915-67010



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.

	Compression pressure
Standard	1400 kPa (14.0 kg/cm^2, 199.0 psi)
Limit	1100 kPa (11.0 kg/cm^2, 156.4 psi)
Max. difference between any two cylinders	100 kPa (1.0 kg/cm^2, 14.2 psi)

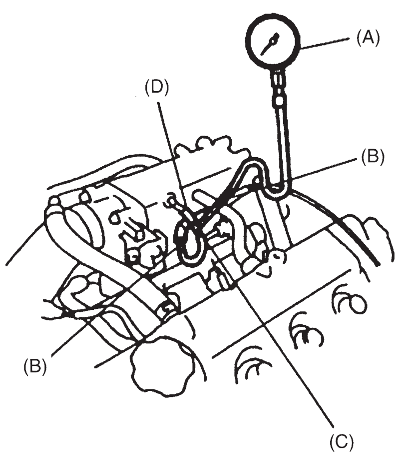
8) Carry out steps 5) through 7) on each cylinder to obtain four readings.
9) After checking, connect couplers to fuel injectors securely and install spark plugs and ignition coil assemblies.

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 EVAP canister purge valve hose from intake manifold and connect 3-way joint, hoses and special tools (vacuum gauge and joint) between intake manifold and vacuum hose disconnected.

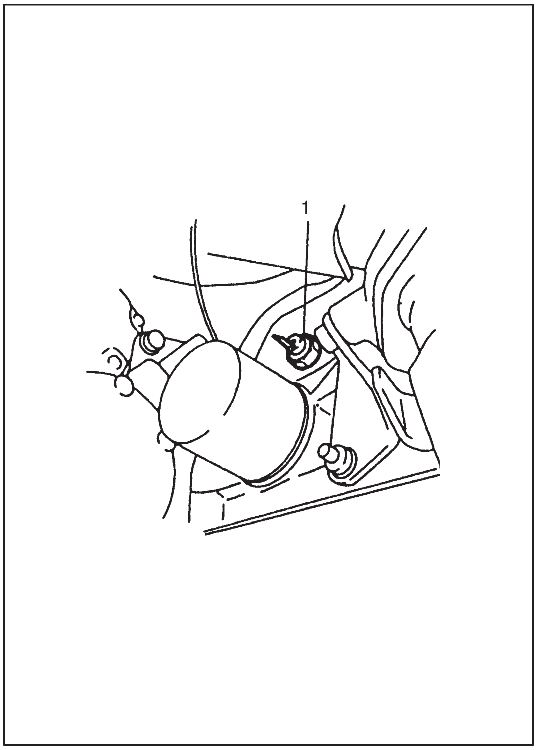
   Special Tool
   (A): 09915-67311
   (B): 09918-08210

   SUZUKI GENUINE PARTS
   (C): Hose 09343-03087
   (D): 3-way joint 09367-04002

3) Run engine at specified idle speed, and read vacuum gauge. Vacuum should be within the following specification.

   Vacuum specification (at sea level):
   52.6 – 65.8 kPa (40 – 50 cm·Hg, 15.7 – 19.7 in.Hg) at specified idling speed

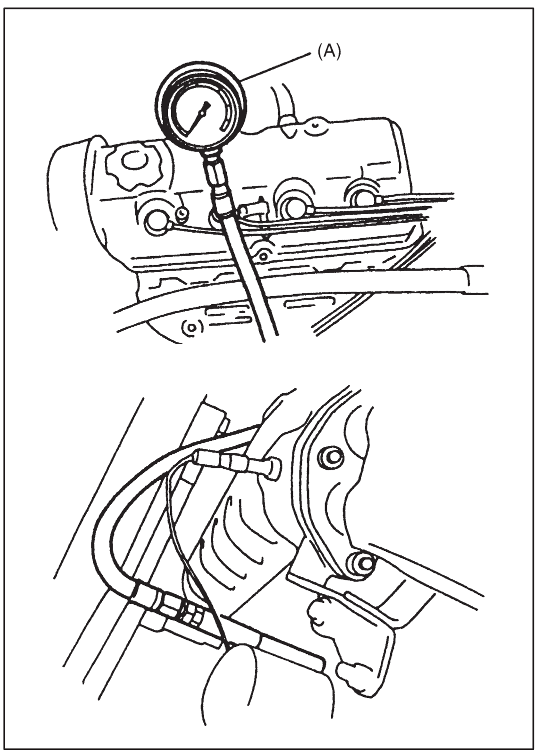
4) After checking, connect vacuum hose to intake surge tank.



OIL PRESSURE CHECK

NOTE:
Prior to checking oil pressure, check the following items.
- **Oil level in oil pan.**
  If oil level is low, add oil up to Full level mark 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 Section 0B.
- **Oil leaks.**
  If leak is found, repair it.

1) Remove oil pressure switch (1) from cylinder block.



2) Install special tool (Oil pressure gauge) to vacated threaded hole.

   Special Tool
   (A): 09915-77311

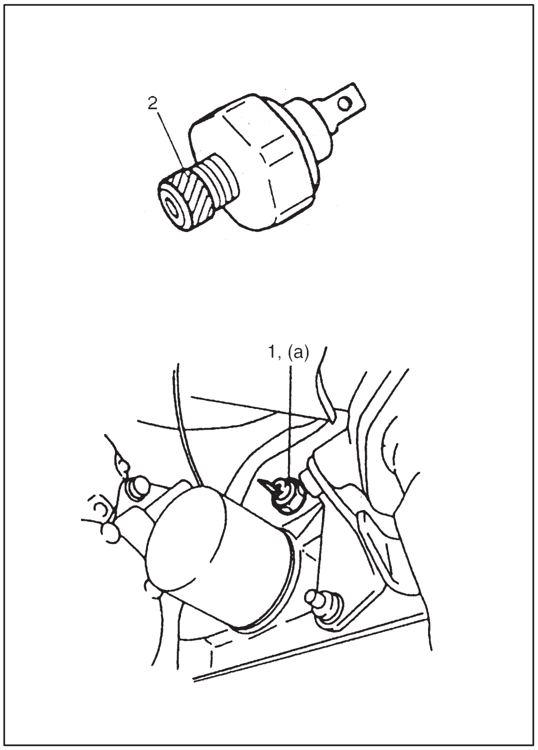
3) Start engine and warm it up to normal operating temperature.

   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:
   360 – 440 kPa (3.6 – 4.4 kg/cm^2, 51.2 – 62.6 psi) at 4,000 r/min (rpm)

5) Stop engine and remove oil pressure gauge.



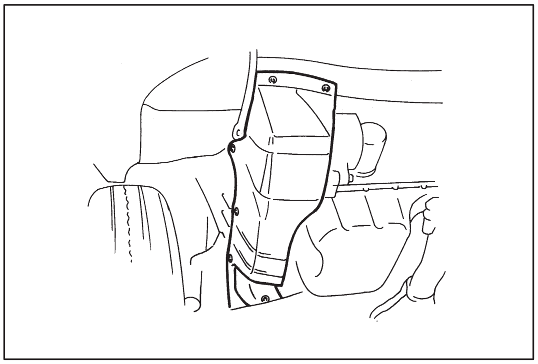
6) Before reinstalling oil pressure switch (1), be sure to wrap its screw threads with sealing tape (2) and tighten switch to specified torque.

NOTE:
If sealing tape edge is bulged out from screw threads of switch, cut it off.

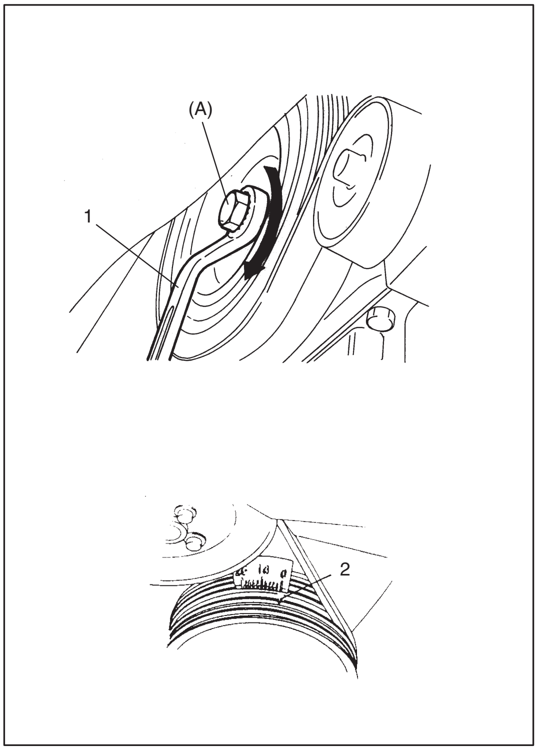
Tightening Torque
(a): 13 N·m (1.3 kg-m, 9.5 lb-ft)

7) Start engine and check oil pressure switch for oil leakage.

VALVE LASH (CLEARANCE)

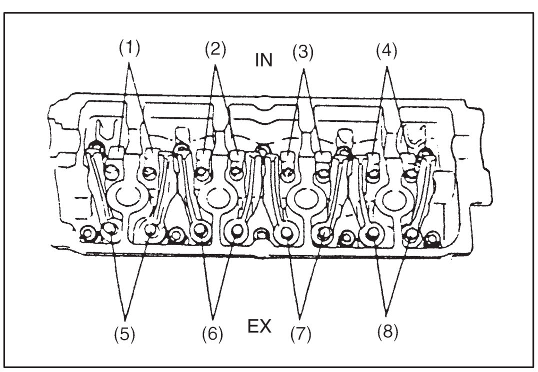


1) Remove negative cable at battery.
2) Remove cylinder head cover referring to item "Cylinder Head cover".
3) Remove engine under cover of right side from body.



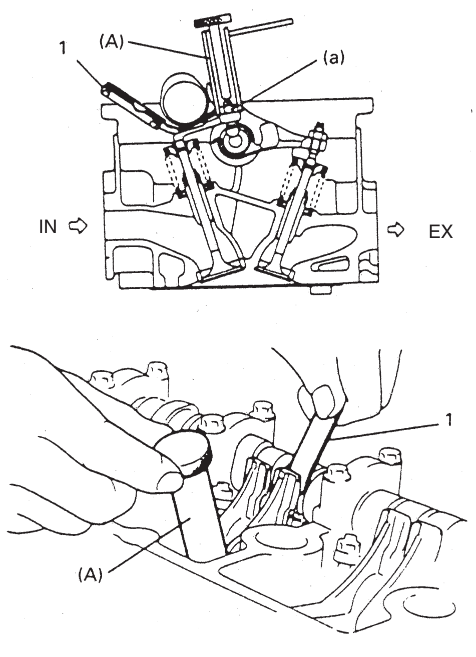
4) Using special tool and wrench (1), turn crankshaft pulley clockwise until "V" mark (2) (in white paint) on pulley aligns with "0" (zero) calibrated on timing belt cover.

   Special Tool
   (A): 09919-16020



5) See 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 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

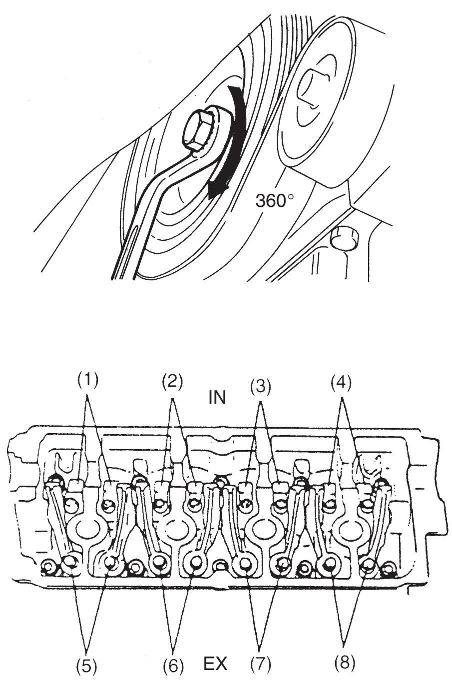
6) If valve lash is out of specification, adjust it to specification by turning adjusting screw after loosening lock nut.
   After adjustment, tighten lock nut to specified torque while holding adjusting screw stationary, and then make sure again that valve lash is within specification.

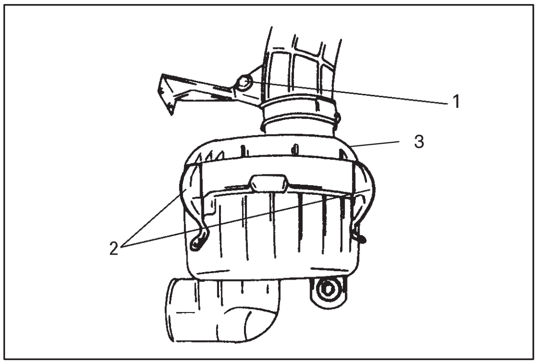
		When cold (Coolant temperature is 15 – 25°C or 59 – 77°F)	When hot (Coolant temperature is 60 – 68°C or 140 – 154°F)
Valve clearance specification	Intake	0.13 – 0.17 mm (0.005 – 0.007 in.)	0.18 – 0.22 mm (0.007 – 0.009 in.)
	Exhaust	0.23 – 0.27 mm (0.009 – 0.011 in.)	0.28 – 0.32 mm (0.011 – 0.013 in.)

Special Tool
(A): 09917-18211

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

7) 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.
8) After checking and adjusting all valves, reverse removal procedure for installation.





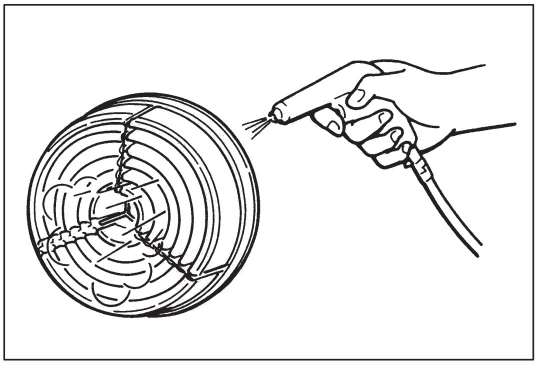
AIR CLEANER ELEMENT

REMOVAL

1) Disconnect air cleaner outlet hose from case after loosening its clamp (2) and removing bolt (1) shown in figure.
2) Remove air cleaner cap (3) from case by unhooking its clamps, then take out air cleaner element.

INSPECTION

Check air cleaner element for dirt. Replace excessively dirty element.

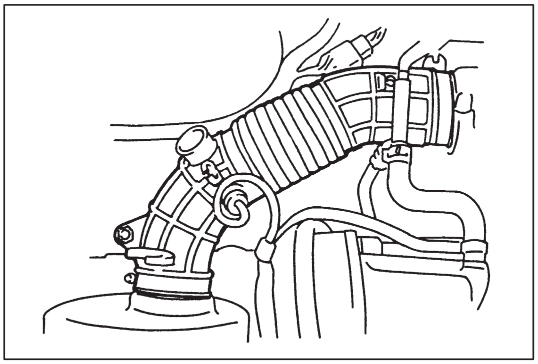


CLEAN

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

INSTALLATION

Reverse removal procedure for installation.



AIR CLEANER OUTLET HOSE

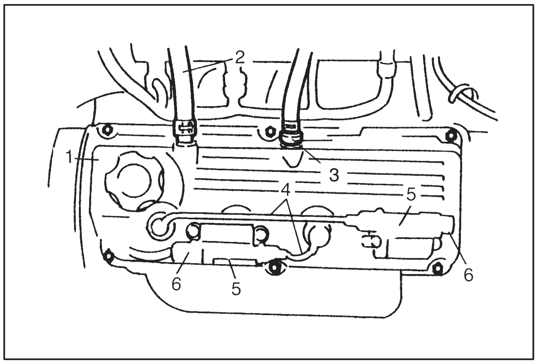
REMOVAL

1) Disconnect negative cable at battery.
2) Disconnect resonator after loosening its clamp.
3) Disconnect breather hose from air cleaner outlet hose.
4) Disconnect IAT sensor wire at coupler.
5) Remove bolt and then air cleaner outlet hose after loosening its clamps.

INSTALLATION

Reverse removal procedure for installation, noting the following.

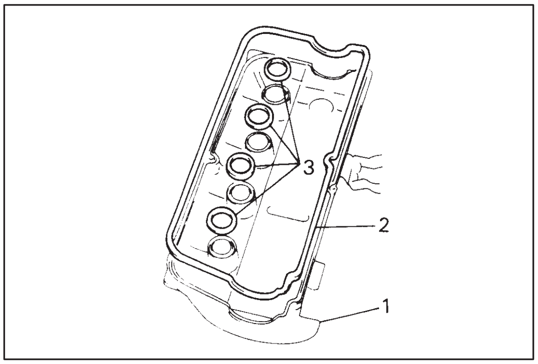
- Clamp each hose securely.



CYLINDER HEAD COVER

REMOVAL

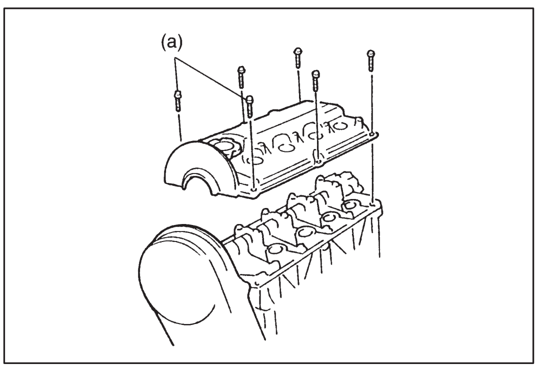
1) Disconnect negative cable at battery.
2) Disconnect breather hose (2) and PCV valve (3) from head cover.
3) Disconnect ignition coil couplers (6).
4) Remove ignition coil assemblies (5) with high-tension cord (4).
5) Remove cylinder head cover (1) with cylinder head cover gasket and O-rings.



INSTALLATION

1) Install O-rings (3) and cylinder head cover gasket (2) to cylinder head cover (1).

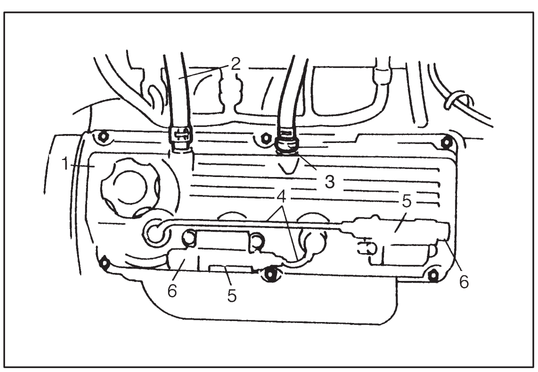
NOTE:
Be sure to check each of these parts for deterioration or any damage before installation and replace if found defective.



2) Install cylinder head cover to cylinder head and tighten cover bolts to specified torque.

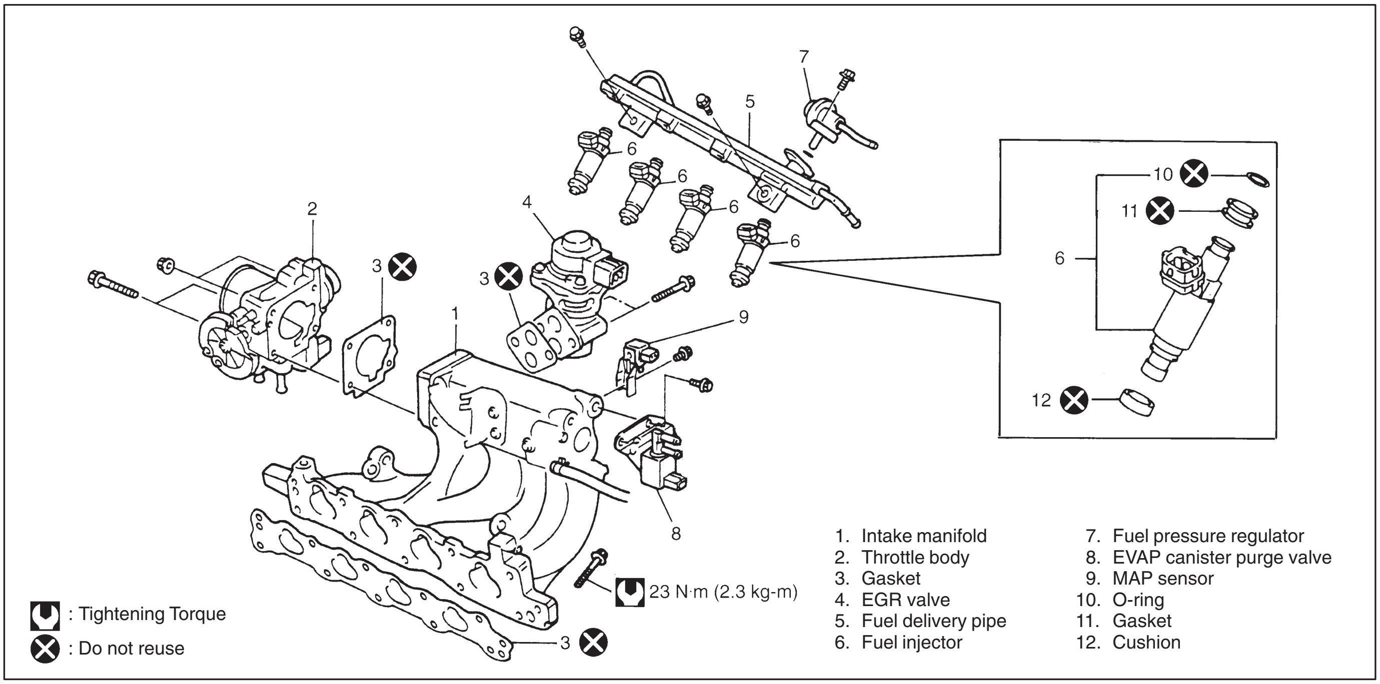
Tightening Torque
(a): 11 N·m (1.1 kg-m, 8.0 lb-ft)

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.



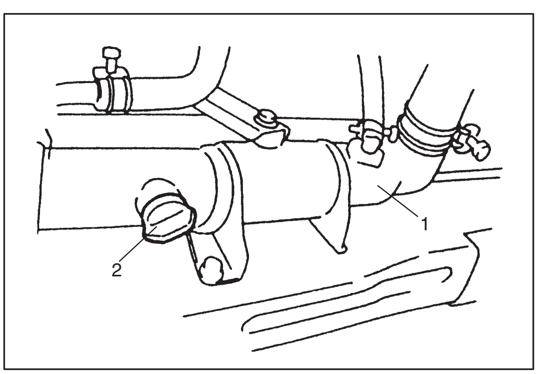
3) Install ignition coil assemblies (5) with high-tension cord (4).
4) Connect ignition coil couplers (6).
5) Connect breather hose (2) and PCV valve (3) to head cover (1).
6) Connect negative cable at battery.

THROTTLE BODY AND INTAKE MANIFOLD



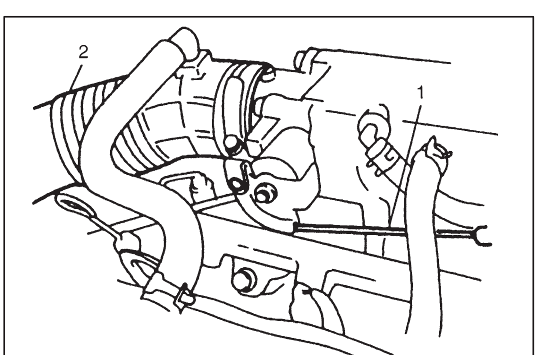
REMOVAL

1) Relieve fuel pressure according to procedure described in Section 6.
2) Disconnect negative cable at battery.

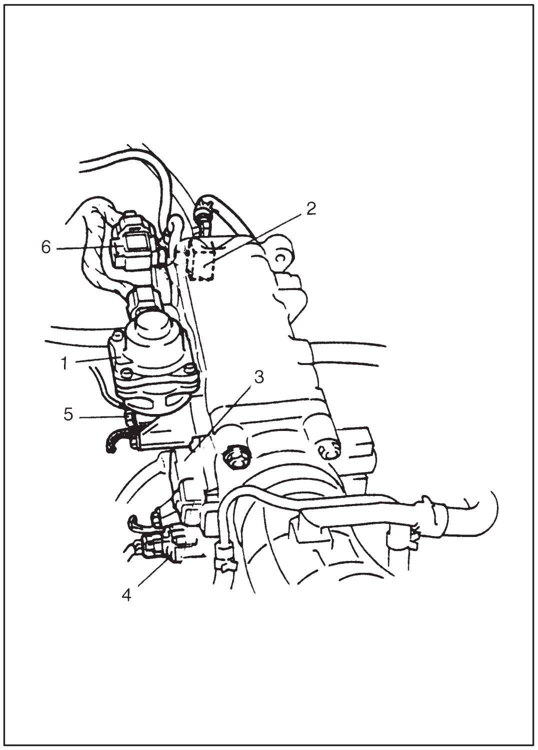


3) Drain cooling system.

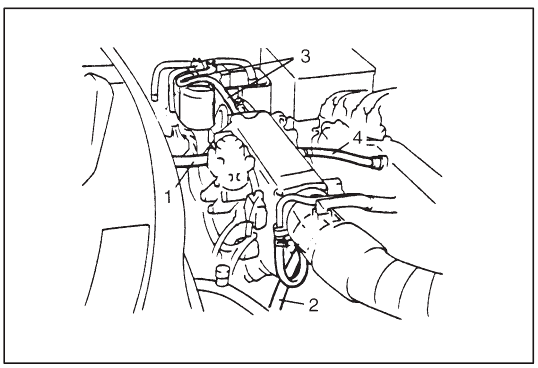
> **WARNING:**
> **To help avoid danger of being burned, do not remove drain plug (2) and radiator cap while engine and radiator (1) are still hot. Scalding fluid and steam can be blown out under pressure if plug and cap are taken off too soon.**



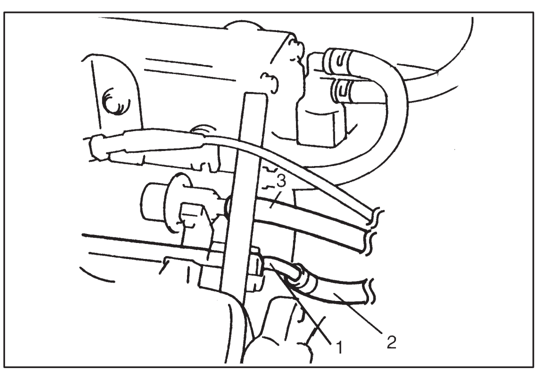
4) Disconnect IAT sensor at coupler.
5) Remove air cleaner outlet hose (2) with resonator.
6) Disconnect accelerator cable (1) from throttle body.



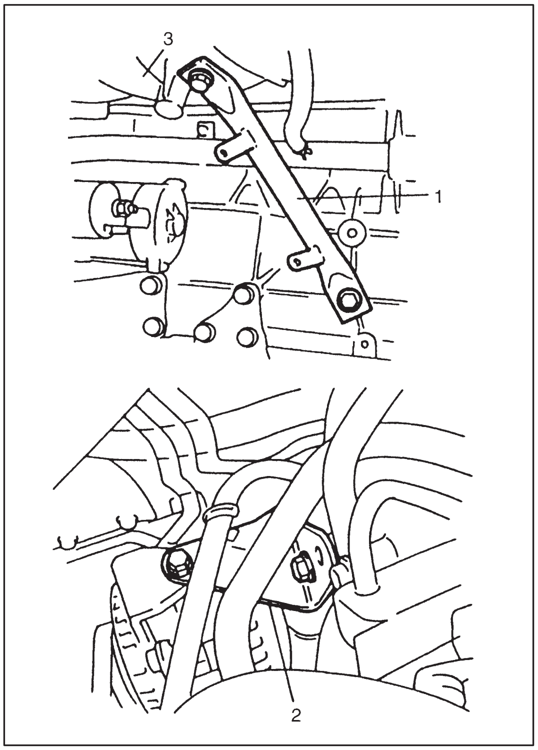
7) Disconnect the following electric lead wires and release clamp:
- Ground wires (5) from intake manifold
- TP sensor (3)
- IAC valve (4)
- Fuel injectors
- EVAP canister purge valve (2)
- MAP sensor (6)
- EGR valve (1)



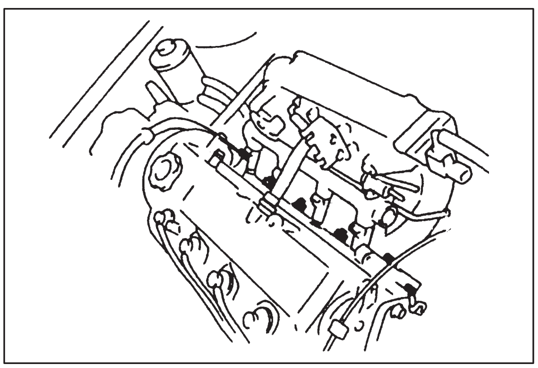
8) Disconnect the following hoses:
- Brake booster hose (1) from intake manifold
- Canister purge hose (3) from EVAP canister purge valve
- Engine cooling water (coolant) hose (2) from IAC valve
- PCV hose (4)
- Breather hose from cylinder head



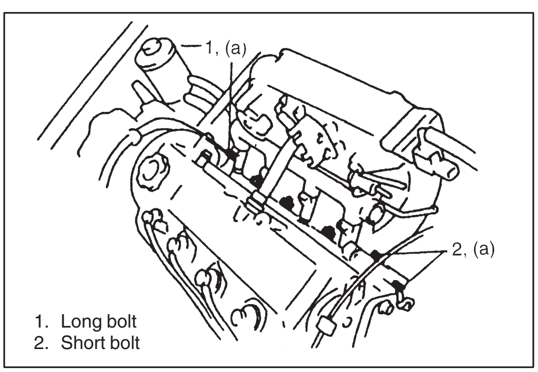
9) Disconnect fuel feed hose (2) from pipe (1), and disconnect fuel return hose (3) from fuel pressure regulator.



10) Remove intake manifold rear stiffener (1) and generator adjust arm reinforcement (2) from intake manifold (3).



11) Remove intake manifold with throttle body from cylinder head, and then its gasket.

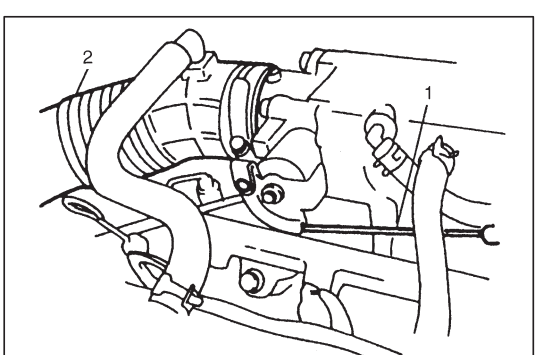


INSTALLATION

Reverse removal procedure for installation noting the followings.

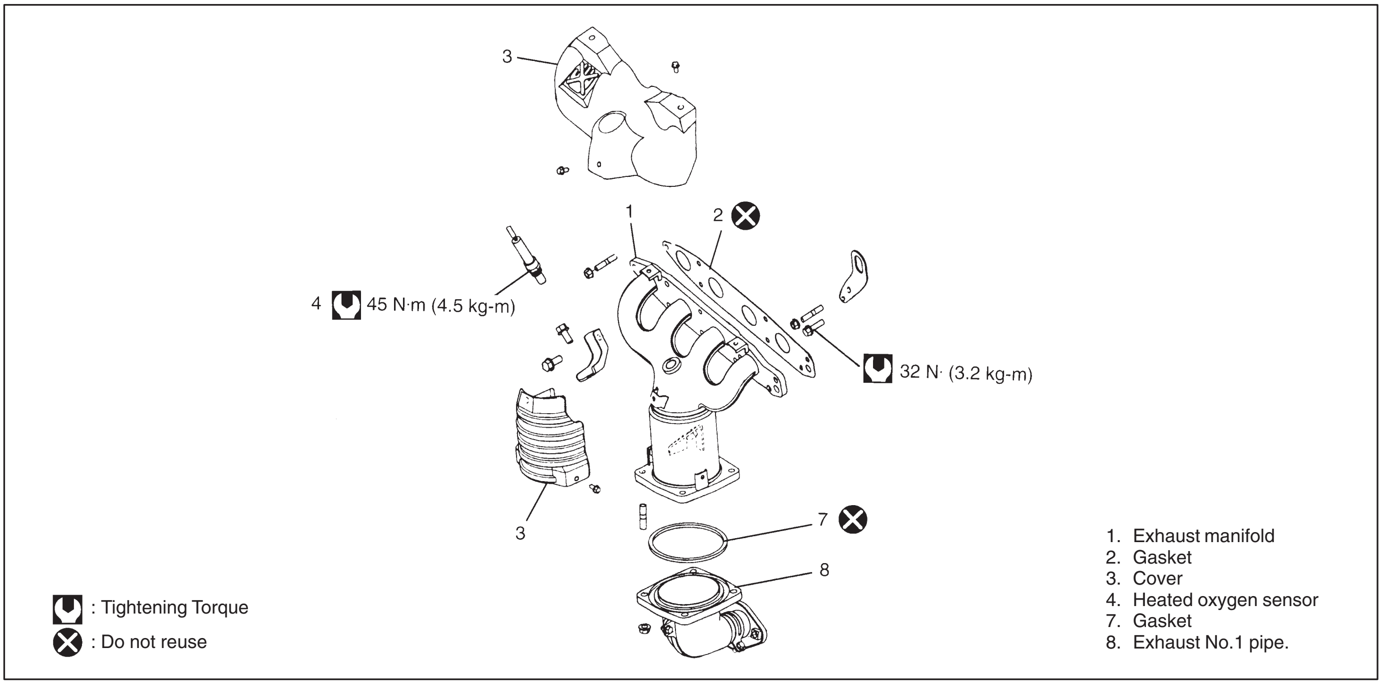
- Use new intake manifold gasket.
- When installing intake manifold, install clamps securely.

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



- Adjust accelerator cable play, referring to Section 6E.
- 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.

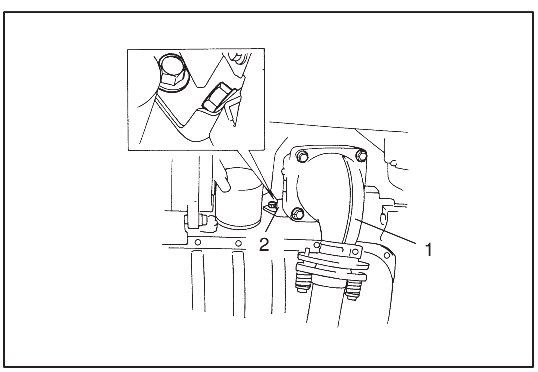
EXHAUST MANIFOLD



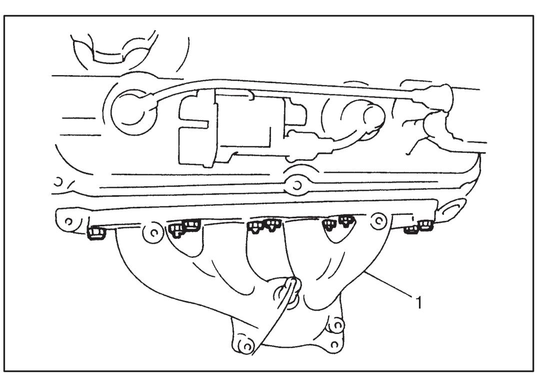
WARNING:
To avoid danger of being burned, do not service exhaust system while it is still hot.
Service should be performed after system cools down.

REMOVAL

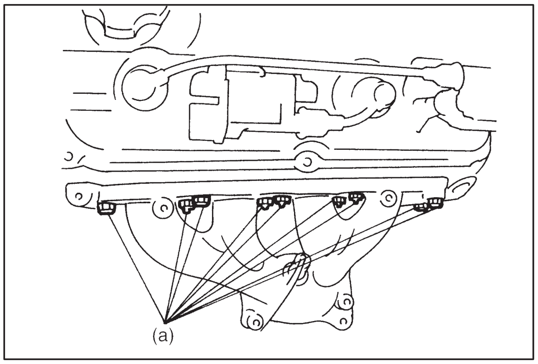
1) Disconnect negative cable at battery.
2) Disconnect heated oxygen sensor coupler.
   Release its wire from clamps.



3) Disconnect exhaust No.1 pipe (1) from WU-TWC.
4) Remove WU-TWC stiffener (2) (if equipped).



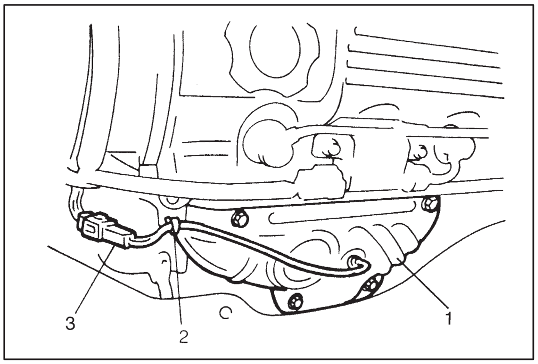
5) Remove exhaust manifold (1) and its gasket from cylinder head.



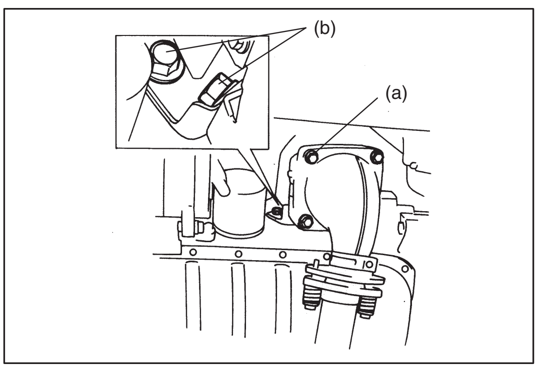
INSTALLATION

1) Install new gaskets to cylinder head.
2) Install exhaust manifold.
   Tighten bolts and nuts to specified torque.

   Tightening Torque
   (a): 32 N·m (3.2 kg-m, 23.5 lb-ft)



3) Install exhaust manifold cover(s) (1).
4) Connect oxygen sensor coupler (3) and clamp (2) its wire securely.

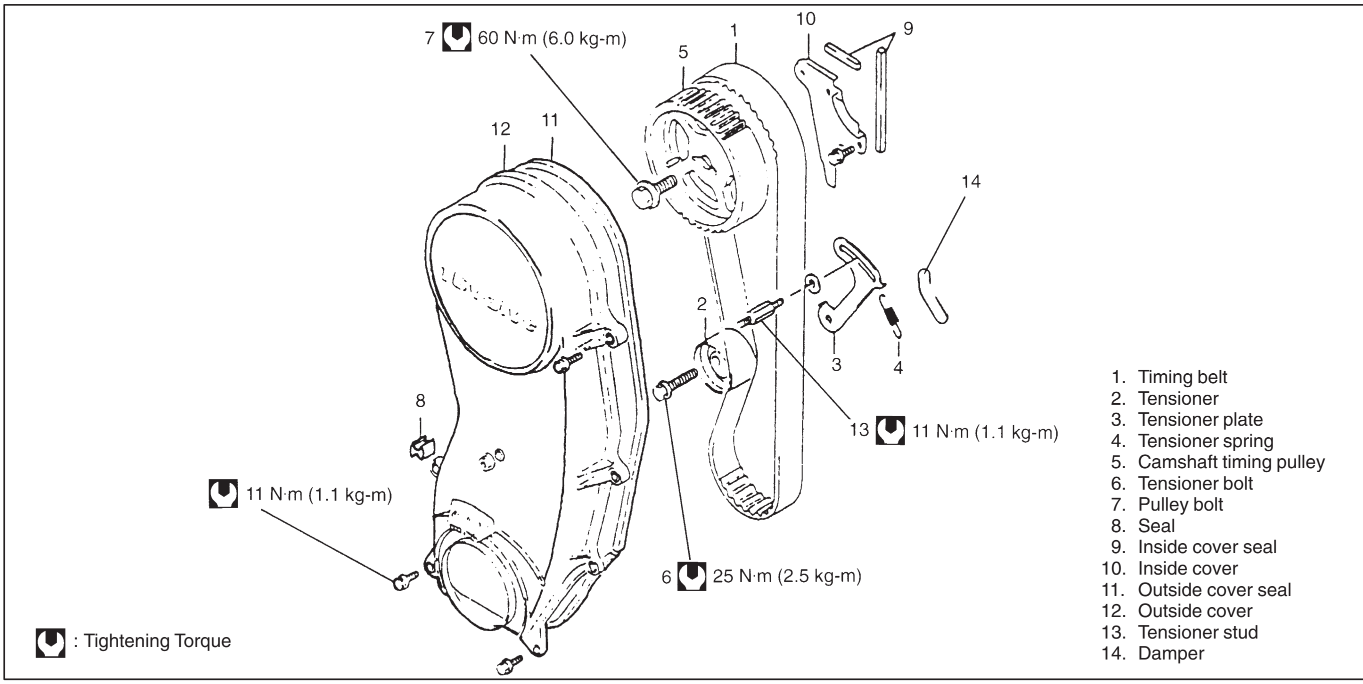


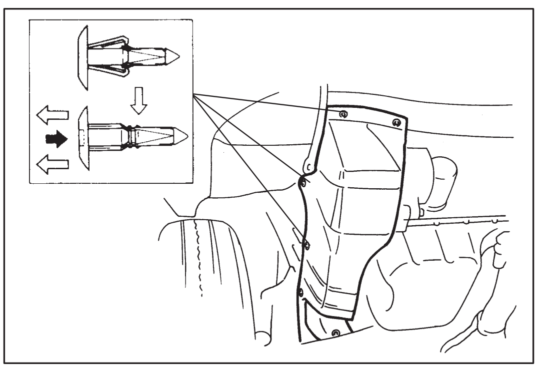
5) Tighten exhaust No.1 pipe to manifold nuts and exhaust manifold stiffener bolt.

   Tightening Torque
   (a): 50 N·m (5.0 kg-m, 36.5 lb-ft)
   (b): 50 N·m (5.0 kg-m, 36.5 lb-ft)

6) Connect negative cable at battery.
7) Check exhaust system for exhaust gas leakage.

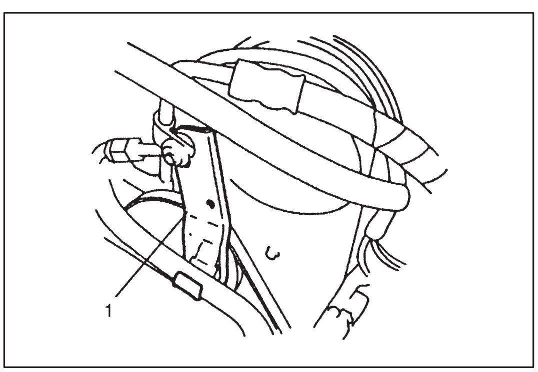
TIMING BELT AND BELT TENSIONER



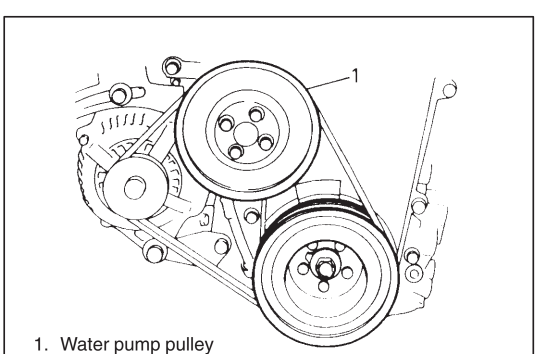


REMOVAL

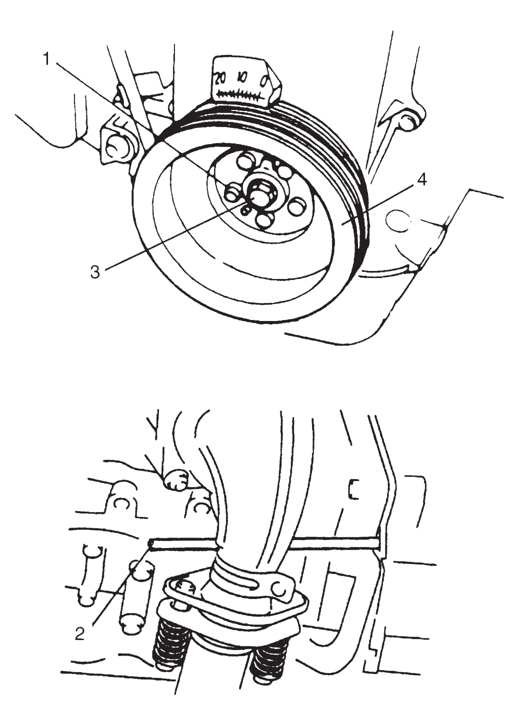
1) Disconnect negative cable at battery.
2) Remove right side of engine under cover.
3) Remove power steering pump belt or A/C compressor belt, if equipped.
4) Disconnect IAT sensor at coupler.
5) Remove air cleaner case with air cleaner outlet hose.



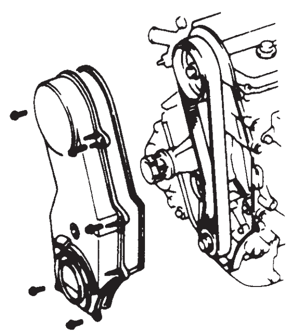
6) Remove power steering hose stay (1) (if equipped).



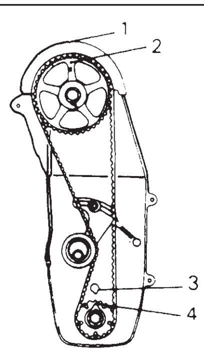
7) Remove water pump pulley and drive belt.



8) Lock crankshaft inserting flat end rod or the like (2) between flywheel ring gear and transmission case, after removing clutch housing (torque converter housing for A/T) lower plate.
   With crankshaft locked, remove crankshaft timing belt pulley bolt (3).
9) Remove crankshaft pulley bolts (1).
10) Remove crankshaft pulley (4).
11) Install crankshaft timing belt pulley bolt temporarily to turn crankshaft.

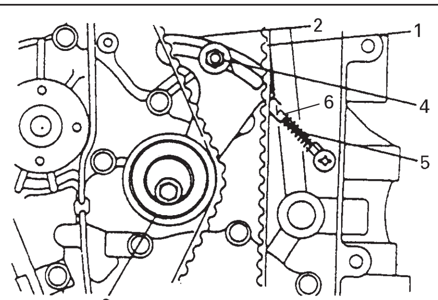


12) Release harness clamps.
13) Remove timing belt outside cover.



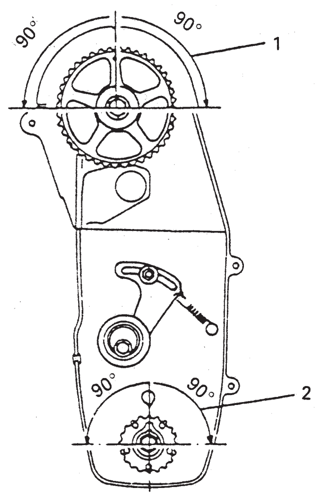
1. “V” mark on cylinder head cover
2. Timing mark by “E” on camshaft timing belt pulley
3. Arrow mark on oil pump case
4. Punch mark on crankshaft timing belt pulley

14) For installation of timing belt, align 4 timing marks as shown in figure by turning crankshaft.



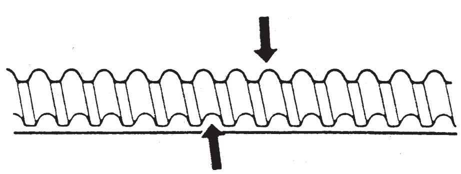
4. Tensioner stud
6. Damper

15) Remove timing belt tensioner (3), tensioner plate (2), tensioner spring (5) and timing belt (1).

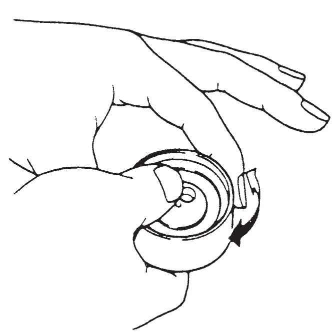


1. Camshaft allowable turning range - - - By timing mark, within 90° from “V” mark on head cover on both right and left.
2. Crankshaft allowable turning range - - - By punch mark, within 90° from arrow mark on oil pump case on both right and left.

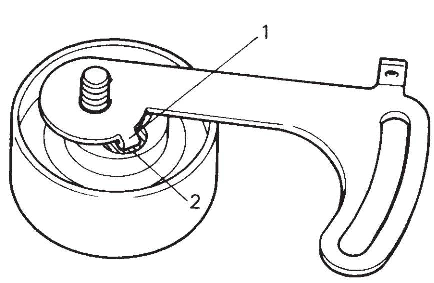
CAUTION:
- **After timing belt is removed, never turn camshaft and crankshaft independently more than such an extent as shown in figure. If turned, interference may occur among piston and valves, and parts related to piston and valves may be damaged.**
- **Never bend timing belt.**



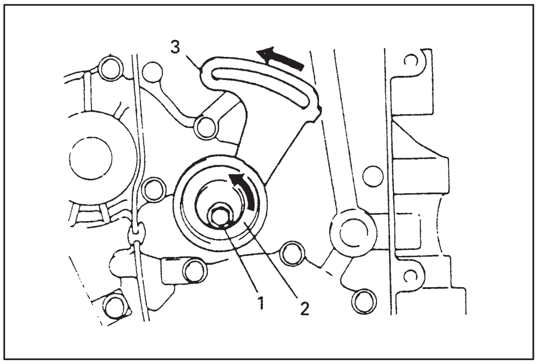
INSPECTION
- Inspect timing belt for wear or crack.
  Replace it as necessary.



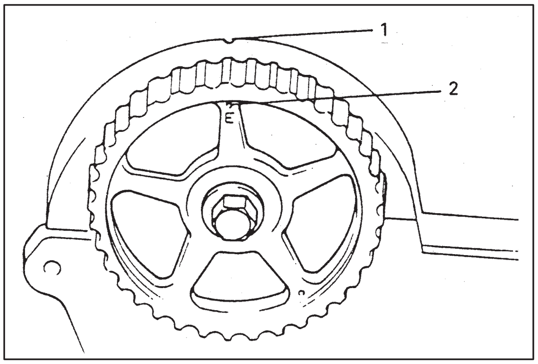
- Inspect tensioner for smooth rotation.



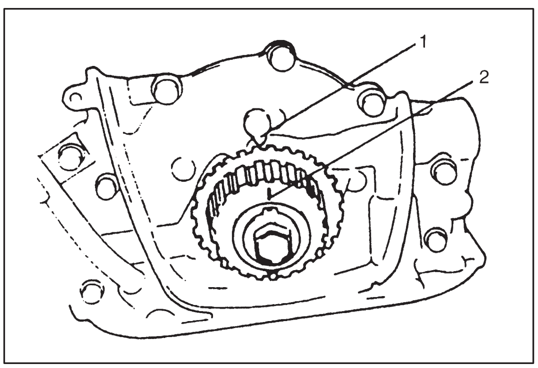
INSTALLATION
1) Install tensioner plate to tensioner.
   Insert lug (1) of tensioner plate into hole (2) in tensioner.



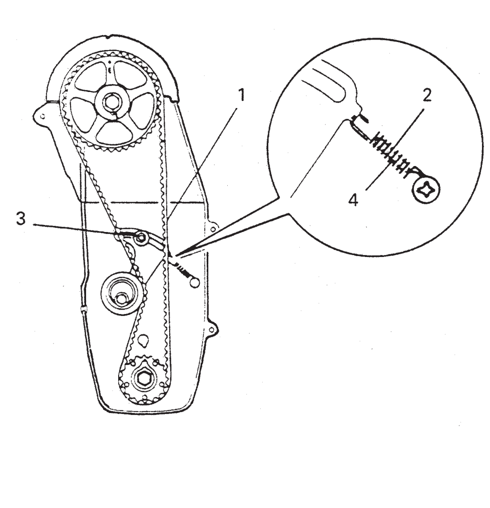
2) Install tensioner (2) and tensioner plate (3):
   Do not tighten tensioner bolt (1) with wrench yet. Hand tighten only at this time.
   Check to ensure that plate movement in arrow direction as shown in figure causes tensioner to move in the same direction.
   If no associated movement between plate and tensioner occurs, remove tensioner and plate again and reinsert plate lug into tensioner hole.



3) Check that timing mark (2) on camshaft timing belt pulley is aligned with "V" mark (1) 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 previous page.



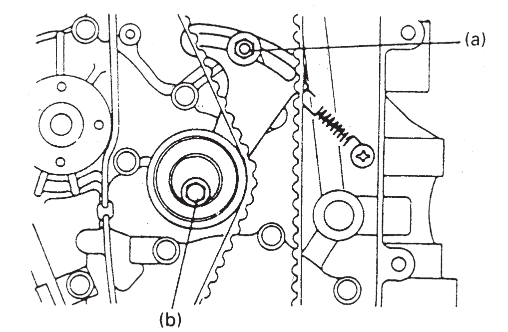
4) Check that timing mark (2) on crankshaft timing belt pulley is aligned with arrow mark (1) on oil pump case. If not, align two marks by turning crankshaft but be careful not to turn it more than its allowable turning range which is described on previous page.



4. Damper

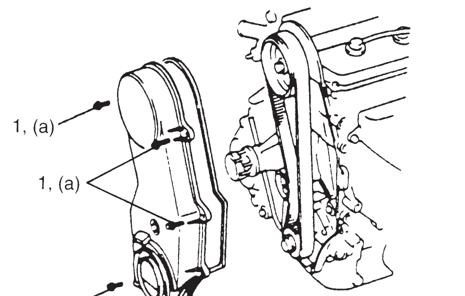
5) Install timing belt and tensioner spring (2).
   With two sets of marks aligned and tensioner plate pushed up, install timing belt on two pulleys in such a way that drive side (1) of belt is free from any slack.
   And then install tensioner spring as shown in figure, and hand-tighten tensioner stud (3).

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.

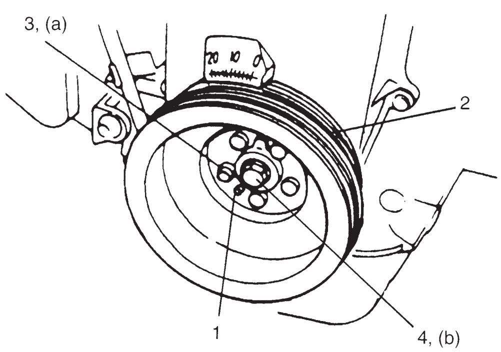
   Tightening Torque
   (a): 11 N·m (1.1 kg-m, 8.0 lb-ft)
   (b): 25 N·m (2.5 kg-m, 18.0 lb-ft)



1. Long bolt
2. Short bolt

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)

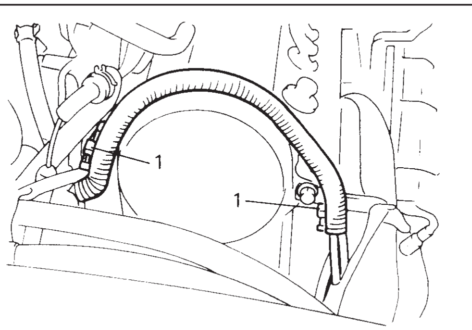


8) With crankshaft locked, remove crankshaft timing belt pulley bolt (4).
9) Install crankshaft pulley (2).
   Fit hole of pulley to pin (1) on crankshaft timing belt pulley, and tighten pulley bolts (3) to specified torque.

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

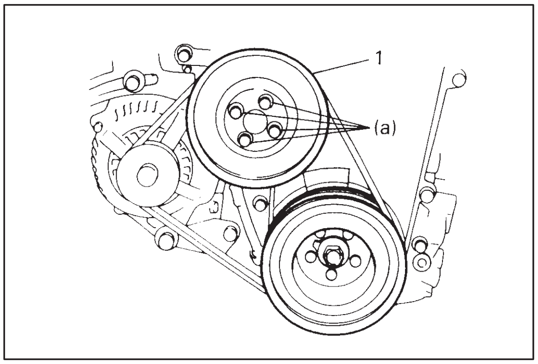
10) With crankshaft locked using flat end rod or the like, tighten crankshaft timing belt pulley bolt (4).

   Tightening Torque
   (b): 130 N·m (13.0 kg-m, 94.0 lb-ft)



1. Clamp

11) Clamp harness securely.

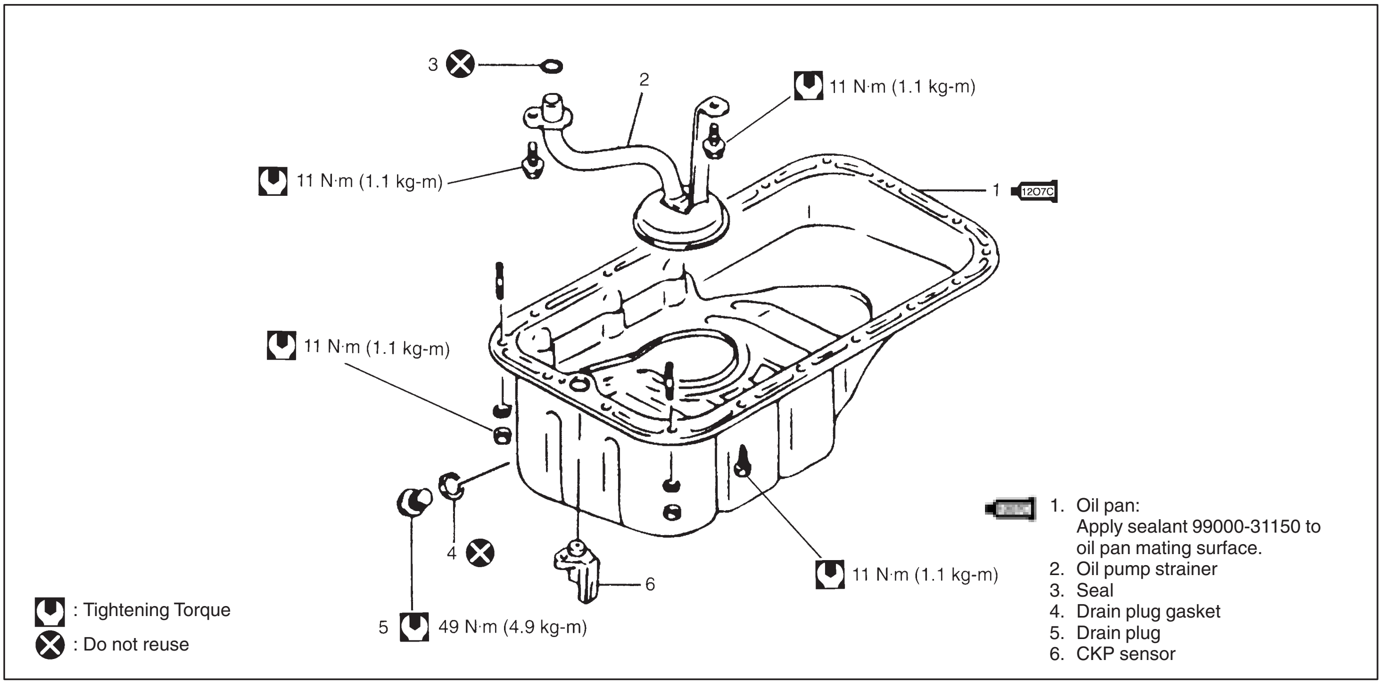


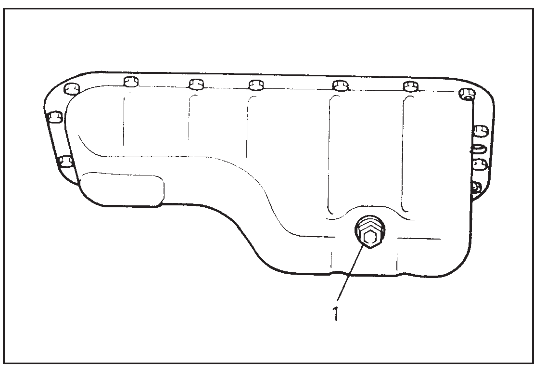
12) Install water pump pulley (1) and drive belt.

    Tightening Torque
    (a): 11 N·m (1.1 kg-m, 8.0 lb-ft)

13) Adjust drive belt tension referring to Section 6B.
14) Adjust power steering pump belt tension or A/C compressor belt tension, if equipped.
    Refer to Section 0B.
15) Install P/S hose stay (if equipped).
16) Install air cleaner case with air cleaner outlet hose.
17) Install right side of engine under cover.
18) Install clutch housing (torque converter housing for A/T) lower plate.
19) Connect negative cable at battery.

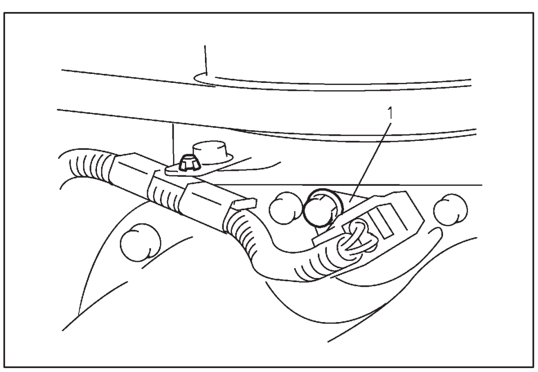
OIL PAN AND OIL PUMP STRAINER



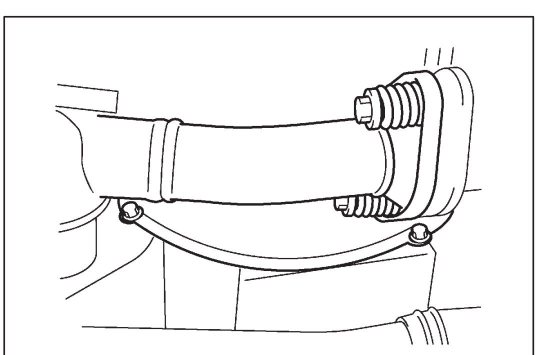


REMOVAL

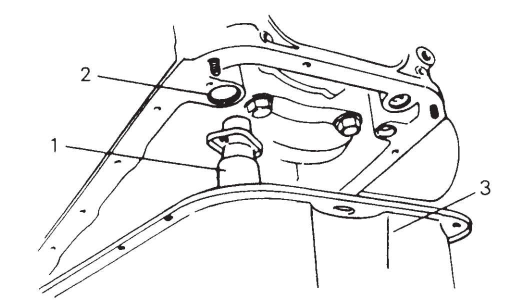
1) Raise vehicle.
2) Drain engine oil by removing drain plug (1).
3) Remove right side of engine under cover.



4) Disconnect CKP sensor coupler and remove CKP sensor (1) by removing its bolt. Then remove CKP sensor wire harness from clamp.



5) Remove clutch housing (torque converter housing for A/T) lower plate.

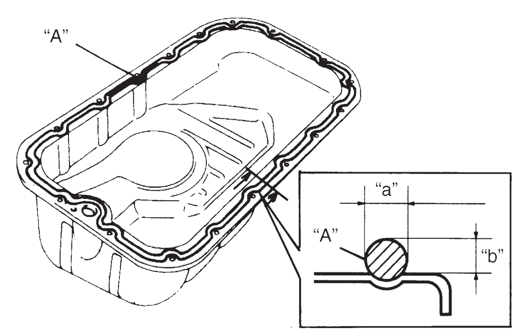


2. O-ring

6) Remove oil pan (3) and then oil pump strainer (1).

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.

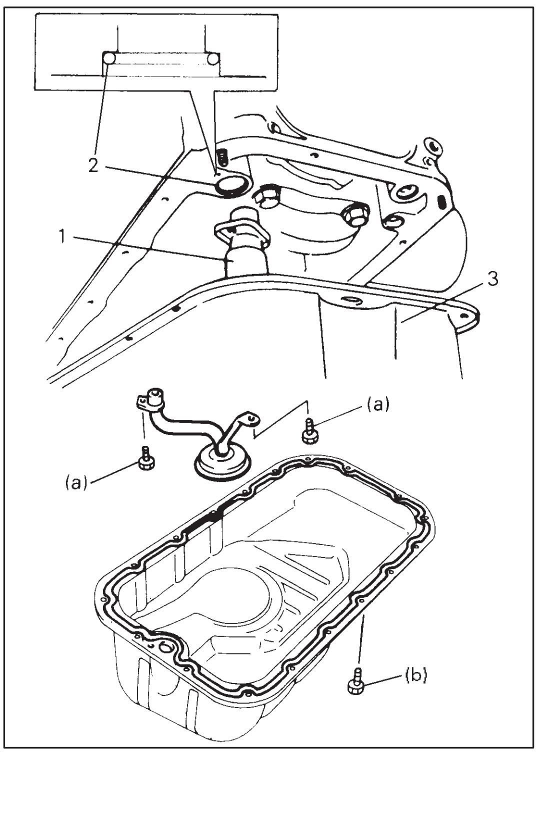


INSTALLATION

1) Apply sealant to oil pan mating surface continuously as shown in figure.

   "A" Sealant: 99000-31150

   Sealant amount
   Width "a": 4 mm, 0.16 in.
   Height "b": 2 mm, 0.08 in.

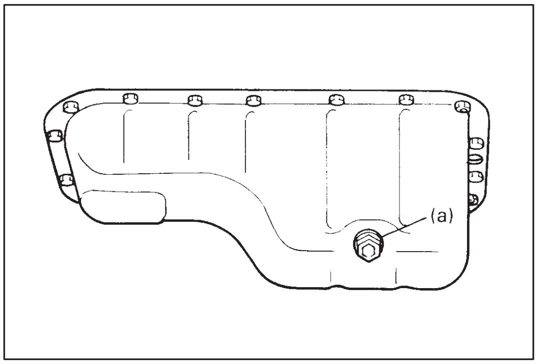


2) Install O-ring (2) into cylinder block securely as shown in figure.
   Install oil pump strainer (1) to cylinder block.
   Tighten strainer bolt first and then bracket bolt to specified torque.

   Tightening Torque
   (a): 11 N·m (1.1 kg-m, 8.0 lb-ft)

   After fitting oil pan (3) 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.

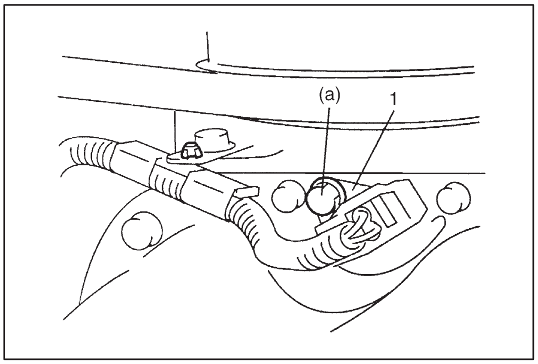
   Tightening Torque
   (b): 11 N·m (1.1 kg-m, 8.0 lb-ft)



3) Install new gasket and drain plug to oil pan.
   Tighten drain plug to specified torque.

   Tightening Torque
   (a): 50 N·m (5.0 kg-m, 36 lb-ft)

4) Install clutch (torque converter) housing lower plate.

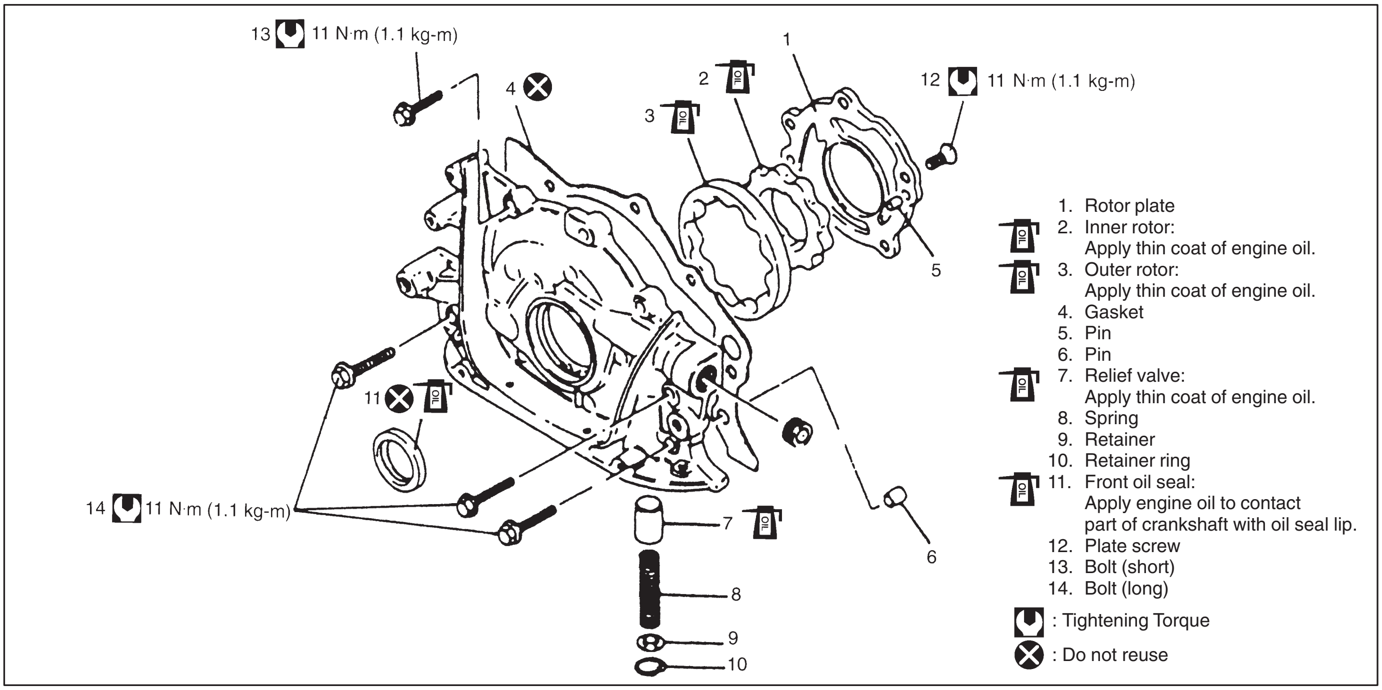


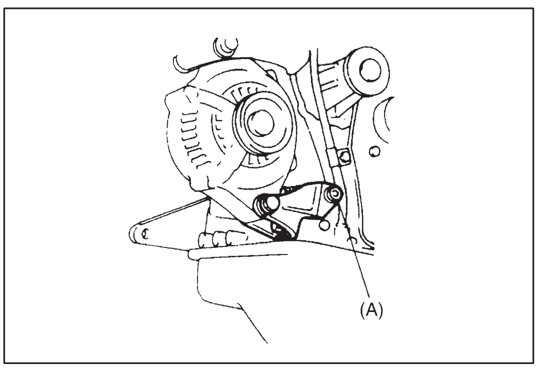
5) Install CKP sensor (1) and connect its coupler, then clamp its harness.

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

6) Install right side of engine under cover.
7) Refill engine with engine oil referring to "ENGINE OIL CHANGE" in Section 0B.

OIL PUMP

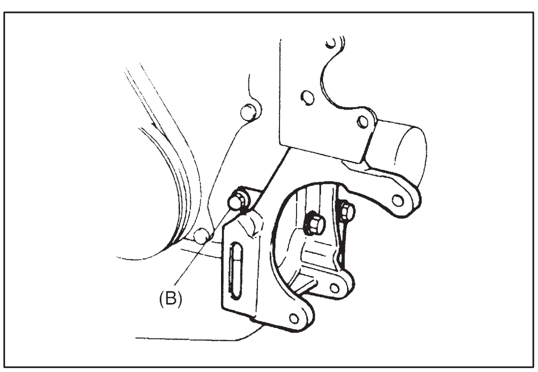




REMOVAL

1) Disconnect negative cable at battery.
2) Remove timing belt as previously outlined.
3) Remove generator and its bracket.

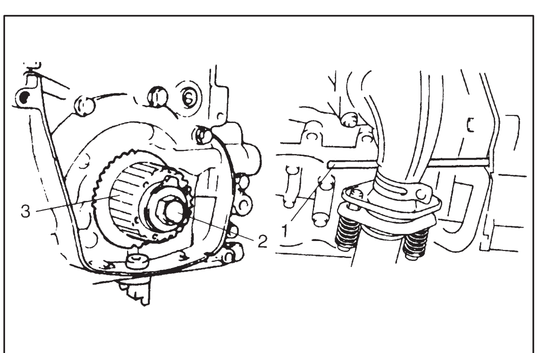
NOTE:
When installing bracket, fasten nut (A) first.



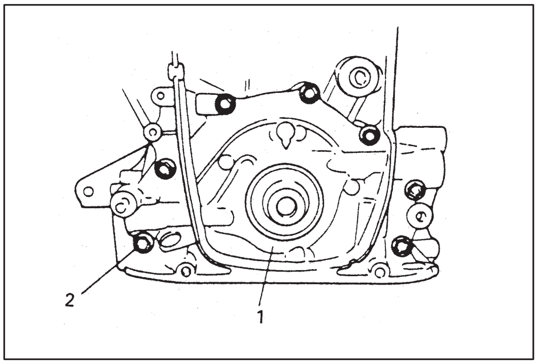
4) Remove power steering pump bracket or A/C compressor bracket, if equipped.

NOTE:
When installing bracket, fasten bolt (B) first.

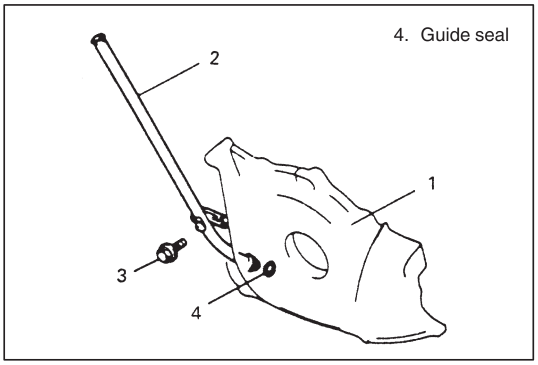
5) Remove oil pan and oil pump strainer as previously outlined.



6) Remove crankshaft timing belt pulley (3).
Lock crankshaft inserting flat end rod or the like (1) between flywheel ring gear and transmission case.
With crankshaft locked, remove crankshaft timing belt pulley bolt (2).

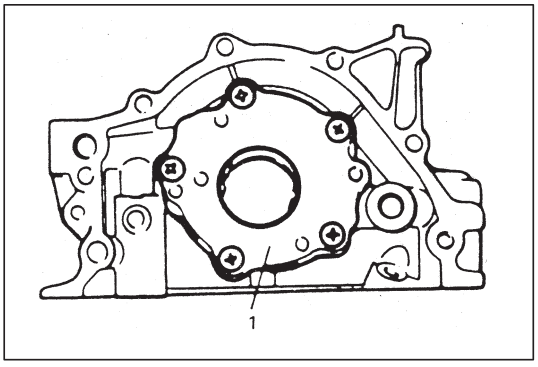


7) Remove oil pump assembly (1) after removing bolts (2).

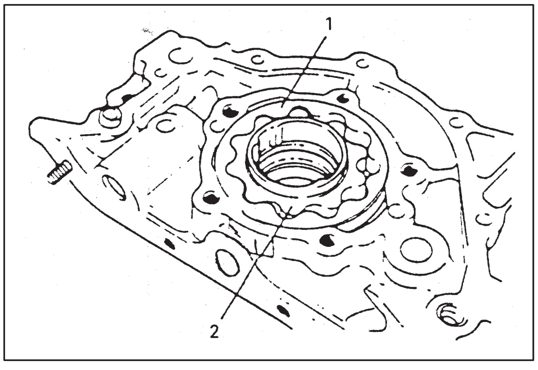


DISASSEMBLY

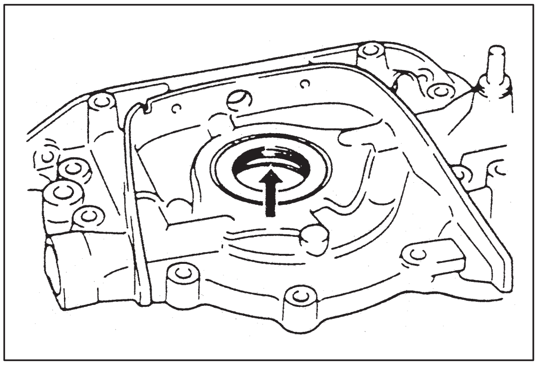
1) Remove oil level gauge guide bolt (3) and pull out guide (2) from oil pump (1).



2) Remove rotor plate (1).

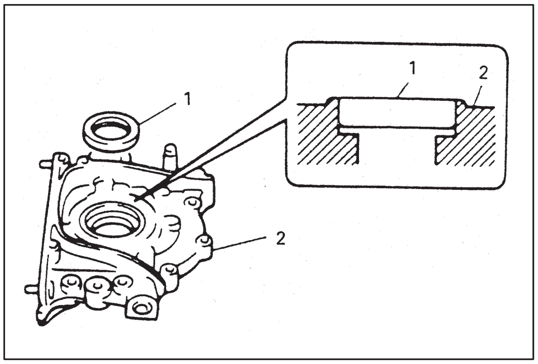


3) Remove outer rotor (1) and inner rotor (2).

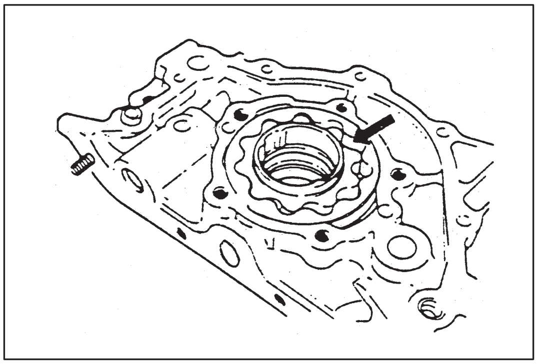


INSPECTION

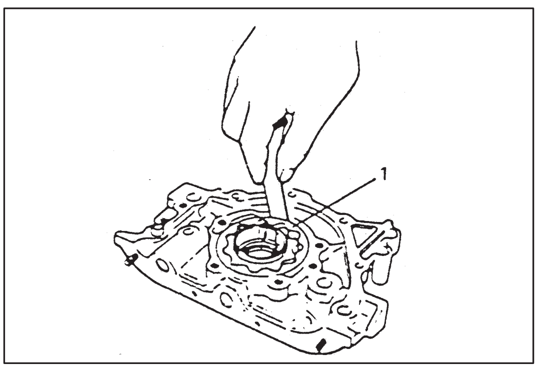
- Check oil seal lip for fault or other damage. Replace as necessary.



NOTE:
When installing oil seal (1), press-fit it till its end face is flush with oil pump case (2) end face.



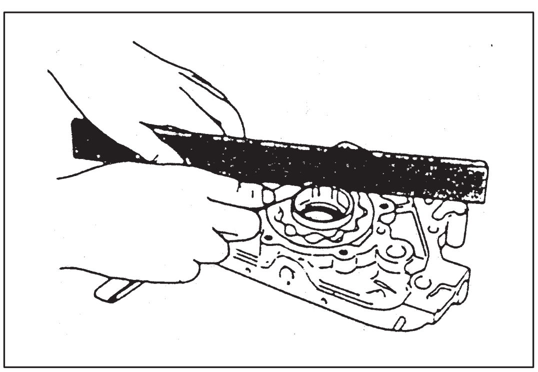
- Check outer and inner rotors, rotor plate, and oil pump case for excessive wear or damage.



MEASUREMENT

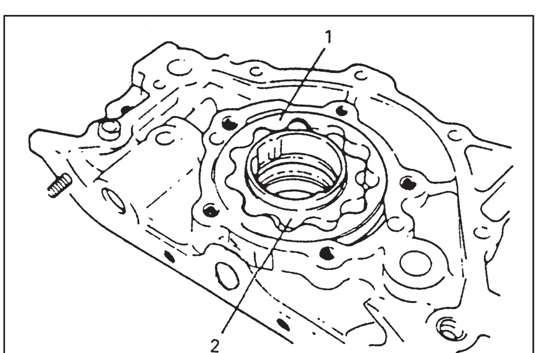
- **Radial clearance**
  Check radial clearance between outer rotor (1) and case, using thickness gauge.
  If clearance exceeds its limit, replace outer rotor or case.

  Limit on radial clearance between outer rotor and case: 0.200 mm (0.079 in.)



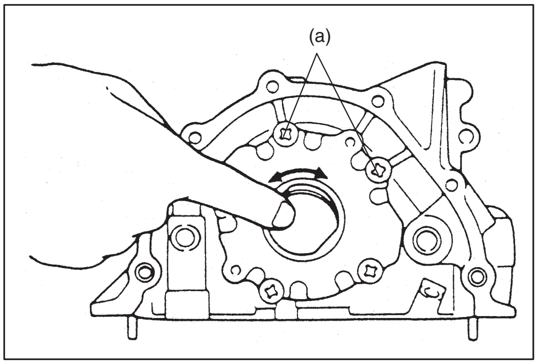
- **Side clearance**
  Using straight edge and thickness gauge, measure side clearance.

  Limit on side clearance: 0.10 mm (0.0039 in.)



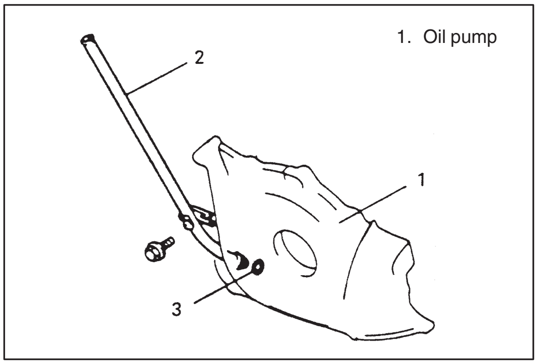
ASSEMBLY

1) Wash, clean and then dry all disassembled parts.
2) Apply thin coat of engine oil to inner (2) and outer rotors (1), oil seal lip portion, and inside surfaces of oil pump case and plate.
3) Install outer and inner rotors to pump case.

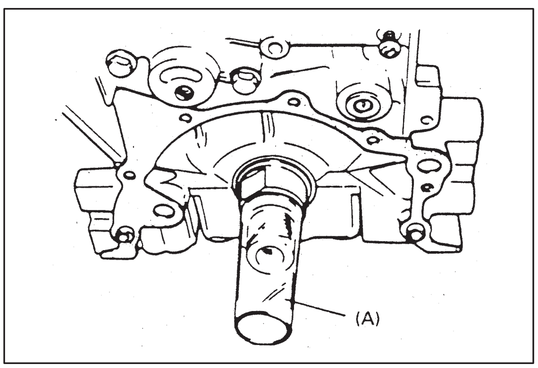


4) Install rotor plate. Tighten 5 screw securely.
   After installing plate, check to be sure that gears turn smoothly by hand.

   Tightening Torque
   (a): 11 N·m (1.1 kg-m, 8.0 lb-ft)



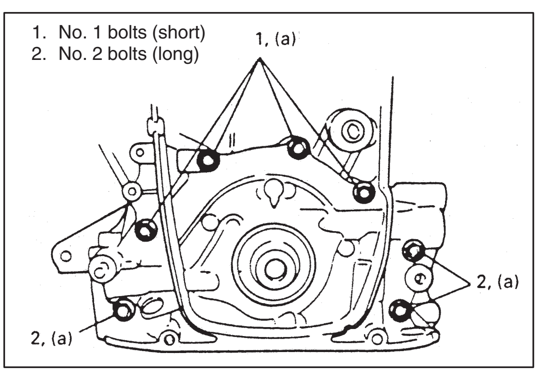
5) Apply engine oil to guide seal (3) and install guide seal and guide (2).



INSTALLATION

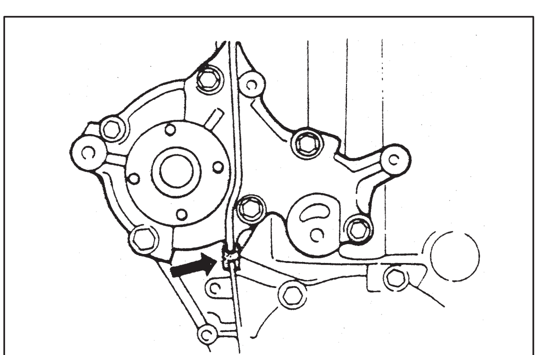
1) Install two oil pump pins and oil pump gasket to cylinder block. Use a new gasket.
2) To prevent oil seal lip from being damaged or upturned when installing oil pump to crankshaft, fit special tool (Oil seal guide) to crankshaft, and apply engine oil to special tool.

   Special Tool
   (A): 09926-18210

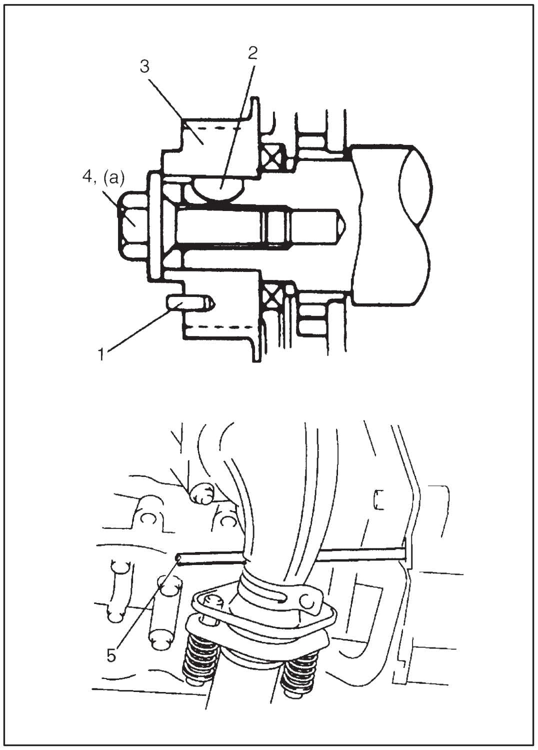


3) Install oil pump to cylinder block.
   As there are 2 types of oil pump bolts, refer to figure for their correct use and tighten them to specified torque.

   Tightening Torque
   (a): 11 N·m (1.1 kg-m, 8.0 lb-ft)



4) Install rubber seal between oil pump and water pump.

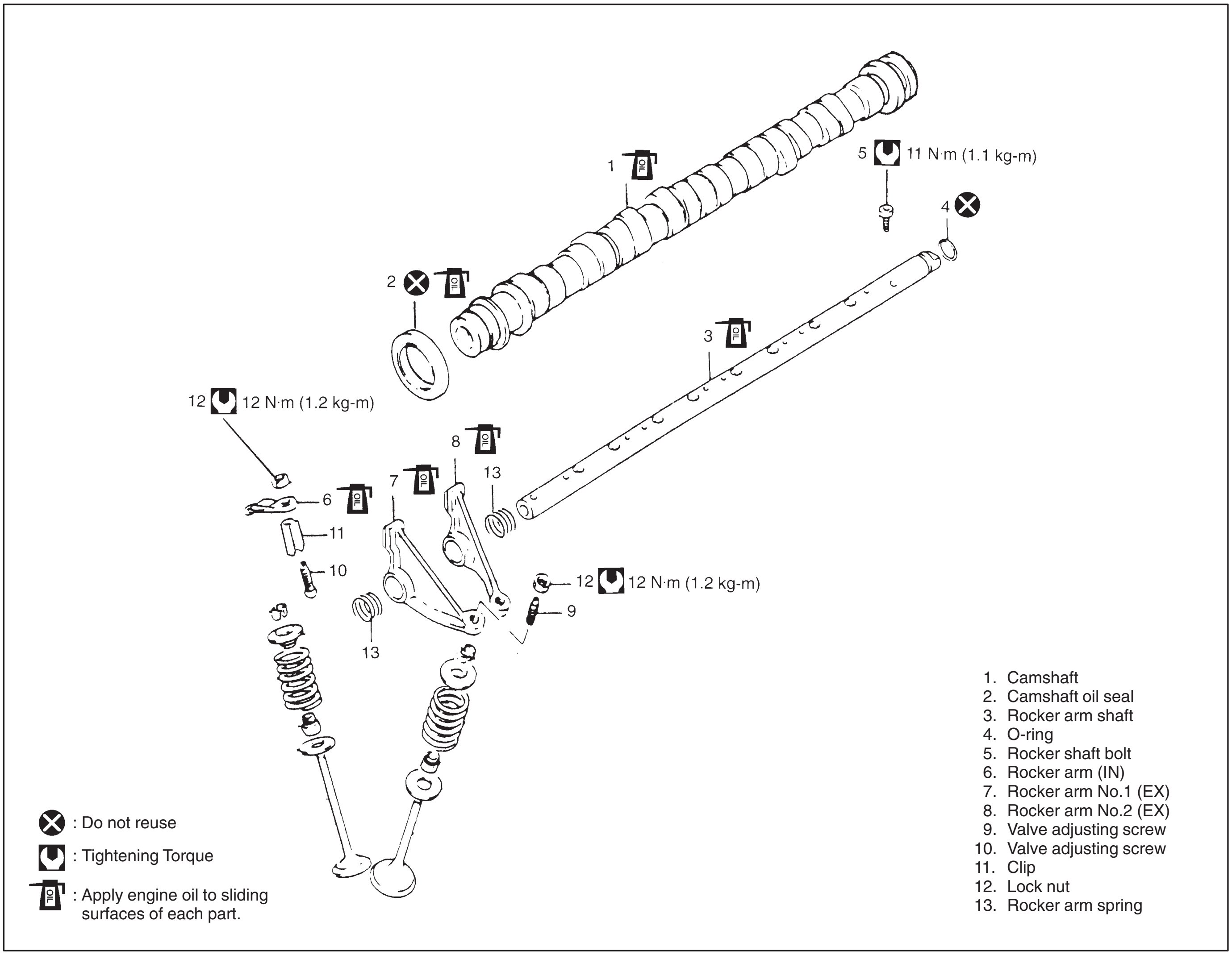


5) Install timing pulley key (2) and crank timing belt pulley (3) and crankshaft pulley pin (1). Refer to figure for proper installation of these parts.
   With crankshaft locked using flat end rod or the like (5), tighten crank timing belt pulley bolt (4) to specified torque.

