SUZUKI

VITARA

SUPPLEMENTARY SERVICE MANUAL

USE THIS SUPPLEMENTARY SERVICE MANUAL WITH MANUALS MENTIONED IN THE FOREWORD OF THIS MANUAL.

SUZUKI
SANTANA MOTOR, S.A.

00000A01271-E

IMPORTANT

WARNING/CAUTION/NOTE

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

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

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

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

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

> WARNING:
> For vehicles equipped with a Supplemental 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.
> - 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 (on or around air bag system components or wiring). Modifications can adversely affect air bag system performance and lead to injury.
> - If the vehicle will be exposed to temperatures over 93°C, 200°F (for example, during a paint baking process), remove the air bag system components (air bag inflator module, sensing and diagnostic module, forward discriminating sensor) beforehand to avoid component damage or unintended deployment.

FOREWORD

This SUPPLEMENTARY SERVICE MANUAL is a supplement to SE416 SERVICE MANUAL.

Applicable model:
SE416 vehicles on and after following body No.

GROUP 1
(X) JSAETA02C01200001 (X)
(X) JSAETA02V01200001 (X)
(X) JSAETD01V01200001 (X)
TD01V-200001
GROUP 2
Refer to body number mentioned in FOREWORD of GROUP 2

When servicing a vehicle with a body number after the above listed number, refer to this Suplementary Service Manual first.

And for any section, item or description not found in this service manual, refer to the right listed SERVICE MANUAL.

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

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

RELATED SERVICE MANUAL
- **VITARA SERVICE MANUAL (99500-60A10)**
- **VITARA SUPPLEMENTARY SERVICE MANUAL (99501-60A70)**
- **VITARA SUPPLEMENTARY SERVICE MANUAL (99501-61A10)**
- **SE/SV/SZ/SY SERIES SUPPLEMENTARY SERVICE MANUAL (99501-60G10)**
- **SE416/SZ416 SUPPLEMENTARY SERVICE MANUAL (99501-61A20)**
- **VITARA SUPPLEMENTARY SERVICE MANUAL (00000A01231-S)**

GROUP1 3D 6E1 7B1 GROUP2 1A 5 8

SANTANA MOTOR, S.A.
DEPARTAMENTO DE SERVICIO

IMPRESO POR SANTANA MOTOR, S.A. - 1997

ABBREVIATIONS USED IN THIS MANUAL

A. ABS	: Anti-lock Brake System
A/C	: Air Conditioning
A/F	: Air Fuel mixture ratio
A/T	: Automatic Transmission
B. B+	: Battery Voltage
C. CMP sensor	: Camshaft Position Sensor
CPU	: Central Processing Unit
CTP switch	: Closed Throttle Position switch
D. DLC	: Data Link Connecter
E. ECM	: Engine Control Module
ECT sensor	: Engine Coolant Temp. sensor
EGR	: Exhaust Gas Recirculation
EVAP	: Evaporative Emission
F. 4WD	: Four Wheel Drive
G. GND	: Ground
I. IAC valve	: Idle Air Control valve
IAT sensor	: Intake Air Temp. sensor
IC	: Ignition Control
M. MAF sensor	: Mass Air Flow sensor
MAP sensor	: Manifold Absolute Pressure sensor
MIL	: Malfunction Indicator Lamp
M/T	: Manual Transmission
O. O/D	: Over Drive
P. PCM	: Powertrain Control Module
PCV valve	: Positive Crankcase Ventilation valve
PSP switch	: Power Steering Pressure switch
T. TCC	: Torque Converter Clutch
TCM	: Transmission Control Module
TP sensor	: Throttle Position sensor
V. VSS	: Vehicle Speed Sensor

3D

SECTION 3D

FRONT SUSPENSION

CONTENTS

FREE WHEEL DEVICE

GENERAL DESCRIPTION

The free wheel device allows the independence of the attachment of the front wheels with the input half-axles, when the double drive is not going to be used, or couple both elements when four wheel drive is wished.

This device is set at the ends of the front half-axles, coupled to the hubs and replacing the channeled flange.

Its correct use avoids front tyre, in its movement from drafting the half-axles, differential group and front drive, avoiding the wear of the elements and providing a reduction of the noise level and obtaining a fuel consumption save.

There are two types of free wheel, the manual driven one, which is coupled on the free wheel hub itself and the automatic one that works when the double drive 4H or 4L is selected .

MANUAL FREE WHEEL PERFORMANCE

The free wheel device must be set at both ends of the front half-axles. It consists of a knob located at the center that can be rotated and its mark matched with the FREE or LOCK marks located outside.

When the knob is set in its FREE position the half-axle and the wheel will be disengaged and the front wheel rotation will be free. When it is set in its LOCK position the axle and the wheel will be engaged. For its use refer to the Owner's Manual, provided with the vehicle.

AUTOMATIC FREE WHEEL PERFORMANCE

The automatic free wheel is located at the ends of the right and left front half-axles in a similar way to that of the manual type.

When a vehicle provided with automatic free wheel moves, when changing the transfer lever from 2H to 4H or 4L position, the driving power is transmitted through the half-axles to the free wheel internal mechanism, causing it to be linked with the wheel hub. This manoeuvre must be done with the vehicle stopped when the lever is for the first time moved from 2H to 4H position. When the vehicle has moved 2 metres approx. the engagement of the free wheel is accomplished. Later we can perform the change from 2H to 4H, or the contrary, with the vehicle moving, even not actuating on the clutch (the vehicle being in a straight line trajectory).

In order to accomplish the disengagement of the free wheel device, simply set the transfer lever in 2H and the gear lever in MA position, approx. 2 metres later the locking device is disconnected. To engage the free wheel in MA, simply set the transfer lever in 4H or 4L and move backward a short track. Now, the unlocking will be produced by selecting 1st gear, the transfer lever in 2H and moving forward some metres.

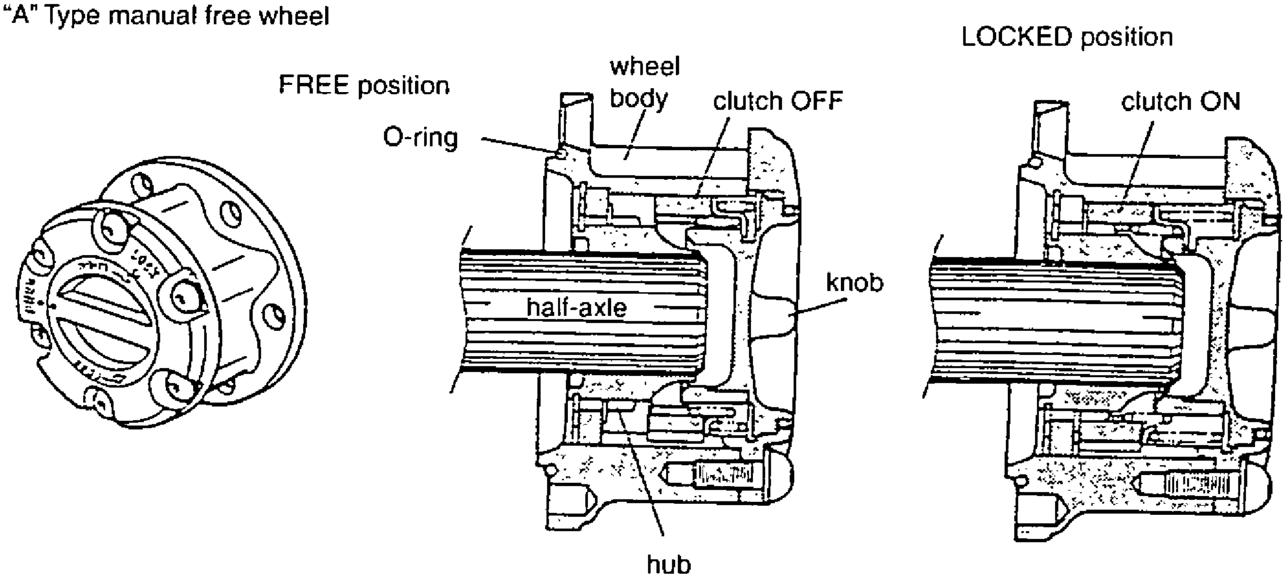
FREE WHEEL TYPES DESCRIPTION

There are two types of free wheel, a manual driven one and an automatic one, and for each type there are two versions, so that, in total there are four kinds of free wheels.

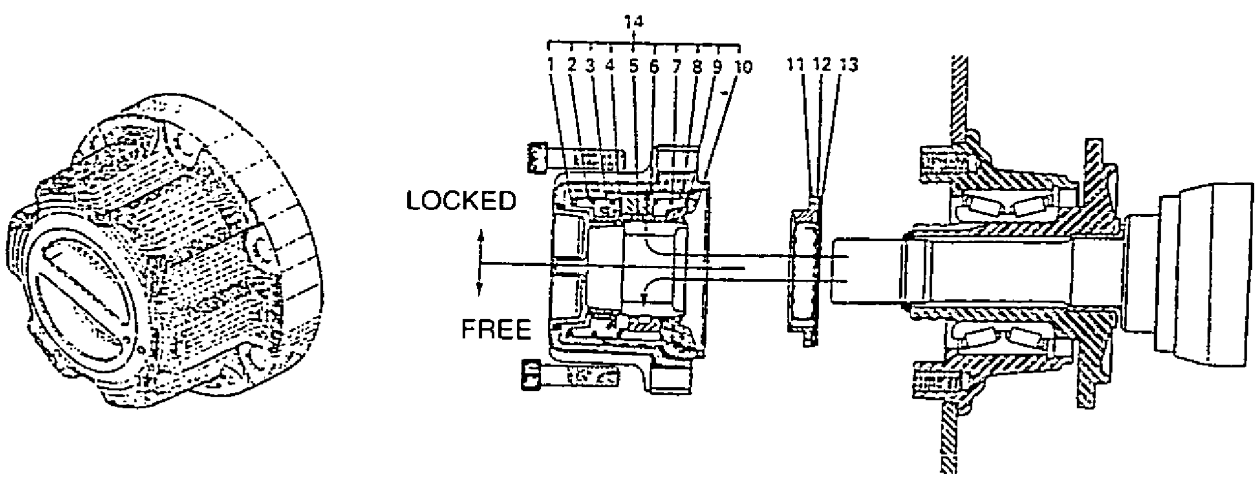
The installation of one or other type depends on the vehicle specification. The installation and maintenance method changes from one to another; make certain you are using the adequate method by consulting up the corresponding section.

CAUTION:
- Make certain the wheel to be installed is identical by both sides.
- For vehicle provided with manual free wheel, the actuating knob must be in the same position.
- Never unfit a free wheel assy. The unfitting may alter its correct performance.

"A" Type manual free wheel

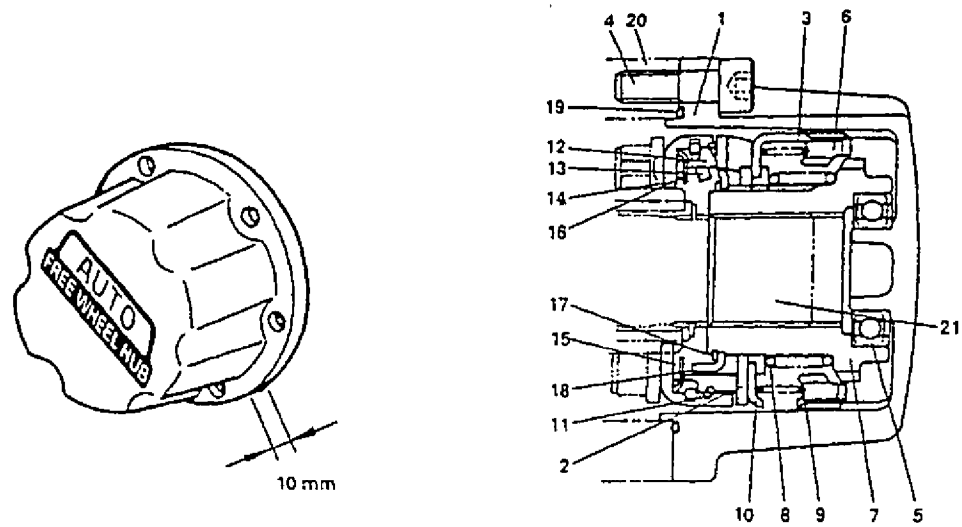


"B" Type manual free wheel



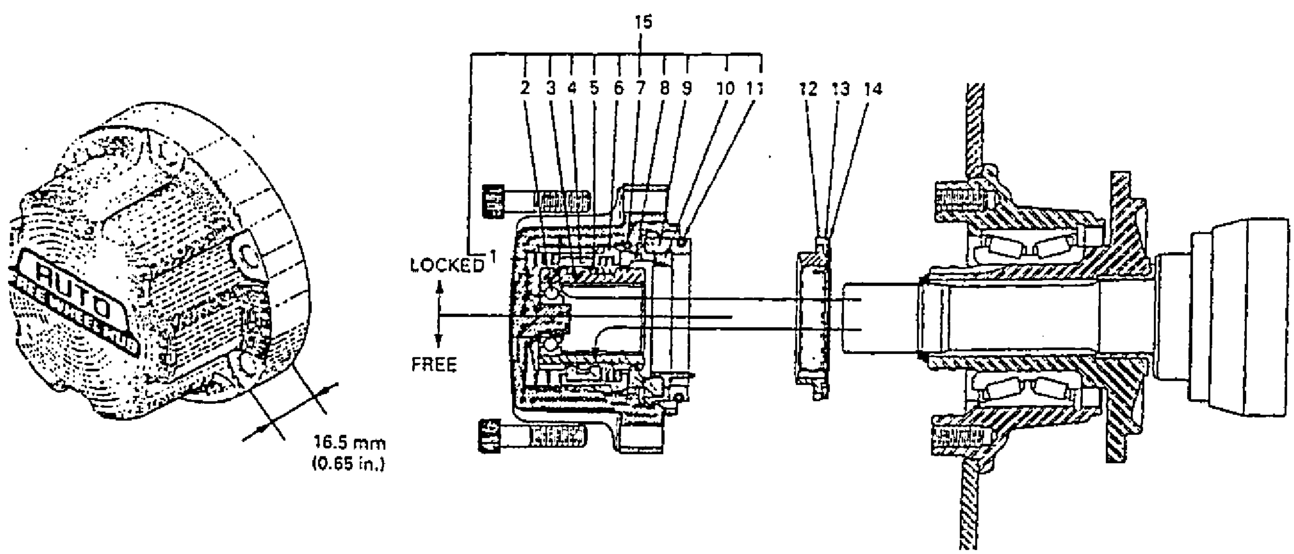
1. Knob
2. Main spring
3. Knob screw
4. Knob nut
5. Internal driving gear
6. Clutch ring
7. Return spring
8. Bearing
9. Retainer ring
10. O-ring
11. Slotted nut
12. Antirotation spring
13. Rear spring plate
14. Free wheel assy

"A" Type automatic free wheel.



1. Cover
2. Cam
3. Retainer
4. Screw
5. Bearing
6. Sliding gear
7. Driving gear
8. Return spring
9. Change spring
10. Sustaining spring
11. O-ring
12. Internal brake
13. Retaining ring
14. External brake
15. Neddle bearing
16. Driving washer
17. Elastic ring
18. Retaining plate
19. O-ring
20. Wheel hub
21. Skid

"B" Type automatic free wheel

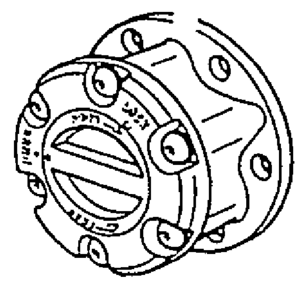


1. Wavy return spring
2. Bearing
3. Internal driving gear
4. Clutch ring
5. Wavy spring box
6. clutch box ring
7. retaining ring
8. follower cam
9. Mobile cam
10. Fix cam
11. O-ring
12. Slotted nut
13. Check spring
14. Plate
15. Assy

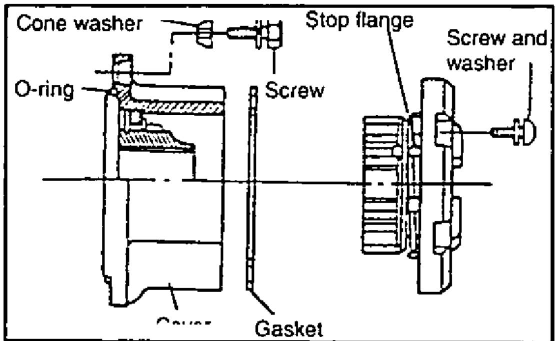
NOTE: Some vehicles may incorporate the hub bearing retaining system consisting of nut (not slotted) and safety washer. This mechanism is compatible with "A" and "B" manual driven free wheels and with "A" type automatic ones. For "B" type automatic free wheel is compulsory the use of the Locking system consisting of slotted nut, check spring and plate, as shown above.