   Tightening Torque
   (a): 130 N·m (13.0 kg-m, 94.0 lb-ft)

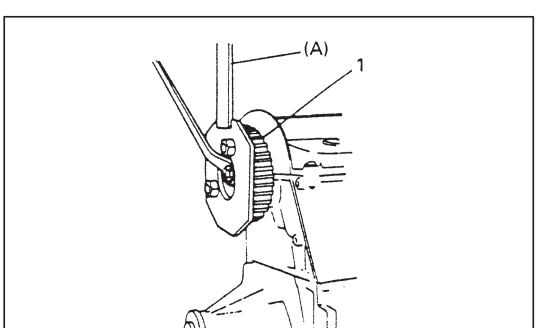
6) Install timing belt, tensioner, oil pump strainer, oil pan and other parts as previously outlined.
7) Check to ensure that all removed parts are back in place. Reinstall any necessary parts which have not been reinstalled.
8) Adjust water pump drive belt tension referring to Section 6B.
9) Adjust 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 “ENGINE OIL CHANGE” in Section 0B.
11) Connect negative cable at battery.
12) After completing installation, check oil pressure by running engine.

ROCKER ARMS, ROCKER ARM SHAFT AND CAMSHAFT



REMOVAL

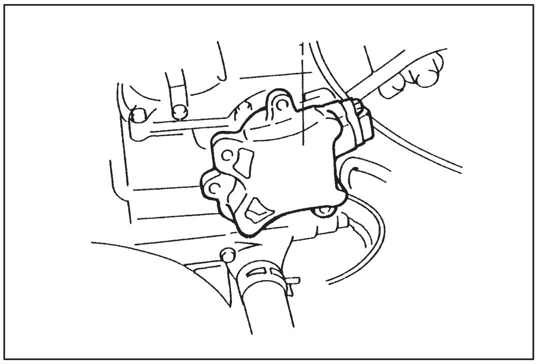
1) Disconnect negative cable at battery.



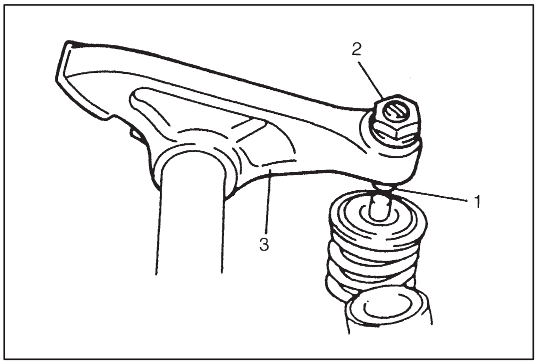
2) Remove timing belt as previously outlined and remove camshaft timing belt pulley (1) by using special tool.

Special Tool
(A): 09917-68221

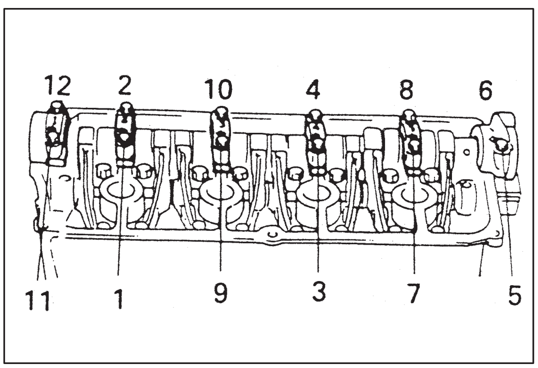
3) Remove cylinder head cover as previously outlined.



4) Disconnect CMP sensor coupler from CMP sensor.
5) Remove CMP sensor case (1) from cylinder head.
   Place a container or rag under CMP sensor case, for a small amount of oil flows out during removal of case.

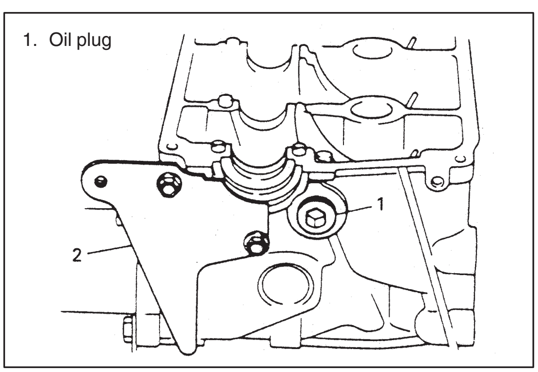


6) After loosening all valve adjusting screw lock nuts (2), turn adjusting screws (1) back all the way to allow all rocker arms (3) to move freely.



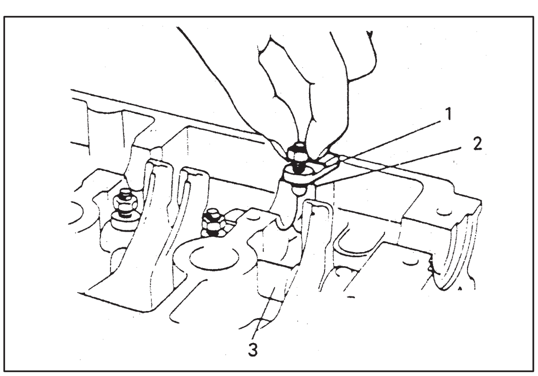
7) Remove camshaft housing and camshaft.

   NOTE:
   To remove camshaft housing bolts, loosen them in such order as indicated in figure, a little at a time.



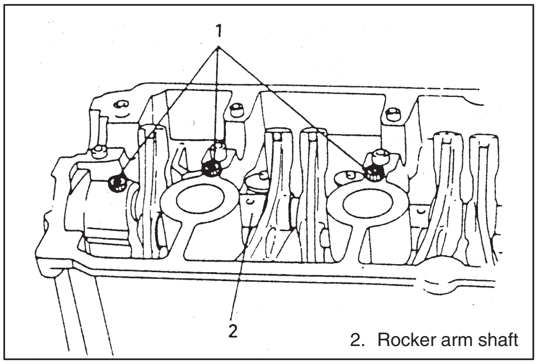
1. Oil plug

8) Remove timing belt inside cover (2).



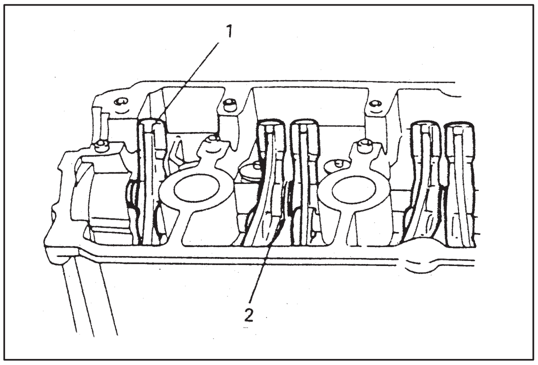
9) Remove intake rocker arm (1) with clip (2) from rocker arm shaft (3).

   NOTE:
   Do not bend clip when removing intake rocker arm.

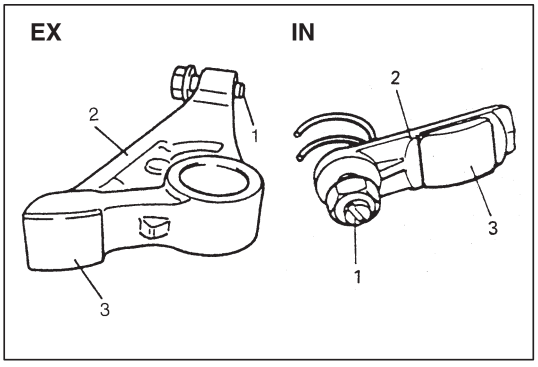


2. Rocker arm shaft

10) Remove rocker arm shaft bolts (1).



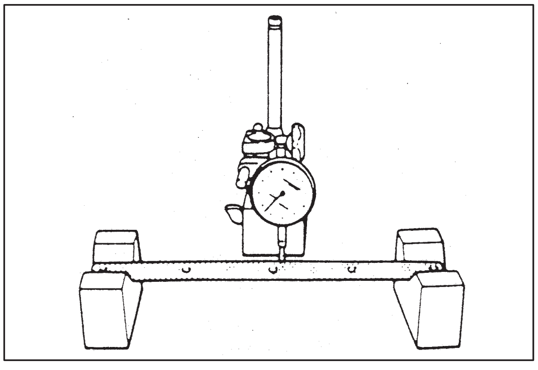
11) Remove exhaust rocker arms (1) and rocker arm spring (2) by pulling out rocker arm shaft to battery side after removing battery.



INSPECTION

Adjusting Screw and Rocker Arm

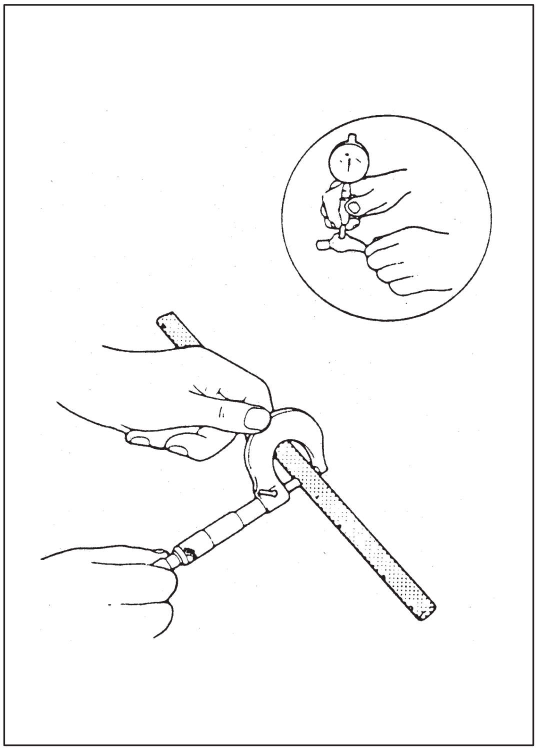
If tip of adjusting screw (1) is badly worn, replace it.
Rocker arm (2) must be replaced if its cam-riding face (3) is badly worn.



Rocker Arm Shaft Runout

Using "V" blocks and dial gauge, check runout. If runout exceeds its limit, replace rocker arm shaft.

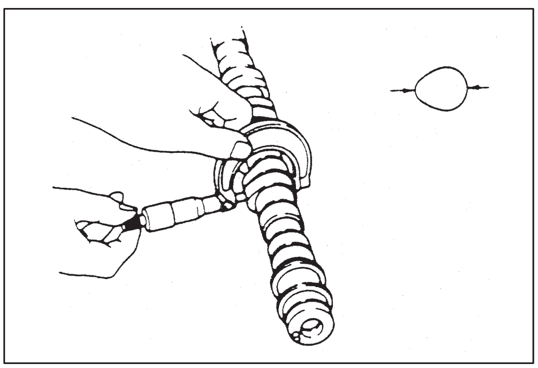
Runout limit: 0.10 mm (0.004 in.)



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.

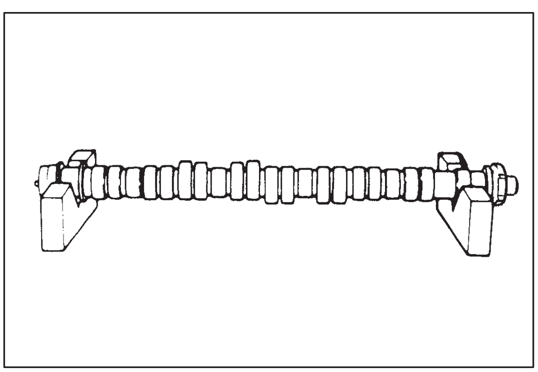
Item	Standard	Limit
Rocker arm I.D.	15.996 – 16.014 mm (0.629 – 0.630 in.)	———
Rocker arm shaft dia.	15.969 – 15.984 mm (0.6287 – 0.6293 in.)	———
Arm-to-shaft clearance	0.012 – 0.045 mm (0.0005 – 0.0018 in.)	0.09 mm (0.0035 in.)



Cam Wear

Using a micrometer, measured height of cam. If measured height is below limit, replace camshaft.

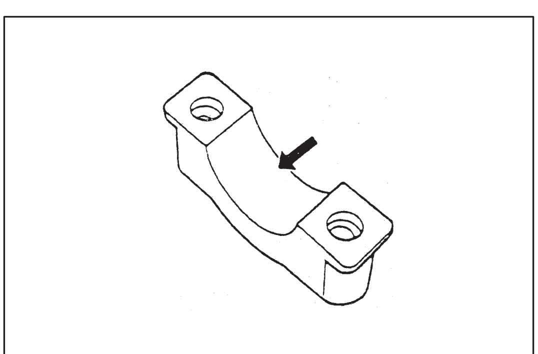
Cam height	Standard	Limit
Intake cam	36.184 – 36.344 mm (1.4246 – 1.4309 in.)	36.084 mm (1.4206 in.)
Exhaust cam	35.900 – 36.060 mm (1.4134 – 1.4197 in.)	35.800 mm (1.4094 in.)



Camshaft Runout

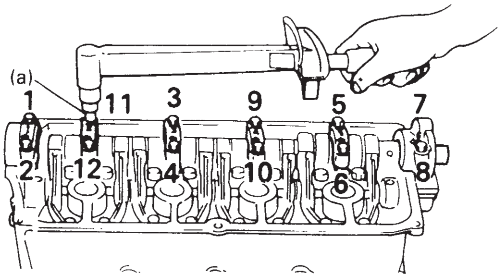
Hold camshaft between two “V” blocks, and measure runout by using a dial gauge.
If runout exceeds the limit, replace camshaft.

Runout limit: 0.10 mm (0.0039 in.)



Camshaft Journal Wear

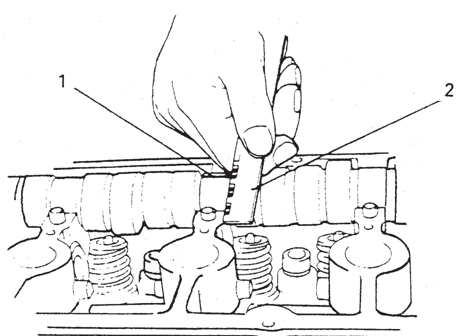
Check camshaft journals and camshaft housings for pitting, scratches, wear or damage.
If any malcondition is found, replace camshaft or cylinder head with housing. Never replace cylinder head without replacing housing.



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 "INSTALLATION" of the following page.
5) Tighten camshaft housing bolts in such order as indicated in figure a little at a time till they are tightened to specified torque.

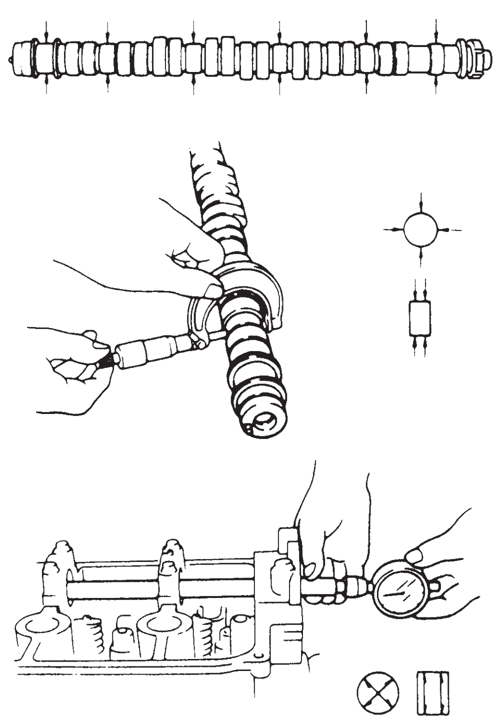
Tightening Torque
(a): 11 N·m (1.1kg-m, 8.0 lb-ft)

NOTE:
Do not rotate camshaft while gaging plastic is installed.



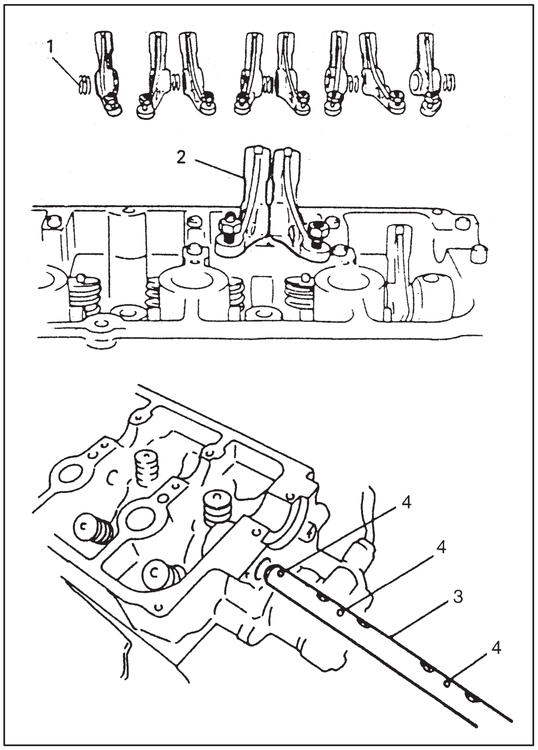
6) Remove housing and using scale (2) on gaging plastic (1) envelope, measure gaging plastic width at its widest point.

	Standard	Limit
Journal clearance	0.040 – 0.082 mm (0.0016 – 0.0032 in.)	0.12 mm (0.0047 in.)



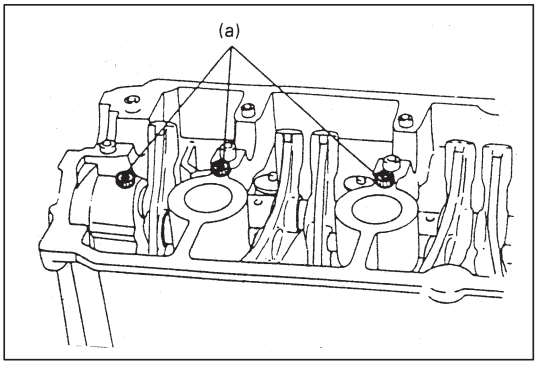
If measured camshaft journal clearance exceeds limit, measure journal (housing) bore and outside diameter of camshaft journal. Replace camshaft or cylinder head assembly whichever the difference from specification is greater.

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.)



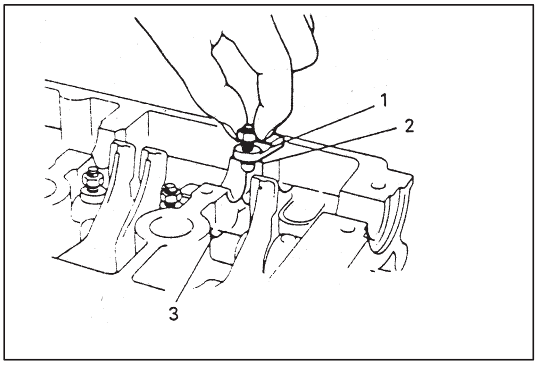
INSTALLATION

1) Apply engine oil to rocker arm shaft and rocker arms.
2) Check O-ring for damage or deterioration. Install O-ring to rocker arm shaft.
3) Install rocker arm shaft (3) with shaft bolt holes (4) facing up, rocker arm (exhaust side) (2) and rocker arm spring (1).

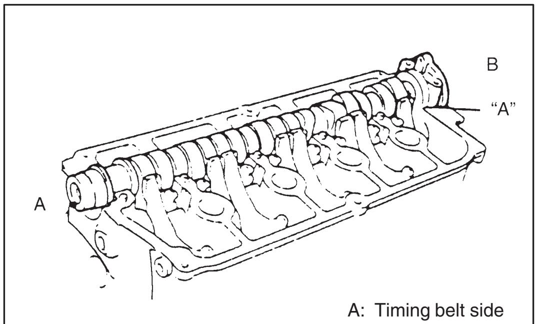


4) Install rocker arm shaft bolts and tighten them to specified torque.

Tightening Torque
(a): 11 N·m (1.1 kg-m, 8.0 lb-ft)



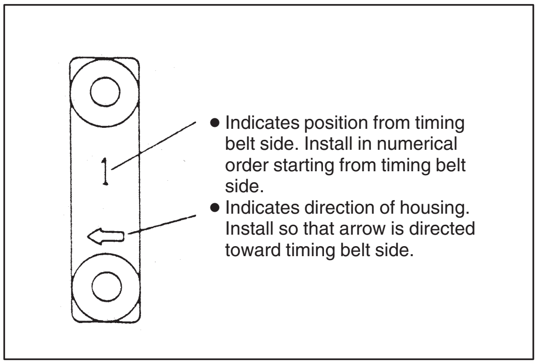
5) Fill small amount of engine oil into arm pivot holding part (3) of rocker arm shaft. Install rocker arm (intake side) (1) with clips (2) to rocker arm shaft.



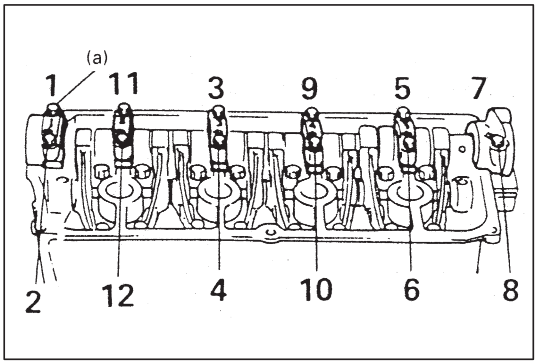
A: Timing belt side
B: Flywheel side

6) Apply engine oil to cams and journals on camshaft and put camshaft on cylinder head. Install camshaft housing to camshaft and cylinder head.
   - Apply engine oil to sliding surface of each housing against camshaft journal.
   - Apply sealant to mating surface of No.6 housing which will mate with cylinder head.

   "A" Sealant: 99000-31110

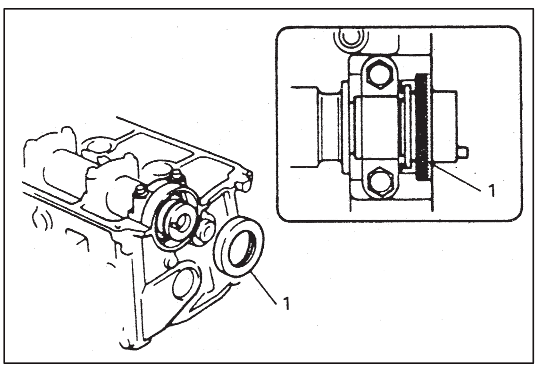


- Embossed marks are provided on each camshaft housing, indicating position and direction for installation.
  Install housing as indicated by these marks.
- As camshaft housing No. 1 retains camshaft in proper position as to thrust direction, make sure to first fit No. 1 housing to No. 1 journal of camshaft securely.

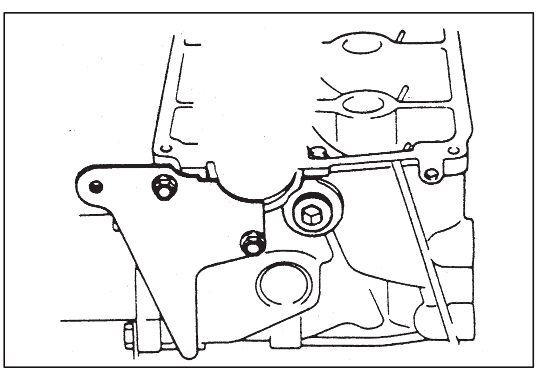


- After applying engine oil to housing bolts, tighten them temporarily first. Then tighten them by the following sequence as indicated in figure.
  Tighten a little at a time and evenly among bolts and repeat tightening sequence three to four times before they are tightened to specified torque.

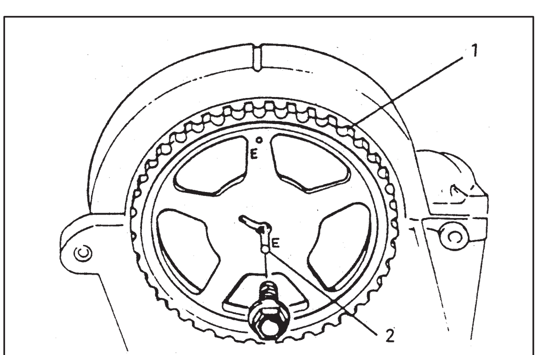
  Tightening Torque
  (a): 11 N·m (1.1 kg-m, 8.0 lb-ft)



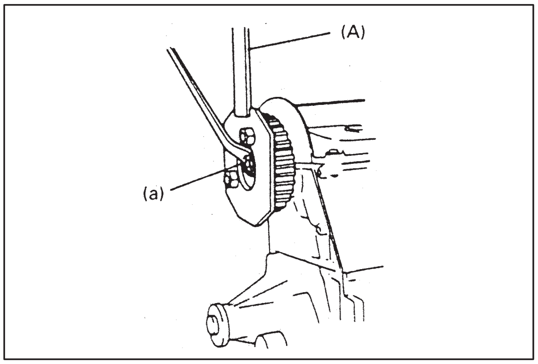
7) Install camshaft oil seal (1).
   After applying engine oil to oil seal lip, press-fit camshaft oil seal till oil seal surface becomes flush with housing surface.



8) Install timing belt inside cover.



9) Install camshaft timing belt pulley (1) to camshaft while fitting pin (2) on camshaft into slot at “E” mark.

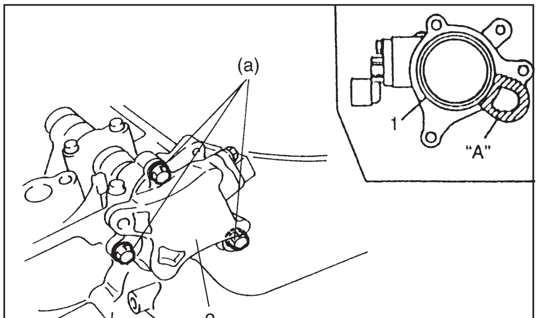


10) Using special tool, tighten pulley bolt to specified torque.

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

Special Tool
(A): 09917-68221

11) Install belt tensioner, timing belt, outside cover, crankshaft pulley and water pump belt as previously outlined.



1. O-ring

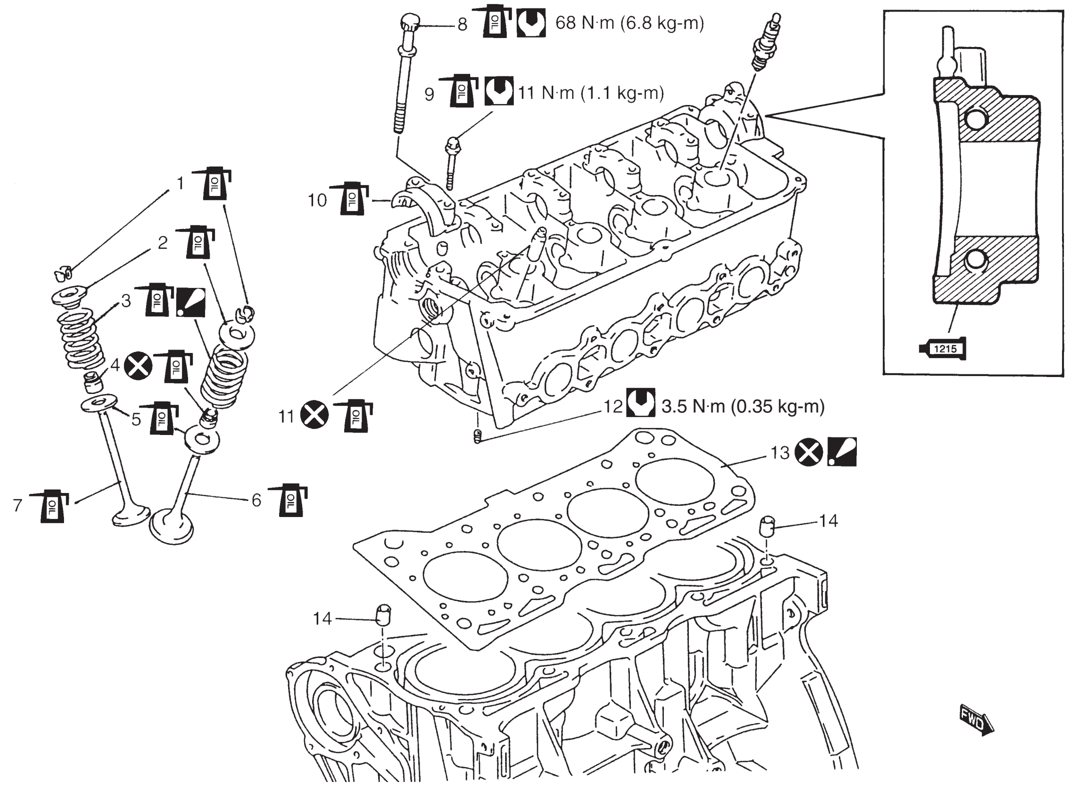
12) After applying sealant to part "A" as shown in figure, install CMP sensor case (2) (Distributorless ignition coil case) to cylinder head and tighten its fixing bolts to specified torque.

"A" Sealant: 99000-31110

Tightening Torque
(a): 11 N·m (1.1 kg-m, 8.0 lb-ft)

13) Adjust valve clearance as previously outlined.
14) Install cylinder head cover and air cleaner outlet hose.
15) Check to ensure that the following parts are back in place:
    - Ignition coil assemblies
    - High tension cords
    - CMP sensor coupler
    - Couplers to ignition coil assembly
    - Other removed parts which have not been reinstalled
16) Connect negative cable at battery.
17) Confirm that ignition timing is within specification referring to Section 6F.

VALVES AND CYLINDER HEAD

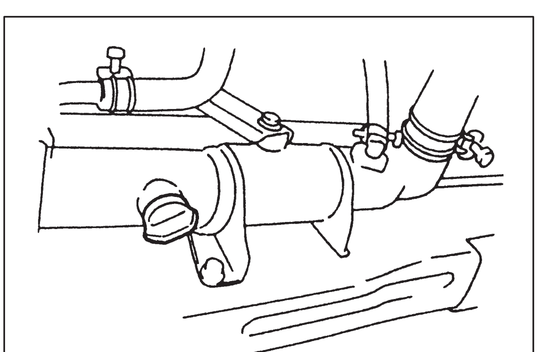


1. Valve cotters
2. Valve spring retainer
3. Valve spring: be sure to position spring in place with its bottom end (small-pitch end) facing the bottom (valve spring seat side).
4. Valve stem seal
5. Valve spring seat
6. Exhaust valve
7. Intake valve
8. Cylinder head bolt
9. Camshaft housing bolt
10. Camshaft housing: Apply sealant to mating surface of No.1 and No.6 housings.
11. Valve guide
12. Oil venturi plug
13. Cylinder head gasket: "TOP" mark provided on gasket comes to crankshaft pulley side, facing up (toward cylinder head side).
14. Dowel pin

: Do not reuse

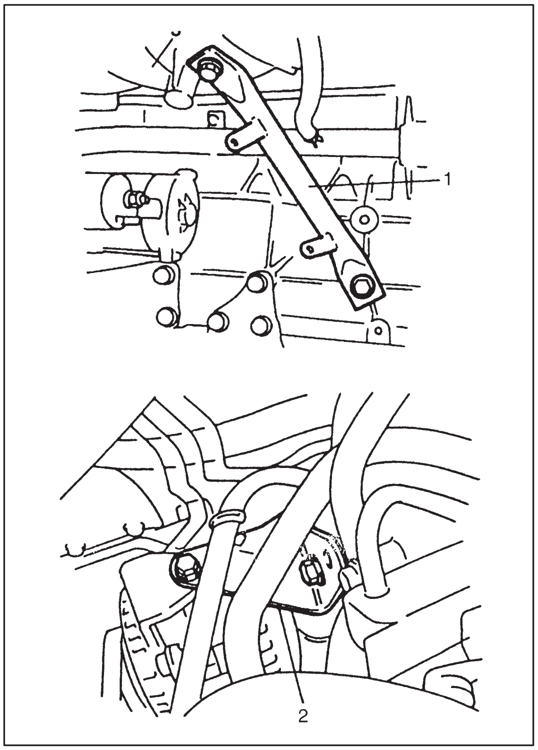
: Tightening Torque

: Apply engine oil to sliding surfaces of each part.



REMOVAL

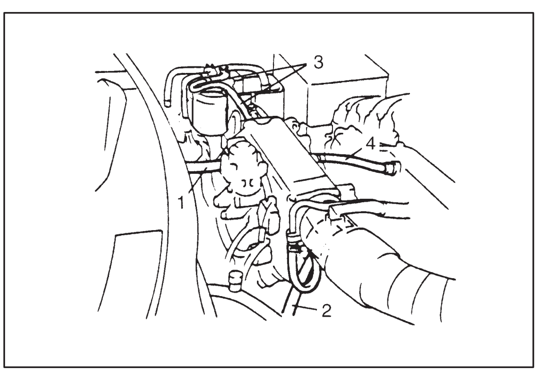
1) Relieve fuel pressure according to procedure described in Section 6.
2) Disconnect negative cable at battery.
3) Drain cooling system.
4) Remove air cleaner outlet hose as previously outlined.



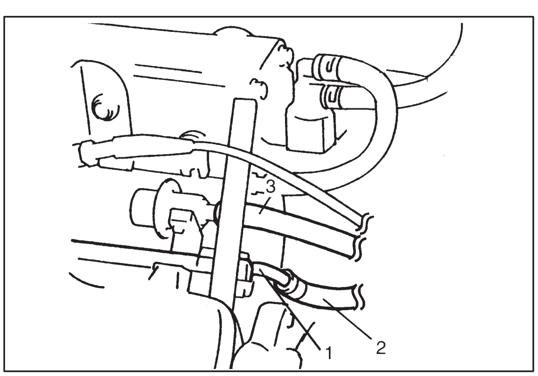
5) Remove intake manifold rear stiffener (1) and generator adjust arm reinforcement (2) from intake manifold.

6) Disconnect the following electric wires:
   - Ignition coil assembly
   - Ground wires from intake manifold
   - EVAP canister purge valve
   - ECT sensor
   - Injectors, TP sensor and IAC valve wires at the coupler
   - Heated oxygen sensor 1
   - MAP sensor

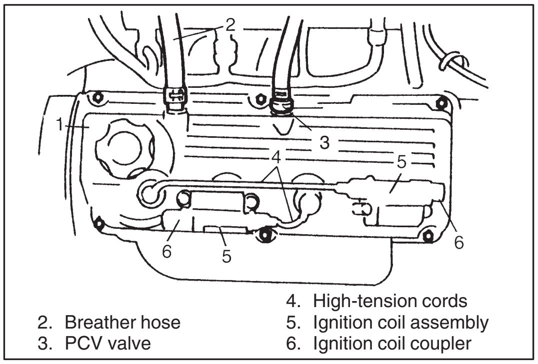
   and then release above wire harnesses from clamps.



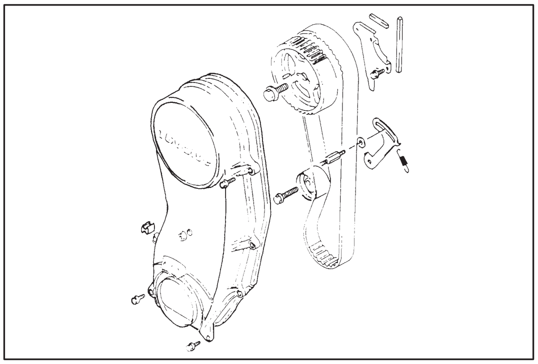
7) Disconnect the following hoses:
   - Brake booster hose (1)
   - EVAP canister purge hose (3) from purge valve
   - Radiator inlet hose
   - Heater inlet hose
   - IAC valve outlet (2)



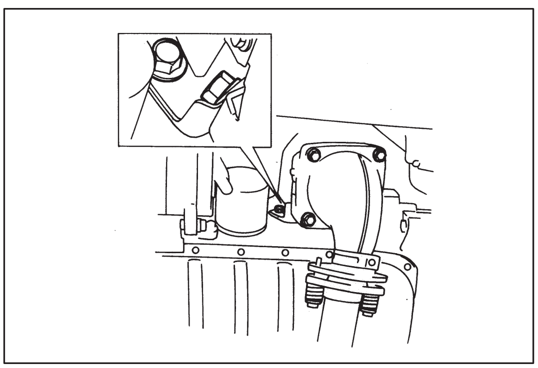
8) Disconnect fuel feed (2) and return hoses (3) from fuel delivery pipe (1).



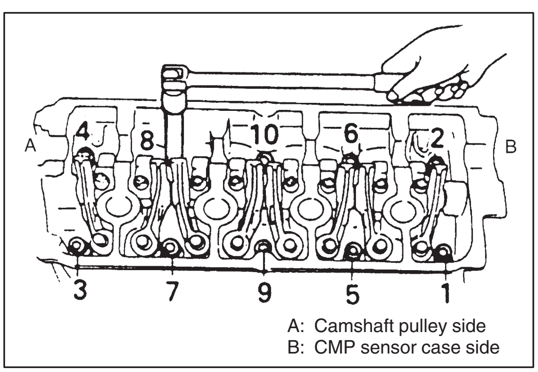
9) Remove cylinder head cover (1) as previously outlined. Loosen all valve lash adjusting screws fully.



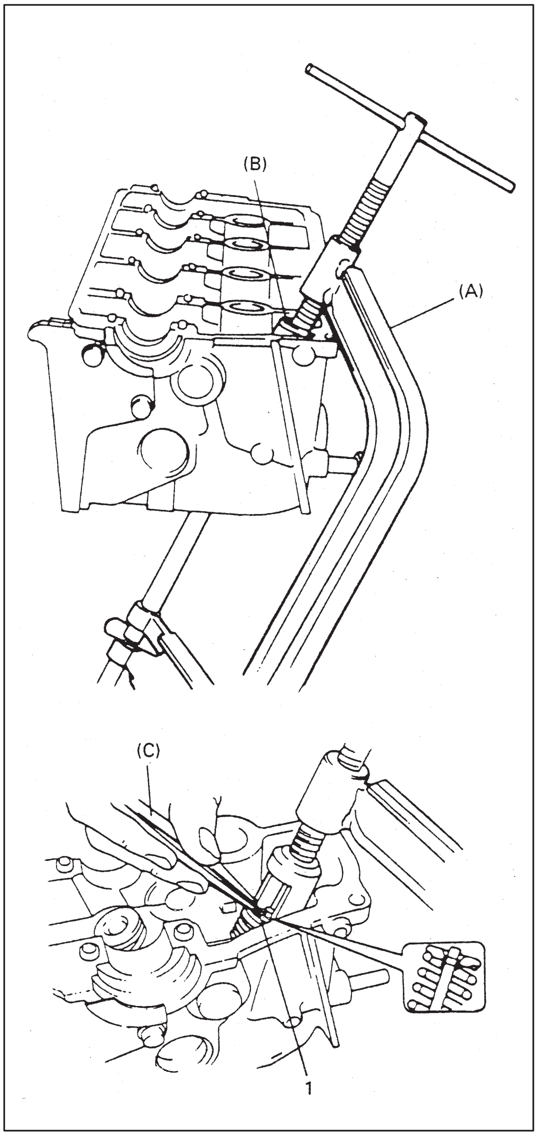
10) Remove timing belt and camshaft as previously outlined.



11) Disconnect exhaust pipe from exhaust manifold and remove exhaust manifold stiffener (if equipped).



12) Loosen cylinder head bolts in such order as indicated in figure and remove them.
13) Check all around cylinder head for any other parts required to be removed or disconnected and remove or disconnect whatever necessary.
14) Remove cylinder head with intake manifold, exhaust manifold CMP sensor case, using lifting device if necessary.

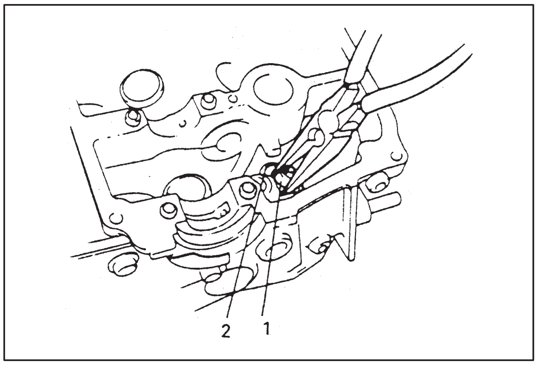


DISASSEMBLY

1) For ease in servicing cylinder head, remove CMP sensor case, intake manifold with throttle body and exhaust manifold from cylinder head.
2) Remove rocker arms and washers by pulling its shaft out to transmission side.
3) Using special tools (Valve lifter), compress valve springs and then remove valve cotters (1) by using special tool (Forceps) as shown.

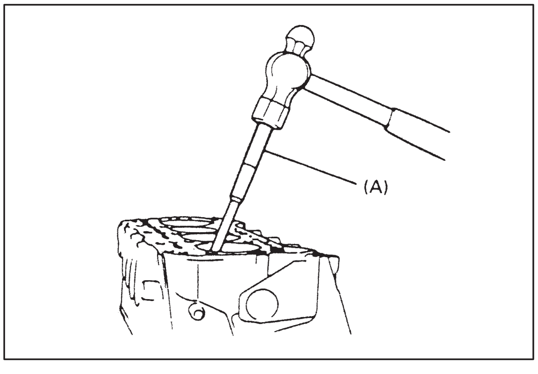
   Special Tool
   (A): 09916-14510
   (B): 09916-14910
   (C): 09916-84511

4) Release special tool, and remove spring retainer and valve spring.
5) Remove valve from combustion chamber side.



6) Remove valve stem oil seal (1) from valve guide, and then valve spring seat (2).

   NOTE:
   Do not reuse oil seal once disassembled. Be sure to use new oil seal when assembling.

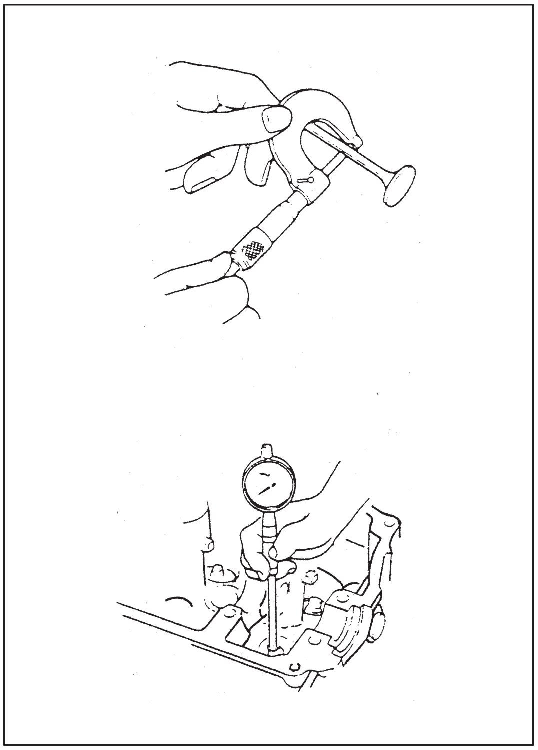


7) Using special tool (Valve guide remover), drive valve guide out from combustion chamber side to valve spring side.

   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.

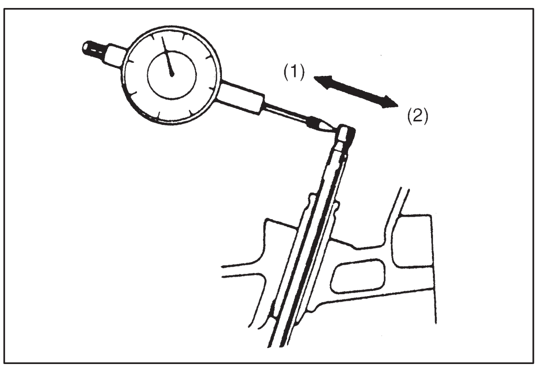


INSPECTION

Valve Guides

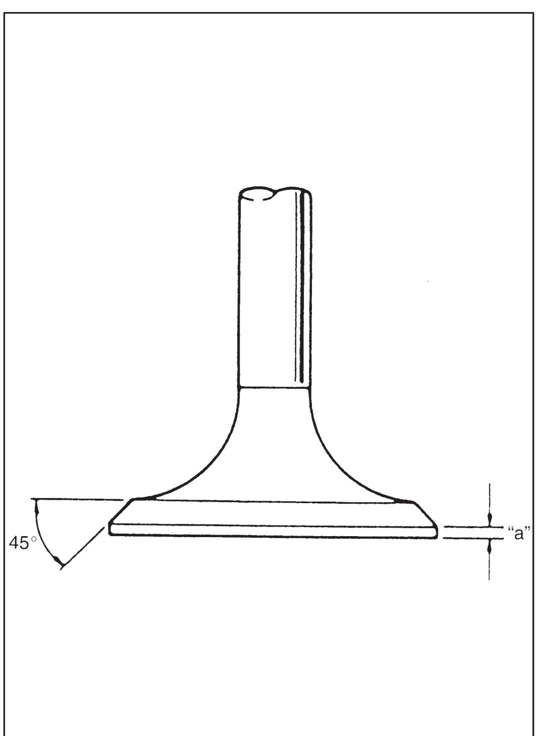
Using a micrometer and bore gauge, take diameter readings on valve stems and guides to check stem-to-guide clearance.
Be sure to take reading at more than one place along the length of each stem and guide.
If clearance exceeds limit, replace valve and valve guide.

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.

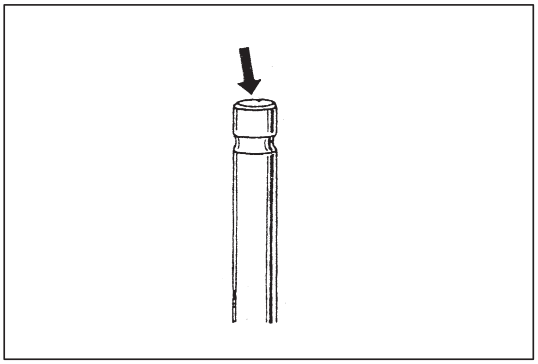
Valve stem end deflection limit	In	0.14 mm (0.005 in.)
	Ex	0.18 mm (0.007 in.)



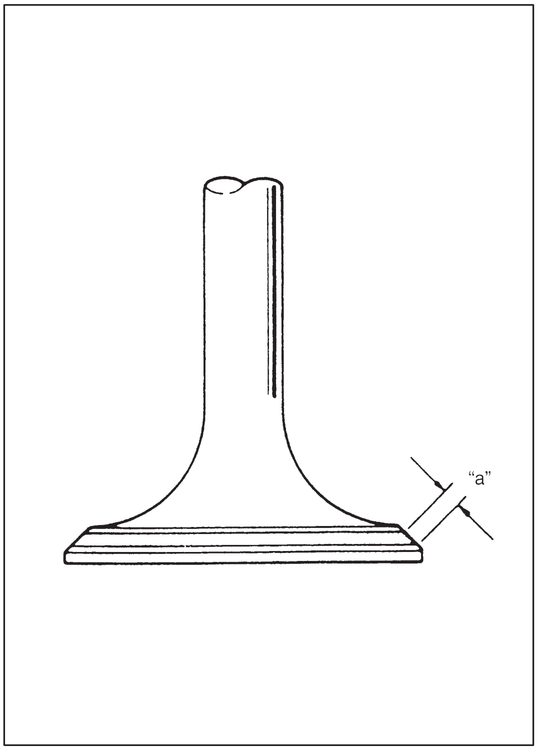
Valves

- 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 "a" 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.)



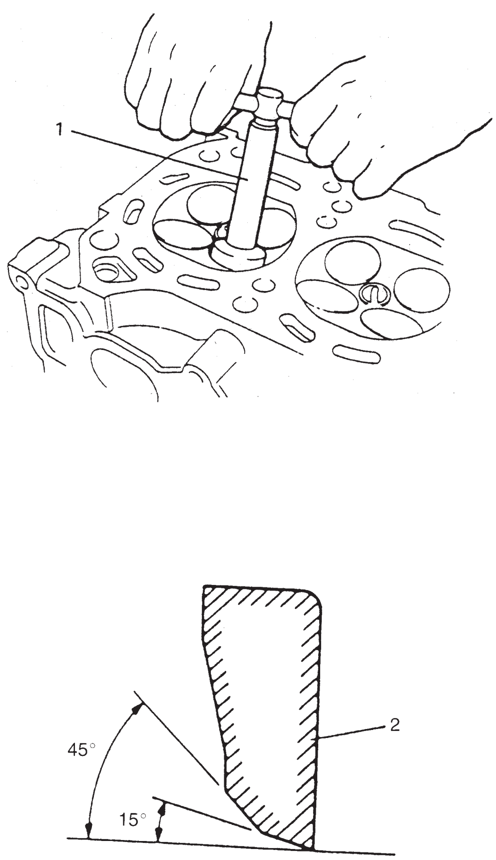
- Inspect valve stem end face for pitting and wear. If pitting or wear is found there, valve stem end may be resurfaced, but not so much as to grind off its chamfer. When it is worn so much that its chamfer is gone, replace valve.



- 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 "a" 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	



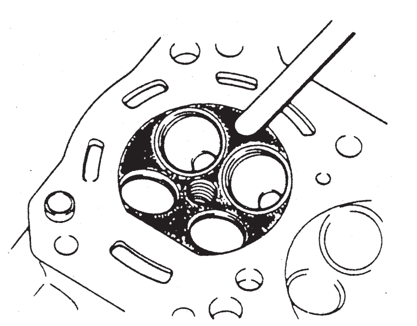
- Valve seat repair:
  A valve seat (2) not producing a uniform contact with its valve or showing width of seating contact that is out of specified range must be repaired by regrinding or by cutting and regrinding and finished by lapping.
  1) EXHAUST VALVE SEAT: Use valve seat cutters (1) to make two cuts as illustrated in figure. Two cutters must be used: the first for making 15° angle, and the second for making 45° angle. The second cut must be made to produce desired seat width.

     Seat width for exhaust valve seat:
     1.1 – 1.3 mm (0.0433 – 0.0512 in.)

  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.

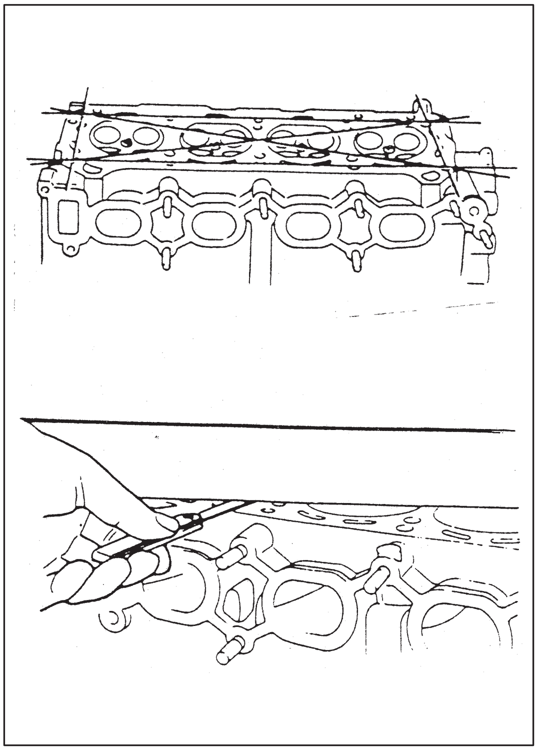


Cylinder Head

- Remove all carbon from combustion chambers.

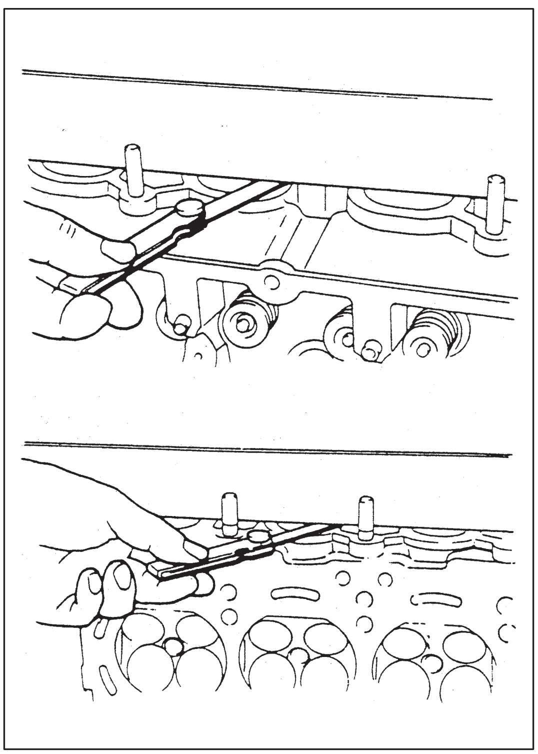
  NOTE:
  Do not use any sharp-edged tool to scrape off carbon. Be careful not to scuff or nick metal surfaces when decarboning. The same applies to valves and valve seats, too.

- Check cylinder head for cracks in intake and exhaust ports, combustion chambers, and head surface.



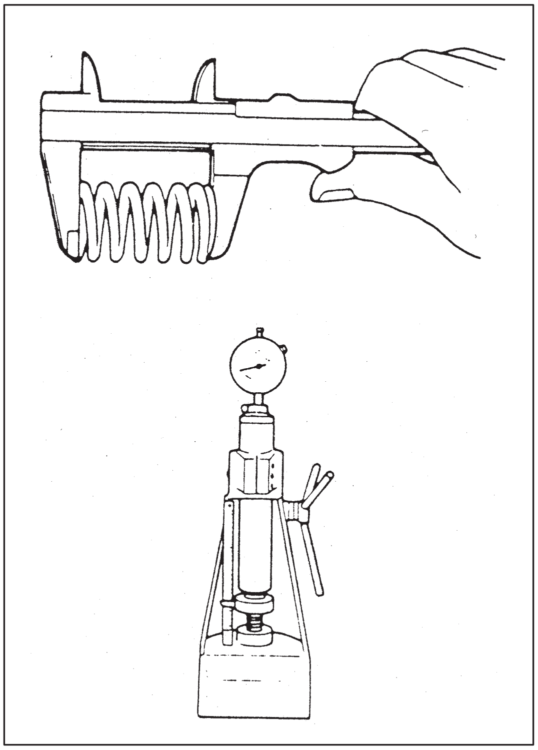
- Flatness of gasketed surface:
  Using a straightedge and thickness gauge, check surface at a total of 6 locations. If distortion limit, given below, is exceeded, correct gasketed surface with a surface plate and abrasive paper of about #400 (Waterproof silicon carbide abrasive paper): place paper on 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.

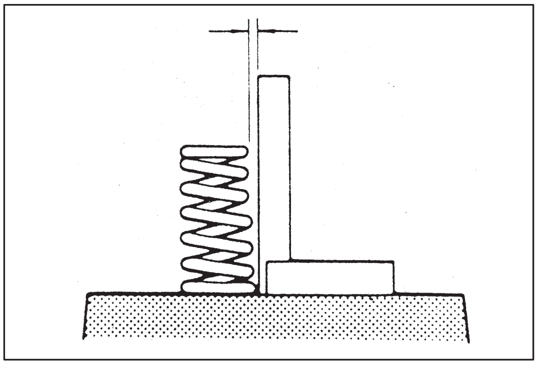
  Limit of distortion: 0.10 mm (0.004 in.)



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.

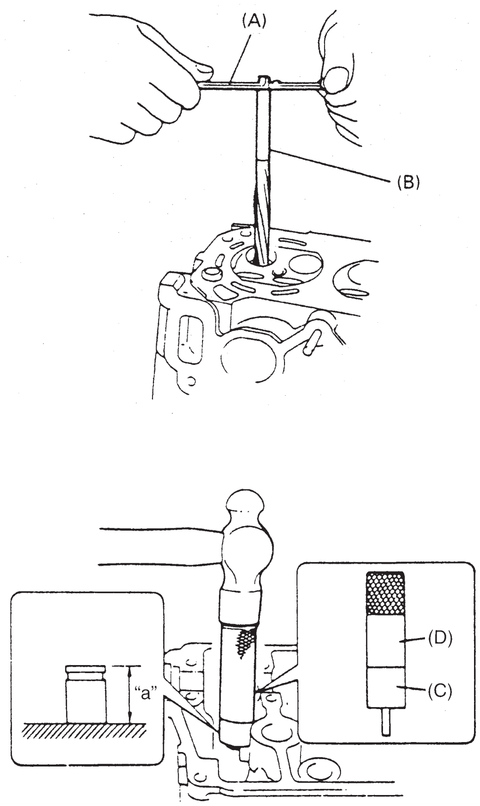
Item	Standard	Limit
Valve spring free length	36.83 mm (1.4500 in.)	35.67 mm (1.4043 in.)
Valve spring preload	10.7 – 12.5 kg for 31.5 mm (23.6 – 27.5 lb/1.24 in.)	9.3 kg for 31.5 mm (20.5 lb/1.24 in.)



- 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: 1.6 mm (0.063 in.)

ASSEMBLY



“a”: Valve guide protrusion (11.5 mm)

1) Before installing valve guide into cylinder head, ream guide hole with special tool (11 mm reamer) to remove burrs and make it truly round.

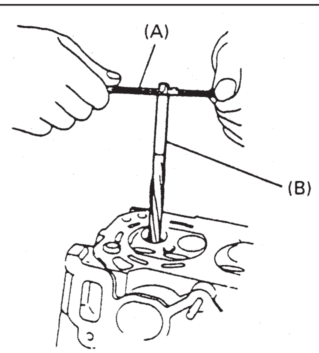
   Special Tool
   (A): 09916-34542
   (B): 09916-38210

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.**

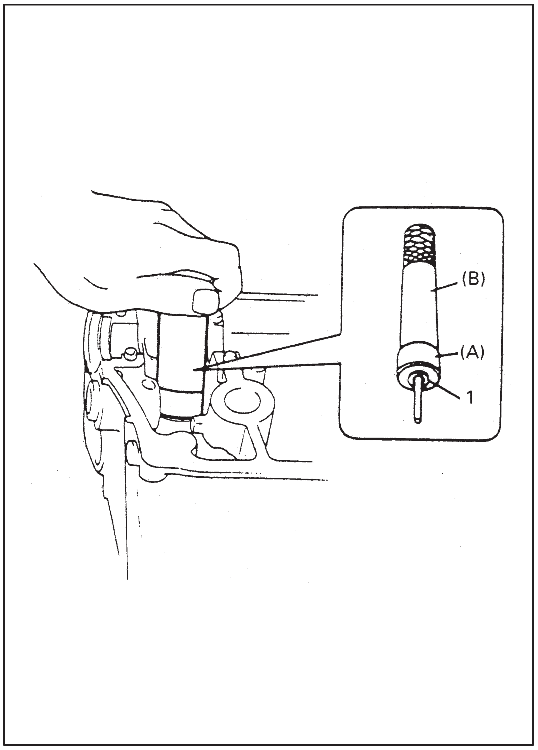
   Valve guide oversize: 0.03 mm (0.0012 in.)
   Valve guide protrusion (In and Ex): 11.5 mm (0.45 in.)



3) Ream valve guide bore with special tool (5.5 mm reamer). After reaming, clean bore.

   Special Tool
   (A): 09916-34542
   (B): 09916-34550

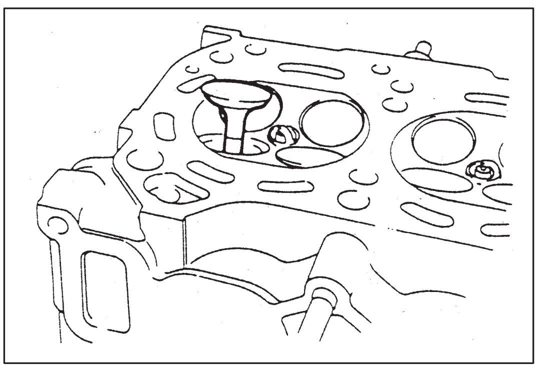
4) Install valve spring seat to cylinder head.



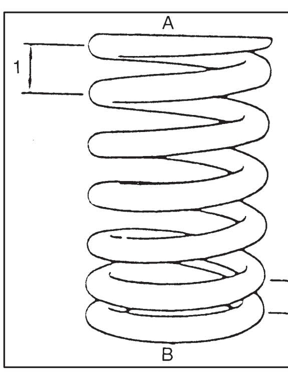
5) Install new valve stem seal (1) to valve guide.
After applying engine oil to seal and spindle of special tool (Valve guide installer handle), fit oil seal to spindle, and then install seal to valve guide by pushing special tool by hand.
After installing, check to be sure that seal is properly fixed to valve guide.

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

NOTE:
- **Do not reuse seal once disassembled. Be sure to install new seal.**
- **When installing, never tap or hit special tool with a hammer or else. Install seal to guide only by pushing special tool by hand. Tapping or hitting special tool may cause damage to seal.**

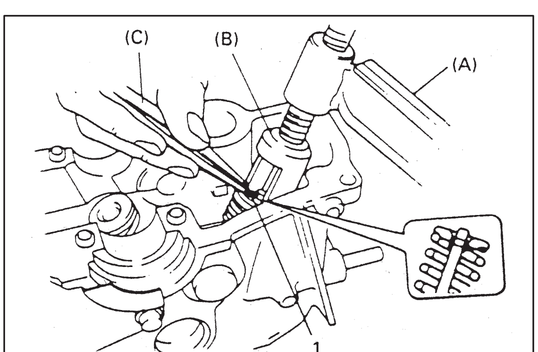


6) Install valve to valve guide.
Before installing valve to valve guide, apply engine oil to stem seal, valve guide bore, and valve stem.



A: Valve spring retainer side
B: Valve spring seat side

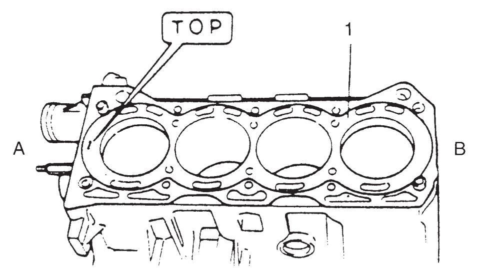
7) Install valve spring and spring retainer.
Each valve spring has top end (large-pitch (1) end) and bottom end (small-pitch (2) end). Be sure to position spring in place with its bottom end (small-pitch end) facing the bottom (valve spring seat side).



8) Using special tools (Valve lifter), compress valve spring and fit two valve cotters (1) into groove in valve stem.

Special Tool
(A): 09916-14510
(B): 09916-14910
(C): 09916-84511

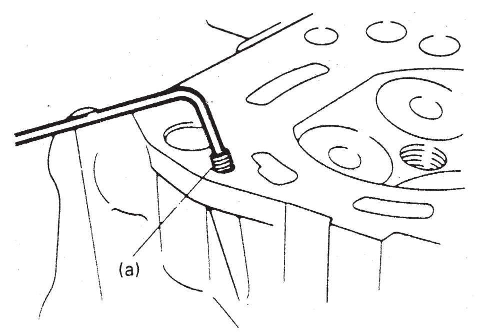
9) Install rocker arms, washers, rocker arm shaft and camshaft as previously outlined.
10) Install CMP sensor case, intake manifold and exhaust manifold.



A: Crankshaft pulley side
B: Flywheel side

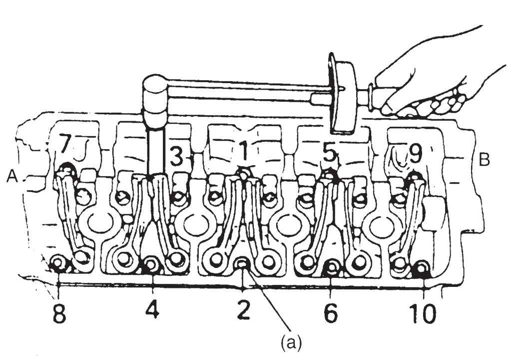
INSTALLATION

1) Remove oil gasket and oil on mating surfaces and install new head gasket (1) 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)



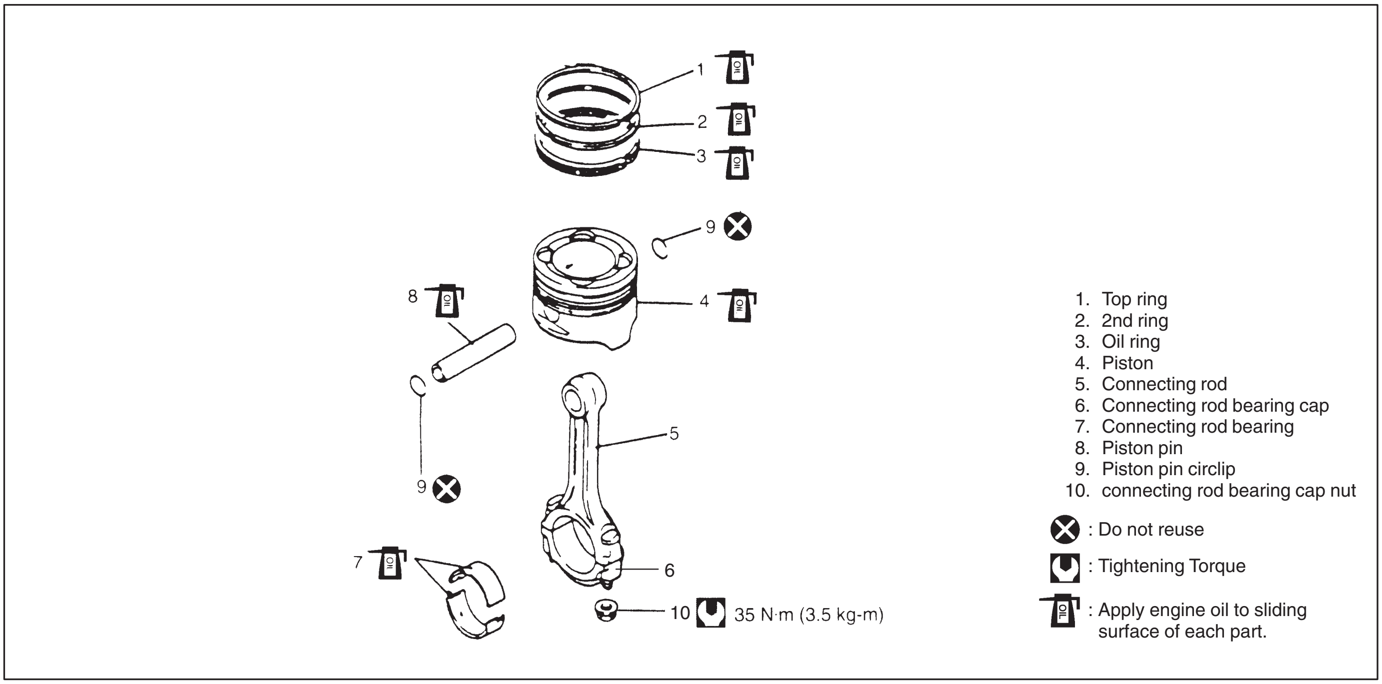
A: Camshaft pulley side
B: CMP sensor case side

3) Apply engine oil to cylinder head bolts and tighten them gradually as follows.
   a) Tighten all bolts to 35 N·m (3.5 kg-m, 25.0 lb-ft) according to numerical order in figure.
   b) In the same manner as in a), tighten them to 55 N·m (5.5 kg-m, 40.0 lb-ft).
   c) Loosen all bolts until tightening torque is reduced to 0 (zero) in reverse order of tightening.
   d) In the same manner as in a), tighten them to 35 N·m (3.5 kg-m, 25.0 lb-ft).
   e) In the same manner as in a) again, tighten them to specified torque.

   Tightening Torque
   (a): 68 N·m (6.8 kg-m, 49.5 lb-ft)

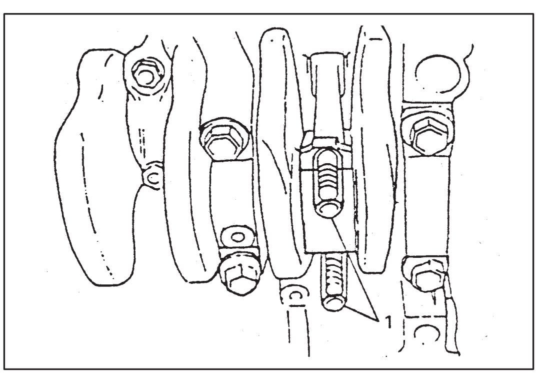
4) Reverse removal procedure for installation.
5) Adjust water pump drive belt tension by referring to “ENGINE COOLING” section.
6) Adjust power steering pump belt tension or A/C compressor belt tension, if equipped.
   Refer to Section 0B.
7) Adjust intake and exhaust valve lashes as previously outlined.
8) Adjust accelerator cable play.
   Refer to Section 6E.
9) Check to ensure that all removed parts are back in place. Reinstall any necessary parts which have not been reinstalled.
10) Refill cooling system referring to Section 6B.
11) Connect negative cable at battery.
12) Confirm that ignition timing is within specification.
13) Verify that there is no fuel leakage, coolant leakage and exhaust gas leakage at each connection.

PISTON, PISTON RINGS, CONNECTING RODS AND CYLINDERS



REMOVAL

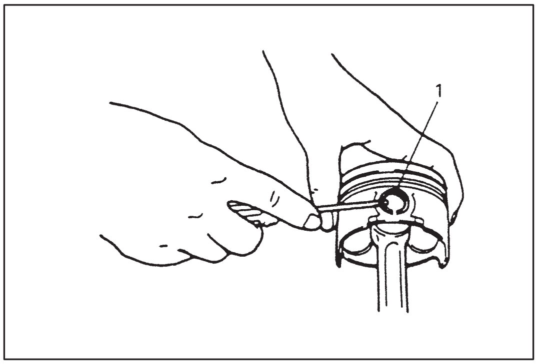
1) Remove cylinder head from cylinder block as previously outlined.
2) Drain engine oil.
3) Remove oil pan and oil pump strainer as previously outlined.
4) Mark cylinder number on all pistons, connecting rods and rod bearing caps, using silver pencil or quick drying paint.



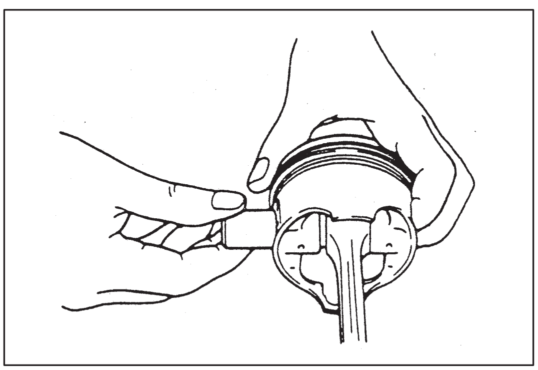
5) Remove rod bearing caps.
6) Install guide hose (1) over threads of rod bolts. This is to prevent damage to bearing journal and rod bolt threads when removing connecting rod.
7) Decarbon top of cylinder bore before removing piston from cylinder.
8) Push piston and connecting rod assembly out through the top of cylinder bore.

DISASSEMBLY

1) Using piston ring expander, remove two compression rings (Top and 2nd) and oil ring from piston.



2) Remove piston pin from connecting rod.
   - Ease out piston pin circlips (1), as shown.



   - Force piston pin out.

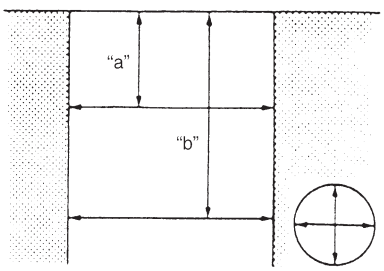
CLEANING

Clean carbon from piston head and ring grooves, using a suitable tool.

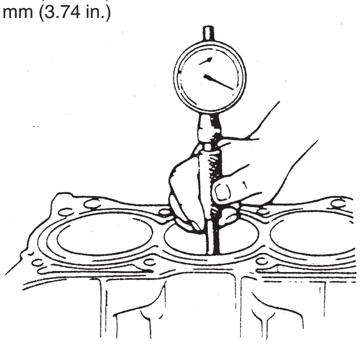
INSPECTION

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.



"a": 50 mm (1.96 in.)
"b": 95 mm (3.74 in.)

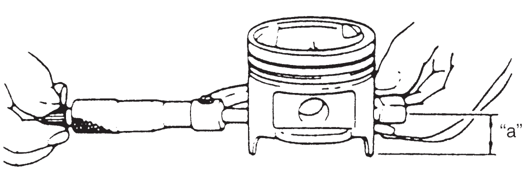


- Using a cylinder gauge, measure cylinder bore in thrust and axial directions at two positions as shown in figure.
  If any of the following conditions is noted, rebore cylinder.

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: 74.15 mm (2.9196 in.)
Tapper 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.

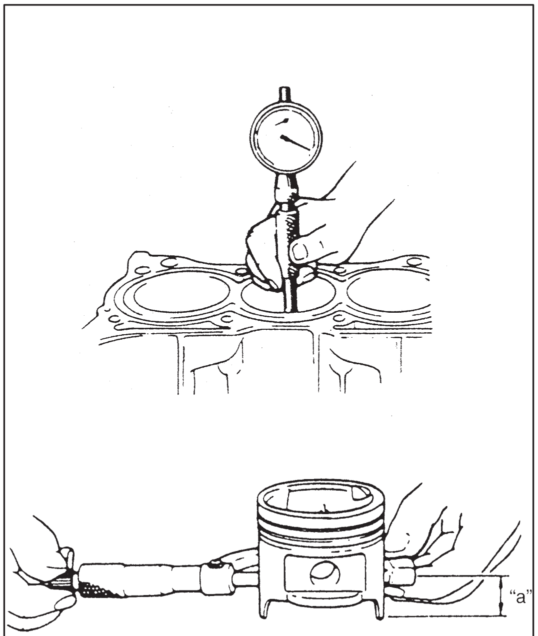


"a": 23 mm (0.91 in.)

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	73.970 – 73.990 mm (2.9122 – 2.9130 in.)
	Oversize: 0.25 mm (0.0098 in.)	74.220 – 74.230 mm (2.9220 – 2.9224 in.)
	0.50 mm (0.0196 in.)	74.470 –74.480 mm (2.9319 – 2.9323 in.)

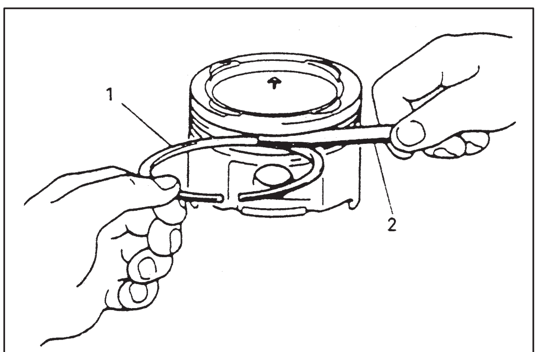


"a": 23 mm (0.91 in.)

- 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, rebore cylinder and use oversize piston.

  Piston clearance: 0.02 – 0.04 mm (0.0008 – 0.0015 in.)

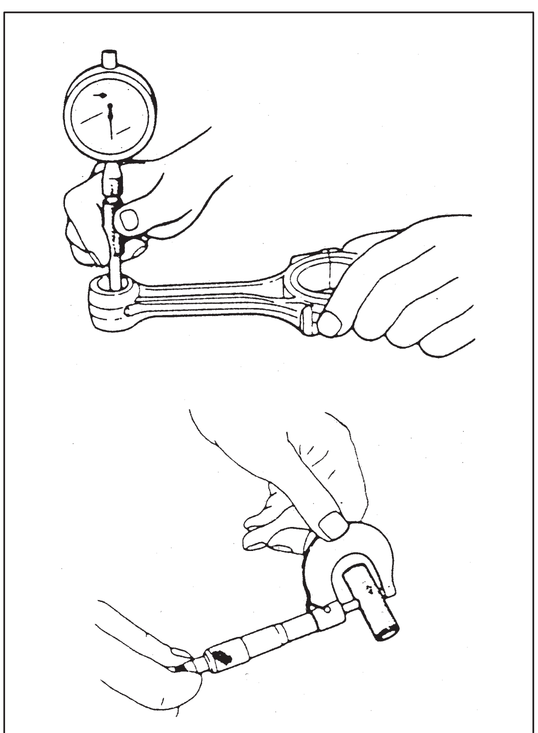
  NOTE:
  Cylinder bore diameters used here are measured in thrust direction at two positions.



- Ring groove clearance:
  Before checking, piston grooves must be clean, dry and free of carbon.
  Fit new piston ring (1) into piston groove, and measure clearance between ring and ring land by using thickness gauge (2).
  If clearance is out of 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

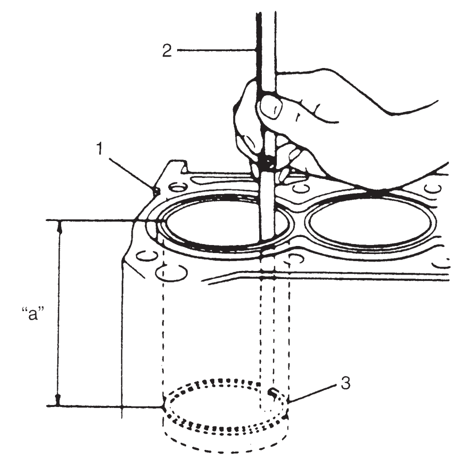


- Check piston pin, connecting rod small end bore and piston bore for wear or damage, paying particular attention to condition of small end bore bush. If pin, connecting rod small end bore or piston bore is badly worn or damaged, replace pin, connecting rod or piston.
- Piston pin clearance:
  Check 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 – 0.016 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.:
18.995 – 19.000 mm (0.7478 – 0.7480 in.)



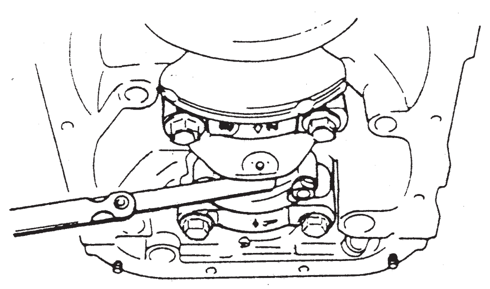
1. Cylinder block
"a": 120 mm (4.72 in.)

Piston Rings

To measure end gap, insert piston ring (3) into cylinder bore and then measure the gap by using thickness gauge (2).
If measured gap is out of specification, replace ring.

NOTE:
Decarbon and clean top of cylinder bore before inserting piston ring.

Item		Standard	Limit
Piston ring end gap	Top ring	0.15 – 0.30 mm (0.0059 – 0.0118 in.)	0.7 mm (0.0275 in.)
	2nd ring	0.2 – 0.35 mm (0.0079 – 0.0137 in.)	0.7 mm (0.0275 in.)
	Oil ring	0.2 – 0.7 mm (0.0079 – 0.0275 in.)	1.7 mm (0.0669 in.)



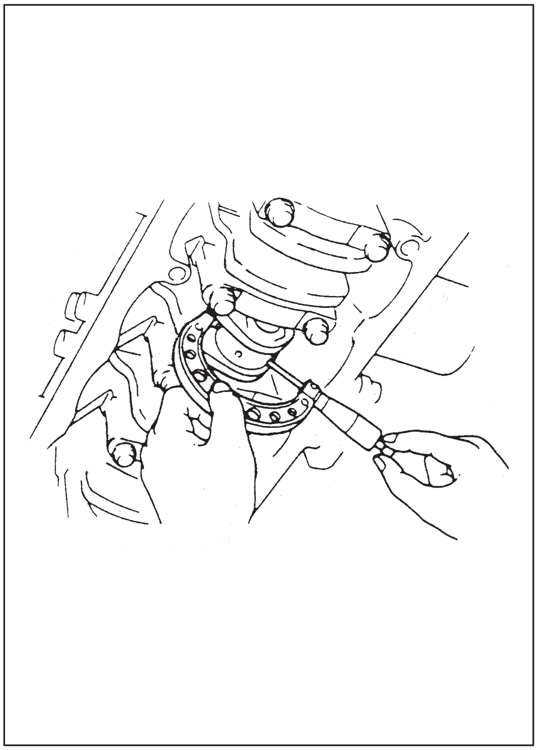
Connecting Rod

- 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 – 0.20 mm (0.0039 – 0.0078 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.)

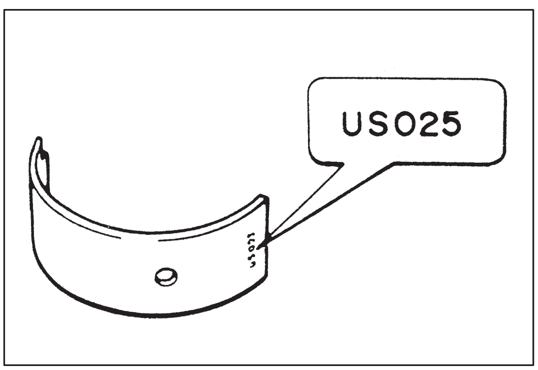


Crank Pin and Connecting Rod Bearings

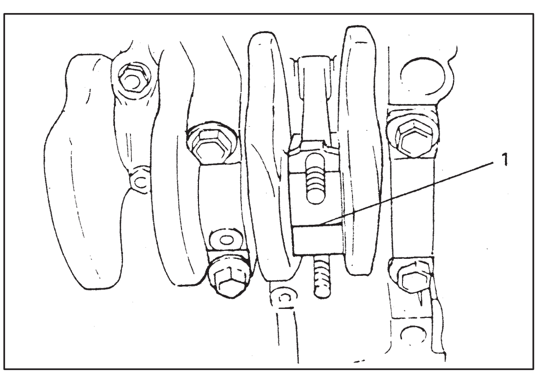
- Inspect crank pin for uneven wear or damage. Measure crank pin for out-of-round or taper with a micrometer. If crank pin is damaged, or out-of-round or taper is out of limit, replace crankshaft or regrind crank pin to undersize and use undersize bearing.

Connecting rod bearing size	Crank pin diameter
Standard	41.982 – 42.000 mm (1.6528 – 1.6535 in.)
0.25 mm (0.0098 in.)	41.732 – 41.750 mm (1.6430 – 1.6437 in.)

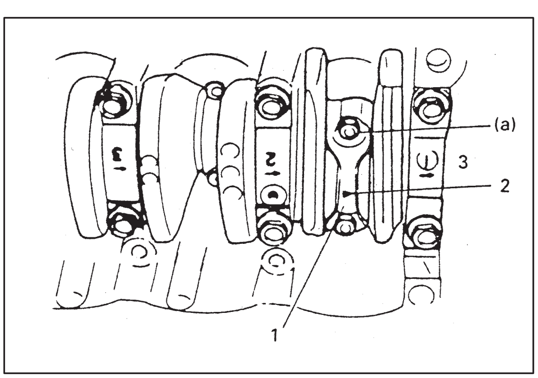
Out-of-round and taper limit: 0.01 mm (0.0004 in.)



- Rod bearing:
  Inspect bearing shells for signs of fusion, pitting, burn or flaking and observe contact pattern. Bearing shells found in defective condition must be replaced.
  Two kinds of rod bearing are available; standard size bearing and 0.25 mm undersize bearing. To distinguish them, 0. 25 mm undersize bearing has the stamped number (US025) on its backside as indicated in figure, but standard size one has no number.

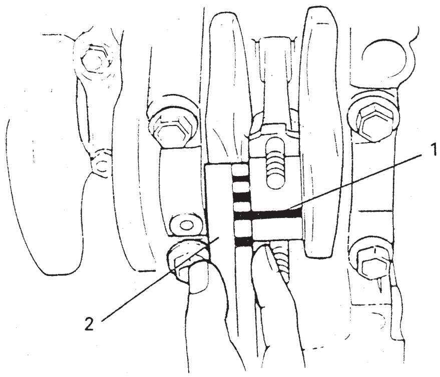


- Rod bearing clearance:
  1) Before checking bearing clearance, clean bearing and crank pin.
  2) Install bearing in connecting rod and bearing cap.
  3) Place a piece of gaging plastic (1) to full width of crankpin as contacted by bearing (parallel to crankshaft), avoiding oil hole.



  4) Install rod bearing cap (1) to connecting rod.
     When installing cap, be sure to point arrow mark (2) on cap to crankshaft pulley side (3), as shown in figure. After applying engine oil to rod bolts, tighten cap nuts to specified torque. DO NOT turn crankshaft with gaging plastic installed.

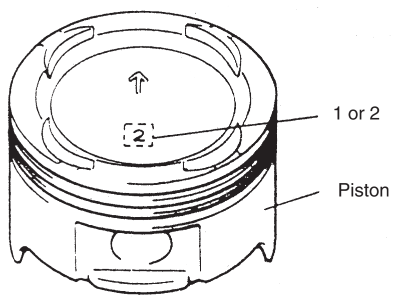
     Tightening Torque
     (a): 35 N·m (3.5 kg-m, 25.5 lb-ft)

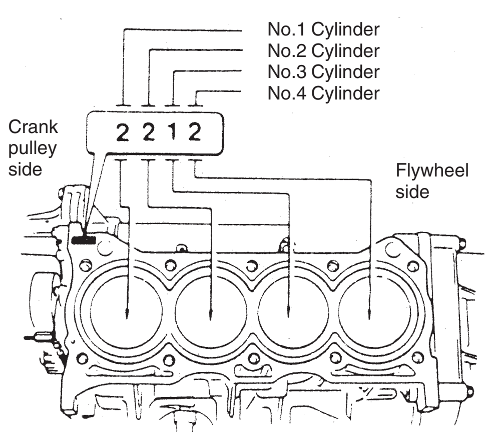


5) Remove cap and using a scale (2) on gaging plastic (1) envelope, measure gaging plastic width at the widest point (clearance).
If clearance exceeds its limit, use a new standard size bearing and remeasure clearance.

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, regrind crankpin to undersize and use 0.25 mm undersize bearing.

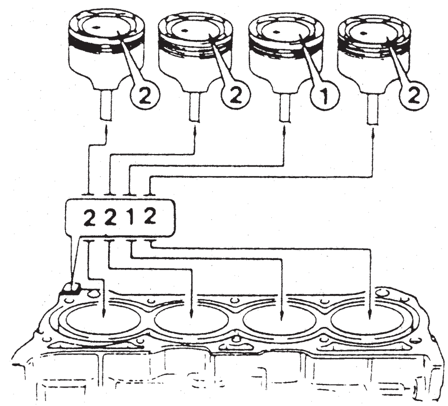




ASSEMBLY

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.

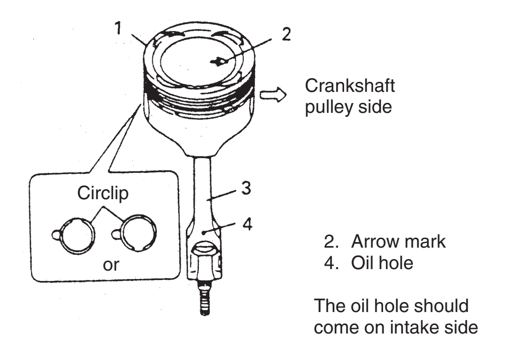
a) Each piston has stamped number 1 or 2 as shown. It represents outer diameter of piston.
b) There are also stamped numbers of 1 and 2 on the cylinder block as shown. The first number represents inner diameter of No.1 cylinder, the second number of No.2 cylinder, the third number of No.3 cylinder and 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.

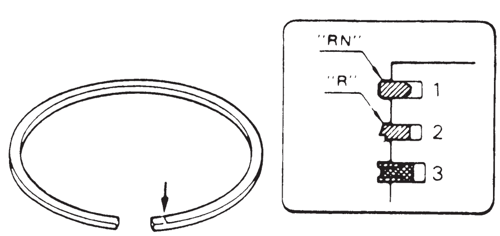
Piston		Cylinder		Piston-to-cylinder clearance
Number at the top (mark)	Outer diameter	Number (mark)	Bore diameter	
1	73.98 – 73.99 mm (2.9126 – 2.9130 in.)	1	74.01 – 74.02 mm (2.9138 – 2.9141 in.)	0.02 – 0.04 mm (0.0008 – 0.0015 in.)
2	73.97 – 73.98 mm (2.9122 – 2.9126 in.)	2	74.00 – 74.01 mm (2.9134 – 2.9138 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.

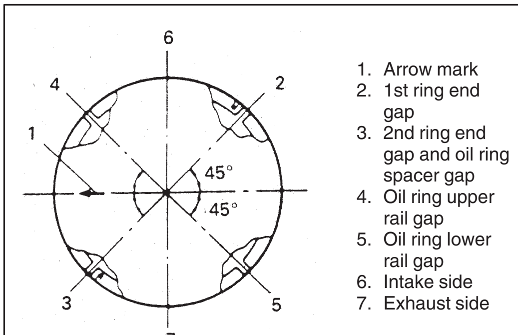


1) Install piston pin to piston (1) and connecting rod (3):
After applying engine oil to piston pin and piston pin holes in piston and connecting rod, fit connecting rod to piston as shown in figure and insert piston pin to piston and connecting rod, and install piston pin circlips.

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, 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 ring (1) difffers from 2nd ring (2) in thickness, shape and color of surface contacting cylinder wall.
Distinguish 1st ring from 2nd ring by referring to figure.
- When installing oil ring (3), install spacer first and then two rails.

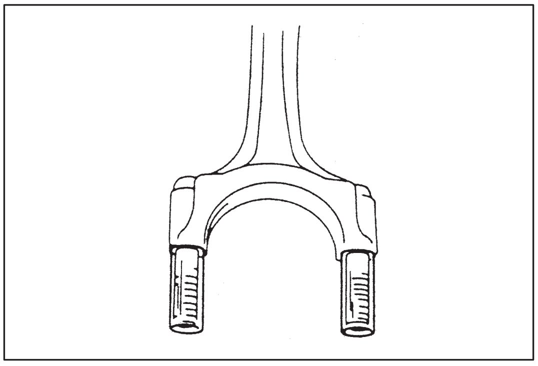


3) After installing three rings (1st, 2nd and oil rings), distribute their end gaps as shown in figure.

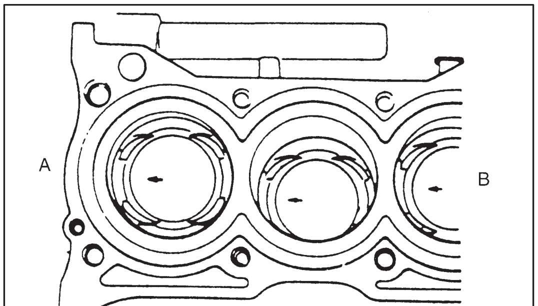
INSTALLATION OR CONNECTION

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.

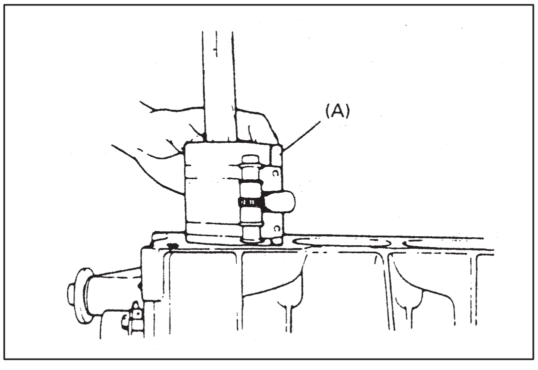


2) Install guide hoses over connecting rod bolts.
These guide hoses protect crankpin and threads of rod bolt from damage during installation of connecting rod and piston assembly.



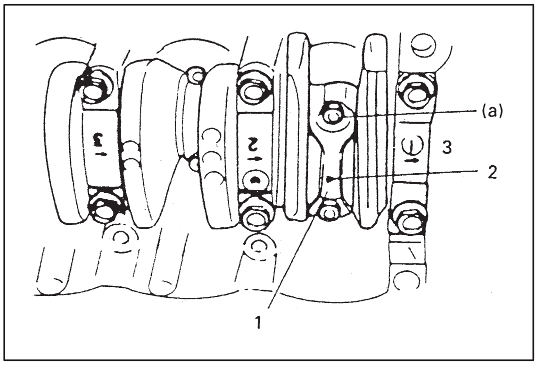
A: Crankshaft pulley side
B: Flywheel side

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



5) Install bearing cap (1):
Point arrow mark (2) on cap to crankshaft pulley side (3).
Tighten cap nuts to specification.

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

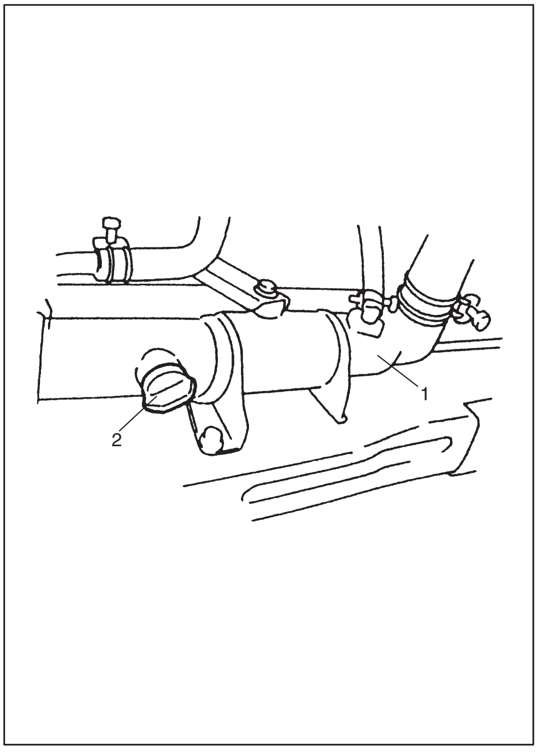
6) Reverse removal procedure for installation, as previously outlined.
7) Adjust water pump drive belt tension referring to Section 6B.
8) Adjust power steering pump belt tension or A/C compressor belt tension, if equipped.
   Refer to Section 0B.
9) Adjust accelerator cable play.
   Refer to Section 6E.
10) Check to ensure that all removed parts are back in place. Reinstall any necessary parts which have not been reinstalled.
11) Refill engine with engine oil by referring to item “ENGINE OIL CHANGE” in Section 0B.
12) Refill cooling system referring to Section 6B.
13) Connect negative cable at battery.
14) Check ignition timing referring to Section 6F.
15) Verify that there is no fuel leakage, coolant leakage, oil leakage and exhaust gas leakage at each connection.

UNIT REPAIR OVERHAUL

ENGINE ASSEMBLY

REMOVAL

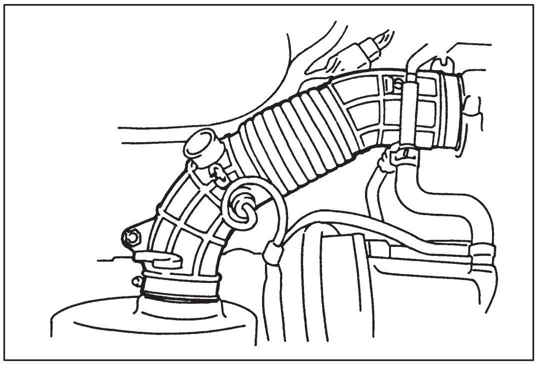
1) Release fuel pressure in fuel feed line by referring to Section 6.
2) Remove battery.
3) Remove engine hood after disconnecting windshield washer hose.



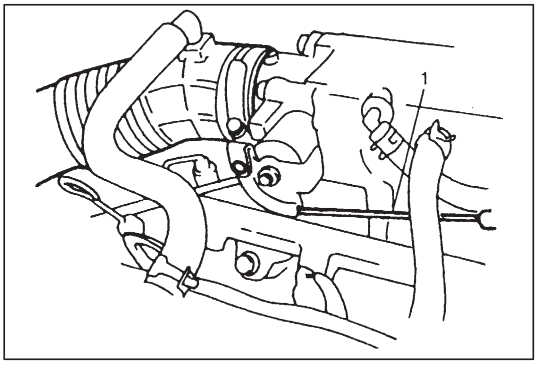
4) Drain cooling system.

> **WARNING:**
> **To help avoid danger of being burned, do not remove drain plug (2) and radiator cap while engine and radiator (1) are still hot. Scalding fluid and steam can be blown out under pressure if plug and cap are taken off too soon.**

5) Disconnect coupler of cooling fan motor.
6) Disconnect radiator inlet hose from thermostat case.
7) Disconnect A/T fluid hoses from A/T fluid pipes (for A/T model)
8) Remove outlet hose from water inlet pipe and radiator.
9) Remove radiator referring to Section 6B.



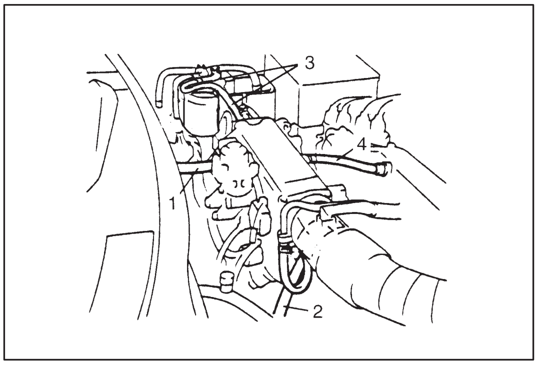
10) Remove air cleaner case and air cleaner outlet hose as previously outlined.



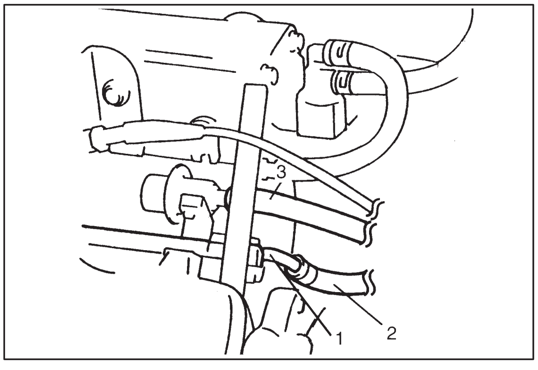
11) Disconnect the following cables.
    - Accelerator cable (1) from throttle body.
    - A/T throttle pressure control cable from A/T.
    - Clutch cable from transmission (M/T).
    - Gear select cable from transmission (A/T).
    - Speedometer cable

12) Disconnect the following electric wires:
    - Ignition coil assembly
    - Ground wires from intake manifold
    - Engine oil pressure switch
    - EVAP canister purge valve (if equipped)
    - Engine coolant temp. sensor
    - Fuel injectors
    - Power steering pressure switch (if equipped)
    - Oxygen sensor-1
    - Back-up light switch (M/T)
    - Transmission range switch (A/T)
    - A/T vehicle speed sensor (A/T)
    - Solenoid coupler (A/T)
    - Generator
    - Starter
    - Battery negative cable from transmission
    - TP sensor
    - IAC valve
    - CMP sensor
    - MAP sensor

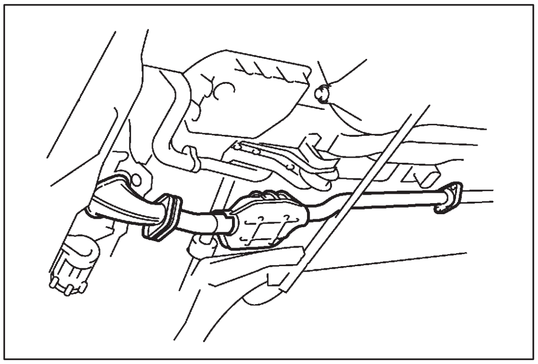
    and then release wire harnesses from clamps.



13) Disconnect the following hoses:
    - Canister purge hose (2) from EVAP canister purge valve
    - Brake booster hose (1) from intake manifold
    - Radiator outlet hose from inlet pipe
    - Heater inlet and outlet hose from heater unit



14) Disconnect fuel feed (2) and return hoses (3) from fuel delivery pipe (1).



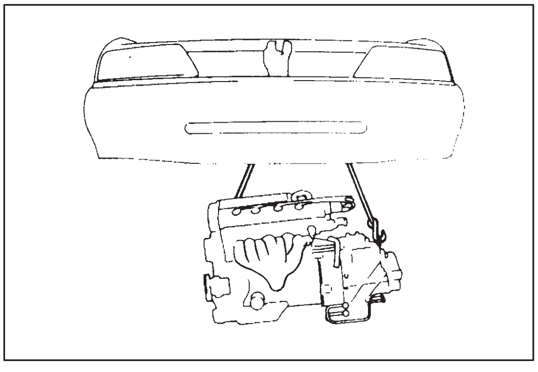
15) Remove exhaust No.1 pipe.
16) Remove right and left engine under covers.
17) Remove gear shift control shaft from transmission and remove extension rod (M/T).
18) Drain engine and transmission oil.
19) Disconnect drive shaft joints from differential gears of transmission or center bearing support referring to Section 4. In this case, it is not necessary to disconnect drive shafts from steering knuckle.
20) With hoses connected, detach A/C compressor and/or P/S pump with bracket from cylinder block, if equipped.

NOTE:
Suspend removed compressor and/or pump at a place where no damage will be caused during removal and installation of engine with transmission.

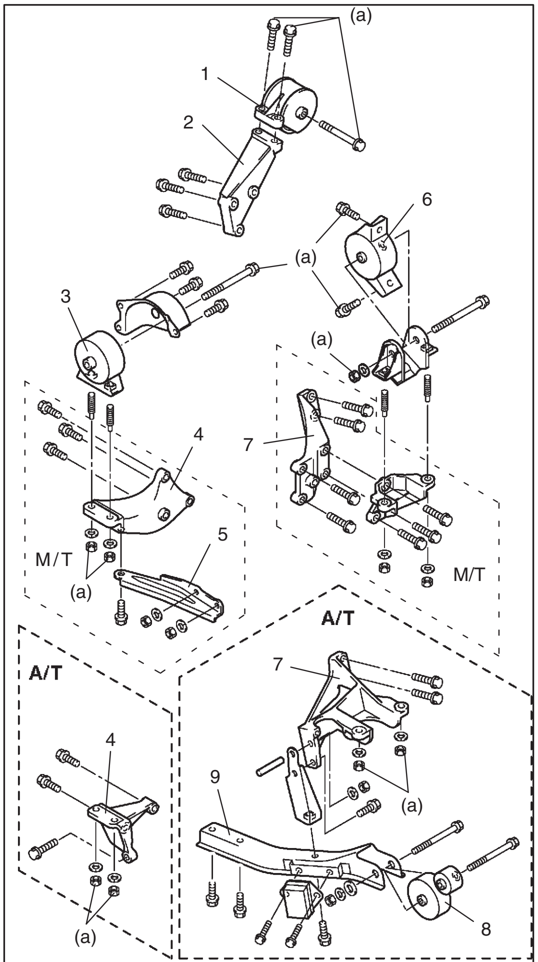
21) Disconnect P/S hose from P/S oil pump. (if equipped)

NOTE:
Plug pipe, hose and pump port.

22) Install support device.
23) Remove rear mounting from body. (For M/T model)
Remove rear torque rod (For A/T model).
24) Remove engine left mounting from body.
25) Remove engine right mounting from right mounting bracket and stiffener.



26) Before removing engine with transmission from body, recheck to make sure all hoses, electric wires and cables are disconnected from engine and transmission.
27) Lower engine with transmission from body.



1. Right mounting
2. Right mounting bracket
3. Left mounting
4. Left mounting bracket
5. Left mounting bracket stiffener
6. Rear mounting
7. Rear mounting bracket
8. Rear torque rod
9. Rear torque rod bracket

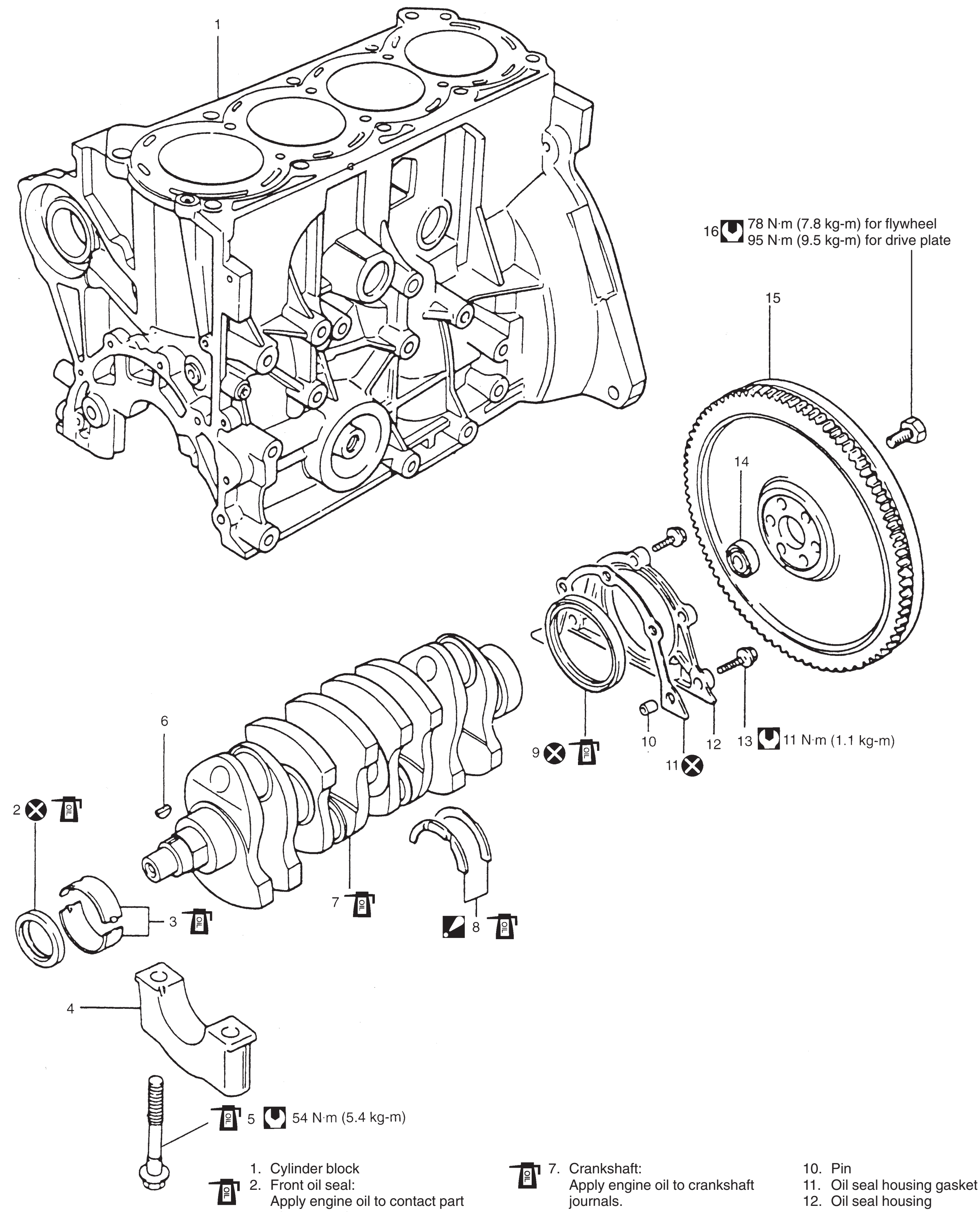
INSTALLATION

1) Lift engine with transmission into engine compartment, but do not remove support device.
2) Install engine right mounting to right mounting bracket and stiffener.
3) Install engine left mounting to body.
4) Install rear mounting to body (For M/T model)
   Install torque rod (For A/T model)
5) Tighten bolts and nuts of all parts installed in above steps 2), 3) and 4) or 5) to specified torque.

   Tightening Torque
   (a): 55 N·m (5.5 kg-m, 40.0 lb-ft)

6) Remove support device.
7) Reverse removal procedures for installation of remainder.
   - Push in each drive shaft joint fully so that snap ring engages with differential gear or center bearing support.
     Use care not to damage oil seal lip when inserting.
   - Clamp electric wire securely.
8) Adjust clutch pedal free travel by referring to Section 7C. (M/T)
   Adjust gear select cable and A/T throttle pressure control cable, referring to Section 7B. (A/T)
9) Adjust gear shift control lever by referring to Section 7A. (M/T)
10) Adjust accelerator cable play by referring to Section 6E.
11) Refill transmission with gear oil. (A/T fluid for A/T model) by referring to Section 0B.
12) Refill engine with engine oil by referring to Section 0B.
13) Refill cooling system by referring to Section 6B.
14) Adjust A/C compressor and/or P/S pump drive belt referring to Section 0B. (if equipped)
15) Check P/S fluid level by referring to Section 3B1. (if equipped)
16) Upon completion of installation, verify that there is no fuel leakage, coolant leakage, transmission oil leakage or exhaust gas leakage at each connection.

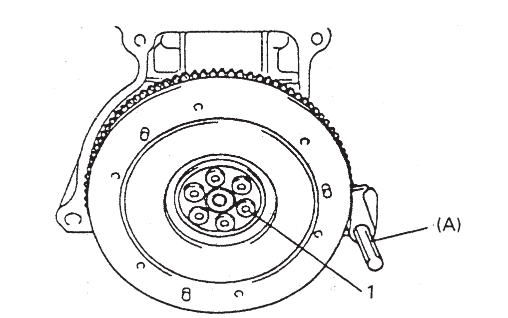
MAIN BEARINGS, CRANKSHAFT AND CYLINDER BLOCK



1. Cylinder block
2. Front oil seal:
   Apply engine oil to contact part of crankshaft with oil seal lip.
3. Main bearing:
   Apply engine oil to bearing inside surfaces.
4. Bearing cap
5. Cap bolt:
   Apply engine oil to bolt and bearing surfaces.
6. Timing pulley key
7. Crankshaft:
   Apply engine oil to crankshaft journals.
8. Thrust bearing:
   Set oil grooves of bearing to crank weds.
   Apply engine oil.
9. Rear oil seal:
   Apply engine oil to contact part of crankshaft with oil seal lip.
10. Pin
11. Oil seal housing gasket
12. Oil seal housing
13. Housing bolt
14. Input shaft bearing
15. Flywheel
16. Flywheel bolt

: Tightening Torque

: Do not reuse

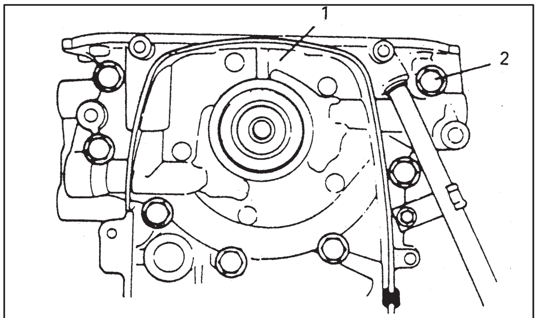


1. Flywheel bolt

REMOVAL

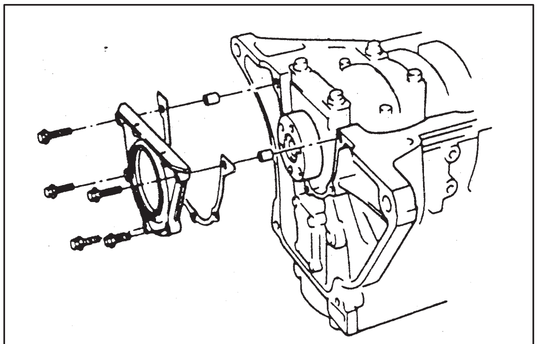
1) Remove engine assembly from body as previously outlined.
2) Remove clutch cover, clutch disc and flywheel (drive plate for A/T).

Special Tool
(A): 09924-17810

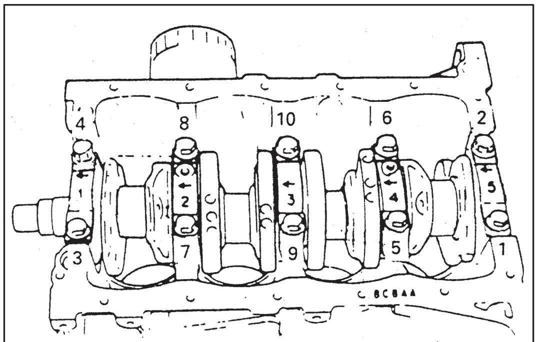


2. Bolt

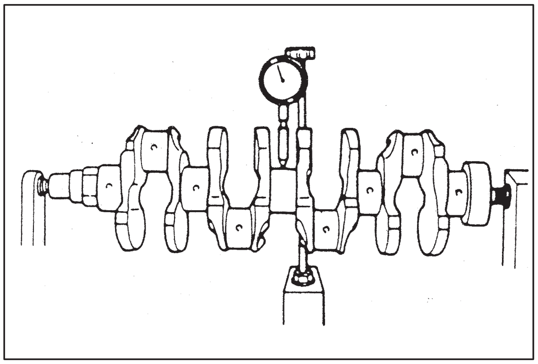
3) Remove crankshaft pulley, timing belt and crankshaft timing pulley.
4) Remove cylinder head assembly.
5) Remove oil pan and oil pump strainer.
6) Remove oil pump (1).



7) Remove oil seal housing.
8) Remove connecting rod bearing caps.



9) Loosen crankshaft bearing cap bolts in such order as indicated in figure a little at a time and remove bearing caps.
10) Remove crankshaft from cylinder block.



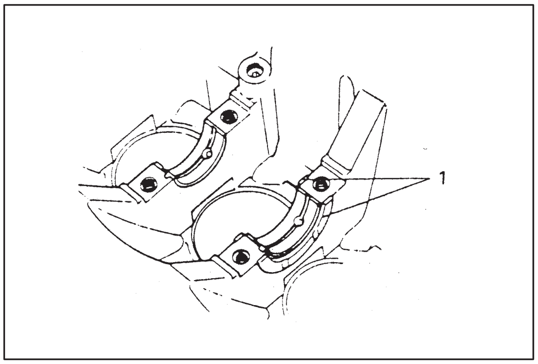
INSPECTION

Crankshaft

Crankshaft runout

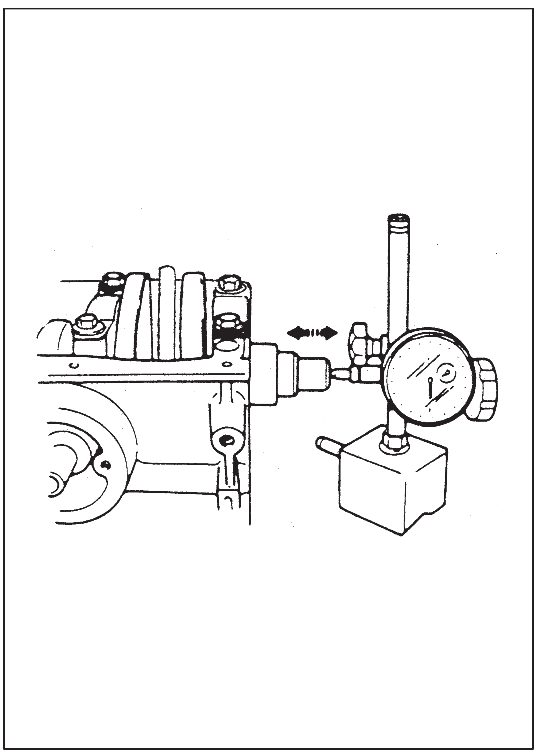
Using a dial gauge, measure runout at center journal. Rotate crankshaft slowly. If runout exceeds its limit, replace crankshaft.

Limit on runout: 0.06 mm (0.0023 in.)



Crankshaft thrust play

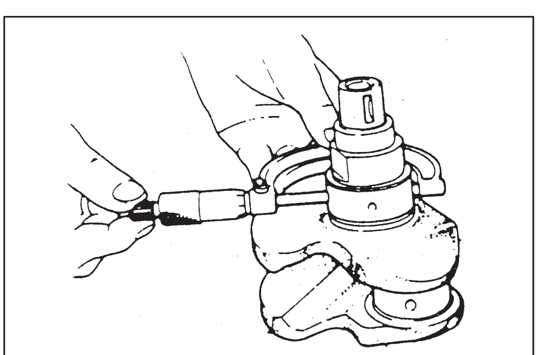
Measure this play with crankshaft set in cylinder block in the normal manner, that is, with thrust bearing (1) and journal bearing caps installed.



Use a dial gauge to read displacement in axial (thrust) direction of crankshaft.
If its limit is exceeded, replace thrust bearing with new standard one or oversize one to obtain standard thrust play.

Item	Standard	Limit
Crankshaft thrust play	0.11 – 0.31 mm (0.0044 – 0.0122 in.)	0.38 mm (0.0149 in.)

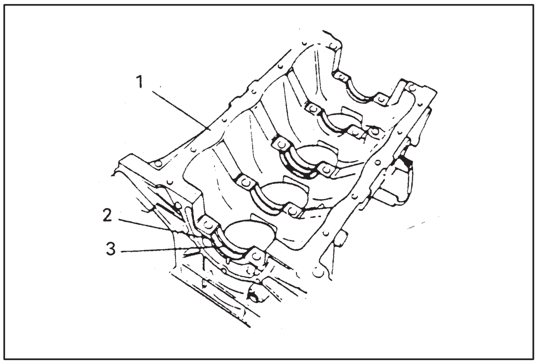
Thickness of crankshaft thrust bearing	Standard		2.500 mm (0.0984 in.)
	Oversize:	0.125 mm (0.0049 in.)	2.563 mm (0.1009 in.)



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.

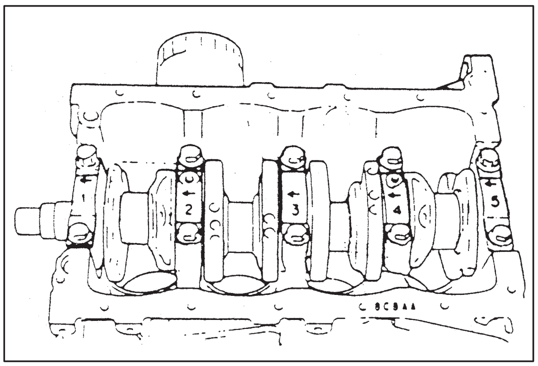
Limit on out-of-round and taper: 0.01 mm (0.0004 in.)



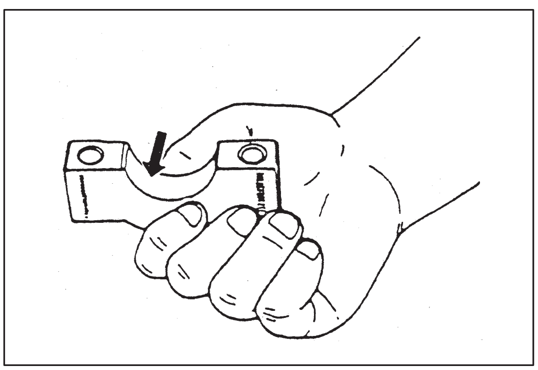
Main Bearings

General information

- Service main bearings are available in standard size and 0.25 mm (0.0098 in.) undersize, and each of them has 5 kinds of bearings differing in tolerance.
- Upper half of bearing (2) has oil groove (3) as shown in figure. Install this half with oil groove to cylinder block (1).

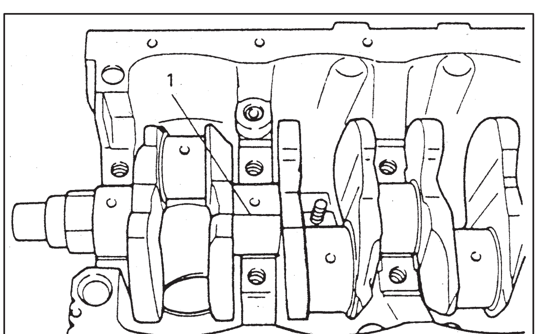


- On each main bearing cap, arrow mark and number are embossed as shown in figure.
  When installing each bearing cap to cylinder block, point arrow mark toward crankshaft pulley side and install each cap from that side to flywheel side in ascending order of numbers “1”, “2”, “3”, “4” and “5”. Tighten cap bolts to specified torque.



Inspection

Check bearings for pitting, scratches, wear or damage.
If any malcondition is found, replace both upper and lower halves.
Never replace one half without replacing the other half.

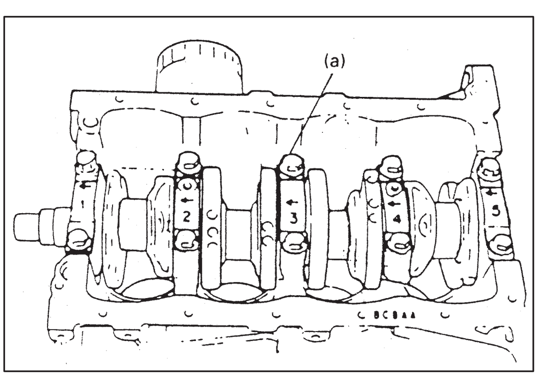


1. Gaging plastic

Main bearing clearance

Check clearance by using gaging plastic (1) according to the following procedure.

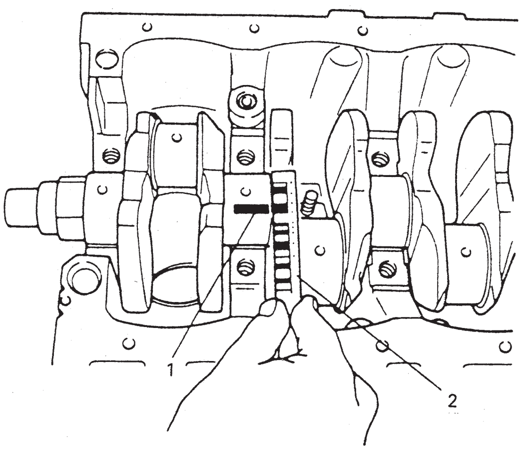
1) Remove bearing caps.
2) Clean bearings and main journals.
3) Place a piece of gaging plastic to full width of bearing (parallel to crankshaft) on journal, avoiding oil hole.



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.

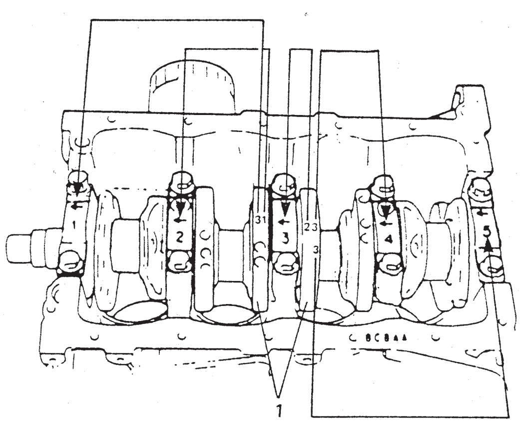
   Tightening Torque
   (a): 54 N·m (5.4 kg-m, 39.0 lb-ft)

   NOTE:
   Do not rotate crankshaft while gaging plastic is installed.



5) Remove cap and using scale (2) on gaging plastic (1) envelope, measure gaging plastic width at its widest point. If clearance exceeds its limit, replace bearing. Always replace both upper and lower inserts as a unit.
   A new standard bearing may produce proper clearance. If not, it will be necessary to regrind crankshaft journal for use of 0.25 mm undersize bearing.
   After selecting new bearing, recheck clearance.

	Standard	Limit
Bearing clearance	0.020 – 0.040 mm (0.0008 – 0.0016 in.)	0.060 mm (0.0023 in.)



Selection of main bearings

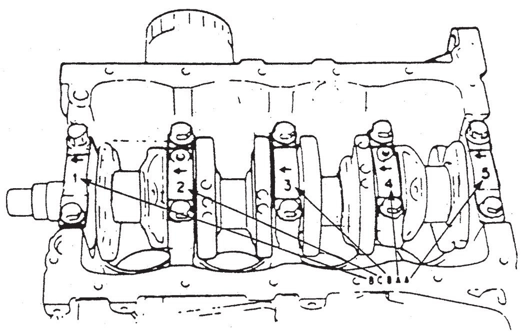
STANDARD BEARING:

If bearing is in malcondition, or bearing clearance is out of specification, select a new standard bearing according to the following procedure and install it.

1) First check journal diameter by using the following procedure.
   As shown in figure, crank webs (1) of No.2 and No.3 cylinders have five stamped numerals.
   Three kinds of numerals (“1”, “2” and “3”) represent the following journal diameters.

Numeral stamped	Journal diameter
1	44.994 – 45.000 mm (1.7714 – 1.7716 in.)
2	44.988 – 44.994 mm (1.7712 – 1.7714 in.)
3	44.982 – 44.988 mm (1.7709 – 1.7712 in.)

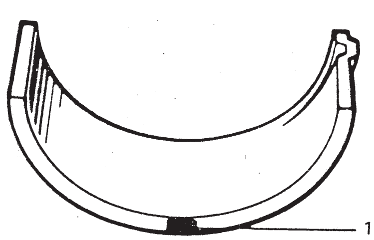
The first, second, third, fourth and fifth (left to right) stamped numerals represent journal diameters at bearing caps “1”, “2”, “3”, “4” and “5” respectively.
For example, in figure, the first (leftmost) numeral “3” indicates that journal dia. at bearing cap “1” is within 44.982 – 44.988 mm, and second one “1” indicate that journal dia. at cap “2” is within 44.994 – 45.000 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 the following cap bore diameters.

Alphabet stamped	Bearing cap bore diameter (without bearing)
A	49.000 – 49.006 mm (1.9291 – 1.9294 in.)
B	49.006 – 49.012 mm (1.9294 – 1.9296 in.)
C	49.012 – 49.018 mm (1.9296 – 1.9298 in.)

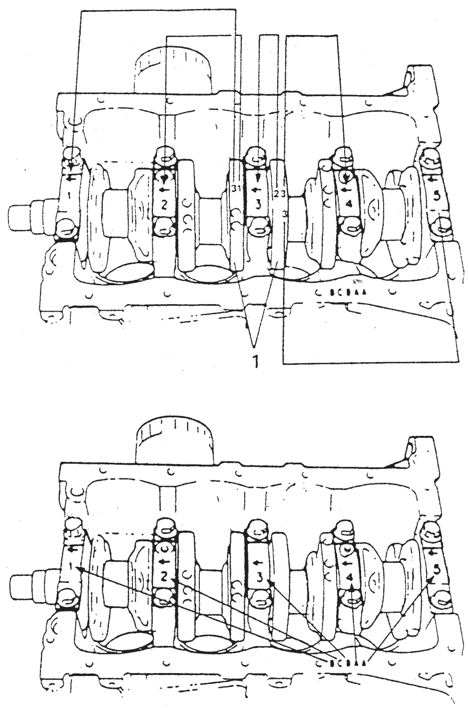
   The first, second, third, fourth and fifth (left to right) stamped alphabets reperesent cap bore diameters of bearing caps “1”, “2”, “3”, “4” and “5”, respectively.
   For example, in figure, the first (leftmost) alphabet “B” indicates that cap bore dia. of bearing cap “1” is within 49.006 – 49.012 mm, and the fifth (rightmost) alphabet “A” indicates that cap bore dia. of cap “5” is within 49.000 – 49.006 mm.



1. Paint

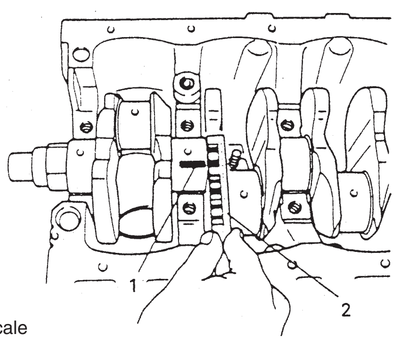
3) There are five kinds of standard bearings differing in thickness. To distinguish them, they are painted in the following colors at the position as indicated in figure.
   Each color indicates the following thickness at the center of bearing.

Color painted	Bearing thickness
Green	1.996 – 2.000 mm (0.0786 – 0.0787 in.)
Black	1.999 – 2.003 mm (0.0787 – 0.0788 in.)
Colorless (no paint)	2.002 – 2.006 mm (0.0788 – 0.0789 in.)
Yellow	2.005 – 2.009 mm (0.0789 – 0.0790 in.)
Blue	2.008 – 2.012 mm (0.0790 – 0.0791 in.)



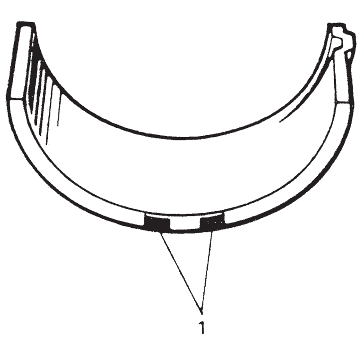
4) From numerals stamped on crank webs (1) of No.2 and No.3 cylinders and the alphabets stamped on mating surface of cylinder block, determine new standard bearing to be installed to journal, by referring to table given below.
   For example, if numeral stamped on crank web is "1" and alphabet stamped 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.		



2. Scale

5) Using gaging plastic (1), check bearing clearance with newly selected standard bearing.
   If clearance still exceeds its limit, use next thicker bearing and recheck clearance.
6) When replacing crankshaft or cylinder block due to any reason, select new standard bearings to be installed by referring to numerals stamped on new crankshaft or alphabets stamped on mating surface of new cylinder block.



1. Paint

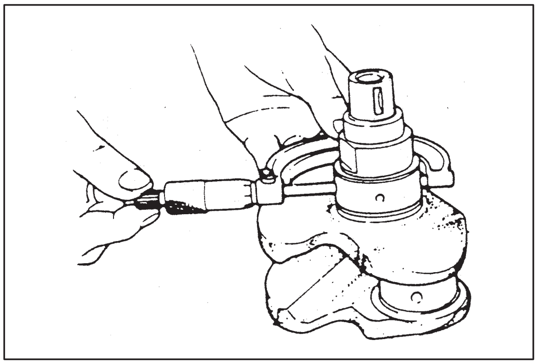
UNDERSIZE BEARING (0.25 mm):

- 0.25 mm undersize bearing is available, in five kinds varying in thickness.
  To distinguish them, each bearing is painted in the following colors at such position as indicated in figure.
  Each color represents the following thicknesses 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.)

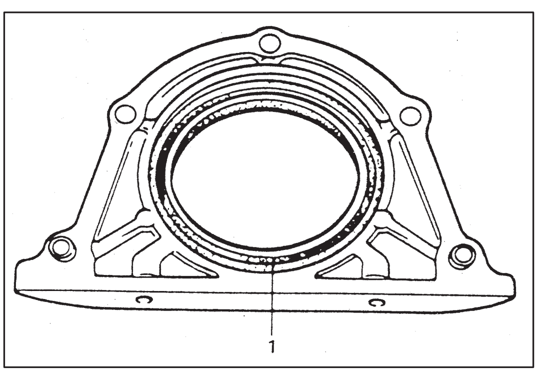
- If necessary, regrind crankshaft journal and select under-size bearing to use with it as follows.
  1) Regrind journal to the following finished diameter.

  Finished diameter: 44.732 – 44.750 mm (1.7611 – 1.7618 in.)



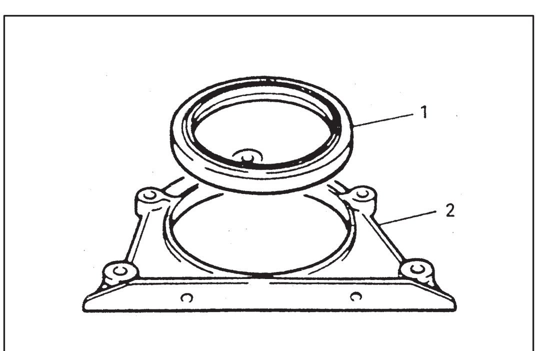
2) Using micrometer, measure reground journal diameter. Measurement should be taken in two directions perpendicular to each other in order to check for out-of-round.
3) Using journal diameter measured above and alphabets stamped on mating surface of cylinder block, select an under-size bearing by referring to table given below. Check bearing clearance with newly selected undersize bearing.

<table>
<tr><td colspan="2" rowspan="2"></td><td colspan="3">Measured journal diameter</td></tr>
<tr><td>44.744 – 44.750 mm
(1.7616 – 1.7618 in.)</td><td>44.738 – 44.744 mm
(1.7613 – 1.7616 in.)</td><td>44.732 – 44.738 mm
(1.7611 – 1.7613 in.)</td></tr>
<tr><td rowspan="3">Alphabets stamped on mating surface of cylinder block</td><td>A</td><td>Green & Red</td><td>Black & Red</td><td>Red only</td></tr>
<tr><td>B</td><td>Black & Red</td><td>Red only</td><td>Yellow & Red</td></tr>
<tr><td>C</td><td>Red only</td><td>Yellow & Red</td><td>Blue & Red</td></tr>
<tr><td colspan="2"></td><td colspan="3">Undersize bearing to be installed</td></tr>
</table>

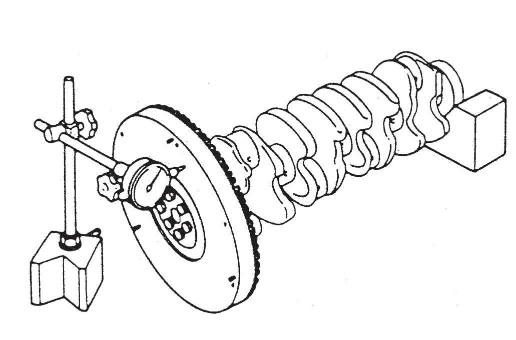


Rear Oil Seal

Carefully inspect oil seal (1) for wear or damage. If its lip is worn or damaged, replace it.



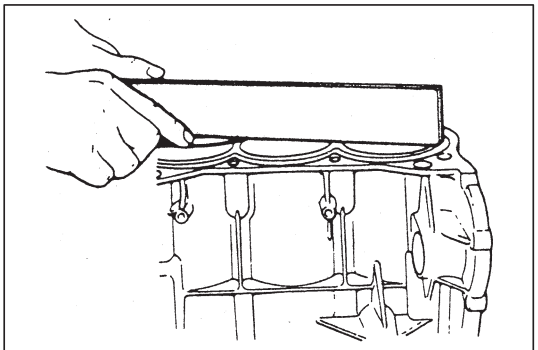
For oil seal installation, press-fit rear oil seal (1) so that oil seal housing (2) end face is flush with oil seal end face.



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

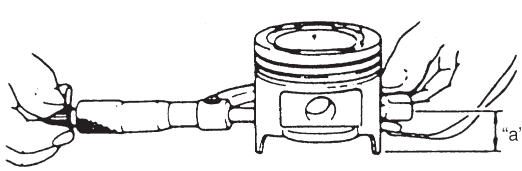
Using straightedge and thickness gauge, check gasketed surface for distortion and, if flatness exceeds its limit, correct it.

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	74.220 – 74.230 mm (2.9220 – 2.9224 in.)
O/S 0.50	74.470 – 74.480 mm (2.9319 – 2.9323 in.)



“a”: 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.

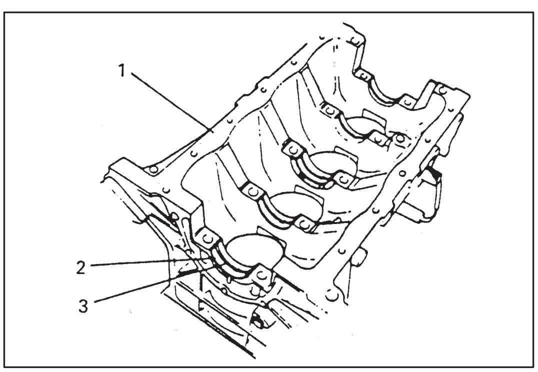
NOTE:
Before reboring, install all main bearing caps in place and tighten to specification to avoid distortion of bearing bores.

6) Measure piston clearance after honing.

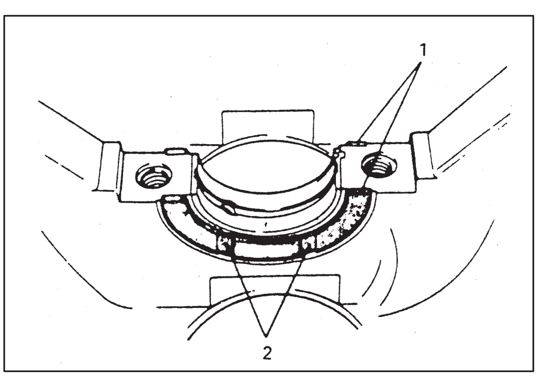
INSTALLATION

NOTE:

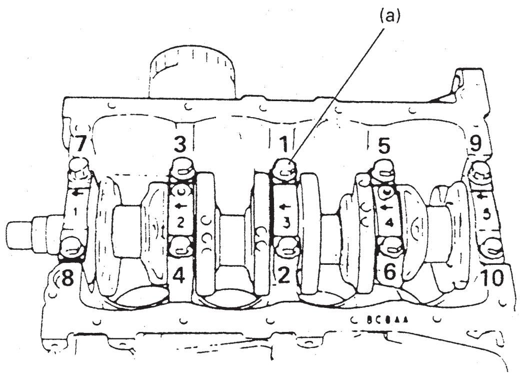
- **All parts to be installed must be perfectly clean.**
- **Be sure to oil crankshaft journals, journal bearings, thrust bearings, crankpins, connecting rod bearings, pistons, piston rings and cylinder bores.**
- **Journal bearings, bearing caps, connecting rods, rod bearings, rod bearing caps, pistons 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 (2), has an oil groove (3). Install it to cylinder block (1), and the other half without oil groove to bearing cap.
Make sure that two halves are painted in the same color.



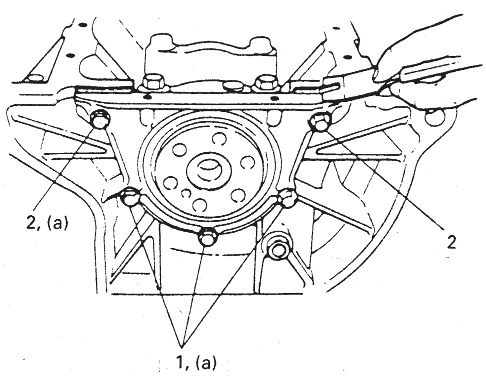
2) Install thrust bearings (1) to cylinder block between No.2 and No.3 cylinders. Face oil groove (2) sides to crank webs.



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

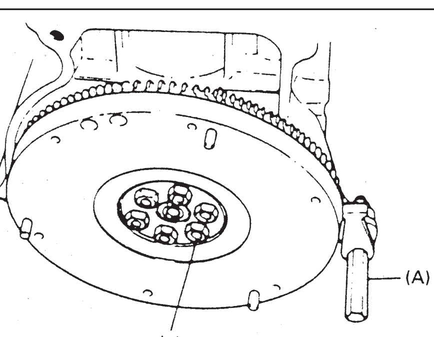
5) Install new gasket and oil seal housing.
Do not reuse gasket removed in disassembly. Apply engine oil to oil seal lip before installation. Tighten housing bolts to specification.

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.

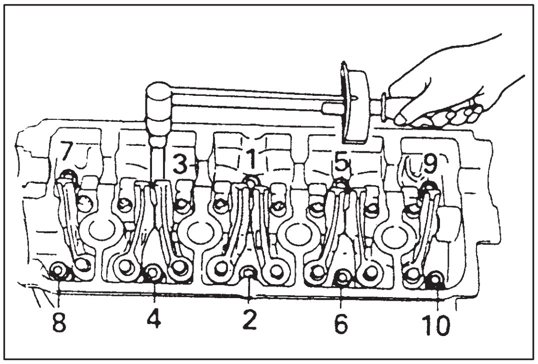


7) Install flywheel (M/T model) or drive plate (A/T model).
Using special tool, lock flywheel or drive plate, and torque its bolts to specification.

Special Tool
(A): 09924-17810

Tightening Torque
(a): 78 N·m (7.8 kg-m, 56.5 lb-ft) (Flywheel bolts)
(a): 95 N·m (9.5 kg-m, 69.0 lb-ft) (Drive plate bolts)

8) Install pistons and connecting rods as previously outlined.
9) Install oil pump strainer and oil pan as previously outlined.

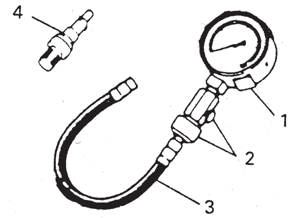


10) Install cylinder head assembly to cylinder block as previously outlined.

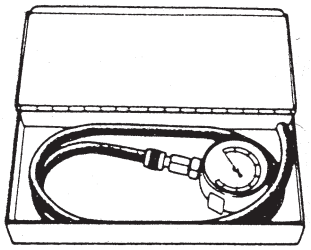
11) Install camshaft, crankshaft timing belt pulley, timing belt, crankshaft pulley, water pump pulley, etc., as previously outlined.
12) Install clutch to flywheel (for M/T vehicle). For clutch installation, refer to “CLUTCH” section.

13) Install engine mountings and brackets.
Refer to tightening torque for INSTALLATION of “ENGINE ASSEMBLY” in this section.
14) Install engine with transmission to vehicle as previously outlined.

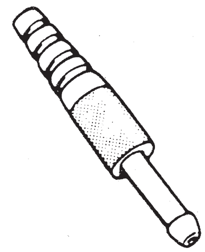
SPECIAL TOOLS



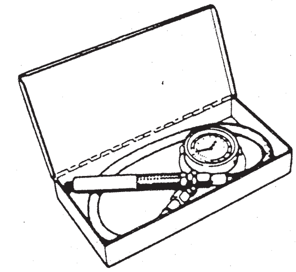
1. 09915-64510-001
   Compression gauge
2. 09915-64510-002
   Connector
3. 09915-64530
   Hose
4. 09915-67010
   Attachment



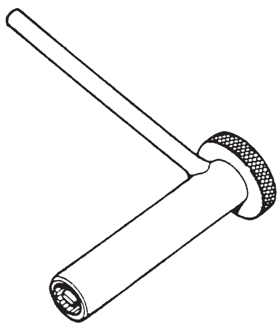
09915-67311
Vacuum gauge



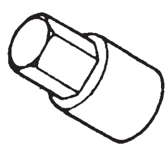
09918-08210
Vacuum gauge hose joint



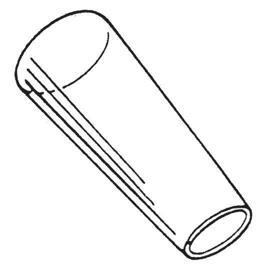
09915-77311
Oil pressure gauge



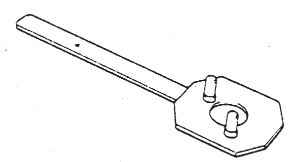
09917-18211
Tappet adjuster wrench



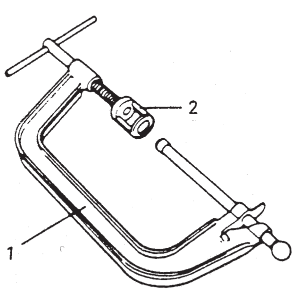
09919-16020
17 mm socket



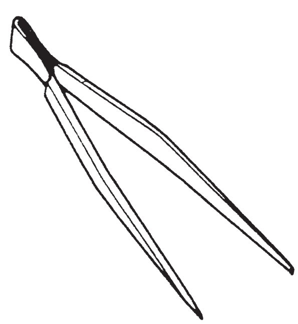
09926-18210
Oil seal guide (Vinyl resin)



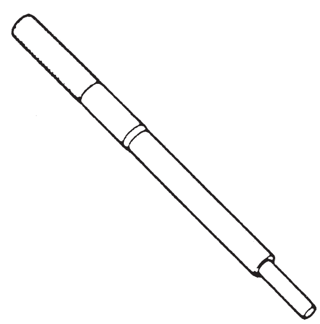
09917-68221
Camshaft pulley holder



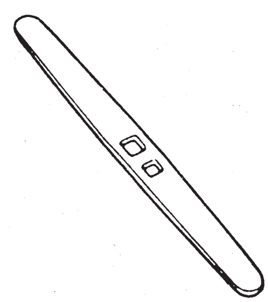
1. 09916-14510
   Valve lifter
2. 09916-14910
   Valve lifter attachment



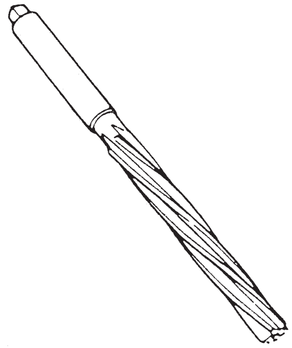
09916-84511
Forceps



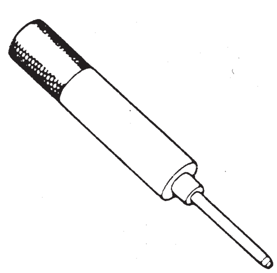
09916-44910
Valve guide remover



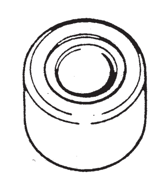
09916-34542
Reamer handle



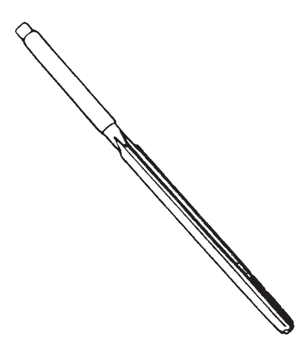
09916-38210
Reamer (11 mm)



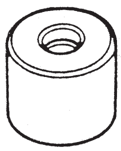
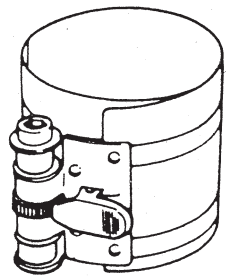
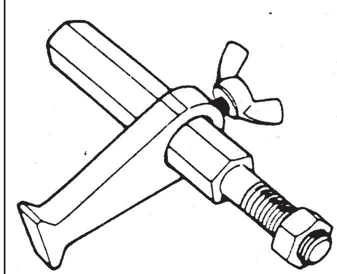
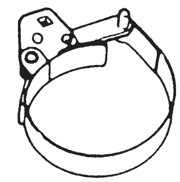
09916-58210
Valve guide installer handle



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 CMP sensor case and cylinder block.

TIGHTENING TORQUE SPECIFICATIONS

FASTENING PARTS	TIGHTENING TORQUE		
	N·m	kg-m	lb-ft
Oil pressure switch	13	1.3	9.5
Valve adjusting screw lock nuts	12	1.2	9.0
Cylinder head cover bolts	11	1.1	8.0
Intake manifold bolts and nuts	23	2.3	17.0
Timing belt tensioner stud	11	1.1	8.0
Timing belt tensioner bolt	25	2.5	18.0
Timing belt cover bolts and nut	11	1.1	8.0
Exhaust manifold bolts and nuts	32	3.2	23.5
Crankshaft pulley bolt	16	1.6	11.5
Crankshaft timing belt pulley bolt	130	13.0	94.0
Exhaust pipe nuts and bolts Exhaust manifold stiffener nut	50	5.0	36.5
Oil pump strainer bolt and stay bolt Oil pan bolts and nuts	11	1.1	8.0
CKP sensor bolt	10	1.0	7.5
Oil pan drain plug	50	5.0	36.0
Oil pump rotor plate screws Oil pump case bolts	11	1.1	8.0
Camshaft housing bolts Rocker arm shaft bolts	11	1.1	8.0
Camshaft timing belt pulley bolt	60	6.0	43.5
Cylinder head venturi plug	3.5	0.35	2.5
Cylinder head bolts	68	6.8	49.0
Connecting rod bearing cap nuts	35	3.5	25.5
Crankshaft main bearing cap bolts	54	5.4	39.0
Flywheel bolts	78	7.8	56.5
Drive plate bolts	95	9.5	69.0
Engine mounting & bracket bolts and nuts	Refer to INSTALLATION of ENGINE ASSEMBLY in this section.		

SECTION 6B

ENGINE COOLING

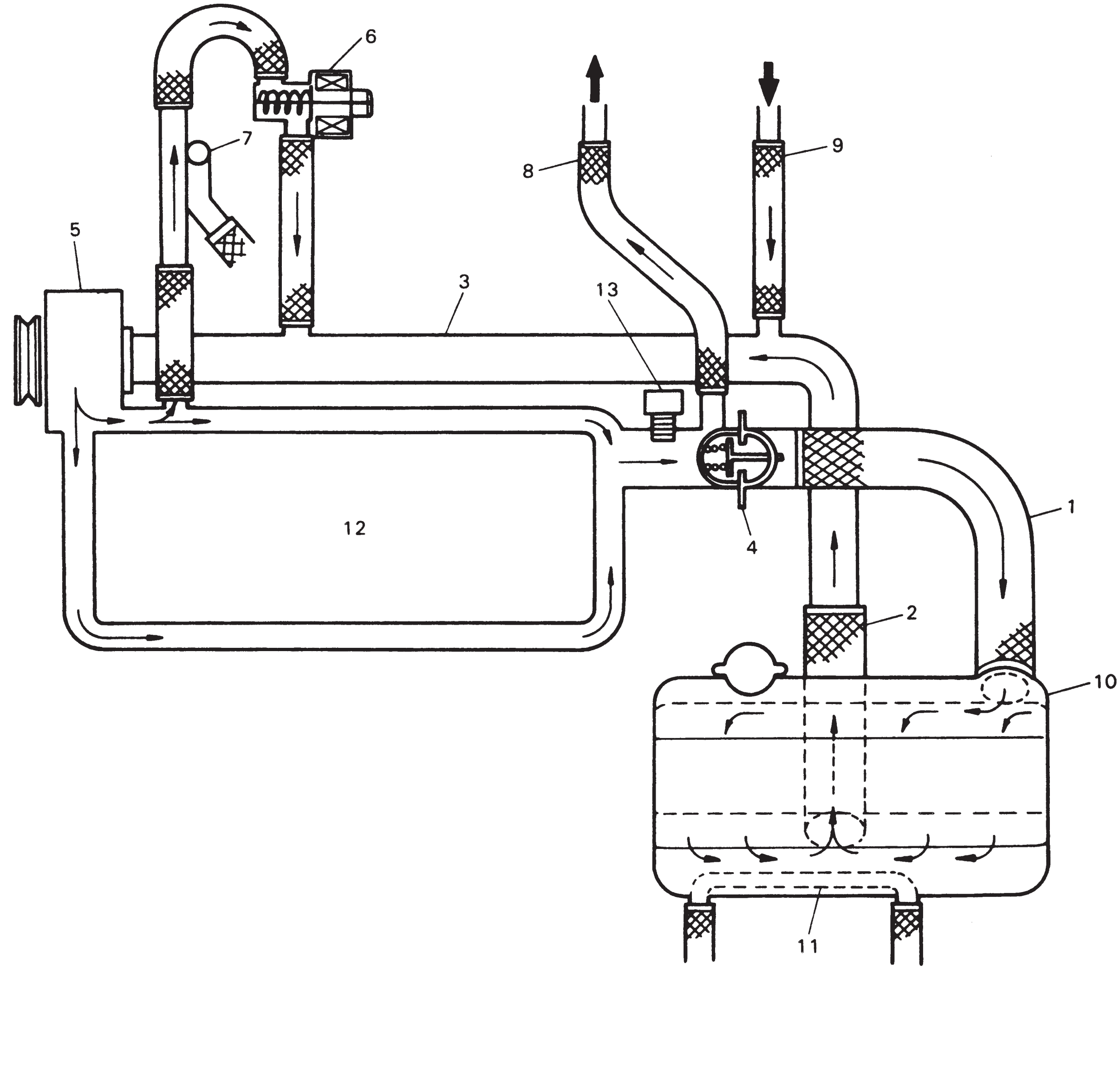
NOTE:
For the descriptions (items) not found in this section, refer to the same section of Service Manual mentioned in FOREWORD of this manual.

CONTENTS

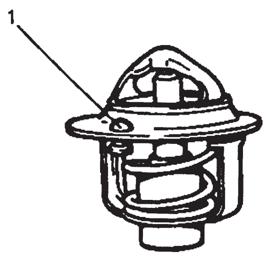
GENERAL DESCRIPTION

COOLING SYSTEM CIRCULATION

During engine warm-up (thermostat closed), the water pump discharges coolant into the water jacket chamber adjacent to No.1 cylinder. Coolant then flows through the cylinder block and the cylinder heat. Coolant then returns to the water pump through intake manifold, heater inlet hose, heater unit, heater outlet hose, and water intake pipe. During normal temperatures (thermostat open), coolant takes the same basic route but is now allowed to flow past the thermostat, the inlet hose and the radiator, and then back to the water pump through the outlet hose and the water intake pipe.



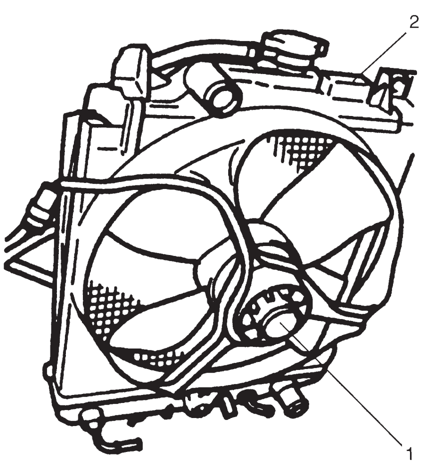
1. Radiator inlet hose
2. Radiator outlet hose
3. Water intake pipe
4. Thermostat
5. Water pump
6. IAC valve (throttle body)
7. Breather pipe (air cleaner outlet hose)
8. Heater inlet hose
9. Heater outlet hose
10. Radiator
11. Oil cooler (A/T only)
12. Engine
13. ECT sensor



THERMOSTAT

A wax pellet type thermostat is used in the coolant outlet passage to control the flow of engine coolant, to provide fast engine warm up and to regulate coolant temperatures.
A wax pellet element is hermetically contained in a metal case, and expands when heated and contracts when cooled.
When the pellet is heated and expands, the metal case pushes down the valve to open it.
As the pellet is cooled, the contraction allows the spring to close the valve.
Thus, the valve remains closed while the coolant is cold, preventing circulation of coolant through the radiator.
At this point, coolant is allowed to circulate only throughout the engine to warm it quickly and evenly.
As the engine warms, the pellet expands and the thermostat valve opens, permitting coolant to flow through the radiator.
In the top portion of the thermostat, an air bleed valve (1) is provided; this valve is for venting out the gas or air, if any, that is accumulated in the circuit.

Thermostat functional spec. ± 2.8°C (5.0°F)	
Temp. at which valve begins to open	88°C (190°F)
Temp. at which valve become fully open	100°C (212°F)

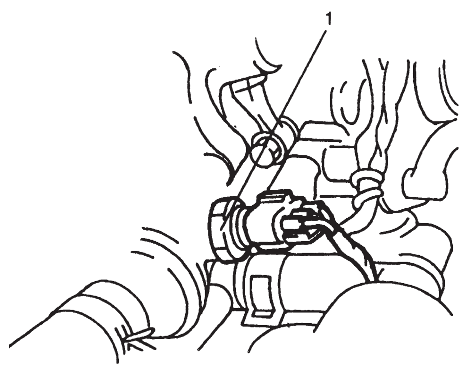


1. Cooling fan motor
2. Radiator

COOLING FAN

The cooling fan is driven by electric motor, and the motor is activated by ECM/PCM (engine coolant temp.). For its details, refer to Section 6E.

WARNING:
Keep hands, tools, and clothing away from engine cooling fan to help prevent personal injury. This fan is electric and can come on whether or not the engine is running. The fan can start automatically in response to the ECM/PCM (engine coolant temp.) with the ignition switch in the "ON" position.



COOLANT (WATER) TEMP. GAUGE

The coolant temp. gauge is included in engine coolant temp. (ECT) sensor (1). This gauge activates a temp. meter in the instrument cluster.

DIAGNOSIS

Condition	Possible Cause	Correction
Engine overheats	● Loose or broken water pump belt	Adjust or replace.
	● Not enough coolant	Check coolant level and add as necessary.
	● Faulty thermostat	Replace.
	● Faulty water pump	Replace.
	● Dirty or bent radiator fins	Clean or remedy.
	● Coolant leakage on cooling system	Repair.
	● Defective cooling fan motor	Check and replace as necessary.
	● Plugged radiator	Check and replace radiator as necessary.
	● Faulty radiator cap	Replace.
	● Maladjusted ignition timing	Adjust.
	● Dragging brakes	Adjust brake.
	● Slipping clutch	Adjust or replace.

MAINTENANCE

COOLANT

The coolant recovery system is standard. The coolant in the radiator expands with heat, and the overflow is collected in the reservoir tank.
When the system cools down, the coolant is drawn back into the radiator.
The cooling system has been filled at the factory with a quality coolant that is either 50/50 mixture of water and GOLDEN CRUISER 1200 (ethylene glycol antifreeze.) or 30/70 mixture of water and GOLDEN CRUISER 1200. The 50/50 mixture coolant solution provides freezing protection to –36°C (–33°F), the 30/70 mixture coolant solution provides freezing protection to –16°C (3°F).
When changing the engine coolant, use mixture of 50% water and 50% GOLDEN CRUISER 1200 for the market where ambient temperature falls lower than –16°C (3°F) in winter and mixture of 70% water and 30% GOLDEN CRUISER 1200 for the market where ambient temperature doesn't fall lower than –16°C (3°F).

NOTE:
- **Alcohol or methanol base coolant or plain water alone should not be used in cooling system at any time as damage to cooling system could occur.**
- **Even in a market where no freezing temperature is anticipated, mixture of 70% water and 30% ethylene glycol antifreeze (Antifreeze/Anticorrosion coolant) should be used for the purpose of corrosion protection and lubrication.**

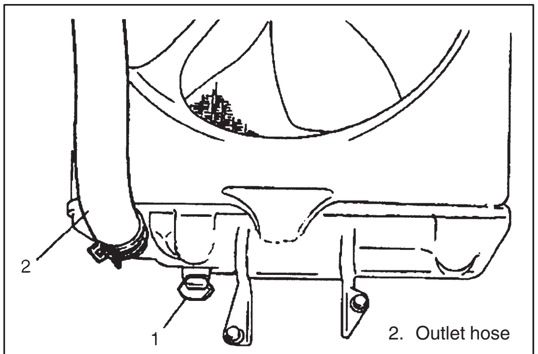
ANTI-FREEZE PROPORTIONING TABLE

				Vehicle with M/T		Vehicle with A/T	
ANTI-FREEZE PROPORTIONING CHART	Freezing temperature		°C	–16	–36	–16	–36
			°F	3	–33	3	–33
	Anti-freeze/Anti-corrosion coolant concentration		%	30	50	30	50
	Ratio of compound to cooling water	G10 engine	ltr.	1.17/2.73	1.95/1.95	1.20/2.80	2.00/2.00
			US pt.	2.47/5.77	4.12/4.12	2.54/5.92	4.23/4.23
			Imp pt.	2.06/4.80	3.43/3.43	2.11/3.70	3.52/3.52
		G13 engine	ltr.	1.38/3.22	2.30/2.30	1.41/3.29	2.35/2.35
			US pt.	2.92/6.80	4.86/4.86	2.98/6.95	4.96/4.96
			Imp pt.	2.43/5.67	4.05/4.05	2.48/5.79	4.13/4.13
COOLANT CAPACITY	G10 engine	Engine radiator and heater		3.3 liters (7.0/5.8 US/Imp pt.)		3.4 liters (7.2/6.0 US/Imp pt.)	
		Reservoir tank		0.6 liters (1.3/1.1 US/Imp pt.)			
		Total		3.9 liters (8.2/6.9 US/Imp pt.)		4.0 liters (8.5/7.0 US/Imp pt.)	
	G13 engine	Engine radiator and heater		4.0 liters (8.5/7.0 US/Imp pt.)		4.1 liters (8.6/7.2 US/Imp pt.)	
		Reservoir tank		0.6 liters (1.3/1.1 US/Imp pt.)			
		Total		4.6 liters (9.7/8.1 US/Imp pt.)		4.7 liters (9.9/8.3 US/Imp pt.)	

COOLING SYSTEM FLUSH AND REFILL

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

1) Remove radiator cap when engine is cool:
   Turn cap counterclockwise slowly until it reaches a “stop”. (Do not press down while turning it.)
   Wait until pressure is relieved (indicated by a hissing sound) then press down on cap and continue to turn it counterclockwise.
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).

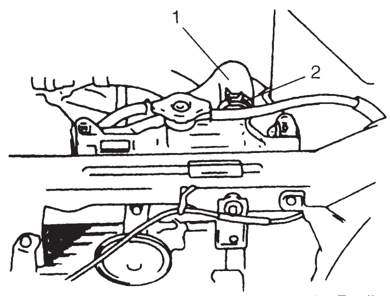


2. Outlet hose

3) Stop engine and open radiator drain plug (1) to drain coolant.
4) Close drain plug. Add water until system is filled and run engine until upper radiator hose is hot again.
5) Repeat Steps 3) and 4) several times until drained liquid is nearly colorless.
6) Drain system and then close radiator drain plug tightly.
7) Disconnect reservoir tank hose from radiator. Remove reservoir tank and pour out any fluid. Scrub and clean inside of tank with soap and water.
   Flush it well with clean water and drain. Reinstall tank and hose.
8) add 50/50 mixture of GOLDEN CRUISER 1200 (Good quality ethylene glycol anti-freeze) and water to radiator and tank.
   Fill radiator to the base of radiator filler neck and reservoir tank to “FULL” level mark. Reinstall reservoir tank 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 tank hose.

ON-VEHICLE SERVICE

WARNING:
- **Check to make sure that engine coolant temperature is cold before removing any part of cooling system.**
- **Also be sure to disconnect negative cord from battery terminal before removing any part.**



1. Radiator hose
2. Clamp

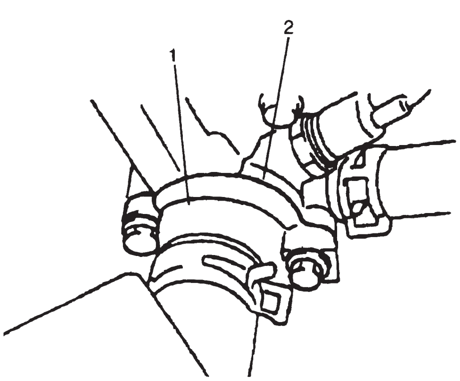
COOLING WATER PIPES OR HOSES

REMOVAL

1) Drain cooling system.
2) To remove these pipes or hoses, loosen screw on each pipe or hose clip and pull hose end off.

INSTALLATION

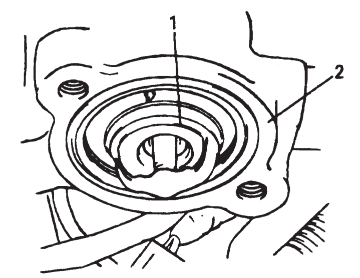
Install removed parts in reverse order of removal procedure, noting the following.
- Tighten each clamp bolt securely.
- Refill cooling system with proper coolant, referring to description on COOLANT of MAINTENANCE.



THERMOSTAT

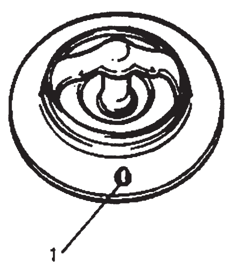
REMOVAL

1) Disconnect negative cable at battery.
2) Drain cooling system and tighten drain plug.
3) Disconnect thermostat cap (1) from thermostat case (2).



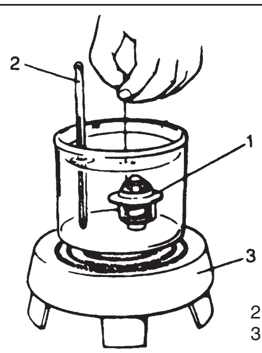
2. Thermostat case

4) Remove thermostat (1).



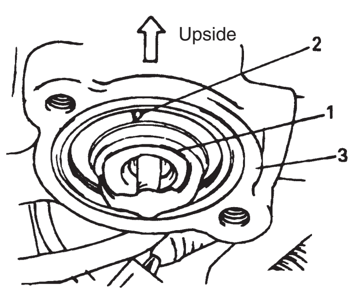
INSPECTION

1) Make sure that air bleed valve (1) of thermostat is clean. Should this valve be clogged, engine would tend to overheat.
2) Check to make sure that valve seat is free from foreign matters which would prevent valve from seating tight.



2. Thermometer
3. Heater

3) Check thermostatic movement of wax pellet as follows:
   - Immerse thermostat (1) in water, and heat water gradually.
   - 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.

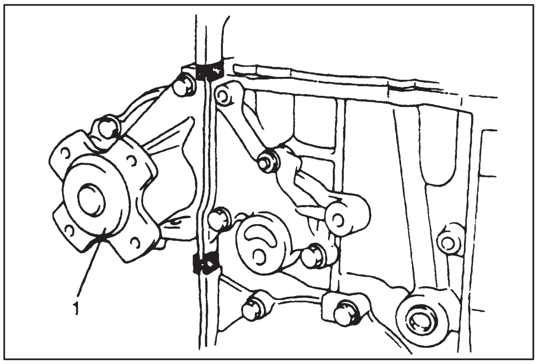


INSTALLATION

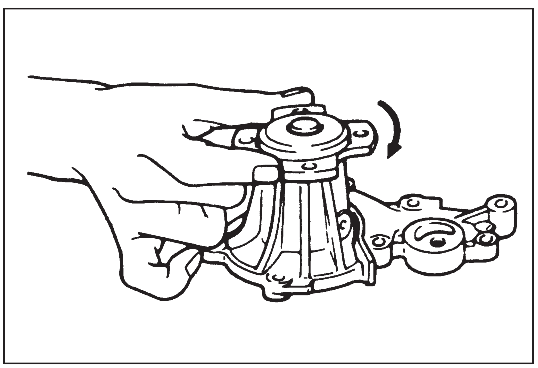
1) When positioning thermostat on thermostat case, be sure to position it so that air bleed valve comes uppermost and into the recession of thermostat case.
2) Install thermostat cap to thermostat case. When installing cap, align arrow marks on cap and case.
3) Fill cooling system.
4) Connect negative cable.
5) After installation, check each part for leakage.

WATER PUMP

1) Disconnect negative cable at battery.
2) Drain cooling system.
3) Remove timing belt and tensioner according to procedure described in “TIMING BELT AND TENSIONER” of Section 6A or 6A1.
4) Remove water pump belt adjusting arm.



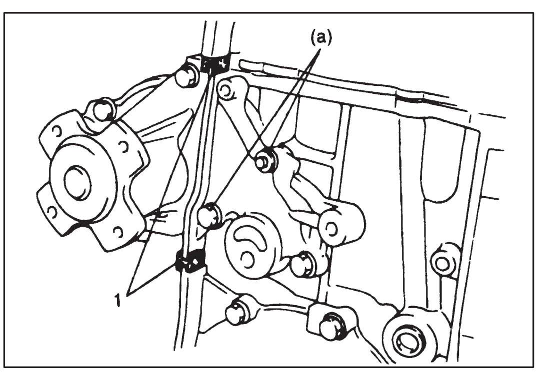
5) Remove water pump assembly (1).



INSPECTION

NOTE:
Do not disassemble water pump.
If any repair is required on pump, replace it as assembly.

Rotate water pump by hand to check for smooth operation.
If pump does not rotate smoothly or makes abnormal noise, replace it.



INSTALLATION

1) Install new pump gasket to cylinder block.
2) Install water pump to cylinder block.

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

3) After installing water pump, install rubber seal (1) between water pump and oil pump, and another between water pump and cylinder head.
4) Install timing belt tensioner, timing belt and timing belt outside covers according to procedure described in “TIMING BELT AND TENSIONER” of Section 6A or 6A1.

   NOTE:
   - **Special care must be used when installing belt tensioner and timing belt.**
   - **Torque each bolt and nut to specification.**
   - **Before installing outside covers, check to make sure that cover seal is fitted in groove of each cover properly.**

5) Install crankshaft pulley, water pump pulley, and pump drive belt referring to Section 6A or 6A1.
6) Adjust water pump belt tension.
7) Install fender apron extension on right side.
8) Install air cleaner assembly.
9) Connect negative cable at battery.
10) Fill cooling system.
11) After installation, check each part for leakage.

SECTION 6C

ENGINE FUEL

NOTE:
For the descriptions (items) not found in this section, refer to the same section of Service Manual mentioned in FOREWORD of this manual.

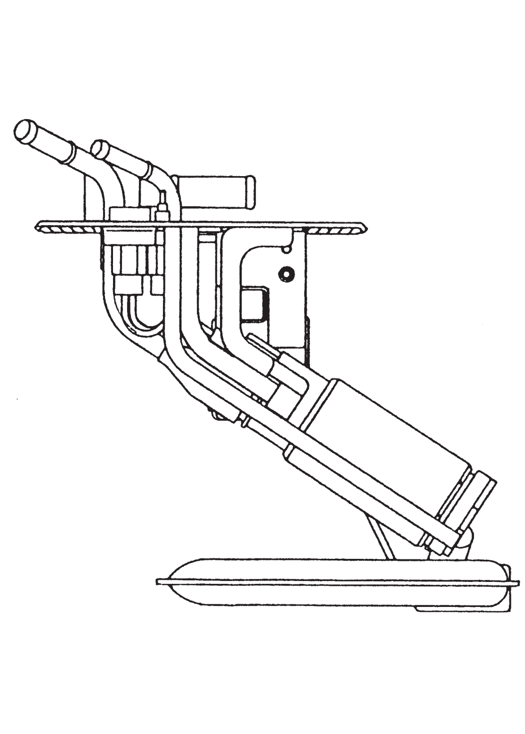
CONTENTS

CAUTION:
BE SURE TO USE UNLEADED FUEL ONLY. USE OF LEADED AND/OR LOW LEAD FUEL CAN RESULT IN ENGINE DAMAGE AND REDUCE THE EFFECTIVENESS OF THE EMISSION CONTROL SYSTEM.

GENERAL DESCRIPTION

FUEL SYSTEM

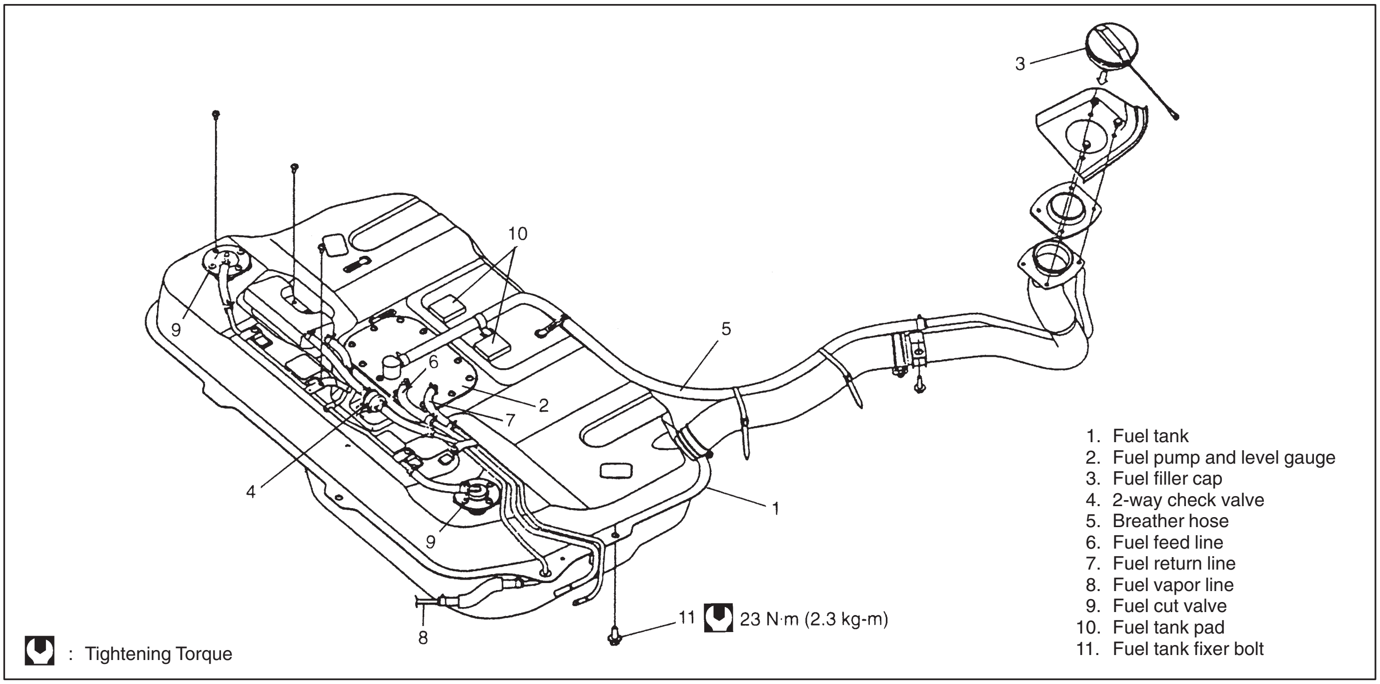
The main components of the fuel system are fuel tank, fuel pump, fuel filter and fuel level gauge and it includes three lines; fuel feed line, fuel return line and fuel vapor line.
For the details of fuel vapor flow, refer to Section 6E “ENGINE AND EMISSION CONTROL SYSTEM”.

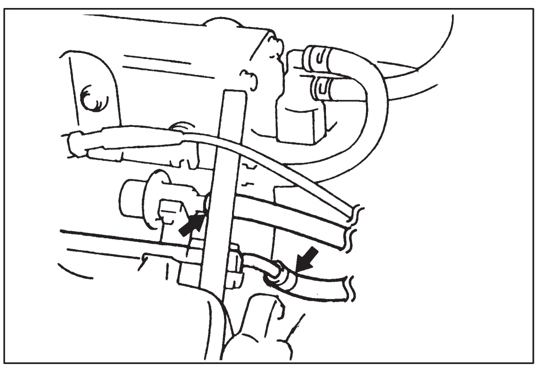


FUEL PUMP ASSEMBLY (WITH FUEL LEVEL GAUGE)

The fuel pump assembly consists of fuel pump and fuel level gauge.
For structure and operation of the fuel pump, refer to Section 6E.

ON-VEHICLE SERVICE





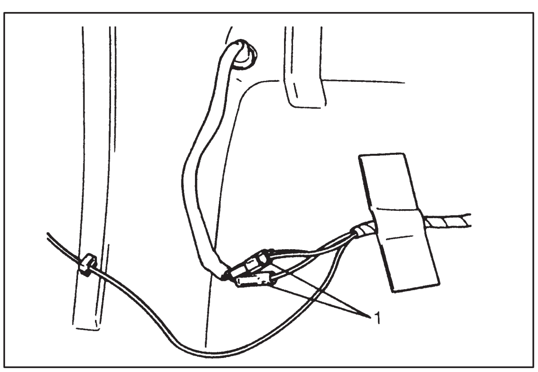
FUEL LINES

INSPECTION

Visually inspect fuel lines for evidence of fuel leakage, hose crack and deterioration, or damage.

Make sure all clamps are secure.

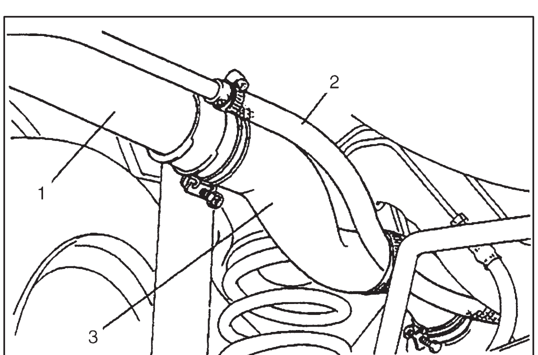
Replace parts as needed.