INSTALLATION OF "A" TYPE MANUAL FREE WHEEL

"A" type manual free wheel



FREE position



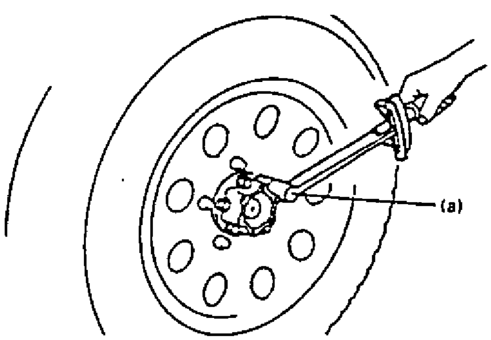
Removal

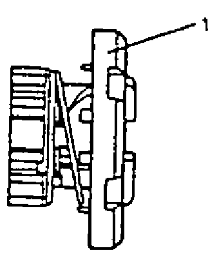
1) Jack the vehicle and remove the tyre, if necessary.
2) Remove the half-axle and hub attaching flange.

Installation

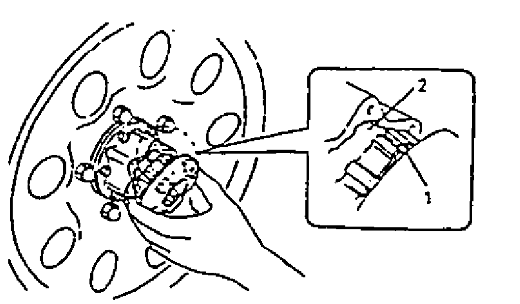
1) Align the "O" mark on the free wheel knob with **FREE** position. Detach from the body assy the free wheel cover assy.
2) Install the free wheel body assy on the wheel hub.

Torque of attaching screws: 2,5 m g. (25 Nm)





1. Cover

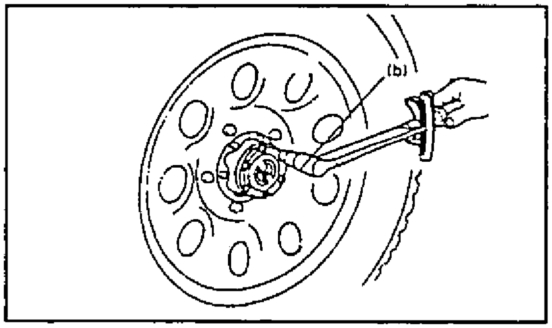


1. Interlocking finger
2. Channel.

3) Install the cover assy on the body assy, so that the interlock finger of the driving roller adjust on the body assy channel.

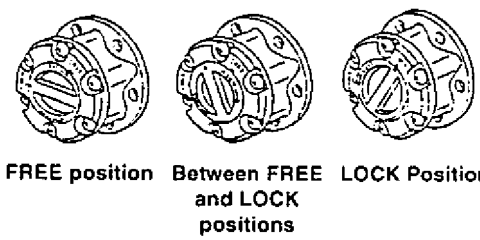
NOTE:
Before installing the cover assy check the following points:

- **The "O" mark of the knob is in FREE position.**
- **The clutch is raised toward the cover side. If not (as shown in the figure), it may cause a defective performance.**
- **The hardware is correctly adjusted**
- **There are two interlocking fingers that may be freely adjusted.**

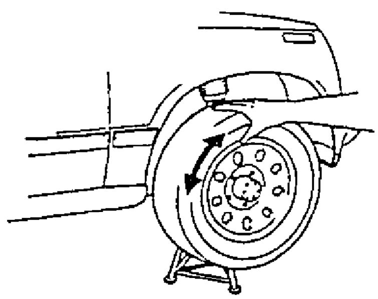


4) Attach the cover assy on the body assy by means of cover screws.

Torque of the cover attaching screws: 1 m Kg. (10 Nm)



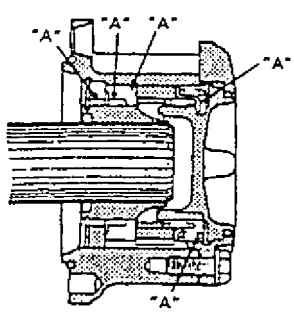
5) To check the performance of the free wheel, jack the front side of the vehicle and move the knob between **FREE** and **LOCK** positions, checking it does softly. Also check, by hand turning, that the wheels remain attached to the half-axle in the **LOCK** position and release from it in **FREE** position.



MAINTENANCE SERVICE

The vehicles provided with free wheel are subject to the following periodic checkings.

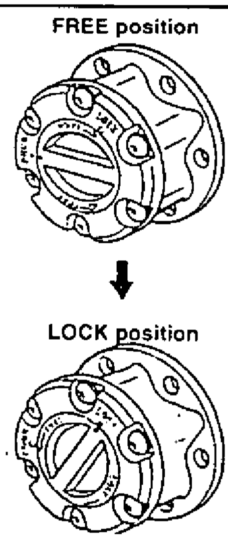
In order to check the performance of the free wheel, jack the front side of the vehicle, move the knob between **FREE** and **LOCK** positions, and check it does softly. Also check if the wheel operates correctly with the knob in **FREE** and **LOCK** positions by turning the wheel by hand.



If the outcome of the check is not satisfactory, remove the free wheel cover and grease each sliding surface using lithium grease or grease after cleaning each sliding part.

LITHIUM GREASE
SUZUKI SUPER GREASE A (99000-25010)

If the performance goes on defective, after the greasing operation, rework the damaged part or replace it by a new one.



CAUTION
The hubs must not be grease covered

INSTALLATION OF "B" TYPE MANUAL FREE WHEEL

Removal
1) Jack the vehicle and remove the tyre
2) Remove axle and hub attaching flange

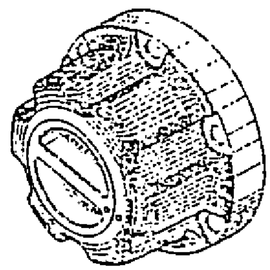
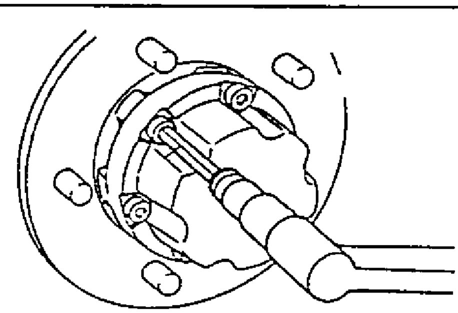
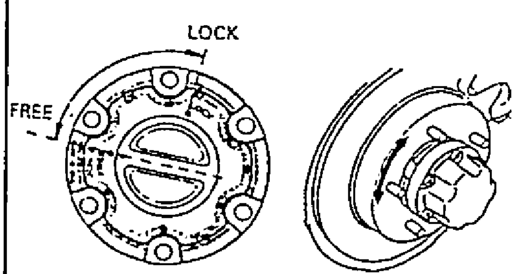


Figure: Manual free wheel

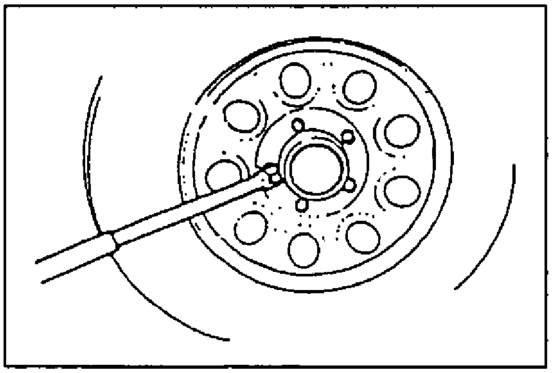
Installation
1) Check the O-ring of the free wheel is not damaged and is correctly placed.
2) Acting on the knob, place the free wheel in **FREE** position.
3) Clean the contact surfaces of the hub and the free wheel and install it.
4) Torque the free wheel attaching screws (supplied with it), in a cross way at the specified value.

Torque of the free wheel screws: 3,3 m Kg (33 Nm).





5) Check the following:
- The knob actuates correctly and changes without difficulty from **FREE** to **LOCK** position and the other way round.
- That once the knob is in its **FREE** position, the wheel turns freely and it is not linked to the half-axle.
- That once the knob is in its **LOCK** position the free wheel assy is linked to the half-axle.



6) Install the tyre and torque the nuts to the specified value.

Torque of attaching screws of wheel nuts: 9,5 m Kg. (95 Nm).

MAINTENANCE

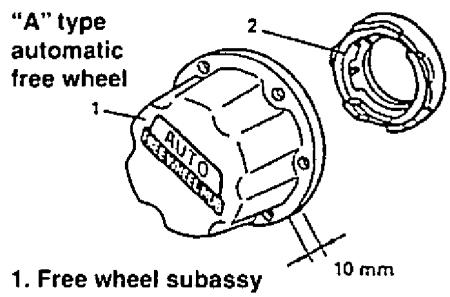
Jack the vehicle and check that the free wheel operates in **FREE** and **LOCK** positions, by turning the wheel. If any defective performance is noted, replace the free wheel assy.

CAUTION:
Hubs must not be grease covered.

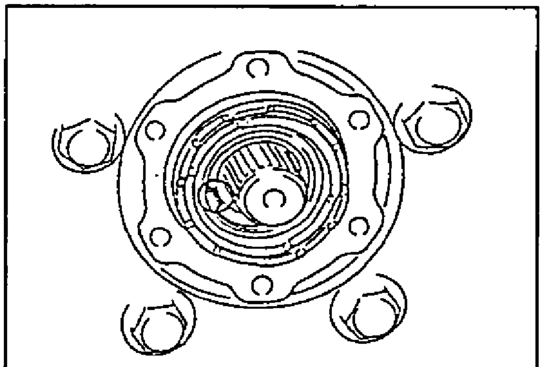
INSTALLATION OF "A" TYPE AUTOMATIC FREE WHEEL

Removal

1) Jack the vehicle and remove the tyre, if required.
2) Remove half-axle and hub attaching flange

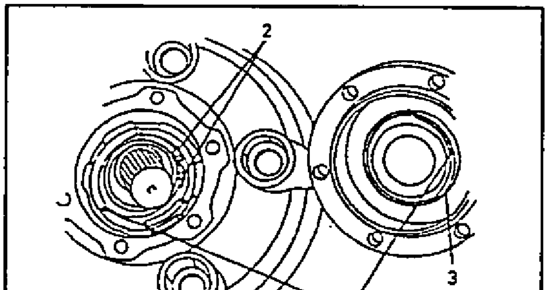


1. Free wheel subassy
2. Free wheel brake assy.



Installation

1) Check the O-ring of the free wheel is not damaged and is correctly placed.
2) Install the free wheel aligning it with free wheel brake assy cotter and with sleeve cotter.
3) Install the free wheel subassy matching the marks of the brake assy and subassy.



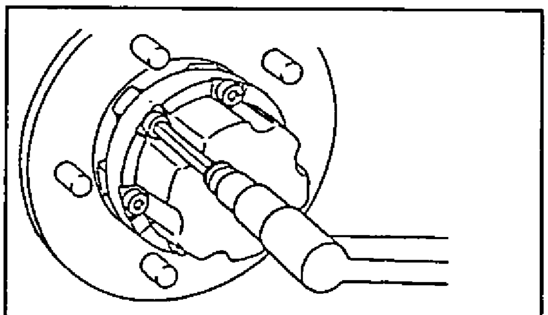
1. Align marks
2. Brake spring
3. Declutching plate

CAUTION:
Make certain the marks mentioned above are aligned, if not, they may interfere one on the others and cause damages.

4) Torque the free wheel screws to the specified value.

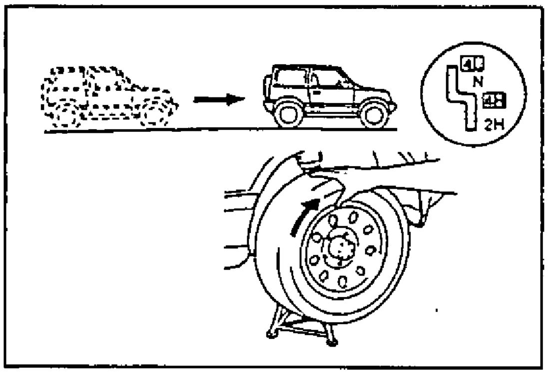
Torque of the screws: 3,3 m Kg. (33 Nm).

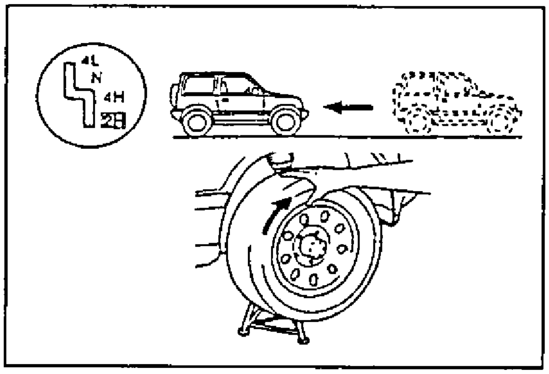
5) Install front tyres, if removed and torque the attaching nuts to the specified value.



Torque of tyre nuts : 9,5 m Kg. (95 Nm).

6) Low the vehicle from the jack and perform the checkings mentioned in paragraph "performance checking"





Performance checking

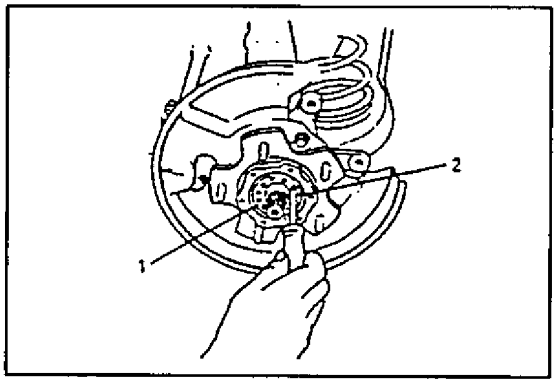
Confirm the performance of the free wheel by means of the following tests:

1) Set the transfer box lever in 4H or 4L and move slowly the vehicle 2 metres or more forward.
2) Jack the vehicle front part and check that the half-axle moves together with the wheel when it is actuated by hand clockwise (counterclockwise for the left wheel).
3) Low the vehicle for the wheel to settle on the ground.
4) Set the transfer lever in 2H and move slowly the vehicle 2 metres or more backwards.
5) Jack the vehicle front part and check that the half-axle does not move together with the wheel when it is actuated by hand clockwise (counterclockwise for the left wheel).
6) Check for sure, that free wheel assy blocks itself backward and unblocks forward, actuating in inverse direction to that mentioned in steps 1) to 4) above. (Now, it must block backward and unblock forward.

If any defective performance is detected, check the free wheel bracket or replace it, if required.

MAINTENANCE

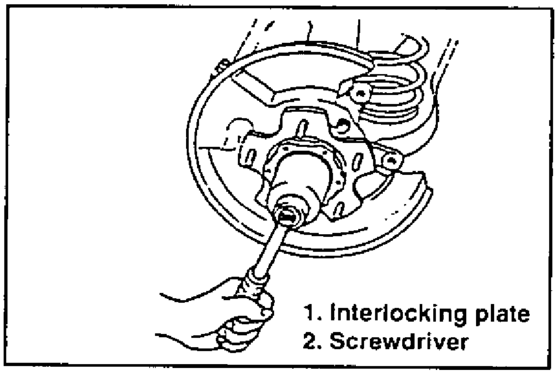
Periodically check the performance of the free wheel following the steps above and replace them if required.



INSTALLATION OF "B" TYPE AUTOMATIC FREE WHEEL

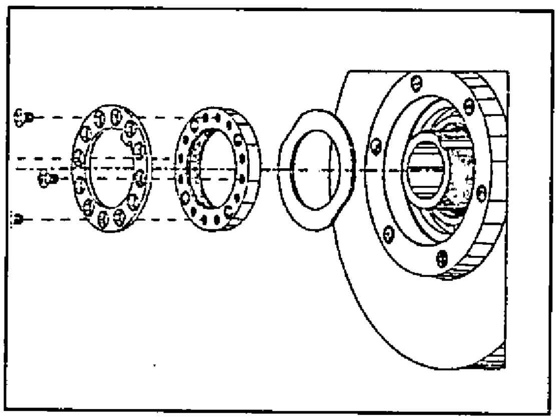
Removal

1) Jack the vehicle and remove the wheel.
2) Remove the axle and hub attaching flange.
3) Remove the hub bearing interlocking plate by loosening the four screws.

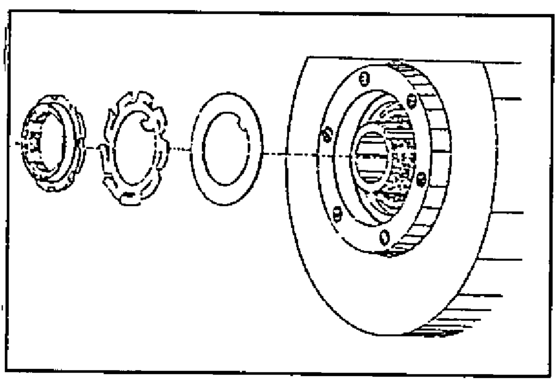


1. Interlocking plate
2. Screwdriver

4) Withdraw the hub bearing nut using the suitable tool.

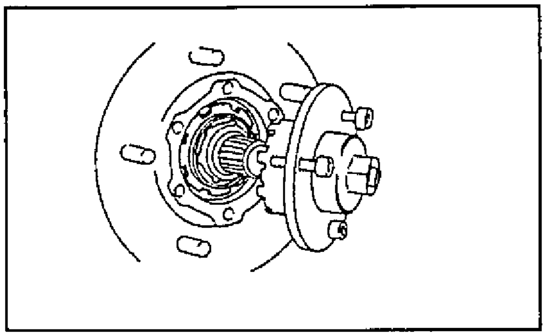


5) Withdraw the hub bearing safety washer



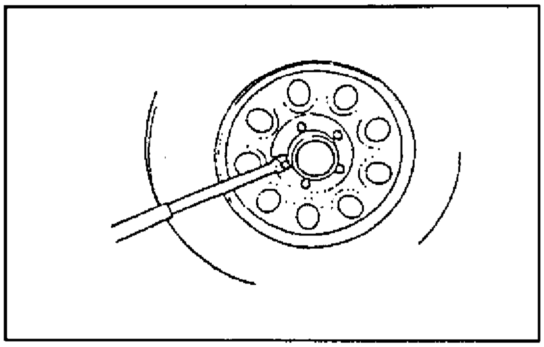
Installation

1) Install the spring washer supplied with the free wheel assy, on the sleeve; aligning the cotter with the channel. This washer may be installed in any position.
2) Install the antirotation spring washer, supplied with the free wheel assy, on the sleeve. The cotter of the washer must be housed on the channel and oriented outwardly.
3) Install the slotted nut, supplied with the free wheel assy, on the sleeve and tighten it by hand.



4) Install the special tool consisting of two parts attaching it to the hub by means of three screws and matching the edges of the wrench with the slotted nut channels.
5) Torque by hand the three tool attaching screws in the previous position.
6) While turning the wheel hub by hand, torque the slotted nut using the special tool to the specified value.

Nut Torque: 21 n Kg. (210 Nm)



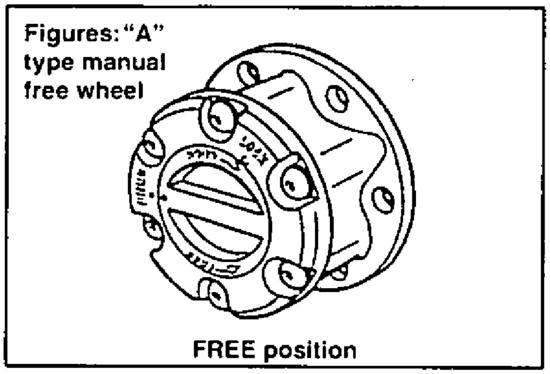
7) Check that the O-ring of the free wheel is not damaged and is correctly located.
8) Check that the contact surfaces of the free wheel and the hub are clean.
9) Install the free wheel matching its edges with the channels of the slotted nut, already installed on the hub.
10) Torque the screws supplied with the free wheel, in a cross way, to the specified value.

Torque of the free wheel attaching screws: 3,3 m Kg (33Nm)

11) Install the wheels and torque the attaching nuts to the specified value.

Torque of wheel attaching nuts: 9,5 m Kg (95 Nm)

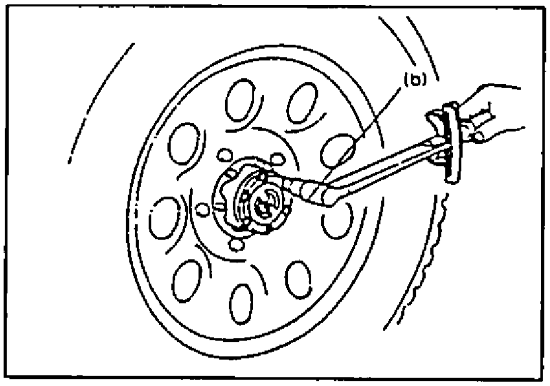
Performance Checking
Accomplish a performance checking of the free wheel as previously described for the "A" type automatic free wheel.



REPLACEMENT OF "A" TYPE MANUAL FREE WHEEL

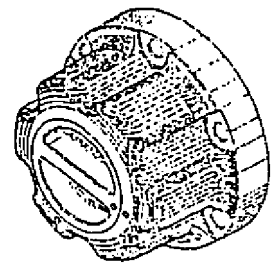
Removal

1) Jack the vehicle and remove the tyre if required.
2) Set the actuating knob of the free wheel in its **FREE** position.
3) Remove the 6 screws attaching the wheel to the hub.

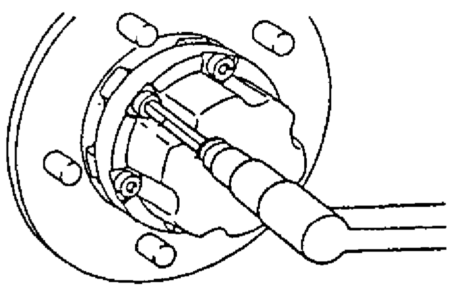


Installation

1) Refer to steps 1) to 5) indicated for the Installation of "A" type manual free wheel, (Section 3D-5)



FREE position



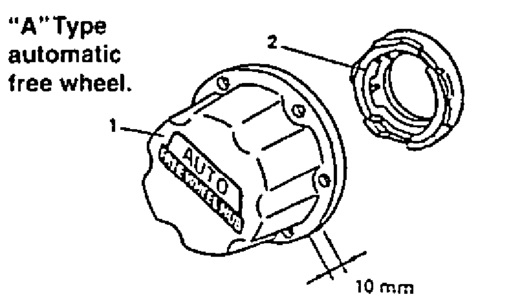
REPLACEMENT OF "B" TYPE MANUAL FREE WHEEL

Removal

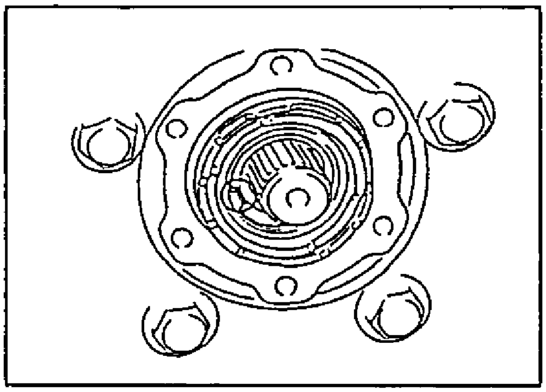
1) Jack the vehicle and remove the wheel.
2) Set free wheel actuating knob in "**FREE**" position.
3) Remove the 6 screws attaching the free wheel to the hub.

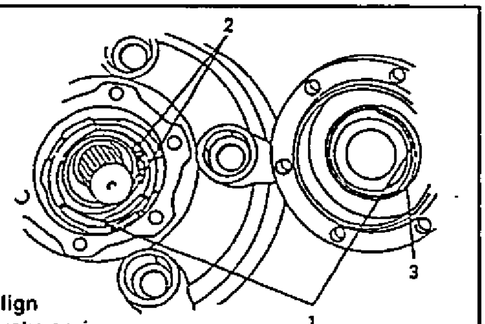
Installation

1) Perform the operations 1) to 5) indicated in the installation of the "B" type manual free wheel (Section 3D-7)

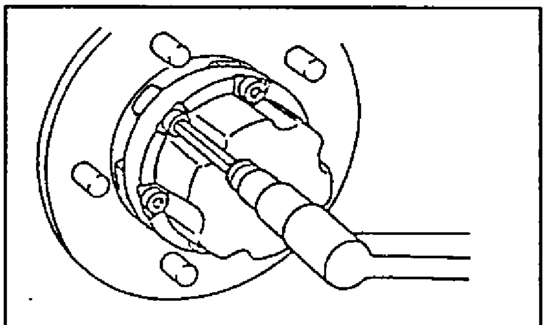


1. Free wheel subassy.
2. Free wheel brake assy





1. Align
2. Brake spring
3. Declutching plate



REPLACEMENT OF "A" TYPE AUTOMATIC FREE WHEEL

Removal

1) Set free wheels in **FREE** position (transfer lever to 2H position and move the vehicle backwards 2 metres or more).
2) Jack the vehicle and , if necessary, remove the wheel.
3) Remove the free wheel subassy and free wheel assy.

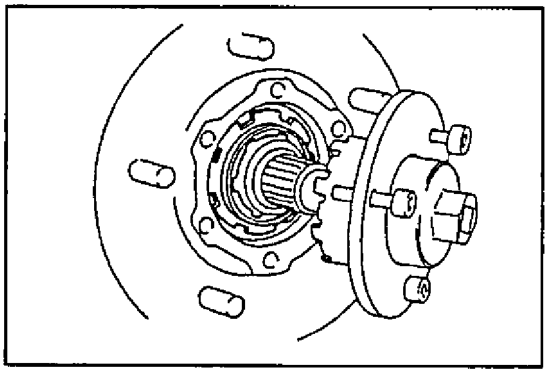
Installation

1) Refer to steps 1) to 6) of the installation of "A" type automatic free wheel and the performance checking. (Pages 3D-9 and 3D-10).

REPLACEMENT OF "B" TYPE AUTOMATIC FREE WHEEL

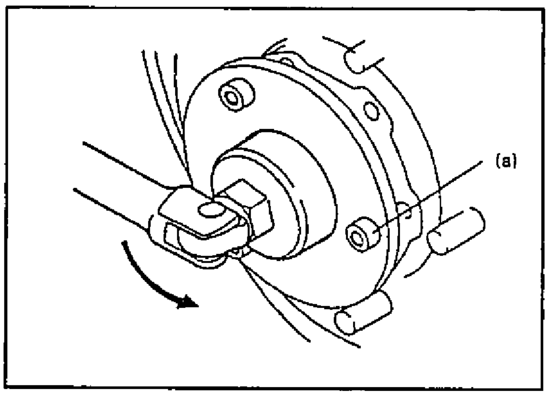
Removal

Free wheel assy
1) Jack the vehicle and remove the wheel.
2) Loose the six screws attaching the free wheel to the hub and withdraw it.

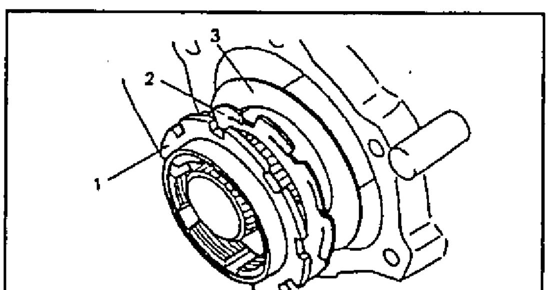


Bearing retaining system
Remove (only if necessary) the slotted nut, the antirotation spring washer and the spring washer following the steps below:
1) Install the plate and slotted wrench assy (tool ref. 09943-06010) on the wheel hub, aligning the edges of the wrench with the slotted nut channels.
2) Torque the three plate attaching screws.

Torque of plate attaching screws: 0,25 m Kg (2,5 Nm)



3) Loose (counterclockwise) 2 complete turns in order to the slotted nut to be loosen from the antirotation spring washer.
4) Remove the special tool attached to the wheel hub.



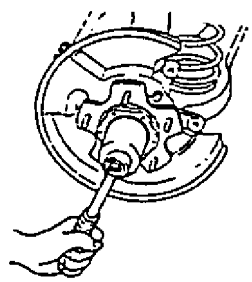
1. Slotted nut
2. Antirotation washer
3. Spring washer

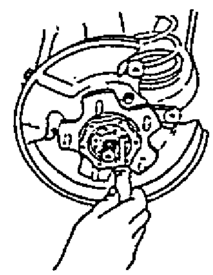
5) Loose and withdraw the slotted nut, the antirotation spring washer and the spring washer.

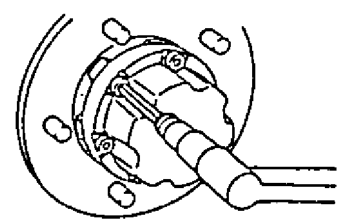
Installation
1) Perform the operations 1) to 6) indicated for the installation of the "B" type automatic free wheel (Page 3D-11) (Only if the spring washer , retaining spring washer and slotted nut assy has been replaced).
2) Install the free wheel assy in accordance with indications on steps 7) to 11) of the installation of "B" type automatic free wheel (page 3d-12).
3) Do performance checks indicated on Page 3D-10.

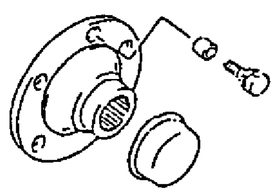
SPECIFIED TORQUES

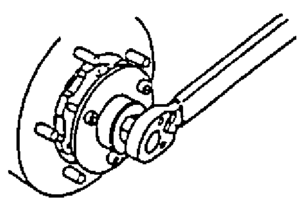
ELEMENT	Torque	
	mKg.	Nm.
Hub attaching nut/slotted nut	21	210
Fixing plate screws	0,15	1,5
Attaching screws of the free wheel ("B" type manual and "A" and "B" types automatic)	3,3	33
Attaching screws of the flange and "A" type manual free wheel	2,5	25


HUB ATTACHING NUT

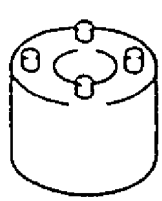

FIXING PLATE SCREWS

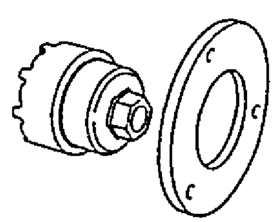

FREE WHEEL ATTACHING SCREWS


FLANGE ATTACHING SCREWS


SLOTTED NUT

SPECIAL TOOLS


09951-16050
HUB NUT TORQUE TOOL


09943-0610
1. SLOTTED NUT TORQUE TOOL

SECTION 6E1

ELECTRONIC FUEL INJECTION SYSTEM

(SEQUENTIAL MULTIPORT FUEL INJECTION)

6E

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.**
- **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 air bags may be deployed by reserve energy in the Sensing and Diagnostic Module (SDM).**

NOTE:
For the descriptions (items) not found in this section of this manual, refer to the same section of SE416/SZ416 supplementary service manual (99501-61A20).

CONTENTS

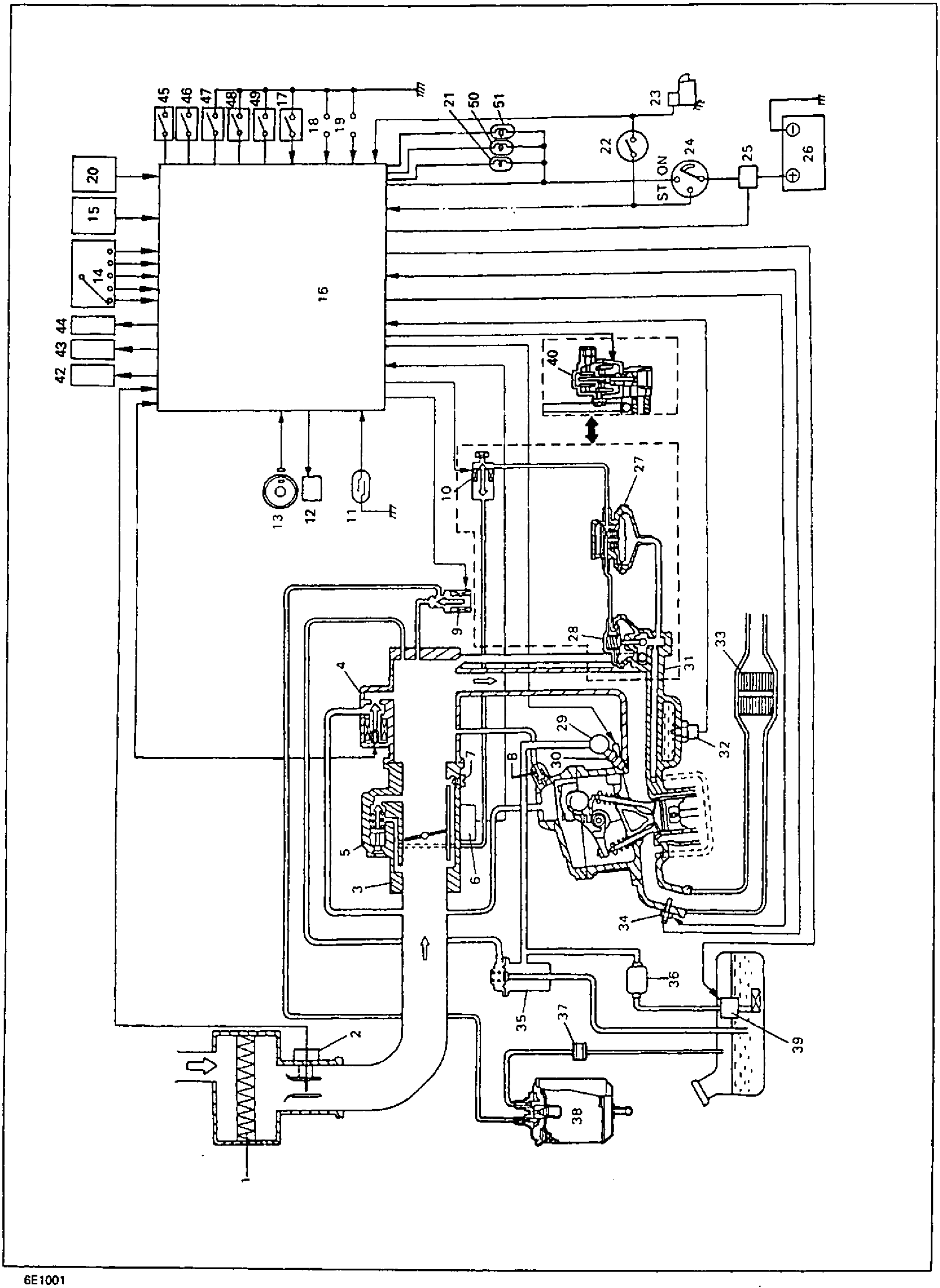
GENERAL DESCRIPTION

The Electronic Fuel Injection System in this vehicle supplies the combustion chambers with air/fuel mixture of optimized ratio under widely varying driving conditions.
It uses the sequential multiport fuel injection system which injects fuel into each intake port of the cylinder head.