FUEL TANK

REMOVAL

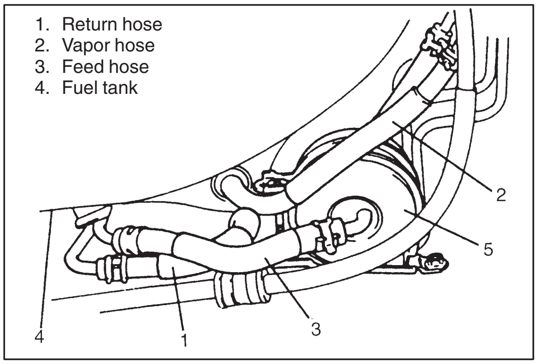
1) Relieve fuel pressure in fuel feed line according to procedure described in Section 6.
2) Disconnect negative cable at battery.
3) Remove rear seat cushion referring to Section 9.
4) Disconnect connectors (1) of fuel tank wire harness.



5) Hoist vehicle.
6) Disconnect fuel filler hose (3) from fuel tank and breather hose (2) from filler neck (1).

7) As fuel tank has no drain plug, drain fuel tank by pumping fuel out through fuel tank filler or fuel tank inlet.
Use hand operated pump to drain fuel tank.

WARNING:
Never drain or store fuel in an open container to avoid possibility of fire or explosion.



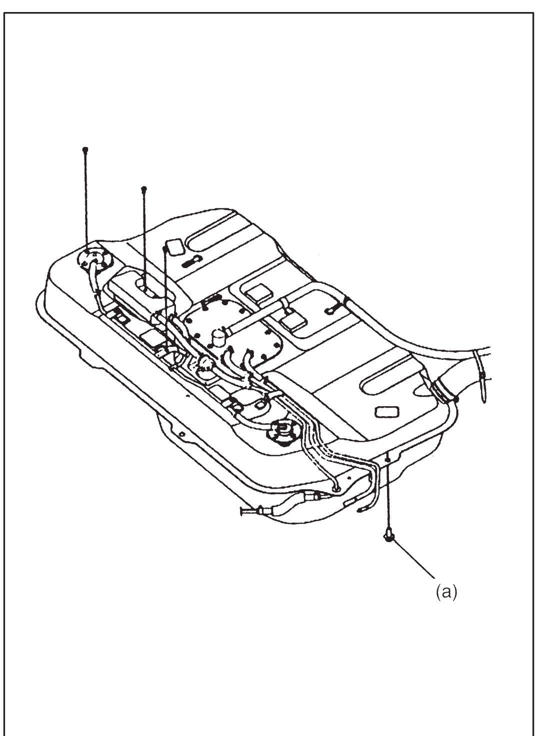
8) Disconnect fuel hoses from filter (5) and pipes.

WARNING:
A small amount of fuel may be released after fuel hose is disconnected. In order reduce the chance of personal injury, cover hose and pipe to be disconnected with a shop cloth. Be sure to put that cloth in an approved container when disconnection is completed.

9) Remove fuel tank from vehicle.

INSPECTION

After removing fuel tank, check hoses and pipes connected to fuel tank for leaks, loose connections, deterioration or damage. Also check for leaks from installation face of parts installed on fuel tank, visually inspect fuel tank for leaks and damage.
Replace any damaged or malconditioned parts.

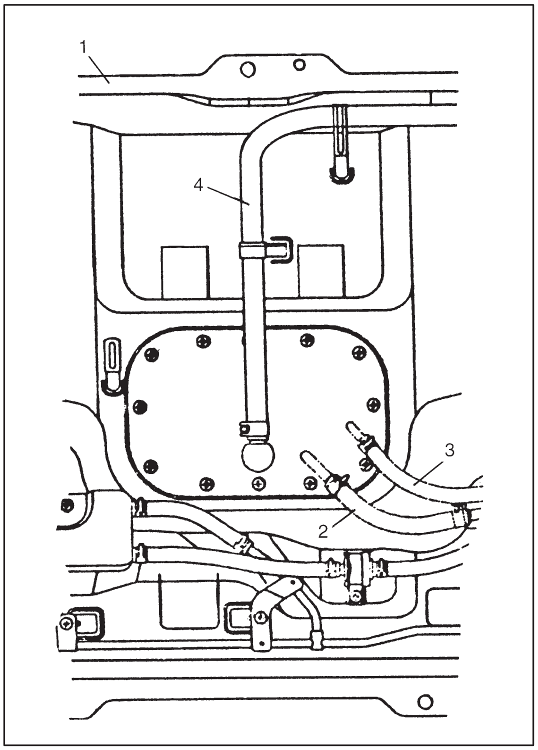


INSTALLATION

1) Install fuel pump assembly to fuel tank.
Use new gasket.
2) Install 2-way check valve to fuel tank directing its black nozzle toward fuel tank.
3) Connect hoses and pipes to fuel tank.
4) Connect breather hose to fuel tank.
5) Install fuel tank to vehicle.

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

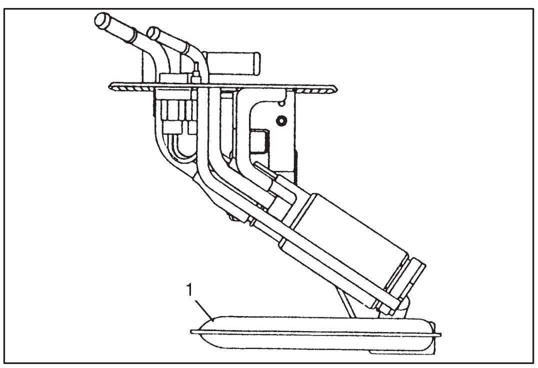
6) Connect fuel filler hose to tank and breather hose to filler neck.
7) Connect fuel hoses to filter and pipes.
8) Connect connectors of fuel tank wire harness.
9) Install rear seat cushion referring to Section 9.
10) Connect negative cable at battery.
11) With engine "OFF" and ignition switch "ON", check for fuel leaks.



FUEL PUMP ASSEMBLY

REMOVAL

1) Remove fuel tank (1) from vehicle referring to “FUEL TANK” in this section.
2) Disconnect fuel feed hose (2), fuel return hose (3) and breather hose (4) from fuel pump assembly (5).
3) Remove fuel pump assembly from fuel tank by removing screws.



INSPECTION

Check fuel pump assembly for damage.
Check fuel suction filter (1) for evidence of dirt and contamination. If present, replace or clean and check for presence of dirt in fuel tank.

INSTALLATION

Reverse removal procedure for installation noting the followings.

- Use new gasket.
- Clamp hoses securely.

SECTION 6E1

ENGINE AND EMISSION CONTROL SYSTEM (TBI FOR G10)

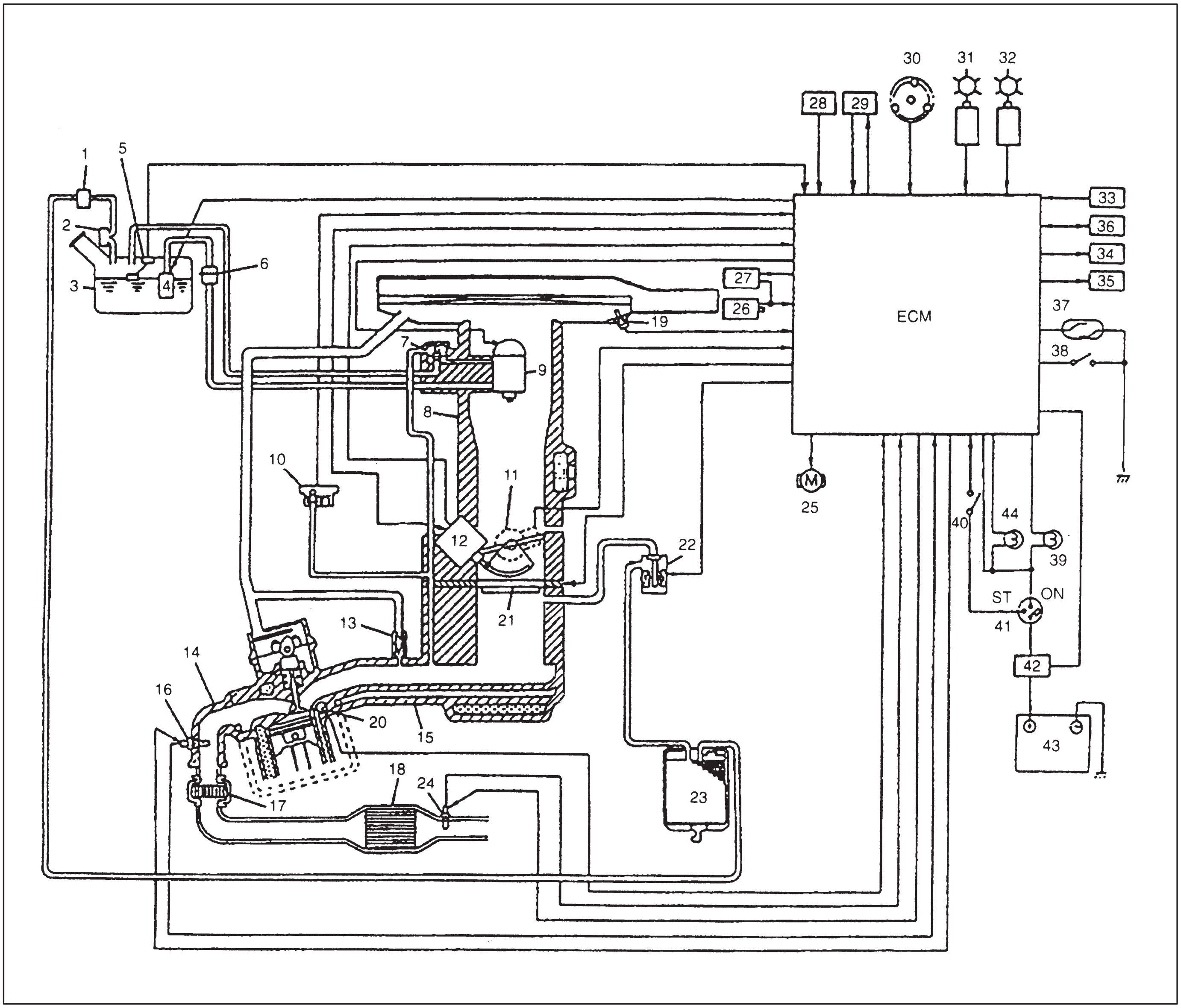
WARNING:
For vehicles equipped with a Supplemental Inflatable Restraint Air Bag System:
- **Service on or around Air Bag System Components or Wiring must be performed only by an authorized Suzuki dealer. Please observe all WARNINGS and SERVICE PRECAUTIONS in Section 9J under "On-Vehicle Service" and the Air Bag System Component and Wiring Location view in Section 9J before performing service on or around Air Bag System Components or Wiring. Failure to follow WARNINGS could result in unintended air bag deployment or could render the air bag inoperative. Either of these two conditions may result in severe injury.**
- **SDM can maintain sufficient voltage to cause a deployment of air bags for up to 15 seconds after ignition switch is turned to "LOCK" position, battery is disconnected or fuse powering SDM is removed. Work must be started after 15 seconds from the time.**

NOTE:
For the descriptions for vehicle without warm up three way catalytic converter (WU TWC), refer to the same section of the Service Manual mentioned in the FOREWORD of this manual.

CONTENTS

GENERAL DESCRIPTION

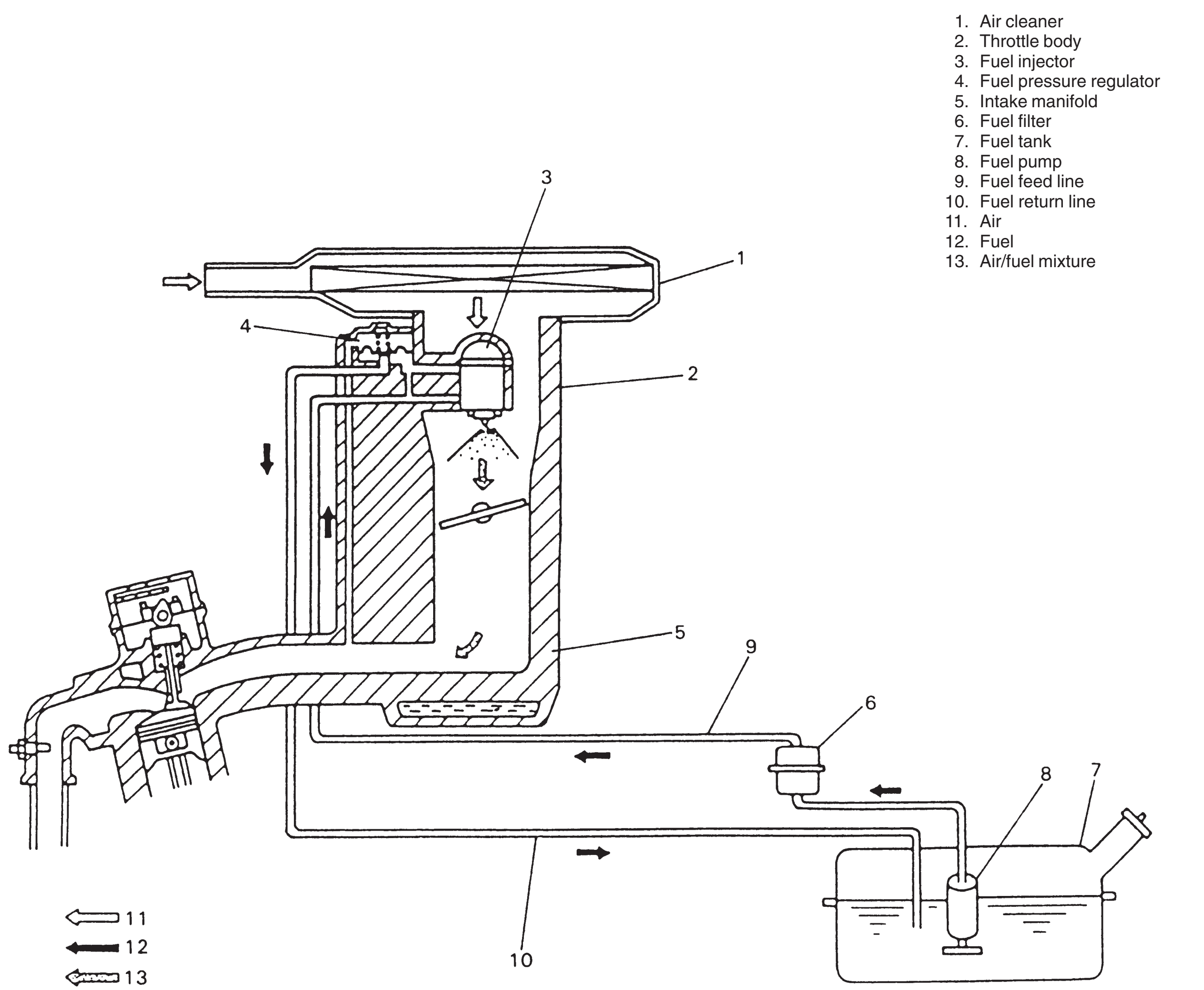
The engine and emission control system is divided into 3 major sub-systems: air/fuel delivery system, electronic control system and emission control system.
Air/fuel delivery system includes fuel pump, throttle body, etc. Electronic control system includes ECM, various sensors and controlled devices.
Emission control system includes EVAP and PCV system.



1. Tank pressure control valve
2. Fuel liquid separator
3. Fuel tank
4. Fuel pump
5. Fuel level sensor (gauge)
6. Fuel filter
7. Fuel pressure regulator
8. Throttle body
9. Fuel injector
10. MAP sensor
11. TP sensor
12. ISC actuator (including CTP switch)
13. PCV valve
14. Exhaust manifold
15. Intake manifold
16. Heated oxygen sensor-1
17. Warm up three way catalytic convertor (WU-TWC) (if equipped)
18. Three way catalytic convertor
19. IAT sensor
20. ECT sensor
21. EFE heater
22. EVAP canister purge valve
23. EVAP canister
24. Heated oxygen sensor-2
25. Radiator fan motor
26. Ignition coil
27. Ignitor
28. Electric load
29. A/C amplifier (if equipped)
30. Camshaft position sensor
31. Crankshaft position sensor
32. VSS (on A/T)
33. Transmission range sensor (switch) (A/T)
34. Shift solenoid-A (A/T)
35. Shift solenoid-B (A/T)
36. Data link connector
37. VSS (in combination meter of M/T vehicle)
38. PSP switch (if equipped)
39. Malfunction indicator lamp
40. Transmission range sensor (switch) (A/T)
41. Main (Ignition) switch
42. Main fuse
43. Battery
44. Immobilizer indicator lamp

AIR AND FUEL DELIVERY SYSTEM

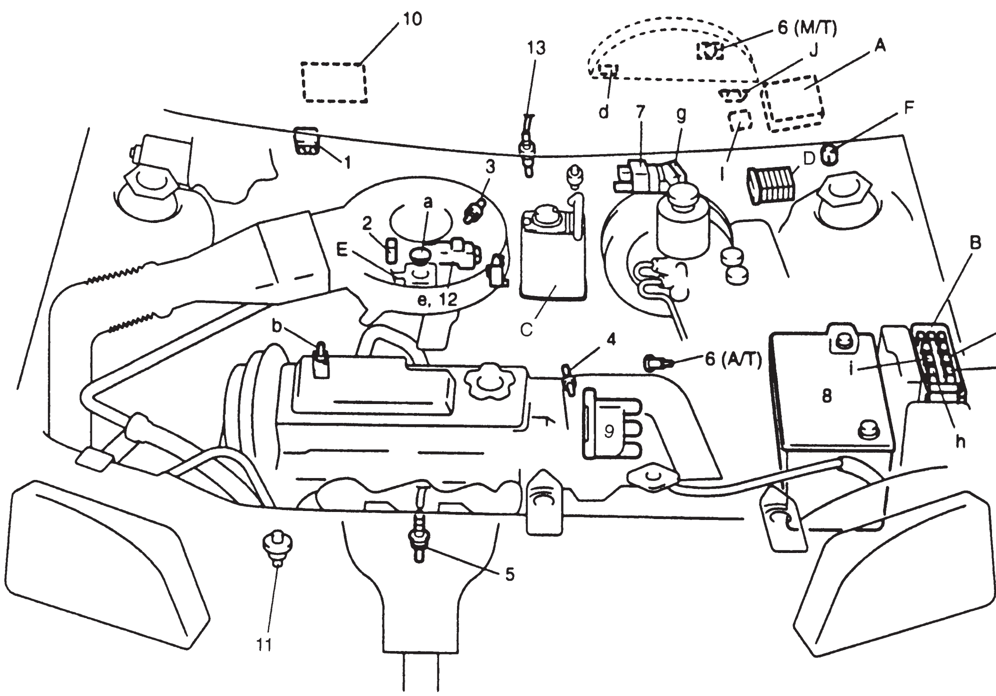
The main components of this system are fuel tank, fuel pump, fuel filter, throttle body (including fuel injector, fuel pressure regulator and idle speed control actuator), fuel feed line, fuel return line and air cleaner.
The fuel in the fuel tank is pumped up by the fuel pump, filtered by the fuel filter and fed under pressure to injector installed in throttle body. As the fuel pressure applied to the fuel 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 throttle body in conic dispersion when the injector opens according to the injection signal from ECM. The fuel relieved by the fuel pressure regulator returns through the fuel return line to the fuel tank.
The injected fuel is mixed with the air which has been filtered through the air cleaner in the throttle body. The air/fuel mixture is drawn through clearance between throttle valve and bore.
Then the intake manifold distributes the air/fuel mixture to each combustion chamber.
For the structure and operation of the fuel tank and filter, refer to SECTION 6C "ENGINE FUEL".



ELECTRONIC CONTROL SYSTEM

The electronic control system consists of 1) various sensors which detect the state of engine and driving conditions, 2) ECM which controls various devices according to the signals from the sensors and 3) various controlled devices.
Functionally, it is divided into following sub systems:

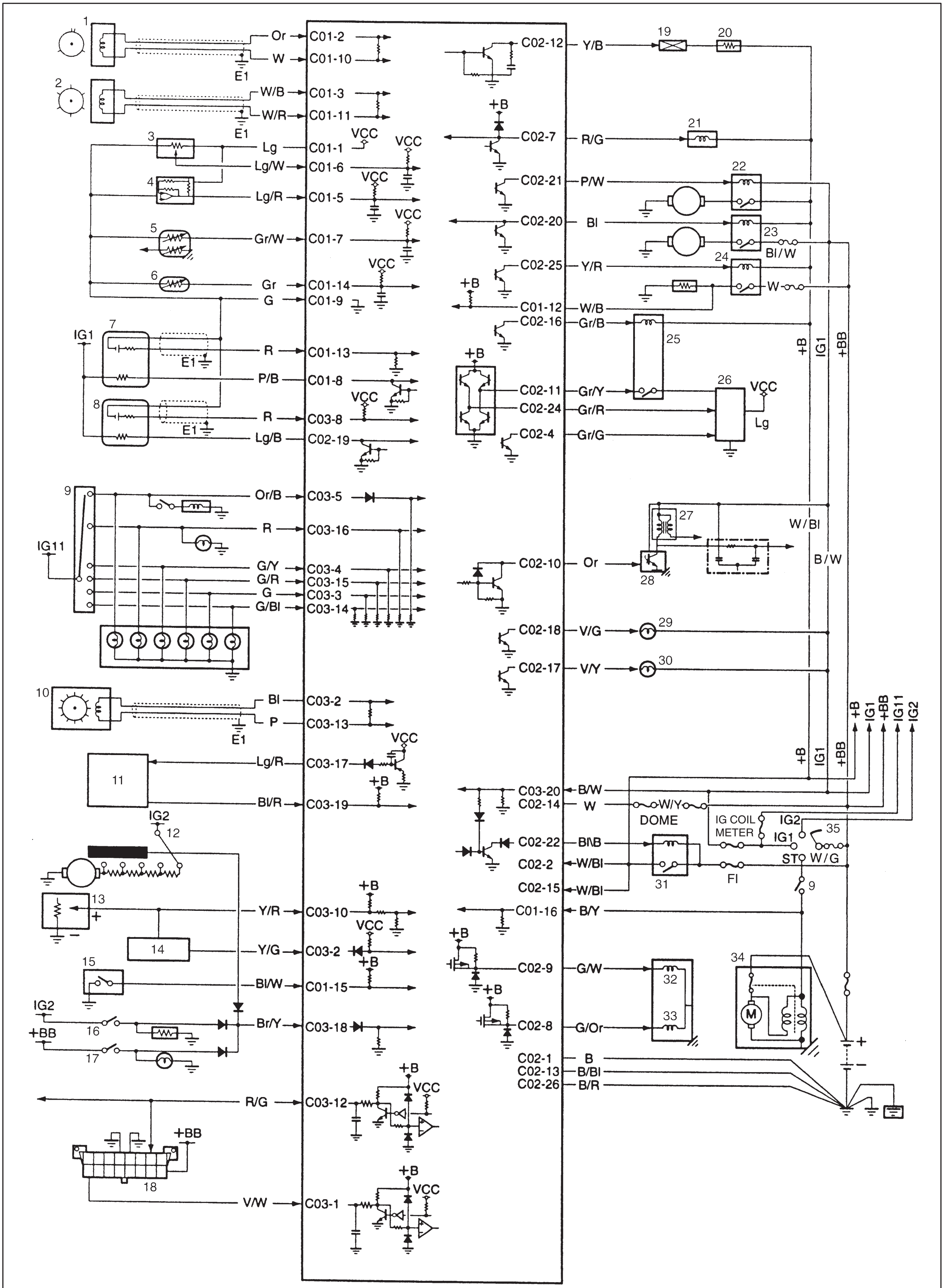
- Fuel injection control system
- Idle speed control system
- Fuel pump control system
- A/C control system (if equipped)
- Radiator fan control system
- Evaporative emission control system
- EFE heater control system
- Oxygen sensor heater control system
- Ignition control system
- A/T control system



INFORMATION SENSORS
1. MAP sensor
2. TP sensor
3. IAT sensor
4. ECT sensor
5. Heated oxygen sensor-1
6. VSS
7. Ignition coil
8. Battery
9. Distributor (CMP sensor)
10. A/C controller (if equipped)
11. CKP sensor
12. CTP switch (in ISC actuator)
13. Heated oxygen sensor-2

CONTROLLED DEVICES
a : Fuel injector
b : EVAP canister purge valve
c : Fuel pump relay
d : Malfunction indicator lamp
e : ISC actuator
f : Radiator fan control relay
g : Ignitor
h : EFE heater relay
i : ISC actuator relay

OTHERS
A : ECM (PCM)
B : Main relay
C : EVAP canister
D : Injector resistor
E : EFE heater
F : Electric load diode
G : Data link connector



1
Or
C01-2
W
C01-10
E1
2
W/B
C01-3
W/R
C01-11
E1
3
Lg
C01-1
VCC
4
Lg/W
C01-6
Lg/R
C01-5
5
Gr/W
C01-7
6
Gr
C01-14
G
C01-9
IG1
7
R
C01-13
P/B
C01-8
8
R
C03-8
Lg/B
C02-19
9
Or/B
C03-5
R
C03-16
IG11
G/Y
C03-4
G/R
C03-15
G
C03-3
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C02-22
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C02-2
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ST
W/G
C02-15
W/Bl
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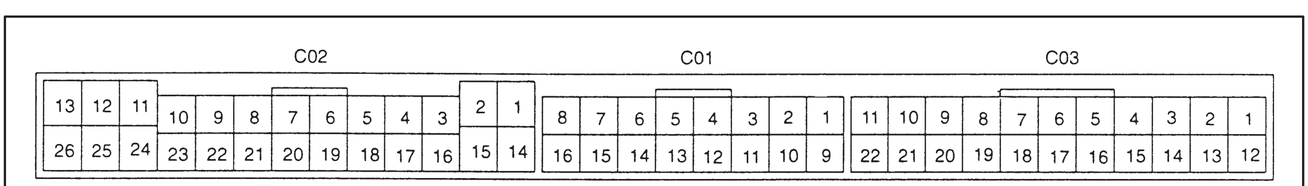
C01-16
B/Y
C02-9
G/W
32
34
C02-8
G/Or
33
M
C02-1
B
C02-13
B/Bl
C02-26
B/R

CONNECTOR	TERMINAL	CIRCUIT
C02	1	ECM ground
	2	Power source (from main relay)
	3	Blank
	4	Blank
	5	Blank
	6	Blank
	7	EVAP canister purge valve
	8	Shift solenoid-B (A/T)
	9	Shift solenoid-A (A/T)
	10	Igniter
	11	Idle speed control actuator
	12	Fuel injector
	13	Injector ground
	14	Power source (from battery)
	15	Power source (from main relay)
	16	Idle speed control actuator relay
	17	Malfunction indicator lamp
	18	Immobilizer indicator lamp
	19	Heater of HO2S-2
	20	Radiator fan relay
	21	Fuel pump relay
	22	Main relay
	23	Blank
	24	Idle speed control actuator
	25	EFE heater relay
	26	Injector ground
C01	1	Power source for sensors
	2	Camshaft position sensor (+)
	3	Crankshaft position sensor (+)
	4	Closed throttle position switch
	5	Manifold absolute pressure sensor
	6	Throttle position sensor
	7	Engine coolant temp. sensor
	8	Heater of HO2S-1
	9	Sensor ground
	10	Camshaft position sensor (–)
	11	Crankshaft position sensor (–)
	12	EFE heater (monitor)
	13	Heated oxygen sensor-1
	14	Intake air temp sensor
	15	Power steering pressure switch (if equipped)
	16	Engine start signal circuit

CONNECTOR	TERMINAL	CIRCUIT	
C03	1	Data link connector	
	2	Vehicle speed sensor (+) (A/T) Vehicle speed sensor (M/T)	
	3	Transmission range sensor (switch)	"2"
	4		"N"
	5		"P"
	6	Blank	
	7	Blank	
	8	Heated oxygen sensor-2	
	9	Blank	
	10	Fuel level sensor (gauge)	
	11	Blank	
	12	Data link connector	
	13	Vehicle speed sensor (–) (A/T)	
	14	Transmission range sensor (switch)	"L"
	15		"D"
	16		"R"
	17	A/C ON (output) signal for A/C control module (if equipped)	
	18	Electric load signal	
	19	A/C (input) signal from A/C control module (if equipped)	
	20	Ignition switch	
	21	Blank	
	22	Blank	

1. CMP sensor (in Distributor)
2. CKP sensor
3. TP sensor
4. MAP sensor
5. ECT sensor
6. IAT sensor
7. HO2S-1
8. HO2S-2
9. Transmission range switch (A/T)
10. VSS (A/T)
11. A/C control module (if equipped)
12. Heater blower switch
13. Fuel level sensor
14. Speedometer
15. P.SP switch
16. Rear defogger switch
17. Light switch
18. DLC
19. Fuel injector
20. Injector resistor
21. Conister purge valve
22. Fuel pump relay
23. Rediator fan relay
24. EFE heater relay
25. ISC actuator relay
26. ISC actuator
27. Ignition coil
28. Igniter
29. Immobilizer indicator lamp
30. MIL
31. Main relay
32. Shift solenoid A (A/T)
33. Shift solenoid B (A/T)
34. Starter motor
35. Ignition switch

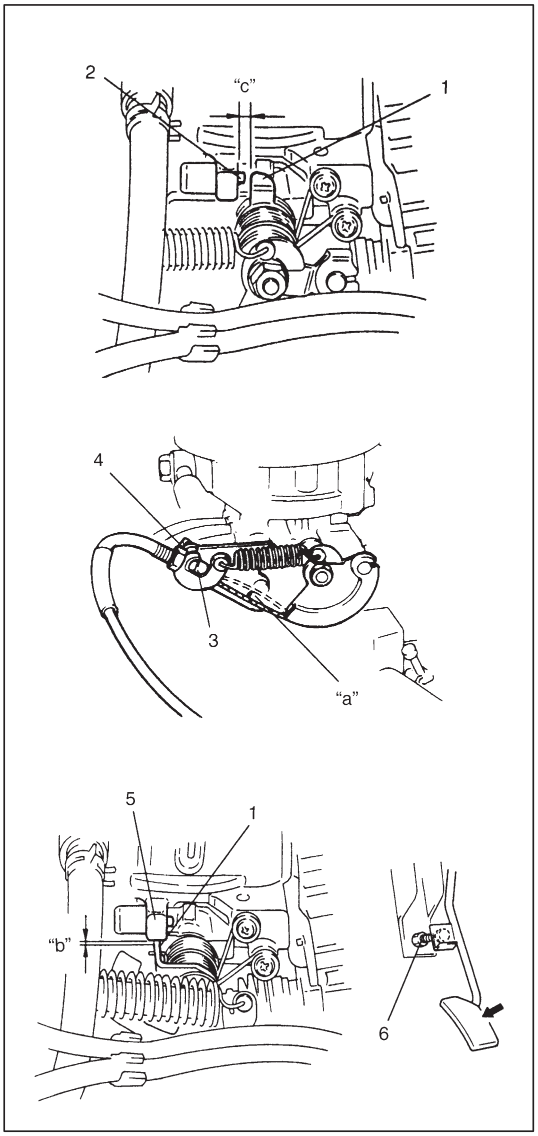


ON-VEHICLE SERVICE

GENERAL

When the hoses have been disconnected and system's component removed for service, be sure to reinstall component properly, and route and connect hoses correctly after service. Refer to Emission Control Information Label for proper connection of hoses (if equipped).

ACCELERATOR CABLE ADJUSTMENT



1) Confirm that ambient temperature is higher than 0°C, 32°F.
2) Warm up engine to normal operating temperature with all electric loads OFF and stop engine.
3) Confirm that clearance "c" between throttle lever (1) and stop screw (2) is less than about 1 mm (0.04 in.).
4) Check accelerator cable for play.

   Accelerator cable play "a": 10 – 15 mm (0.4 – 0.6 in.)

   Cable play should be within specification. If out of specification, loosen accelerator cable lock nut and adjust by turning adjusting nut (3). Be sure to tighten lock nut (4) securely after adjustment.
5) With accelerator pedal depressed fully, check clearance between throttle lever and lever stopper (5) (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 (6).

IDLE SPEED INSPECTION

Before inspecting idle speed, make sure to the following.

- Lead wires and hoses of Electronic Fuel Injection and engine emission control systems are connected securely.
- After warming up engine, accelerator cable has some play, that is, it is not tight.
- Ignition timing is within specification.
- All of electrical loads except ignition are switched off.
- Air cleaner has been properly installed and is in good condition.
- Malfunction indicator lamp does not light when engine running.

After above items are all confirmed, check idle speed as follows.

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 and block drive wheels.

1) Warm up engine to normal operating temperature.
2) Set tachometer.
3) Check idle speed with A/C OFF.
   If idle speed is not within specified range, check idle speed control system and any other system and parts which might affect idle speed. Refer to "Engine Diagnosis of Section 6" for inspection.

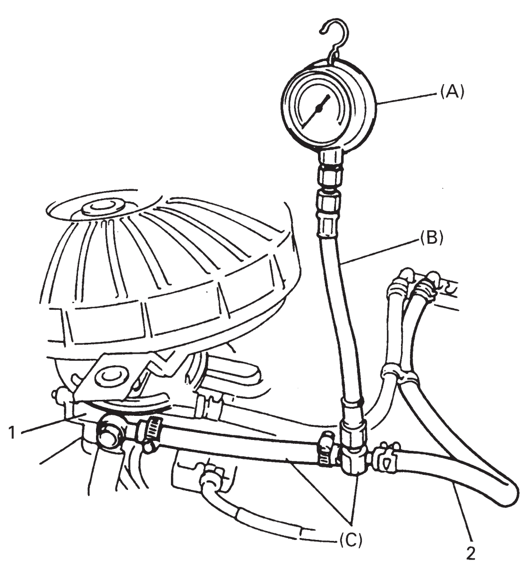
   Engine idle speed: 850 ± 50 r/min

   NOTE:
   Idle speed is not adjustable manually. If it is out of its specified range, there is a faulty condition somewhere. Check each of related systems and parts.

AIR AND FUEL DELIVERY SYSTEM

FUEL PRESSURE

INSPECTION



1. Throttle body
2. Fuel feed hose

1) Relieve fuel pressure, referring to Section 6.
2) Separate air cleaner assembly from throttle body and shift its position.
3) Disconnect fuel feed hose from throttle body.

CAUTION:
A small amount of fuel may be released after fuel line is disconnected.
In order to reduce chance of personal injury, cover fitting to be disconnected with a shop cloth. Place that cloth in an approved container when disconnection is completed.

4) Connect special tools and hose between throttle body and fuel feed pipe as shown in figure, and clamp hoses securely to ensure no leaks occur during checking.

   Special Tool
   (A): 09912-58441
   (B): 09912-58431
   (C): 09912-58490

5) Install air cleaner assembly to throttle body and cylinder head cover.

6) Start engine and warm it up to normal operating temperature.

   If engine doesn't start, turn ignition switch ON to operate fuel pump and after 2 seconds turn it OFF. Repeat this 3 or 4 times and then check fuel pressure.

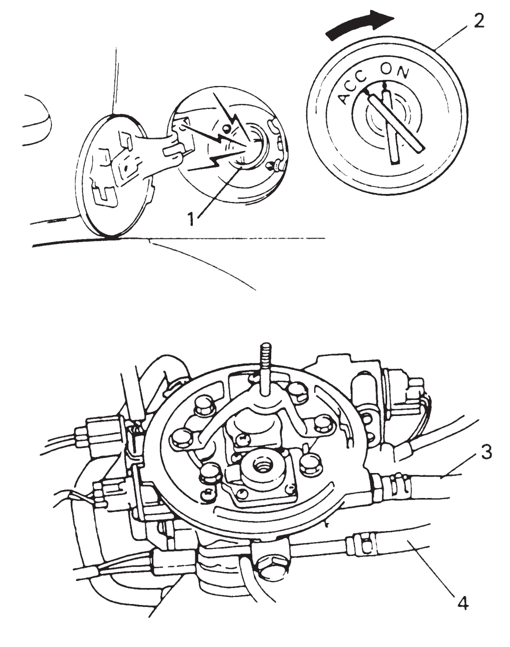
   NOTE:
   Check that battery voltage is 11 V or more before operating fuel pump.

7) Measure fuel pressure under each of the following conditions.

CONDITION	FUEL PRESSURE
At specified idle speed	0.9 – 1.4 kg/cm^2 90 – 140 kPa 12.8 – 20.0 psi
With fuel pump operating and engine at stop	1.6 – 2.1 kg/cm^2 160 – 210 kPa 22.7 – 29.9 psi
Within 1 min. after engine (fuel pump) stop (Pressure reduces as time passes)	Over 0.9 kg/cm^2 90 kPa 12.8 psi

   If measured pressure doesn't satisfy specification, refer to "DIAGNOSTIC FLOW TABLE B-3" and check each possibly defective part. Replace if found defective.

8) Relieve fuel pressure, referring to Section 6.
9) Remove fuel pressure gauge, hose & 3-way joint after removing air cleaner assembly.
10) Connect fuel feed hose to throttle body and clamp it securely.
11) Install air cleaner assembly.
12) With engine "OFF" and ignition switch "ON", check for fuel leaks.



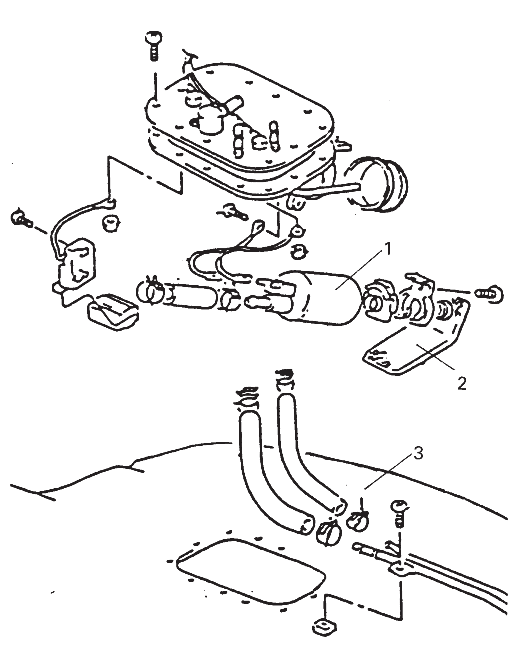
1. Fuel filler
2. Ignition switch
3. Fuel return hose
4. Fuel feed hose

FUEL PUMP

ON-VEHICLE INSPECTION

WARNING:
When fuel filler cap is removed in any procedure, work must be done with no smoking, in a well-ventilated area and away from any open flames.

1) Remove filler cap and turn ON ignition switch.
   Then fuel pump operating sound should be heard from fuel filler for about 2 seconds and stop. Be sure to reinstall fuel filler cap after checking.
   If above check result is not satisfactory, advance to "DIAGNOSTIC FLOW TABLE B-2".
2) Fuel pressure should be felt at fuel return hose for 2 seconds after ignition switch ON.
   If fuel pressure is not felt, advance to "DIAGNOSTIC FLOW TABLE B-3".



1. Fuel pump
2. Filter
3. Fuel tank

REMOVAL

1) Remove fuel tank from body according to procedure described in Section 6C and remove fuel pump from fuel tank.
2) Remove fuel pump from its bracket.

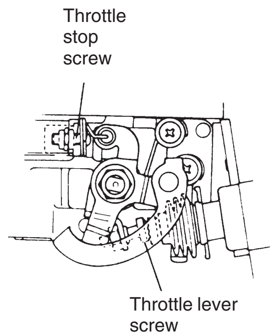
INSPECTION

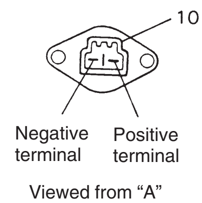
Check fuel pump filter for evidence of dirt and contamination. If present, clean and check for presence of dirt in fuel tank.

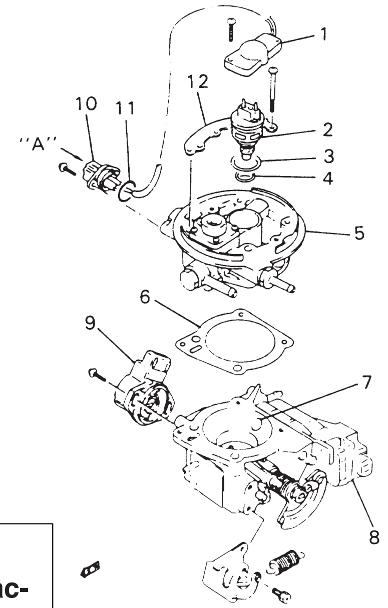
INSTALLATION

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 Section 6C.

THROTTLE BODY

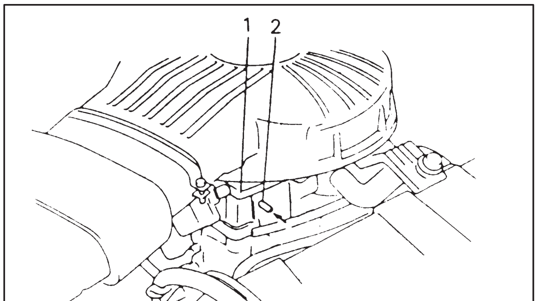






1. Fuel injector wire
2. Fuel injector
3. Upper O-ring
4. Lower O-ring
5. Throttle upper body
6. Gasket
7. Throttle lower body
8. ISC actuator
9. TP sensor
10. Injector sub wire coupler
11. O-ring
12. Injector wire cover

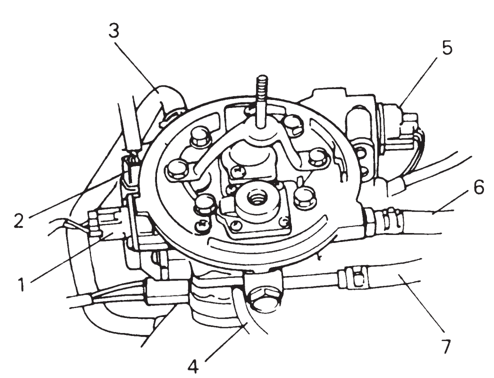
CAUTION:
As throttle stop screw and throttle lever screw are factory adjusted precisely, don’t remove or adjust them.



1. Throttle body
2. Vacuum nozzle

ON-VEHICLE INSPECTION

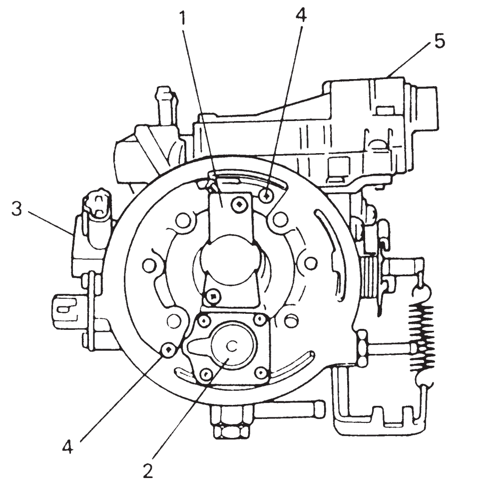
- Check that throttle valve lever moves smoothly.
- Vacuum passage inspection.
  With fingers placed against vacuum nozzle, increase engine speed a little and check that vacuum is applied.



1. Injector coupler
2. TP sensor
3. Water hose
4. Vacuum hose
5. ISC actuator
6. Fuel return hose
7. Fuel feed hose

REMOVAL

1) Relieve fuel pressure, referring to Section 6.
2) Disconnect battery negative cable at battery.
3) Remove air cleaner assembly referring to Section 6A.
4) Drain cooling system.
5) Disconnect following wire harness couplers:
   - TP sensor
   - Fuel injector
   - ISC actuator
6) Disconnect following hoses from throttle body.
   - Fuel feed and return hoses
   - Engine cooling water hoses
   - Vacuum hoses
7) Disconnect accelerator cable from throttle valve lever and cable bracket.
8) Remove throttle body from intake manifold.



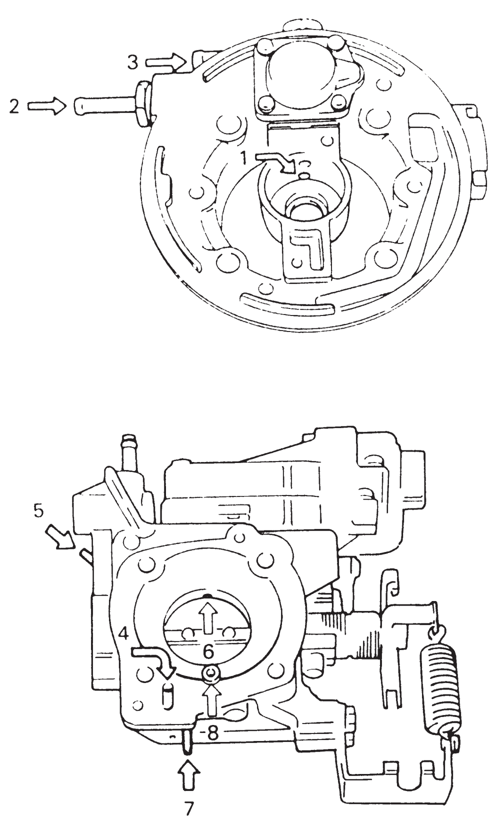
1. Fuel injector wire
2. Fuel pressure regulator
3. TP sensor
4. Screws
5. ISC actuator

DISASSEMBLY

NOTE:

- **Be sure not to remove either fuel pressure regulator or idle speed control actuator from throttle body. They are factory adjusted precisely.**
- **Be sure to replace gaskets and O-rings as well as worn or damaged parts.**
- **While disassembling and assembling throttle body, use special care not to deform levers on throttle valve shaft or cause damage to any other parts.**

1) Remove fuel injector from throttle body according to procedure described in FUEL INJECTOR REMOVAL.
2) Remove TP sensor.
3) After removing screws, separate upper and lower bodies.



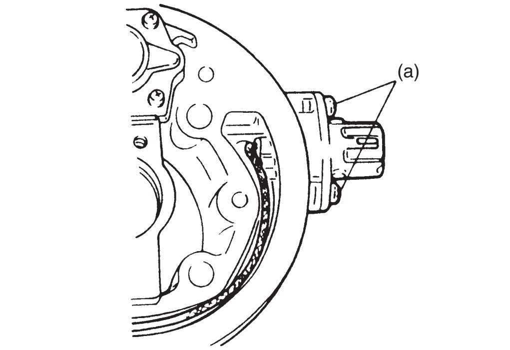
1. Injector chamber
2. Fuel return passage
3. Fuel feed passage
4. Vacuum passage for fuel pressure regulator
5. Vacuum passage for MAP sensor
6. Air induction passage
7. Vacuum passage
8. Fresh air passage

CLEANING

Clean passages and fuel injector chamber by blowing compressed air.

NOTE:

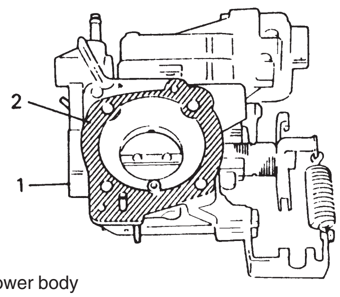
- **TP sensor, fuel pressure regulator, fuel injector, ISC actuator, other components containing rubber (resin) or throttle valve shaft seal must not be placed in a solvent or cleaner bath. Chemical reaction will cause these parts to swell, harden or get distorted.**
- **Don’t put drills or wires into passages for cleaning. It causes damage in passages.**



ASSEMBLY

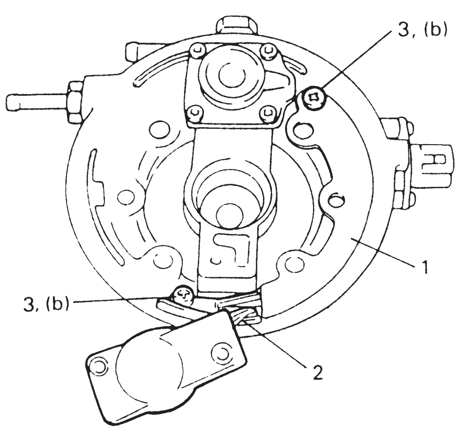
1) Install injector wire and coupler to throttle body.
   Use new O-ring.
   Tighten injector wire coupler screw to specified torque.

   Tightening Torque
   (a): 2.0 N·m (0.20 kg-m, 1.5 lb-ft)



1. Lower body
2. Gasket

2) Install new gasket to lower body.
3) Install upper body on gasket, using care not to cause gasket to slip out of place.

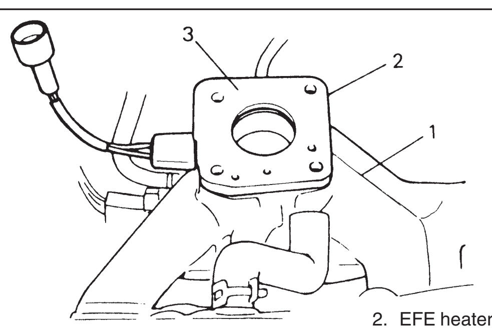


1. Wire cover
2. Fuel injector wire
3. Screws

4) Make sure to injector wire harness to fit in grooves of throttle body and install wire cover to throttle body.
   Tighten screws to specified torque.

   Tightening Torque
   (b): 3.5 N·m (0.35 kg-m, 2.5 lb-ft)

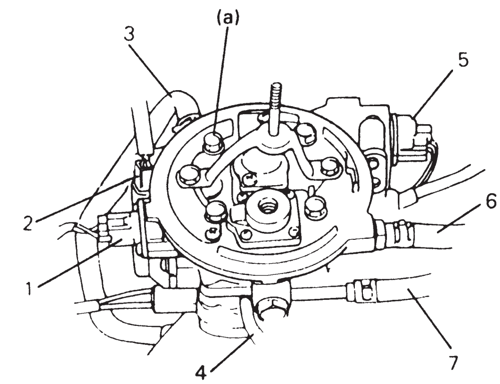
5) Install fuel injector according to procedure described in FUEL INJECTOR INSTALLATION.
6) Install TP sensor according to procedure described in THROTTLE POSITION SENSOR INSTALLATION.



1. Intake manifold
2. EFE heater
3. Gasket

INSTALLATION

1) Clean mating surfaces and install throttle body gasket to EFE heater. Use new gasket.



1. Injector coupler
2. TP sensor
3. Water hose
4. Vacuum hose
5. ISC actuator
6. Fuel return hose
7. Fuel feed hose

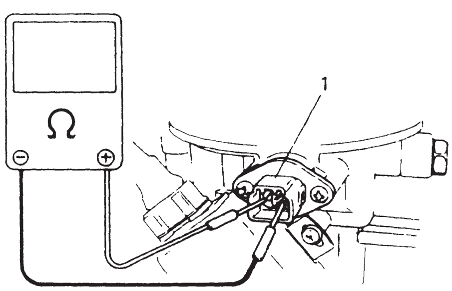
2) Install throttle body to EFE heater and tighten bolts to specified torque.

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

3) Install accelerator cable to throttle valve lever and cable bracket.
4) Connect fuel, cooling water and vacuum hoses to throttle body, and clamp securely.
5) Connect TP sensor and injector couplers securely.
6) Refill cooling system referring to Section 6B.
7) Connect negative cable at battery.
8) With engine "OFF" and ignition switch "ON", check for fuel leaks around fuel line connection.
9) Install air cleaner assembly referring to Section 6A.
10) Upon completion of installation, start engine and check for fuel leaks and engine coolant leaks.
Adjust cable play to specification according to procedure described in ACCELERATOR CABLE ADJUSTMENT.

FUEL INJECTOR

ON-VEHICLE INSPECTION

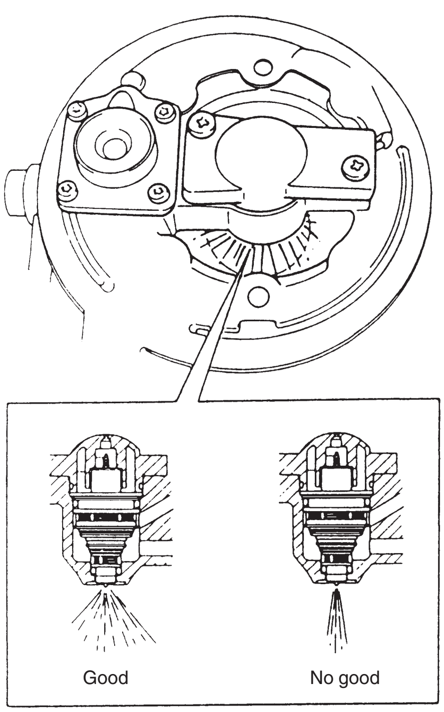


1. Injector coupler

1) With battery negative cable disconnected, disconnect injector coupler.
2) Connect ohmmeter to each injector terminal and measure resistance.

Resistance of injector: 0.5 – 1.5 Ω at 20°C (68°F)

If resistance is out of specification, replace fuel injector.



3) Connect injector coupler.
4) Remove air cleaner assembly without disconnecting IAT sensor coupler.
5) Check that fuel is injected out in conical shape from fuel injector when cranking or running engine.
If no fuel is injected, check wiring harness for continuity and couplers for proper connection referring to "DIAGNOSTIC FLOW TABLE B-1".
If fuel is not injected out in conical shape, replace injector.
6) Check injector for fuel leakage after injection is stopped (i.e., after cranking or engine stop).
Replace if leakage exists.

Fuel leakage: Less than 1 drop/min.

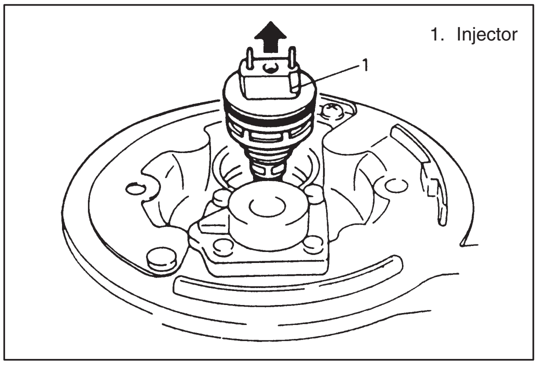
7) Install air cleaner assembly.

REMOVAL

NOTE:

Use care when handling fuel injector especially not to damage filter and its needle.

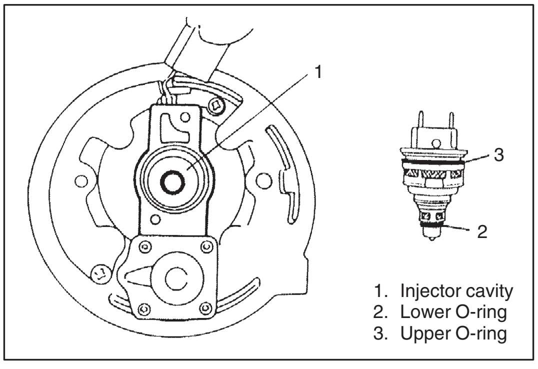
Also, because injector is an electrical component, it should not be immersed in any type of liquid solvent or cleaner, or it may get damaged.



1) Relieve fuel pressure, referring to Section 6.
2) Disconnect battery negative cable at battery.
3) Remove air cleaner assembly referring to Section 6A.
4) Remove air cleaner mounting stay from throttle body.
5) Remove injector wire and then remove fuel injector from throttle body.

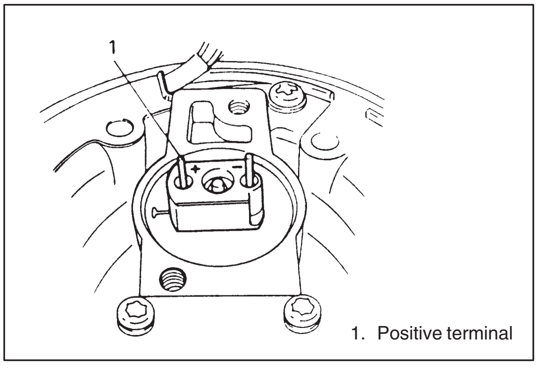
INSPECTION

Check fuel injector filter for evidence of dirt and contamination. If present, clean and check for presence of dirt in fuel lines and fuel tank.

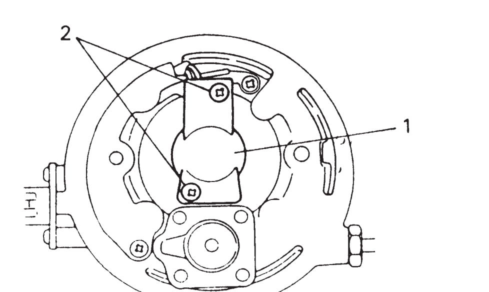


INSTALLATION

1) Apply thin coat of spindle oil or gasoline to new upper and lower O-rings, install lower O-ring and upper O-ring to injector.



2) Install injector by pushing it straight into fuel injector cavity. Never turn injector while pushing it.

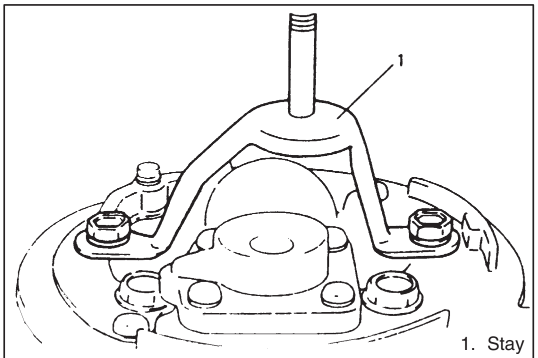


1. Injector wire
2. Screws

3) Make sure that injector wire O-ring is free from any damage and deterioration, and apply thin coat of spindle oil or gasoline to O-ring.
Install injector wire and tighten new wire screw to specified torque.

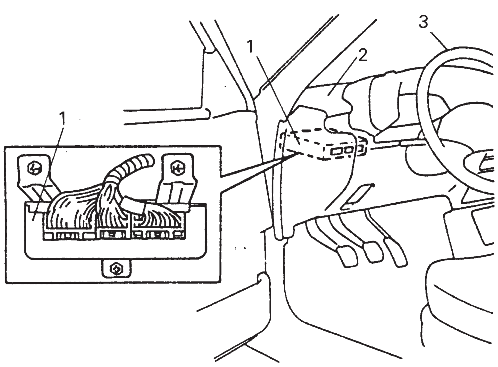
Tightening Torque
(a): 3.5 N·m (0.35 kg-m, 2.5 lb-ft)

4) Connect battery negative cable at battery.
5) With engine "OFF" and ignition switch "ON", check for fuel leaks.



1. Stay

6) Install air cleaner mounting stay as shown left.
7) Install air cleaner assembly referring to Section 6A.



1. ECM
2. Instrument panel
3. Steering wheel

ELECTRONIC CONTROL SYSTEM

ENGINE CONTROL MODULE (ECM)

CAUTION:
As ECM consists of precision parts, be careful not to expose it to excessive shock.

REMOVAL

1) Disconnect battery negative cable at battery.
2) Lower fuse box after removing bolt.
3) Disconnect couplers from ECM while releasing coupler lock.
4) Remove ECM from body.

INSTALLATION

1) Install ECM to body.
2) Connect couplers to ECM securely.
3) Install fuse box and tighten its bolt.
4) Connect battery negative cable at battery.

MANIFOLD ABSOLUTE PRESSURE SENSOR (MAP SENSOR)

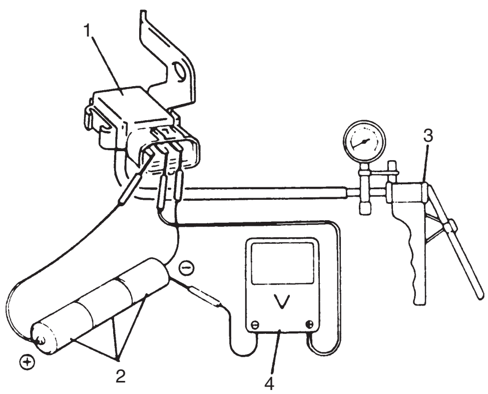
MAP SENSOR INDIVIDUAL CHECK

1) Disconnect MAP sensor vacuum hose from filter.
2) Disconnect coupler from MAP sensor.
3) Remove MAP sensor.
4) Arrange 3 new 1.5 V batteries 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 40 cmHg by using vacuum pump.

   Output voltage (Vin voltage 4.5 – 5.0 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	3.1 – 3.6
2 001 – 5 000	611 – 1 524	Under 707 over 634	94 – 85	2.8 – 3.4
5 001 – 8 000	1 525 – 2 438	Under 634 over 567	85 – 76	2.6 – 3.1
8 001 – 10 000	2 439 – 3 048	Under 567 over 526	76 – 70	2.4 – 2.9

   If check result is not satisfactory, replace MAP sensor.



1. MAP sensor
2. 1.5 V battery (4.5 V in total)
3. Vacuum pump
4. Digital type voltmeter

5) Install MAP sensor and connect vacuum hose securely.
6) Connect MAP sensor coupler securely.

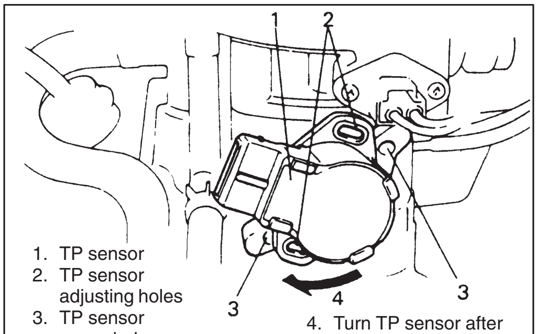
THROTTLE POSITION SENSOR (TP SENSOR)

INSPECTION

Check TP sensor referring to step 2 of DTC P0121 Flow Table. If malfunction is found, replace.

REMOVAL

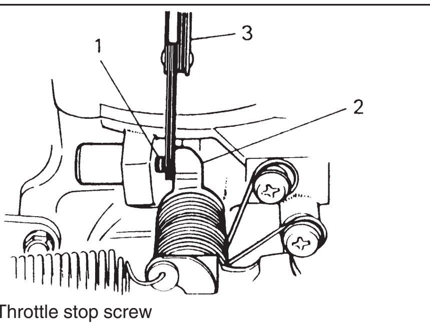
1) Disconnect battery negative cable at battery.
2) Remove air cleaner assembly referring to Section 6A.
3) Disconnect coupler from TP sensor.
4) Remove TP sensor from throttle body.



1. TP sensor
2. TP sensor adjusting holes
3. TP sensor screw holes
4. Turn TP sensor after fitting and align holes.

INSTALLATION

1) Install TP sensor to throttle body.
   Fit TP sensor to throttle body in such way that its adjusting 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.
   Then hand-tighten TP sensor screws.
2) Connect coupler to TP sensor securely.
3) Install air cleaner assembly referring to Section 6A.
4) Connect battery negative cable battery.
5) Adjust installation angle of TP sensor according to procedure described in item “ADJUSTMENT”.

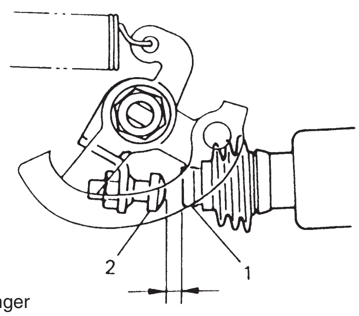


1. Throttle stop screw
2. Throttle lever
3. Thickness gauge

ADJUSTMENT

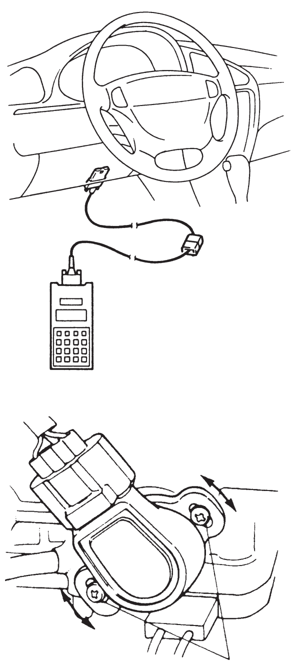
1) Insert 3.5 mm (0.14 in.) thickness gauge between throttle stop screw and throttle lever.

> **CAUTION:**
> **As throttle stop screw is factory adjusted precisely, don’t remove or adjust it.**



1. Plunger
2. Throttle lever screw

2) Check to make sure that plunger of ISC actuator and throttle lever screw are not in contact with each other. If they are, warm up engine.



3) Loosen TP sensor screws.
   a) Connect SUZUKI scan tool to DLC with ignition switch OFF.
   b) Select "Data List" mode on SUZUKI scan tool.
   c) Observe TP sensor voltage.
4) Turn TP sensor clockwise or counterclockwise and tighten TP sensor screw at a position where voltage as specified below is obtained.

TP sensor voltage when lever-to-stop screw clearance is 3.5 mm (0.14 in.) : 0.98 – 1.02 V

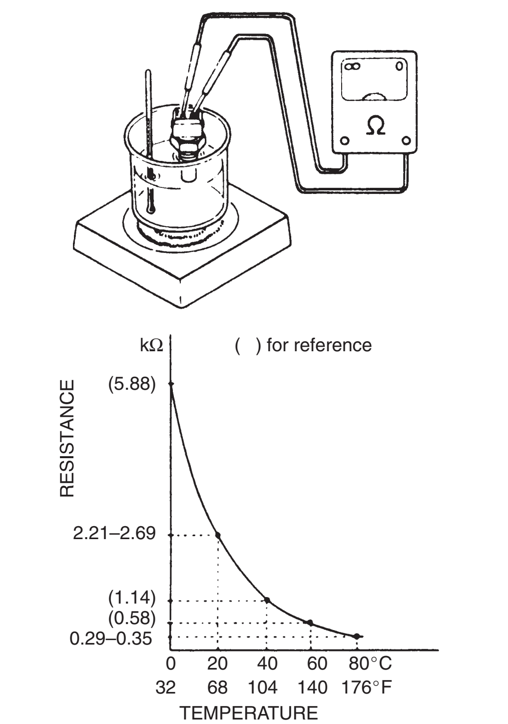
Tightening Torque
(a): 2.0 N·m (0.20 kg-m, 1.5 lb-ft)

5) Install ECM and connect couplers securely.

INTAKE AIR TEMPERATURE SENSOR (IAT SENSOR)

REMOVAL

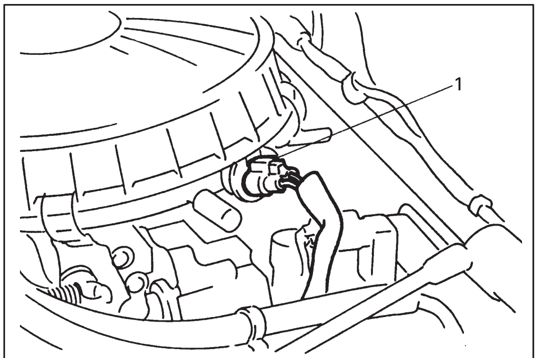
1) Disconnect battery negative cable at battery.
2) Disconnect coupler from IAT sensor.
3) Remove IAT sensor and gasket from air cleaner case.



INSPECTION

Immerse temperature sensing part of IAT sensor in water (or ice) and measure resistance between sensor terminals while heating water gradually.

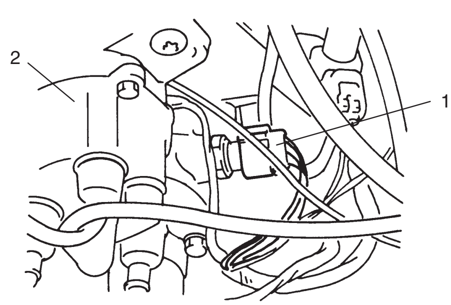
If measured resistance doesn't show such characteristic as shown in left figure, replace IAT sensor.



INSTALLATION

Reverse removal procedure noting the following.

- Clean mating surfaces of IAT sensor and air cleaner case.
- Connect IAT sensor coupler securely.



1. ECT sensor
2. Distributor

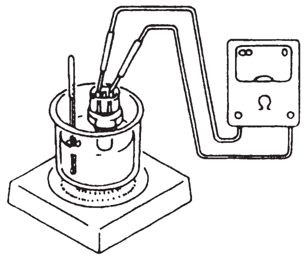
ENGINE COOLANT TEMPERATURE SENSOR (ECT SENSOR)

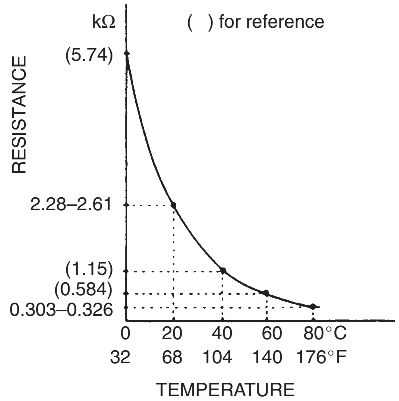
REMOVAL

1) Disconnect battery negative cable at battery.
2) Drain coolant referring to Section 6B.

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

3) Disconnect coupler from ECT sensor.
4) Remove ECT sensor from thermostat case.

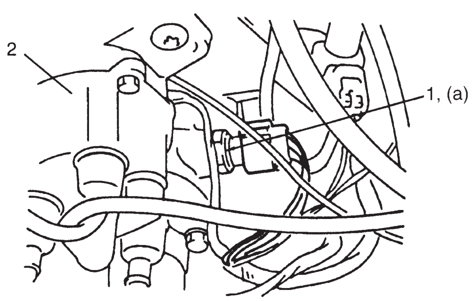




INSPECTION

Immerse temperature sensing part of ECT sensor in water (or ice) and measure resistance between sensor terminals while heating water gradually.

If measured resistance doesn't show such characteristic as shown in left figure, replace ECT sensor.



1. ECT sensor
2. Distributor

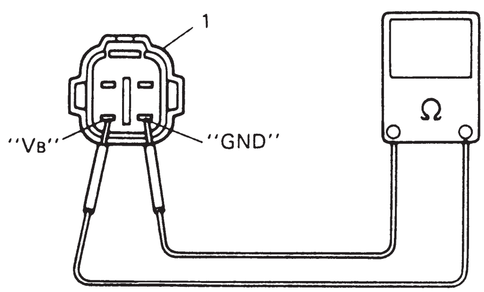
INSTALLATION

Reverse removal procedure noting the following.

- Clean mating surfaces of ECT sensor and thermostat case.
- 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 ECT sensor securely.
- Refill coolant referring to Section 6B.



1. Viewed from terminal side

HEATED OXYGEN SENSOR (SENSOR-1 AND SENSOR-2)

OXYGEN SENSOR HEATER INSPECTION

1) Disconnect sensor coupler.
2) Using ohmmeter, measure resistance between terminals "V_B" and "GND" of sensor coupler.

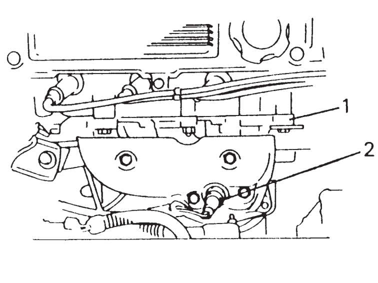
NOTE:
Temperature of sensor affects resistance value largely. Make sure that sensor heater is at correct temperature.

Resistance of oxygen sensor heater:
11.7 – 14.3 Ω at 20°C, 68°F

If found faulty, replace oxygen sensor.

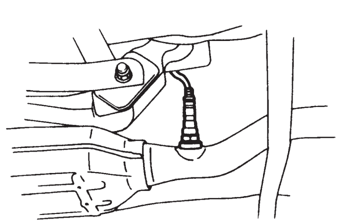
3) Connect sensor coupler securely.

Sensor-1



1. Exhaust manifold
2. 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) Hoist vehicle when removing sensor-2.
3) Disconnect coupler of heated oxygen sensor and release its wire harness from clamps.
4) Remove heated oxygen sensor from exhaust manifold.

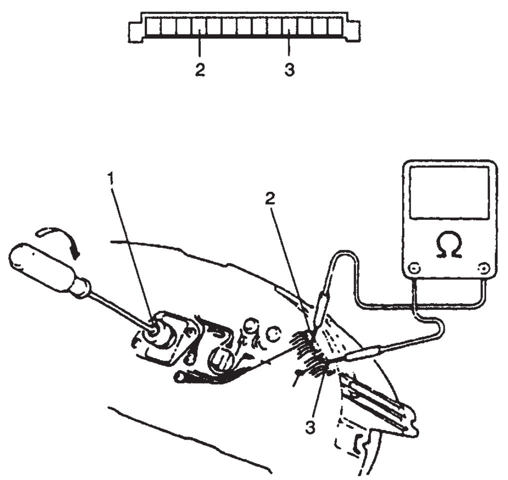
INSTALLATION

Reverse removal procedure noting the following.

- Tighten heated oxygen sensor to specified torque.

Tightening Torque for heated oxygen sensor
45 N·m (4.5 kg-m, 32.5 lb-ft)

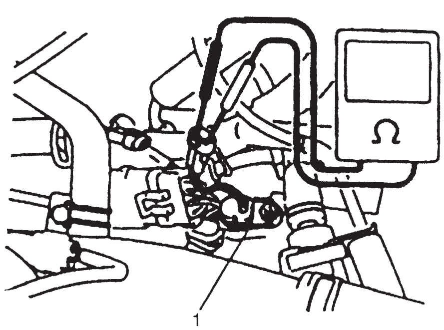
- Connect coupler of heated oxygen sensor and clamp wire harness securely.
- After installing heated oxygen sensor, start engine and check that no exhaust gas leakage exists.



VEHICLE SPEED SENSOR (VSS) For M/T

INSPECTION

1) Disconnect negative cable at battery.
2) Remove combination meter from instrument panel.
3) Connect ohmmeter between “VSS” terminal (2) and “GND” terminal (3) of combination meter and turn cable joint (1) of speedometer with a screwdriver. Ohmmeter indicator should move back and forth between 0 (zero) and ∞ (infinity) 4 times while cable joint is turned one full revolution.
   Replace speedometer if check result is not satisfactory.
4) Install combination meter to instrument panel.
5) Connect negative cable at battery.



VEHICLE SPEED SENSOR (VSS) For A/T

INSPECTION

Vehicle speed sensor (1) itself can be checked on its resistance by disconnecting connector.

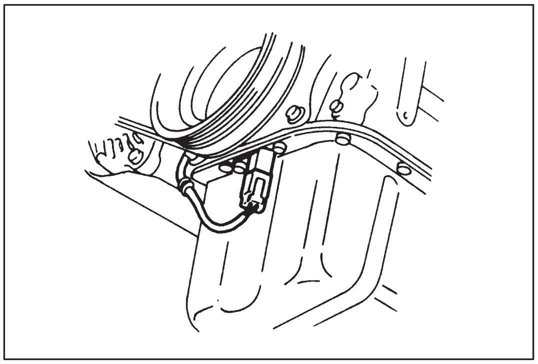
NOTE:
- **Function of vehicle speed sensor can be checked by measuring generated pulse as voltage.**
- **For its measurement, use an analog type voltmeter while spinning wheels on lift and with selector lever in D position.**

Vehicle speed sensor specifications	
Coil resistance	100 – 300 Ω
Output voltage at 40 km/h (25 mile/h)	approximately 1 V

FUEL LEVEL SENSOR (GAUGE)

Refer to Section 8.

CRANKSHAFT POSITION SENSOR

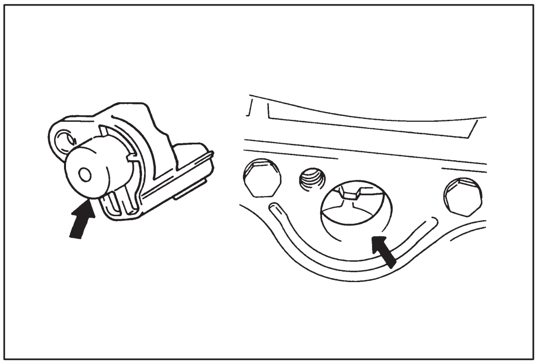


INSPECTION

Check crankshaft position sensor referring to step 1 and 2 of DTC P0335 Flow Chart. If malfunction is found, replace.

REMOVAL

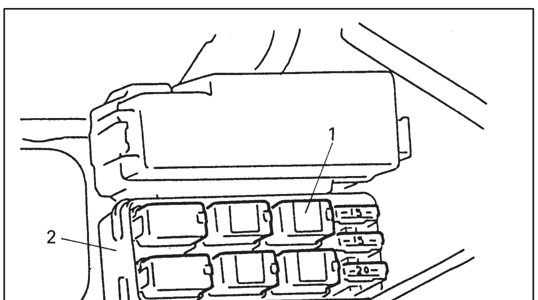
1) Hoist vehicle.
2) Remove fender apron extension on right side.
3) Disconnect connector from crankshaft position sensor.
4) Remove crankshaft position sensor from oil pan.



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.
3) Connect connector to it securely.
4) Install fender apron extension.

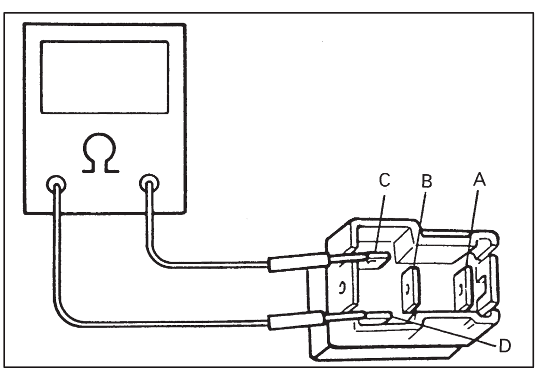
MAIN RELAY



1. Main relay
2. Relay box

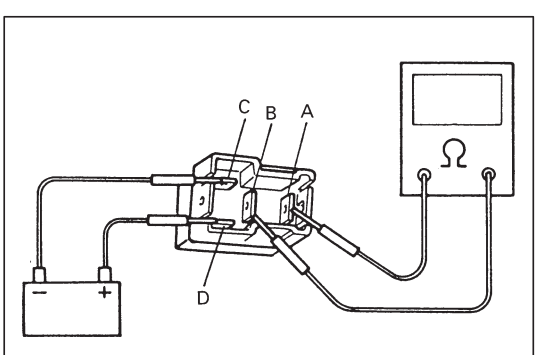
INSPECTION

1) Disconnect negative cable at battery.
2) Remove main relay from relay box.

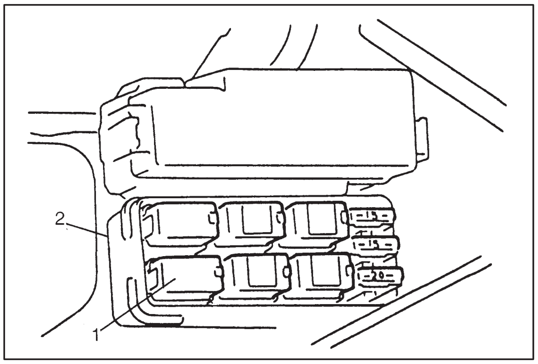


3) Check resistance between each two terminals as in table below. If check results are as specified, proceed to next operation check. If not, replace.

TERMINALS	RESISTANCE
Between A and B	∞ (infinity)
Between C and D	100 – 120 Ω



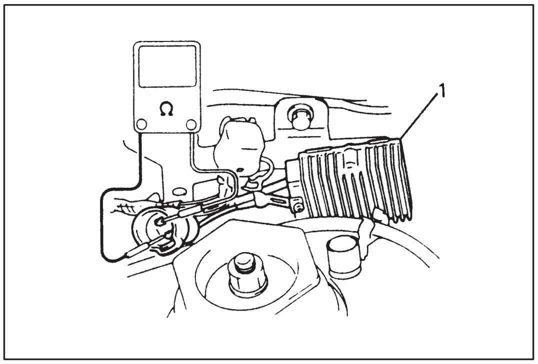
4) Check that there is continuity between terminals “A” and “B” when battery is connected to terminals “C” and “D”.
If found defective, replace.



FUEL PUMP RELAY

INSPECTION

1) Disconnect negative cable at battery.
2) Remove fuel pump relay (1) from relay box (2).
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 found defective, replace.



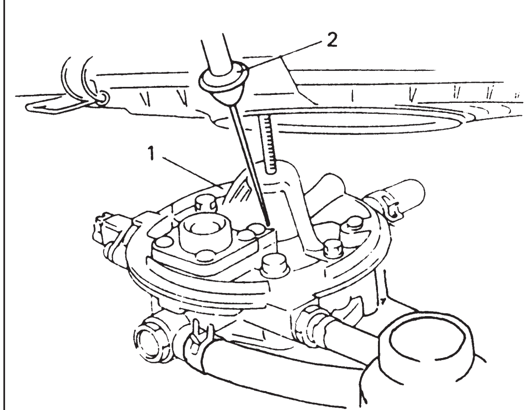
FUEL INJECTOR RESISTOR

INSPECTION

1) With ignition switch OFF, disconnect resistor coupler.
2) Check resistor (1) for resistance.

   Resistance: 1.9 – 2.1 Ω at 20°C, 68°F

   If check result is not satisfied, replace.



1. Throttle body

FUEL CUT OPERATION

INSPECTION

NOTE:

Before inspection, check to make sure that gear shift lever is in neutral position (with A/T model, selector lever in “P” range), A/C is OFF and that parking brake lever is pulled all the way up.

1) Warm up engine to normal operating temperature.
2) While listening to sound of injector by using sound scope (2) or such, increase engine speed to higher than 3,000 r/min.
3) Check to make sure that sound to indicate operation of injector stops when throttle valve 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.

IDLE SPEED CONTROL SYSTEM

SYSTEM INSPECTION

NOTE:

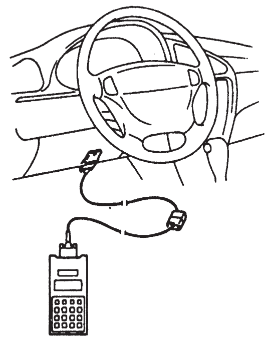
Before inspection, check to make sure that:

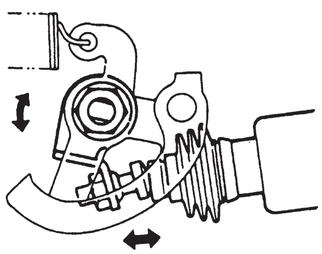
– Gear shift lever is in neutral position (with A/T vehicle, selector lever in “P” range) and that parking brake lever is pulled all the way up.

– Battery voltage is higher than 11 V.

– Throttle valve moves smoothly.

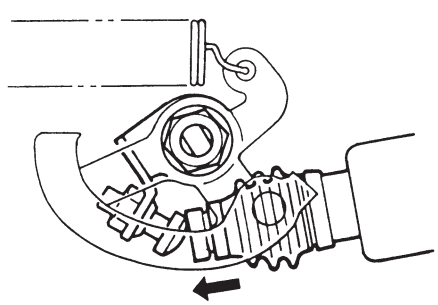
– Ambient temperature is higher than 0°C (32°F)





1) Connect scan tool to DLC with ignition switch OFF, if it is available.
2) Warm up engine to normal operating temperature.
3) Select "Data List" mode on scan tool to check "IAC duty".
4) Apply load to engine as described below and check that idle speed is kept at specified level and "IAC duty" increases as specified below. At the same time, check that plunger of ISC actuator moves.

Increase of ISC duty
when headlight turns ON : About 3.5%
when A/C is operating : About 10%



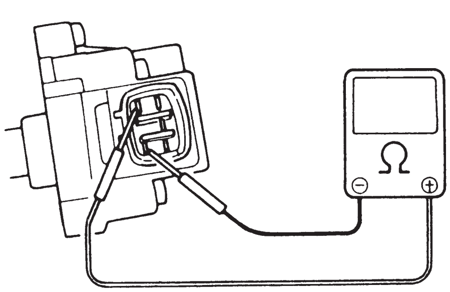
5) Stop engine and leave it as it is till it cools off. Then check that plunger of ISC actuator moves when ignition switch is turned from OFF to ON once.
If abnormality is found in Steps 4) and 5), check ISC relay, ISC actuator, ISC electric circuit and closed throttle position switch signal.
If abnormality is found in Step 4) only, check A/C signal circuit or power steering pressure switch signal circuit first.

ISC ACTUATOR

NOTE:
As ISC actuator has been preadjusted precisely at factory, it must not be taken out of throttle body or disassembled.

INSPECTION

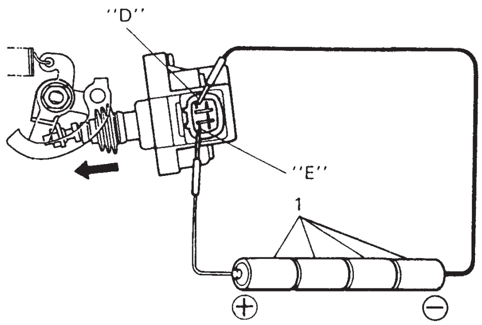
1) Disconnect connector from ISC actuator.



2) Check whether ISC actuator coil is open or short.

ISC actuator resistance at 20°C (68°F): 3 – 50 Ω

NOTE:
Above data should be used as reference value for determining whether coil is open or short only. ISC actuator resistance may be out of above specified range even when ISC actuator is normal.



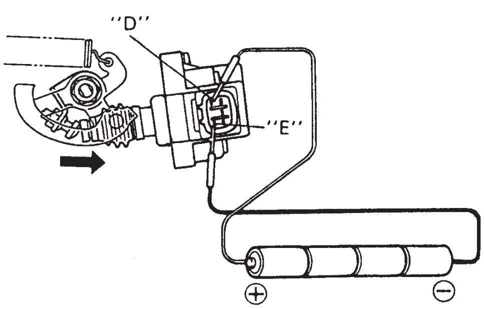
1. 1.5 V battery (6.0 V in total)

3) Arrange 4 new 1.5 V batteries in series (6.0 V in total).
   With throttle lever in contact with plunger of ISC actuator, connect these batteries to ISC actuator terminals and check ISC actuator for operation.

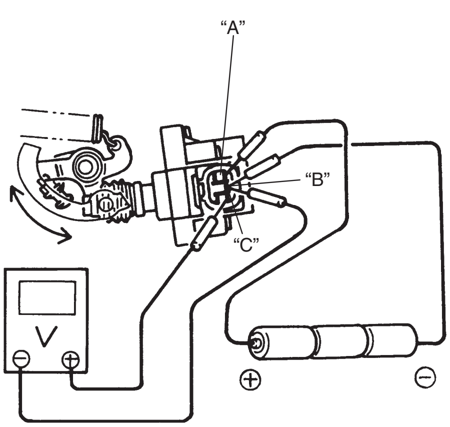
CAUTION:
- **Make sure that connection is made correctly between batteries and terminals. Also, voltage must not be applied for longer than 1 second, or a faulty condition will occur.**
- **Make sure that connection is correct. Connecting to other terminals may cause damage to closed throttle position switch (idle switch).**
- **After inspection, be sure to check that CTP switch is ON. If it is OFF, move ISC actuator again and turn CTP switch ON.**

When positive terminal is connected to "E" terminal while plunger is contracted: Plunger expands

When positive terminal is connected to "D" terminal while plunger is expanded : Plunger contracts



When an abnormality has been found in above checks 2) and 3), replace.



CLOSED THROTTLE POSITION (CTP) SWITCH, IDLE SWITCH (IN ISC ACTUATOR)

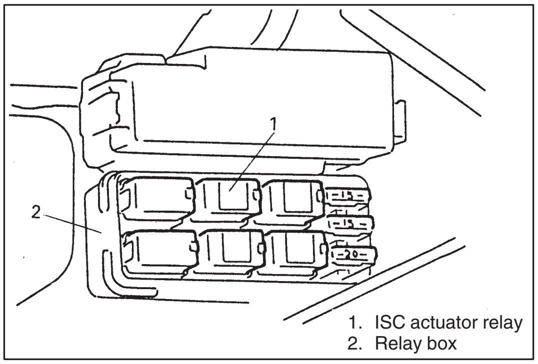
INSPECTION

1) Disconnect connector from ISC actuator.
2) Arrange 3 new 1.5 V batteries in series (4.5 V in total) and connect these batteries to CTP switch terminals "A" and "B".
   Check voltage between terminals "B" and "C" under following each condition.