This system has 3 major sub-systems: air intake system, fuel delivery system and electronic control system.
Air intake system includes air cleaner, mass air flow sensor, throttle body, fast idle air valve, idle air control valve and intake manifold.
Fuel delivery system includes fuel pump, delivery pipe, fuel pressure regulator, etc.
Electronic control system includes ECM, various sensors and controlled devices.

This section explains the system related to the electronic fuel injection as well as such functions of ECM as listed below.

- EGR system. (Stepper motor or solenoid vacuum valve, if equipped)
- Evaporative emission control system.
- IC (Ignition Control) system.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6E1001

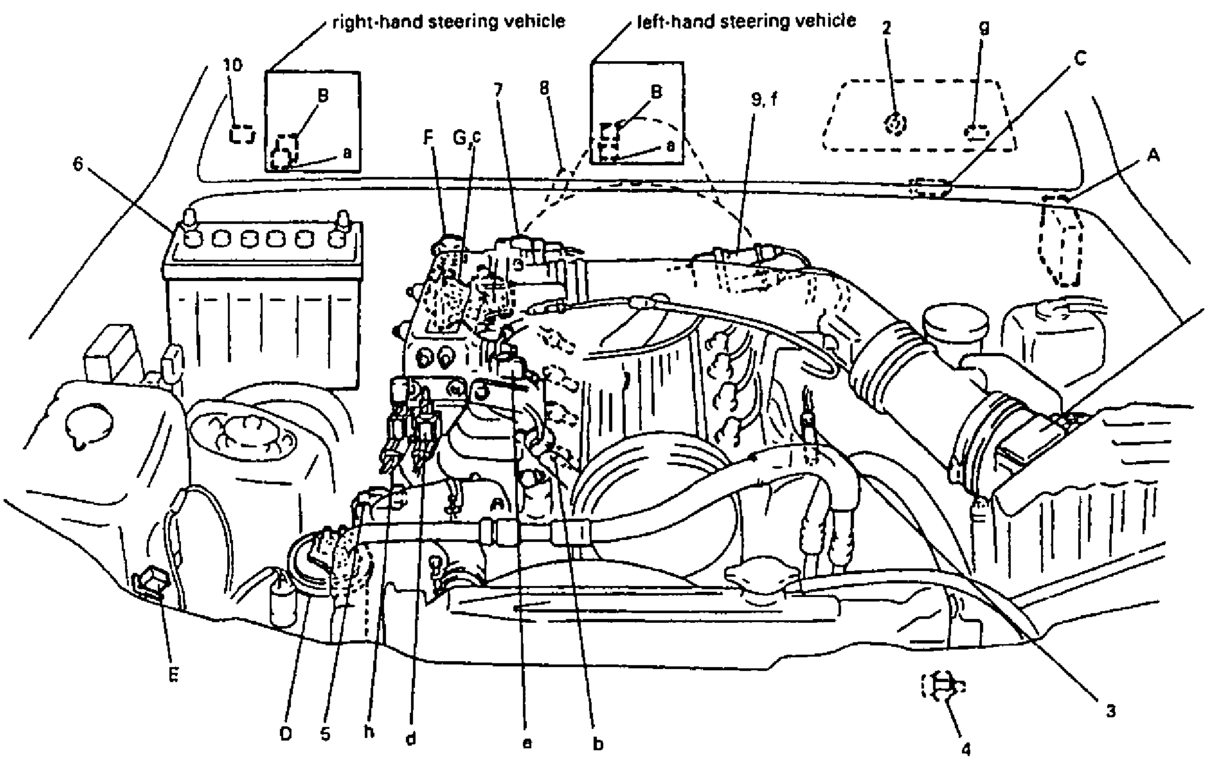
1. Air Cleaner
2. Mass air flow sensor
3. Throttle body
4. Idle air control valve
5. Fast idle air valve
6. Throttle position sensor
7. Idle air adjusting screw
8. PCV valve
9. EVAP canister purge valve
10. EGR solenoid vacuum valve (if equipped)
11. Vehicle speed sensor
12. Igniter
13. Camshaft position sensor
14. Transmission range switch (A/T)
15. A/C amplifier (if equipped)
16. ECM
17. Power steering pressure switch (if equipped)
18. Test switch terminal
19. Diag. switch terminal
20. CO adjusting resistor (if equipped)
21. Malfunction indicator lamp ("CHECK ENGINE" light)
22. Clutch pedal position switch (M/T, if equipped) or transmission range switch (A/T)
23. Starter magnetic switch
24. Main switch
25. Main fuse
26. Battery
27. EGR pressure transducer (if equipped)
28. EGR valve (if equipped)
29. Fuel delivery pipe
30. Fuel injector
31. Intake manifold
32. Engine coolant temp. sensor
33. Three way catalytic converter (if equipped)
34. Heated oxygen sensor (if equipped)
35. Fuel pressure regulator
36. Fuel filter
37. Tank pressure control valve
38. EVAP canister
39. Fuel pump
40. EGR valve (stepper motor), if equipped
41. Shift solenoid valve A (A/T)
42. Shift solenoid valve B (A/T)
43. TCC solenoid valve (A/T)
44. Lighting switch (A/T)
45. Brake switch (A/T)
46. Mode selector switch (A/T)
47. O/D cut switch (A/T)
48. 4WD low switch (A/T)
49. "OD/OFF" light (A/T)
50. "POWER" light (A/T)

ELECTRONIC CONTROL SYSTEM

The electronic control system consists of 1) various sensors which detect the state of engine and driving conditions, 2) ECM which controls various devices according to the signals from the sensors and 3) various controlled devices. Functionally, it is divided into the following sub systems:

- Fuel injection control system
- Heated oxygen sensor heater control system (if equipped)
- Idle air control system
- Fuel pump control system
- Evaporative emission control system
- IC (Ignition Control) system
- EGR system (stepper motor or solenoid vacuum valve, if equipped)

Also, with 4 A/T model, ECM controls A/T.



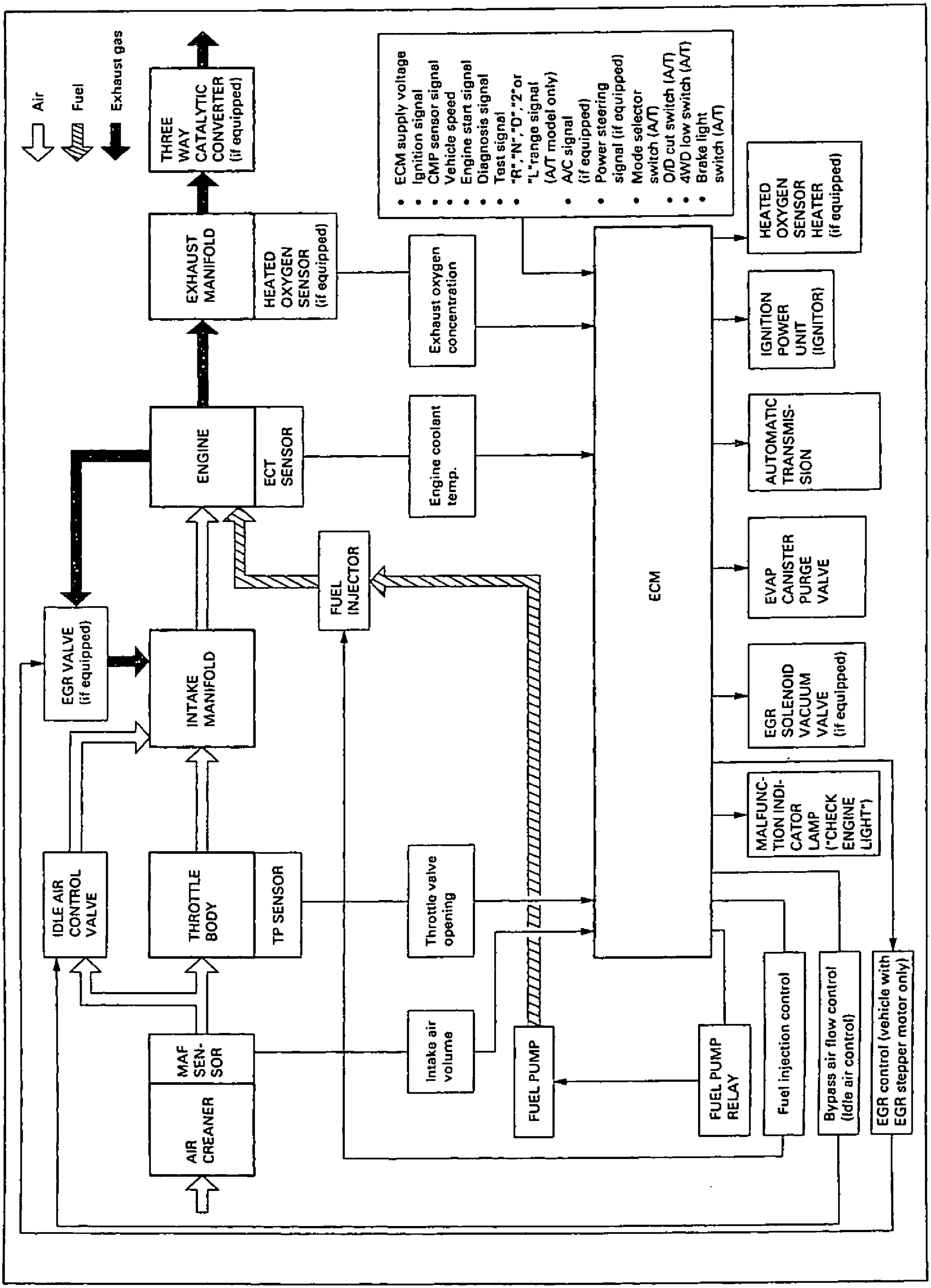
INFORMATION SENSORS
1. MAF sensor
2. VSS
3. Heated oxygen sensor (if equipped)
4. Power steering pressure switch (if equipped)
5. ECT sensor
6. Battery
7. TP sensor
8. Transmission range switch (A/T only)
9. Camshaft position sensor (CMP sensor) (in distributor)
10. CO adjust resistor (vehicle without heated oxygen sensor)

CONTROLLED DEVICES
a : Fuel pump relay
b : Injector
c : EGR valve (stepper motor, if equipped)
d : Idle air control valve
e : Igniter (in distributor)
g : Malfunction indicator lamp ("CHECK ENGINE" light)
h : EGR solenoid vacuum valve (if equipped)

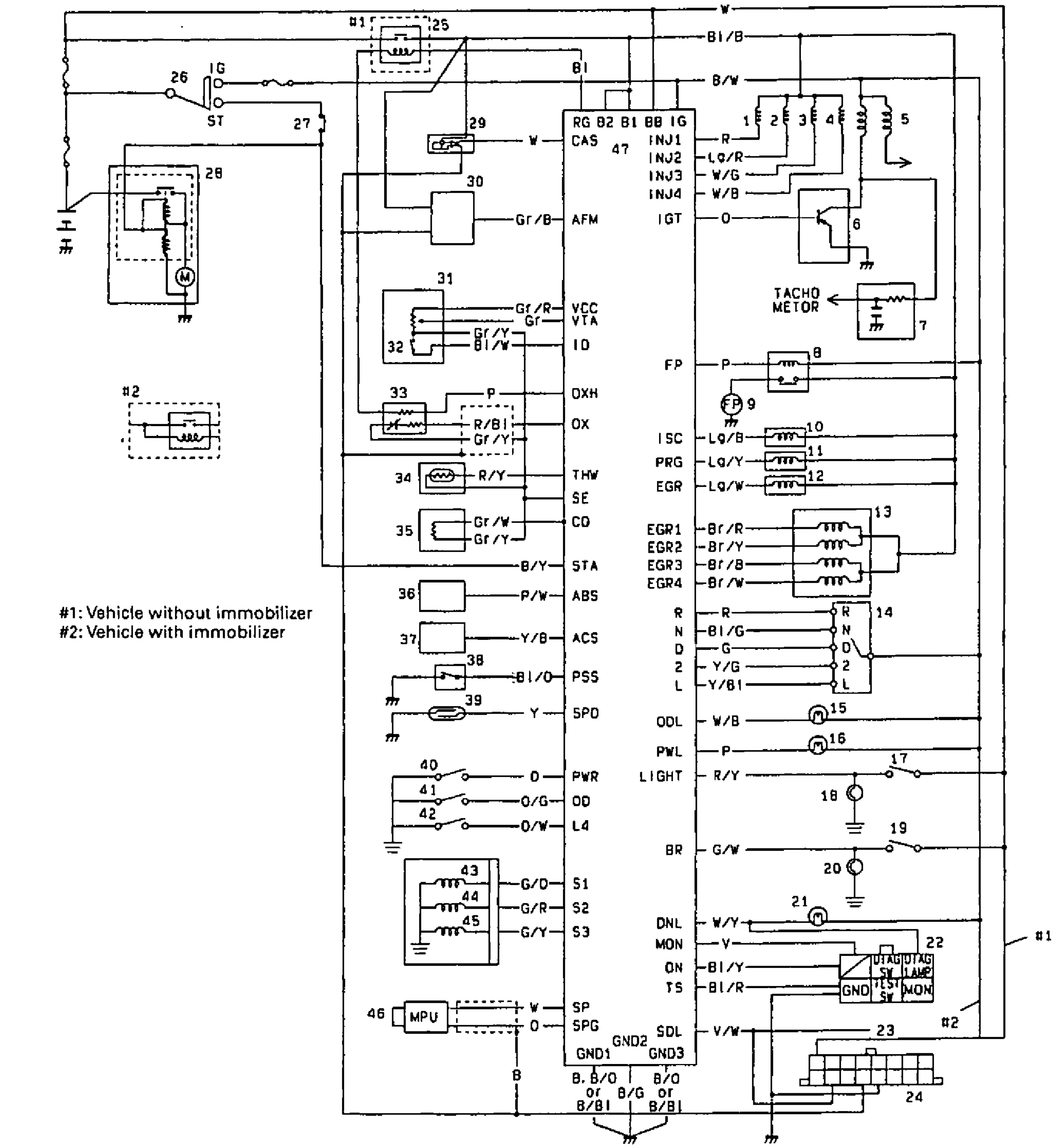
OTHERS
A : ECM
B : Main relay
C : Data link connector (Assembly line diag. link)
D : EVAP canister
E : Monitor coupler (Engine)
F : EGR pressure transducer (if equipped)
G : EGR valve (if equipped)

NOTE:
Above figure shows left-hand steering vehicle. For right-hand steering vehicle, CO adjusting resister, combination meter, DLC and ECM are installed at the other side.

6E1002


Air
Fuel
Exhaust gas
THREE WAY CATALYTIC CONVERTER (if equipped)
EXHAUST MANIFOLD
HEATED OXYGEN SENSOR (if equipped)
ENGINE
ECT SENSOR
EGR VALVE (if equipped)
INTAKE MANIFOLD
FUEL INJECTOR
IDLE AIR CONTROL VALVE
THROTTLE BODY
TP SENSOR
MAF SEN-SOR
AIR CREANER
Exhaust oxygen concentration
Engine coolant temp.
Throttle valve opening
Intake air volume
FUEL PUMP
FUEL PUMP RELAY
Fuel injection control
Bypass air flow control (Idle air control)
EGR control (vehicle with EGR stepper motor only)
ECM
• ECM supply voltage
• Ignition signal
• CMP sensor signal
• Vehicle speed
• Engine start signal
• Diagnosis signal
• Test signal
• "R","N","D","2"or "L"range signal (A/T model only)
• A/C signal (if equipped)
• Power steering signal (if equipped)
• Mode selector switch (A/T)
• O/D cut switch (A/T)
• 4WD low switch (A/T)
• Brake light switch (A/T)
HEATED OXYGEN SENSOR HEATER (if equipped)
IGNITION POWER UNIT (IGNITOR)
AUTOMATIC TRANSMIS-SION
EVAP CANISTER PURGE VALVE
EGR SOLENOID VACUUM VALVE (if equipped)
MALFUNC-TION INDI-CATOR LAMP ("CHECK ENGINE LIGHT")

6E1003



TERMINAL ARRANGEMENT OF ECM COUPLER (VIEWED FROM HARNESS SIDE)

M/T VEHICLE

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11
A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24	A25	A26	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22

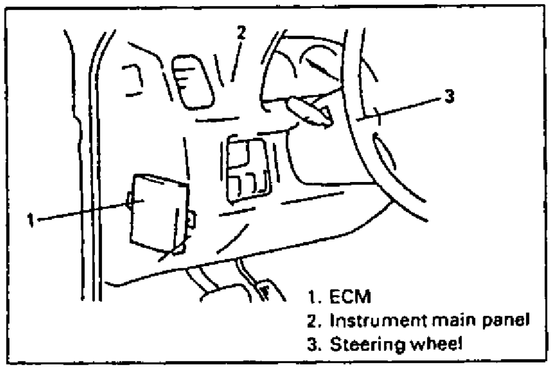
A/T VEHICLE

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	B1	B2	B3	B4	B5	B6	B7	B8									D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11
A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24	A25	A26	B9	B10	B11	B12	B13	B14	B15	B16									D12	D13	D14	D15	D16	D17	D18	D19	D20	D21	D22

1. No.1 injector
2. No.2 injector
3. No.3 injector
4. No.4 injector
5. Ignition coil
6. Ignitor
7. Noise suppressor
8. Fuel pump relay
9. Fuel pump
10. IAC valve
11. EVAP canister purge valve
12. EGR solenoid vacuum valve (if equipped)
13. EGR valve (stepper motor, if equipped)
14. Transmission range switch (A/T)
15. "OD/OFF" indicator light (A/T)
16. "POWER" indicator light (A/T)
17. Lighting switch
18. Small light
19. Brake switch
20. Brake light
21. Malfunction indicator lamp ("CHECK ENGINE" light)
22. Monitor coupler
23. To immobilizer (if equipped)
24. Data link connector
25. Main relay
26. Ignition switch
27. Transmission range switch (A/T)
28. Starter magnetic switch
29. CMP sensor
30. MAF sensor
31. TP sensor
32. CTP switch
33. Heated oxygen sensor
34. ECT sensor
35. CO adjusting resister (vehicle without heated oxygen sensor)
36. ABS controller (if equipped)
37. A/C amplifier (if equipped)
38. Power steering pressure switch (if equipped)
39. Vehicle speed sensor (in speedometer)
40. Mode selector switch (A/T)
41. OD cut switch (A/T)
42. 4WD-low switch (A/T)
43. Shift solenoid valve A (A/T)
44. Shift solenoid valve B (A/T)
45. TCC solenoid valve (A/T)
46. A/T vehicle speed sensor (A/T)
47. ECM

TERMINAL	POSITION		CIRCUIT	
	M/T	A/T		
BB	B11	A10	Power source for back up	
B1	B22	A11	Power source	
B2	B21	A24		
RG	B2	A13	Main relay	
CAS	A11	D9	CMP sensor	
AFM	A6	D3	MAF sensor	
VCC	A8	D2	Power source (for sensors)	
VTA	A7	D14	TP sensor	
ID	B16	D19	CTP switch	
OXH	A17	A21	Heated oxygen sensor heater (if equipped)	
OX	A20	D4	Heated oxygen sensor (if equipped)	
THW	A5	D13	ECT sensor	
SE	A25	D1	Sensor ground	
ACS	B3	D7	A/C signal	
STA	B10	D10	Engine start switch	
PSS	B15	D18	Power steering pressure switch (if equipped)	
SPD	B5	D8	Vehicle speed sensor (in speedometer)	
INJ1	A3	A3	Injector No.1	
INJ2	A16	A16	Injector No.2	
INJ3	A1	A1	Injector No.3	
INJ4	A14	A14	Injector No.4	
IGT	B8	A8	Ignitor	
FP	B13	A15	Vehicle with immobilizer	Fuel pump relay
	B7	A5	Vehicle without immobilizer	
ISC	A2	A2	IAC valve	
PRG	A15	A5	Vehicle with immobilizer	EVAP canister purge valve
		A15	Vehicle without immobilizer	
EGR	B19	A7	EGR solenoid vacuum valve (if equipped)	
DNL	B20	A17	Malfunction indicator lamp ("CHECK ENGINE" light)	
MON	B9	A9	Duty output terminal	
DN	B17	D6	Diag. switch terminal	
TS	B6	D16	Test switch terminal	
SDL	A24	A23	Data link connector	

TERMINAL	POSITION		CIRCUIT
	M/T	A/T	
GND1	A12	A12	Ground
GND2	A26	A25	
GND3	A13	A26	
CO	A21	D5	CO adjusting resister (vehicle without heated oxygen sensor)
ABS	B14	D17	ABS controller (if equipped)
IG	A18	D11	Ignition switch (vehicle with immobilizer)
EGR1	A10	A7	EGR valve (stepper motor coil 1, if equipped)
EGR2	A23	A20	EGR valve (stepper motor coil 2, if equipped)
EGR3	A9	A6	EGR valve (stepper motor coil 3, if equipped)
EGR4	A22	A19	EGR valve (stepper motor coil 4, if equipped)
R	-	B11	Transmission range switch ("R" range, A/T)
N	-	B12	Transmission range switch ("N" range, A/T)
D	-	B13	Transmission range switch ("D" range, A/T)
2	-	B14	Transmission range switch ("2" range, A/T)
L	-	B15	Transmission range switch ("L" range, A/T)
SP	-	B8	A/T vehicle speed sensor (positive, A/T)
SPG	-	B16	A/T vehicle speed sensor (negative, A/T)
OD	-	B7	OD cut switch (A/T)
LIGHT	-	B4	Lighting switch (A/T)
L4	-	B6	4WD -low switch (A/T)
PWR	-	B5	Mode selector switch (A/T)
BR	-	D21	Brake switch (A/T)
S1	-	B10	Shift solenoid valve A (A/T)
S2	-	B1	Shift solenoid valve B (A/T)
S3	-	B9	TCC solenoid valve (A/T)
ODL	-	B3	"OD/OFF" indicator light (A/T)
PWL	-	B2	"POWER" indicator light (A/T)



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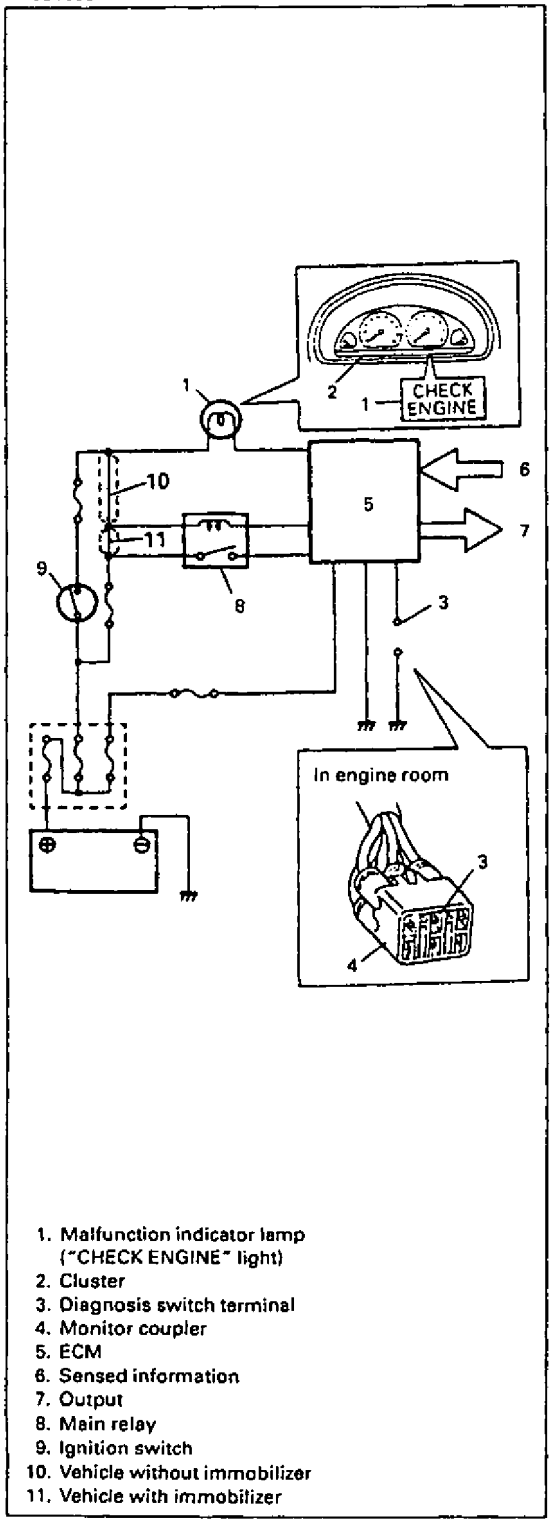


6E1007

Engine Control Module (ECM)

ECM is installed to the underside of the instrument panel at the driver's seat side.

ECM is a precision unit consisting of microcomputer, A/D (Analog/Digital) converter, I/O (Input/Output) unit, etc..

It is an essential part of the electronic control system, for its functions include not only such a major function as to control fuel injector, idle air control valve, fuel pump relay, etc. but also on-board diagnostic system (self-diagnosis function) and fail-safe function as described in the following section.

On-board diagnostic system (Self-diagnosis function)

ECM diagnoses troubles which may occur in the areas including the following parts when the ignition switch is ON or the engine is running, and indicates the result by turning on or flashing malfunction indicator lamp ("CHECK ENGINE" light).

- Heated oxygen sensor (if equipped)
- Engine coolant temp. sensor
- Throttle position sensor (including idle switch)
- Vehicle speed sensor
- Mass air flow sensor
- Camshaft position sensor
- EGR stepper motor (if equipped)
- CPU (Central Processing Unit) of ECM

ECM and malfunction indicator lamp ("CHECK ENGINE" light) operate as follows.

- Malfunction indicator lamp ("CHECK ENGINE" light) lights when the ignition switch is turned ON (but the engine at stop) with the diagnosis switch terminal ungrounded regardless of the condition of Electronic Fuel Injection system. This is only to check the malfunction indicator lamp ("CHECK ENGINE" light) bulb and its circuit.
- If the above areas of Electronic Fuel Injection system is free from any trouble after the engine start (while engine is running), malfunction indicator lamp ("CHECK ENGINE" light) turns OFF.
- When ECM detects a trouble which has occured in the above areas, it makes malfunction indicator lamp ("CHECK ENGINE" light) turn ON while the engine is running to warn the driver of such occurrence of trouble and at the same time it stores the exact trouble area in ECM back-up memory.
  (The memory is kept as it is even if the trouble was only temporary and disappeared immediately. And it is not erased unless the power to ECM is shut off for 20 seconds or longer.)
  ECM also indicates trouble area in memory by means of flashing of malfunction indicator lamp ("CHECK ENGINE" light) at the time of inspection (i.e. when diagnosis switch terminal is grounded and ignition switch is turned ON).

NOTE:

- **Even when a trouble occurs in CMP sensor or CTP switch circuit (circuit open), ECM does not indicate it (or activate malfunction indicator lamp ("CHECK ENGINE" light)) while engine is running.**
  And when that troubled circuit regains good condition, the memory of defective area will be erased automatically even if the power circuit to ECM is not opened as described above.
- **For on-board diagnostic system and fail-safe function of A/T releat parts, refer to On-Board Diagnostic System in the section 7B1.**

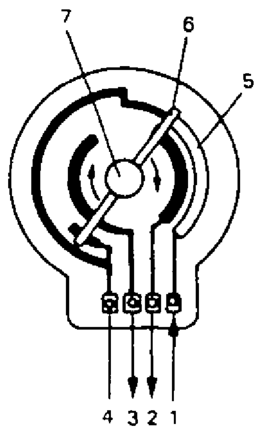
Fail-safe function

Even when a trouble has occurred in such areas of Electronic Fuel Injection system that include the following parts and a failure signal is sent to ECM, control over the injector, idle air control valve and other is maintained on the basis of the standard signals and/or back-up program prestored in the ECM while ignoring that failure signal and/or CPU. This function is called "fail-safe function". Thus, with this function, a certain level of engine performance is available even when some failure occurs in such areas so that disability in running is avoided.

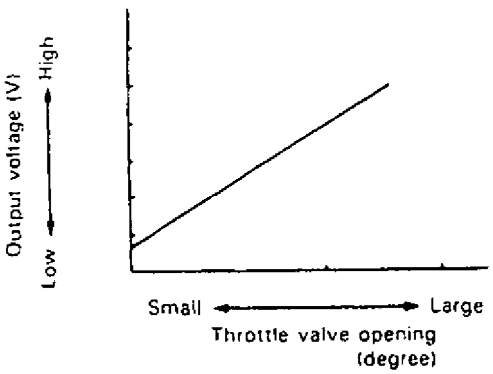
- Engine coolant temp. sensor
- Throttle position sensor
- Mass air flow sensor
- EGR stepper motor (if equipped)
- CPU in ECM

Throttle Position Sensor (TP Sensor)

The throttle position sensor consisting of a contact point (CTP switch) and a potentiometer is installed on the throttle body, and detects the throttle valve opening.
The throttle opening in the idle state is detected by means of the contact point which turns ON in that state.
But beyond that, the full opening is detected by the potentiometer as follows.
A 5-volt reference voltage is applied to the sensor from ECM and as its brush moves over the print resistance according to the throttle valve opening, the output voltage varies accordingly.
By monitoring the ON/OFF signal and sensor output voltage, ECM detects the throttle valve opening.
ECM uses the signal from TP sensor as one of the signals to control fuel injector, idle air control valve, ignition timing, EVAP solenoid purge valve and EGR solenoid vacuum valve (if equipped).
Also for A/T model, ECM controls the automatic transmission.



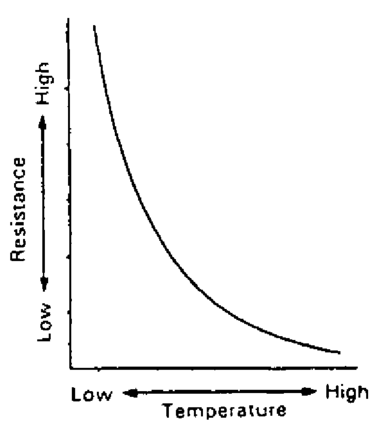
1. Reference voltage
2. Output voltage
3. ON/OFF signal
4. Ground
5. Resistance
6. Brush
7. Rotor



6E1008 6E1009

Engine Coolant Temperature Sensor (ECT Sensor)

Located at the side of intake manifold, this sensor measures the temperature of the engine coolant and converts its change into that in resistance through the thermister.
By monitoring the resistance of the coolant temperature sensor, ECM detects the engine coolant temperature and that affects most systems under the control of ECM.
Also for A/T model, ECM control the automatic transmission (TCC operation and gear shift to O/D gear).



Engine coolant temp. sensor characteristic

6E1010

EXHAUST GAS RECIRCULATION (EGR) SYSTEM (For vehicle with EGR stepper motor)

This system controls the formation of NOx emission by recirculating the exhaust gas into the combustion chamber through the intake manifold.

The EGR system consists EGR valve and piping for exhaust gas.

The EGR valve is controlled by ECM according to the signals from CMP sensor, ECT sensor, MAF sensor and VSS.

The EGR valve consists of a stepper motor, rods, valve, etc.

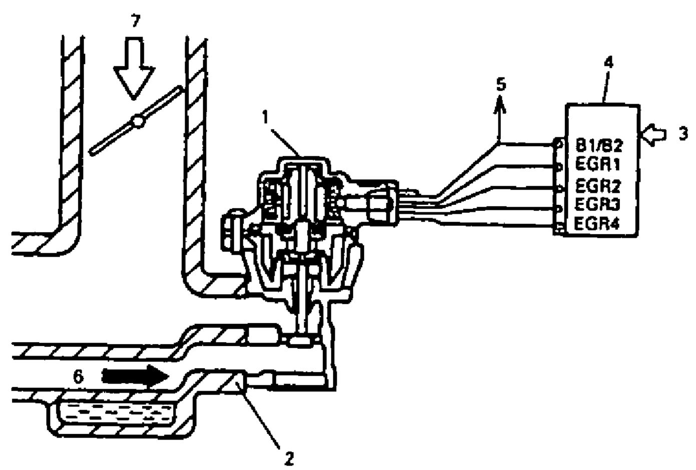
When the EGR valve stepper motor receives "open" signal from ECM, it turns in the "open" direction according to the number of steps and pushes out the rod which is in mesh with the worm of the stepper motor. As the rod installed to the EGR valve is pushed by this rod, the EGR valve opens by the amount corresponding to the number of steps of the "open" signal from ECM to let the exhaust gas flow from the exhaust manifold to the intake manifold.

To close the EGR valve, the stepper motor turns in the "close" direction according to the number of steps of the "close" signal from ECM and pulls up the rod. In this way, the valve is closed by the spring force.