Throttle lever is in contact with ISC actuator plunger : 0 – 1 V

Throttle lever is apart from plunger : 3.5 – 5.5 V

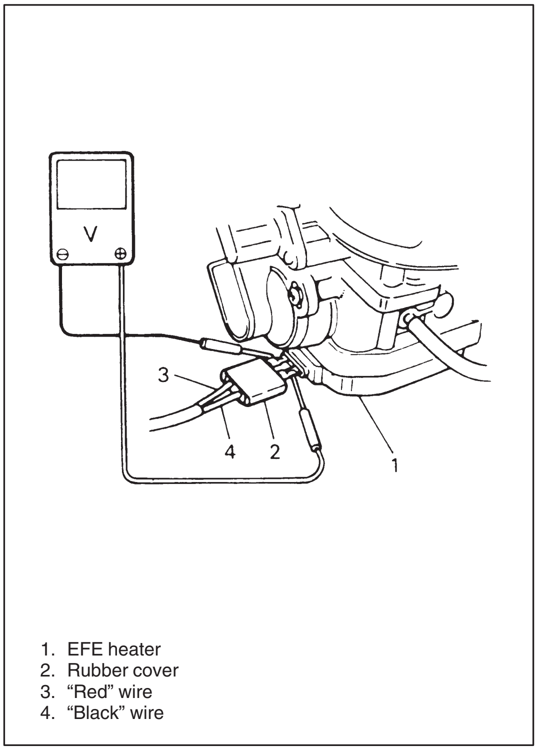
If check result is not satisfactory, replace throttle lower body.



ISC ACTUATOR RELAY

INSPECTION

1) Disconnect negative cable at battery.
2) Remove ISC actuator relay from relay box.
3) Structure of ISC actuator relay is the same as that of main relay. Check its resistance and operation using the same procedure as that for main relay.



EFE HEATER CONTROL SYSTEM

SYSTEM CIRCUIT INSPECTION

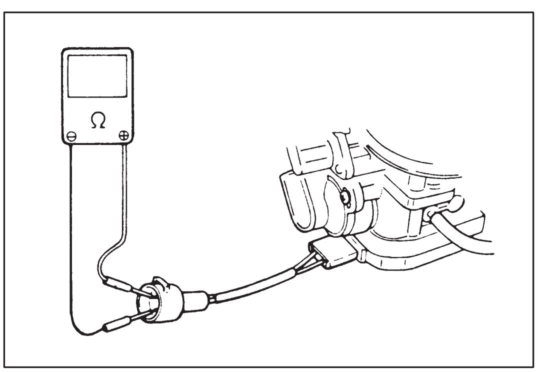
NOTE:
Before inspection, check to make sure that gear shift lever is in neutral position (with A/T model, selector lever in "P" range) and that parking brake lever is pulled all the way up.

1) Turn up rubber cover of EFE heater to expose terminal-to-wire connections.
2) Connect voltmeter to EFE terminals and check for voltage under each condition given below.

CONDITION	VOLTAGE
Fast idle condition [Coolant temp.: below 80°C (176°F) Engine speed: over 750 r/min.]	Battery voltage
After warming up (other than above)	No voltage

If check results are not as specified in above table, check EFE heater, relay and wire harness.

3) Cover EFE heater connections with rubber cover.



EFE HEATER

> **CAUTION:**
> **Do not bend wire harness of EFE heater excessively.**

ON-VEHICLE INSPECTION

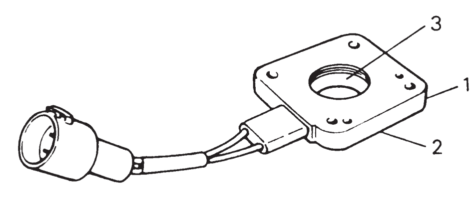
1) Disconnect EFE heater coupler.
2) Check resistance of EFE heater.
If it is not as specified below, replace.

EFE heater resistance: 0.5 – 3.0 Ω at 20°C (68°F)

3) Connect EFE heater coupler securely.

REMOVAL

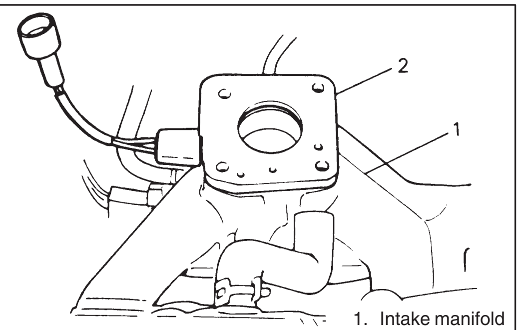
1) Remove throttle body according to procedure described previously.
In this case, however, it is not necessary to disconnect fuel hoses and engine cooling water hoses from throttle body.
2) Disconnect EFE heater coupler.
3) Remove EFE heater from intake manifold.



1. Insulator
2. Lower gasket
3. Heater

INSPECTION

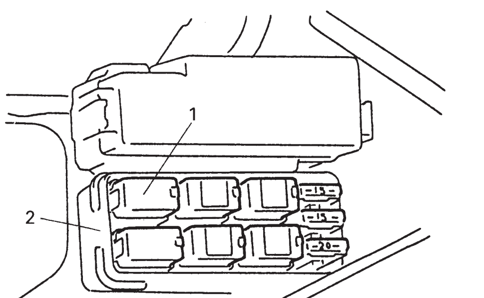
- Check lower gasket for damage and deterioration. Replace as necessary.
- Check heater and insulator for crack, corrosion or any other damage. Replace as necessary.



1. Intake manifold
2. EFE heater

INSTALLATION

1) Clean mating surfaces of throttle body and intake manifold that mate with EFE heater.
2) Install EFE heater to intake manifold.
   Use new upper gasket.
3) Install throttle body according to procedure described previously.
4) Connect EFE heater coupler.

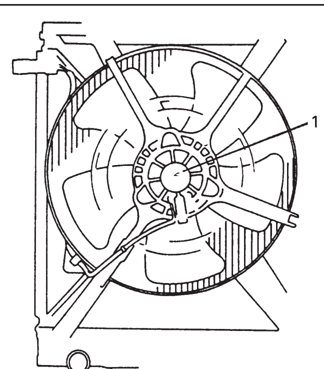


1. EFE heater relay
2. Relay box

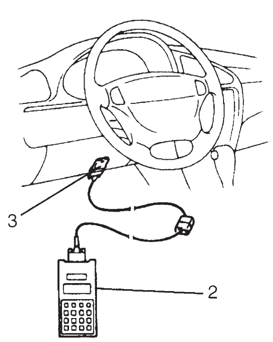
EFE HEATER RELAY

INSPECTION

1) Disconnect negative cable at battery.
2) Remove EFE heater relay from relay box.
3) Structure of EFE heater relay is the same as that of main relay.
   Check its resistance and operation using the same procedure as that for main relay.
   If found defective, replace.



1. Radiator fan motor

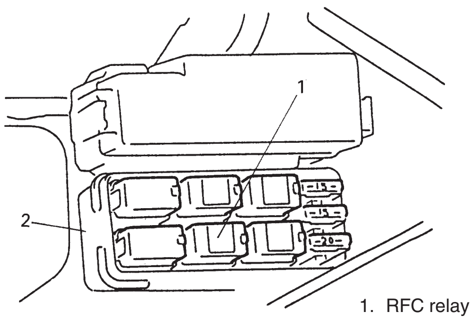


RADIATOR FAN CONTROL SYSTEM

SYSTEM INSPECTION

> **WARNING:**
> **Keep hands, tools, and clothing away from engine cooling fan to help prevent personal injury. This fan is electric and can come on whether or not the engine is running. The fan can start automatically in response to the ECT sensor with the ignition switch in the "ON" position.**

Connect SUZUKI scan tool (2) to DLC (3).
Start engine and keep it running to warm it up.
Now check to ensure that radiator fan is started when the coolant temperature displayed on SUZUKI scan tool reaches 96°C (205°F).
If check result is not satisfactory, check RFC relay, wire harness, ECT sensor, ECM, coolant temp. meter and sender gauge unit.
Refer to "DTC P0480 FLOW TABLE" of Section 6 and "COOLANT TEMP. METER AND GAUGE UNIT" of Section 8.

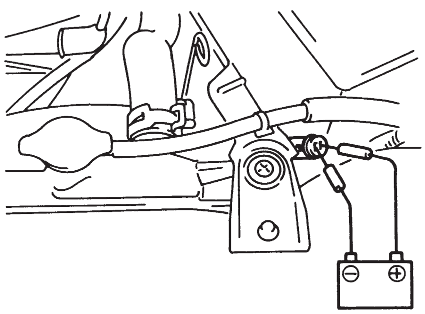


1. RFC relay
2. Relay box

RADIATOR FAN CONTROL RELAY (RFC RELAY)

INSPECTION

1) Disconnect negative cable at battery.
2) Remove RFC relay from relay box.
3) Structure of RFC relay is the same as that of main relay. Check its resistance and operation using the same procedure as that for main relay. If found defective, replace.



RADIATOR FAN

INSPECTION

1) Disconnect negative cable at battery.
2) Disconnect radiator fan motor connector.
3) Connect battery to the motor and check for operation. If fan fails to operate, replace.

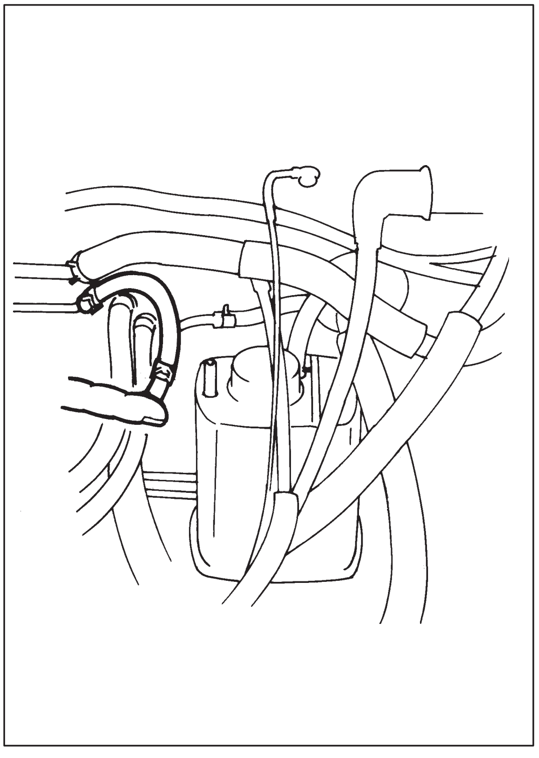
EMISSION CONTROL SYSTEM

EVAPORATIVE EMISSION CONTROL SYSTEM

EVAP CANISTER PURGE INSPECTION

NOTE:

Before inspection, check to make sure that gear shift lever is in neutral position (with A/T model, selector lever in "P" range) and that parking brake lever is pulled all the way up.

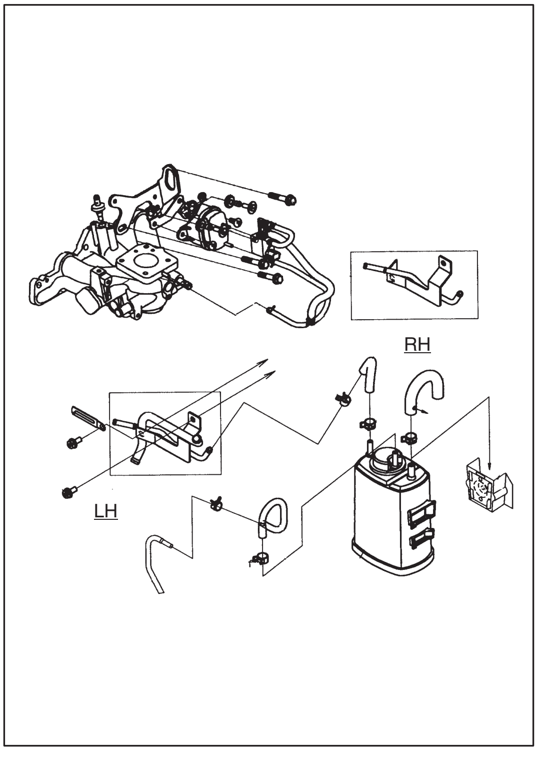


1) Disconnect purge hose from EVAP canister.
2) Place finger against the end of disconnected hose and check that vacuum is not felt there when engine is cool and running at idle speed.
3) Connect purge hose to EVAP canister and warm up engine to normal operating temperature.
4) Disconnect purge hose from EVAP canister.
5) Also check that vacuum is felt when engine is running at idle speed.

   NOTE:

   The EVAP canister purge system does not perform purging (vacuum is not detected at the purge hose) unless the engine is sufficiently warmed up and the heated oxygen sensor is activated fully. Also, when the purge hose is disconnected in Step 4), the air is drawn into the purge line. As a result, ECM detects a change in the purge gas concentration and sometimes stops purging but this indicates nothing abnormal.

If check result is not satisfactory, check vacuum passage, hoses, EVAP canister purge valve, wire harness and ECM.



VACUUM PASSAGE INSPECTION

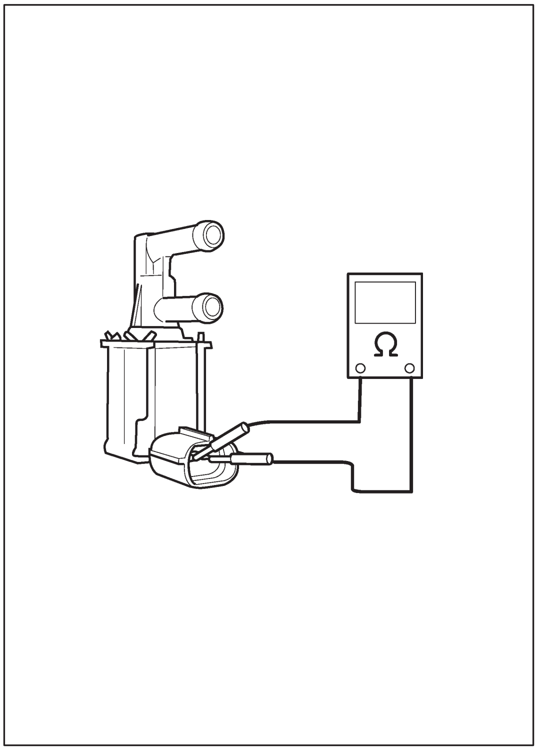
Start engine end run it at idle speed. Disconnect vacuum hose from EVAP canister purge valve. With finger placed against hose disconnected, check that vacuum is applied.

If it is not applied, clean vacuum passage by blowing compressed air.

VACUUM HOSE INSPECTION

Check hoses for connection, leakage, clog and deterioration. Replace as necessary.

EVAP CANISTER PURGE VALVE INSPECTION

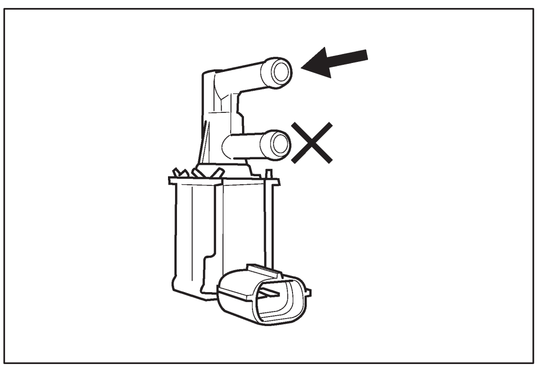


> **WARNING:**
> **Do not suck the air through valve. Fuel vapor inside valve is harmful.**

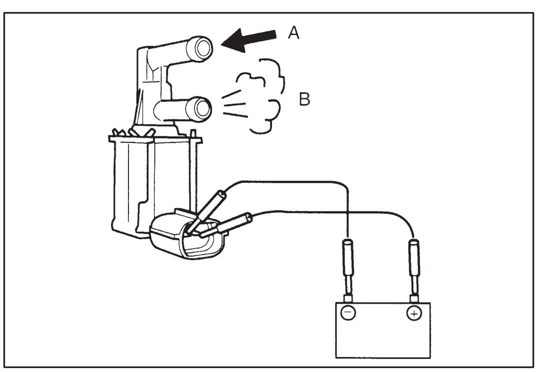
1) With the ignition switch OFF position, disconnect coupler from EVAP canister purge valve.
2) Check resistance between two terminals of EVAP canister purge valve.

   Resistance of EVAP canister purge valve:
   33 – 39 Ω at 20°C (68°F)

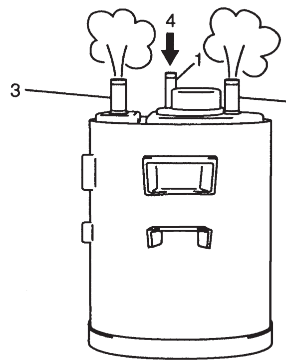
   If resistance is as specified, proceed to next operation check.
   If not, replace.



3) Disconnect vacuum hoses from intake manifold and its pipe.
4) With coupler disconnected, blow into pipe “A”. Air should not come out of pipe “B”.



5) Connect 12 V-battery to EVAP canister purge valve terminals.
   In this state, blow pipe “A”.
   Air should come out of pipe “B”.
   If check result is not as described, replace canister purge valve.
6) Connect vacuum hoses.
7) Connect EVAP canister purge valve coupler securely.

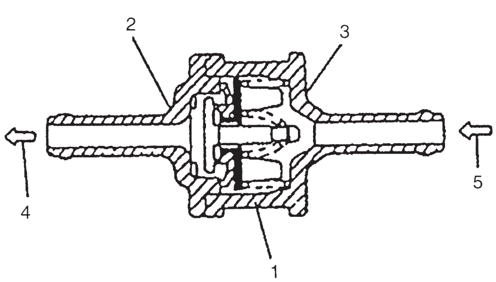


1. Tank pipe
2. Purge pipe
3. Air pipe
4. Blow air

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

WARNING:
DO NOT SUCK air through tank pressure control valve. Fuel vapor inside the valve is harmful.

1) Remove tank pressure control valve.
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 though valve in step 2) or hard blow is required in step 3), replace tank pressure control valve.
5) Install tank pressure control valve.

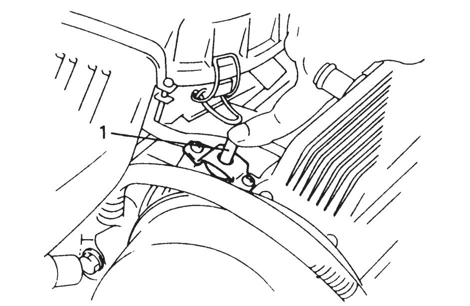
   NOTE:
   When connecting tank pressure control valve between hoses, refer to figure at the left for installing direction.

PCV SYSTEM

NOTE:
Be sure to check that there is no obstruction in PCV valve or its hoses before adjusting engine idle speed, for obstructed PCV valve or hose hampers its accurate adjustment.

PCV HOSE INSPECTION

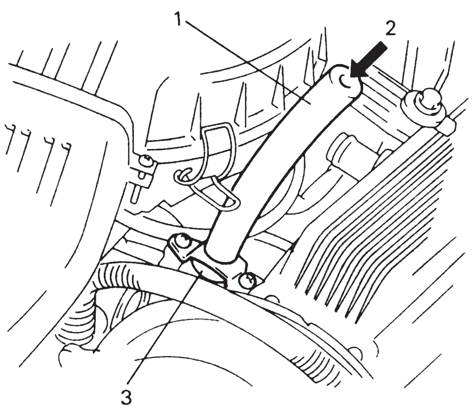
Check hoses for connection, leakage, clog and deterioration. Replace as necessary.



1. PCV valve

PCV VALVE INSPECTION

1) Disconnect PCV hose from PCV valve.
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.



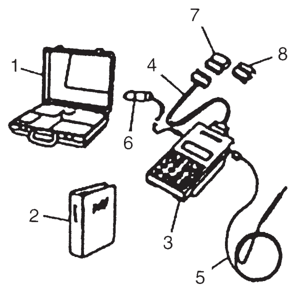
1. Proper size hose
2. Blow air
3. PCV valve

4) After checking vacuum, stop engine and check PCV valve for sticking.
   With engine stopped, connect a new hose to PCV valve for inspection.
   Blow air into the hose and check that air flows with difficulty from cylinder head side to intake manifold side.
   If air flows without difficulty, valve is stuck in “Open” position. Replace PCV valve.

WARNING:
Do not suck air through PCV valve. Petroleum substances inside the valve and fuel vapor inside the intake manifold are harmful.

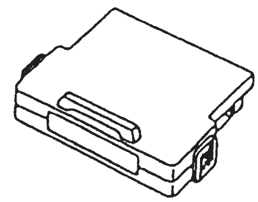
5) After removing the hose, connect PCV hose and clamp securely.

SPECIAL TOOLS

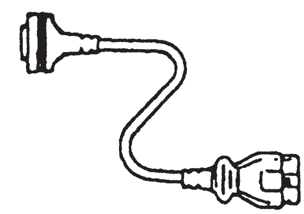


1. Storage case
2. Operator's manual
3. Tech 1A
4. DLC cable (14/26 pin, 09931-76040)
5. Test lead/probe
6. Power source cable
7. DLC cable adaptor
8. Self-test adaptor

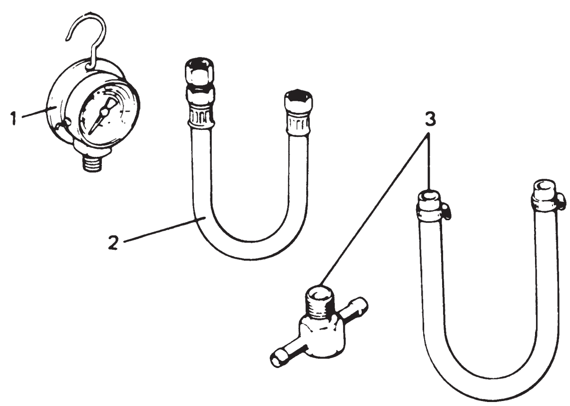
09913-76011
SUZUKI scan tool (Tech 1A) kit



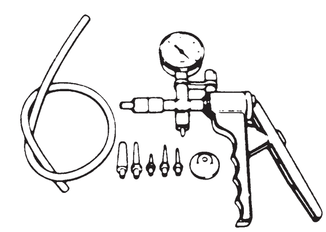
Mass storage cartridge



09931-76030
16/14 pin DLC cable



1. Fuel pressure gauge
   09912-58441
2. Pressure hose
   09912-58431
3. 3-way joint & hose
   09912-58490



09917-47010
Vacuum pump gauge

TIGHTENING TORQUE SPECIFICATIONS

Fastening parts	Tightening torque		
	N·m	kg-m	lb-ft
Throttle body mounting bolt	23	2.3	17.0
Throttle upper and lower body screw	3.5	0.35	2.5
Fuel injector wire connector screw	2.0	0.20	1.5
Fuel injector cover screw	3.5	0.35	2.5
TP sensor mounting screw	2.0	0.20	1.5
ECT sensor	15	1.5	11.0
Heated oxygen sensor -1 and -2	45	4.5	32.5

SECTION 6E1

ENGINE AND EMISSION CONTROL SYSTEM (TBI FOR G13)

NOTE:
For the details of this section, refer to the same section of the Service Manual mentioned in the FOREWORD of this manual.

SECTION 6E2

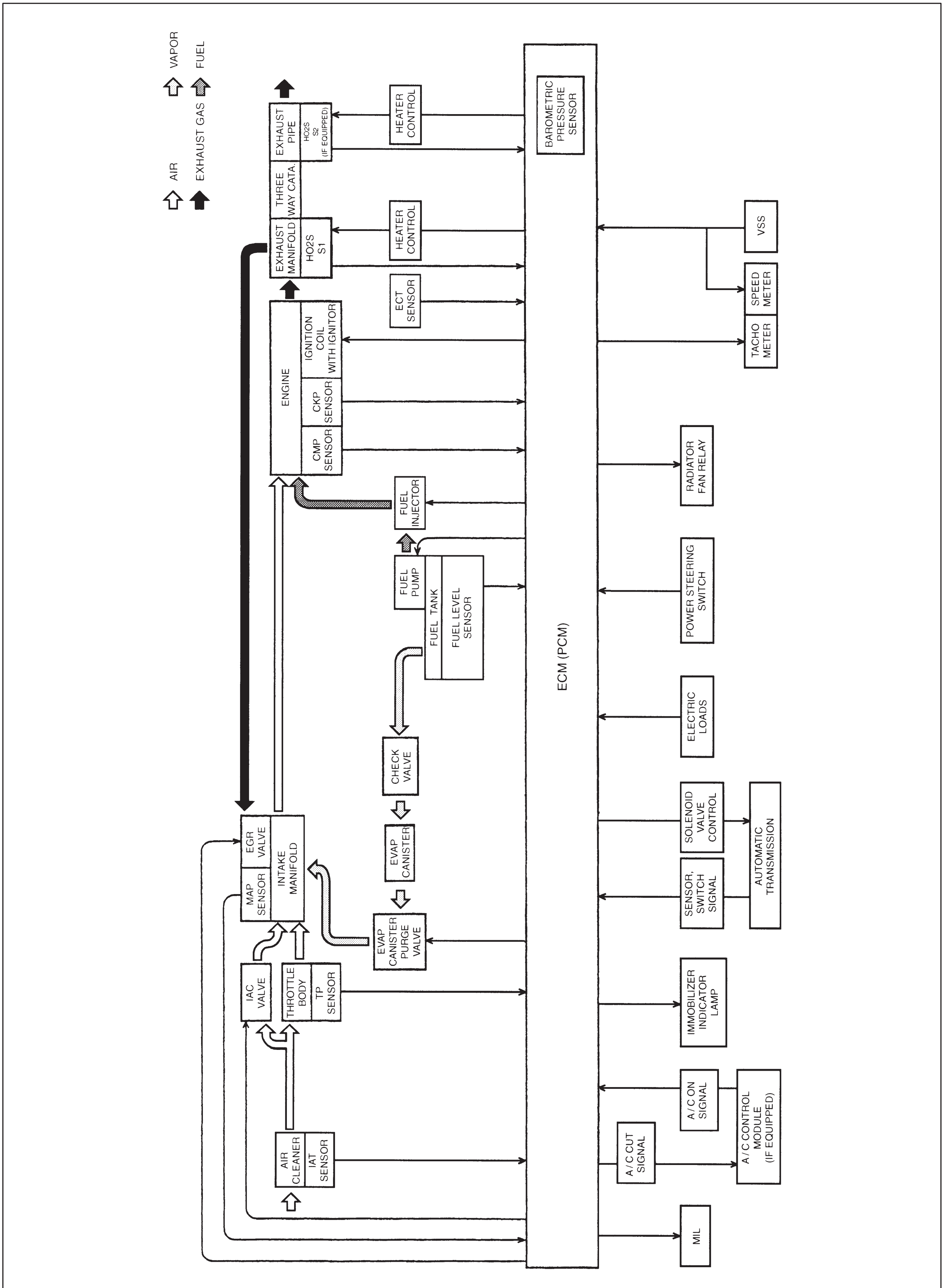
ENGINE AND EMISSION CONTROL SYSTEM (SFI FOR G13)

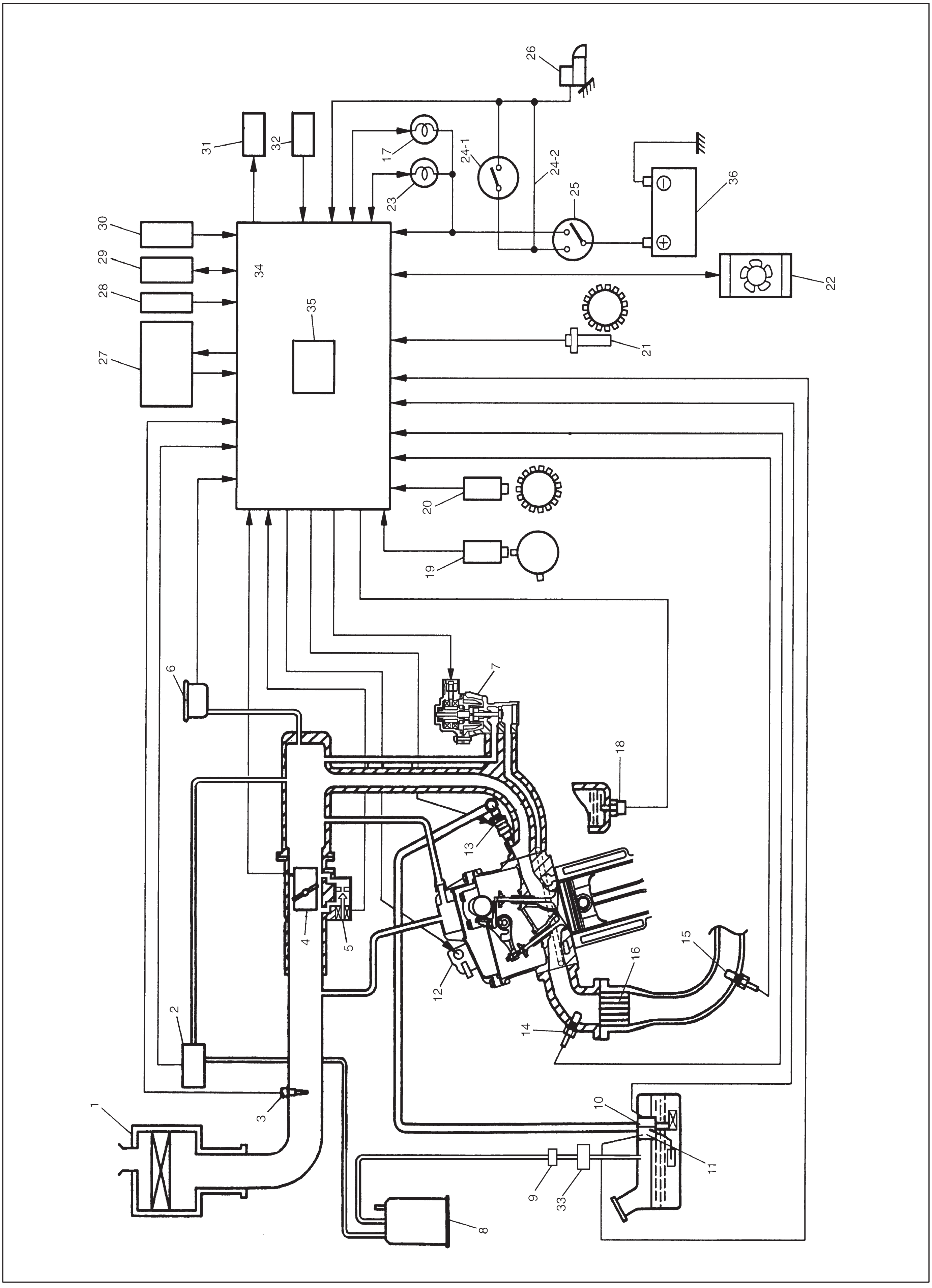
WARNING:
For vehicles equipped with Supplemental Restraint (Air Bag) System:
- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "Air Bag System Components and Wiring Location View" under "General Description" in air bag system 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

The engine and emission control system is divided into 4 major sub-systems: air intake system, fuel delivery system, electronic control system and emission control system.
Air intake system includes air cleaner, throttle body, IAC valve and intake manifold.
Fuel delivery system includes fuel pump, delivery pipe, fuel pressure regulator, etc. Electronic control system includes ECM (PCM), various sensors and controlled devices.
Emission control system includes EGR, EVAP and PCV system.


AIR
EXHAUST GAS
VAPOR
FUEL
EXHAUST MANIFOLD
HO2S S1
THREE WAY CATA.
EXHAUST PIPE
HO2S S2 (IF EQUIPPED)
HEATER CONTROL
HEATER CONTROL
ECT SENSOR
BAROMETRIC PRESSURE SENSOR
ENGINE
CMP SENSOR
CKP SENSOR
IGNITION COIL WITH IGNITOR
FUEL INJECTOR
FUEL PUMP
FUEL TANK
FUEL LEVEL SENSOR
CHECK VALVE
EVAP CANISTER
EVAP CANISTER PURGE VALVE
MAP SENSOR
EGR VALVE
INTAKE MANIFOLD
IAC VALVE
THROTTLE BODY
TP SENSOR
AIR CLEANER
IAT SENSOR
ECM (PCM)
VSS
SPEED METER
TACHO METER
RADIATOR FAN RELAY
POWER STEERING SWITCH
ELECTRIC LOADS
SOLENOID VALVE CONTROL
SENSOR, SWITCH SIGNAL
AUTOMATIC TRANSMISSION
IMMOBILIZER INDICATOR LAMP
A / C ON SIGNAL
A / C CONTROL MODULE (IF EQUIPPED)
A / C CUT SIGNAL
MIL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24-1
24-2
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31
32
33
34
35
36

1. Air Cleaner
2. EVAP canister purge valve
3. IAT sensor
4. TP sensor
5. IAC valve
6. MAP sensor
7. EGR valve
8. EVAP canister
9. Tank pressure control valve
10. Fuel pump
11. Fuel level sensor
12. Ignition coil assembly
13. Fuel injector
14. Heated Oxygen Sensor (HO2S)-1
15. Heated Oxygen Sensor (HO2S)-2
16. Three way catalytic convertor
17. Immobilizer indicator lamp in combination meter
18. ECT sensor
19. CMP sensor
20. CKP sensor
21. VSS (A/T)
22. Radiator fan
23. Malfunction indicator lamp in combination meter

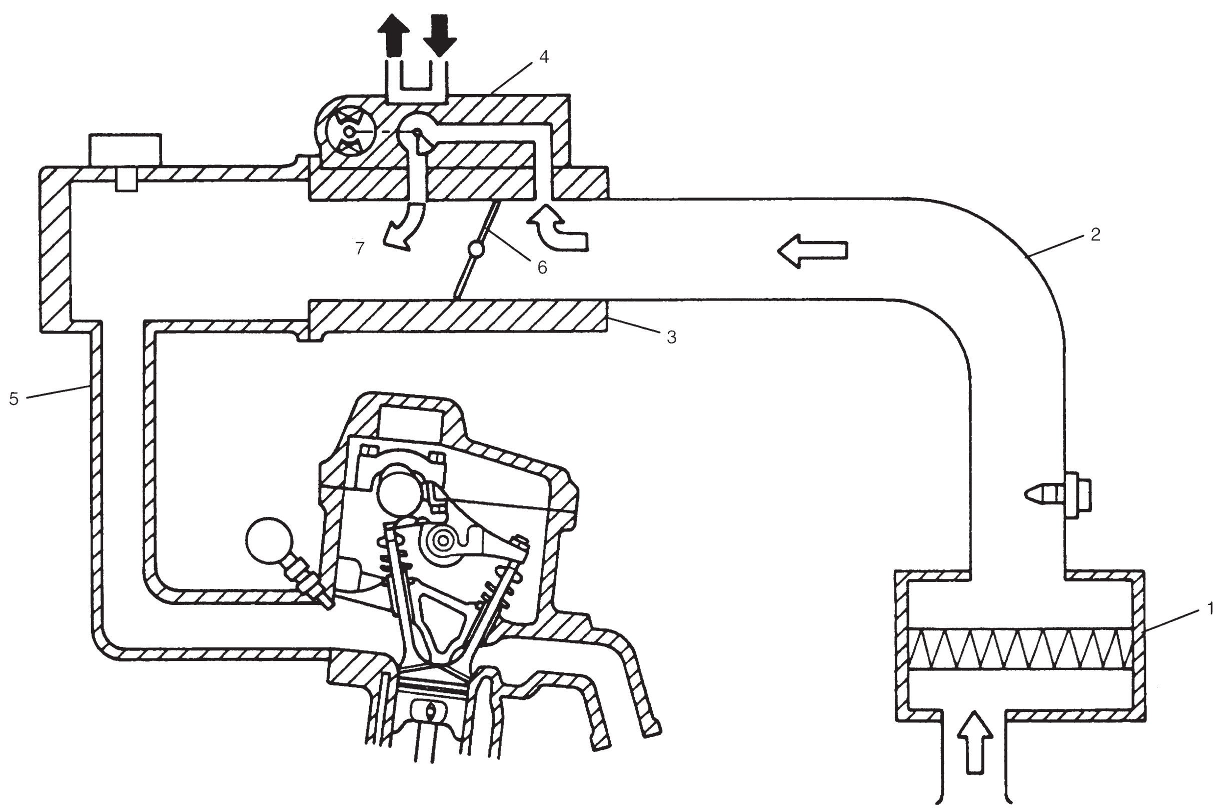
24-1. Park/Neutral position switch
24-2. Wiring harness (M/T)

25. Ignition switch
26. Starter magnetic switch
27. A/C control module (if equipped)
28. Transmission range switch (A/T)
29. DLC
30. Electric load
31. Tachometer
32. VSS (speedometer) (M/T)
33. Fuel and vapor separator
34. ECM/PCM
35. Barometric pressure sensor
36. Battery

AIR INTAKE SYSTEM

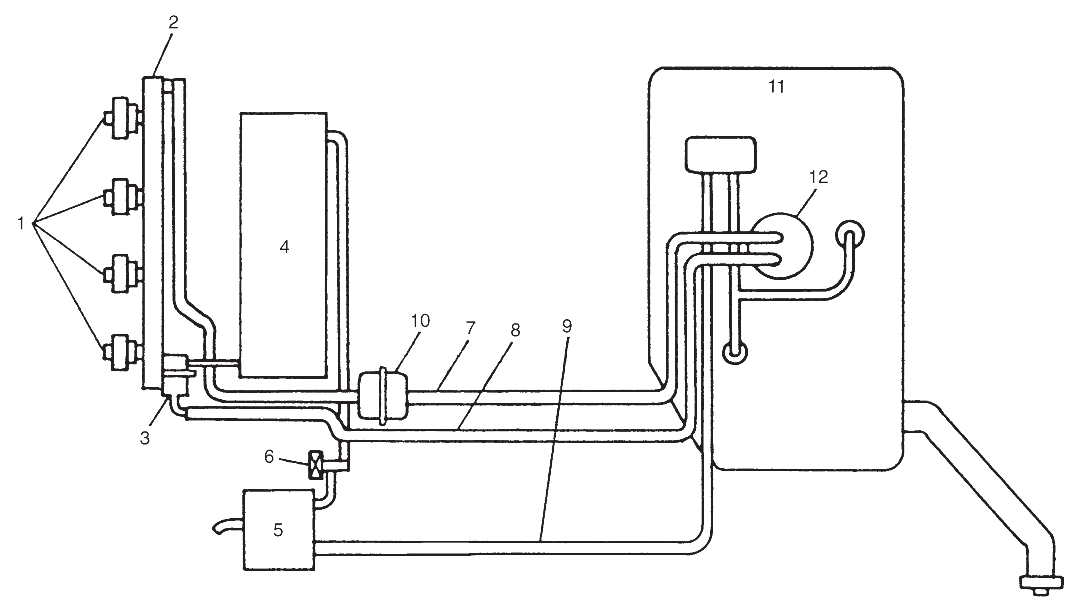
The main components of the air intake system are air cleaner (1), air cleaner outlet hose (2), throttle body (3), idle air control valve (4) and intake manifold (5). The air (by the amount corresponding to the throttle valve (6) opening and engine speed) is filtered by the air cleaner (1), passes through the throttle body (3), is distributed by the intake manifold (5) and finally drawn into each combustion chamber.

When the idle air control valve (4) is opened according to the signal from ECM (PCM), the air (7) bypasses the throttle valve (6) through bypass passage and is finally drawn into the intake manifold (5).



FUEL DELIVERY SYSTEM

The fuel delivery system consists of the fuel tank (11), fuel pump (12), fuel filter (10), fuel pressure regulator (3), delivery pipe (2) and fuel injectors (1).
The fuel in the fuel tank (11) is pumped up by the fuel pump (12), filtered by the fuel filter (10) and fed under pressure to each injector through the delivery pipe (2). As the fuel pressure applied to the injector (the fuel pressure in the fuel feed line (7)) is always kept a certain amount higher than the pressure in the intake manifold (4) by the fuel pressure regulator (3), the fuel is injected into the intake port of the cylinder head when the injector opens according to the injection signal from ECM (PCM).
The fuel relieved by the fuel pressure regulator returns through the fuel return line (8) to the fuel tank (11).
Also, fuel vapor generated in fuel tank is led through the fuel vapor line (9) into the EVAP canister (5).



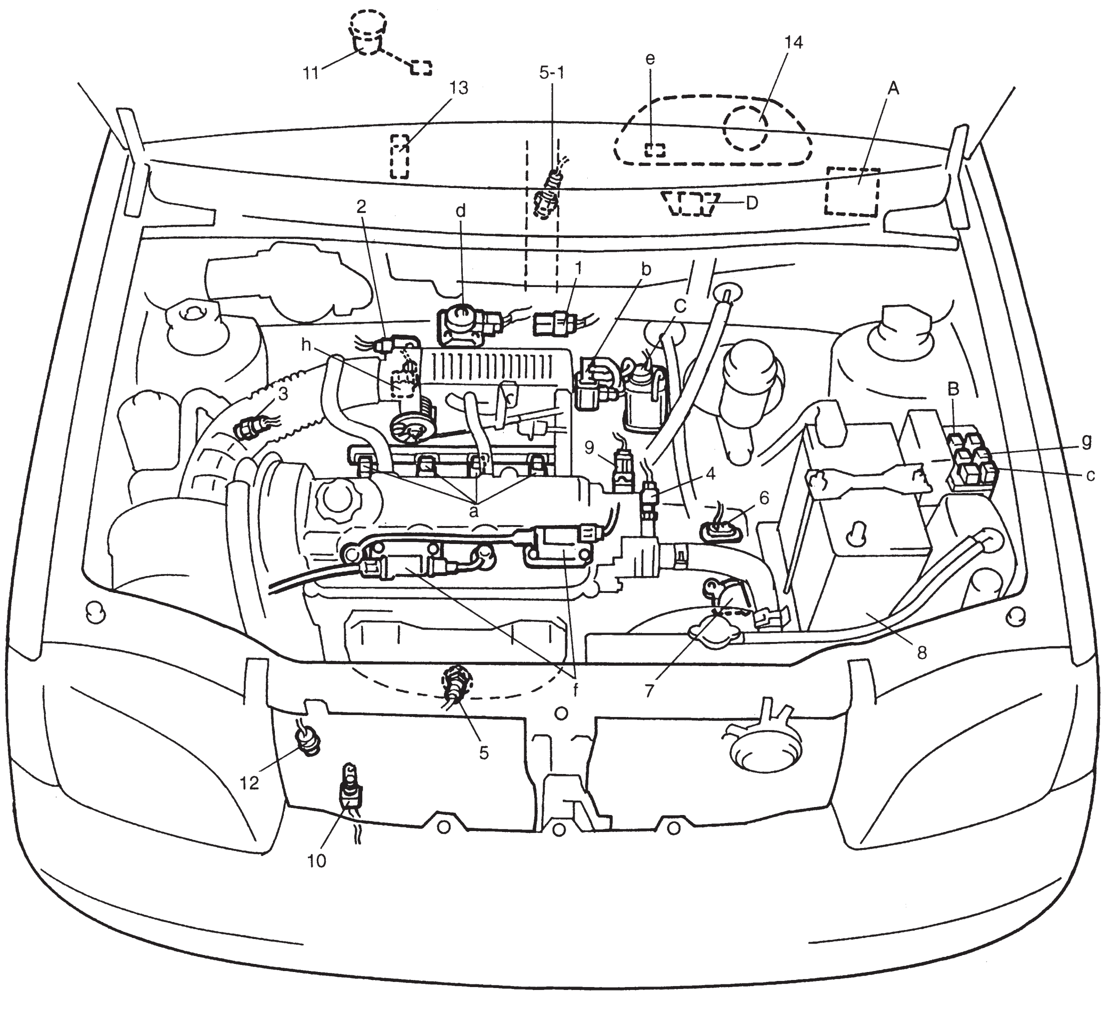
6. EVAP canister purge valve

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 nine sub systems:

- Fuel injection control system
- Idle speed control system
- Fuel pump control system
- A/C control system (if equipped)
- Radiator fan control system
- EGR system
- Evaporative emission control system
- Oxygen sensor heater control system
- Ignition control system

Also, with A/T model, PCM controls A/T.



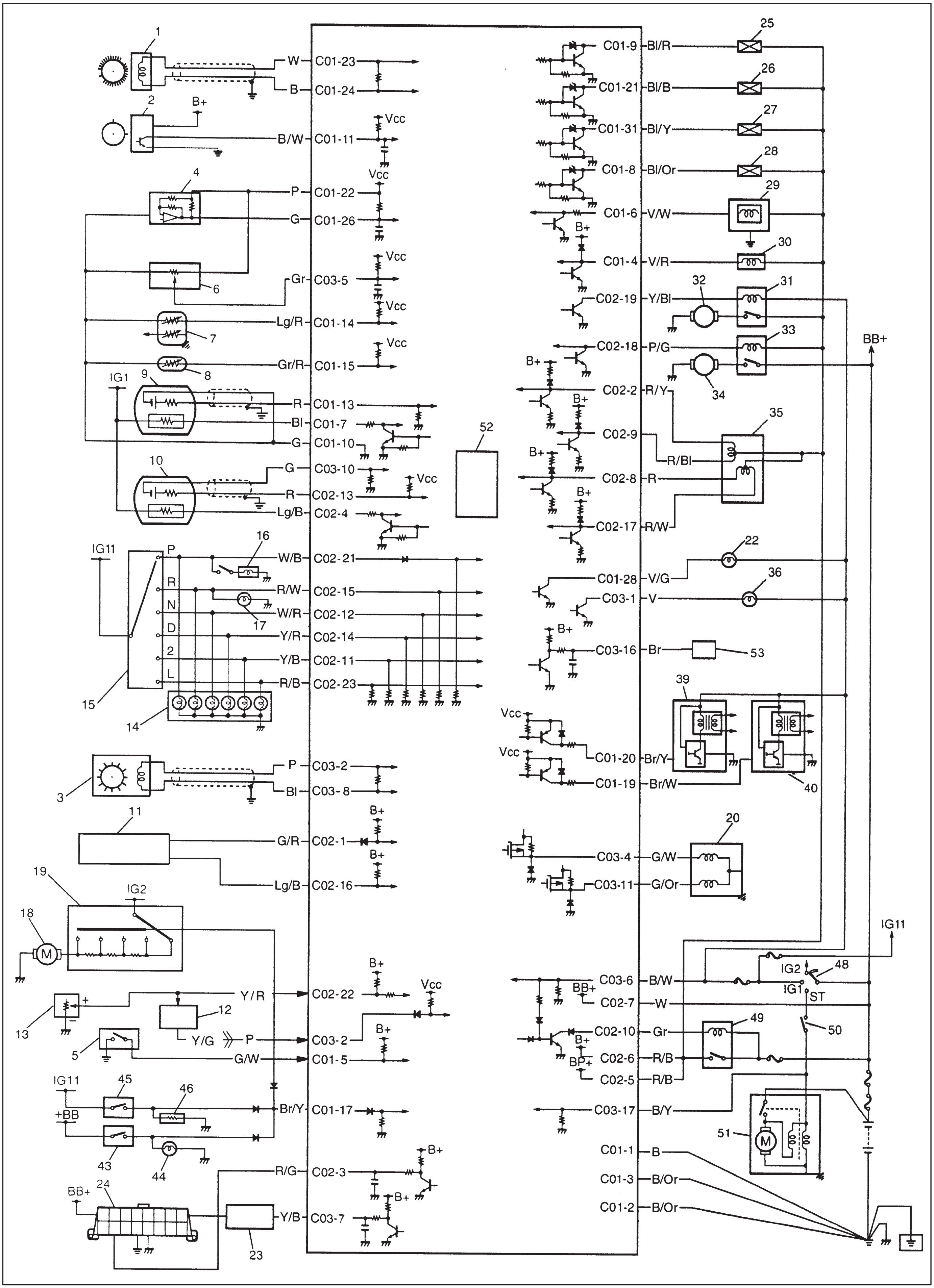
INFORMATION SENSORS
1. MAP sensor
2. TP sensor
3. IAT sensor
4. ECT sensor
5. Heated oxygen sensor-1
5-1. Heated oxygen sensor-2
6. VSS (A/T)
7. Transmission range switch (A/T)
8. Battery
9. CMP sensor
10. CKP sensor
11. Fuel level sensor (gauge) (in fuel tank)
12. PSP switch
13. A/C control module (if equipped)
14. VSS (speedometer) (M/T)

CONTROL DEVICES
a: Fuel injector
b: EVAP canister purge valve
c: Fuel pump relay
d: EGR valve (step motor)
e: Malfunction indicator lamp
f: Ignition coil assembly
g: Radiator fan control relay
h: IAC valve

OTHERS
A: ECM (PCM)
B: Main relay
C: EVAP canister
D: Data link connector

ENGINE & EMISSION CONTROL INPUT/OUTPUT TABLE

	OUTPUT / INPUT	ELECTRIC CONTROL DEVICE										
		FUEL PUMP RELAY	FUEL INJECTOR	HO2S HEATER	IAC VALVE	IGNITION COIL WITH IGNITER	EGR VALVE	EVAP CANISTER PURGE VALVE	A/C CONTROL MODULE	RADIATOR FAN RELAY	MIL	MAIN RELAY
SIGNAL FROM SENSOR, SWITCH AND CONTROL MODULE	FUEL LEVEL SENSOR	For detecting fuel level										
	BAROMETRIC PRESSURE SENSOR		○		○						○	
	START SWITCH	○	○		○				○		○	
	IGNITION SWITCH	○	○	○	○	○	○	○	○	○		○
	LIGHTING SWITCH				○							
	REAR DEFOGGER SWITCH (IF EQUIPPED)				○							
	BLOWER SWITCH				○						○	
	A/C SWITCH				○				○	○		
	VSS				○				○	○	○	
	HEATED OXYGEN SENSOR-1		○					○			○	
	HEATED OXYGEN SENSOR-2	For detecting deterioration of three way catalytic convertor									○	
	IAT SENSOR		○		○	○	○	○	○		○	
	ECT SENSOR		○	○	○	○	○	○	○	○	○	
	TP SENSOR		○		○	○			○		○	
	MAP SENSOR		○	○	○	○	○	○	○		○	
	CMP SENSOR	○	○	○	○	○	○	○	○		○	
	CKP SENSOR	○	○	○	○	○	○	○	○		○	

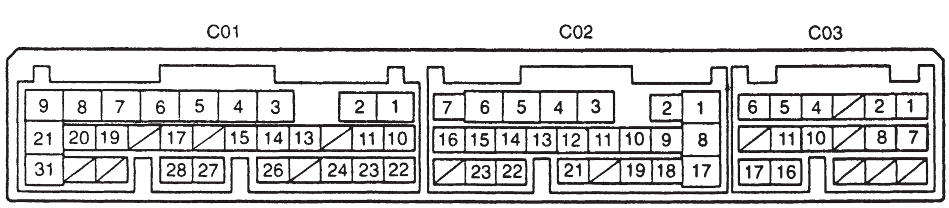

W C01-23
B C01-24
B+
B/W C01-11
Vcc
P C01-22
G C01-26
Gr C03-5
Lg/R C01-14
Gr/R C01-15
IG1
R C01-13
Bl C01-7
G C01-10
G C03-10
R C02-13
Lg/B C02-4
IG11
P R N D 2 L
W/B C02-21
R/W C02-15
W/R C02-12
Y/R C02-14
Y/B C02-11
R/B C02-23
P C03-2
Bl C03-8
G/R C02-1
Lg/B C02-16
IG2
Y/R C02-22
Y/G P C03-2
G/W C01-5
+BB
Br/Y C01-17
R/G C02-3
BB+
Y/B C03-7
C01-9 Bl/R
C01-21 Bl/B
C01-31 Bl/Y
C01-8 Bl/Or
C01-6 V/W
C01-4 V/R
C02-19 Y/Bl
C02-18 P/G
C02-2 R/Y
C02-9 R/Bl
C02-8 R
C02-17 R/W
C01-28 V/G
C03-1 V
C03-16 Br
C01-20 Br/Y
C01-19 Br/W
C03-4 G/W
C03-11 G/Or
C03-6 B/W
C02-7 W
C02-10 Gr
C02-6 R/B
C02-5 R/B
BP+
C03-17 B/Y
C01-1 B
C01-3 B/Or
C01-2 B/Or
IG1 ST
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 39 40 43 44 45 46 48 49 50 51 52 53

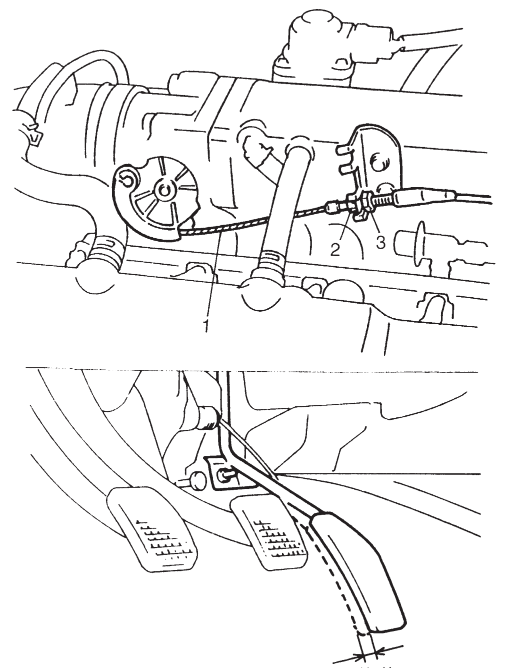
1. CKP sensor
2. CMP sensor
3. Output shaft speed sensor (A/T VSS)
4. MAP sensor
5. Power steering pressure switch
6. TP sensor
7. ECT sensor
8. IAT sensor
9. Heated oxygen sensor-1
10. Heated oxygen sensor-2
11. A/C control module (if equipped)
12. M/T VSS (in speedometer)
13. Fuel level sensor
14. Transmission range indicator lamp (A/T)
15. Transmission range switch (A/T)
16. Shift lock solenoid (A/T)
17. Backup lamp (A/T)
18. Heater fan motor
19. Heater fan switch
20. Shift solenoid valve (A/T)
21. Blank
22. Immobilizer indicator lamp
23. Immobilizer control module
24. Data link connector
25. Injector No.1
26. Injector No.2
27. Injector No.3
28. Injector No.4
29. IAC
30. EVAP canister purge valve
31. Fuel pump relay
32. Fuel pump
33. Radiator fan relay
34. Radiator fan motor
35. EGR valve
36. Malfunction indicator lamp
37. Blank
38. Blank
39. Ignition coil assembly (for No.1 and No.4 spark plugs)
40. Ignition coil assembly (for No.2 and No.3 spark plugs)
41. Blank
42. Blank
43. Lighting switch
44. Position lamp
45. Rear defogger switch
46. Rear defogger
47. Blank
48. Ignition switch
49. Main relay
50. Transmission range switch (Park/Neutral position switch)
51. Starting motor
52. Barometric pressure sensor
53. Tachometer

CONNECTOR	TERMINAL	WIRE COLOR	CIRCUIT
C01	1	B	Ground for ECM/PCM
	2	B/Or	Ground for drive circuit
	3	B/Or	Ground for drive circuit
	4	V/R	Canister purge valve
	5	G/W	Power steering pressure switch
	6	V/W	IAC valve
	7	Bl	Heater of HO2S-1
	8	Bl/Or	No.4 fuel injector
	9	Bl/R	No.1 fuel injector
	10	G	Ground for sensor circuit
	11	B/W	CMP sensor
	12	——	———
	13	R	Heated oxygen sensor-1
	14	Lg/R	Coolant temp. sensor
	15	Gr/R	Intake air temp. sensor
	16	——	———
	17	Br/Y	Electric load (+)
	18	——	———
	19	Br/W	IG coil assembly for No.2 and 3 spark plugs
	20	Br/Y	IG coil assembly for No.1 and 4 spark plugs
	21	Bl/B	No.2 fuel injector
	22	P	Power supply for sensor
	23	W	CKP sensor (+)
	24	B	CKP sensor (–)
	25	——	———
	26	G	MAP sensor
	27	——	———
	28	V/G	Immobilizer indicator lamp
	29	——	———
	30	——	———
	31	Bl/Y	No.3 fuel injector
C02	1	G/R	A/C compressor clutch
	2	R/Y	EGR valve (stepper motor coil 1)
	3	R/G	Data link connector
	4	Lg/B	Heater of HO2S-2
	5	R/B	Power source
	6	R/B	Power source
	7	W	Backup power source
	8	R	EGR valve (stepper motor coil 3)
	9	R/Bl	EGR valve (stepper motor coil 2)
	10	Gr	Ground for main relay
	11	Y/B	“2”-range signal (A/T)
	12	W/R	“N”-range signal (A/T)
	13	R	Heated oxygen sensor-2
	14	Y/R	“D”-range signal (A/T)
	15	R/W	“R”-range signal (A/T)
	16	Lg/B	A/C SW signal
	17	R/W	EGR valve (stepper motor coil 4)
	18	P/G	Radiator fan relay
	19	Y/Bl	Fuel pump relay
	20	——	———
	21	W/B	“P”-range signal (A/T)
	22	P/Bl	Fuel level gauge
	23	R/B	“L”-range signal (A/T)
	24	——	———
C03	1	V	Malfunction indicator lamp
	2	P	Vehicle speed sensor (M/T) Output shaft speed sensor (+) (A/T)
	3	——	———
	4	G/W	Shift solenoid – A (A/T)
	5	Gr	Throttle position (TP) sensor
	6	B/W	Ignition switch signal
	7	Y/B	Data link connector
	8	Bl	Output shaft speed sensor (–) (A/T)
	9	——	———
	10	G	GND for HO2S-2
	11	G/Or	Shift solenoid – B (A/T)
	12	——	———
	13	——	———
	14	——	———
	15	——	———
	16	Br	Tachometer signal
	17	B/Y	Engine start signal

Wire color

B	: Black	P	: Pink
B/Or	: Black/Orange	P/Bl	: Pink/Blue
B/W	: Black/White	P/G	: Pink/Green
B/Y	: Black/Yellow	V	: Violet
Bl	: Blue	V/G	: Violet/Green
Bl/Or	: Blue/Orange	V/R	: Violet/Red
Bl/B	: Blue/Black	V/W	: Violet/White
Bl/R	: Blue/Red	W	: White
Bl/Y	: Blue/Yellow	W/B	: White/Black
Br	: Brown	W/R	: White/Red
Br/W	: Brown/White	R	: Red
Br/Y	: Brown/Yellow	R/B	: Red/Black
G	: Green	R/Bl	: Red/Blue
G/Or	: Green/Orange	R/G	: Red/Green
G/R	: Green/Red	R/W	: Red/White
G/W	: Green/White	R/Y	: Red/Yellow
Gr	: Gray	Y/B	: Yellow/Black
Gr/R	: Gray/Red	Y/Bl	: Yellow/Blue
Lg/B	: Lightgreen/Black	Y/R	: Yellow/Red
Lg/R	: Lightgreen/Red		





1. Accelerator cable
3. Lock nut

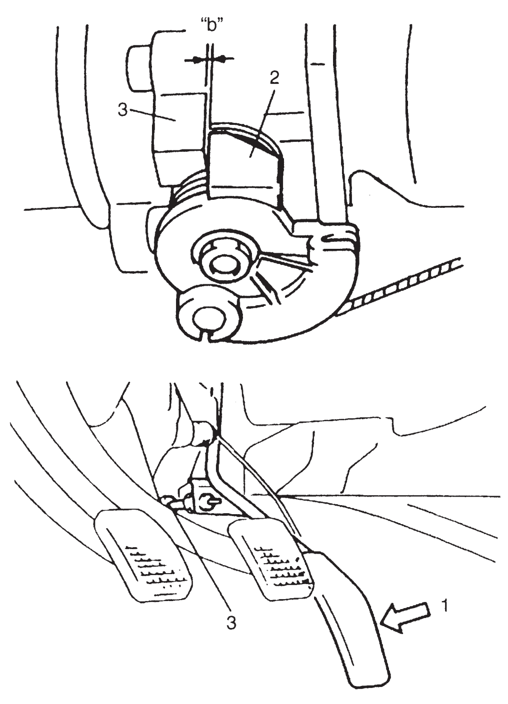
ON-VEHICLE SERVICE

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 (2).



2) With accelerator pedal depressed fully (1), check clearance between throttle lever (2) and lever stopper (3) (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 with cable adjusting nut.

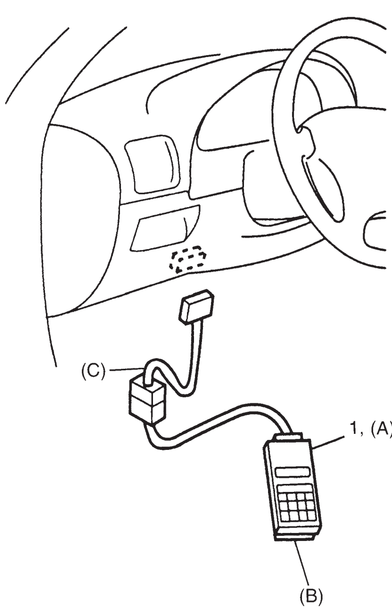
IDLE SPEED/IDLE AIR CONTROL (IAC) DUTY INSPECTION

Before idle speed/IAC duty check, make sure of the following.

- Lead wires and hoses of Electronic Fuel Injection and engine emission control systems are connected securely.
- Accelerator cable has some play, that is, it is not tight.
- Valve lash is checked and adjusted according to maintenance schedule.
- Ignition timing is within specification.
- All accessories (wipers, heater, lights, A/C, etc.) are out of service.
- Air cleaner has been properly installed and is in good condition.
- No abnormal air inhaling from air intake system.

After above items are all confirmed, check idle speed and IAC duty as follows.

NOTE:
Before starting engine, place transmission gear shift lever in "Neutral" (shift selector lever to "P" range for A/T vehicle), and set parking brake and block drive wheels.



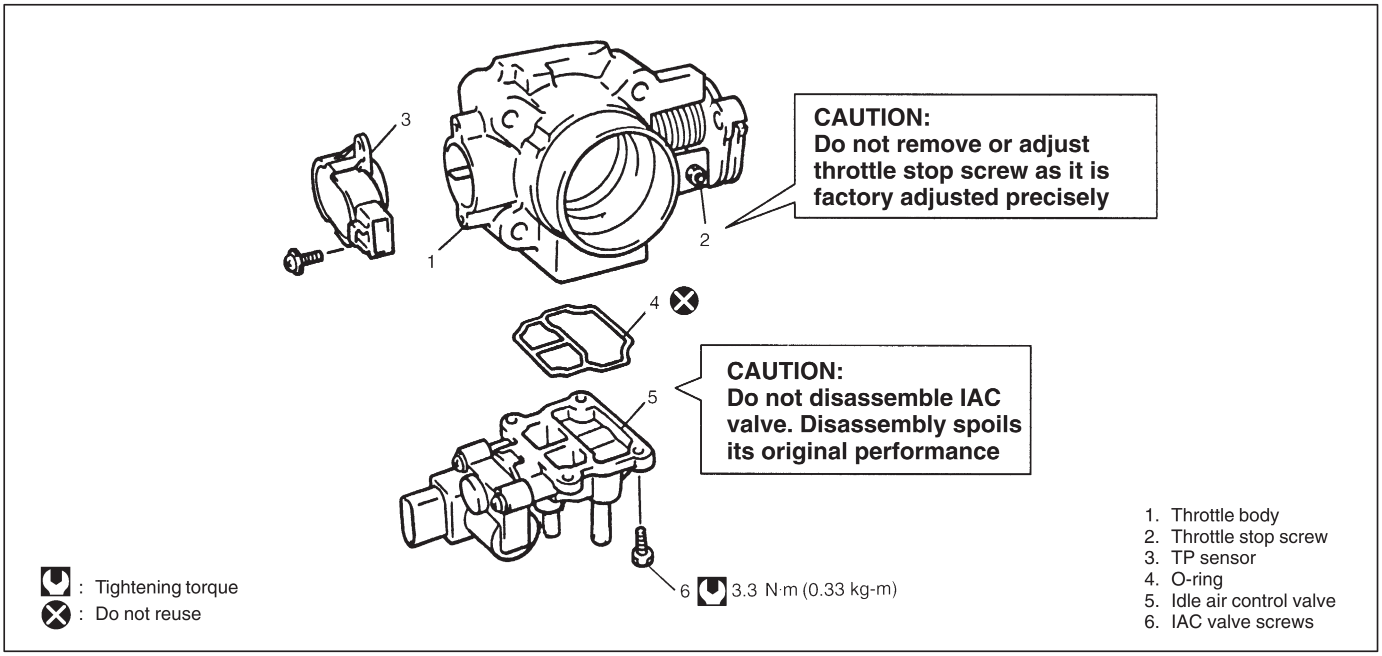
1) Connect SUZUKI scan tool (1) to DLC with ignition switch OFF, if it is available.
2) Warm up engine to normal operating temperature.
3) Check engine idle speed and "IAC duty" as follow:
   Select "Data List" mode on scan tool to check "IAC duty" and engine speed.
   Special Tool
   (A): 09931-76011 (SUZUKI scan tool)
   (B): Mass storage cartridge
   (C): 09931-76030 (16/14 pin DLC cable)
   If duty and/or idle speed is out of specifications, inspect idle air control system referring to Diagnostic Flow Table B-4 IDLE AIR CONTROL SYSTEM CHECK in Section 6.

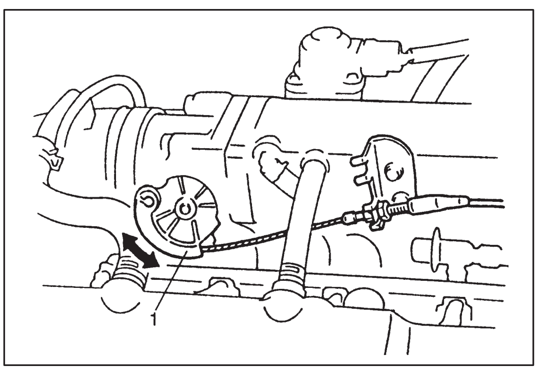
ENGINE IDLE SPEED AND IAC DUTY		
	A/C OFF	A/C ON
M/T vehicle	750 ± 50 r/min (rpm) 8 – 25 or *8 – 35%	875 ± 50 r/min (rpm)
A/T vehicle at P/N range		

   NOTE:
   Duty values with (*) are applicable to vehicle used at high altitude (higher than 2,000 m or 6,560 ft).
4) Check that 875 ± 50 r/min. idle speed is obtained with lighting switch ON and heater blower switch in 2 – 4 position.
   If not, check "Electric load (+)" circuit and "Heater blower switch signal" circuit referring to "ELECTRONIC CONTROL SYSTEM" in this section and idle air control system.
5) Check that specified engine idle speed is obtained with A/C ON if vehicle is equipped with A/C.
   If not, check A/C ON signal circuit.

AIR INTAKE SYSTEM

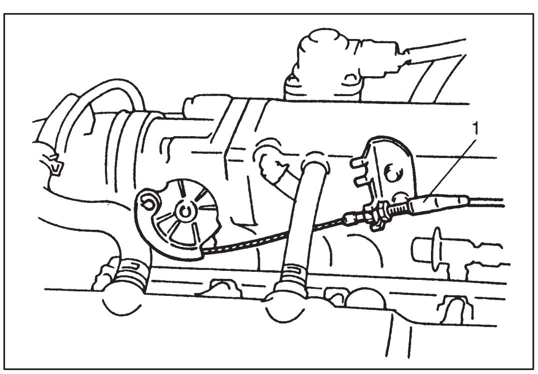
THROTTLE BODY





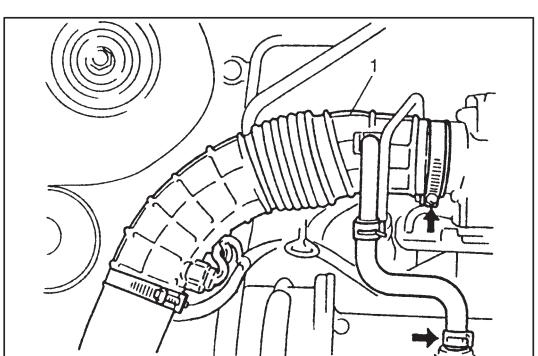
On-Vehicle Inspection

- Check that throttle valve lever (1) moves smoothly.

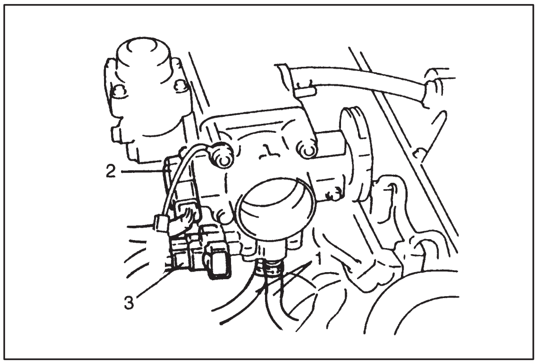


Removal

1) Disconnect negative cable at battery.
2) Drain cooling system.
3) Disconnect accelerator cable (1) from throttle body.



4) Disconnect air cleaner outlet hose (1) from throttle body.



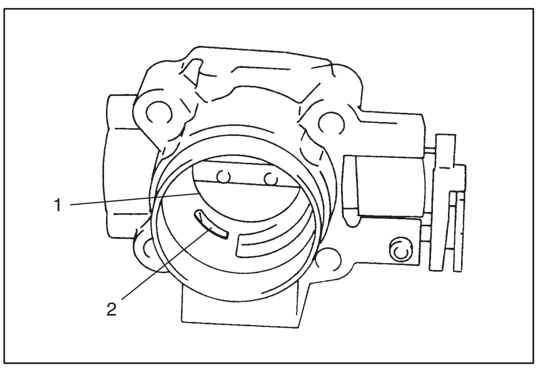
5) Disconnect electric coupler from TP sensor (2) and IAC valve (3).
6) Remove throttle body from intake manifold.
7) Disconnect engine coolant hoses (1) from throttle body.

Disassembly

NOTE:

While disassembling and assembling throttle body, use special care not to deform levers on throttle valve shaft or cause damage to any other parts.

1) Remove TP sensor and IAC valve from throttle body.



Cleaning

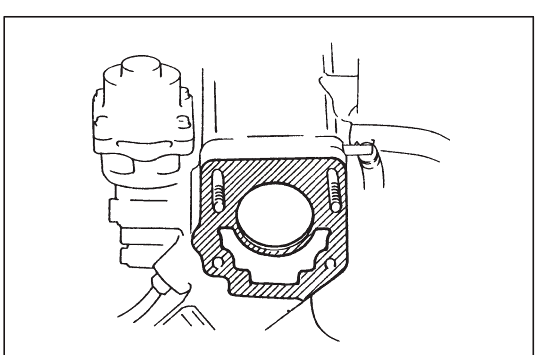
Clean throttle body bore (1) and idle air passage (2) by blowing compressed air.

NOTE:

TP sensor, idle air control valve or other components containing rubber must not be placed in a solvent or cleaner bath. A chemical reaction will cause these parts to swell, harden or get distorted.

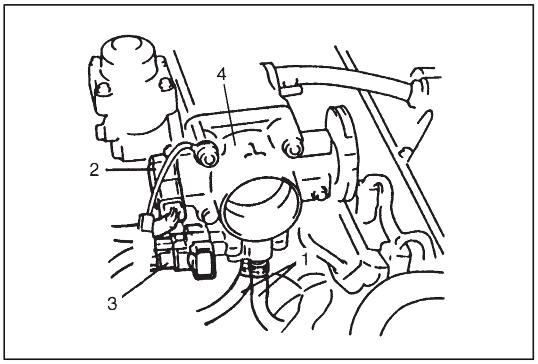
Reassembly

1) Install IAC valve to throttle body referring to “IAC valve Installation” section.
2) Install TP sensor to throttle body referring to “TP sensor Installation” section.

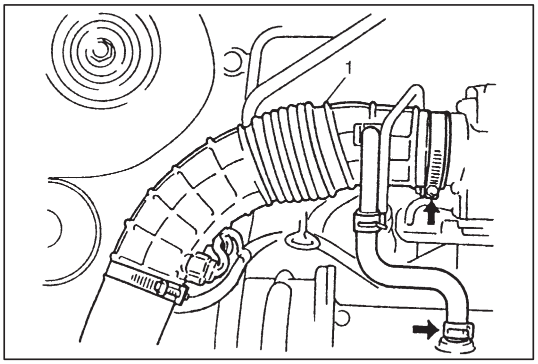


Installation

1) Clean mating surfaces and install throttle body gasket to intake manifold.
   Use new gasket.



2) Connect engine coolant hoses (1).
3) Install throttle body (4) to intake manifold.
4) Connect coupler to TP sensor (2) and IAC valve (3) securely.

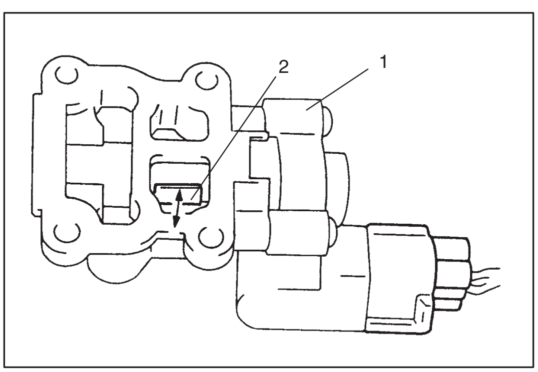


5) Install air cleaner outlet hose (1) and pipe.
6) Connect accelerator cable and adjust cable play to specification.
7) Refill cooling system.
8) Connect negative cable at battery.

IDLE AIR CONTROL VALVE (IAC VALVE)

Removal

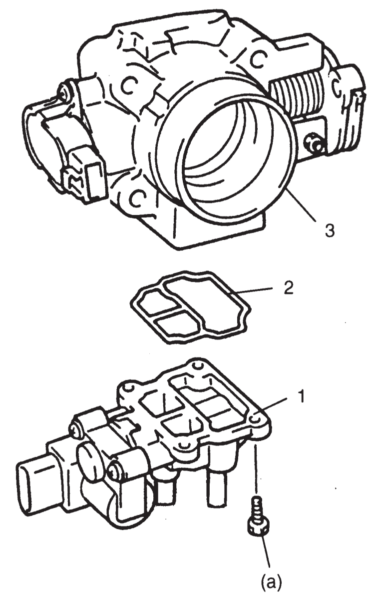
1) Remove throttle body from intake manifold referring to “Throttle Body Removal” section.
2) Remove IAC valve from throttle body.



Inspection

1) Connect each connector to IAC valve (1), TP sensor and IAT sensor.
2) Check that rotary valve (2) of IAC valve opens and closes once and then stops in about 60 ms as soon as ignition switch is turned ON.

NOTE:
- **This check should be performed by two people, one person turns on ignition switch while the other checks valve operation.**
- **As valve operation is momentary, it may be overlooked. To prevent this, perform this operation check 3 times or more continuously.**
  If rotary valve of IAC valve does not operate at all, check wire harness for open and short. If wire harness is in good condition, replace IAC valve and recheck.



Installation

1) Install new O-ring (2) to IAC valve (1).
2) Install IAC valve (1) to throttle body (3).
   Tighten IAC valve screws to specified torque.

   Tightening Torque
   (a): 3.3 N·m (0.33 kg-m, 2.5 lb-ft)

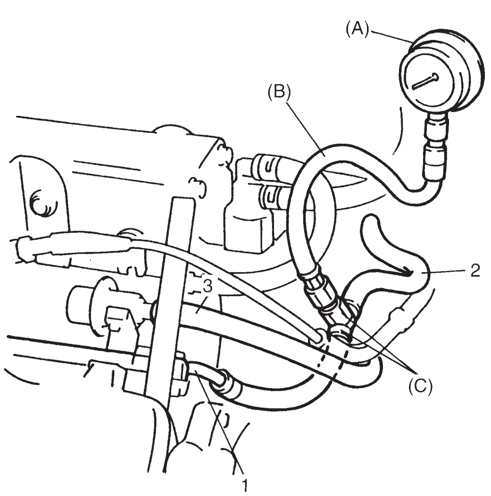
3) Install throttle body to intake manifold referring to "Throttle Body Installation" section.

FUEL DELIVERY SYSTEM

FUEL PRESSURE INSPECTION

WARNING:
Be sure to perform work in a well-ventilated area and away from any open flames, or there is a risk of a fire breaking out.

1) Relieve fuel pressure in fuel feed line referring to "Fuel Pressure Relief Procedure" in Section 6.



3. Fuel return pipe

2) Disconnect fuel feed hose from fuel delivery pipe.

   CAUTION:
   A small amount of fuel may be released when fuel hose is disconnected. Place container under the joint with a shop cloth so that released fuel is caught in container or absorbed in cloth. Place that cloth in an approved container.

3) Connect special tools and hose between fuel delivery pipe (1) and fuel feed hose (2) as shown in figure, and clamp hoses securely to ensure no leaks occur during checking.

   Special Tool
   (A): 09912-58441
   (B): 09912-58431
   (C): 09912-58490

4) Check that battery voltage is above 11 V.

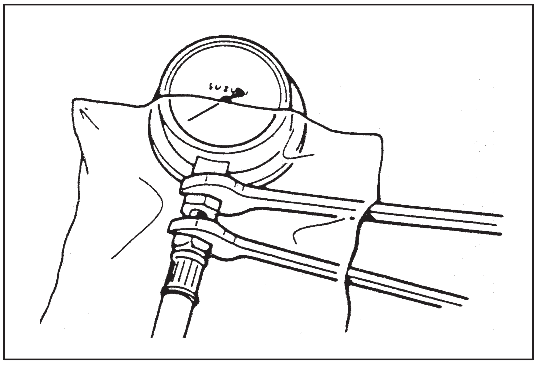
CONDITION	FUEL PRESSURE
With fuel pump operating and engine stopped	270 – 310 kPa 2.7 – 3.1 kg/cm^2 38.4 – 44.0 psi
At specified idle speed	200 – 240 kPa 2.0 – 2.4 kPa 28.4 – 34.1 psi
With 1 min. after engine (fuel pump) stop (Pressure reduces as time passes)	over 200 kPa 2.0 kg/cm^2 28.4 psi

5) Check fuel pressure as follows.

[Not using SUZUKI scan tool]

a) Turn ignition switch ON to operate fuel pump and after 2 seconds turn it OFF. Repeat this 3 or 4 times and then check fuel pressure.
b) Start engine and warm it up to normal operating temperature.
c) 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.



d) 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.**

e) Remove special tools from fuel delivery pipe.
f) Connect fuel feed hose to fuel delivery pipe and clamp it securely.
g) With engine OFF and ignition switch ON, check for fuel leaks.

[Using SUZUKI scan tool]

a) Connect SUZUKI scan tool to DLC with ignition switch OFF.
b) Turn ignition switch ON and then select "DATA LIST" mode on scan tool.
c) Make sure that vehicle condition is as following.
- Vehicle speed = 0 KPH
- Engine speed = 0 RPM
- Fuel tank level ≧ 15%

d) Clear DTC by using "CLEAR INFO" mode.
e) Check fuel pressure by using "FUEL PUMP CONT" mode in "MISC TEST" menu.

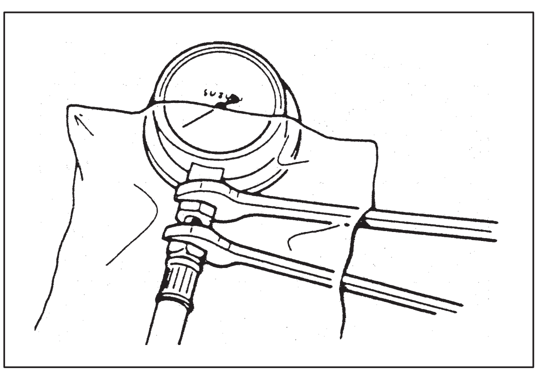
CONDITION	FUEL PRESSURE
With fuel pump operating	2.7 – 3.1 kg/cm^2 270 – 310 kPa 38.4 – 44.0 psi
Within 1 min. after fuel pump stop (Pressure reduces as time passes)	Over 2.0 kg/cm^2 200 kPa 28.4 psi

If measured pressure doesn't satisfy specification, refer to "Diagnostic Flow Table B-3" and check each possibly defective part. Replace if found defective.

f) Start engine and warm it up to normal operating temperature. And then check fuel pressure.

CONDITION	FUEL PRESSURE
At specified idle speed	2.0 – 2.4 kg/cm^2 200 – 240 kPa 28.4 – 34.1 psi

If measured pressure doesn't satisfy specification, refer to "Diagnostic Flow Table B-3" and check each possibly defective part. Replace if found defective.



g) 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.**

h) Remove special tools from fuel delivery pipe.
i) Connect fuel feed hose to fuel delivery pipe and clamp it securely.
j) With engine OFF and ignition switch ON, check for fuel leaks.

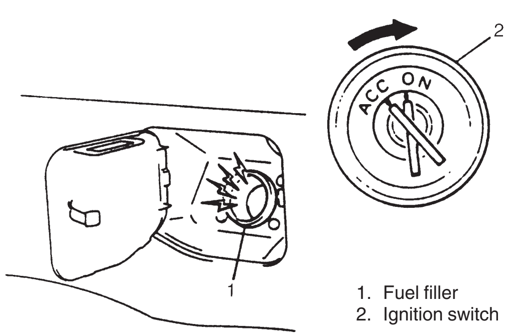
Tightening Torque
Fuel pressure regulator bolt: 11 N·m (1.1 kg-m, 8.0 lb-ft)

FUEL PUMP

On-Vehicle Inspection

CAUTION:
When fuel filler cap is removed in any procedure, work must be done in a well-ventilated area, keep away from any open flames and without smoking.

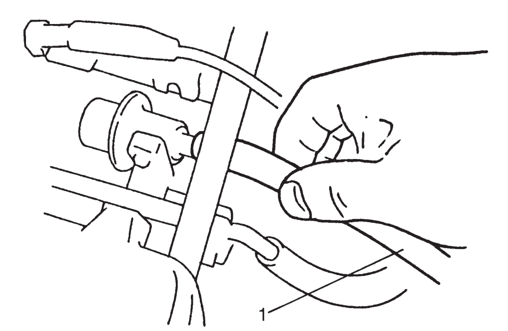
NOTE:
The fuel pressure regulator is the one body with the fuel pump assembly so individual inspection of it is impossible.



1. Fuel filler
2. Ignition switch

1) Remove filler cap and turn ON ignition switch. Then fuel pump operating sound should be heard from fuel filler for about 2 seconds and stop. Be sure to reinstall fuel filler cap after checking.

   If above check result is not satisfactory, advance to “Diagnostic Flow Table B-2”.



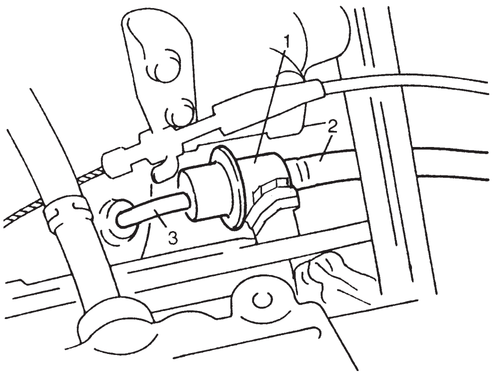
2) Turn OFF ignition switch and leave over 10 minutes as it is.
3) Fuel pressure should be felt at fuel return hose (1) for 2 seconds after ignition switch ON.

   If fuel pressure is not felt, advance to “Diagnostic Flow Table B-3”.

Removal
Remove fuel tank from body according to procedure described in Section 6C and remove fuel pump from fuel tank.

Inspection
Check fuel pump filter for evidence of dirt and contamination. If present, clean and check for presence of dirt in fuel tank.

Installation
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 Section 6C.



FUEL PRESSURE REGULATOR

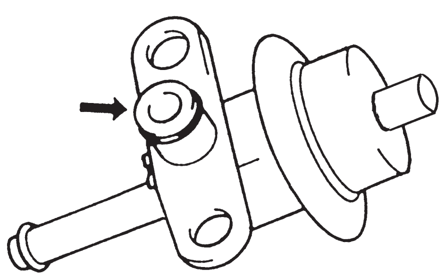
Removal

1) Relieve fuel pressure according to procedure described in section 6.
2) Disconnect battery negative cable at battery.
3) Disconnect vacuum hose (3) from fuel pressure regulator (1).
4) Disconnect fuel return hose (2) from fuel pressure regulator (1).

CAUTION:
A small amount of fuel may be released when hose is disconnected. Cover hose to be disconnected with a shop cloth.

5) Remove fuel pressure regulator.

CAUTION:
A small amount of fuel may be released when it is from delivery pipe.
Place a shop cloth under delivery pipe so that released fuel is absorbed in it.

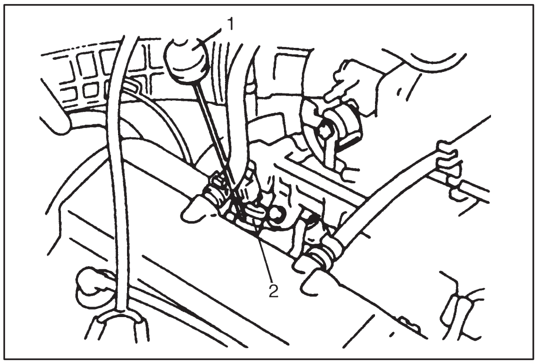


Installation

For installation, reverse removal procedure and note following precautions.

- Use new O-ring.
- Apply thin coat of spindle oil or gasoline to O-ring to facilitate installation.
- With engine OFF and ignition switch ON, check for fuel leaks around fuel line connection.

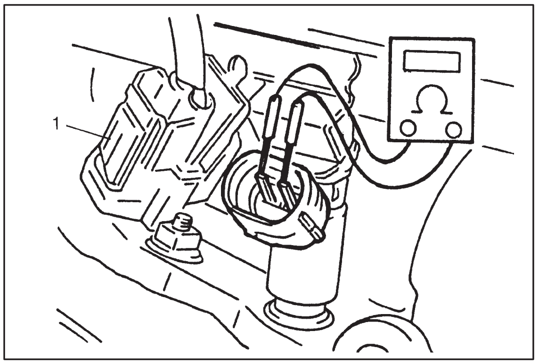
Tightening Torque
Fuel pressure regulator bolt: 11 N·m (1.1 kg-m, 8.0 lb-ft)



FUEL INJECTOR

On-Vehicle Inspection

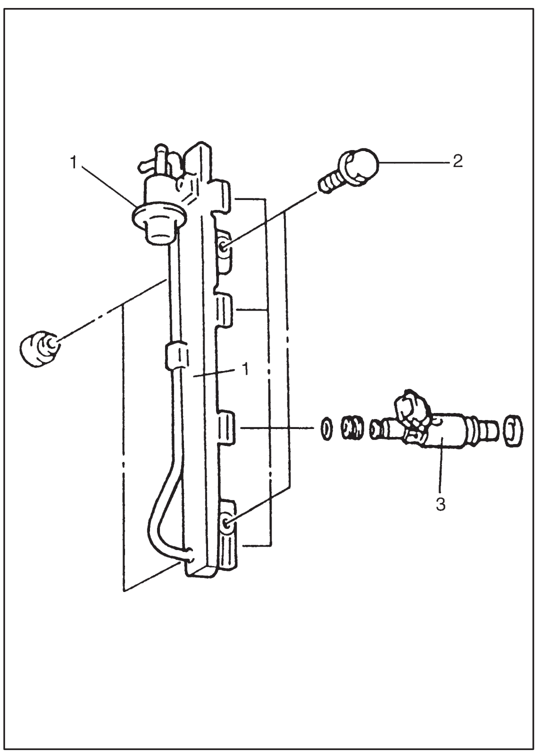
1) Using sound scope (1) or such, check operating sound of injector (2) when engine is running or cranking.
   Cycle of operating sound should vary according to engine speed.
   If no sound or an unusual sound is heard, check injector circuit (wire or coupler) or injector (2).



2) Disconnect coupler (1) from injector, connect ohmmeter between terminals of injector and check resistance.

   Resistance of injector: 12.0 – 13.0 Ω at 20°C, 68°F

   If resistance is out of specification, replace.
3) Connect coupler (1) to injector securely.