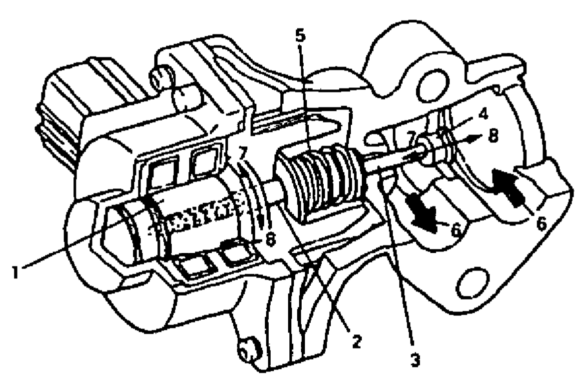
And in this state, the exhaust gas is not allowed to flow to the air intake system or the combustion chamber.

Under any one of the following conditions, ECM closes the EGR valve.

- When engine coolant temperature is low
- When throttle valve is at idle position
- When engine is running under high load



1. EGR valve
2. Intake manifold
3. Sensed information
4. ECM
5. From main relay
6. Exhaust gas
7. Fresh air



1. Stepper motor
2. Rod (with thread)
3. Rod
4. Valve
5. Spring
6. Exhaust gas
7. Valve close
8. Valve open

6E1011 6E1012

EXHAUST GAS RECIRCULATION (EGR) SYSTEM (For vehicle with EGR valve, pressure transducer and solenoid vacuum valve)

This system controls the formation of NOx emission by recirculating the exhaust gas into the combustion chamber through the intake manifold.

The EGR valve is controlled by EGR pressure transducer and EGR solenoid vacuum valve controlled by ECM according to signals from various sensors.

The diaphragm mounted in the EGR pressure transducer is operated by back pressure of the exhaust gas to open and close the valve. By this opening and closing action of the valve, the EGR pressure transducer controls the vacuum transmitted to the EGR valve.

Under a low load condition such as low speed driving, the exhaust pressure is low. In this state, the diaphragm in the EGR pressure transducer is pushed down by the spring force and the pressure transducer valve opens to allow the air into the vacuum passage from the outside.

As a result, the vacuum transmitted to the EGR valve becomes smaller and so does the opening of the EGR valve.

Thus, less amount of exhaust gas is recirculated to the intake manifold.

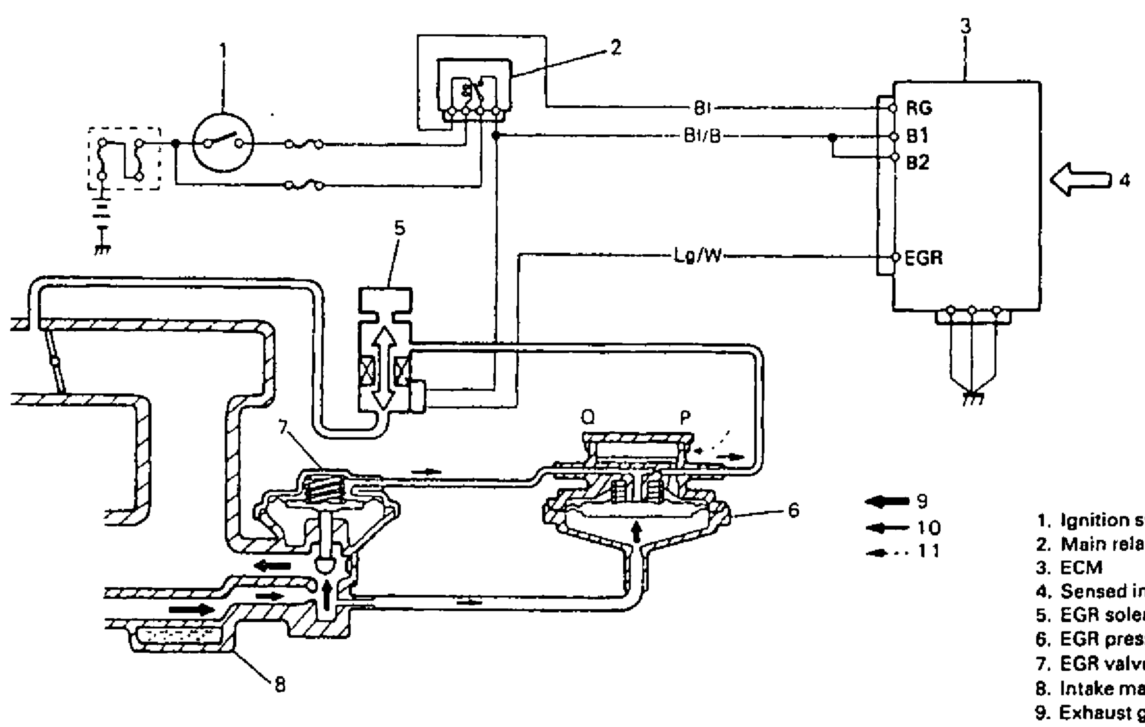
Under a high load condition such as high speed driving, on the other hand, the exhaust pressure is high. By the high exhaust pressure, the diaphragm in the modulator is pushed up and closes its valve. As the air does not enter the vacuum passage in this state, the vacuum transmitted to the EGR valve grows larger and so does the opening of the EGR valve.

Thus, larger amount of exhaust gas is recirculated to the intake manifold.

Under any one of the followinig conditions, ECM closes the vacuum passage of solenoid vacuum valve. In this state, as the vacuum is not transmitted to the EGR valve, it remains closed.

- When engine coolant temperature is low
- When throttle valve opening is less than specification.
- When engine is running under high load
- When vehicle is stopped.

Other than the above, EGR valve opens and closes in accordance with the EGR pressure transducer operation.



1. Ignition switch
2. Main relay
3. ECM
4. Sensed information
5. EGR solenoid vacuum valve
6. EGR pressure transducer
7. EGR valve
8. Intake manifold
9. Exhaust gas
10. Vacuum
11. Air

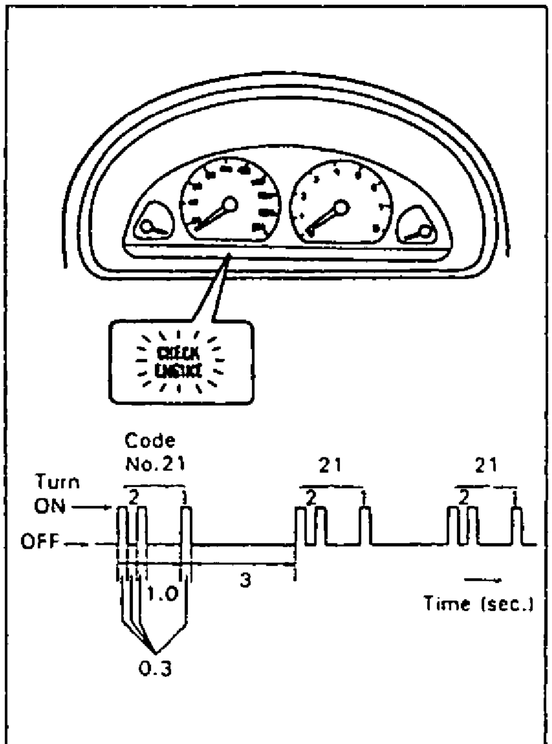
6E1013

DIAGNOSIS

ECM has on-board diagnostic system (a system self-diagnosis function) as described previously (p. 6E1-10). Investigate where the trouble is by referring to "DIAGNOSTIC FLOW CHART" and "DIAGNOSTIC TROUBLE CODE TABLE" on later pages.

NOTE:

For diagnosis of A/T related part detected by ECM, refer to DIAGNOSIS in section 7B1.



6E1014

PRECAUTIONS IN DIAGNOSING TROUBLES

[PRECAUTIONS IN IDENTIFYING DIAGNOSTIC TROUBLE CODE]

- Before identifying diagnostic trouble code indicated by malfunction indicator lamp ("CHECK ENGINE" light), don't disconnect couplers from ECM, battery cable from battery, ECM ground wire harness from engine. Such disconnection will erase memorized trouble in ECM memory
- If abnormality or malfunction lies in two or more areas, malfunction indicator lamp ("CHECK ENGINE" light) indicates applicable codes three times each.
  And flashing of these codes is repeated as long as diagnosis terminal is grounded and ignition switch is held at ON position.
- Take a note of diagnostic trouble code indicated first.

DIAGNOSTIC FLOW CHART

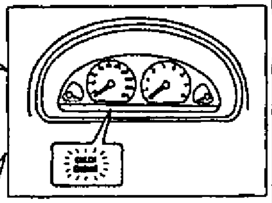
START

Does malfunction indicator lamp ("CHECK ENGINE" light) turn ON when ignition switch is turned ON (without starting engine.)?

NO (Flashes) → Proceed to DIAGNOSIS of SECTION 8A.

NO (Remains OFF) → Does engine start?

- NO → Proceed to chart A-1. (ECM power and ground circuit check.)
- YES → Proceed to chart A-2 (Malfunction indicator lamp ("CHECK ENGINE" light) circuit check).



YES ↓

Using service wire, ground diagnosis switch terminal and observe malfunction indicator lamp ("CHECK ENGINE" light).

NOTE:
If engine fails to start, crank it for 2 seconds and then while keeping ignition switch ON (Don't turn it OFF) ground diagnosis switch terminal.

Remains ON → Proceed to chart A-3.(Malfunction indicator lamp ("CHECK ENGINE" light) circuit check).

Flashes ↓

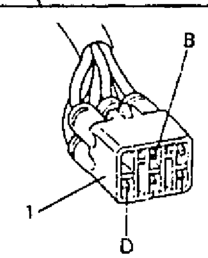
Is diagnostic trouble code No. 12 indicated?

YES → Are engine basic parts described in SECTION 6 "ENGINE DIAGNOSIS" in good condition?

- YES → Proceed to "TROUBLE DIAGNOSIS" (p. 6E1-62.) Check Electronic Fuel Injection system parts that are not indicated by on-board diagnostic system (self-diagnosis function).
- NO → Repair or replace.

NO ↓

Check and repair according to flow chart corresponding to that code No.



1. Moniter coupler
B: Diagnosis switch terminal
D: Ground terminal

↓

1. After repair, disconnect battery negative cable for longer than 20 sec. to erase diagnostic trouble code stored in ECM memory and reconnect it.
2. Start engine and warm it up to normal operating temperature.
3. With grounding diagnosis switch terminal and ignition switch turned ON, make sure that malfunction indicator lamp ("CHECK ENGINE" light) shows code No. 12.
4. Remove service wire and reinstall cap.

↓

Is trouble corrected?

NO → START

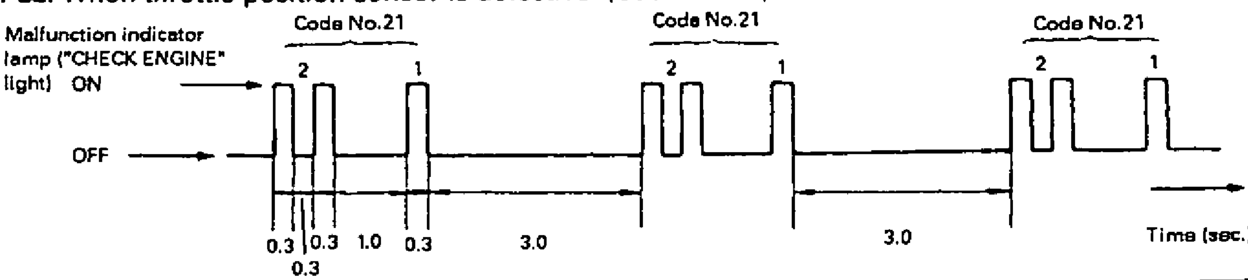
YES ↓

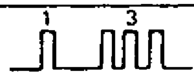
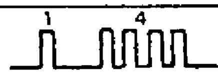
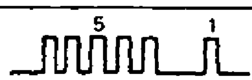
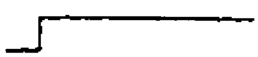
END

6E1091 6E1015

DIAGNOSTIC TROUBLE CODE TABLE (1 OF 2, M/T AND A/T)

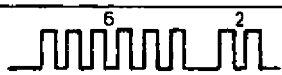
EXAMPLE: When throttle position sensor is defective (Code No.21)



DIAGNOSTIC TROUBLE CODE NO.	MALFUNCTION INDICATOR LAMP ("CHECK ENGINE" LIGHT) FLASHING PATTERN	DIAGNOSTIC ITEM	DIAGNOSIS
13		Heated oxygen sensor (if equipped)	Diagnose trouble according to "DIAGNOSTIC FLOW CHART" corresponding to each code No.
14		Engine coolant temperature sensor	
15			
21		Throttle position sensor	
22			
24		Vehicle speed sensor	
33		Mass air flow sensor	
34			
42		Camshaft position sensor	Diagnose trouble according to "DIAGNOSTIC FLOW CHART" corresponding to each code No.
44		CTP switch of throttle position sensor	
45			
51		EGR valve (stepper motor, if equipped)	
ON		ECM	ECM failure.
12		Normal	This code appears when none of the other codes (above codes) are identified.

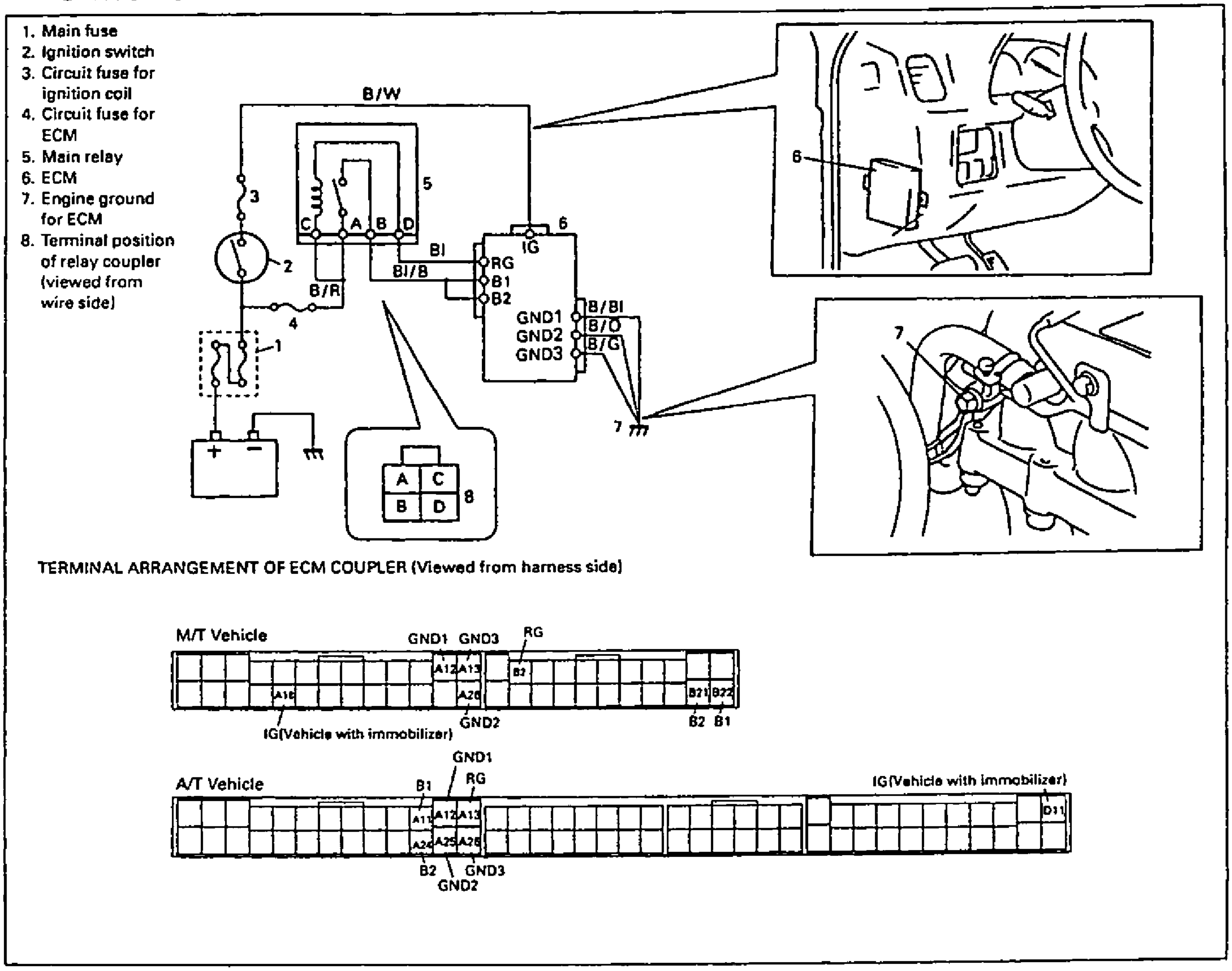
6E1016 6E1017

DIAGNOSTIC TROUBLE CODE TABLE (2 OF 2, A/T)

DIAGNOSTIC TROUBLE CODE NO.	MALFUNCTION INDICATOR LAMP ("CHECK ENGINE" LIGHT) FLASHING PATTERN	DIAGNOSTIC ITEM	DIAGNOSIS
61		Shift solenoid valve A	Refer to section 7B1.
62			
63		Shift solenoid valve B	
64			
65		TCC solenoid valve.	
66			
72		Transmission range switch	
75		A/T vehicle speed sensor.	

6E1093

A-1 ECM POWER AND GROUND CIRCUIT CHECK (VEHICLE WITH IMMOBILIZER) (MALFUNCTION INDICATOR LAMP ("CHECK ENGINE" LIGHT) DOESN'T LIGHT AT IGNITION SWITCH ON AND ENGINE DOESN'T START THOUGH IT IS CRANKED UP.)



6E1018 6E1019

Is operation of main relay heard at ignition switch ON?

- **YES** → Is operation of fuel pump relay heard at ignition switch ON?
  - **NO** → To Ⓐ
  - **YES** → Proceed to chart A-2. (Malfunction indicator lamp ("CHECK ENGINE" light) circuit check.)
- **NO** → Are main fuse and circuit fuses (for ignition coil and ECM) in good condition?
  - **YES** → Is main relay in good condition? (Check main relay.) → To Ⓑ
  - **NO** → Repair and replace.

From Ⓐ

1. Disconnect ECM couplers with ignition switch OFF.
2. Using service wire, ground RG terminal.
3. Is battery voltage applied to B1 or B2 terminals at ignition switch ON?

YES

Poor connection at both B terminals.
If connection is OK, check ECM and its circuit referring to p. 6E1-45.

NO

"B/R" wire open, poor relay-to-coupler connection or "Bl/B" wire open.
If all above are OK, check main relay.

From Ⓑ

YES

Check voltage between IG terminal and body ground with ignition switch ON.
Is it 10–14V?

YES

Poor relay-to-coupler connection, "B/R" wire open, "Bl" wire open, poor RG connection, poor IG connection, or poor engine ground.
If all above are OK, substitute a known-good ECM and recheck.

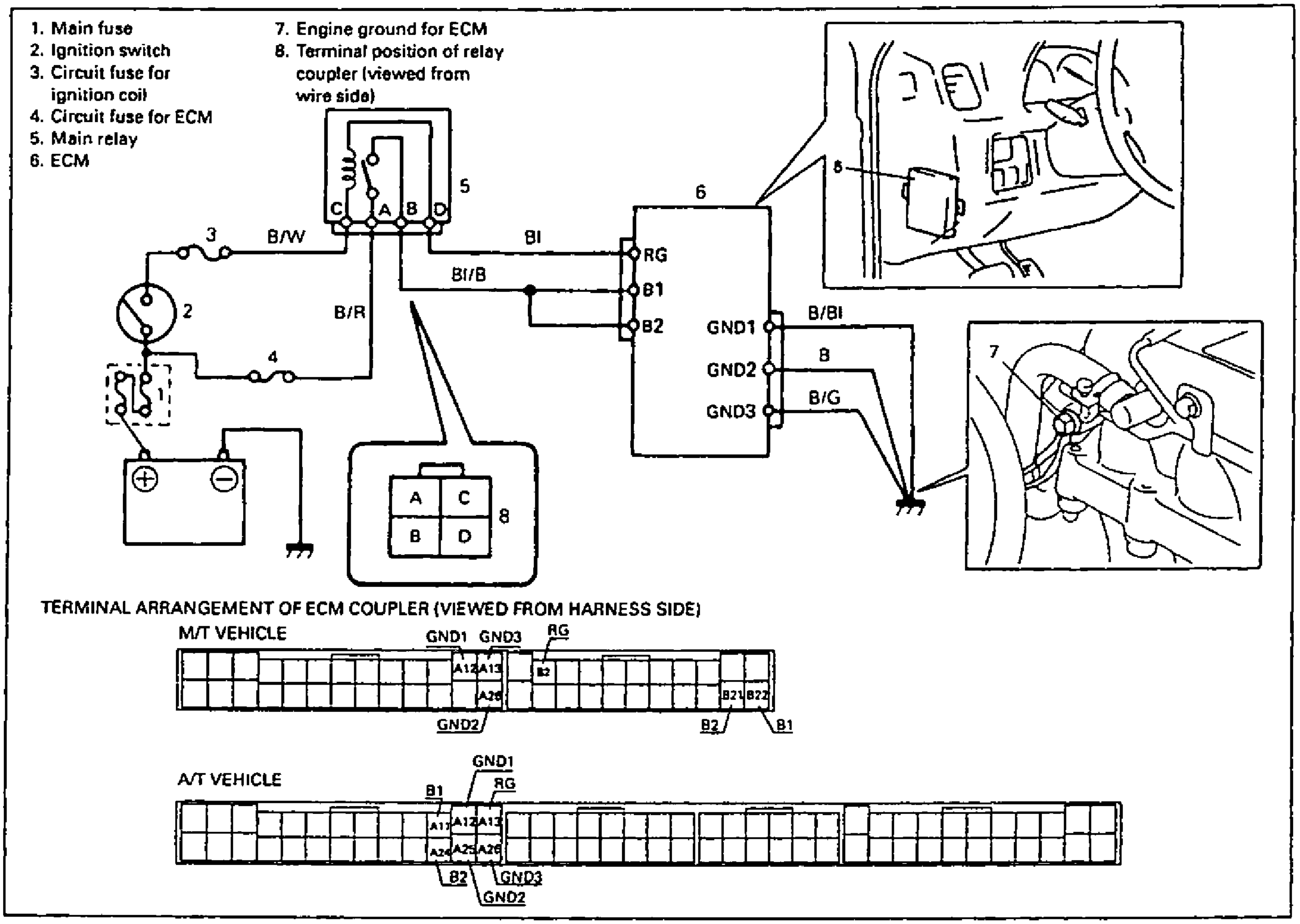
NO

"B/W" wire open.

NO

Replace.

A-1 ECM POWER AND GROUND CIRCUIT CHECK (VEHICLE WITHOUT IMMOBILIZER). (MALFUNCTION INDICATOR LAMP ("CHECK ENGINE" LIGHT) DOESN'T LIGHT AT IGNITION SWITCH ON AND ENGINE DOESN'T START THOUGH IT IS CRANKED UP.)

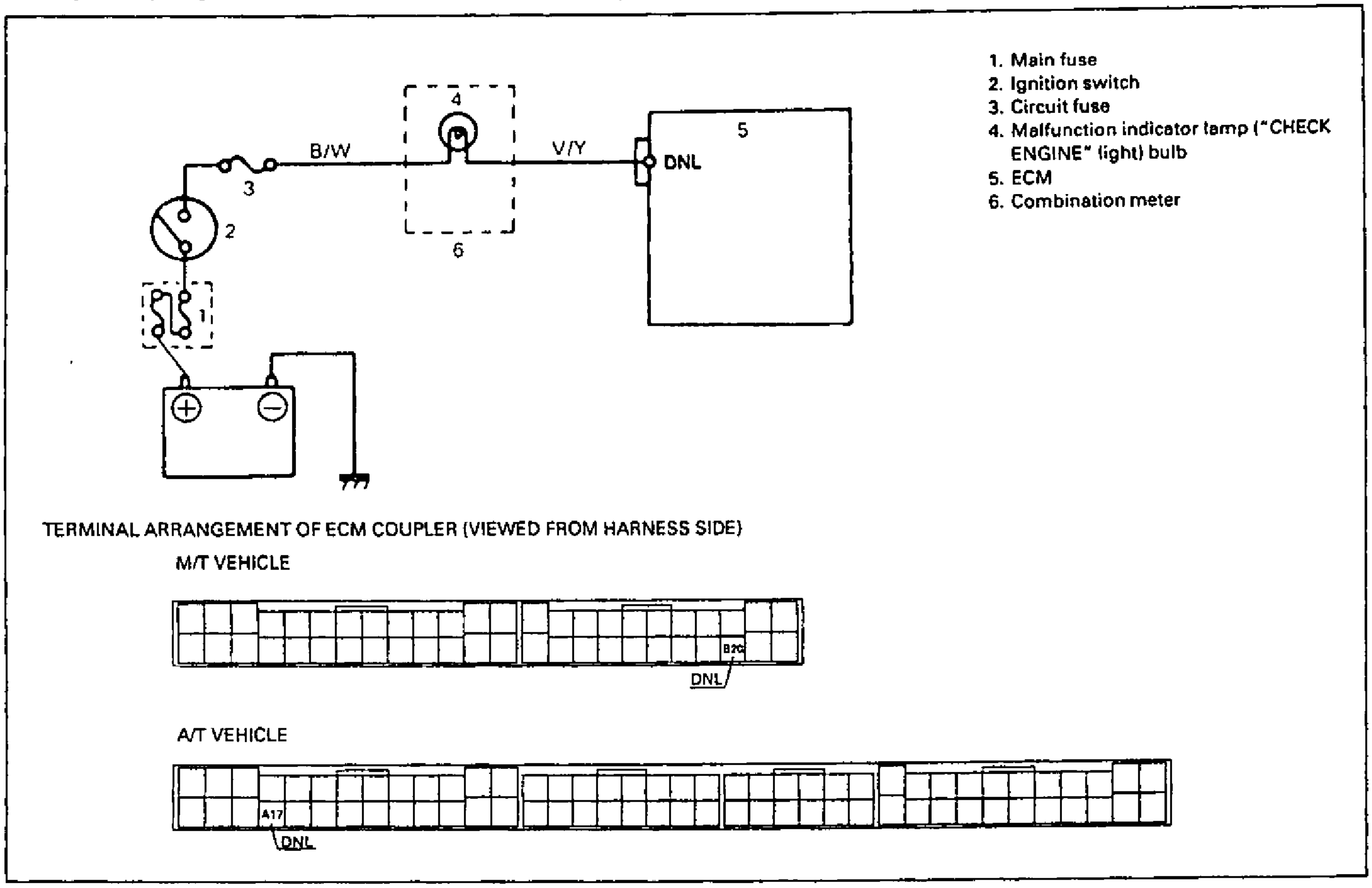


6E1020 6E1021

Is operation of main relay heard at ignition switch ON?

- **YES** → Is circuit fuse (for ECM) in good condition?
  - **YES** →
    1. Disconnect ECM coupler with ignition switch OFF.
    2. Using service wire, ground RG terminal.
    3. Is battery voltage applied to B1 or B2 terminal at ignition switch ON?
    - **YES** → Poor connection at both B1 and B2. If connection is OK, check ECM and its circuit referring to p. 6E1-46.
    - **NO** → "B/R" wire open, poor relay-to-coupler connection or "Bl/B" wire open. If all above are OK, check main relay.
  - **NO** → Repair and replace.
- **NO** → Are main fuse and circuit fuse (for ignition coil) in good condition?
  - **YES** → Is main relay in good condition? (Check main relay)
    - **YES** → Poor relay-to-coupler connection, "B/W" wire open, "Bl" wire open poor RG connection or poor engine ground. If all above are OK, substitute a known-good ECM and recheck.
    - **NO** → Replace.
  - **NO** → Repair and replace.

A-2 MALFUNCTION INDICATOR LAMP ("CHECK ENGINE" LIGHT) CIRCUIT CHECK
(MALFUNCTION INDICATOR LAMP ("CHECK ENGINE" LIGHT) DOESN'T LIGHT AT IGNITION SWITCH ON THOUGH ENGINE STARTS.)



6E1022 6E1023

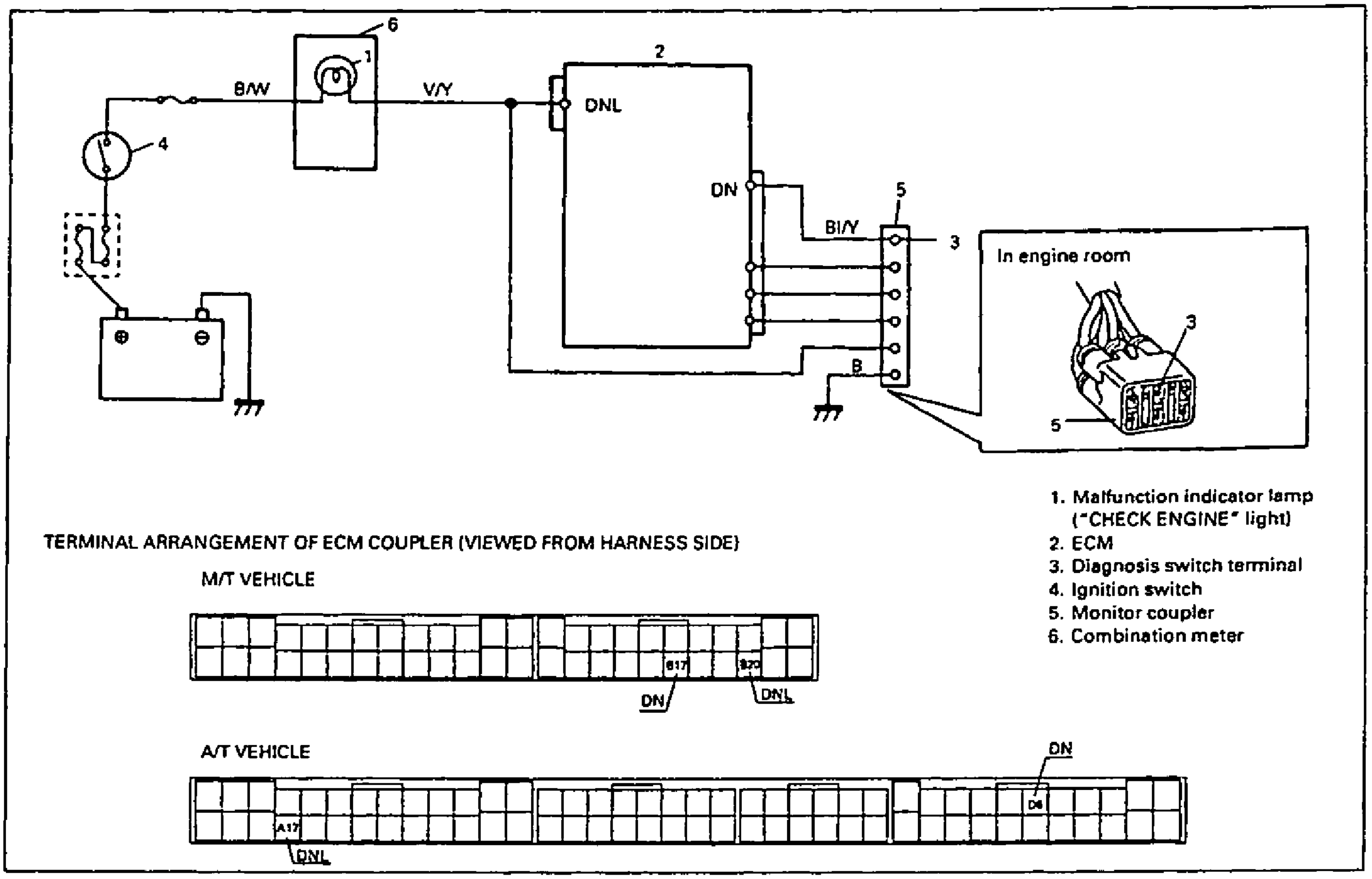
1. With ignition switch turned OFF, disconnect coupler from ECM.
2. Body-ground terminal DNL in coupler disconnected.
3. Does malfunction indicator lamp ("CHECK ENGINE" light) turn ON at ignition switch ON?

NO → Bulb burned out, "V/Y" wire circuit open or "B/W" wire circuit open.

YES ↓

Poor DNL connection.
If connection OK, is substitute a known-good ECM and recheck.

A-3 MALFUNCTION INDICATOR LAMP ("CHECK ENGINE" LIGHT) CIRCUIT CHECK
(MALFUNCTION INDICATOR LAMP ("CHECK ENGINE" LIGHT) DOESN'T FLASH OR JUST REMAINS ON EVEN WITH GROUNDING DIAGNOSIS SWITCH TERMINAL.)



6E1024 6E1025

Not For Federal Spec. Vehicle

1. Disconnect ECM coupler (terminal DN) with ignition switch turned OFF.
2. Does malfunction indicator lamp ("CHECK ENGINE" light) turn ON at ignition switch ON?

YES → "V/Y" wire circuit shorted to ground.

NO ↓

Is coupler (terminal DN) connected to ECM properly?

NO → Poor connection.

YES ↓

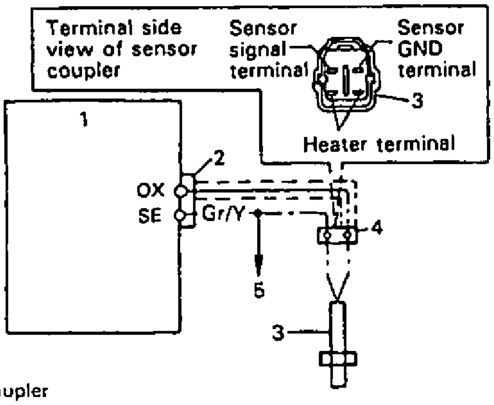
1. Using service wire, ground terminal DN with couplers connected to ECM.
2. Does malfunction indicator lamp ("CHECK ENGINE" light) flash at ignition switch ON?

YES → Poor grounding, "Bl/Y" wire circuit open or "B" wire open.

NO ↓

Substitute a known-good ECM and recheck.