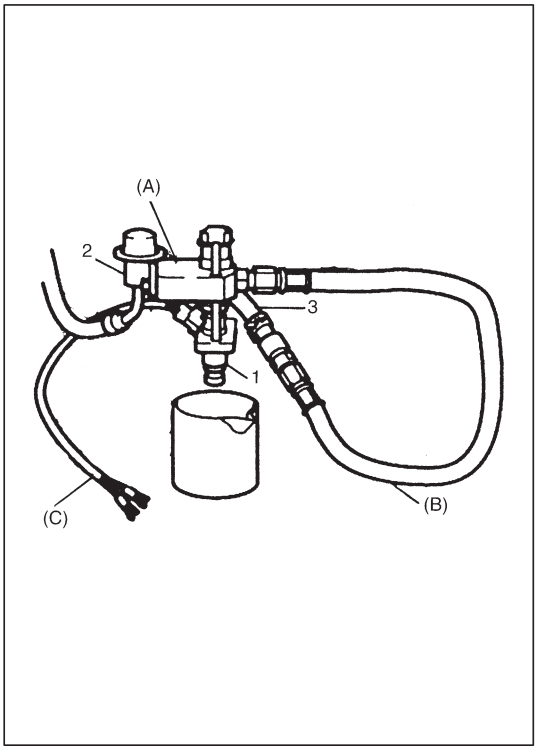
Removal

1) Relieve fuel pressure according to procedure described in Section 6.
2) Disconnect battery negative cable at battery.
3) Disconnect fuel injector couplers.
4) Disconnect vacuum hose from fuel pressure regulator (1).
5) Remove fuel delivery pipe bolts (2).
6) Remove fuel injector(s) (3).

CAUTION:
A small amount of fuel may come out after removal of fuel injectors, cover them with shop cloth.

Inspection

> **WARNING:**
> **As fuel is injected in this inspection, perform in a well ventilated area and away from open flames.**
> **Use special care to prevent sparking when connecting and disconnecting test lead to and from battery.**



1) Install injector (1) and fuel pressure regulator (2) to special tool (injector checking tool).

   Special Tool
   (A): 09912-58421

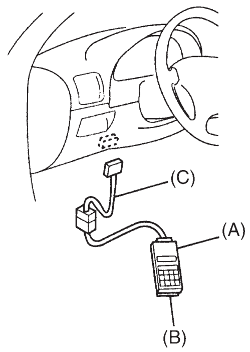
2) Connect special tools (hose and attachment) to fuel feed hose (3) of vehicle.

   Special Tool
   (B): 09912-58431

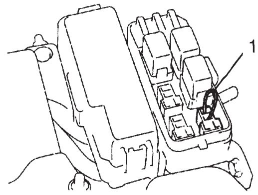
3) Connect special tool (test lead) to injector.

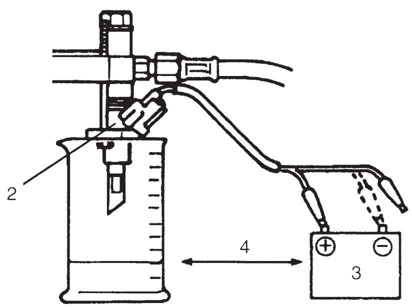
   Special Tool
   (C): 09930-88530

When using SUZUKI scan tool :



When not using SUZUKI scan tool :





4. 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 using SUZUKI scan tool :
   a) Connect SUZUKI scan tool to DLC with ignition switch OFF.
   b) Turn ignition switch ON, clear DTC and select “MISC TEST” mode on SUZUKI scan tool.
   c) Turn fuel pump ON by using SUZUKI scan tool.

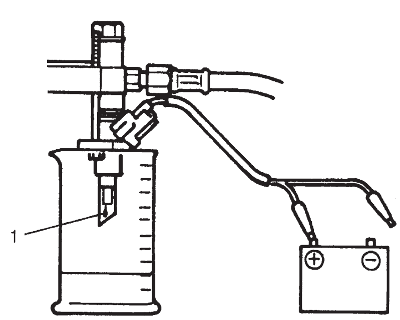
   Special Tool
   (A): 09931-76011 (SUZUKI scan tool)
   (B): Mass storage cartridge
   (C): 09931-76030 (16/14 pin DLC cable)

   When not using SUZUKI scan tool :
   a) Remove fuel pump relay from connector.
   b) Connect two terminals of relay connector using service wire (1) as shown in figure.

   CAUTION:
   Check to make sure that connection is made between correct terminals. Wrong connection can cause damage to ECM, wire harness, etc.

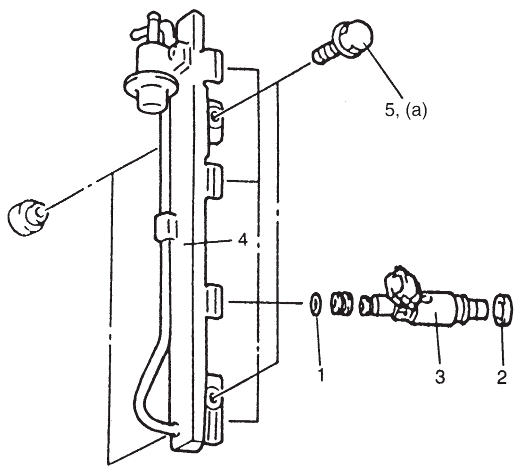
   c) Turn ignition switch ON.
7) Apply battery voltage (3) to injector (2) for 15 seconds and measure injected fuel volume with graduated cylinder.
   Test each injector two or three times.
   If not within specification, replace injector.

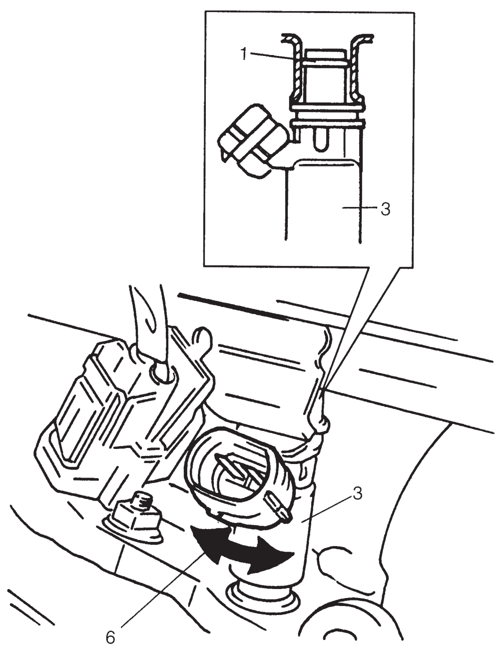
   Injected fuel volume:
   38 – 48 cc/15 sec. (1.28/1.34 – 1.62/1.69 US/Imp. oz/15 sec.)



8) Check fuel leakage from injector nozzle. Do not operate injector for this check (but fuel pump should be at work).
   If fuel leaks (1) more than following specifications, replace.

   Fuel leakage (1): Less than 1 drop/min.





Installation

For installation, reverse removal procedure and note following precautions.

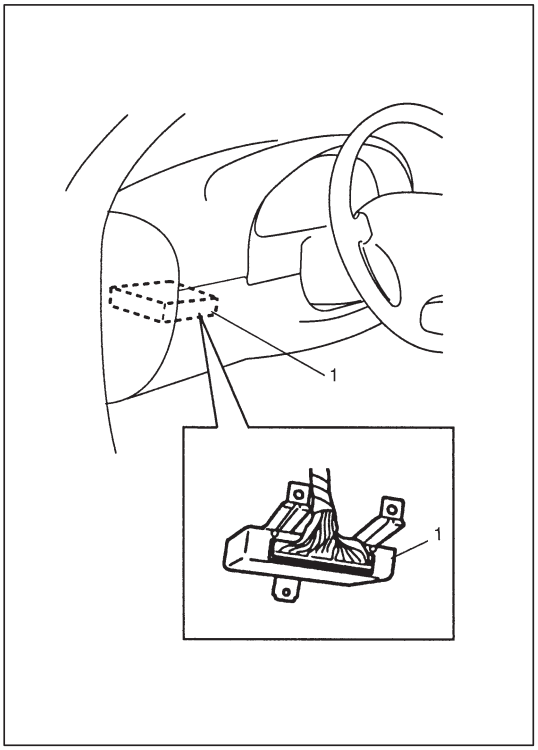
- Replace injector O-ring (1) with new one using care not to damage it.
- Check if cushion (2) is scored or damaged. If it is, replace with new one.
- Apply thin coat of fuel to O-rings (1) and then install injectors (3) into delivery pipe (4) and intake manifold.
  Make sure that injectors (3) rotate smoothly (6). If not, probable cause is incorrect installation of O-ring (1). Replace O-ring (1) with new one.
- Tighten delivery pipe bolts (5) and make sure that injectors (3) rotate smoothly (6).

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

- After installation, with engine OFF and ignition switch ON, check for fuel leaks around fuel line connection.

ELECTRONIC CONTROL SYSTEM

ENGINE CONTROL MODULE (POWERTRAIN CONTROL MODULE) [ECM (PCM)]



CAUTION:
As ECM (PCM) consists of precision parts, be careful not to expose it to excessive shock.

Removal

1) Disconnect battery negative cable at battery.
2) Disable air bag system, refer to “DISABLING THE AIR BAG SYSTEM” in Section 9J if equipped.
3) Lower fuse box after removing screws and remove fuse box bracket.
4) Remove ECM (PCM) (1) from body.
5) Disconnect couplers from ECM (PCM).

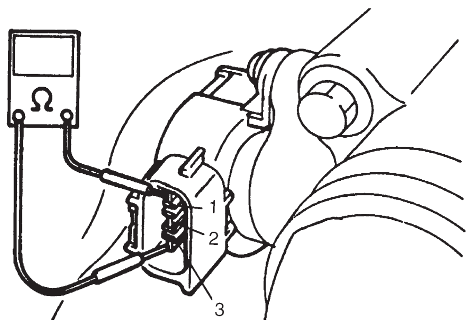
Installation

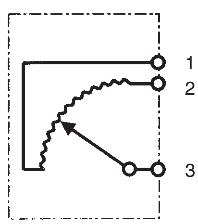
Reverse removal procedure noting the following:
- Connect couplers to ECM (PCM) securely.

MANIFOLD ABSOLUTE PRESSURE SENSOR (MAP SENSOR)

Inspection

Check MAP sensor referring to “MAP Sensor Individual Check” in DTC P0105 Flow Table. If malfunction is found, replace.





1. Ground terminal
2. Reference voltage terminal
3. Output 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 2 terminals	2.5 – 6.0 kΩ	
Between 1 and 3 terminals	Throttle valve is at idle position	0.17 – 11.4 kΩ
	Throttle valve is fully opened	1.72 – 15.50 kΩ

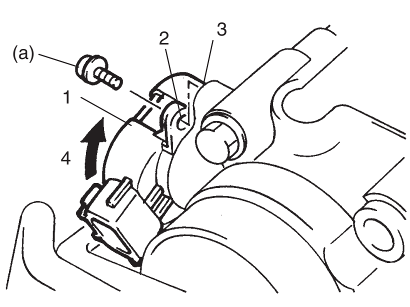
NOTE:
There should be more than 1.5 kΩ resistance difference between when throttle valve is at idle position and when it is fully open.

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.

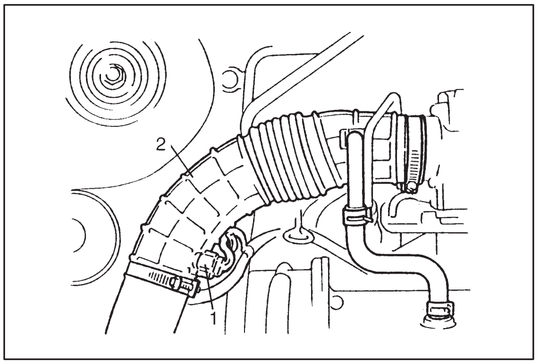


Installation

1) Install TP sensor (1) to throttle body.
   Fit TP sensor to throttle body in such way that its holes (3) are a little away from TP sensor screw holes (2) as shown in left figure and turn TP sensor clockwise so that those holes align (4).

   Tightening Torque
   (a): 2.0 N·m (0.20 kg-m, 1.5 lb-ft)

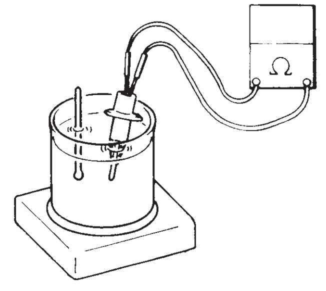
2) Connect coupler to TP sensor securely.
3) Connect battery negative cable to battery.

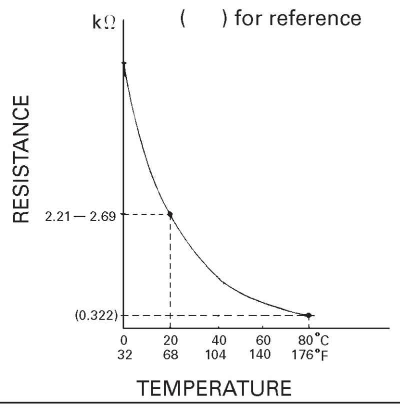


INTAKE AIR TEMPERATURE SENSOR (IAT SENSOR)

Removal

1) Disconnect battery negative cable at battery.
2) Disconnect coupler from IAT sensor (1).
3) Remove IAT sensor (1) from air cleaner outlet hose (2).

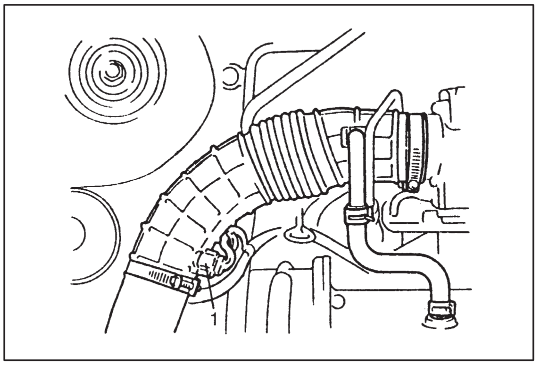




Inspection

Immerse temperature sensing part of IAT sensor in water (or ice) and measure resistance between sensor terminals while heating water gradually.

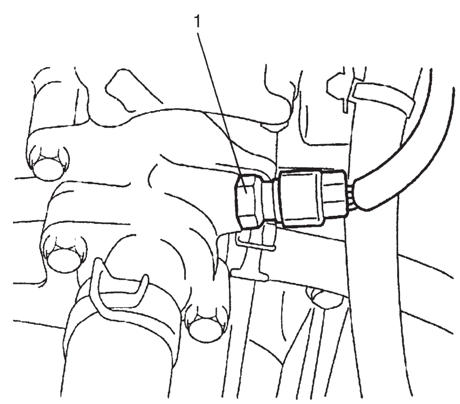
If measured resistance doesn't show such characteristic as shown in left figure, replace IAT sensor.



Installation

Reverse removal procedure noting the following.

- Clean mating surfaces of IAT sensor and air cleaner outlet hose.
- Connect IAT sensor coupler (1) securely.



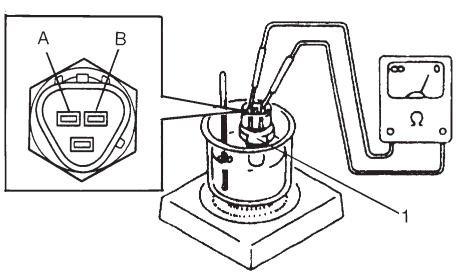
ENGINE COOLANT TEMPERATURE SENSOR (ECT SENSOR)

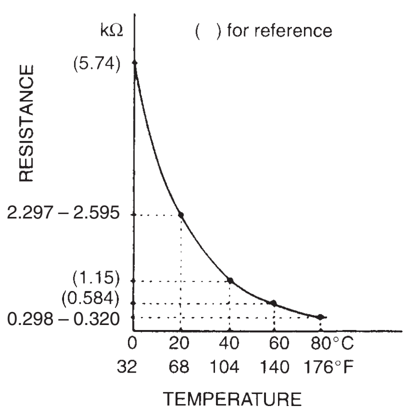
Removal

1) Disconnect battery negative cable at battery.
2) Drain coolant referring to Section 6B.

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

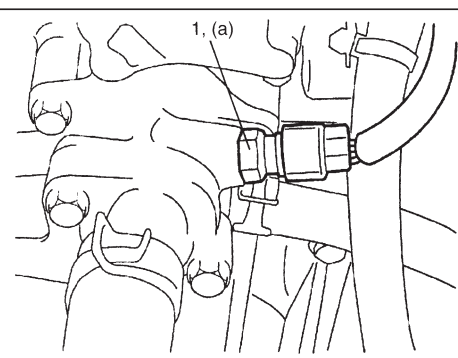
3) Disconnect coupler from ECT sensor.
4) Remove ECT sensor (1) from thermostat case.





Inspection

Immerse temperature sensing part of ECT sensor (1) in water (or ice) and measure resistance between terminal "A" and "B" while heating water gradually.
If measured resistance doesn't show such characteristic as shown in left figure, replace ECT sensor (1).



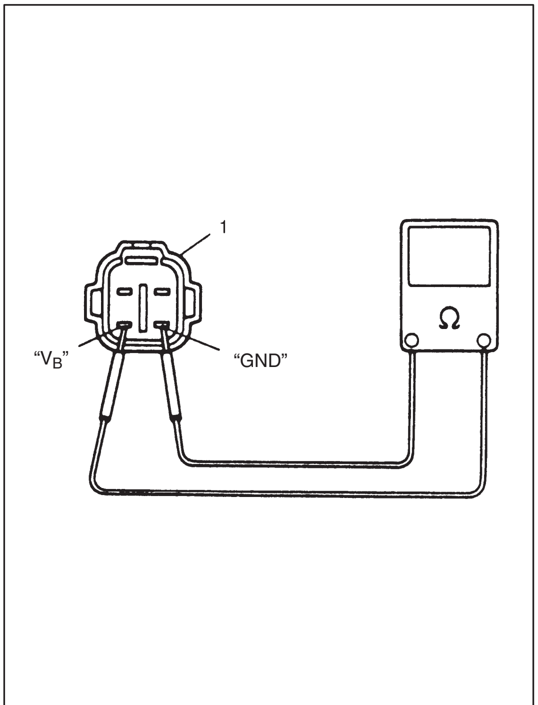
Installation

Reverse removal procedure noting the following:

- Clean mating surfaces of ECT sensor (1) and thermostat case.
- Check O-ring for damage and replace if necessary.
- Tighten ECT sensor (1) to specified torque.

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

- Connect coupler to ECT sensor (1) securely.
- Refill coolant referring to Section 6B.



1. Viewed from terminal side

HEATED OXYGEN SENSOR (Sensor-1 and Sensor-2)

Oxygen Sensor Heater Inspection

1) Disconnect sensor coupler.
2) Using ohmmeter, measure resistance between terminals "V_B" and "GND" of sensor coupler.

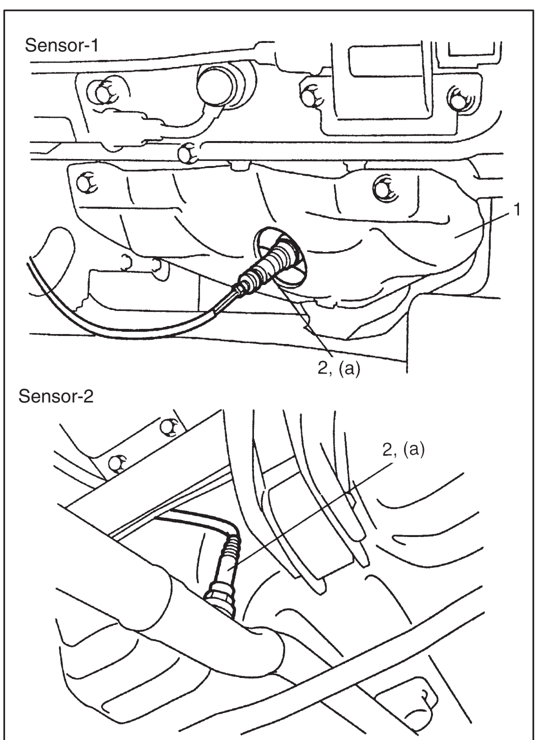
   NOTE :
   Temperature of sensor affects resistance value largely. Make sure that sensor heater is at correct temperature.

   Resistance of oxygen sensor heater :
   11.7 – 14.3 Ω at 20°C, 68°F

   If found faulty, replace oxygen sensor.
3) Connect sensor coupler securely.

Removal

WARNING:
To avoid danger of being burned, do not touch exhaust system when system is hot. Oxygen sensor removal should be performed when system is cool.



1) Disconnect negative cable at battery.
2) For sensor-1, disconnect coupler of heated oxygen sensor and release its wire harness from clamps and remove exhaust manifold cover (1).
3) For sensor-2, disconnect coupler of heated oxygen sensor and release its wire harness from clamp and hoist vehicle.
4) Remove heated oxygen sensor (2) from exhaust manifold or exhaust pipe.

Installation

Reverse removal procedure noting the following.

- Tighten heated oxygen sensor (2) to specified torque.

  Tightening Torque for heated oxygen sensor
  (a): 45 N·m (4.5 kg-m, 32.5 lb-ft)

- Connect coupler of heated oxygen sensor (2) and clamp wire harness securely.
- After installing heated oxygen sensor (2), start engine and check that no exhaust gas leakage exists.

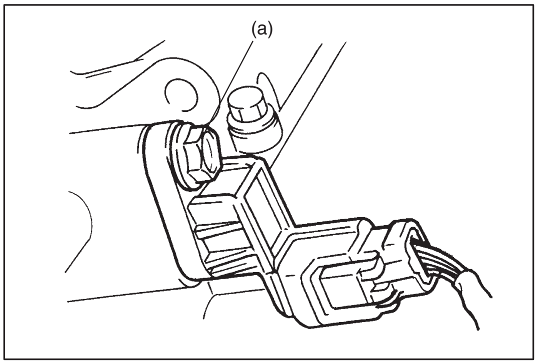
CAMSHAFT POSITION SENSOR

Inspection

Check camshaft position sensor referring to DTC P0340 Diag. Flow Table in Section 6. If malfunction is found, replace.

Removal

1) Disconnect negative cable at battery.
2) Disconnect connector from camshaft position sensor.
3) Remove camshaft position sensor from sensor case (distributorless ignition case).

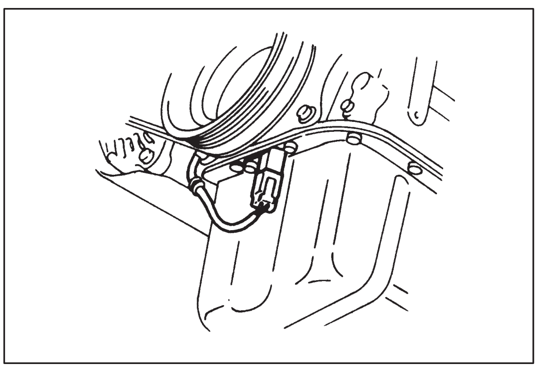


Installation

1) Check that O-ring is free from damage.
2) Check that camshaft position sensor and signal rotor tooth are free from any metal particles and damage.
3) Install camshaft position sensor to sensor case.

Tightening Torque
(a): 9 N·m (0.9 kg-m, 6.5 lb-ft)

4) Connect connector to it securely.
5) Connect negative cable to battery.



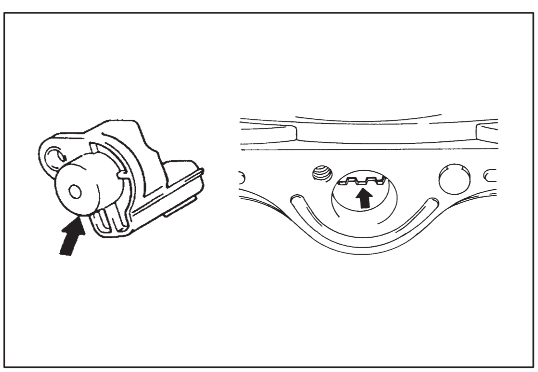
CRANKSHAFT POSITION SENSOR

Inspection

Check crankshaft position sensor referring to step 1 and 2 of DTC P0335 Flow Table. If malfunction is found, replace.

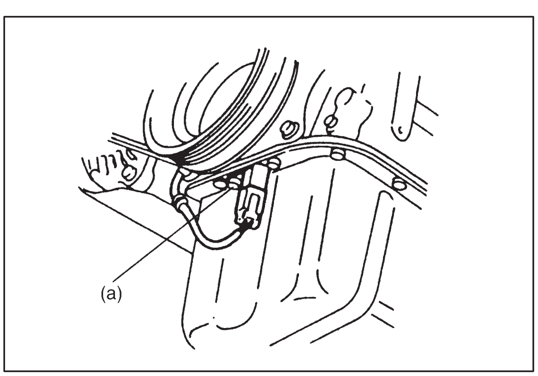
Removal

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.

VEHICLE SPEED SENSOR (VSS)

Inspection

Check vehicle speed sensor referring to step 3 of DTC P0500 Flow Table. If malfunction is found, replace.

Removal/Installation

Refer to Section 7A.

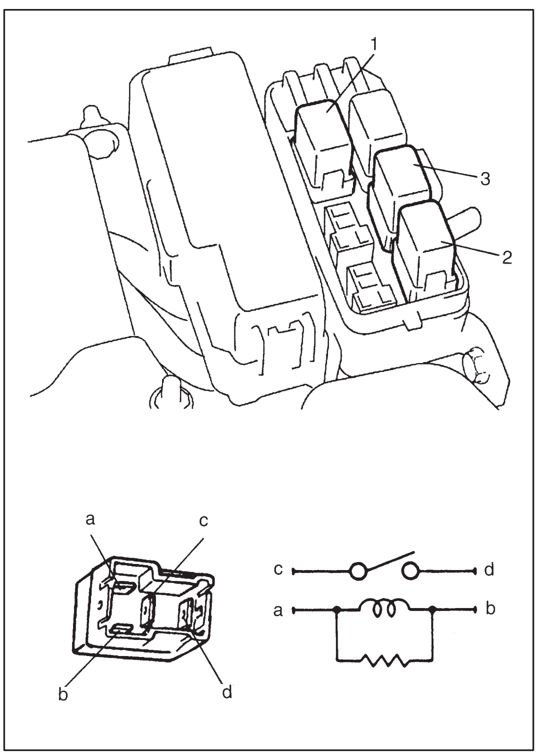
FUEL LEVEL SENSOR (GAUGE)

Inspection

Refer to Section 8.

Removal/Installation

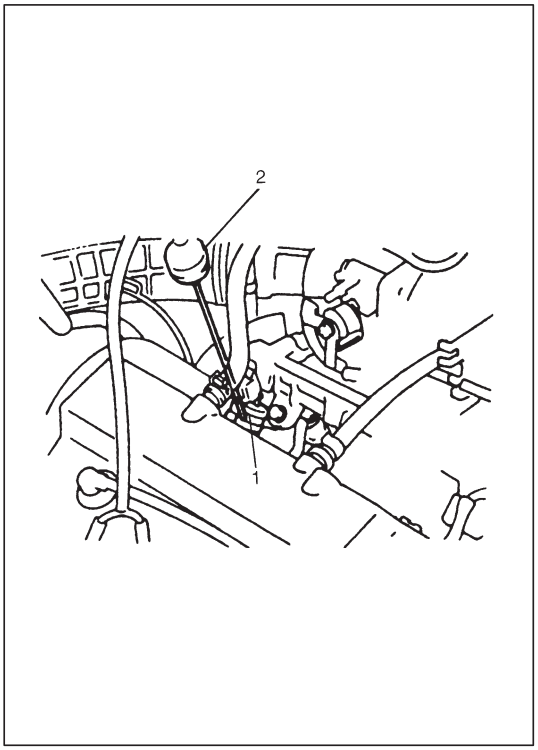
Refer to Section 6C.



MAIN RELAY, FUEL PUMP RELAY AND RADIATOR FAN CONTROL RELAY

Inspection

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



FUEL CUT OPERATION

Inspection

NOTE:

Before inspection, check to make sure that gear shift lever is in neutral position (with A/T model, selector lever in “P” range), A/C is OFF and that parking brake lever is pulled all the way up.

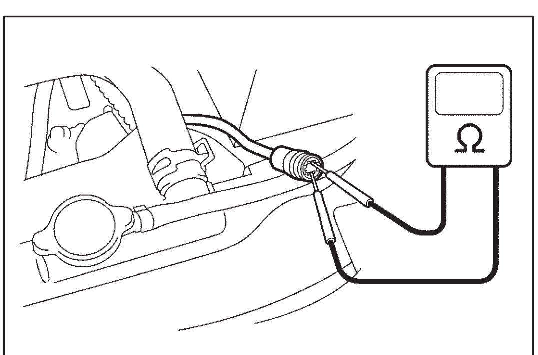
1) Warm up engine to normal operating temperature.
2) While listening to sound of injector (1) by using sound scope (2) or such, increase engine speed to higher than 3,000 r/min.
3) Check to make sure that sound to indicate operation of injector stops when throttle valve is closed instantly and it is heard again when engine speed is reduced to less than about 2,000 r/min.

RADIATOR FAN CONTROL SYSTEM

System Inspection

WARNING:
Keep hands, tools, and clothing away from engine cooling fan to help prevent personal injury. This fan is electric and can come on whether or not the engine is running. The fan can start automatically in response to the ECT sensor with the ignition switch in the ON position.

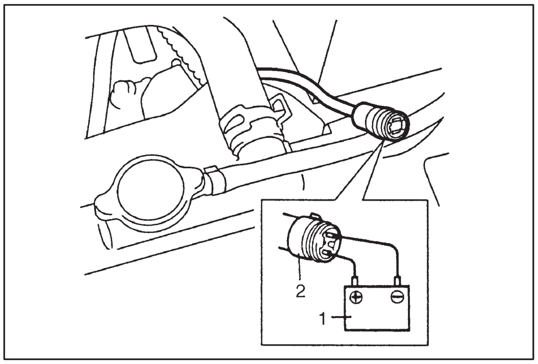
Check system for operation referring to Flow Table B-8 in Section 6.
If radiator fan fails to operate properly, check relay, radiator fan and electrical circuit.



Radiator Fan

Inspection

1) Check continuity between each two terminals.
   If there is no continuity, replace radiator fan motor.



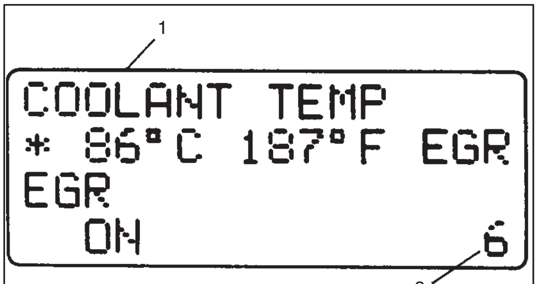
2) Connect battery (1) to radiator fan motor coupler (2) as shown in figure, then check that the radiator fan motor operates smoothly.
   If radiator fan motor does not operate smoothly, replace motor.

EMISSION CONTROL SYSTEM

EGR SYSTEM

System Inspection (using SUZUKI scan tool)

1) Connect SUZUKI scan tool to DLC with ignition switch OFF.
2) Turn ignition switch ON and then select "DATA LIST" mode on scan tool.
3) Make sure that vehicle condition is as following.
   - Vehicle speed = 0 KPH
   - Engine coolant temp. ≧ 80°C
   - Engine speed ≦ 3000 rpm
4) Clear DTC by using "CLEAR INFO" mode.

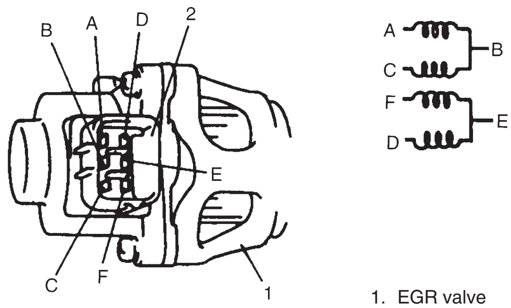


1. SUZUKI scan tool display
2. EGR valve opening (0: Close, 100: Full Open)

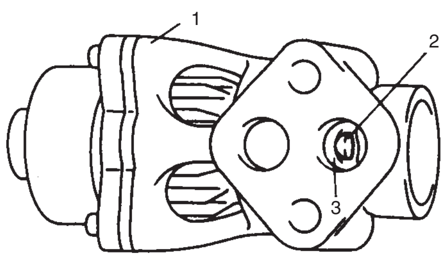
5) With engine idling (without depressing accelerator pedal), open EGR valve by using "STEP EGR" mode in "MISC TEST" menu.
   In this state, according as EGR valve opening increases engine idle speed drops. If not, possible cause is clogged EGR gas passage, stuck or faulty EGR valve, poor performance of ECT sensor or TP sensor or DTC and/or pending DTC is (are) stored in ECM memory.

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

Inspection

1) Check resistance between following terminals of EGR valve in each pair.

Terminal	Standard resistance
A – B C – B F – E D – E	20 – 24 Ω

If found faulty, replace EGR valve assy.

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.

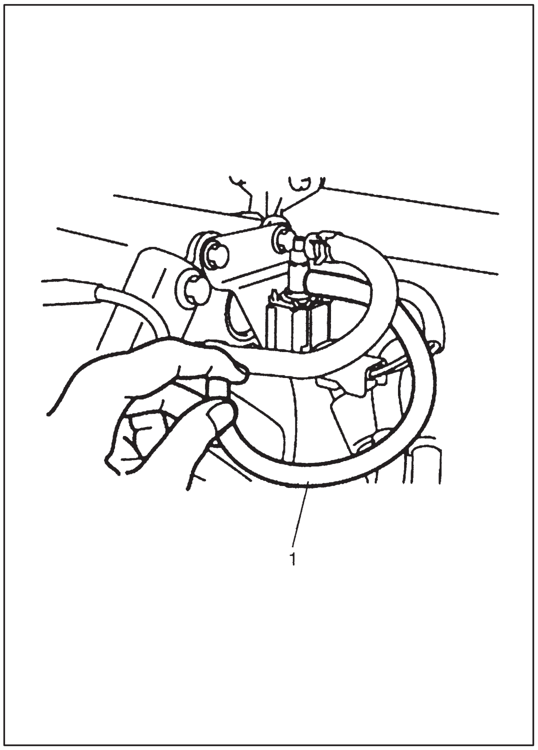
Installation

Reverse removal procedure noting following.
- Clean mating surface of valve and intake manifold.
- Use new gasket.

EVAPORATIVE EMISSION CONTROL SYSTEM

EVAP Canister Purge Inspection

NOTE:
Before inspection, check to make sure that gear shift lever is in neutral position (with A/T model, selector lever in “P” range) and that parking brake lever is pulled all the way up.

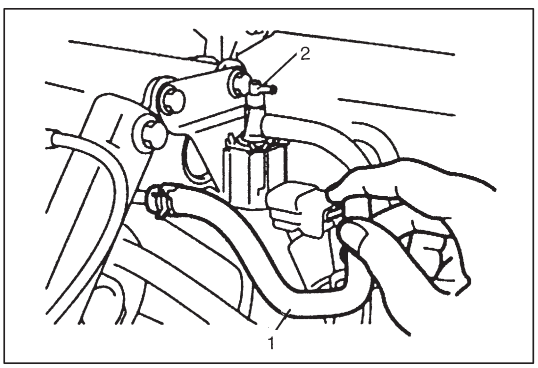


1) Disconnect purge hose (1) from EVAP canister.
2) Place finger against the end of disconnected hose and check that vacuum is not felt there when engine is cool and running at idle speed.
3) Connect purge hose to EVAP canister and warm up engine to normal operating temperature.
4) Disconnect purge hose from EVAP canister.
5) Also check that vacuum is felt when engine is running at idle speed.

   NOTE:

   The EVAP canister purge system does not perform purging (vacuum is not detected at the purge hose) unless the engine is sufficiently warmed up and the heated oxygen sensor is activated fully. Also, when the purge hose is disconnected in Step 4), the air is drawn into the purge line. As a result, ECM (PCM) detects a change in the purge gas concentration and sometimes stops purging but this indicates nothing abnormal.

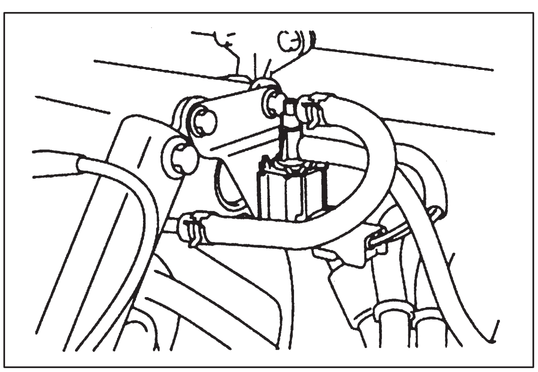
If check result is not satisfactory, check vacuum passage, hoses, EVAP canister purge valve, wire harness and ECM (PCM).



Vacuum Passage Inspection

Start engine and run it at idle speed. Disconnect vacuum hose (1) from EVAP canister purge valve (2). With finger placed against hose disconnected, check that vacuum is applied.

If it is not applied, clean vacuum passage by blowing compressed air.



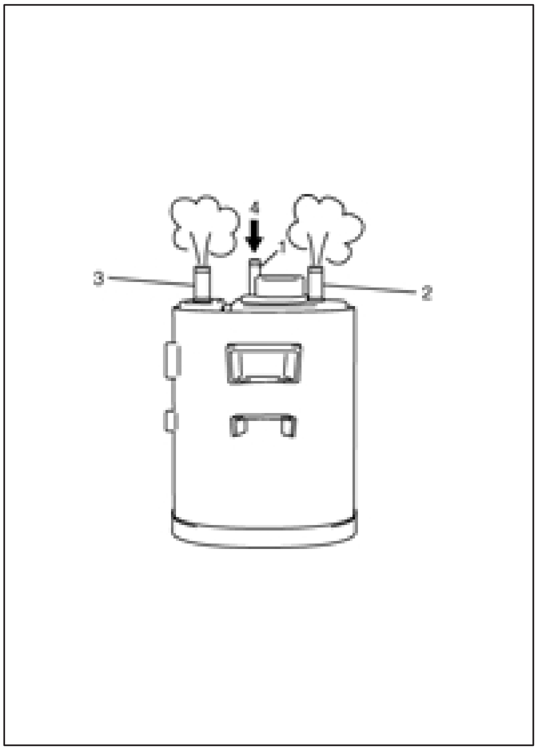
Vacuum Hose Inspection

Check hoses for connection, leakage, clog and deterioration. Replace as necessary.

EVAP Canister Purge Valve Inspection

Check EVAP canister purge valve referring to step 1 of DTC P0443 Flow Table.

If found malfunction, replace.



EVAP Canister Inspection

> **WARNING:**
> **DO NOT SUCK nozzles on EVAP canister. Fuel vapor inside EVAP canister is harmful.**

1) Check outside of EVAP canister visually.
2) Disconnect vacuum hoses from EVAP canister.
3) Check that there should be no restriction of flow through purge pipe (2) and air pipe (3) when air is blown (4) into tank pipe (1). If any faulty condition is found in above inspection replace.

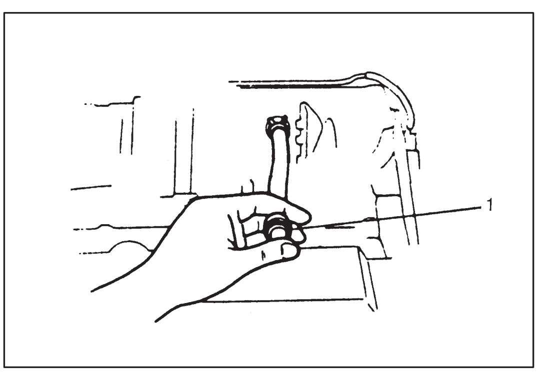
PCV SYSTEM

NOTE:

Be sure to check that there is no obstruction in PCV valve or its hoses before checking IAC duty, for obstructed PCV valve or hose hampers its accurate adjustment.

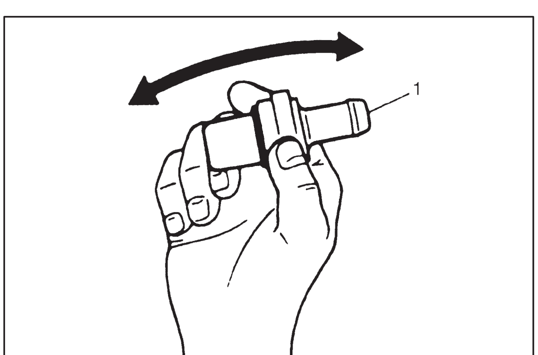
PCV Hose Inspection

Check hoses for connection, leakage, clog and deterioration. Replace as necessary.



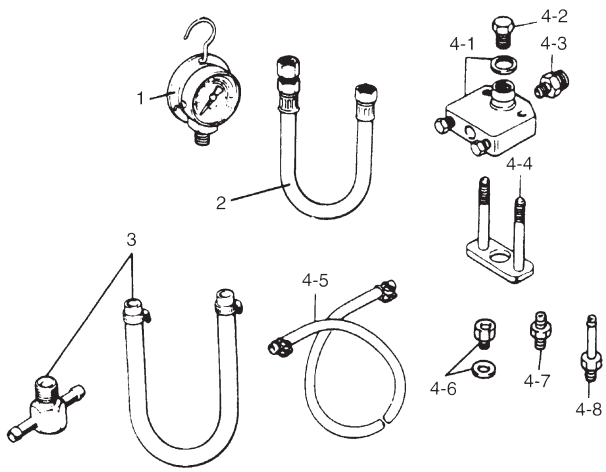
PCV Valve Inspection

1) Disconnect PCV valve (1) from cylinder head cover and install plug to head cover hole.
2) Run engine at idle.
3) Place your finger over end of PCV valve (1) to check for vacuum. If there is no vacuum, check for clogged valve. Replace as necessary.



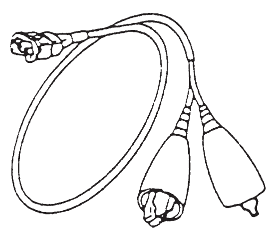
4) After checking vacuum, stop engine and remove PCV valve (1). Shake valve and listen for the rattle of check needle inside the valve. If valve does not the rattle, replace valve.
5) After checking, remove plug and install PCV valve (1).

SPECIAL TOOLS

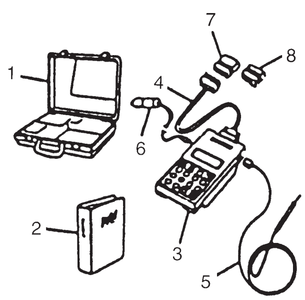


1. Pressure gauge
   09912-58441
2. Pressure hose
   09912-58431
3. 3-way joint & hose
   09912-58490
4. Checking tool set
   09912-58421

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

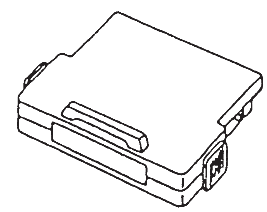


09930-88530
Injector test lead

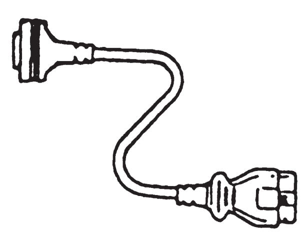


1. Storage case
2. Operator's manual
3. Tech 1A
4. DLC cable (14/26 pin, 09931-76040)
5. Test lead/probe
6. Power source cable
7. DLC cable adaptor
8. Self-test adaptor

09931-76011
SUZUKI scan tool (Tech 1A) kit



Mass storage cartridge



09931-76030
16/14 pin DLC cable

TIGHTENING TORQUE SPECIFICATIONS

Fastening parts	Tightening torque		
	N·m	kg-m	lb-ft
TP sensor mounting screw	2	0.2	1.5
IAC valve	3.3	0.33	2.5
ECT sensor	12	1.2	9.0
Heated oxygen sensor-1 and -2	45	4.5	32.5
Camshaft position sensor	9	0.9	6.5

SECTION 6F

IGNITION SYSTEM

WARNING:
For vehicles equipped with a Supplemental Inflatable Restraint Air Bag System:
- **Service on or around Air Bag System Components or Wiring must be performed only by an authorized Suzuki dealer. Please observe all WARNINGS and SERVICE PRECAUTIONS in Section 9J under "On-Vehicle Service" and the Air Bag System Component and Wiring Location view in Section 9J before performing service on or around Air Bag System Components or Wiring. Failure to follow WARNINGS could result in unintended air bag deployment or could render the air bag inoperative. Either of these two conditions may result in severe injury.**
- **SDM can maintain sufficient voltage to cause a deployment of air bags for up to 10 seconds after ignition switch is turned to "LOCK" position, battery is disconnected or fuse powering SDM is removed. Work must be started after 15 seconds from the time.**

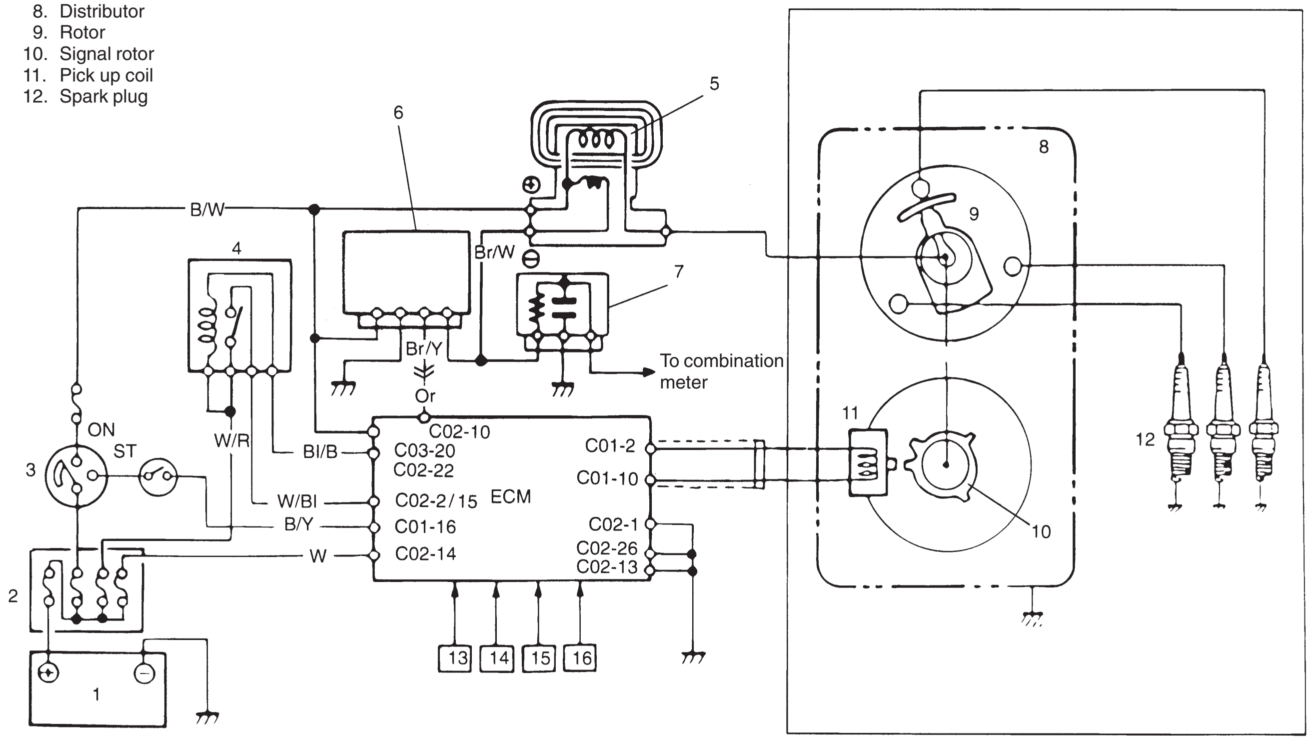
CONTENTS

GENERAL DESCRIPTION

The ignition system used for this vehicle has an electronic ignition control system and consists of the following parts.
- ECM
  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 power unit.
- Power unit (Igniter)
  It turns ON and OFF the primary current of the ignition coil according to the signal from ECM.
- Ignition coil
  When the ignition coil primary current is turned OFF, a high voltage is induced in the secondary winding.
- Distributor
  It distributes a high voltage current to each plug.
- High-tension cords and spark plugs.
- CMP sensor (Camshaft position Sensor)
  Located in the distributor, it converts the crank angle into voltage variation and sends it to ECM. For its details, refer to Section 6E1.
- TP sensor, ECT sensor and MAP sensor
  For their details, refer to Section 6E.

In electronic ignition control system, the ECM is programmed for the best ignition timing under every engine condition. Receiving signals which indicate the engine condition from the sensors, e.g., engine revolution, intake air pressure, coolant temperature, etc., it selects the most suitable ignition timing from its memory and operates the power unit.
Thus ignition timing is controlled to yield the best engine performance.
For more information, refer to Section 6E1.

1. Battery
2. Main fuse
3. Ignition switch
4. Main relay
5. Ignition coil
6. Igniter
7. Noise suppressor
8. Distributor
9. Rotor
10. Signal rotor
11. Pick up coil
12. Spark plug



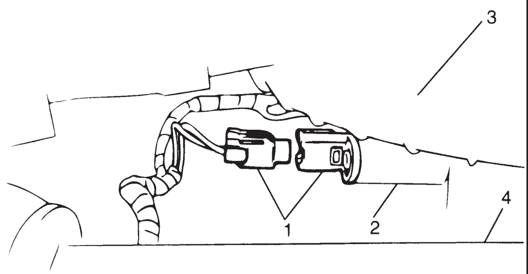
DIAGNOSIS

Condition	Possible Cause	Correction
Engine cranks, but will not start or hard to start	● Blown fuse for ignition coil ● Loose connection or disconnection of lead wire or high-tension cord(s) ● Faulty high-tension cord(s) ● Faulty spark plug(s) ● Cracked rotor or cap ● Maladjusted signal rotor air gap ● Faulty ignition coil ● Faulty noise suppressor ● Faulty CMP sensor ● Faulty igniter ● Faulty ECM (or PCM) ● Maladjusted ignition timing	Replace Connect securely Replace Adjust, clean or replace Replace Adjust Replace Replace Replace Replace Replace Adjust
Poor fuel economy or engine performance	● Incorrect ignition timing ● Faulty spark plug(s) or high-tension cord(s) ● Faulty ECM (or PCM)	Adjust Adjust, clean or replace 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 Plugs” 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 11 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 flow table corresponding to that code No. in SECTION 6.	Go to Step 4.
4	Electrical Connection and Noise Suppressor Check 1) Check ignition coil for electrical connection and noise suppressor for conductivity. Are they good condition?	Go to Step 5.	Repair or replace.
5	High-tension Cord Check 1) Check high-tension cord for resistance, referring to “High-tension Cords” in this section. Is check result satisfactory?	Go to Step 6.	Replace high-tension cord(s).

STEP	ACTION	YES	NO
6	Ignition Coil Power Supply and Ground Circuit Check 1) Check ignition coil power supply (“B/W” wire) circuit for open and short. Are circuits in good condition?	Go to Step 7.	Repair or replace.
7	Ignition Coil Check 1) Check ignition coil for resistance, referring to “Ignition Coil” in this section. Is check result satisfactory?	Go to Step 8.	Replace ignition coil assembly.
8	CMP Sensor Check 1) Check CMP sensor and signal rotor, referring to “Distributor Unit” in this section. Is check result satisfactory?	Go to Step 9 on the next page.	Adjust or replace.
9	Ignition Trigger Signal Circuit Check 1) Check ignition trigger signal (“Br/Y” or “Or” wire) circuit for open, short and poor connection. Are circuits in good condition?	Go to Step 10.	Repair or replace.
10	Igniter Check 1) Check igniter, referring to “Igniter” in this section. Is check result satisfactory?	Go to Step 11.	Replace igniter.
11	Ignition Timing Check 1) Check initial ignition timing and ignition timing advance, referring to “Ignition Timing” in this section. Is check result satisfactory?	Substitute a known-good ECM (or PCM) and then repeat Step 2.	Go to Step 12.
12	Ignition Timing Adjustment and Recheck 1) Adjust initial ignition timing, referring to “Ignition Timing” in this section. 2) Recheck initial ignition timing and ignition timing advance, referring to “Ignition Timing” in this section. Is check result satisfactory?	System is in good condition.	Substitute a known-good ECM (or PCM) and then repeat Step 2.



1. Injector coupler
2. Throttle body
3. Air cleaner case
4. Cylinder head cover

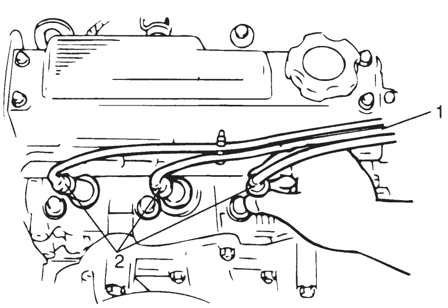
ON-VEHICLE SERVICE

IGNITION SPARK TEST

1) Disconnect injector coupler at throttle body side.

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 plugs and connect them to high-tension cords, and then ground spark plugs.
3) Crank engine and check if each spark plug sparks.
4) If no spark is emitted, inspect high-tension cords, spark plugs, ignition coil, distributor, etc.

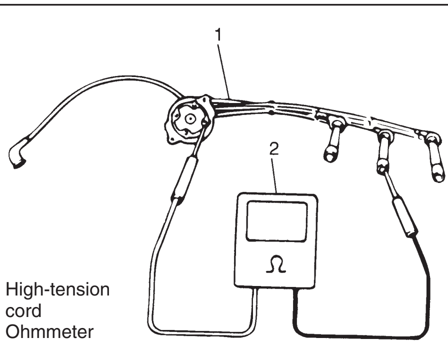


1. High-tension code 2. Cap

HIGH-TENSION CORDS

1) Remove high-tension cord at ignition coil while gripping its cap.
2) Remove distributor cap installed with high-tension cords.
3) Remove high-tension cord clamp from cylinder head cover.
4) Pull out high-tension cords from spark plugs while gripping each cap.

CAUTION:
- **Removal of high-tension cords together with clamps will be recommended so as not to damage their inside wire (resistive conductor).**
- **For the same reason, pull out each connection by gripping cap portion.**



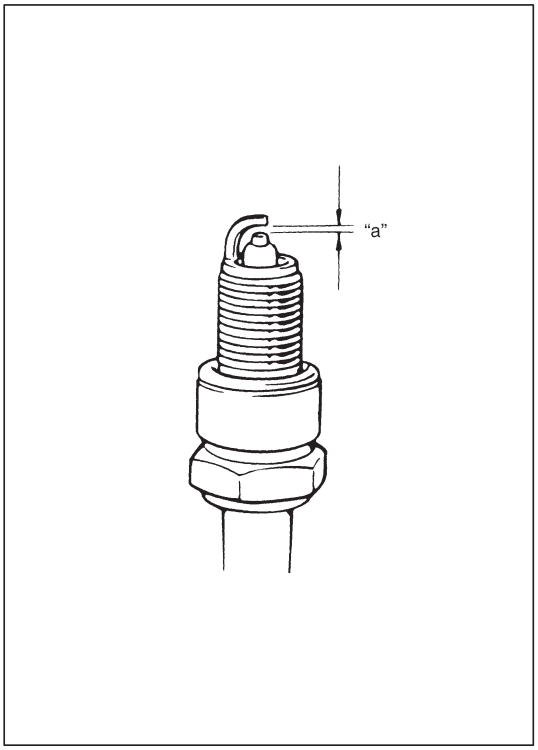
1. High-tension cord
2. Ohmmeter

5) Measure resistance of high-tension cord by using ohmmeter.

High-tension cord resistance: 10 – 22 kΩ/m (3.0 – 6.7 kΩ/ft)

6) If resistance exceeds specification, inspect distributor terminal and replace high-tension cord(s) and/or distributor cap as required.

> **CAUTION:**
> - **Never attempt to use metal conductor high-tension cords as replacing parts.**
> - **Insert each cap portion fully when installing high-tension cords.**



SPARK PLUGS

1) Pull out high-tension cords by gripping their caps and then remove spark plugs.
2) Inspect them for:
   - Electrode wear
   - Carbon deposits
   - Insulator damage
3) If any abnormality is found, adjust air gap, clean with spark plug cleaner or replace them with specified new plugs.

Spark plug air gap "a": 1.0 – 1.1 mm (0.039 – 0.043 in.)
Spark plug type : NGK BPR6ES-11
: DENSO W20EPR-U11

4) Install spark plugs and torque them to specification.

Tightening Torque for spark plug
25 N·m (2.5 kg-m, 18.0 lb-ft)

5) Install high-tension cords securely by gripping their caps.

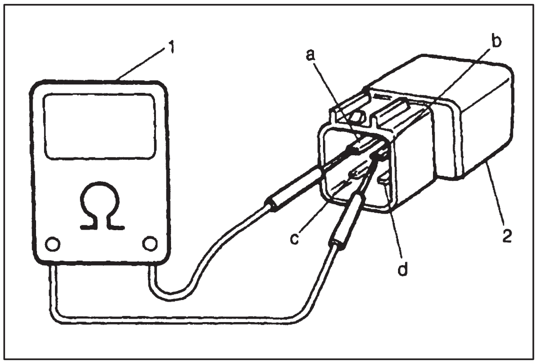
NOISE SUPPRESSOR

REMOVAL

1) Unwrap tape from noise suppressor.
2) Disconnect coupler of noise suppressor.
3) Remove noise suppressor.

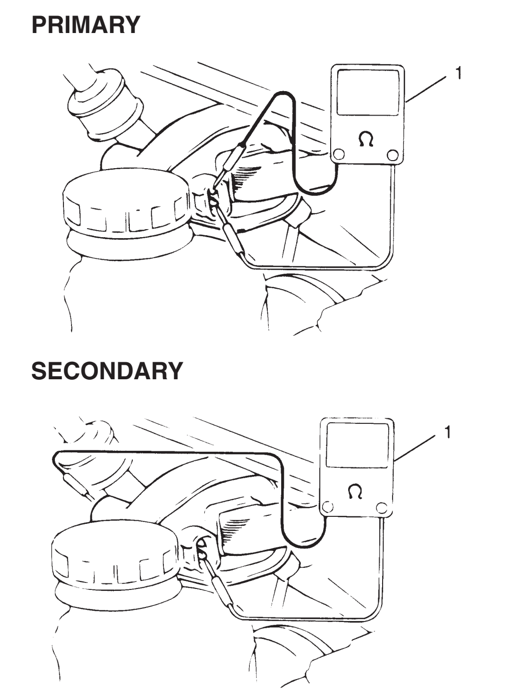
INSTALLATION

Reverse removal procedure for installation.



INSPECTION

Using an ohmmeter (1) to check continuity as the following.
"a" – "b": No continuity
"a" – "c": No continuity
"c" – "d": Continuity (Approx. 2.2 kΩ)
If check result is not satisfactory, replace noise suppressor (2).



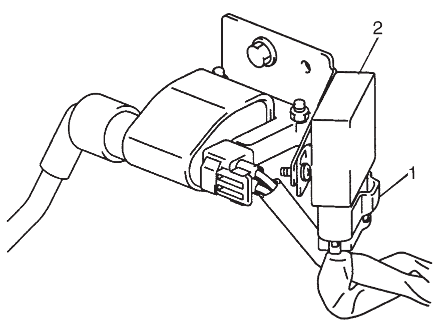
1. Ohmmeter

IGNITION COIL

1) Pull out high-tension cord by gripping its cap.
2) Disconnect ignition coil coupler.
3) Measure primary and secondary coil resistances.

Ignition coil resistance (at 20°C, 68°F)
Primary : 0.87 – 1.05 Ω
Secondary : 11.2 – 15.2 kΩ

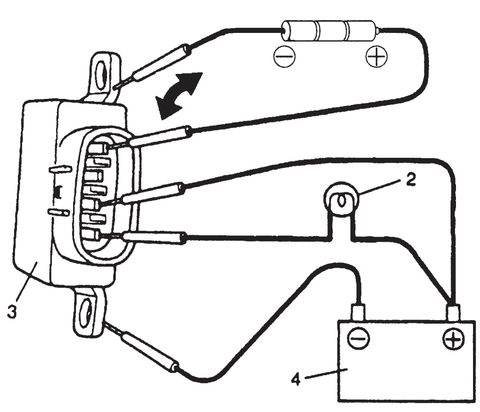
4) If resistance is out of specification, replace coil with new one.



IGNITER

Before this inspection, prepare 5 V power supply (3 new 1.5 V batteries), one 12 V 3.4 W light bulb and one 12 V battery (fully charged).

1) Disconnect igniter coupler (1).
2) Remove igniter (2) from its bracket.



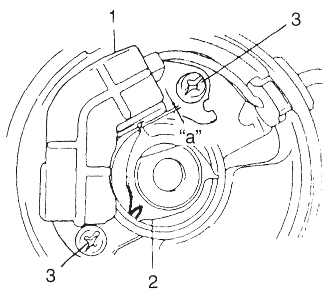
3) Arrange 3 new batteries in series (1) (check total voltage is about 4.7 V).
4) Connect light bulb (2) between “c” terminal of igniter (3) and battery (4) positive (+) terminal, then connect battery negative (–) terminal to igniter body.
   Also connect battery positive (+) terminal and “b” terminal of igniter.
   Check that the light bulb does not illuminate.
5) Connect negative (–) terminal of batteries (1) and igniter body.
   Check that the light bulb illuminate when positive (+) terminal of batteries (1) is connected to “a” terminal of igniter.
   If inspection result is not satisfactory, replace igniter.
6) Install igniter and connect igniter coupler.

DISTRIBUTOR

DISTRIBUTOR CAP AND ROTOR

INSPECTION

Check cap and rotor for crack and their terminals for corrosion and wear. Replace as necessary.



1. Pickup coil
2. Signal rotor
3. Screws

SIGNAL ROTOR AIR GAP

INSPECTION

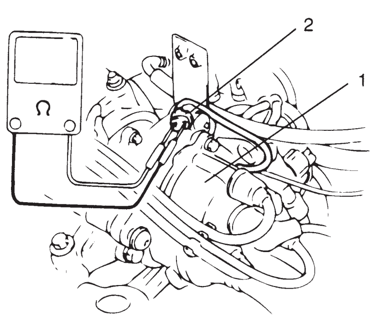
1) Remove distributor cap and rotor.
2) Using thickness gauge, measure air gap, between signal rotor tooth and CMP sensor (generator).

   Signal rotor air gap "a": About 0.2 mm (about 0.008 in.)

3) If gap is out of specification, loose CMP sensor (signal generator) securing screws. Using blade (–) screw driver, move CMP sensor (generator) and adjust gap to specification. After adjustment, tighten securing screws and recheck gap.

   NOTE:
   Check to make sure that CMP sensor (signal generator) tooth is free from any metal particles.

4) Install distributor cap and rotor.



1. Distributor
2. Coupler
3. Ohmmeter

CMP SENSOR (PICKUP COIL) RESISTANCE

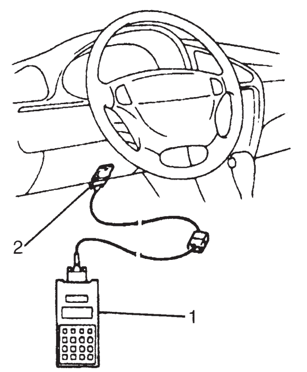
INSPECTION

1) Disconnect distributor lead coupler.
2) Measure resistance of pickup coil by using ohmmeter.
3) If resistance is out of specification, replace CMP sensor (signal generator) as follows.

   Pickup coil resistance:
   185 – 275 Ω at – 10°C (14°F) – 50°C (122°F)
   240 – 325 Ω at 50°C (122°F) – 100°C (212°F)

4) Remove distributor cap and rotor.
5) Remove CMP sensor (signal generator) securing screws and lead wire clamp screws.
6) Replace CMP sensor (signal generator).
7) Adjust signal rotor air gap to specifications as previously outlined.
8) Install rotor, distributor cap seal and cap.

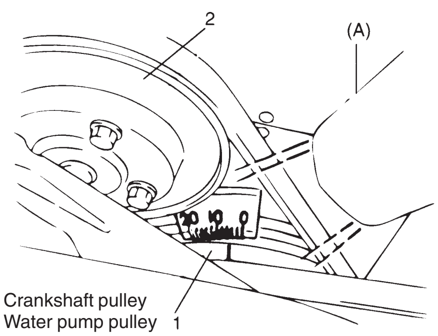
IGNITION TIMING



NOTE:
Before starting engine, place transmission gear shift lever in "Neutral" (shift selector lever to "P" range for A/T model), and set parking brake.

INSPECTION AND ADJUSTMENT

1) Connect SUZUKI scan tool (1) to DLC (2) with ignition switch OFF.
2) Start engine and warm it up to normal operating temperature.
3) Make sure that all of electrical loads except ignition are switched off.
4) Check to be sure that idle speed is within specification. (Refer to SECTION 6E1)
5) Set timing light to No.1 high-tension cord.
6) Fix ignition timing to initial one as follows:
   Select "MISC" made on SUZUKI scan tool and fix ignition timing to initial one.

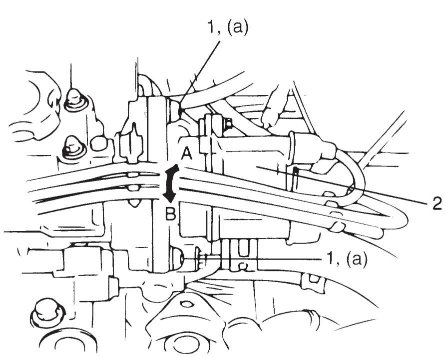


1. Crankshaft pulley
2. Water pump pulley

7) Using timing light, check that timing is within specification.

   Initial ignition timing (Ignition timing fixed):
   $5 \pm 3°$ BTDC (at idle speed)
   Ignition order: 1-3-2

   Special Tool
   (A): 09900-27301 or 09930-76420



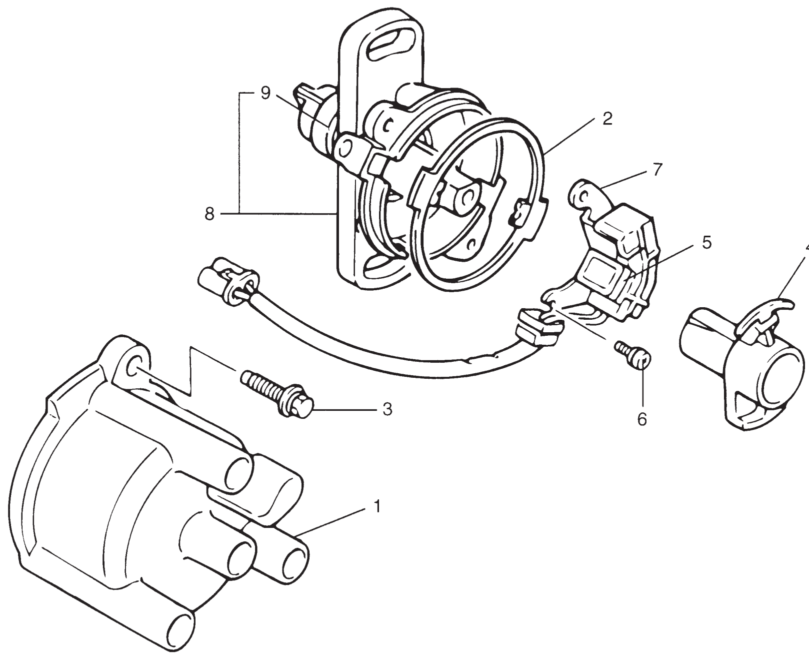
A: To be advanced
B: To be retarded
1. Distributor flange bolt
2. Distributor

8) If ignition timing is out of specification, loosen flange bolts, adjust timing by turning distributor assembly while engine is running, and then tighten bolts.

   Tightening Torque
   (a): 15 N·m (1.5 kg-m, 11.0 lb-ft)

9) After tightening distributor flange bolts, recheck that ignition timing is within specification.
10) After checking and/or adjusting Initial Ignition Timing, release ignition timing fixation by SUZUKI scan tool.
11) With engine idling (ignition timing not fixed, idle switch ON and car stopped), check that ignition timing is about 10° BTDC. (Constant variation within a few degrees from 10° indicates no abnormality but proves operation of electronic timing control system.) Also, check that increasing engine speed advances ignition timing.
    If above check results are not satisfactory, check CTP switch, test switch terminal circuit and ECM.

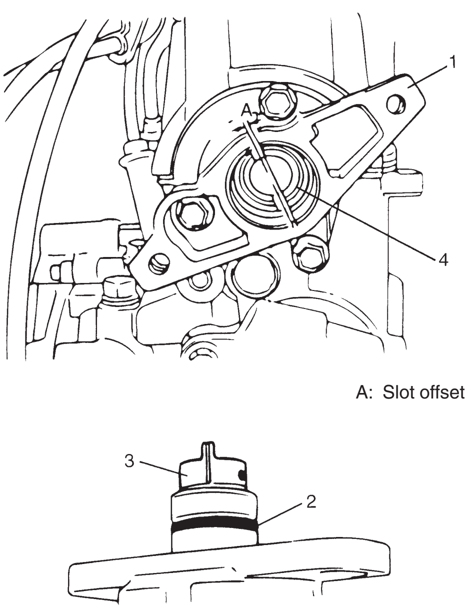
DISTRIBUTOR UNIT



1. Cap
2. Cap seal
3. Cap screw
4. Rotor
5. CMP sensor (Signal generator)
6. Screw
7. Cover
8. Housing
9. O-ring

DISMOUNTING

1) Disconnect distributor lead coupler.
2) Remove distributor cap screws and cap.
3) Remove distributor flange bolts.
4) Pull out distributor housing assembly.



A: Slot offset

1. Distributor case
2. O-ring
3. Distributor coupling
4. Camshaft

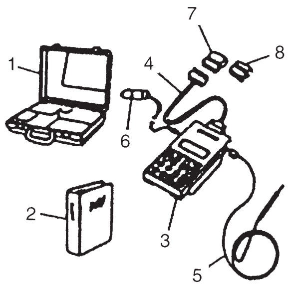
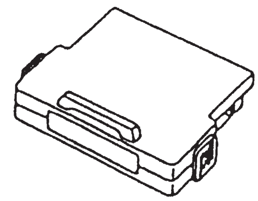
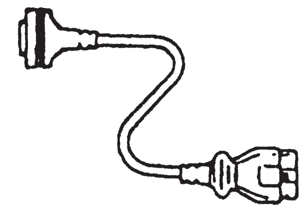
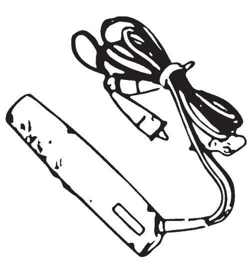
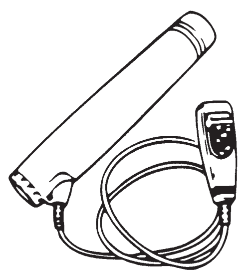
REMOUNTING

NOTE:

- **Before installing distributor, check to make sure that its O-ring is in good condition.**
- **If new O-ring is installed, apply oil.**

1) Install distributor without cap to camshaft.
   Fit the dogs of distributor coupling into the slots of camshaft, when installing. The dogs of distributor coupling are offset. Therefore, if the dogs can not shaft by 180 degree and try again.
2) Lightly install flange bolts and prepare for ignition timing adjustment.
3) Check to make sure that rotor is in good condition.
4) Inspect distributor cap and clean or replace as required.
5) Make sure that distributor cap seal is placed properly and install cap, and then fasten it with screws.
6) Connect distributor lead coupler.
7) Check and adjust ignition timing as previously outlined.

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 adaptor 8. Self-test adaptor 09913-76011 SUZUKI scan tool (Tech 1A) kit	 Mass storage cartridge	 09931-76030 16/14 pin DLC cable
 09900-27301 Timing light (DC 12 V)	 09930-76420 Timing light (Dry cell type)	

SECTION 6F

IGNITION SYSTEM
(TBI FOR G13)

NOTE:
For the details of this section, refer to the same section of the Service manual mentioned in the FOREWORD of this manual.

SECTION 6F1

IGNITION SYSTEM
(SFI FOR G13)

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

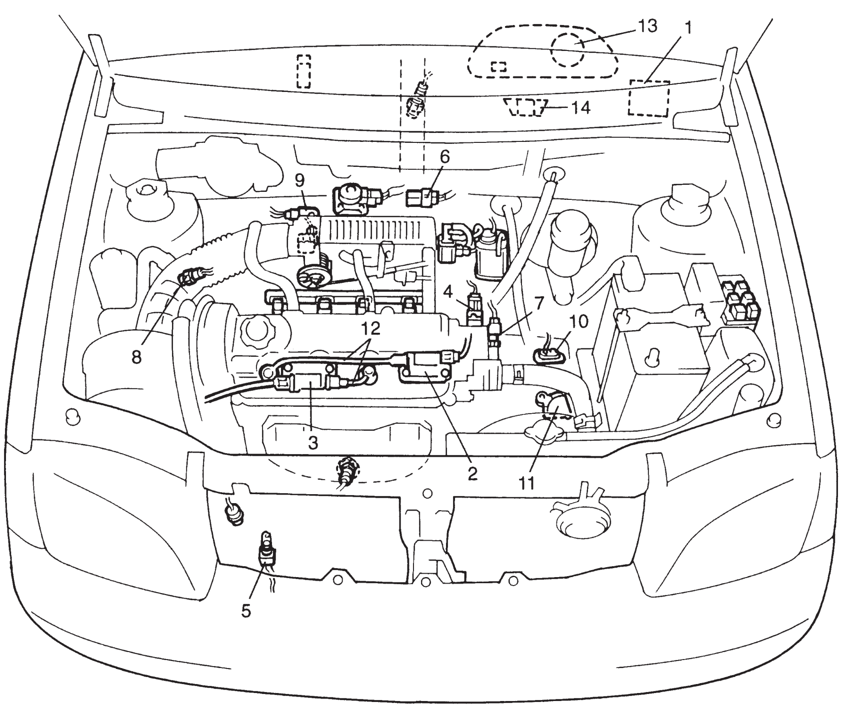
GENERAL DESCRIPTION

The ignition system is an electronic (distributorless) ignition system. It consists of the parts as described below and has an electronic ignition control system.

- ECM (PCM)
  It detects the engine and vehicle conditions through the signals from the sensors, determines the most suitable ignition timing and time for electricity to flow to the primary coil and sends a signal to the ignitor (power unit) in the ignition coil assembly.
- Ignition coil assembly (including an ignitor)
  The ignition coil assembly has a built-in ignitor which turns ON and OFF the current flow to the primary coil according to the signal from ECM (PCM). When the current flow to the primary coil is turned OFF, a high voltage is induced in the secondary coil.
- High tension cords and spark plugs.
- CMP sensor (Camshaft position sensor) and CKP sensor (Crankshaft position sensor)
  Using signals from these sensors, ECM (PCM) identifies the specific cylinder whose piston is in the compression stroke and detects the crank angle.
- TP sensor, ECT sensor, MAP sensor and other sensors/switches
  Refer to section 6E2 for details.

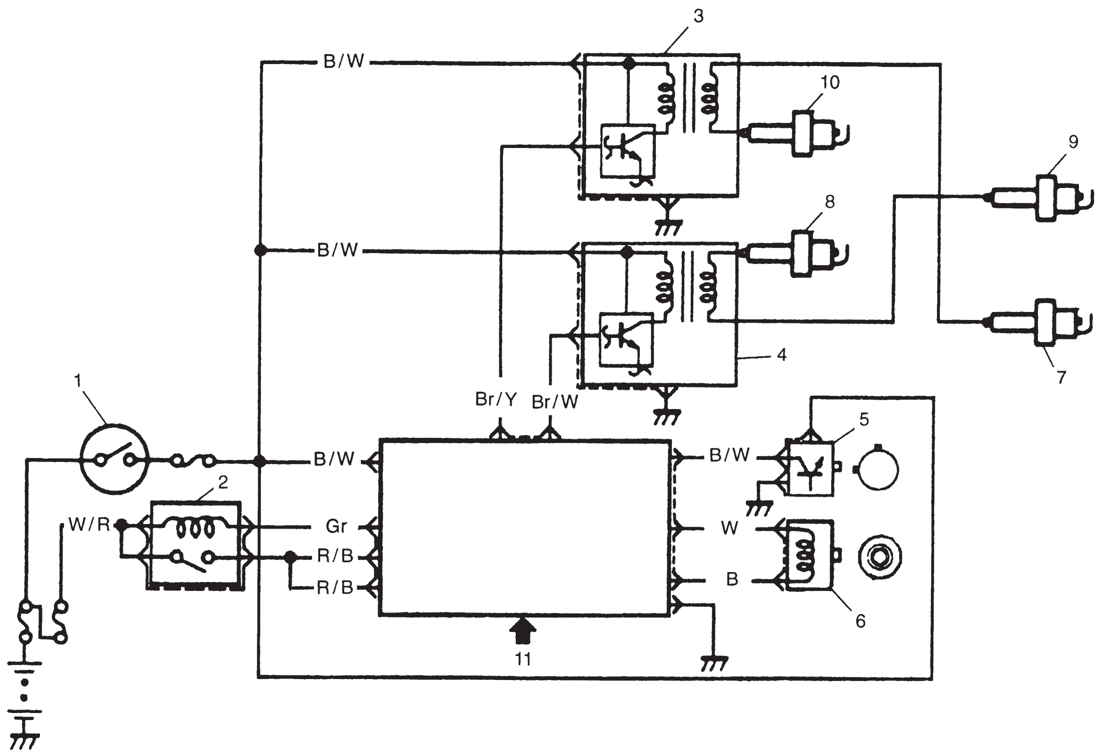
Although this ignition system does not have a distributor, it has two ignition coil assemblies (one is for No.1 and No.4 spark plugs and the other is for No.2 and No.3 spark plugs). When an ignition signal is sent from ECM (PCM) to the ignitor in the ignition coil assembly for No.1 and No.4 spark plugs, a high voltage is induced in the secondary coil and that passes through the high-tension cords and causes No.1 and No.4 spark plugs to spark simultaneously. Likewise, when an ignition signal is sent to the ignitor in the other ignition coil assembly, No.2 and No.3 spark plugs spark simultaneously.

SYSTEM COMPONENTS



1. ECM (PCM)
2. Ignition coil assembly for No.1 and No.4 spark plugs
3. Ignition coil assembly for No.2 and No.3 spark plugs
4. CMP sensor
5. CKP sensor
6. MAP sensor
7. ECT sensor
8. IAT sensor
9. TP sensor
10. VSS (A/T)
11. Transmission range switch (A/T)
12. High-tension cords
13. VSS (speedometer) (M/T)
14. Data link connector

SYSTEM WIRING DIAGRAM



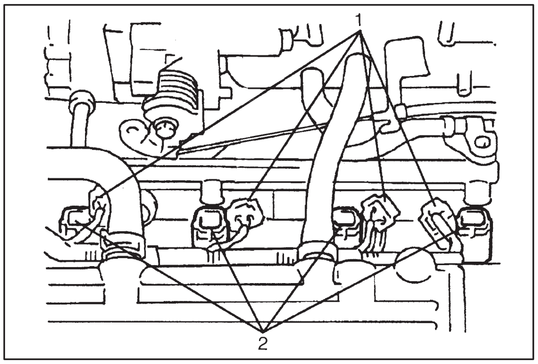
1. Ignition switch
2. Main relay
3. Ignition coil assembly for No.1 and No.4 spark plugs
4. Ignition coil assembly for No.2 and No.3 spark plugs
5. CMP sensor
6. CKP sensor
7. No.1 spark plug
8. No.2 spark plug
9. No.3 spark plug
10. No.4 spark plug
11. Sensed information
    - MAP sensor
    - ECT sensor
    - IAT sensor
    - TP sensor
    - VSS
    - Park/Neutral position signal (A/T)
    - Electric load signal
    - Engine start signal

DIAGNOSIS

Condition	Possible Cause	Correction
Engine cranks, but will not start or hard to start	**No spark** ● Blown fuse for ignition coil ● Loose connection or disconnection of lead wire or high-tension cord(s) ● Faulty high-tension cord(s) ● Faulty spark plug(s) ● Faulty ignition coil ● Faulty CKP sensor or crankshaft timing belt pulley ● Faulty ECM (PCM)	 Replace. Connect securely. Replace. Adjust, clean or replace. Replace ignition coil assembly. Clean, tighten or replace. Replace.
Poor fuel economy or engine performance	● Incorrect ignition timing ● Faulty spark plug(s) or high-tension cord(s) ● Faulty ignition coil assembly ● Faulty CKP sensor or crankshaft timing belt pulley ● Faulty ECM (PCM)	Check related sensors and crankshaft timing belt pulley. Adjust, clean or replace. Replace. Clean, tighten or replace. Replace.

IGNITION SYSTEM DIAGNOSTIC FLOW TABLE

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE" in section 6.
2	Ignition Spark Test 1) Check all spark plugs for condition and type referring to "Spark Plugs" section. 2) If OK, perform ignition spark test, referring to "Ignition Spark Test" section. Is spark emitted from all spark plugs?	Go to Step 11.	Go to Step 3.
3	Diagnostic Trouble Code (DTC) Check Is DTC stored in ECM (PCM)?	Go to applicable DTC Diag. Flow Table in section 6.	Go to Step 4.
4	Electrical Connection Check 1) Check ignition coil assemblies and high-tension cords for electrical connection. Are they connected securely?	Go to Step 5.	Connect securely.
5	High-Tension Cords Check 1) Check high-tension cord for resistance referring to "High-Tension Cords" section. Is check result satisfactory?	Go to Step 6.	Replace high-tension cord(s).
6	Ignition Coil Assembly Power Supply and Ground Circuit Check 1) Check ignition coil assembly power supply and ground circuits for open and short. Are circuits in good condition?	Go to Step 7.	Repair or replace.
7	Ignition Coil Assembly Check 1) Check ignition coil for resistance referring to "Ignition Coil Assembly" section. Is check result satisfactory?	Go to Step 8.	Replace ignition coil assembly.
8	Crankshaft Position (CKP) Sensor Check 1) Check crankshaft position sensor referring to Step 3 and 4 of DTC P0335 Diag. Flow Table in section 6. Is check result satisfactory?	Go to Step 9.	Tighten CKP sensor bolt, replace CKP sensor or crankshaft timing belt pulley.
9	Ignition Trigger Signal Circuit Check 1) Check ignition trigger signal wire for open, short and poor connection. Is circuit in good condition?	Go to Step 10.	Repair or replace.
10	A Known-good Ignition Coil Assembly Substitution 1) Substitute a known-good ignition coil assembly and then repeat Step 2. Is check result of Step 2 satisfactory?	Go to Step 11.	Substitute a known-good ECM (PCM) and then repeat Step 2.
11	Ignition Timing Check 1) Check initial ignition timing and ignition timing advance referring to "Ignition Timing" section. Is check result satisfactory?	System is in good condition.	Check CKP sensor, crankshaft timing belt pulley (signal rotor) and input signals related to this system.



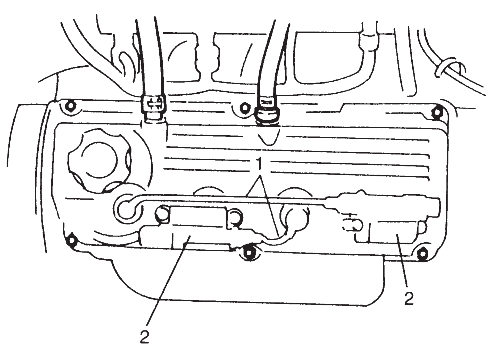
ON-VEHICLE SERVICE

IGNITION SPARK TEST

1) Disconnect all injector couplers (1) from injectors (2).

> **WARNING:**
> **Without disconnection of injector couplers, combustible gas may come out from spark plug holes during this test and may get ignited in engine room.**

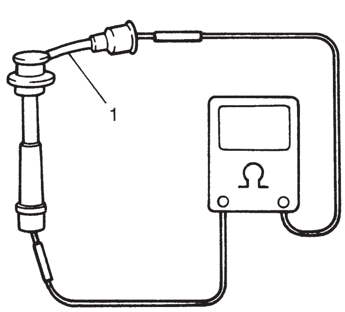
2) Remove spark plug and check it for condition and type referring to "Spark Plugs" in this section.
3) If OK, connect ignition coil coupler to ignition coil assembly and connect spark plug to ignition coil assembly or high-tension cord. Ground spark plug.
4) Crank engine and check if each spark plug sparks.
5) If no spark is emitted, inspect the related parts as described under "Diagnosis" earlier in this section.



HIGH-TENSION CORDS

1) Disconnect high-tension cords (1) from ignition coil assemblies (2) while gripping each cap.
2) Pull out high-tension cords from spark plugs while gripping each cap.

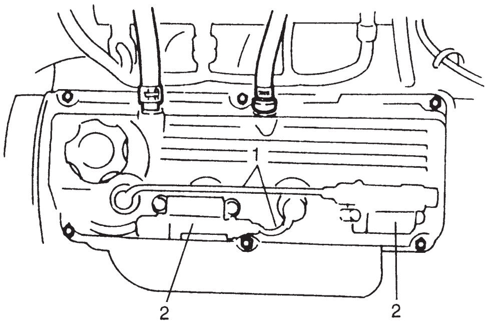
> **CAUTION:**
> **Pull out each connection by gripping cap portion so as not to damage their inside wire (resistive conductor).**



3) Measure resistance of high-tension cord (1) by using ohmmeter.

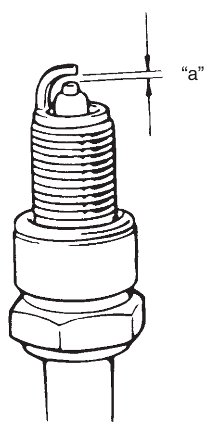
   High-tension cord resistance: 4 – 10 kΩ/m (1.2 – 3.0 kΩ/ft)

4) If resistance exceeds specification, replace high-tension cord(s).



5) Install high-tension cords (1) to spark plugs and ignition coil assemblies (2) while gripping each cap.

CAUTION:
- **Never attempt to use metal conductor high-tension cords as replacing parts.**
- **Insert each cap portion fully when installing high-tension cords.**



SPARK PLUGS

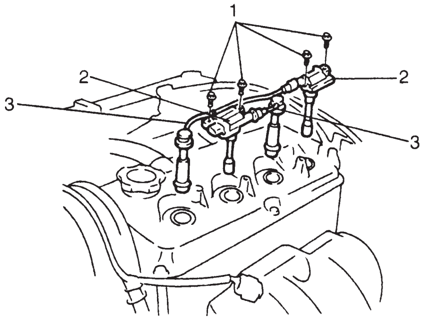
1) Pull out high-tension cords by gripping their caps and then remove ignition coil assemblies referring to IGNITION COIL ASSEMBLY in this section.
2) Remove spark plugs.
3) Inspect them for:
   - Electrode wear
   - Carbon deposits
   - Insulator damage
4) If any abnormality is found, adjust air gap, clean with spark plug cleaner or replace them with specified new plugs.

Spark plug air gap "a" : 1.0 – 1.1 mm (0.040 – 0.043 in.)
Spark plug type : NGK BKR6E-11
: DENSO K20PR-U11

5) Install spark plugs and torque them to specification.

Tightening Torque for spark plug
28 N·m (2.8 kg-m, 20.0 lb-ft)

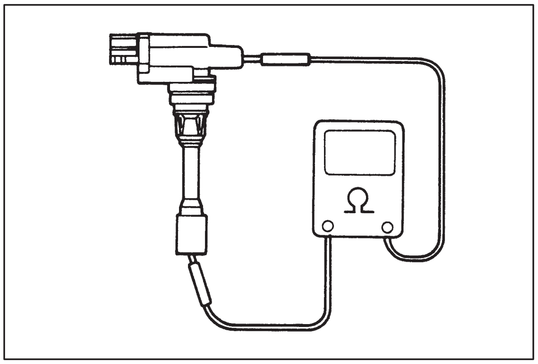
6) Install ignition coil assemblies referring to IGNITION COIL ASSEMBLY in this section.
7) Install high-tension cords securely by gripping their caps.



IGNITION COIL ASSEMBLY (INCLUDING IGNITOR)

Inspection

1) Disconnect negative cable at battery.
2) Disconnect ignition coil coupler.
3) Disconnect high-tension cord (3) from ignition coil assembly (2).
4) Remove ignition coil bolts (1) and then pull out ignition coil assembly.



5) Measure secondary coil for resistance.

Secondary coil resistance : 7.6 – 10.2 kΩ at 20°C, 68°F

If resistance is out of specification, replace ignition coil assembly.

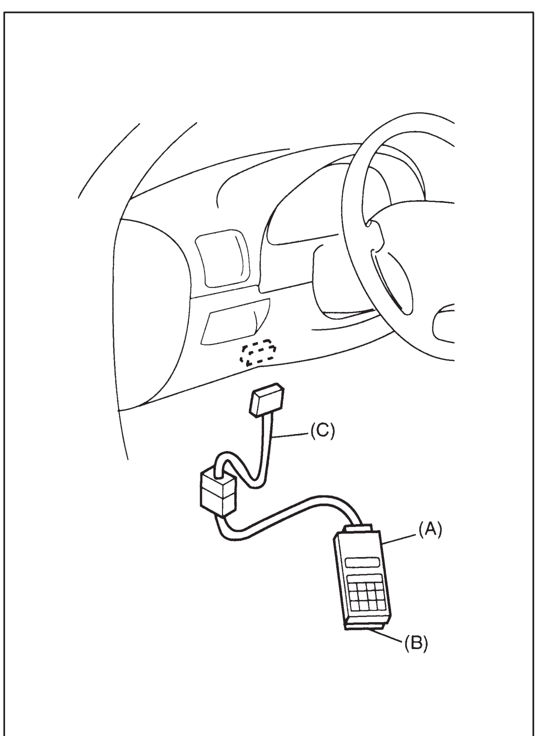
6) Install ignition coil assembly.
7) Tighten ignition coil bolts, and then connect ignition coil coupler.
8) Install high-tension cord to ignition coil assembly while gripping its cap.

CRANKSHAFT POSITION SENSOR (CKP SENSOR)

Refer to section 6E2 for removal, inspection and installation.

IGNITION TIMING

NOTE:
- **Ignition timing is not adjustable. If ignition timing is out of specification, check system related parts.**
- **Before starting engine, place transmission gear shift lever in “Neutral” (shift selector lever to “P” range for A/T model), and set parking brake.**



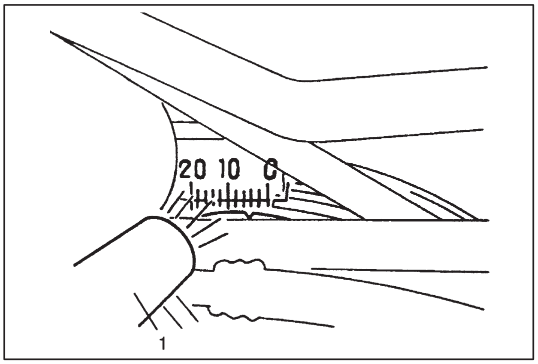
INSPECTION

1) Connect SUZUKI scan tool to DLC with ignition switch OFF.

Special Tool
(A): 09931-76011 (SUZUKI scan tool)
(B): Mass storage cartridge
(C): 09931-76030 (16/14 pin DLC cable)

2) Start engine and warm it up to normal operating temperature.
3) Make sure that all of electrical loads except ignition are switched off.
4) Check to be sure that idle speed is within specification. (Refer to SECTION 6E2)

5) Fix ignition timing to initial one as follow.
   Select "MISC" mode on SUZUKI scan tool and fix ignition timing to initial one.



6) Detach air cleaner case and shift air cleaner case and hose position to observe ignition timing.
7) Using timing light (1), check that ignition timing is within specification.

   Initial ignition timing (fixed with SUZUKI scan tool) : 5 ± 3° BTDC at idle speed
   Ignition order : 1-3-4-2

8) If ignition timing is out of specification, check the followings:
   - CKP sensor
   - Crankshaft timing belt pulley (signal rotor)
   - TP sensor
   - VSS
   - Timing belt cover installation
9) After checking Initial Ignition Timing, release ignition timing fixation by using SUZUKI scan tool.
10) With engine idling (throttle opening at closed position and vehicle stopped), check that ignition timing is about 9°–15° BTDC. (Constant variation within a few degrees from 9°–15° indicates no abnormality but proves operation of electronic timing control system.) Also, check that increasing engine speed advances ignition timing.
    If above check results are not satisfactory, check CKP sensor and ECM (PCM).
11) Install air cleaner case.

SPECIAL TOOLS

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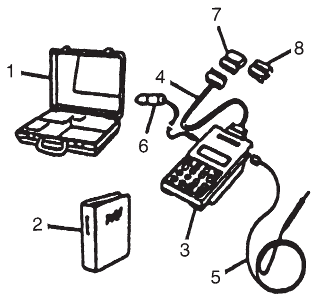

1. Storage case
2. Operator’s manual
3. Tech 1A
4. DLC cable (14/26 pin, 09931-76040)
5. Test lead/probe
6. Power source cable
7. DLC cable adaptor
8. Self-test adaptor

09931-76011
SUZUKI scan tool (Tech 1A) kit

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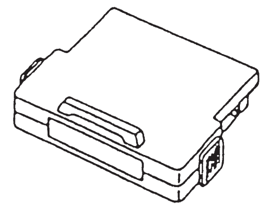

Mass storage cartridge

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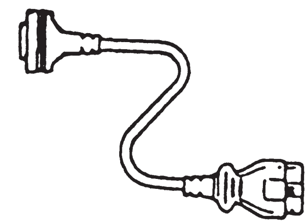


09931-76030
16/14 pin DLC cable

</td>
</tr>
</table>

SECTION 6K

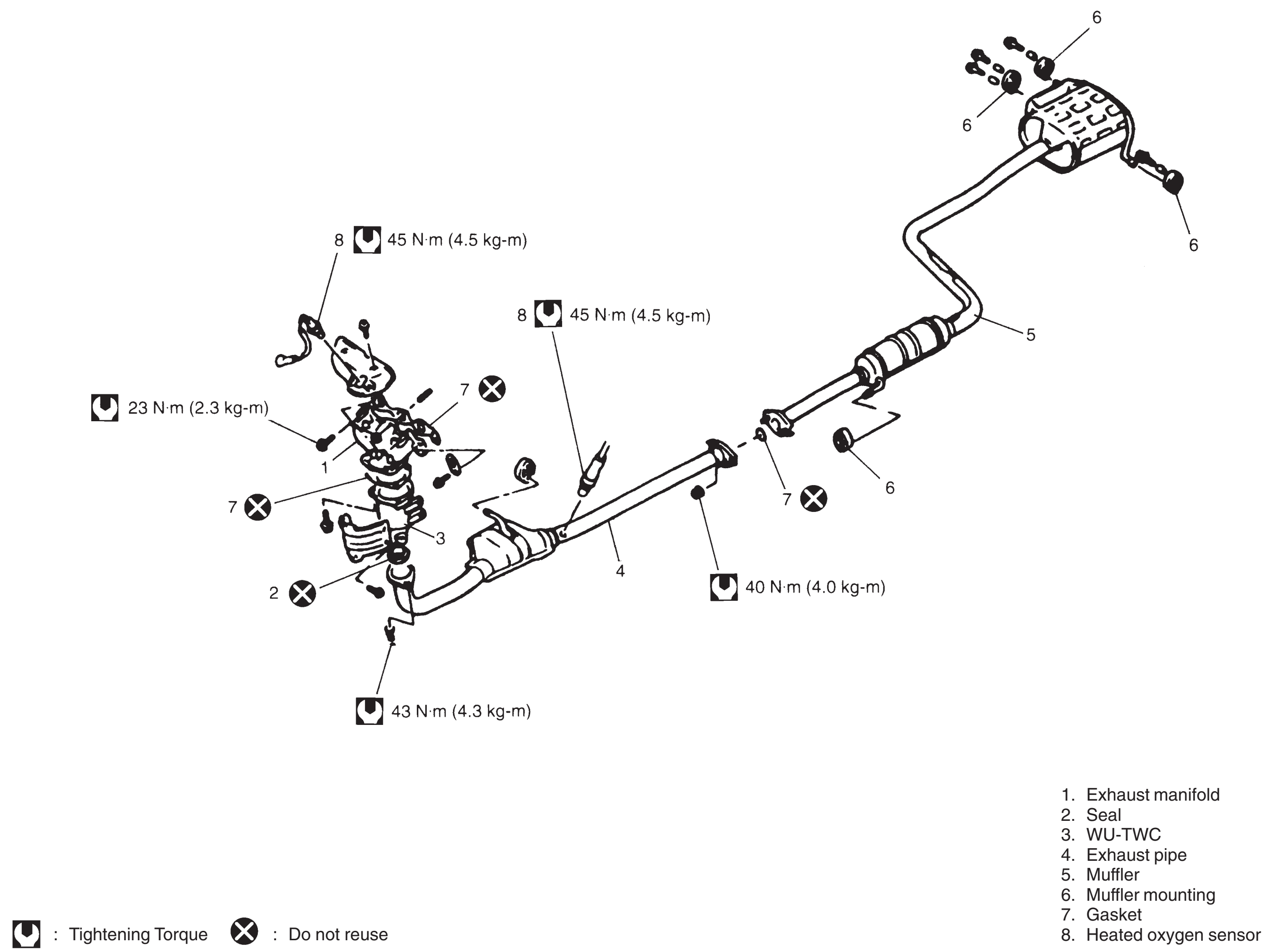
EXHAUST SYSTEM

NOTE:
For the descriptions (items) not found in this section, refer to the same section of Service Manual mentioned in FOREWORD of this manual.

CONTENTS

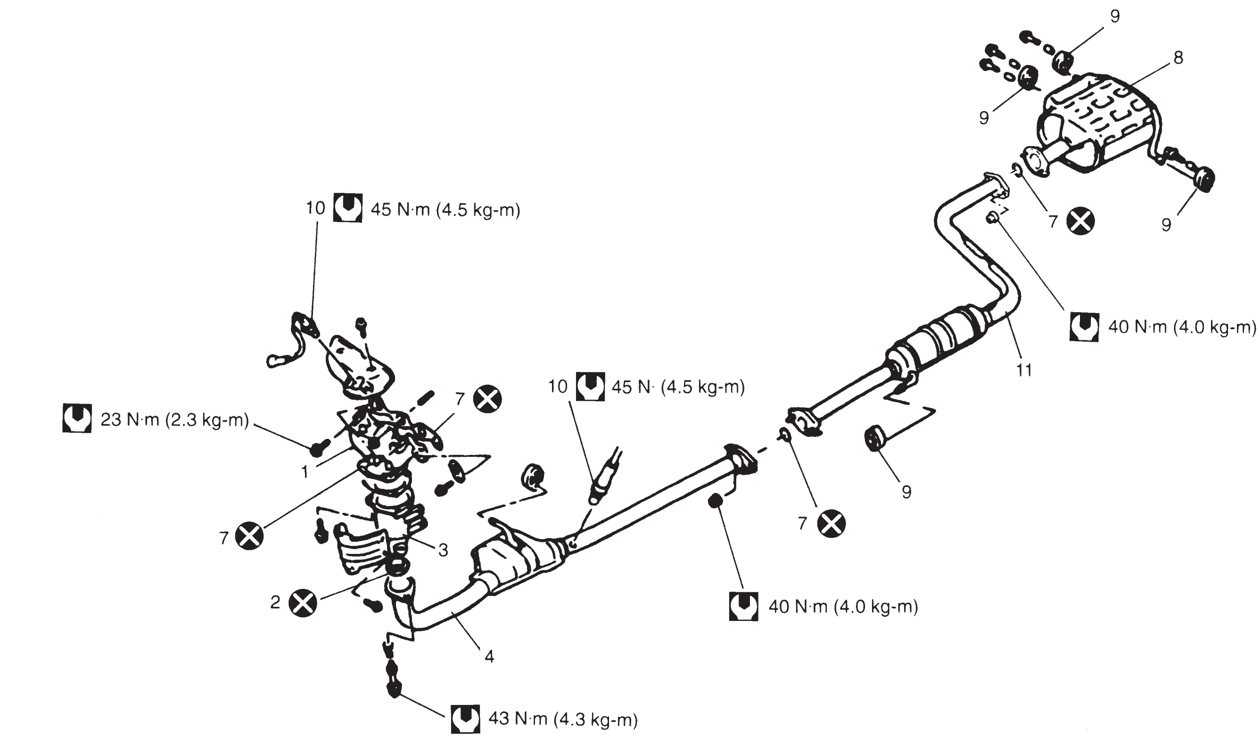
ON-VEHICLE SERVICE

[For 1.0 ℓ 2WD H/B model]

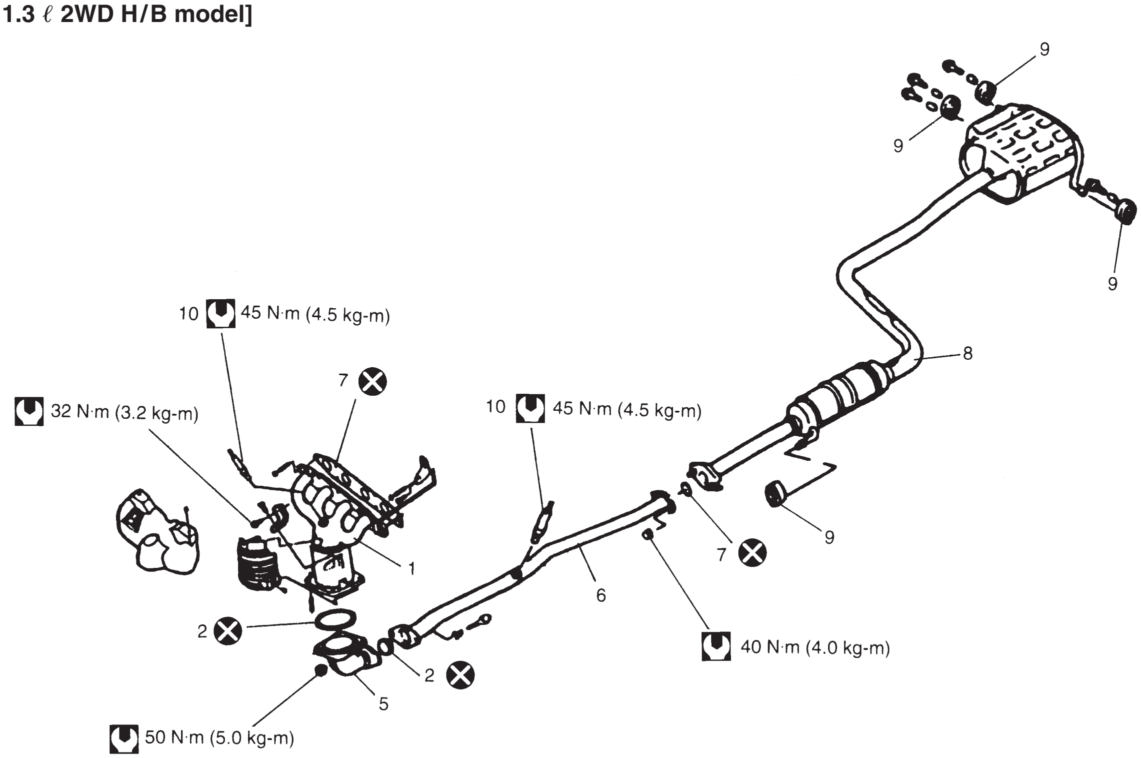


1. Exhaust manifold
2. Seal
3. WU-TWC
4. Exhaust pipe
5. Muffler
6. Muffler mounting
7. Gasket
8. Heated oxygen sensor

[For 1.0 ℓ 2WD N/B model]



[For 1.3 ℓ 2WD H/B model]

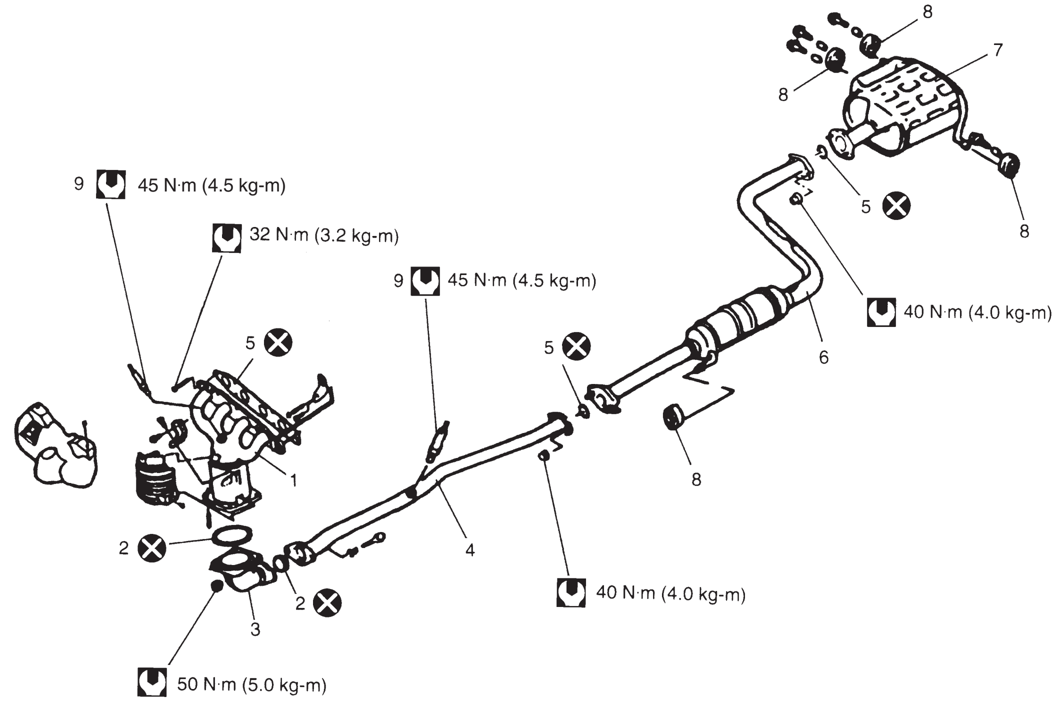


1. Exhaust manifold
2. Seal
3. WU-TWC
4. Exhaust pipe
5. Exhaust No.1 pipe
6. Exhaust No.2 pipe
7. Gasket
8. Muffler
9. Muffler mounting
10. Heated oxygen sensor
11. Exhaust center pipe

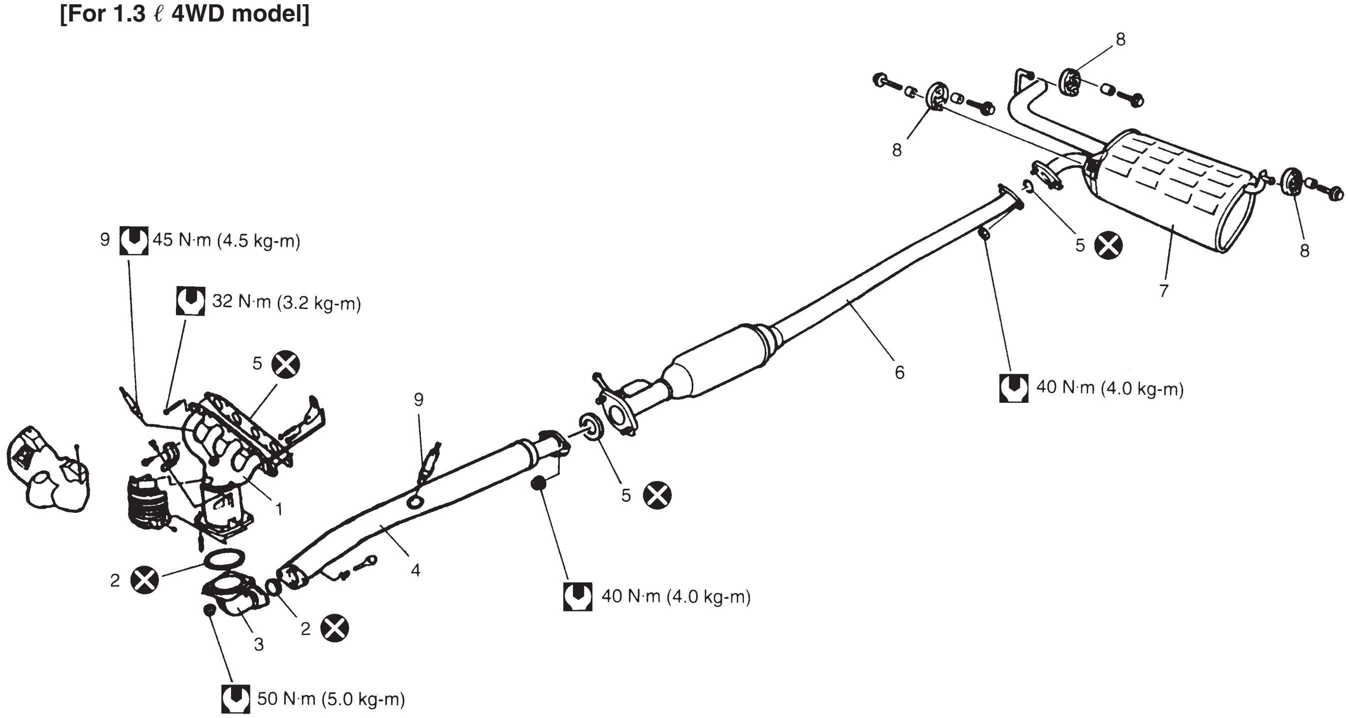
: Do not reuse

: Tightening Torque

[For 1.3 ℓ 2WD N/B model]



[For 1.3 ℓ 4WD model]



1. Exhaust manifold
2. Seal
3. Exhaust No.1 pipe
4. Exhaust No.2 pipe
5. Gasket
6. Exhaust center pipe
7. Muffler
8. Muffler mounting
9. Heated oxygen sensor

Ⓧ : Do not reuse

: Tightening Torque

SECTION 7B

AUTOMATIC TRANSMISSION (3 A/T) (VEHICLE WITH WU-TWC)

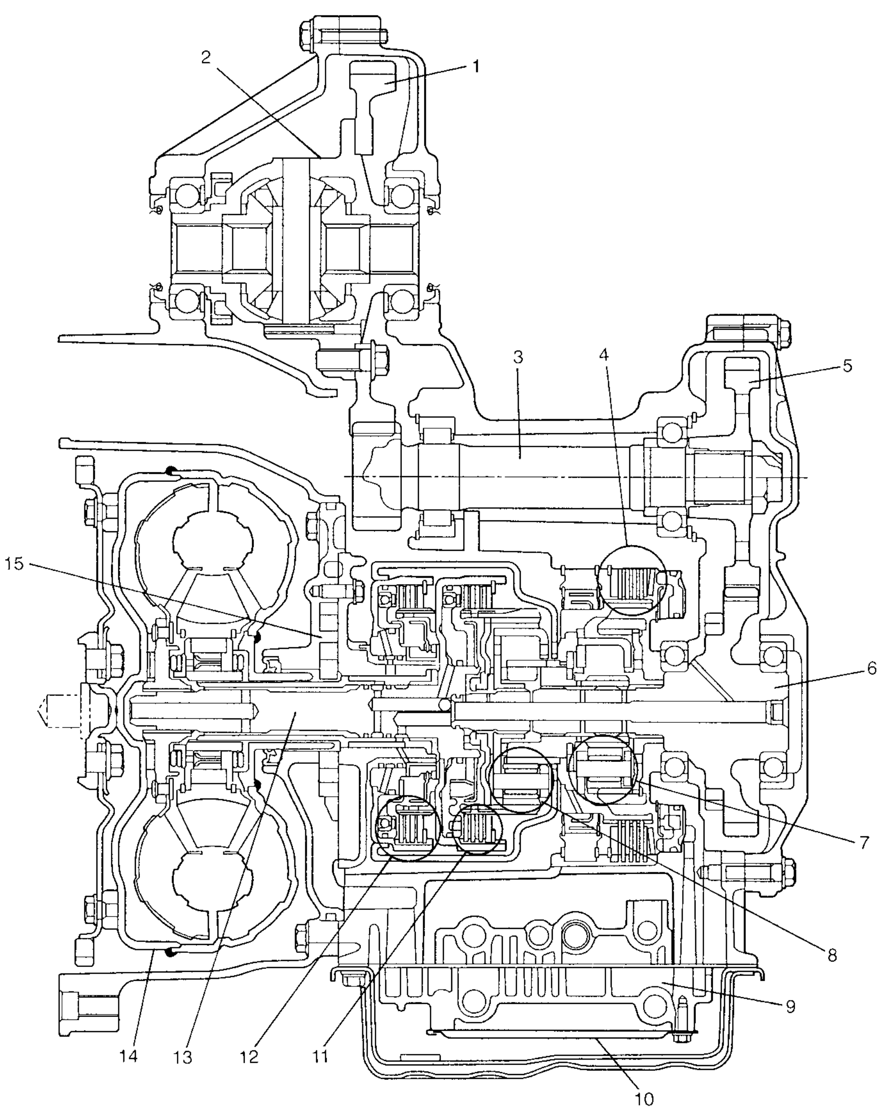
WARNING:
For vehicles equipped with Supplemental Restraint (Air Bag) System:
- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "Air Bag System Components and Wiring Location View" under "General Description" in air bag system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

NOTE:
For the descriptions (items) not found in this section, refer to the same section of the Service Manual mentioned in the FOREWORD of this manual.

CONTENTS

GENERAL DESCRIPTION

The automatic transmission consists of the hydraulic torque converter, electronically controlled 3-speed automatic transmission, countershaft and differential.
The transmission consists of 2 planetary gears, 2 disk clutches, 1 band brake, 1 disk brake and 1 one-way clutch.
Its operation is controlled by selecting a position from 6 positions (P, R, N, D, 2 and L ranges) manually by means of the selector lever installed on the compartment floor.
In the D or 2 range, the gear ratio is changed for the 1st, 2nd or 3rd speed (D range only) automatically by engine control module (electronic control).
For the automatic transmission fluid, DEXRON®-IIE, DEXRON®-III or its equivalent must be used. Lubrication in the automatic transmission is provided by the oil pump which is operated by the engine revolution. Therefore, the engine should not be stopped even during coasting to obtain proper lubrication.
When it becomes necessary to be towed, front wheels must be raised so as not to roll them.



1. Final gear
2. Differential gear assembly
3. Counter shaft
4. 1st and reverse brake
5. Counter driven gear
6. Output shaft
7. Rear planetary gear
8. Front planetary gear
9. Valve body assembly
10. Oil strainer
11. Forward clutch
12. Direct clutch
13. Input shaft
14. Torque converter
15. Oil pump

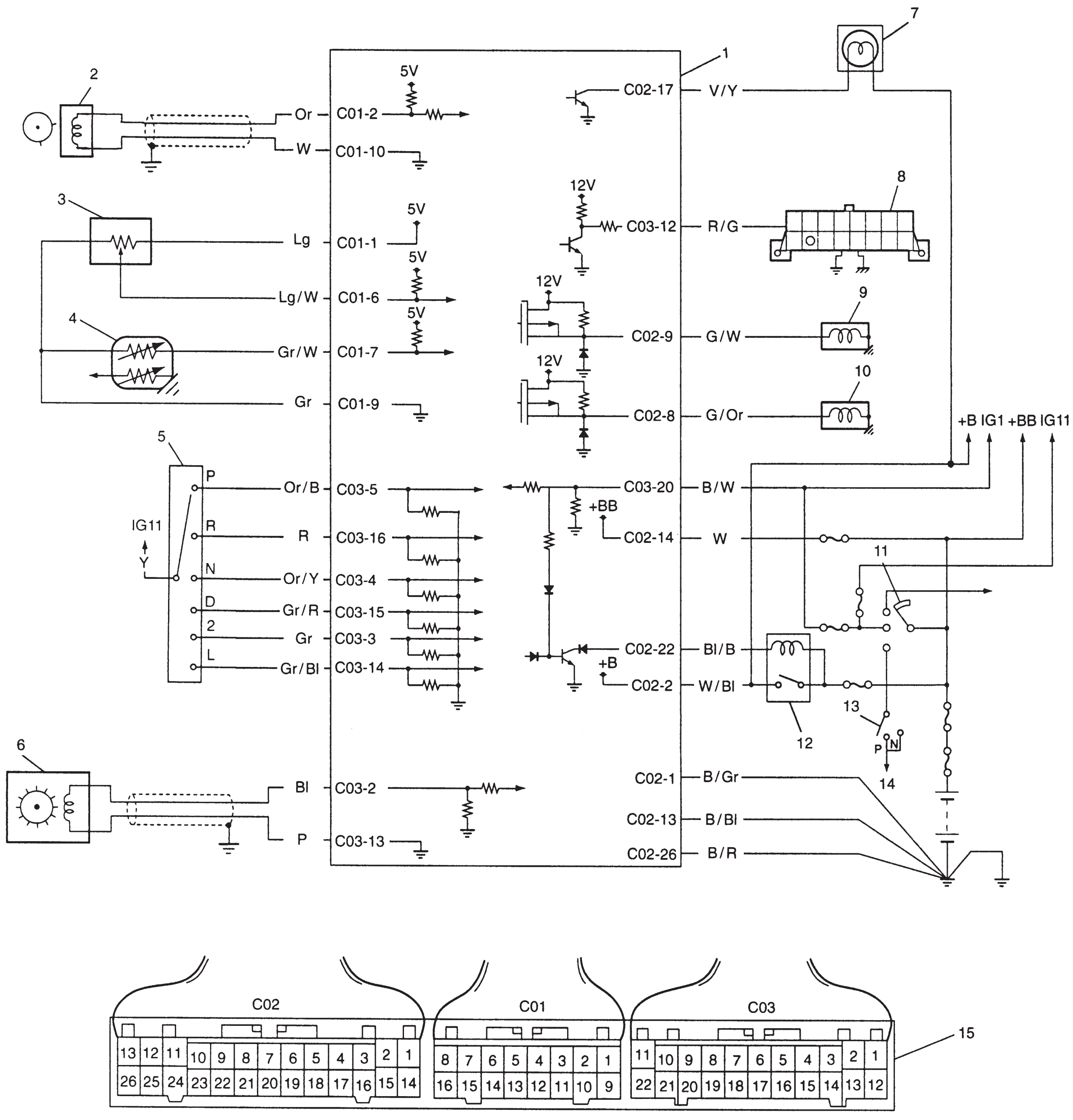
COMPONENTS OPERATION CHART

Range	Gear	Forward Clutch	Direct Clutch	Second Brake	1st & Reverse Brake	One-way Clutch	Parking Lock Pawl
P	Parking	–	–	–	**○	–	○
R	Reverse	–	○	–	○	–	–
N	Neutral	–	–	–	–	–	–
D	1st	○	–	–	–	○	–
	2nd	○	–	○	–	–	–
	3rd	○	○	–	–	–	–
2	1st	○	–	–	–	○	–
	2nd	○	–	○	–	–	–
L	1st	○	–	–	○	○	–
	*2nd	○	–	○	–	–	–

○: Operated
*: To prevent over-revolution of engine, this 2nd gear is operated only when selector lever is shifted to L range at a higher than 37 km/h (23 mile/h) (G10 engine model), 40 km/h (25 mile/h) (G13 engine model) speed.
**: When engine is running.

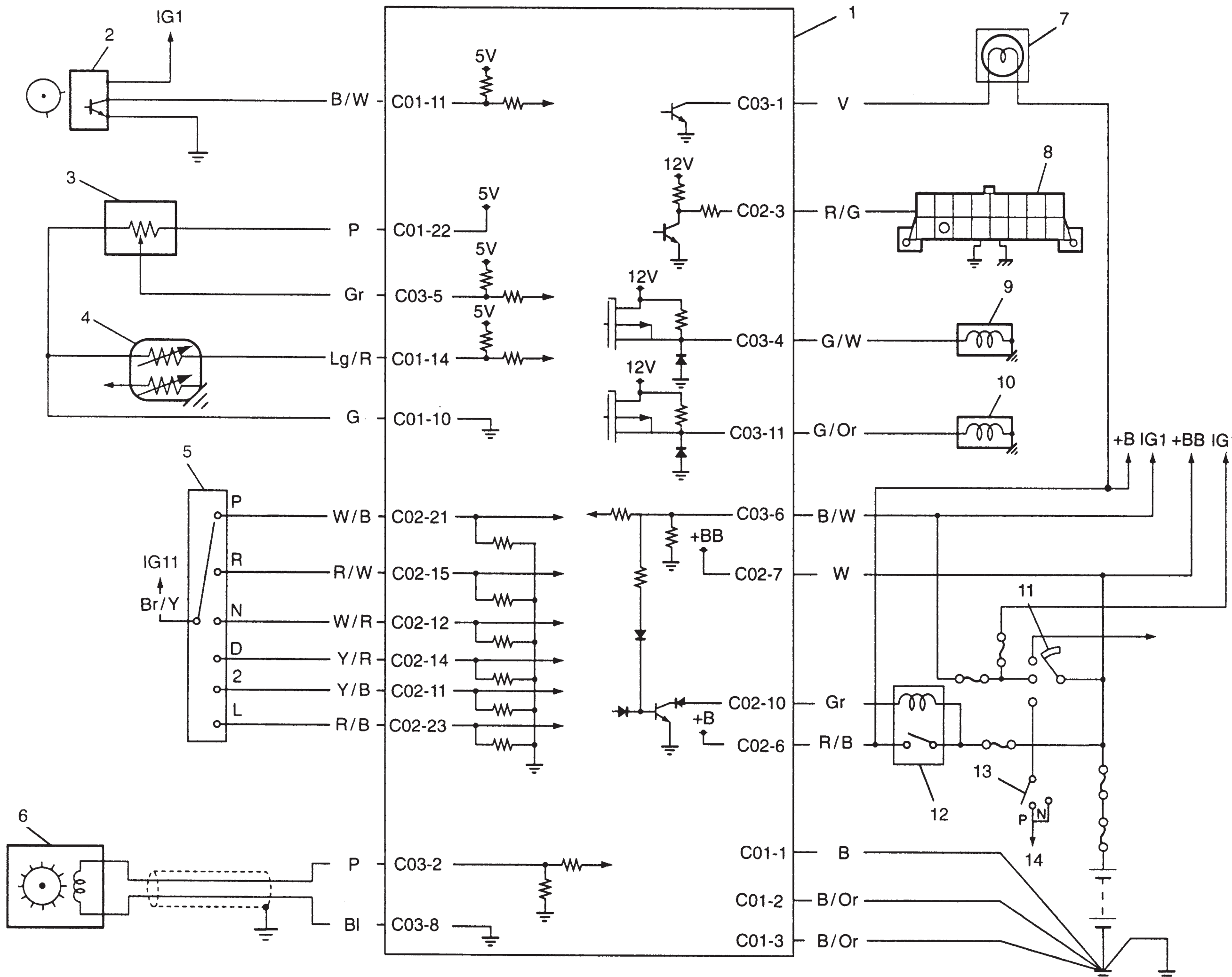
ELECTRONIC SHIFT CONTROL SYSTEM

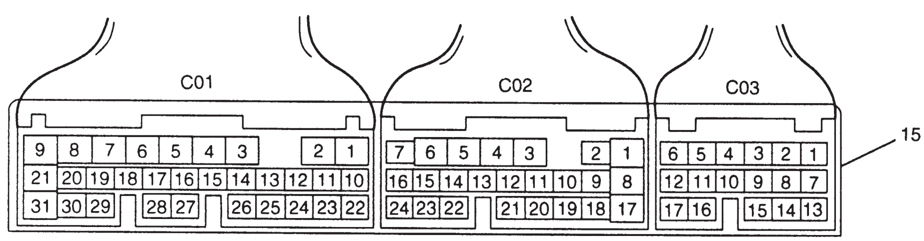
[G10 Engine Model]



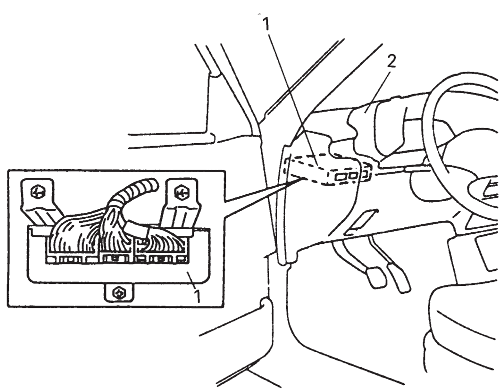
1. PCM
2. Camshaft position (CMP) sensor
3. Throttle position (TP) sensor
4. Engine coolant temperature (ECT) sensor
5. Transmission range sensor (shift switch)
6. Output shaft speed sensor (A/T VSS)
7. Malfunction indicator lamp (MIL)
8. Data link connector (DLC)
9. Shift solenoid-A (No.1, Direct clutch solenoid valve)
10. Shift solenoid-B (No.2, 2nd brake solenoid valve)
11. Ignition switch
12. Main relay
13. Inhibitor switch
14. To starter
15. Terminal arrangement of PCM coupler (Viewed from harness side)

[G13 Engine Model]





1. PCM
2. Camshaft position (CMP) sensor
3. Throttle position (TP) sensor
4. Engine coolant temperature (ECT) sensor
5. Transmission range sensor (shift switch)
6. Output shaft speed sensor (A/T VSS)
7. Malfunction indicator lamp (MIL)
8. Data link connector (DLC)
9. Shift solenoid-A
   (No.1, Direct clutch solenoid valve)
10. Shift solenoid-B
   (No.2, 2nd brake solenoid valve)
11. Ignition switch
12. Main relay
13. Inhibitor switch
14. To starter
15. Terminal arrangement of PCM coupler
   (Viewed from harness side)

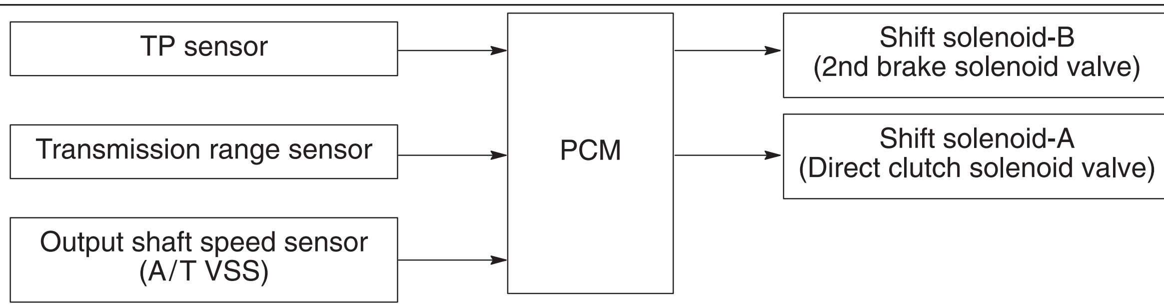


1. PCM
2. Instrument panel

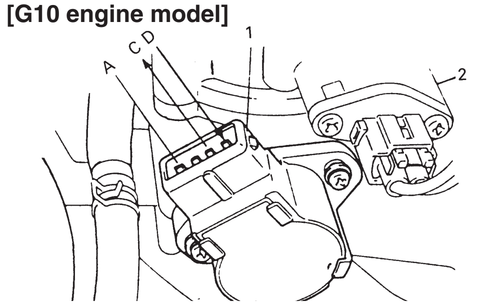
POWERTRAIN CONTROL MODULE (PCM)

The powertrain control module controls the shift solenoid B (2nd brake solenoid valve) and the shift solenoid A (direct clutch solenoid valve) by sending electric signals to them so as to attain automatic gear shift between the 1st and 2nd gears, and the 2nd and 3rd gears. Equipped as PCM sensed parameters are the throttle position sensor, transmission range switch and vehicle speed sensor. These switch and sensors sense the throttle valve opening, selector lever's position and vehicle speed, and send those signals to the powertrain control module. Then, the powertrain control module opens and closes valves of the above solenoids according to these signals. The powertrain control module is installed to the underside of the instrument panel at the driver's seat side.

GEAR SHIFT CONTROL SYSTEM

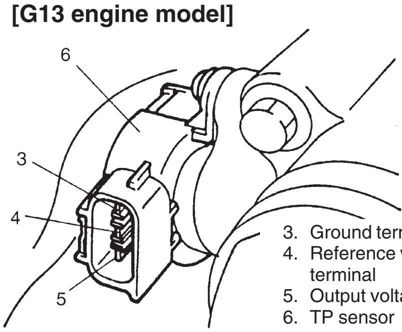


[G10 engine model]



1. Throttle position sensor
2. Throttle body
A: Ground
C: Output voltage (opening angle signal)
D: Power supply from ECM (reference voltage)

[G13 engine model]

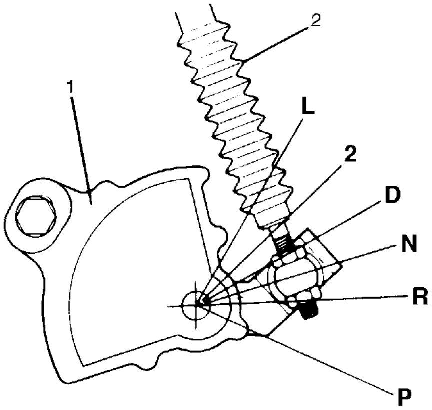


3. Ground terminal
4. Reference voltage terminal
5. Output voltage terminal
6. TP sensor

THROTTLE POSITION SENSOR (TP sensor)

The throttle position sensor consisting of a potentiometer is connected to the throttle valve shaft.

Throttle valve opening signal (output voltage) is transmitted from throttle position sensor to PCM as voltage signal. PCM uses it as one of the signals to control transmission gear shift.



1. Transmission range sensor
2. Select cable

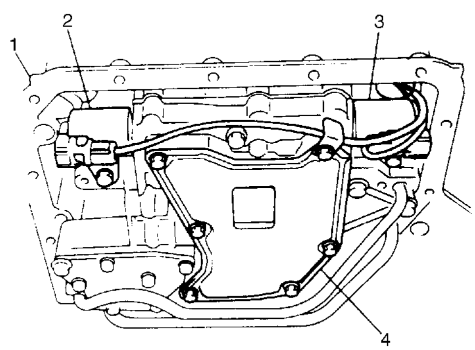
TRANSMISSION RANGE SENSOR (SHIFT SWITCH)

Being linked with the selector lever, this sensor changes selector lever positions into electric signals and send them to the engine control module. The contact points of this sensor for P and N ranges are also connected with the starting motor circuit.

So when the selector lever is shifted to the P or N range position, the contact points for P or N range are connected and cause the starting motor to operate by turning the starter switch ON.

When the selector lever is in any other position than P and N ranges, the sensor remains OFF and therefore the starting motor cannot be operated, that is, the engine cannot be started.

Also, as its contact point for R range is connected with the backup lamp circuit, only when the selector lever is shifted to R range, the contact point contacts to light the backup lamp.



1. Transmission
2. Shift solenoid-B (No.2, 2nd brake solenoid valve)
3. Shift solenoid-A (No.1, direct clutch solenoid valve)
4. Oil strainer

DIRECT CLUTCH AND 2ND BRAKE SOLENOID VALVES

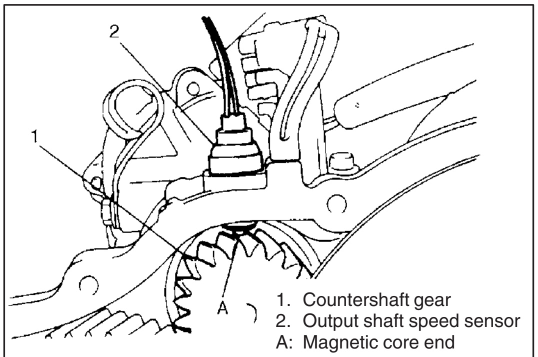
These solenoid valves are mounted on the valve body. They are turned ON and OFF by the signals from the engine control module and actuate each shift valve (1 – 2 and 2 – 3 valves) so as to control transmission gear shift.

Shift solenoid-B (2nd brake solenoid valve) operates 1 – 2 shift valve, and shift solenoid-A (direct clutch solenoid valve) does 2 – 3 shift valve.

OPERATION OF DIRECT CLUTCH AND 2ND BRAKE SOLENOIDS

Range	D			2		L		P, N & R
Gear	1st	2nd	3rd	1st	2nd	1st	(2nd)	–
Shift solenoid-A (No.1) (Direct clutch solenoid valve)	○	○	×	×	○	×	×	×
Shift solenoid-B (No.2) (2nd brake solenoid valve)	○	×	×	○	×	×	○	×

○: Operated (Solenoid Valve is Open) ×: Unoperated (Solenoid Valve is Closed)



1. Countershaft gear
2. Output shaft speed sensor
A: Magnetic core end

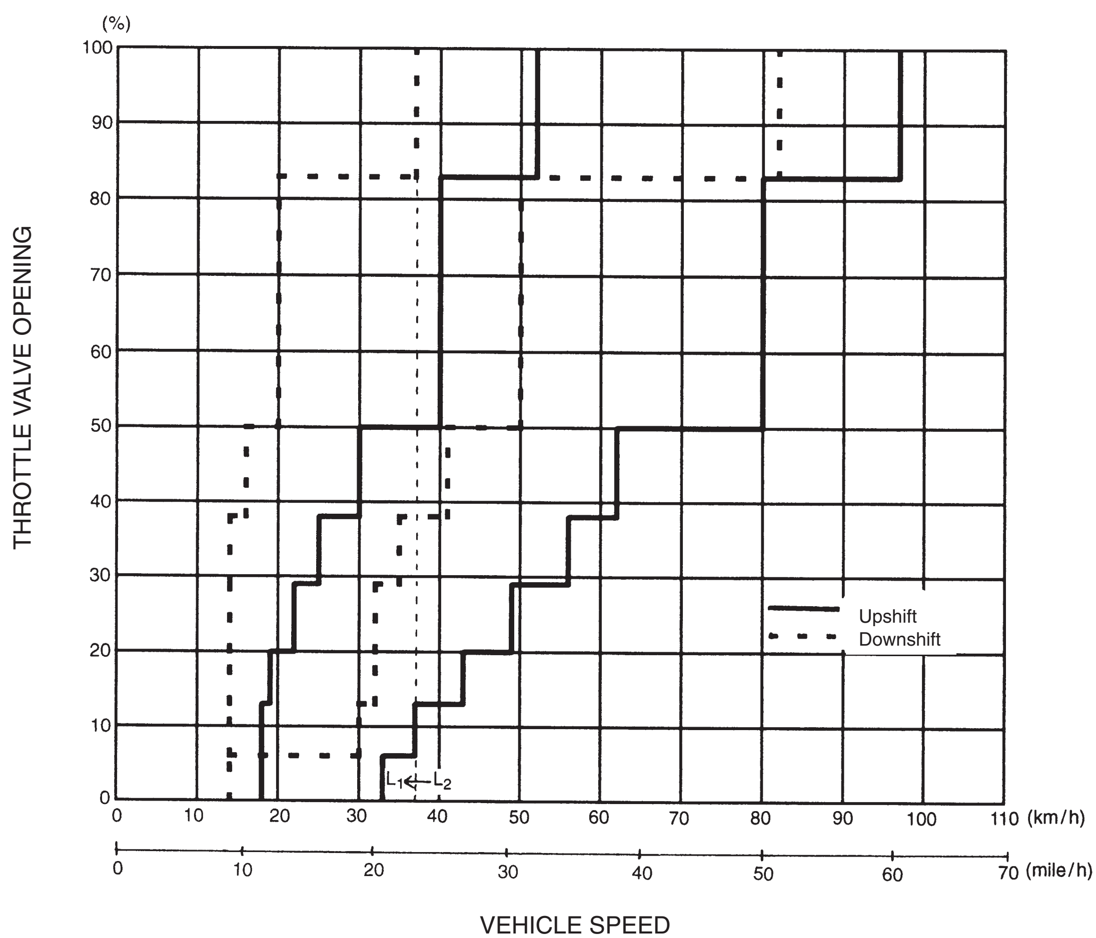
OUTPUT SHAFT SPEED SENSOR (A/T VSS)

The output shaft speed sensor consists of a magnetic core with magnet and coil. It is mounted on transmission case with 0.6 mm (0.024 in.) air gap between the core end and countershaft gear tooth.
While the countershaft rotates, magnetic flux is cut by gear tooth thus a pulse is generated in the sensor coil according to the speed. And then, the pulse is transmitted to engine control module as speed signal.

AUTOMATIC SHIFT DIAGRAM

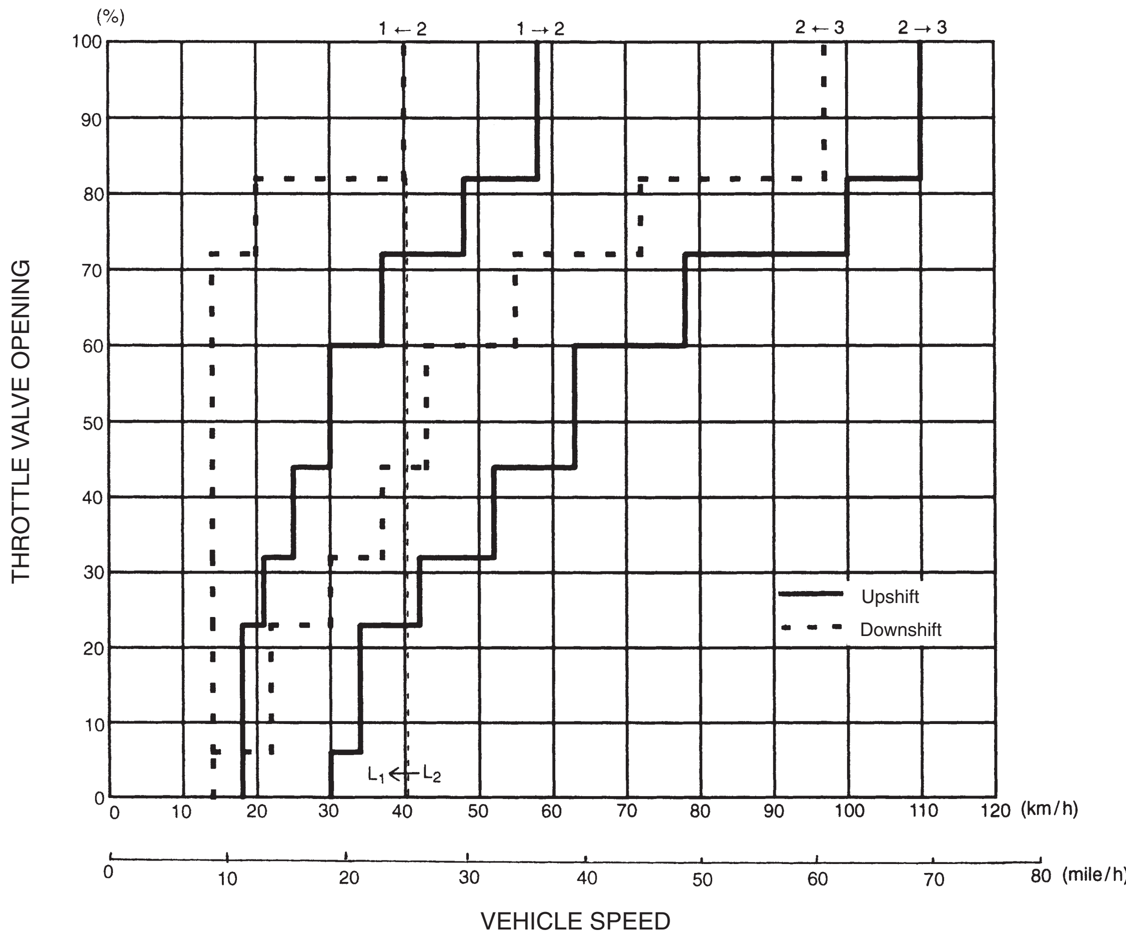
Automatic shift schedule as a result of shift control is shown below. In case that selector lever is shifted to L range at a higher than 37 km/h (23 mile/h) (G10 engine model), 40 km/h (25 mile/h) (G13 engine model) speed, 2nd gear is operated and then down shifts to 1st at a speed lower than that. No up shift is available in L range.

[G10 Engine Model]



Throttle	Speed	Selector / Gear				
	Selector	D or 2	D		D or 2	L
	Gear	1→2	2→3	3→2	2→1	2→1
Full close	km/h	18	33	14	14	37
	mile/h	11	21	9	9	23
Full open	km/h	52	97	82	37	37
	mile/h	33	61	51	23	23

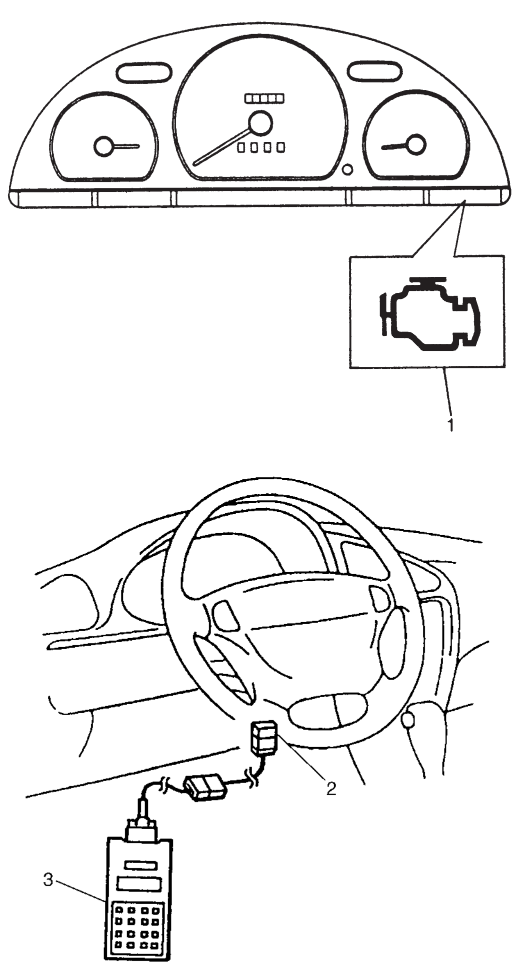
[G13 Engine Model]



Throttle	Speed	Selector: D or 2	D		D or 2	L
	Gear	1→2	2→3	3→2	2→1	2→1
Full close	km/h	18	30	14	14	40
	mile/h	11	19	9	9	25
Full open	km/h	58	110	97	40	40
	mile/h	36	69	61	25	25

DIAGNOSIS

This vehicle is equipped with an electronic transmission control system, which control the automatic shift up and shift down timing, 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. Malfunction indicator lamp (MIL)
2. Data link connector (DLC)
3. SUZUKI scan tool (Tech-1)

ON-BOARD DIAGNOSTIC SYSTEM

For automatic transmission control system, PCM (ECM) has following functions. Refer to Section 6 or 6-1 for details.

- When ignition switch is turned ON with engine at a stop malfunction indicator lamp (MIL) turns ON to check bulb of MIL.
- When PCM detects a malfunction in A/T control system (and/or a malfunction which gives an adverse effect to vehicle emission) while engine is running, it makes malfunction indicator lamp in meter cluster of instrument panel turn ON and stores malfunction area (DTC) in its memory.
  If it detects that continuously 3 driving cycles are normal after detecting a malfunction, however, it makes MIL turn OFF although DTC stored in its memory will remain.
- It is possible to communicate with PCM through data link connecter (DLC) by using SUZUKI scan tool (Tech-1).
  (Diagnostic information can be checked and erased by using a scan tool)

2 Driving Cycle Detection Logic

Refer to Section 6 or 6-1 for details.

Freeze Frame Data

Refer to Section 6 or 6-1 for details.

PRECAUTION IN DIAGNOSING TROUBLE

- Don't disconnect couplers from PCM, battery cable from battery, PMC 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.
- Using SUZUKI scan tool (Tech-1) the diagnostic information stored in PCM memory can be checked and cleared as well. Before its use, be sure to read Operator's (instruction) Manual supplied with it carefully to have good understanding of its functions and usage.
- Priorities for diagnosing troubles
  If two or more diagnostic trouble codes (DTCs) are stored, proceed to flow table (chart) of DTC which was detected earliest in order and follow instruction in that table (chart).
  If no instructions are given, troubleshoot diagnostic trouble codes according to the following priorities.
  1. Diagnostic trouble codes (DTCs) other than DTC P0171/P0172 (Fuel system too lean/too rich), DTC P0300/P0301/P0302/P0303/P0304 (Misfire detected) and DTC P0400 (EGR flow malfunction)
  2. DTC P0171/P0172 (Fuel system too lean/too rich) and DTC P0400 (EGR flow malfunction)
  3. DTC P0300/P0301/P0302/P0303/P0304 (Misfire detected)
- Be sure to read "PRECAUTION FOR ELECTRICAL CIRCUIT SERVICE" in Section 0A before inspection and observe what is written there.
- PCM replacement
  When substituting a known-good PCM, check for following conditions.
  Neglecting this check may result in damage to good PCM.
  – All relays and actuators have resistance of specified value.
  – MAF sensor, TP sensor and fuel tank pressure sensor (if equipped) 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.

<table>
<tr><th>STEP</th><th>ACTION</th><th>YES</th><th>NO</th></tr>
<tr><td>1</td><td>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?</td><td>Go to Step 2.</td><td>Perform customer complaint analysis.</td></tr>
<tr><td>2</td><td>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)?</td><td>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.</td><td>Go to Step 4.</td></tr>
<tr><td>3</td><td>Visual Inspection
1) Perform visual inspection referring to the next page.
Is there any faulty condition?</td><td rowspan="2">1) Repair or replace malfunction part.
2) Go to Step 11.</td><td>Go to Step 5.</td></tr>
<tr><td>4</td><td>Visual Inspection
1) Perform visual inspection referring to the next page.
Is there any faulty condition?</td><td>Go to Step 8.</td></tr>
<tr><td>5</td><td>Trouble Symptom Confirmation
1) Confirm trouble symptom referring to the next page.
Is trouble symptom identified?</td><td>Go to Step 6.</td><td>Go to Step 7.</td></tr>
<tr><td>6</td><td>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)?</td><td>Go to Step 9.</td><td>Go to Step 8.</td></tr>
<tr><td>7</td><td>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)?</td><td>Go to Step 9.</td><td>Go to Step 10.</td></tr>
<tr><td>8</td><td>Automatic Transmission Basic Inspection and Symptoms-to-Inspection Table
1) Check and repair according to “A/T BASIC CHECK” and “SYMPTOM-TO-INSPECTION TABLE” in this section.
Are check and repair complete?</td><td rowspan="2">Go to Step 11.</td><td rowspan="2">1) Check and repair malfunction part(s).
2) Go to Step 11.</td></tr>
<tr><td>9</td><td>Trouble shooting for DTC
1) Check and repair according to applicable DTC flow Table.
Are check and repair complete?</td></tr>
<tr><td>10</td><td>Check for Intermittent Problems
1) Check for intermittent problems referring to the next page.
Is there any faulty condition?</td><td>1) Repair or replace malfunction part(s).
2) Go to Step 11.</td><td>Go to Step 11.</td></tr>
<tr><td>11</td><td>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?</td><td>Go to Step 6.</td><td>End.</td></tr>
</table>

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 (shown in next page) 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” in this 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” in this 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 engine and automatic transmission referring to “VISUAL INSPECTION” in this section.

5. **TROUBLE SYMPTOM CONFIRMATION**
   Check trouble symptoms based on information obtained in Step 1 “Customer complaint analysis” and Step 2 “DTC/freeze frame data check”.
   Also, reconfirm DTC according to “DTC CONFIRMATION PROCEDURE” described in each “DTC Flow Table” in this section.

6. **and 7. RECHECKING AND RECORD OF DTC/FREEZE FRAME DATA**
   Refer to “DTC CHECK” in this section for checking procedure.

8. **AUTOMATIC TRANSMISSION BASIC CHECK AND SYMPTOM-TO-INSPECTION TABLE**
   Perform basic check of A/T according to “AUTOMATIC TRANSMISSION 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 “SYMPTOM -TO- INSPECTION 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 “DTC 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 vehicle 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 check to ensure that no DTC is indicated.

CUSTOMER PROBLEM INSPECTION FORM (EXAMPLE)

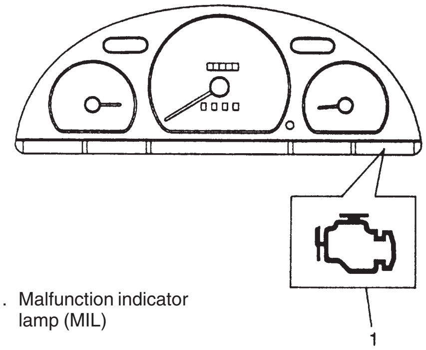
User name:	Model:	VIN:	
Date of issue:	Date Reg.	Date of problem:	Mileage:

PROBLEM SYMPTOMS
☐ Vehicle does not move (R, D, 2, L range) ☐ No upshift automatically (☐ 1st to 2nd ☐ 2nd to 3rd ☐ 2 range ☐ D range) ☐ No downshift automatically (☐ 3rd to 2nd ☐ 2nd to 1st ☐ 2 range ☐ D range) ☐ No gear change manually (☐ 1st ↔ 2nd ☐ 2nd ↔ 3rd) ☐ Automatic shift point too high or too low ☐ Excessive gear change shock (1st/2nd/3rd/Reverse) ☐ No kickdown ☐ Transmission slipping in (1st/2nd/3rd/Reverse) ☐ Others ______________________________

VEHICLE/ENVIRONMENTAL CONDITION WHEN PROBLEM OCCURS	
Environmental Condition	
Weather	☐ Fair ☐ Cloudy ☐ Rain ☐ Snow ☐ Always ☐ Other ____________________
Temperature	(°F/ °C) ☐ Hot ☐ Warm ☐ Cool ☐ Cold ☐ always
Frequency	☐ Always ☐ Sometimes (times/ day, month) ☐ Only once ☐ Under certain condition
Road	☐ Urban ☐ Suburb ☐ Highway ☐ Mountainous ☐ Uphill ☐ Downhill ☐ Tarmacadam ☐ Grave ☐ Other ________________
Vehicle Condition	
Engine & transmission condition	☐ Cold/☐ Warming up phase/ ☐ Warmed up Engine speed (r/min) Throttle opening (☐ Idle/☐ About %/☐ full)
Vehicle condition	☐ At stop/ ☐ During driving (☐ Constant speed ☐ Accelerating ☐ Decelerating) ☐ Right hand corner ☐ Left hand corner ☐ Vehicle speed (km/h Mile/h) ☐ Other ____________________

Malfunction indicator lamp	☐ Blink ☐ Always ON ☐ Sometimes ON ☐ Always OFF ☐ Good condition
Diagnostic trouble code	First check: ☐ No code ☐ Malfunction code ( )
	Second check: ☐ No code ☐ Malfunction code ( )

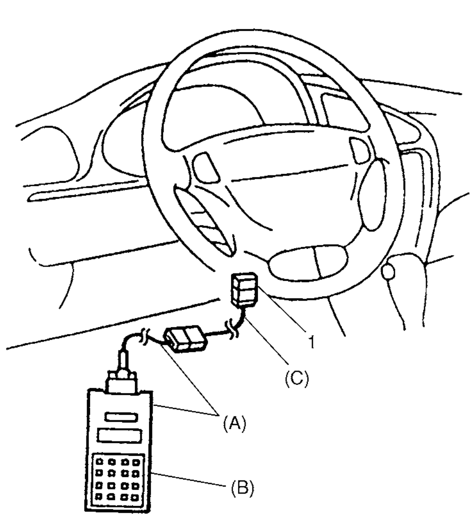
NOTE:
The above form is a standard sample. It should be modified according to conditions characteristic of each market.



1. Malfunction indicator lamp (MIL)

MALFUNCTION INDICATOR LAMP (MIL) CHECK

Refer to the same item in Section 6 or 6-1 for checking procedure.



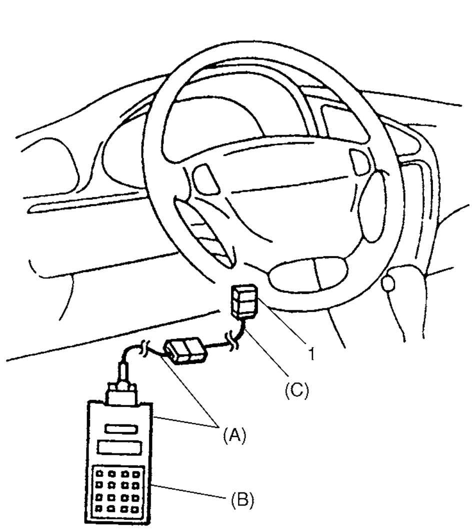
1. Data link connector (DLC)

DIAGNOSTIC TROUBLE CODE(S) CHECK

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 (16/14 pin DLC cable)

3) Turn ignition switch ON.
4) Read DTC according to instructions displayed on SUZUKI scan tool and print it or write it down. Refer to SUZUKI scan tool operator's manual for further details.
5) After completing the check, turn ignition switch OFF and disconnect SUZUKI scan tool from data link connector (DLC).



1. Data link connector (DLC)

DIAGNOSTIC TROUBLE CODE(S) CLEARANCE

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 (16/14 pin DLC cable)

3) Turn ignition switch ON.
4) Erase DTC according to instructions displayed on SUZUKI scan tool. Refer to SUZUKI scan tool operator's manual for further details.
5) After completing the check, turn ignition switch OFF and disconnect SUZUKI scan tool from data link connector (DLC).

DIAGNOSTIC TROUBLE CODE (DTC) TABLE

DTC NO.	DETECTING ITEM	DETECTING CONDITION (DTC will set when detecting:)	MIL
P0705	Transmission range sensor circuit malfunction	No signal or multiple signals inputted with shifted in "D" range.	1 driving cycle
P0720	Output speed sensor circuit malfunction	No signal inputted while running vehicle with "D" or "2" range.	1 driving cycle
P0751	Shift solenoid-A performance or stuck off	While running in "D" range, engine speed as compared to vehicle speed higher or lower than specified value	2 driving cycles
P0756	Shift solenoid-B performance or stuck off		
P0753	Shift solenoid-A electrical	Output command from PCM and output voltage do not agree. (Solenoid circuit shorted to ground or open)	1 driving cycle
P0758	Shift solenoid-B electrical		

FAIL-SAFE TABLE

DTC No.	DETECTED ITEM	FAIL-SAFE OPERATION	
P0705	Transmission range sensor (switch) circuit malfunction	No signal inputted	PCM controls solenoids on "L" range base.
		Multiple signal inputted	PCM controls solenoids according to following priority order. L > R > D > 2 > N > P
P0720	Output speed sensor (A/T VSS) circuit malfunction	Gear is held at 3rd gear when in "D" range and at 2nd gear when in "2" range.	
P0753	Shift solenoid-A electrical	When short circuit is detected, PCM does not output ON command to shift solenoid until vehicle stops and selector lever is shifted to "P" or "N" range.	Gear is held at 3rd gear when in "D" range.
P0758	Shift solenoid-B electrical		Gear is not shifted to 1st gear when in "D" range or in "2" range.

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 7B
● Throttle cable – – – – – play, installation	Section 6E1 or 6E2
● A/T oil pressure control cable and select cable – – – – – installation	Section 7B
● 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 or 6-1
● Fuses – – – – – burning	Section 8
● Parts – – – – – installation, bolt – – – – – looseness	
● Parts – – – – – deformation	
● Other parts that can be checked visually	
Also check following items at engine start, if possible.	
● Malfunction indicator lamp	Section 6 or 6-1
● Charge warning lamp	Section 6H
● Engine oil pressure warning lamp	Section 8 (Section 6A or 6A1 for pressure check)
● Engine coolant temp. meter	
● Other parts that can be checked visually	

AUTOMATIC TRANSMISSION BASIC CHECK

This check is very important for troubleshooting when PCM (ECM) has detected no DTC and no abnormality has been found in visual inspection. Follow the flow table carefully.

STEP	ACTION	YES	NO
1	Was "AUTOMATIC TRANSMISSION DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "AUTOMATIC TRANSMISSION DIAG. FLOW TABLE".
2	Check A/T Fluid. Warm transmission to normal operating temperature and check fluid level and contamination referring to "FLUID LEVEL CHECK" of "ON-VEHICLE SERVICE" in this section. Is it in good condition?	Go to Step 3.	Add or change fluid.
3	Check Fluid Pressure Control Cable. 1) Warm up engine to normal operating temperature. 2) Check fluid pressure control cable for play referring to "FLUID PRESSURE CONTROL CABLE" of "ON-VEHICLE SERVICE" in this section. Is it in good condition?	Go to Step 4.	Adjust.
4	Check Select Cable for Adjustment referring to "SELECT CABLE" of "ON-VEHICLE SERVICE" in this section. Is it adjusted correctly?	Go to Step 5.	Adjust.
5	Check Transmission Range Sensor (Switch) 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 manual selector to each range. See Fig. 1. Is applicable range indicated? When not using SUZUKI scan tool: 1) Turn ignition switch ON. 2) Check voltage at terminals C03-3, C03-4, C03-5, C03-14, C03-15 and C03-16 for G10 engine model (C02-11, C02-12, C02-14, C02-15, C02-21 and C02-23 for G13 engine model) respectively with selector lever shifted to each range. See Fig. 2. Taking terminal C03-3 for G10 engine model (C02-11 for G13 engine model) as an example, is battery voltage indicated only when selector lever is shifted to "2" range and 0 V for other ranges as shown in Fig. 3? Check voltage at other terminals likewise, referring to Fig. 3. Are check results satisfactory?	Go to Step 6.	Go to Step 3 of DTC P0705 Flow Table.
6	Check Engine Idle speed referring to Section 6E1 or 6E2. Is it in good condition?	Go to "SYMPTOM-TO-INSPECTION TABLE" below.	Go to Section 6E1 or 6E2.

Fig. 1 for Step 5.

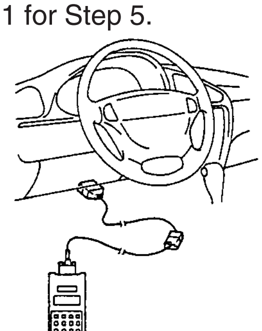


Fig. 2 for Step 5.

When not using SUZUKI scan tool:

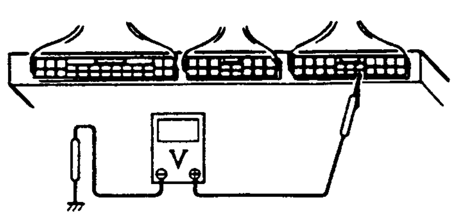


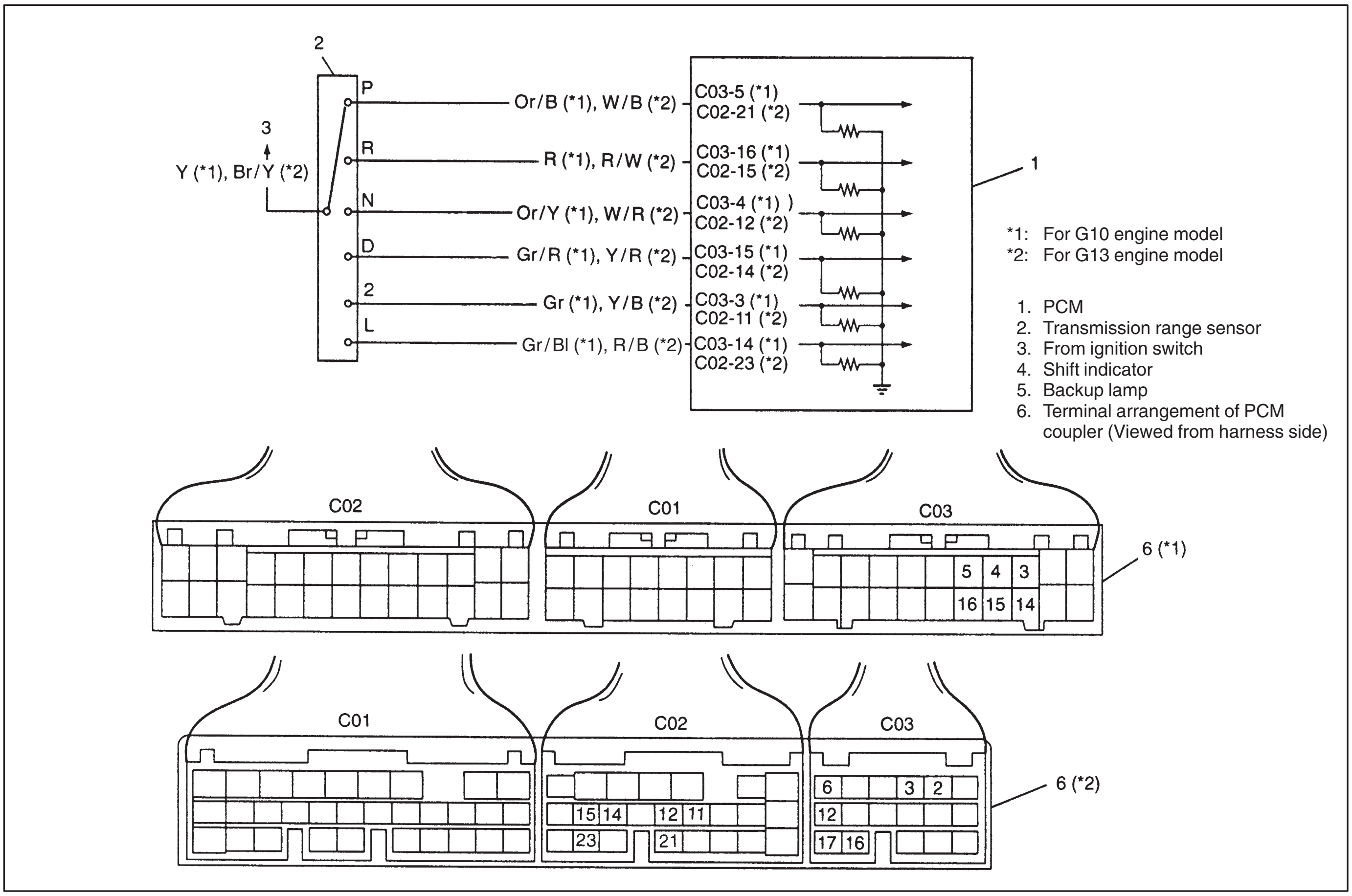
Fig. 3 for Step 5.

Terminal / Selector lever position	C03-5 (C02-21)	C03-16 (C02-15)	C03-4 (C02-12)	C03-15 (C02-14)	C03-3 (C02-11)	C03-14 (C02-23)
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

SYMPTOM-TO-INSPECTION TABLE

SYMPTOM	APPLICABLE DIAGNOSTIC FLOW TABLE. OR CHECK (DESCRIBED IN THIS SECTION)
No starting or slipping in any drive range	A/T DIAGNOSTIC FLOW TABLE A-1
Gear change failure	A/T DIAGNOSTIC FLOW TABLE A-2
Excessive shock at range selection or gear change	A/T DIAGNOSTIC FLOW TABLE A-3
Engine brake fails to operate	ENGINE BRAKE TEST
Gear shift failure in “D” or “2” range	A/T DIAGNOSTIC FLOW TABLE B-1
Gear is shifted to 2nd in “L” range	A/T DIAGNOSTIC FLOW TABLE B-2
Vehicle does not move backward in “R” range	

DTC P0705 TRANSMISSION RANGE SENSOR (SWITCH) CIRCUIT MALFUNCTION



CIRCUIT DESCRIPTION – Refer to "GENERAL DESCRIPTION" in this section.

DTC DETECTING CONDITION	POSSIBLE CAUSE
DTC will set when either condition A or condition B occurs. A: No signal is inputted at ignition switch ON. B: Multiple signals are inputted while running at higher than specified vehicle speed with gear in 3rd gear of "D" range.	• "Y", "Or/B", "R", "Or/Y", "Gr/R", "Gr" or "Gr/Bl" (G10 engine model) ("Br/Y", "W/B", "R/W", "W/R", "Y/R", "Y/B" or "R/B" (G13 engine model)) circuit open or short. • Transmission range sensor malfunction. • Select cable maladjusted. • PCM malfunction.

DTC CONFIRMATION PROCEDURE

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester, on a level road.**

1) Turn ignition switch OFF and then ON.
2) Clear DTC and warm up engine to normal operating temperature.
3) Shift selector lever to each of P, R, N, D, 2 and L ranges and hold it there for longer than 5 seconds each.
4) Check for DTC and if no DTC appears on display, proceed to the next step.
5) Drive vehicle at 40 mph, 60 km/h or more in 3rd gear of "D" range for longer than 5 sec.
6) Stop vehicle and check DTC.

TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was "AUTOMATIC TRANSMISSION DIAGNOSTIC FLOW TABLE" performed?	Go to Step 2.	Go to "AUTOMATIC TRANSMISSION DIAGNOSTIC FLOW TABLE".
2	Check Transmission Range 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 manual selector to each range. See Fig. 1. Is applicable range indicated? When not using SUZUKI scan tool: 1) Turn ignition switch ON. 2) Check voltage at terminals C03-3, C03-4, C03-5, C03-14, C03-15 and C03-16 for G10 engine model (C02-11, C02-12, C02-14, C02-15, C02-21 and C02-23 for G13 engine model) respectively with selector lever shifted to each range. See Fig. 2. Taking terminal C03-3 for G10 engine model (C02-11 for G13 engine model) as an example, is battery voltage indicated only when selector lever is shifted to "2" range and 0 V for other ranges as shown in Fig. 3? Check voltage at other terminals likewise, referring to Fig. 3. 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" of "ON-VEHICLE SERVICE" in this section. Is it adjusted correctly?	Go to Step 4.	Adjust.
4	Check Transmission Range Sensor. 1) Remove TR sensor from A/T. 2) At each of P, R, N, D, 2 and L shift position, check continuity between terminals as well as each terminal and sensor case. See Fig. 4. Continuity should be indicated only between those terminals as shown in Fig. 4 and 5 at each shift position. Continuity should not exist between any terminal and sensor case. Are check results satisfactory?	Go to Step 5.	Replace TR sensor.
5	Check Transmission Range Sensor for Installation Position. 1) Install TR sensor to transmission referring to "TRANSMISSION RANGE SENSOR" of "ON-VEHICLE SERVICE" in this section. 2) Perform check as described in step 2 of this table. Is check result satisfactory?	Transmission range sensor maladjusted.	Check "Y", "Or/B", "R", "Or/Y", "Gr/R", "Gr" or "Gr/Bl" (G10 engine model) ("Br/Y", "W/B", "R/W", "W/R", "Y/R", "Y/B" or "R/B" (G13 engine model)) circuit for open or short. If wires and connections are OK, substitute a known-good PCM and recheck.

Fig. 1 for Step 2.

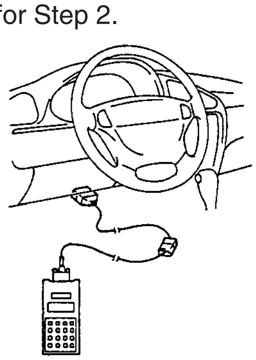


Fig. 2 for Step 2.

When not using SUZUKI scan tool:

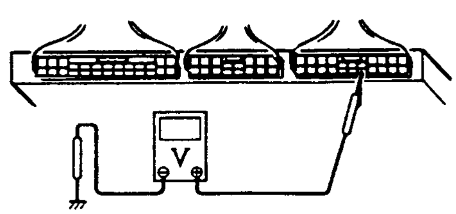


Fig. 3 for Step 2.

Terminal / Selector lever position	C03-5 (C02-21)	C03-16 (C02-15)	C03-4 (C02-12)	C03-15 (C02-14)	C03-3 (C02-11)	C03-14 C02-23)
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

Fig. 4 for Step 4.

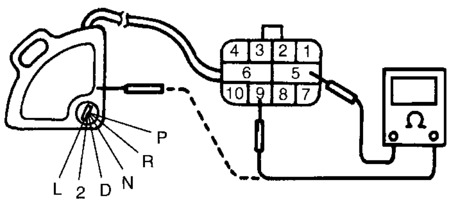
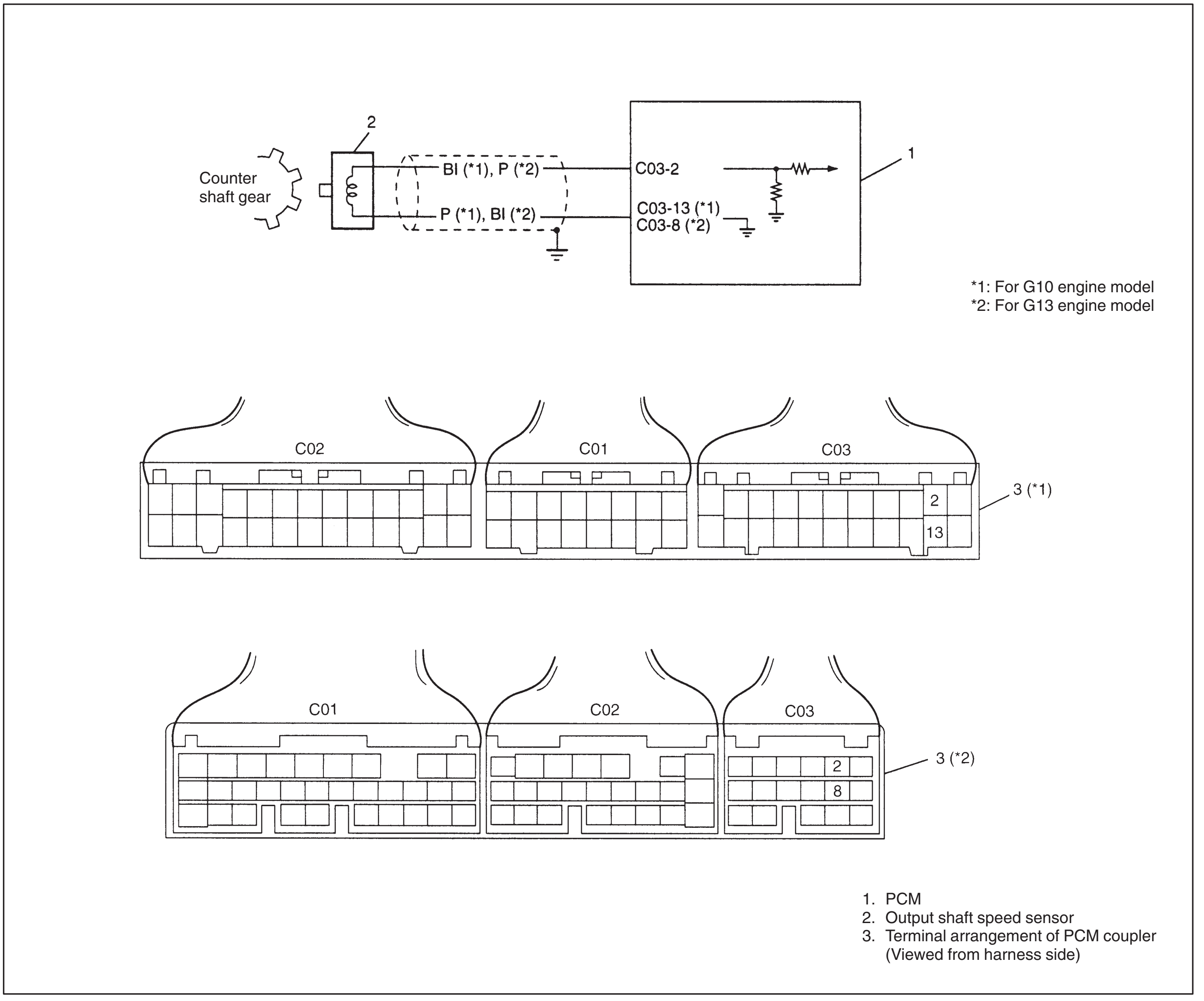


Fig. 5 for Step 4.

Range \ Terminal	6	5	1	8	2	3	4	9	10
P	○	○							
P				○				○	
R			○	○					
N	○	○							
N				○					○
D				○	○				
2				○		○			
L				○			○		

DTC P0720 OUTPUT SPEED SENSOR (A/T VSS) CIRCUIT MALFUNCTION



CIRCUIT DESCRIPTION – Refer to "GENERAL DESCRIPTION" in this section.

DTC DETECTING CONDITION	POSSIBLE CAUSE
No signal inputted while running vehicle with "D" or "2" range.	● "P" or "Bl" circuit open or short. ● Output shaft speed sensor malfunction. ● Foreign material being attached or sensor installed improperly. ● Gear damaged.

DTC CONFIRMATION PROCEDURE

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester, on a level road.**

1) Turn ignition switch OFF and then ON.
2) Clear DTC, shift selector lever to "2" range and drive vehicle at 3500 r/min engine speed for 3.5 seconds.
3) Stop vehicle and check DTC.

TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was "AUTOMATIC TRANSMISSION DIAGNOSTIC FLOW TABLE" performed?	Go to Step 2.	Go to "AUTOMATIC TRANSMISSION DIAGNOSTIC FLOW TABLE".
2	Check Output Shaft Speed Sensor for Resistance. 1) Disconnect output shaft speed sensor connector with ignition switch OFF. 2) Check for proper connection to output shaft speed sensor at "P" and "Bl" wire terminals. 3) If OK, then check resistance of output shaft speed sensor. See Fig. 1. Resistance between terminals : 100 – 300 Ω Resistance between terminal and transmission : 1 MΩ or more Are check results satisfactory?	Go to Step 3.	Replace output shaft speed sensor.
3	Check visually output shaft speed sensor and counter shaft gear for the following. See Fig. 2 and 3. ● No damage ● No foreign material attached ● Correct installation Are they in good condition?	"P" or "Bl" wire open or shorted to ground or poor C03-2 or C03-13 for G10 engine model (C03-2 or C03-8 for G13 engine model) connection. If wire and connection are OK, intermittent trouble or faulty PCM. Check for intermittent referring to "INTERMITTENT AND POOR CONNECTION" in Section 0A.	Clean, repair or replace.

Fig. 1 for Step 2.

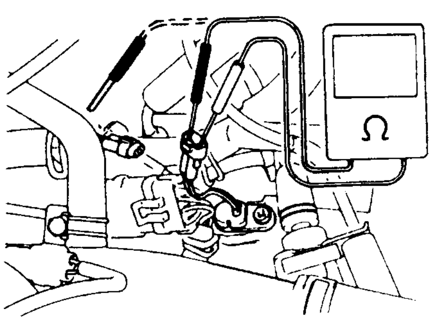


Fig. 2 for Step 3.

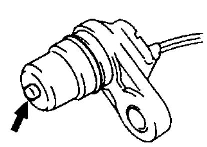
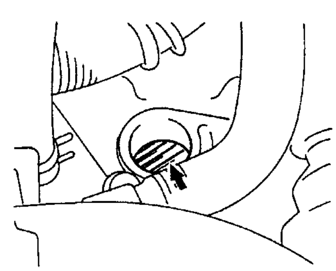
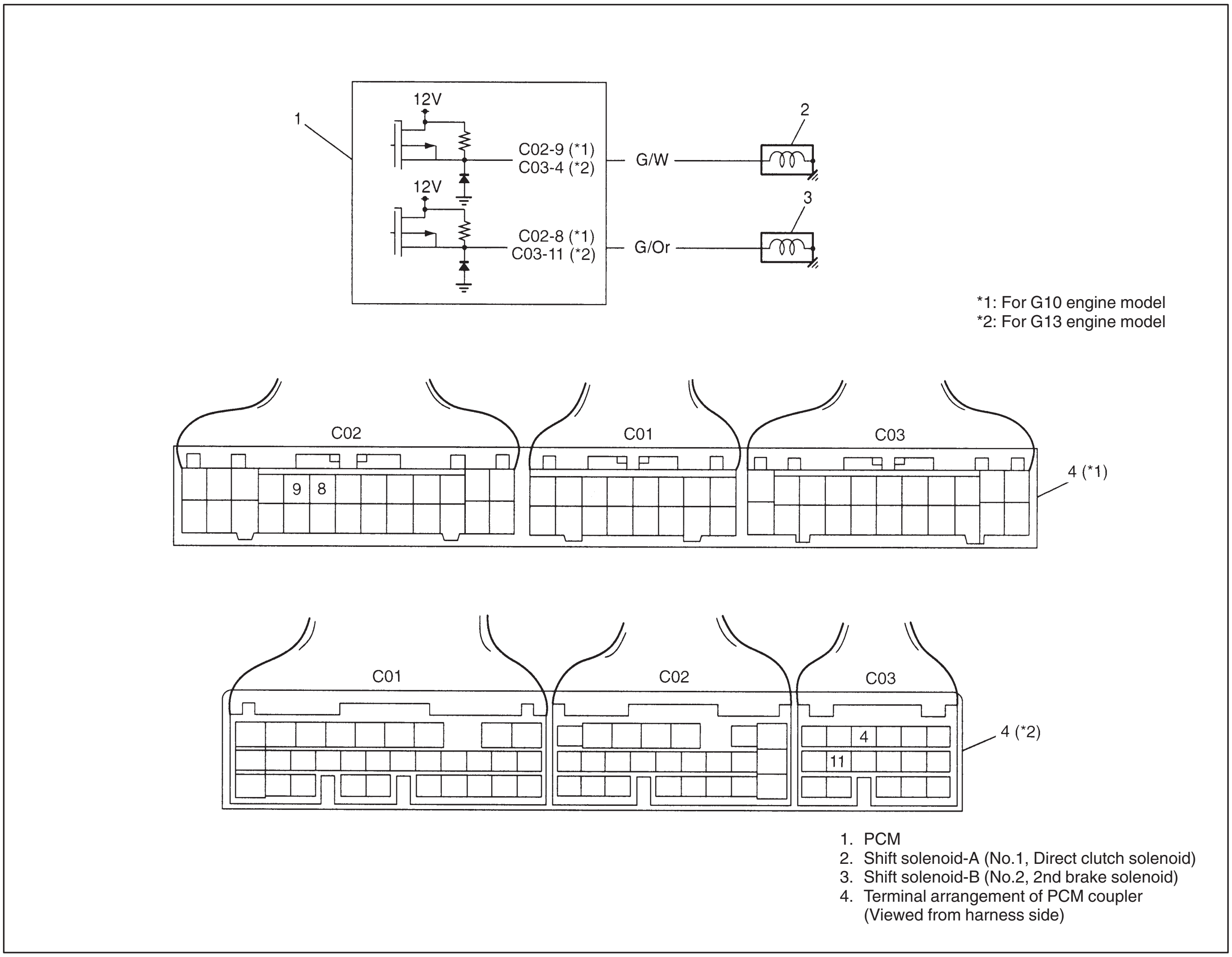


Fig. 3 for Step 3.



DTC P0753 SHIFT SOLENOID-A (NO.1) ELECTRICAL
DTC P0758 SHIFT SOLENOID-B (NO.2) ELECTRICAL



CIRCUIT DESCRIPTION – Refer to “GENERAL DESCRIPTION” of this section.

DTC DETECTING CONDITION	POSSIBLE CAUSE
Output command from PCM and output voltage do not agree.	DTC P0753: ● “G/W” circuit open or short ● Shift solenoid-A malfunction ● PCM malfunction DTC P0758: ● “G/Or” circuit open or short ● Shift solenoid-B malfunction ● PCM malfunction

DTC CONFIRMATION PROCEDURE

1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON and warm up engine to normal operating temperature at “P” range.
3) Shift selector lever to “D” range for 1 sec. or longer.
4) Shift it to “P” range and check DTC.

TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was "AUTOMATIC TRANSMISSION DIAGNOSTIC FLOW TABLE" performed?	Go to Step 2.	Go to "AUTOMATIC TRANSMISSION DIAGNOSTIC FLOW TABLE".
2	Check Shift Solenoid Circuit. 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. See Fig. 1. 4) Check "SHIFT SOL A-MONI" or "SHIFT SOL B-MONI" on scan tool at "N" and "D" range. "N" range: OFF "D" range: ON Is OFF/ON displayed as described above? When not using SUZUKI scan tool: 1) Turn ignition switch ON. 2) Check voltage at terminal C02-8 or C02-9 for G10 engine model (C03-4 or C03-11 for G13 engine model) of PCM connector connected. See Fig. 2. "N" range: 0 V "D" range: 10 – 14 V Is voltage displayed as described above?	Intermittent trouble. Check for intermittent referring to "INTERMITTENT AND POOR CONNECTION" in Section 0A.	Go to Step 3.
3	Check Shift Solenoid for Resistance. 1) Turn ignition switch OFF. 2) Disconnect connector of shift solenoid. 3) Check resistance between solenoid terminal C29-1 or C29-2 and transmission. See Fig. 3. Is it 8 – 20 Ω?	"G/W" or "G/Or" wire open or short, or poor C02-8 or C02-9 for G10 engine model (C03-4 or C03-11 for G13 engine model) connection. If wire and connection are OK, substitute a known-good PCM and recheck.	Replace shift solenoid.

Fig. 1 for Step 2.

When using SUZUKI scan tool:

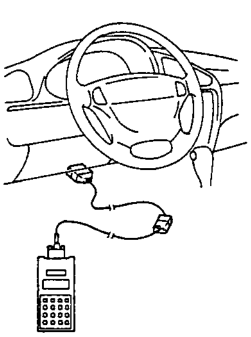


Fig. 2 for Step 2.

When not using SUZUKI scan tool:

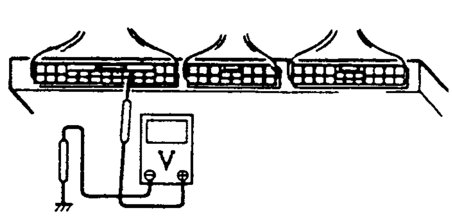
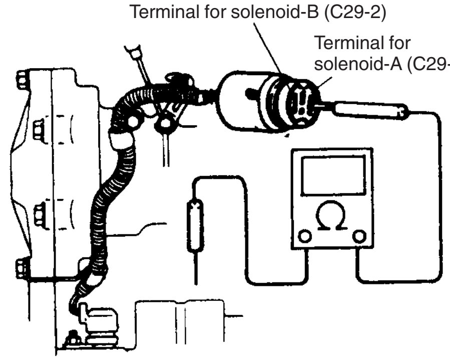


Fig. 3 for Step 3.

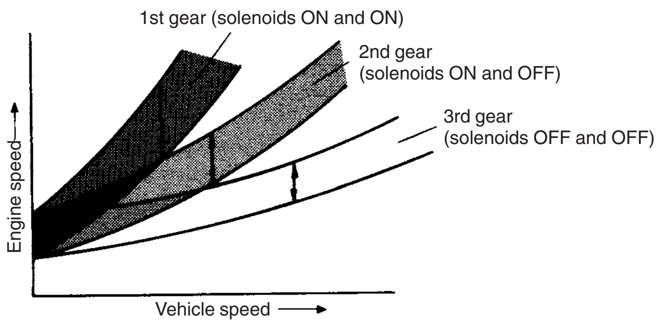


DTC P0751 SHIFT SOLENOID-A (No.1) PERFORMANCE OR STUCK OFF
DTC P0756 SHIFT SOLENOID-B (No.2) PERFORMANCE OR STUCK OFF

CIRCUIT DESCRIPTION

PCM monitors throttle opening, engine speed, vehicle speed and gear position and compares the actual engine speed and its specified value (i.e., engine speed obtained by PCM through calculation using the throttle opening/gear position and vehicle speed).

ACCEPTABLE RANGE



DTC DETECTING CONDITION	POSSIBLE CAUSE
● While running in “D” range after engine warmed up, engine speed as compared with vehicle speed is not within acceptable range. ✳ 2 driving cycle detection logic, continuous monitoring.	● A/T oil pressure control cable maladjusted ● Selector cable maladjusted ● Mechanical malfunction of shift solenoid valve (stick or leakage) ● Mechanical malfunction in transmission ● Torque converter malfunction

DTC CONFIRMATION PROCEDURE

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester, on a level road.**

1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON and warm up engine to normal operating temperature.
3) Shift selector lever to “D” range.
4) Start vehicle and increase vehicle speed to 40 – 55 km/h (25 – 35 mile/h) by depressing accelerator pedal half a stroke.
5) Keep vehicle at above speed for 5 sec. or longer.
6) Increase vehicle speed to 75 – 90 km/h (45 – 55 mile/h) by depressing accelerator pedal half a stroke and keep it at that speed for 5 sec. or longer.
7) Stop vehicle and check pending DTC and DTC.

TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was "AUTOMATIC TRANSMISSION DIAGNOSTIC FLOW TABLE" performed?	Go to Step 2.	Go to "AUTOMATIC TRANSMISSION DIAGNOSTIC FLOW TABLE".
2	Is DTC other than shift malfunction (DTC P0751/P0756) displayed?	Go to applicable DTC Flow Table.	Go to Step 3.
3	Perform Road Test to check if upshift and downshift take place at specified vehicle speed, referring to "ROAD TEST" in this section. Do they take place properly?	Intermittent trouble. Check electrical circuit of system for intermittent referring to "INTERMITTENT AND POOR CONNECTION" in Section 0A.	Go to Step 4.
4	Perform Manual Shift Road Test referring to "MANUAL ROAD TEST" in this section. Is test result satisfactory?	Go to Step 5.	Go to "A/T Basic Check".
5	Check Transmission Range Sensor and Its Circuit according to Step 1 of DTC P0705 Flow Table. Are they in good condition?	Go to Step 6.	"D" range signal circuit shorted to other signal circuit or TR sensor malfunction.
6	Check Output Shaft Speed Sensor and Its Circuit referring to "OUTPUT SHAFT SPEED SENSOR CHECK" in this section. Are they in good condition?	Go to Step 7.	Output shaft speed sensor circuit open or short or output shaft speed sensor malfunction.
7	Check Shift Solenoid A and B for Operation referring to "SHIFT SOLENOID VALVE CHECK" in this section. Are they in good condition?	Substitute a known-good PCM and recheck.	Replace shift solenoid A or B.

TABLE A-1 NO STARTING OR SLIPPING IN ANY DRIVE RANGE

STEP	ACTION	YES	NO
1	Was "AUTOMATIC TRANSMISSION DIAGNOSTIC FLOW TABLE" performed?	Go to Step 2.	Go to "AUTOMATIC TRANSMISSION DIAGNOSTIC FLOW TABLE".
2	Is engine rpm at stall test normal?	Transmission failure.	Go to Step 3.
3	Is engine rpm at stall test too low in any range?	Poor engine power or torque converter defective.	Go to Step 4.
4	Is engine rpm at stall test too high only in "D" range?	Go to Step 7.	Go to Step 5.
5	Is engine rpm at stall test too high only in "R" range?	Go to Step 9.	Go to Step 6.
6	Is line pressure proper?	Transmission failure.	Oil pump defective, Regulator valve operation failure, Throttle valve operation failure or Accelerator cable and oil pressure control cable maladjusted.
7	Does engine rpm at stall test become normal when coupler of solenoid valve wire is disconnected?	One-way clutch operation failure.	Go to Step 8.
8	Is line pressure proper?	Forward clutch worn.	Oil leak in forward clutch oil circuit or Oil leak in "D" range oil circuit.
9	Does engine rpm at stall test become normal when coupler of solenoid valve wire is disconnected?	1st-Reverse brake worn.	Go to Step 10.
10	Is line pressure proper?	Direct clutch worn.	Oil leak in direct clutch oil circuit or Oil leak in "R" range oil circuit.

TABLE A-2 GEAR CHANGE FAILURE

STEP	ACTION	YES	NO
1	Was “AUTOMATIC TRANSMISSION DIAGNOSTIC FLOW TABLE” performed?	Go to Step 2.	Go to “AUTOMATIC TRANSMISSION DIAGNOSTIC FLOW TABLE”.
2	Disconnect solenoid valve wire coupler and perform manual road test. Is upshift from 1st to 2nd possible?	Go to Step 3.	1-2 shift valve sticks or Shift solenoid-B (2nd brake solenoid) valve sticks.
3	Is upshift from 2nd to 3rd possible?	Gear shift control system defective. Go to A/T Diagnostic Flow Table B.	2-3 shift valve sticks or Shift solenoid-A (Direct clutch solenoid) valve sticks.

TABLE A-3 EXCESSIVE SHOCK AT RANGE SELECTION OR GEAR CHANGE

STEP	ACTION	YES	NO
1	Was “AUTOMATIC TRANSMISSION DIAGNOSTIC FLOW TABLE” performed?	Go to Step 2.	Go to “AUTOMATIC TRANSMISSION DIAGNOSTIC FLOW TABLE”.
2	Is line pressure proper?	Go to Step 3.	Regulator valve defective, Throttle valve defective or Accelerator cable maladjusted.
3	Does excessive shock occur when selecting “D” range from “N” range?	Forward clutch accumulator operation failure, Forward clutch worn or Forward clutch oil circuit check ball operation failure.	Go to Step 4.
4	Does excessive shock occur when selecting “R” range from “N” range?	1st-Reverse brake worn, 1st-Reverse brake oil circuit check ball operation failure.	Go to Step 5.
5	Does excessive shock occur at 1st to 2nd gear change?	2nd brake accumulator defective, 2nd brake worn, 2nd brake oil circuit check ball operation failure.	In case of excessive shock at 2nd to 3rd gear change, Direct clutch worn or Direct clutch oil circuit check ball operation failure.

STALL TEST

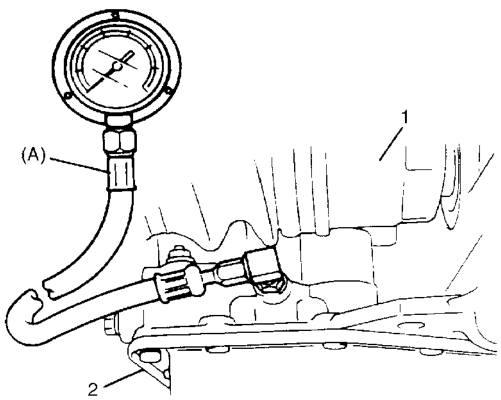
This test is to check overall performance of automatic transmission and engine by measuring stall speed at D and R ranges.
Be sure to perform this test only when transmission fluid is at normal operating temperature (70–80°C/158–176°F) and its level is between FULL HOT and LOW HOT. (Refer to “Fluid level” in this section.)

> **CAUTION:**
> **Do not run engine at stall more than 5 seconds continuously, for oil temperature may rise excessively high.**

1) Install tachometer.
2) Apply parking brake and block vehicle wheels.
3) Start engine with selector lever shifted to P range.
4) Depress brake pedal.
5) Shift selector lever to D range and depress accelerator pedal fully while watching tachometer. Read engine rpm quickly when it has become constant (stall speed).
6) Release accelerator pedal immediately after stall speed is checked.
7) In the same way, check stall speed at R range.
8) Stall speed should be within following specification.

   Stall speed: 2,500 – 2,900 r/min
   (For both G10 and G13 engine models)
9) Possible causes for out-of-specification stall speed are as follows. Check each part which is suspected to be the cause.

Stall speed measured	Possible causes
Lower than specification	• Engine output insufficient • Torque converter defective
Higher than specification in D range	• Forward clutch slippage • One-way clutch defective
Higher than specification in R range	• Direct clutch slippage • 1st-reverse brake slippage



1. Front drive shaft (LH)
2. Oil pan

LINE PRESSURE TEST

This test is to check oil pressure system for operation by measuring oil pressure in oil pressure line. Make sure to perform this test only when transmission fluid is at normal operating temperature.

NOTE:

- **Make sure that transmission fluid level is between FULL HOT and LOW HOT marks on oil level gauge at normal operating temperature which corresponds to 70–80°C (155–176°F) of fluid. (Refer to "Fluid level" in this section.)**
- **Check that transmission is free from fluid leakage.**

1) With engine at stop, remove plug and connect oil pressure gauge to plug hole.

   Special Tool
   (A): 09925-37811-001

2) Install tachometer.
3) Apply parking brake and block vehicle wheels.
4) With selector lever shifted to P range, start engine.
5) Depress brake pedal fully.
6) Shift selector lever to D range and check oil pressure with engine running at idling speed and at stall speed respectively.
7) Repeat the same check as in step 6) with selector lever shifted to R range.

CAUTION:
Do not run engine at stall more than 5 seconds continuously, for oil temperature may rise excessively high.

8) If line pressure is within respective specification in table below, oil pressure system is in good condition.

[G10 Engine Model]

Engine speed	Line pressure	
	D range	R range
Idling speed	200 – 390 kPa 2.0 – 3.9 kg/cm^2 28.4 – 55.5 psi	540 – 780 kPa 5.4 – 7.8 kg/cm^2 76.8 – 110.9 psi
Stall speed	390 – 590 kPa 3.9 – 5.9 kg/cm^2 55.5 – 83.9 psi	880 – 1230 kPa 8.8 – 12.3 kg/cm^2 125.1 – 174.9 psi

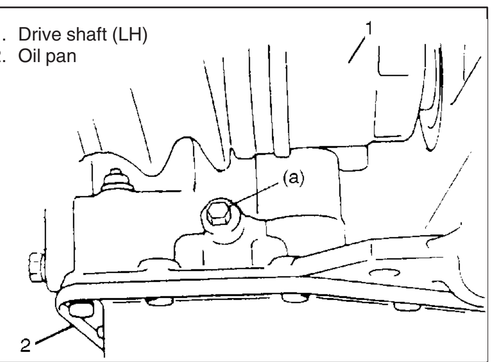
[G13 Engine Model]

Engine speed	Line pressure	
	D range	R range
Idling speed	260 – 460 kPa 2.6 – 4.6 kg/cm^2 37.0 – 65.4 psi	660 – 900 kPa 6.6 – 9.0 kg/cm^2 93.9 – 128.0 psi
Stall speed	660 – 850 kPa 6.6 – 8.5 kg/cm^2 93.9 – 120.9 psi	1330 kPa or more 13.3 kg/cm^2 or more 189.0 psi or more

9) Possible causes for out-of-specification line pressure are as follows. Check each part which is suspected to be the cause.

Line pressure	Possible causes
Higher than specification in D and R ranges	● Regulator valve defective ● Throttle valve in valve body defective ● Accelerator cable and oil pressure control cable maladjusted
Lower than specification in D and R ranges	● Oil pump defective ● Regulator valve defective ● Throttle valve in valve body defective ● Accelerator cable and oil pressure control cable maladjusted
Lower than specification only in D range	● Forward clutch oil pressure system oil leakage ● D range oil pressure system oil leakage
Lower than specification only in R range	● Direct clutch oil pressure system oil leakage ● 1st-reverse brake oil pressure system oil leakage ● R range oil pressure system oil leakage

1. Drive shaft (LH)
2. Oil pan



10) Reinstall plug and tighten it to specification.

Tightening Torque
(a): 7.5 N·m (0.75 kg-m, 5.5 lb-ft)

ROAD TEST

This test is to check if upshift and downshift take place at specified speeds while actually driving vehicle on a level road.

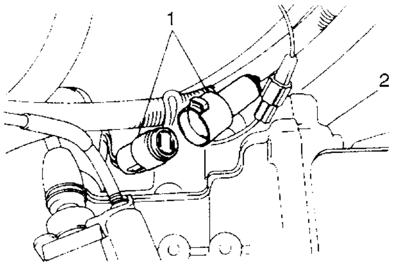
WARNING:
- **Carry out the test in very little traffic area to prevent an accident.**
- **The test requires 2 persons, a driver and a tester.**

1) Warm up engine.
2) With engine running at idle, shift selector lever to D range.
3) i) Accelerate vehicle speed by depressing accelerator pedal very little (within 4 deg. of throttle valve opening).
   ii) Check if upshift takes place from 1st to 2nd at about 18 km/h (11 mile/h) and from 2nd to 3rd at about 30 km/h (19 mile/h).
   iii) **[For G10 Engine Model]**
   Stop vehicle once. Then start it again and while accelerating by depressing accelerator pedal fully, check if upshift takes place from 1st to 2nd at 52 km/h (33 mile/h) and from 2nd to 3rd at 97 km/h (61 mile/h).

   [For G13 Engine Model]
   Stop vehicle once. Then start it again and while accelerating by depressing accelerator pedal fully, check if upshift takes place from 1st to 2nd at 58 km/h (36 mile/h) and from 2nd to 3rd at 110 km/h (69 mile/h).

   iv) Stop vehicle again.
   v) Start vehicle and keep it running at 25 km/h (15 mile/h) and then release accelerator pedal completely. 1 or 2 seconds later, depress accelerator pedal fully and check if downshift from 2nd to 1st takes place.
   vi) Keep vehicle running at 75 km/h (47 miles/h) and in the same way as in step v), check if downshift from 3rd to 2nd takes place.
   vii) If upshift or downshift fails to take place at each specified speed in the road test, possible causes for such failure are as follows. Check each part which is suspected to be the cause.

Condition	Possible causes
No upshift from 1st to 2nd	• 1 – 2 shift valve defective • 2nd brake solenoid valve defective • PCM defective, or disconnection or poor connection in electric circuit
No upshift from 2nd to 3rd	• 2-3 shift valve defective • Direct clutch solenoid valve defective • PCM defective, or disconnection or poor connection in electric circuit
No downshift from 2nd to 1st or 3rd to 2nd	• Throttle position sensor defective • PCM defective, or disconnection or poor connection in electric circuit



1. Solenoid valve wire coupler (Disconnected)
2. Transmission

MANUAL ROAD TEST

This test checks the gears being used in L, 2 or D range when driven with unoperated gear shift control system.
Test drive vehicle on a level road.

1) With selector lever in P range, start engine and warm it up.
2) After warming up engine, disconnect coupler of solenoid valve wire as shown in left figure.
3) With selector lever in L range, start vehicle and accelerate to 30 km/h (19 mile/h). Check in this state that 1st gear is being used.
4) At 30 km/h (19 mile/h), shift selector lever to 2 range and accelerate to 60 km/h (37 mile/h).
   Check in this state that 2nd gear is being used.
5) At 60 km/h (37 mile/h), shift selector lever to D range and check that 3rd gear is used when speed is higher than 60 km/h (37 mile/h).
6) After above checks, stop vehicle then engine, and connect solenoid valve wire coupler.

ENGINE BRAKE TEST

WARNING:
Before test, make sure that there is no vehicle behind so as to prevent rear-end collision.

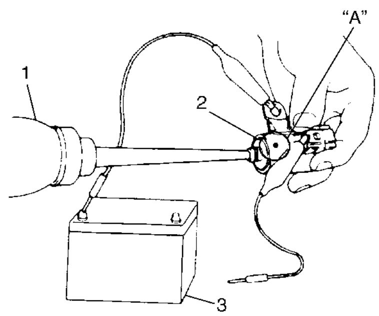
1) While driving vehicle in 3rd gear of D range, shift selector lever down to 2 range and check if engine brake operates.
2) In the same way as in step 1), check engine brake for operation when selector lever is shifted down to L range.
3) If engine brake fails to operate in above tests, possible cause for such failure are as follows.
   Check each part which is suspected to be the cause.

Condition	Possible causes
Fails to operate when shifted down to 2 range	Second brake defective
Fails to operate when shifted down to L range	1st-reverse brake defective

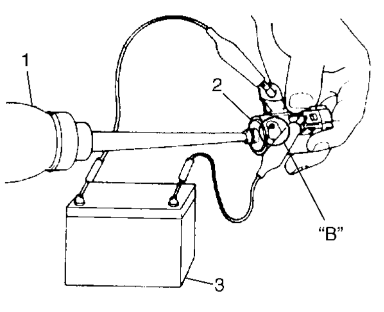
"P" RANGE TEST

1) Stop vehicle on a slope, shift selector lever to P range and at the same time apply parking brake.
2) After stopping engine, release parking brake lever gradually and check that vehicle remains stationary.

WITHOUT BATTERY VOLTAGE



WITH BATTERY VOLTAGE



1. Oiler (with transmission fluid)
2. Solenoid valve
3. 12V battery
"A": Side hole (Should be dry)
"B": Exhausting fluid

SHIFT SOLENOID VALVE CHECK

Whenever shift solenoid valves 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 from side holes of solenoid valve when battery voltage is not conducted.
2) Holding the above condition, conduct battery voltage and then make sure that fluid is exhausted with vigor.

NOTE:
If fluid does not come out with vigor in above step 2) inspection, do not reuse that solenoid valve.

TABLE B-1 GEAR SHIFT FAILURE IN "D" OR "2" RANGE

STEP	ACTION	YES	NO
1	Was "TABLE A-2 GEAR CHANGE FAILURE" performed?	Go to Step 2.	Go to "TABLE A-2".
2	Is gear no shift at all?	Go to Step 3.	Go to Step 4.
3	Perform vehicle speed sensor check refer to "OUTPUT SPEED SENSOR CHECK" in this section. Is check result satisfactory?	Go to Step 5.	Repair or replace.
4	Perform throttle position sensor check referring to DTC P0121 Flow Table in Section 6-1. Is check result satisfactory?	Go to Step 5.	Repair or replace.
5	Perform "SHIFT SOLENOID VALVE CIRCUIT CHECK" described later in this section. Is check result satisfactory?	Substitute a known-good PCM and recheck.	Replace shift solenoid-A (direct clutch solenoid) valve or shift solenoid-B (2nd brake solenoid) valve.

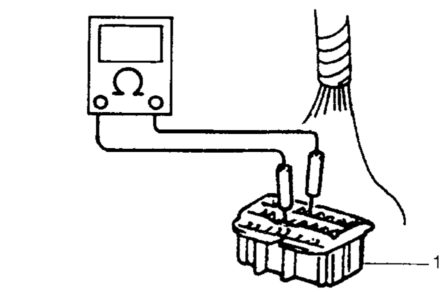
TABLE B-2 GEAR IS SHIFTED TO 2ND GEAR IN "L" RANGE VEHICLE DOES NOT MOVE BACKWARD IN "R" RANGE

NOTE:
Gear shift to 2nd may occur when selector lever is shifted from D or 2 to L, but this is normal.

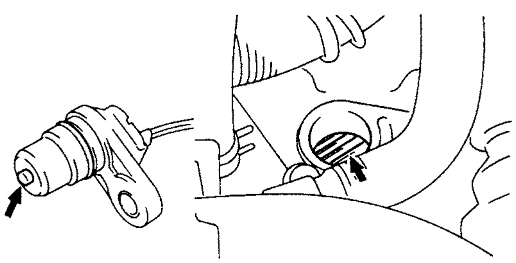
STEP	ACTION	YES	NO
1	Was "TABLE A-2 GEAR CHANGE FAILURE" performed?	Go to Step 2.	Go to "TABLE A-2".
2	Perform "SHIFT SOLENOID VALVE CIRCUIT CHECK" described later in this section. Is check result satisfactory?	Substitute a known-good PCM and recheck.	Replace shift solenoid-A (direct clutch solenoid) valve or shift solenoid-B (2nd brake solenoid) valve.

TRANSMISSION RANGE SENSOR CHECK

Check transmission range sensor referring to Step 2 of DTC P0705 Flow Table.



1. PCM coupler disconnected



OUTPUT SHAFT SPEED SENSOR CHECK

1) Turn OFF ignition switch.
2) Disconnect coupler(s) from powertrain control module.
3) Bring ohmmeter probes in touch with coupler terminals from harness side.
4) Check resistance of output shaft speed sensor.

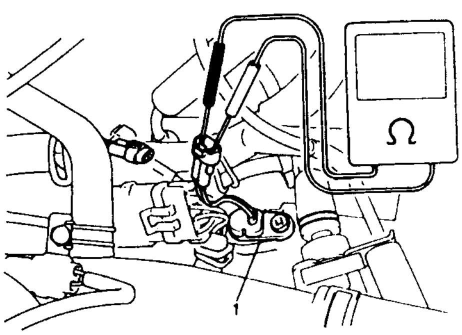
Resistance between terminals
C03-2 and C03-13
(For G10 engine model)
C03-2 and C03-8
(For G13 engine model) : 100 – 300 Ω

Resistance between terminal
and ground : 1 MΩ or more

If resistance are out of specification, check wire harness and connector for open or short and output shaft speed sensor itself for resistance.
If resistance are within above specifications, proceed to next step.

5) Visually check output shaft speed sensor and counter shaft gear for the following:
   - No damage
   - No foreign material attached
   - Correct installation

   If any malfunction is found, clean, repair or replace.

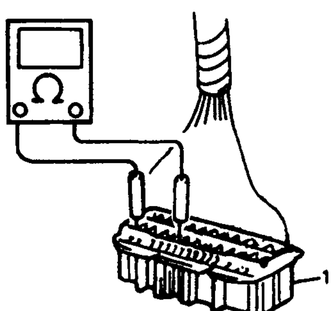


1. Output shaft speed sensor

Separately from the above inspection, output shaft speed sensor itself can be checked on its resistance by disconnecting coupler.

NOTE:
- **Function of output shaft speed sensor can be checked by measuring generated pulse as voltage.**
- **For its measurement, use an analog type voltmeter while spinning wheels on lift and with selector lever in "D" range.**

Output shaft speed sensor specifications	
Coil resistance	100 – 300 Ω
Output voltage at 40 km/h (25 mile/h)	Approximately 1 V



1. PCM coupler disconnected

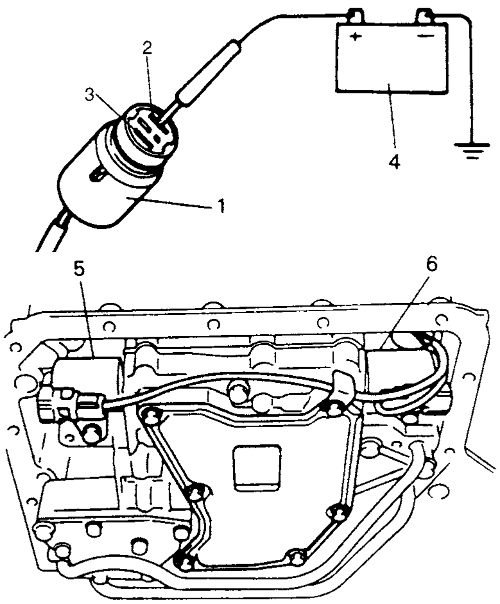
SHIFT SOLENOID VALVE CIRCUIT CHECK

1) With ignition switch turned OFF, disconnect PCM couplers.
2) Bring ohmmeter probes in touch with coupler terminals from harness side and measure each resistance.

Resistance between C02-9 and C02-1 for G10 engine model (C03-4 and C01-1 for G13 engine model) (Shift solenoid-A, direct clutch) : 8 – 20 Ω

Resistance between C02-8 and C02-1 for G10 engine model (C03-11 and C01-1 for G13 engine model) (Shift solenoid-B, 2nd brake) : 8 – 20 Ω

If resistance is out of specification, check shift solenoid itself for resistance (referring to Step 3 of DTC P0753/P0756 Flow Table) and wire harness for open or short.
If resistance is within specification, proceed to step 3).



1. Solenoid valve wire coupler
2. Terminal for shift solenoid-A. (direct clutch solenoid)
3. Terminal for shift solenoid-B. (2nd brake solenoid)
4. 12 V battery
5. Shift solenoid-B. (2nd brake solenoid valve)
6. Shift solenoid-A. (Direct clutch solenoid valve)

3) Disconnect shift solenoid valve coupler from harness.
4) Apply 12 V to each terminal in solenoid valve coupler and check to be sure that a click sound is heard from each of shift solenoid-A and -B.
   If no click sound is heard, check lead wire and connections in oil pan, and then replace applicable shift solenoid-A or B if wire and connections are in good condition.
   If click sound is heard from each of shift solenoids A and B, shift solenoid electrical circuits are in good condition. Proceed to "SHIFT SOLENOID VALVE CHECK" previously described in this section.

THROTTLE POSITION SENSOR CHECK

Check throttle position sensor and its circuit referring to DTC P0121 Flow Table in Section 6 or 6-1.

TIGHTENING TORQUE SPECIFICATIONS

Refer to the same section of the service manual mentioned in the “FOREWORD” of this manual.

SPECIAL TOOLS

Refer to the same section of the service manual mentioned in the “FOREWORD” of this manual.

SECTION 8

BODY ELECTRICAL SYSTEM

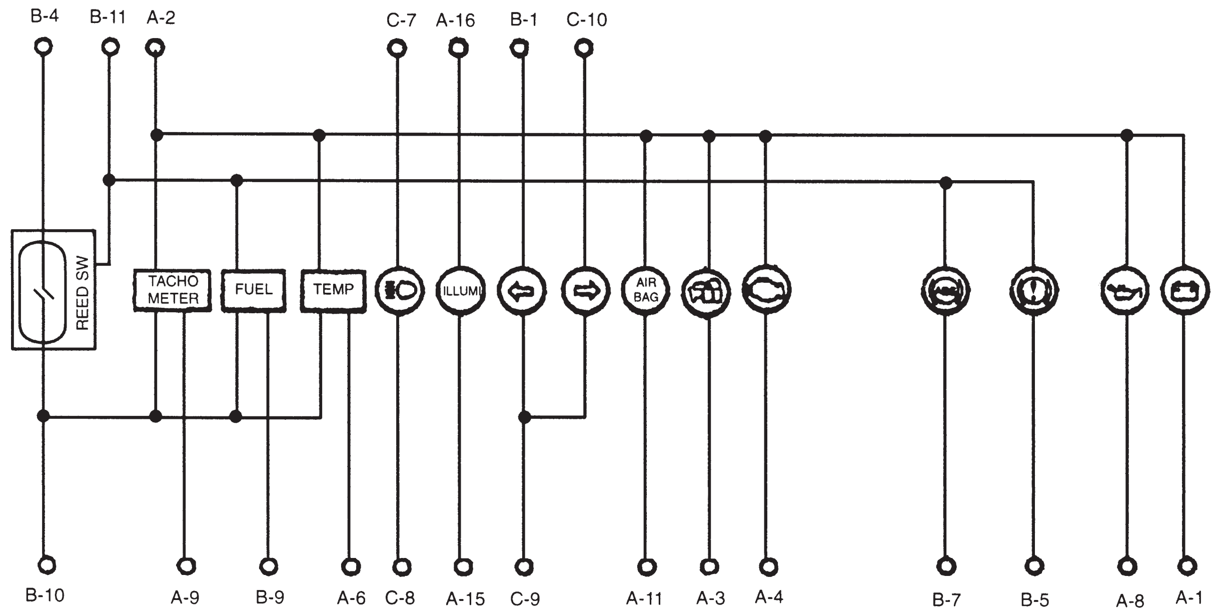
WARNING:
For vehicles equipped with Supplemental Restraint (Air Bag) System:
- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "Air Bag System Components and Wiring Location View" under "General Description" in air bag system 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).**

NOTE:
For the descriptions (items) not found in this section, refer to the same section of the Service Manual mentioned in the FOREWORD of this manual.

CONTENTS

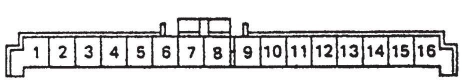
GENERAL DESCRIPTION

COMBINATION METER

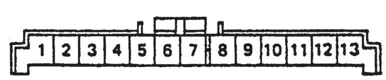


NOTE:
Terminal arrangement of coupler viewed from harness side.

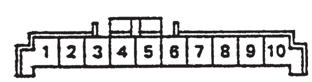
Coupler A



Coupler B



Coupler C



Coupler A

1.	To generator	W/R
2.	To ignition switch	B/W
3.	To ECM	V/G
4.	To ECM	V
5.	Blank	–
6.	To ECT sensor	Y/W
7.	Blank	—
8.	To engine oil pressure switch	Y/B
9.	To ECM	Br
10.	Blank	—
11.	To SDM (if equipped)	Bl
12.	Blank	—
13.	Blank	—
14.	Blank	—
15.	To ground	R
16.	To combination switch	R/Y

Coupler B

1.	To combination switch	G/R
2.	Blank	—
3.	Blank	—
4.	To ECM	Y/G
5.	To brake fluid level switch and parking brake switch	R/B
6.	Blank	—
7.	To ABS control module (if equipped)	R/Bl
8.	Blank	—
9.	To fuel level gauge	Y/R
10.	To ground	B/Bl
11.	To ignition switch	B/W
12.	Blank	—
13.	Blank	—

Coupler C

1.	Blank	—
2.	Blank	—
3.	Blank	—
4.	Blank	—
5.	Blank	—
6.	Blank	—
7.	To main fuse	R
8.	To combination switch	W/Bl
9.	To ground	B
10.	To combination switch	G/Y

KEYLESS ENTRY SYSTEM (IF EQUIPPED)

The keyless entry system uses radio wave. When the button on the transmitter is pressed, a signal is transmitted in the form of radio wave to the receiver. Then the signal causes the door lock controller to lock and unlock the door. The door locks can not operated with the transmitter when either of the following conditions applies.

- For 2 seconds after the ignition switch is turned from ON to OFF position.
- The ignition switch is at ON or START position.
- Any door is open.

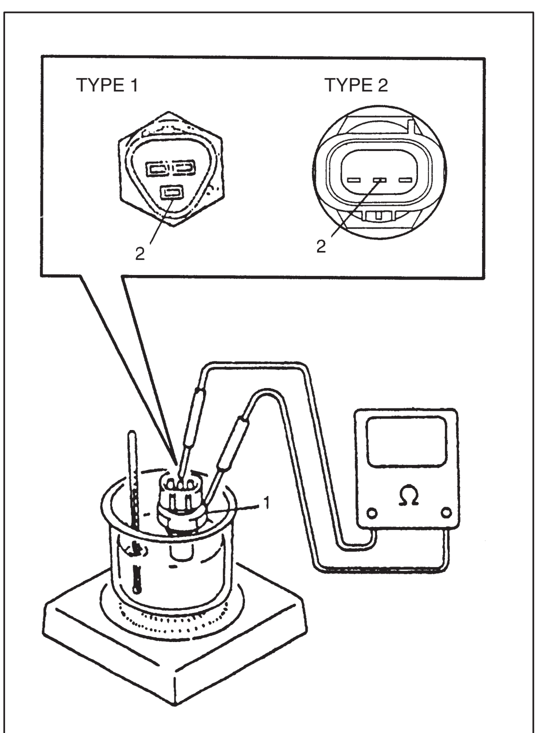
DIAGNOSIS

KEYLESS ENTRY SYSTEM (IF EQUIPPED)

Condition	Possible Cause	Correction
The power door lock function is available but the keyless entry function is not.	● Fuse blown ● Code registration error ● Transmitter battery dead ● Wiring or grounding faulty ● Receiver faulty ● Transmitter faulty	Replace fuse to check for short. Register code. Replace battery. Repair as necessary. Replace. Replace.
Only one power door lock does not operate.	● Wiring or coupler faulty ● Actuator (door lock motor) faulty	Repair as necessary Replace.
Operation distance unstable.	● Transmitter battery dead ● Transmitter faulty	Replace battery. Replace.

NOTE:

- **The operation distance of this system varies depending on the position where the transmitter is operated, at the front side, the rear side or the lateral side. The distance can be affected by radio noises from a TV station, a power plant, a broadcasting station and so forth.**



ON-VEHICLE SERVICE

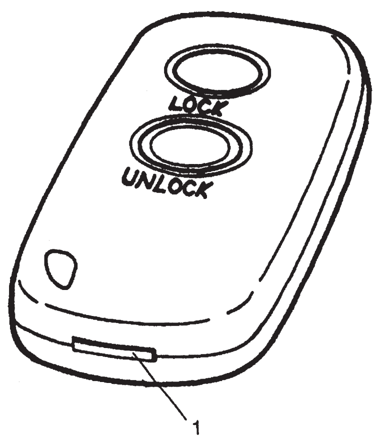
ENGINE COOLANT TEMP. (ECT) METER AND SENSOR

ECT SENSOR

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). If check result is not as specified below, replace sensor.

Temperature	Resistance
50°C (122°F)	136 – 216 Ω



1. Slot

KEYLESS ENTRY SYSTEM (IF EQUIPPED)

TRANSMITTER

REPLACEMENT OF THE BATTERY

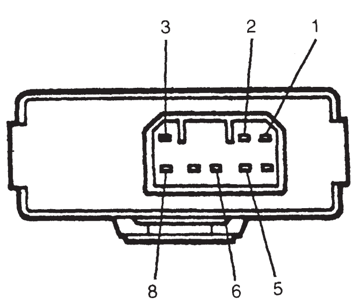
If the transmitter becomes unreliable, replace the battery.
As the battery power is consumed, the operation distance will be shorter.

1) Put the edge of a coin or a flat blade screw driver in the slot of the transmitter and pry it open.
2) Replace the battery (lithium disc-type CR2025 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.**



1. To power door lock controller (Unlock)
2. To power door lock controller (Lock)
3. To IG switch
5. To door switch
6. To GND
8. To battery

RECEIVER

INSPECTION

Using a tester, check for continuity and voltage between each terminal of the connector connected to the receiver and the body ground at the following condition.

Terminal	Check for	Condition	Standard value
1	Continuity	Unlock the driver's seat side door by using the key.	No continuity → Continuity
2	Continuity	Lock the driver's seat side door by using the key.	No continuity → Continuity
3	Voltage	Insert the ignition key and turn ON the ignition switch.	0 V → 10 – 14 V
5	Voltage	Open any one of all closed doors.	10 – 14 V → 0 V
6	Continuity	Anytime	Continuity
8	Voltage	Anytime	10 – 14 V

CODE REGISTRATION PROCEDURE

1) Start of code registration
   (Initial conditions: IG switch OFF, all doors closed)
2) Open the door and then turn ON the IG switch within 10 seconds.
3) Turn OFF the IG switch within 10 seconds after it is turned ON.
4) Turn the door switch ON and OFF 3 times within 20 seconds after the IG switch is turned OFF.
5) Within 10 seconds after the door switch is turned ON, turn ON the IG switch and then OFF within next 10 seconds.
6) After LOCK and UNLOCK operation once, the registration mode is set.
7) Press the UNLOCK button of the transmitter once within 60 seconds after the registration mode is set.
8) LOCK and UNLOCK operation once again completes the registration procedure.

NOTE:
- **Perform the above procedure to register a code.**
- **Two codes can be registered.**
- **When a new code is registered, the oldest one will be cleared.**

SECTION 8G

IMMOBILIZER CONTROL SYSTEM

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

NOTE:
- **Whether the immobilizer indicator lamp is used in the particular vehicle or not depends on specifications. If there is a monitor coupler in the engine room near the left strut assembly, the vehicle is not equipped with immobilizer indicator lamp and if there isn't, it is equipped with immobilizer indicator lamp.**
- **For the descriptions (items) not found in this section, refer to the section 8G of the Service Manual mentioned in FOREWORD of this manual.**

CONTENTS

GENERAL DESCRIPTION

The immobilizer control system designed to prevent vehicle burglar consists of following components.

- Engine Control Module (ECM)
- Immobilizer Control Module
- Ignition key (with built-in transponder)
- Coil antenna

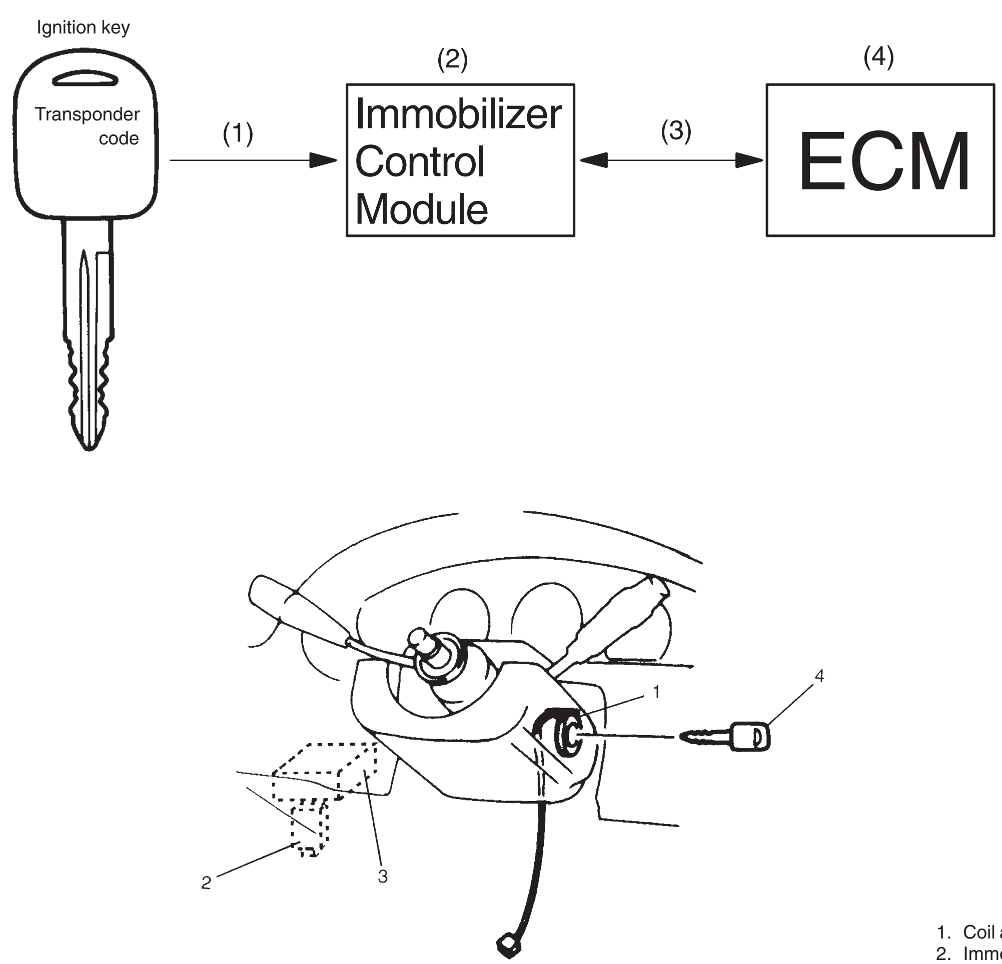
Operation of this system is as follows.

(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.

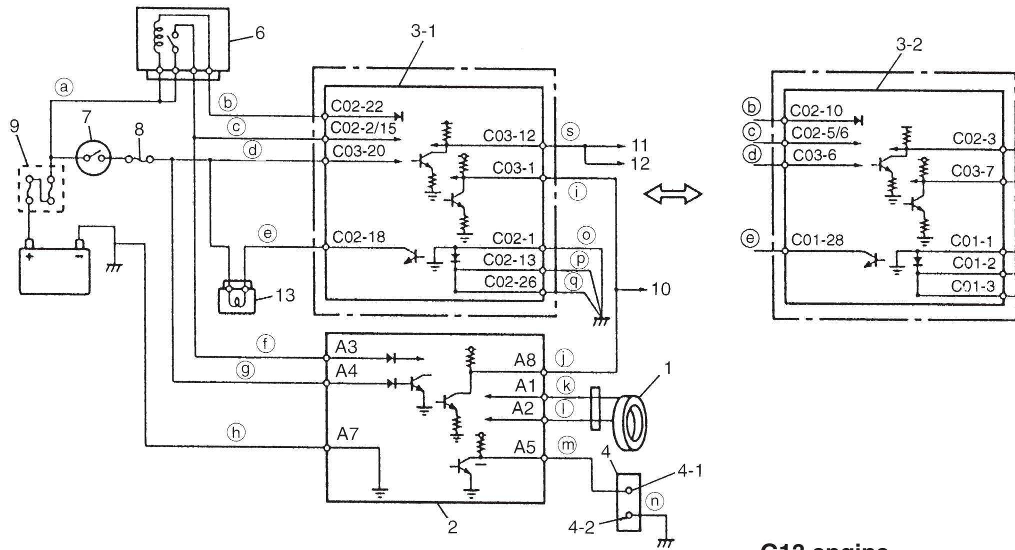
(3) When it is confirmed that two Transponder codes match each other as described above, Immobilizer Control Module and ECM check if ECM/Immobilizer Control Module codes registered in them respectively match.

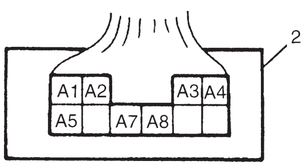
(4) Only when it is confirmed that ECM/Immobilizer Control Module codes match, the engine starts running. If Transponder codes in Step (2) or ECM/Immobilizer Control Module codes in Step (3) do not match, ECM will stop operation of the injector and the ignitor (i.e., ignition of spark plug).



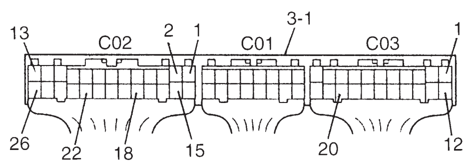
1. Coil antenna
2. Immobilizer Control Module
3. Engine Control Module (ECM)
4. Ignition key

Vehicle without monitor coupler

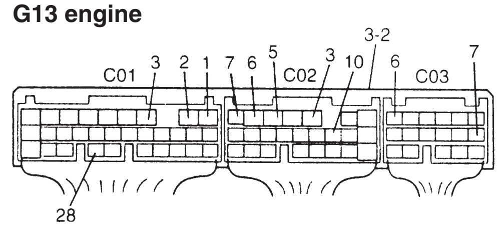




G10 engine

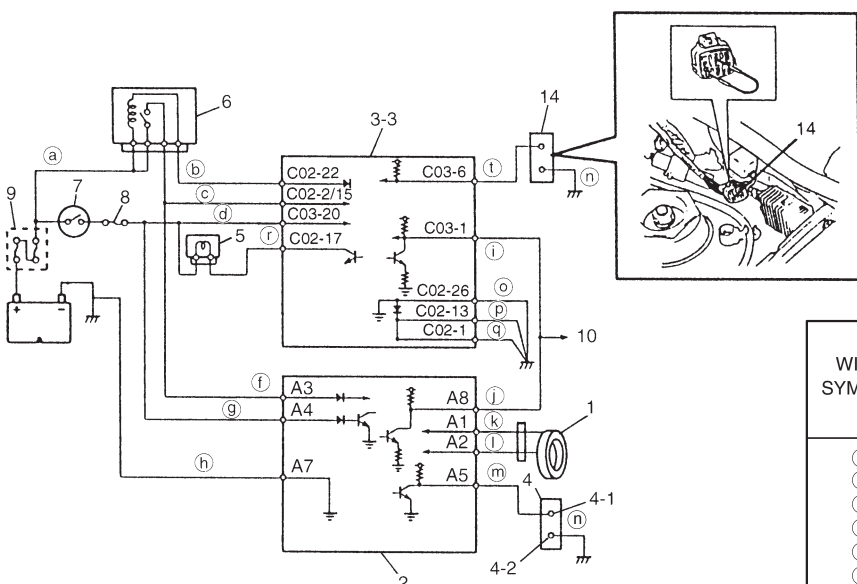


G13 engine



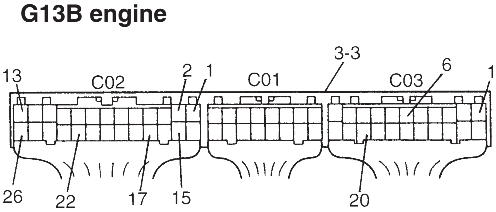
1. Coil antenna
2. Immobilizer Control Module
3-1. ECM (G10 engine)
3-2. ECM (G13 engine without monitor coupler)
3-3. ECM (G13 engine with monitor coupler)
4. Immobilizer diagnostic coupler
4-1. Diagnostic output terminal
4-2. Ground terminal
5. Malfunction indicator lamp
6. Main relay
7. Ignition switch
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)

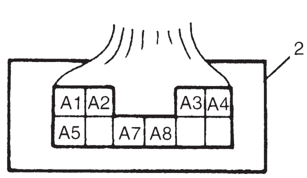
Vehicle with monitor coupler



WIRE SYMBOL	WIRE COLOR		
	G10 engine	G13 engine without monitor coupler	G13 engine with monitor coupler
a	W/R	W/R	W/R
b	Bl/B	Gr	G/B
c	W/Bl	R/B	W/Bl
d	B/W	B/W	B/W
e	V/G	V/G	–
f	W/Bl	W/Bl	W/Bl
g	B/W	B/W	B/W
h	B	B	B
i	V/W	Y/B	V/W
j	V/W	V/W	V/W
k	P/B	P/B	P/B
l	P/Bl	P/Bl	P/Bl
m	P/G	P/G	P/G
n	B	B	B
o	B	B	B/Bl
p	B/Bl	B/Or	B/Bl
q	B/R	B/Or	B/G
r	–	–	V
s	R/G	R/G	–
t	–	–	V/Y

G13B engine



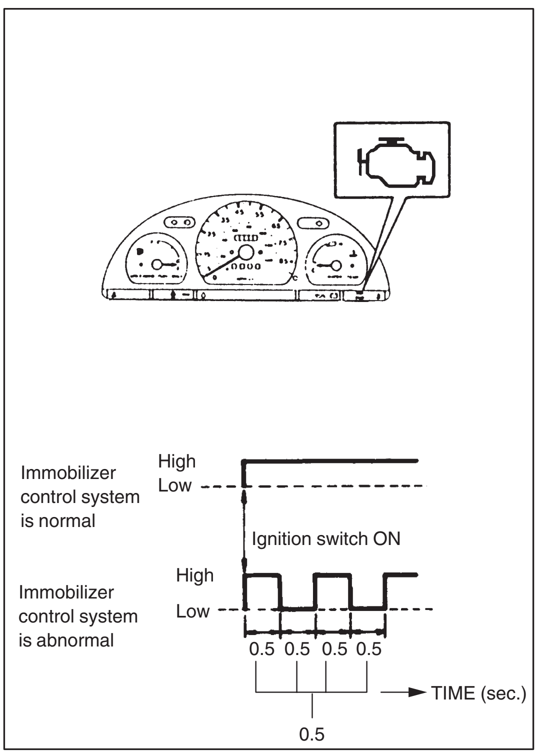


ON-BOARD DIAGNOSTIC SYSTEM (SELF-DIAGNOSIS FUNCTION)

Immobilizer Control Module & ECM diagnose troubles which may occur in the area including the following parts when the ignition switch is ON.

ECM:
- ECM/Immobilizer Control Module code
- Data link connector wire
- ECM

Immobilizer Control Module:
- Transponder code
- Coil antenna
- ECM/Immobilizer Control Module code
- Data link connector wire
- Immobilizer Control Module
- Ignition signal

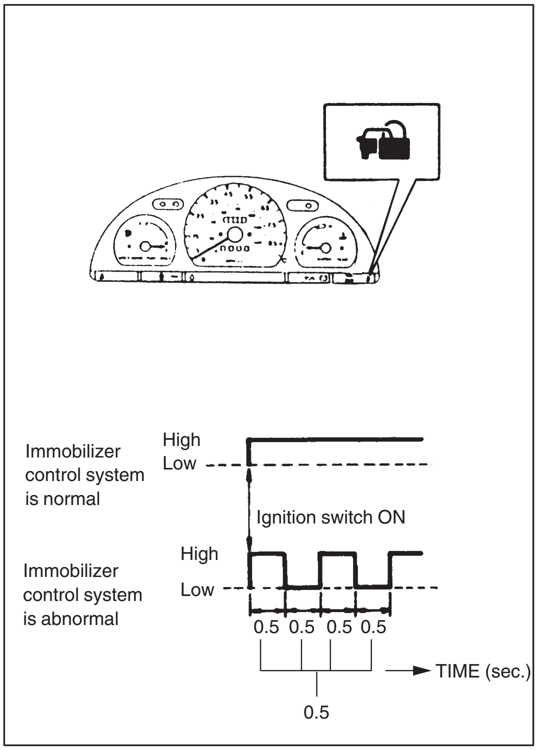


<Vehicle equipped with monitor coupler>

With the diagnosis switch terminal of monitor coupler for ECM not grounded, the ignition switch turned ON (but the engine at stop) and regardless of the condition of the engine and emission control system, ECM indicates whether a trouble has occurred in the immobilizer control system or not by causing the malfunction indicator lamp to flash or turn ON.

Malfunction indicator lamp is ON:
No trouble exists in the immobilizer control system.
Malfunction indicator lamp is flashing:
ECM or Immobilizer Control Module has detected some trouble in the immobilizer control system.

NOTE:
As soon as the ignition switch is turned ON, ECM and Immobilizer Control Module diagnose if a trouble has occurred in the immobilizer control system. While the diagnosis is being made, the malfunction indicator lamp stays ON and if the diagnosis result is "abnormal", 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 engine and emission control system, ECM indicates whether a trouble has occurred in the immobilizer control system or not by causing the immobilizer indicator lamp to flash or turn ON.

Immobilizer indicator lamp is ON:
No trouble exists in the immobilizer control system.
Immobilizer indicator lamp is flashing:
ECM or Immobilizer Control Module has detected some trouble in the immobilizer control system.

NOTE:
As soon as the ignition switch is turned ON, ECM and Immobilizer Control Module diagnose if a trouble has occurred in the immobilizer control system. While the diagnosis is being made, the Immobilizer indicator lamp stays ON and if the diagnosis result is "abnormal", it immediately changes to flashing but if the result is "normal", it remains ON. Diagnosis takes about 3 seconds at maximum.

When ECM and Immobilizer Control Module detects a trouble, it stores DTC corresponding to the exact trouble area in ECM and Immobilizer Control Module memory.

DTCs stored in memory of each controller (Immobilizer Control Module and ECM) can be read by using the procedure described in "DIAGNOSTIC TROUBLE CODE CHECK (IMMOBILIZER CONTROL MODULE)" and "DIAGNOSTIC TROUBLE CODE CHECK (ECM)" in this section.

DIAGNOSIS

ECM 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

<Vehicle equipped with monitor coupler>

- Before identifying diagnostic trouble code indicated by malfunction indicator lamp, don’t disconnect couplers from ECM, battery cable from battery, ECM ground wire harness from engine.
  Such disconnection will clear trouble codes for engine and emission control system stored in memory of ECM.
- If abnormality or malfunction lies in two or more areas, malfunction indicator lamp indicates applicable codes three times each. And flashing of these codes is repeated as long as diagnosis terminal is grounded and ignition switch is held at ON position.
- When ECM detects a trouble in both engine and emission control system and immobilizer control system, malfunction indicator lamp indicates trouble codes of both systems alternately while the ignition switch is turned ON and the diagnosis terminal is grounded.
- Take a note of diagnostic trouble code indicated first.

<Vehicle not equipped with monitor coupler>

- Before identifying diagnostic trouble code indicated through Suzuki scan tool, don’t disconnect couplers from ECM, battery cable from battery, ECM ground wire harness from engine.
  Such disconnection will clear trouble codes for engine and emission control system stored in memory of ECM.
- When ECM detects a trouble in both engine and emission control system and immobilizer control system, Suzuki scan tool indicates trouble codes of both systems using Suzuki mode of ECM applications.
- Take a note of diagnostic trouble code indicated first.

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 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 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 indicate a diagnostic trouble code representing a trouble which occurred only temporarily and has gone. In such case, it may occur that good parts are replaced unnecessarily. To prevent such accident, be sure to follow instructions given below when checking by using “Diagnostic Flow Table”.
  - * When trouble can be identified, it is not an intermittent one: Check coil antenna, ignition key, wires and each connection and if they are all in good condition, substitute a known-good ECM and recheck.
  - * When trouble can not be identified but output of diagnostic output terminal and/or Suzuki scan tool indicate a trouble code:
    Diagnose trouble by using that code No. and if ignition key, coil antenna, wires and each connection are all in good condition, turn OFF ignition switch and then ON.

Then check what Suzuki scan tool and/or output of diagnostic output terminal indicate.
Only when they indicate trouble code again, substitute a known-good ECM or Immobilizer Control Module and check again.
If they indicate not trouble code but normal code, it means that an intermittent trouble did occur and has gone. In this case, check wires and connections carefully again.

DIAGNOSTIC FLOW TABLE

<Vehicle 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 referring to “DIAGNOSTIC TROUBLE CODE CHECK (ECM)” in this section. Is there any DTC(s)?	Go to flow table for DTC No.	Substitute a known-good ECM and recheck. NOTE: After replacing with a known-good ECM, register ECM/ Immobilizer Control Module code in ECM by performing procedure described in “Procedure after ECM Replacement” section.

Fig. 1 for Step 1

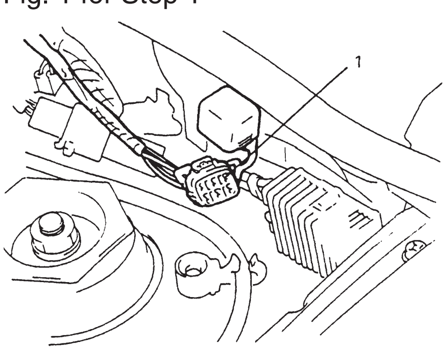


Fig. 2 for Step 1

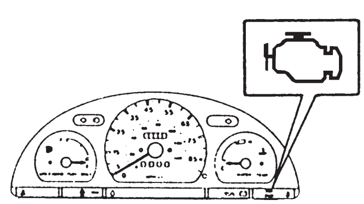
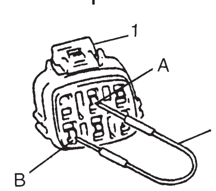
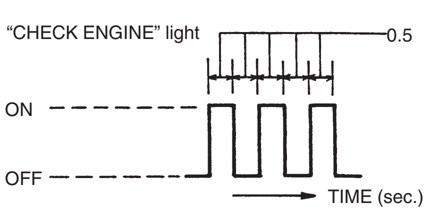


Fig. 3 for Step 2



1. Monitor coupler
2. Service wire
A: Diagnosis switch terminal
B: Ground terminal

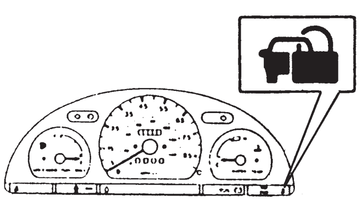
Fig. 4 for Step 3

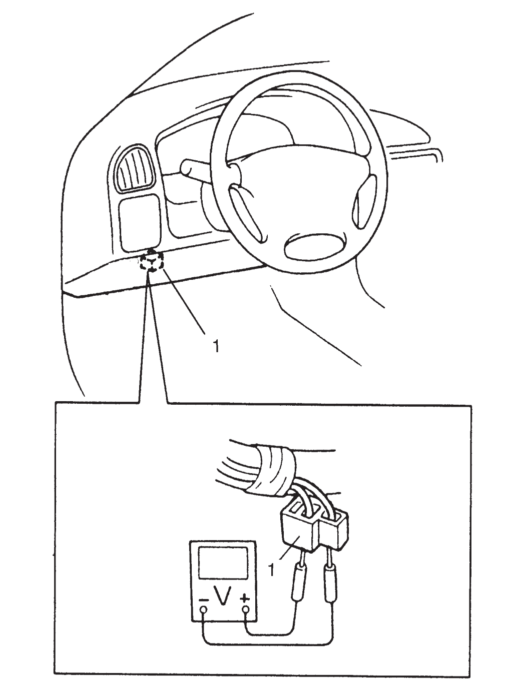


<Vehicle not equipped with monitor coupler>

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 referring to “DIAGNOSTIC TROUBLE CODE CHECK (ECM)” in this section. Is there any DTC(s)?	Go to “IMMOBILIZER INDICATOR LAMP CHECK” in this section.	Immobilizer control system is in good condition.
3	1) Check DTC stored in Immobilizer Control Module referring to “DIAGNOSTIC TROUBLE CODE CHECK (IMMOBILIZER CONTROL MODULE)” in this section. Is there any DTC(s)?	Go to flow table for DTC No.	Go to Step 4.
4	1) Check DTC stored in ECM referring to “DIAGNOSTIC TROUBLE CODE CHECK (ECM)” in this section. Is there any DTC(s) for immobilizer control system?	Go to flow table for DTC No.	Substitute a known-good ECM and recheck. NOTE: After replacing with a known-good ECM, register ECM/ Immobilizer Control Module code in ECM by performing procedure described in “Procedure after ECM Replacement” section.

FIg. 1 for Step 1



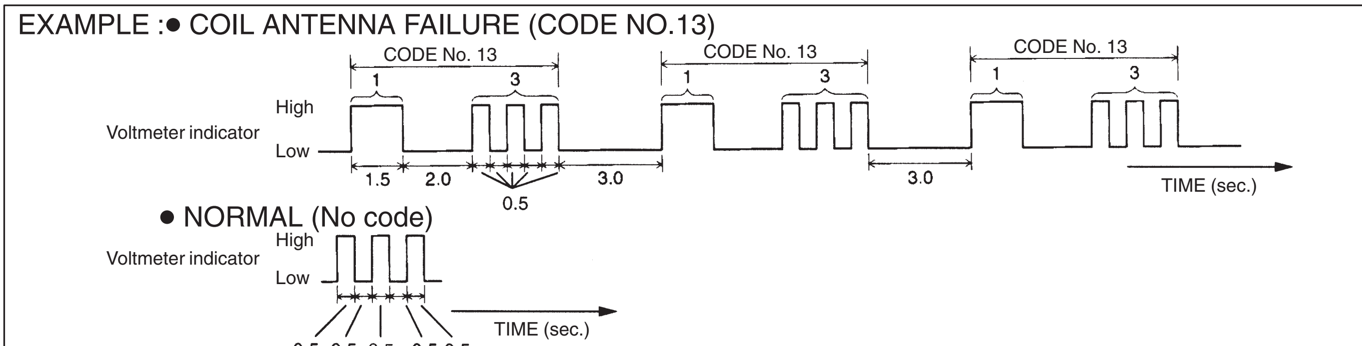


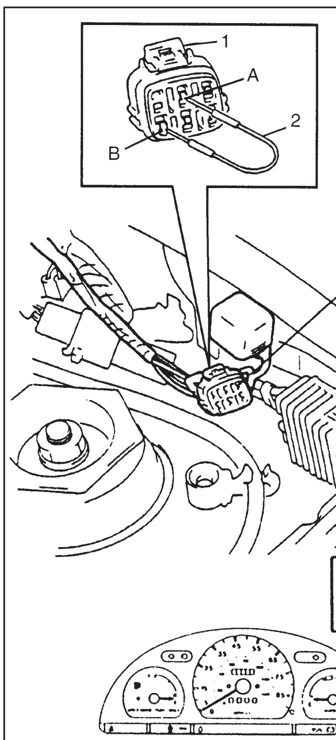
1. Immobilizer diagnostic coupler

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.





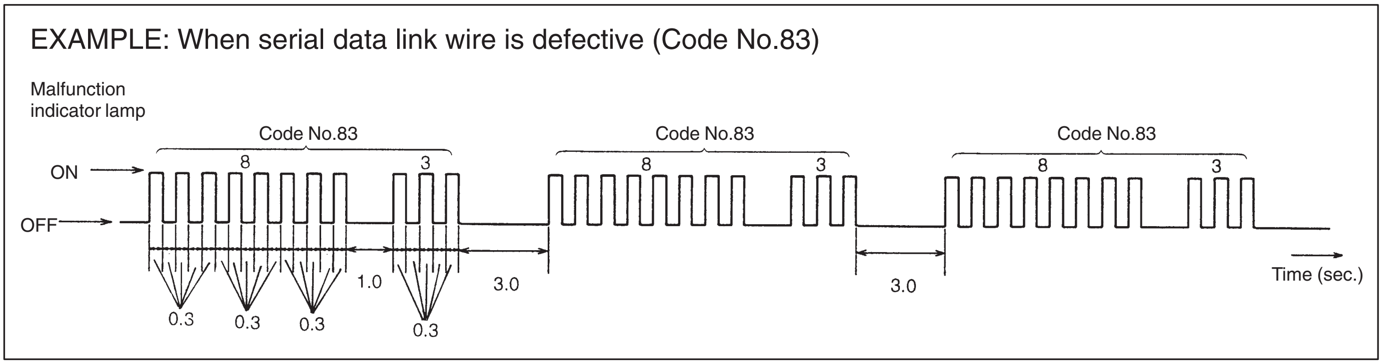
1. Monitor coupler
2. Service wire
A: Diagnosis switch terminal
B: Ground terminal

DIAGNOSTIC TROUBLE CODE (DTC) CHECK (ECM)

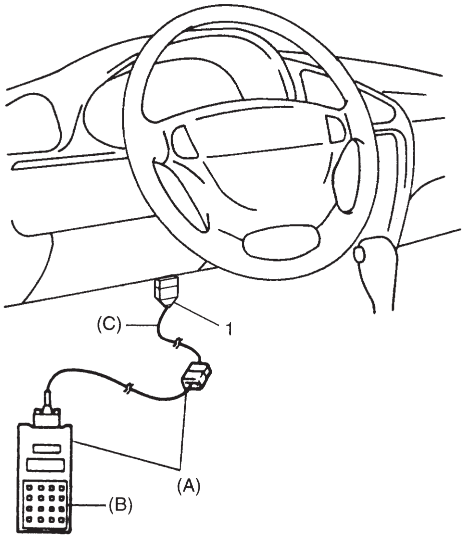
[Not using SUZUKI scan tool] (Vehicle equipped with monitor coupler)

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 side in “Diagnostic Trouble Code Table”.
   If lamp remains ON, go to “Malfunction Indicator Lamp Check” in Section 6.

NOTE:
If abnormality or malfunction lies in two or more areas, malfunction indicator lamp indicates applicable codes three times each.
And flashing of these codes is repeated as long as diagnosis terminal is grounded and ignition switch is held at ON position.



3) After completing the check, turn ignition switch OFF and disconnect service wire from monitor coupler.



1. Data link connector (DLC)

[Using SUZUKI scan tool] (Vehicle not equipped with monitor coupler)

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 (16/14 pin DLC adapter)

3) Turn ignition switch ON.
4) Read DTC stored in ECM according to instructions displayed on Suzuki scan tool and print it or write it down. Refer to Suzuki scan tool operator's manual for further details.

   NOTE:
   - **When reading DTC stored in ECM using Suzuki scan tool, select "ECM" from the applications menu and "SUZUKI mode" from the communication mode menu displayed on Suzuki scan tool.**
   - **If ECM detects a trouble in both electric fuel injection system and immobilizer control system, Suzuki scan tool indicates trouble codes of both systems using Suzuki mode of ECM application.**

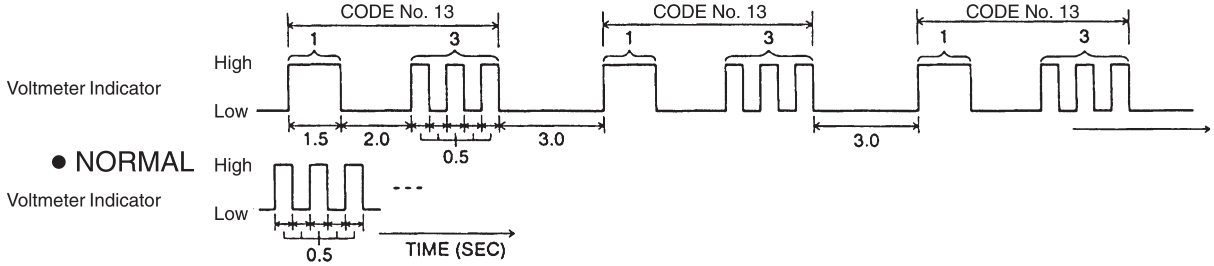
   If communication between Suzuki scan tool and ECM is not possible, check if Suzuki scan tool is communicable by connecting it to ECM in another vehicle. If communication is possible in this case, Suzuki scan tool is in good condition. Then check data link connector and serial data line (circuit) in the vehicle with which communication was not possible.

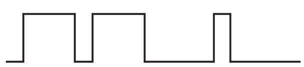
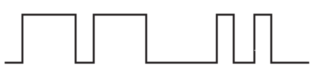
5) After completing the check, turn ignition switch OFF and disconnect Suzuki scan tool from data link connector (DLC).

DIAGNOSTIC TROUBLE CODE TABLE

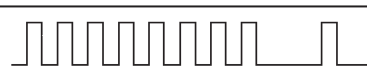
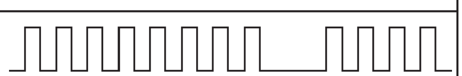
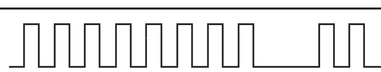
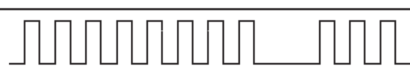
Immobilizer Control Module

EXAMPLE: ● COIL ANTENNA FAILURE (CODE NO.13)

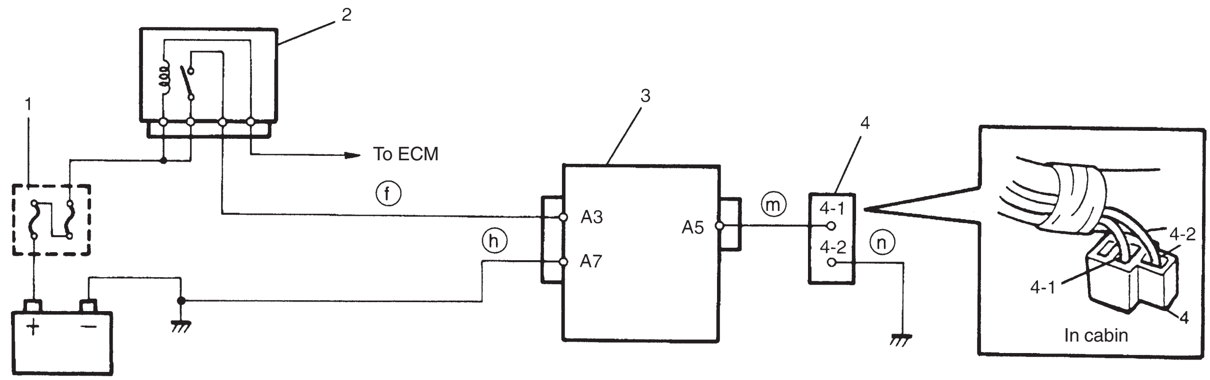


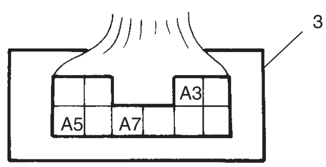
DIAGNOSTIC TROUBLE CODE NO.	VOLTMETER INDICATION	DIAGNOSTIC AREA	DIAGNOSIS
–		Normal	This code appears when none of the other codes are identified.
11		Transponder code	Diagnose trouble according to “DIAGNOSTIC FLOW TABLE” corresponding to each code No.
31			
12		Immobilizer Control Module	
13		Coil antenna or ignition key with built-in transponder	
21		ECM/Immobilizer Control Module code	
22		Ignition switch circuit	
23		Serial data link wire	

Engine Control module (ECM)

DTC (indicated on Suzuki scan tool)	DTC (indicated by MIL)	Malfunction Indicator lamp (MIL) flashing pattern	DIAGNOSTIC AREA	DIAGNOSIS
NO DTC	12		Normal	This code appears when it is confirmed that none of other trouble codes is set for immobilizer control system or engine and emission control system.
P1623	81		ECM/Immobilizer Control Module code	Diagnose trouble according to “DIAGNOSTIC FLOW TABLE” corresponding to each code No.
P1620	84			
P1622	82		ECM	
P1621	83		Serial data link wire	

A-1 CODE (DTC) IS NOT OUTPUTTED FROM DIAGNOSTIC OUTPUT TERMINAL OF IMMOBILIZER DIAGNOSTIC COUPLER





1. Main fuse
2. Main relay
3. Immobilizer Control Module
4. Immobilizer diagnostic coupler

4-1. Diagnostic output terminal
4-2. Ground terminal

Step 1: Check voltage between A3 terminal and body ground with ignition switch turned ON. Is it 10 – 14 V?

- **NO** → "f" wire open.
- **YES** → go to next step.

Step 2:
1. Connect voltmeter between A5 terminal and body ground.
2. Does voltmeter indicator deflect?

- **NO** →
  - 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.

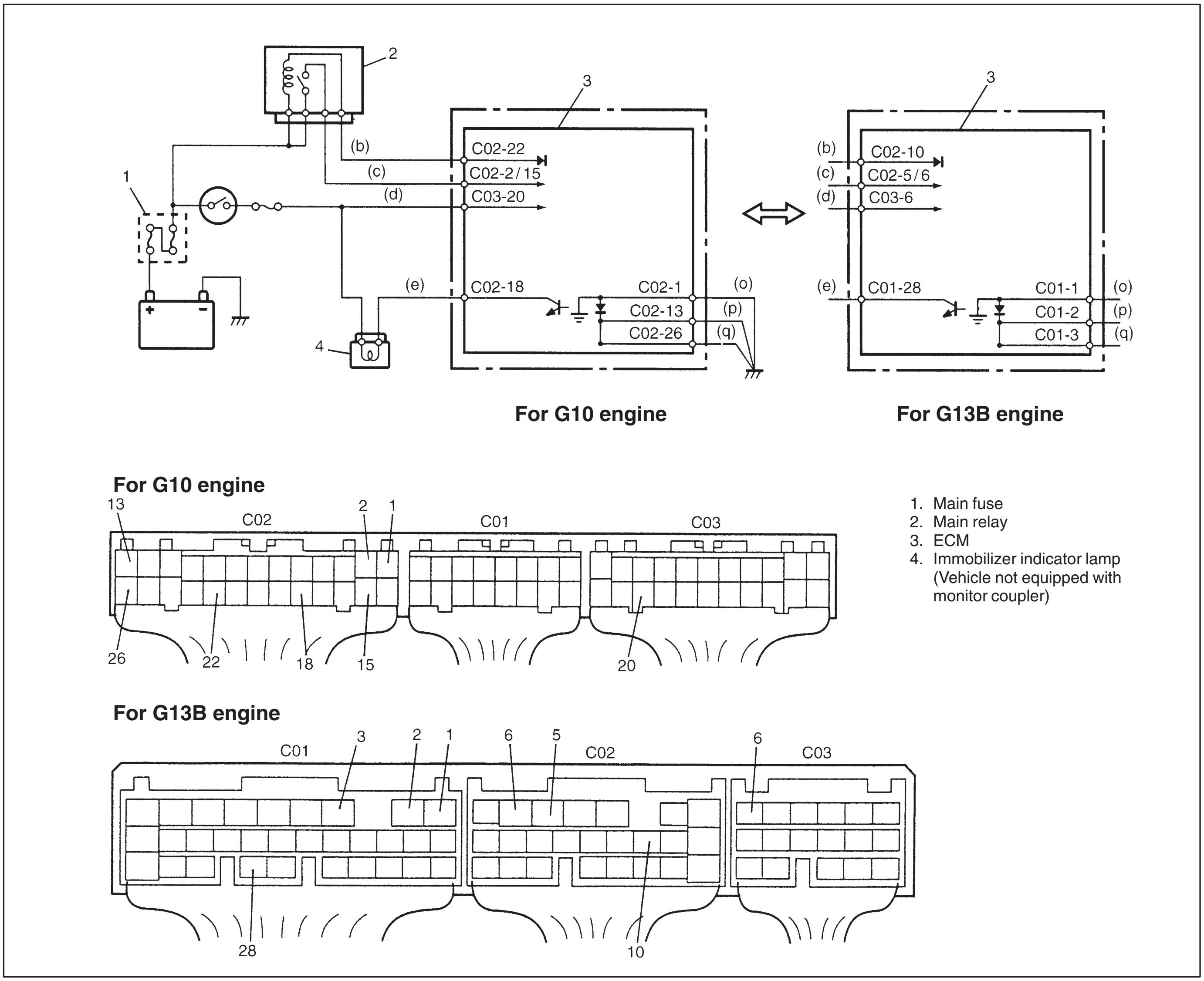
  If wire and connections are OK, substitute a known-good ICM and recheck.

  NOTE:
  After replacing with a known-good ICM, register ECM/ICM code in ECM and TP code and ECM/ICM code in ICM by performing procedure described in "Procedure after ICM Replacement" section.
- **YES** → go to next step.

Step 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?

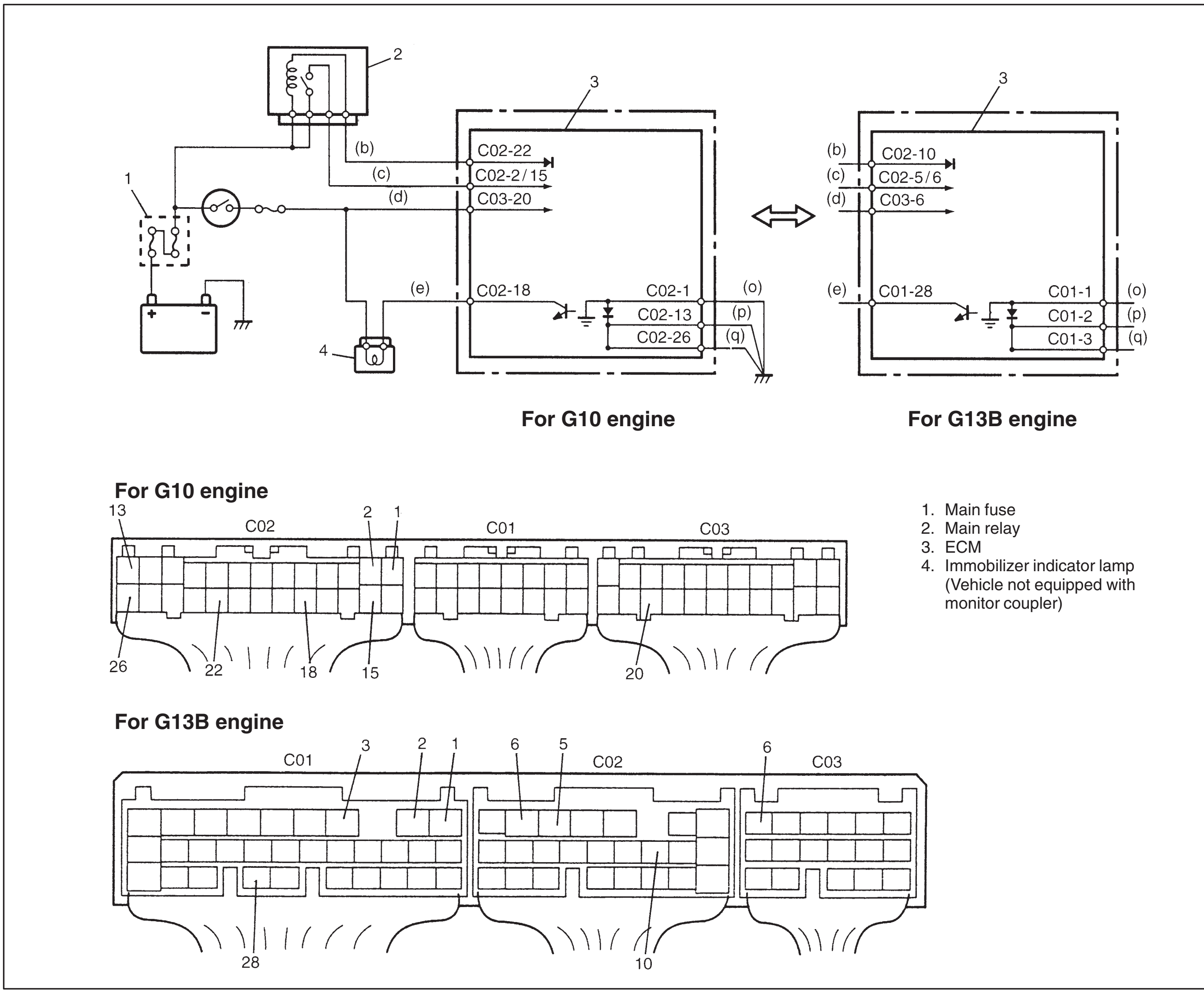
- **NO** → "m" wire between A5 terminal and diagnostic output terminal of immobilizer diagnostic coupler open.
- **YES** → "n" wire of ground terminal for immobilizer diagnostic coupler open.

A-2 IMMOBILIZER INDICATOR LAMP CHECK (IMMOBILIZER INDICATOR LAMP DOSE NOT LIGHT AT IGNITION SWITCH ON)



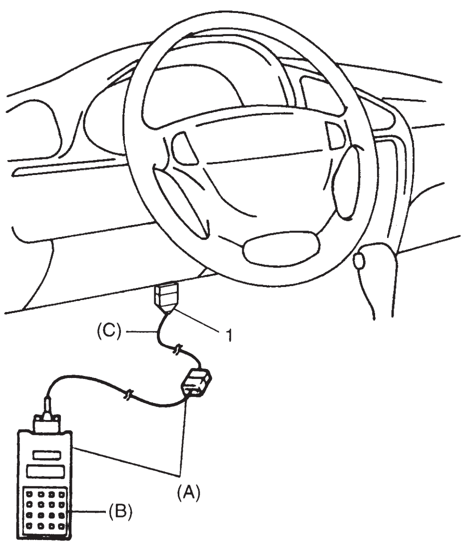
STEP	ACTION	YES	NO
1	1) Turn ignition switch ON. Do other indicator/warning lights in combination meter come ON?	Go to Step 2.	“IG” fuse blown, main fuse blown, ignition switch malfunction, “(d)” circuit between “IG” fuse and combination meter or poor coupler connection at combination meter.
2	1) Turn ignition switch OFF and disconnect connectors from ECM. 2) Check for proper connection to ECM at terminal C02-18 for G10 engine or C01-28 for G13B engine. 3) If OK, then using service wire, ground terminal C02-18 for G10 engine or C01-28 for G13B engine in connector disconnected. Does immobilizer indicator lamp turn on at ignition switch ON?	Substitute a known-good ECM and recheck.	Bulb burned out or “(P)” wire circuit open.

A-3 IMMOBILIZER INDICATOR LAMP CHECK (IMMOBILIZER INDICATOR LAMP REMAINS ON AFTER ENGINE STARTS)



STEP	ACTION	YES	NO
1	1) With ignition switch OFF, disconnect couplers from ECM. Does immobilizer indicator lamp turn ON at ignition switch ON?	"(p)" wire shorted to ground circuit.	Substitute a known-good ECM and recheck.

HOW TO REGISTER IGNITION KEY



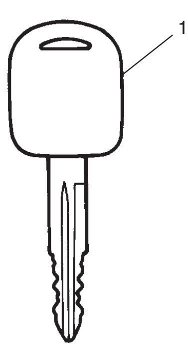
1. Data link connector (DLC)

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 vehicles 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 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 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 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 REPLACEMENT

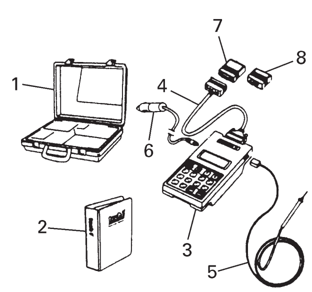
When ECM was replaced, including when replaced because rechecking by using a known-good ECM was necessary during trouble diagnosis, register ECM/Immobilizer Control Module code in ECM by performing following procedure.

1) Perform Steps 1) and 2) described in “How to register ignition key” section. And then turn ignition switch ON.
2) Using Suzuki scan tool, register ECM/Immobilizer Control Module code in ECM by executing “RECORD ECU (RECORD ECM/Immobilizer Control Module)” command in SELECT MODE menu.

   NOTE:
   For operation procedure of Suzuki scan tool, refer to Suzuki scan tool operator’s manual.

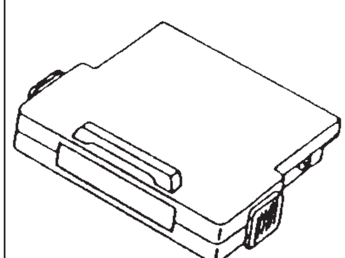
3) [Vehicle equipped with monitor coupler]
   Make sure that malfunction indicator lamp lights when ignition switch is turned OFF once and then ON.
   [Vehicle not equipped with monitor coupler]
   Make sure that immobilizer indicator lamp lights when ignition switch is turned OFF once and then ON.

SPECIAL TOOLS

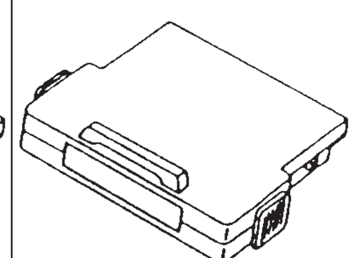


1. Storage case
2. Operator’s manual
3. Tech 1A
4. DLC cable
   (14/26 pin, 09931-76040)
5. Test lead/probe
6. Power source cable
7. DLC cable adapter
8. Self-test adapter

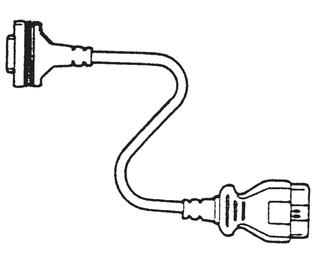
09931-76011
Suzuki scan tool (Tech 1A kit)



Immobilizer cartridge of version 1.1 or more



Mass storage cartridge of version 1.5 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

Prepared by

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