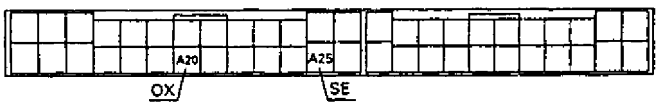
CODE NO. 13 HEATED OXYGEN SENSOR CIRCUIT (if equipped) (SIGNAL VOLTAGE DOESN'T CHANGE)



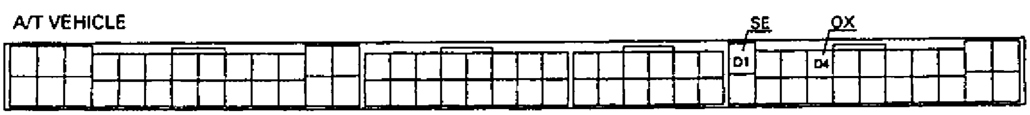
1. ECM
2. ECM coupler
3. Heated oxygen sensor
4. Coupler
5. To other sensor

TERMINAL ARRANGEMENT OF ECM COUPLER (VIEWED FROM HARNESS SIDE)

M/T VEHICLE



A/T VEHICLE



6E1026 6E1027

NOTE:

- **Before diagnosing trouble according to flow chart given below, check to make sure that following system and parts other than Electronic Fuel Injection system are in good condition.**
  - **Air cleaner (clogged)**
  - **Vacuum leaks (air inhaling)**
  - **Spark plugs (contamination, gap)**
  - **High-tension cords (crack, deterioration)**
  - **Distributor rotor or cap (wear, crack)**
  - **Ignition timing**
  - **Engine compression**
  - **Any other system and parts which might affect A/F mixture or combustion.**
- **If code No. 13 and another code No. are indicated together, the latter has priority. Therefore, check and correct what is represented by that code No. first and then proceed to the following check.**
- **Be sure to use a voltmeter with high impedance (MΩ/V minimum) or digital type voltmeter for accurate measurement.**

1. Remove ECM and connect couplers to ECM.
2. Warm up engine to normal operating temperature.
3. Connect voltmeter between OX terminal of ECM coupler and body ground.
4. Maintain engine speed at 2000 r/min. After 60 seconds, check voltmeter.

0V

- Wire between sensor and ECM open.
- "Gr/Y" wire open or
- Poor connection.

If wire and connection are OK, replace heated oxygen sensor and recheck.

Remains unchanged at below 0.45V.

1. Maintain engine speed at 2,000 r/min. for 60 sec.
2. Check voltmeter while repeating racing engine. Does it indicate 0.45V or more even once?

NO: Replace heated oxygen sensor and recheck.

YES: Poor OX connection or lean A/F mixture.
- Check MAF sensor, ECT sensor, fuel pressure and injectors.

If all above are OK, check ECM and its circuit referring to p. 6E1-46.

Remains unchanged at above 0.45V.

Poor OX connection or rich A/F mixture.
- Check TP sensor, MAF sensor, ECT sensor, fuel pressure and injectors.

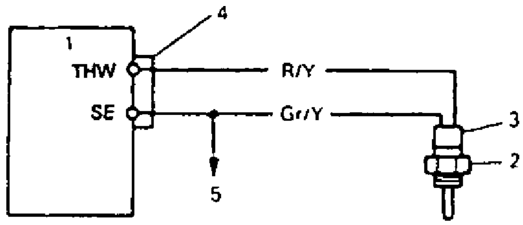
If all above are OK, check ECM and its circuit referring to p. 6E1-46.

Deflects between above and below 0.45V repeatedly.

Heated oxygen sensor and its circuit (Air/fuel ratio feed back system) are in good condition. Intermittent trouble or faulty ECM.
Recheck referring to "intermittent trouble".

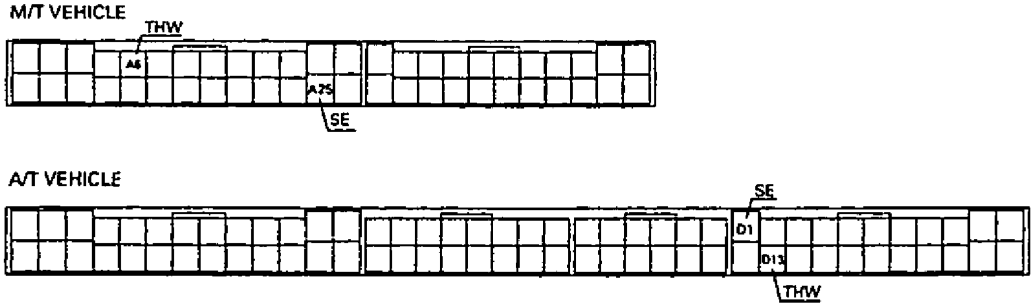
6E1028

CODE NO. 14 ECT SENSOR (ENGINE COOLANT TEMP. SENSOR) CIRCUIT (LOW TEMPERATURE INDICATED, SIGNAL VOLTAGE HIGH)



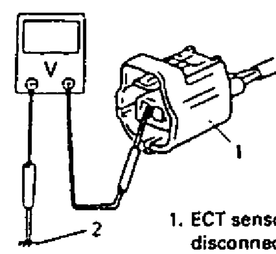
NOTE:
When Code Nos. 13, 14 and 21 are indicated together, it is possible that "Gr/Y" wire is open or SE terminal connection is poor.

TERMINAL ARRANGEMENT OF ECM COUPLER (VIEWED FROM HARNESS SIDE)



1. ECM
2. ECT sensor
3. Coupler
4. ECM coupler
5. To other sensors

6E1029 6E1030



1. ECT sensor coupler disconnected
2. Engine ground

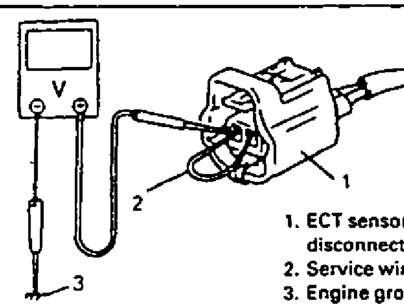
1. Disconnect ECT sensor coupler with ignition switch OFF.
2. With ignition switch ON, check voltage at "R/Y" wire terminals of ECT sensor coupler. Is it about 4–5V?

YES

1. Using service wire, connect ECT sensor coupler terminals.
2. Check voltage at "R/Y" wire terminal of ECT sensor coupler with ignition switch ON. Is it below 0.15V?

NO

"R/Y" wire open, poor THW connection or "R/Y" wire shorted to power circuit.
If wire and connection are OK, substitute a known-good ECM and recheck.



1. ECT sensor coupler disconnected
2. Service wire
3. Engine ground

NO

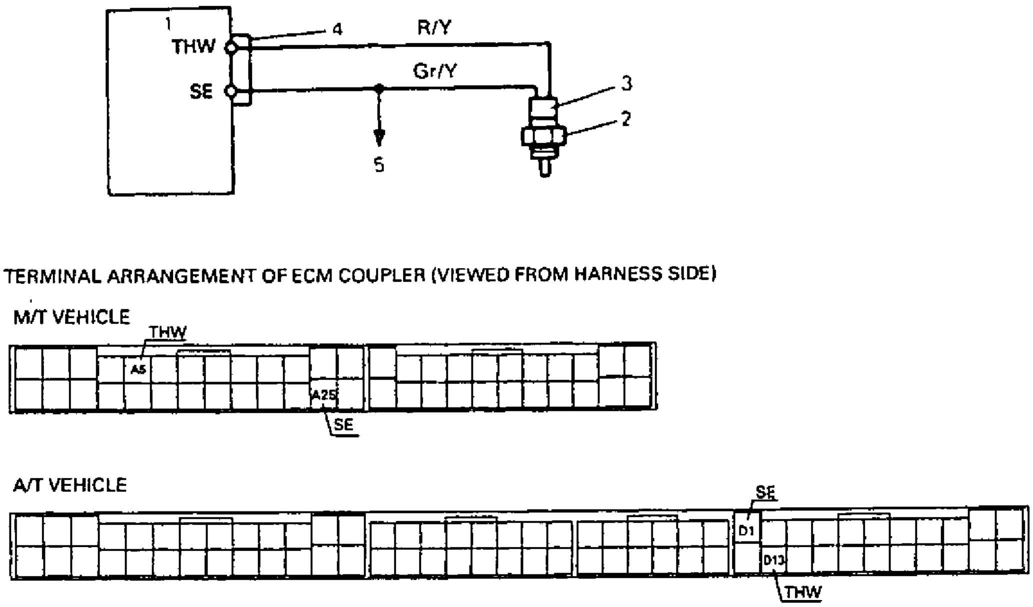
"Gr/Y" wire open or poor SE connection.
If wire and connection are OK, faulty ECM. Substitute a known-good ECM and recheck.

YES

Poor ECT sensor-to-coupler connection of faulty ECT sensor.
If connection and ECT sensor are OK, intermittent trouble or faulty ECM. Recheck referring to "Intermittent trouble".

6E1031 6E1032

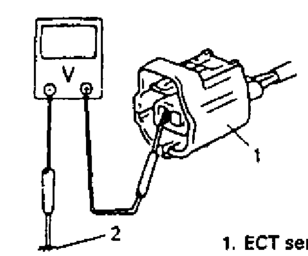
CODE NO. 15 ECT SENSOR (ENGINE COOLANT TEMP. SENSOR) CIRCUIT (HIGH TEMPERATURE INDICATED, SIGNAL VOLTAGE LOW)



1. ECM
2. ECT sensor
3. Coupler
4. ECM coupler
5. To other sensors

6E1033 6E1034

1. Disconnect ECT sensor coupler with ignition switch OFF.
2. With ignition switch ON, is voltage applied to "R/Y" wire terminal of ECT sensor coupler 4V or more?



1. ECT sensor coupler disconnected
2. Engine ground

YES: Check ECT sensor. Is it in good condition?

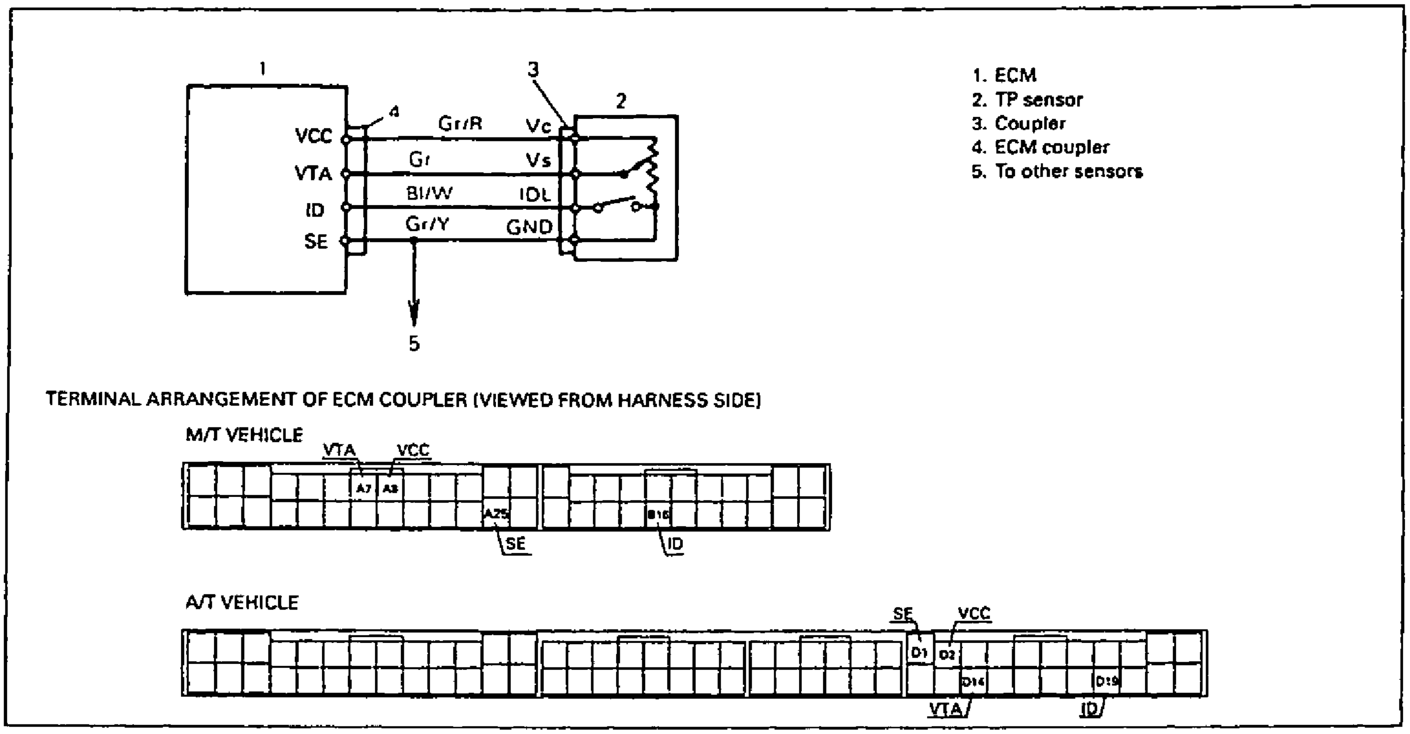
NO: "R/Y" wire shorted to "Gr/Y" wire or ground circuit. If wire is OK, substitute a known-good ECM and recheck.

Check ECT sensor — **YES**: Intermittent trouble or faulty ECM. Recheck referring to "Intermittent trouble".

Check ECT sensor — **NO**: Faulty ECT sensor

6E1035

CODE NO. 21 TP SENSOR (THROTTLE POSITION SENSOR) CIRCUIT (SIGNAL VOLTAGE HIGH)



6E1036 6E1037

NOTE:
Be sure to turn OFF ignition switch for this check.

1. Disconnect TP sensor coupler.
2. Check TP sensor. Is it in good condition?

- **NO** → Faulty TP sensor
- **YES** ↓

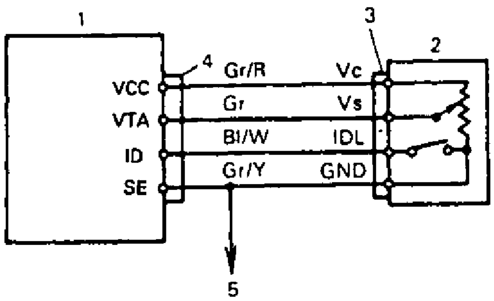
1. Disconnect ECM coupler.
2. With TP sensor coupler disconnected, is there continuity between ECM coupler terminals VCC and VTA?

- **YES** → "Gr/R" wire shorted to "Gr" wire.
- **NO** ↓

1. Connect TP sensor coupler.
2. Is resistance between ECM coupler terminals VCC and SE 3.5–6.5 kΩ?

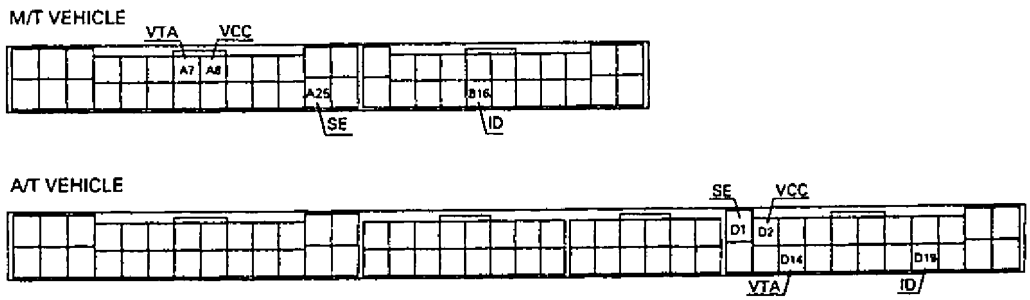
- **YES** → Poor SE connection. If connection is OK, intermittent trouble or faulty ECM. Recheck referring to "Intermittent trouble".
- **NO** → "Gr/Y" wire open or poor TP sensor-to-"Gr/Y" wire connection.

CODE NO. 22 TP SENSOR (THROTTLE POSITION SENSOR) CIRCUIT (SIGNAL VOLTAGE LOW)



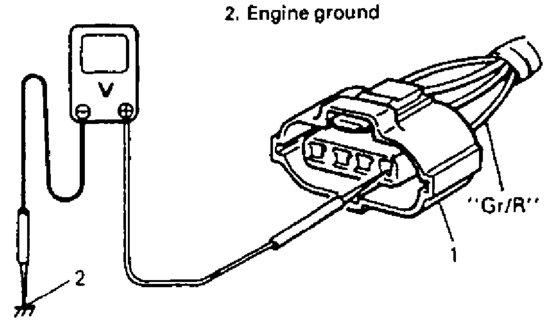
1. ECM
2. TP sensor
3. Coupler
4. ECM coupler
5. To other sensors

TERMINAL ARRANGEMENT OF ECM COUPLER (VIEWED FROM HARNESS SIDE)



6E1038 6E1039

1. Disconnect TP sensor coupler with ignition switch OFF.
2. With ignition switch ON, is voltage applied to "Gr/R" wire terminal of TP sensor coupler about 4–5V?



1. TP sensor coupler disconnected
2. Engine ground

YES

Check TP sensor.
Is it in good condition?

NO

"Gr/R" wire open, "Gr/R" wire shorted to ground circuit or "Gr/Y" wire, or poor VCC connection.
If wire and connection are OK, substitute a known-good ECM and recheck.

YES

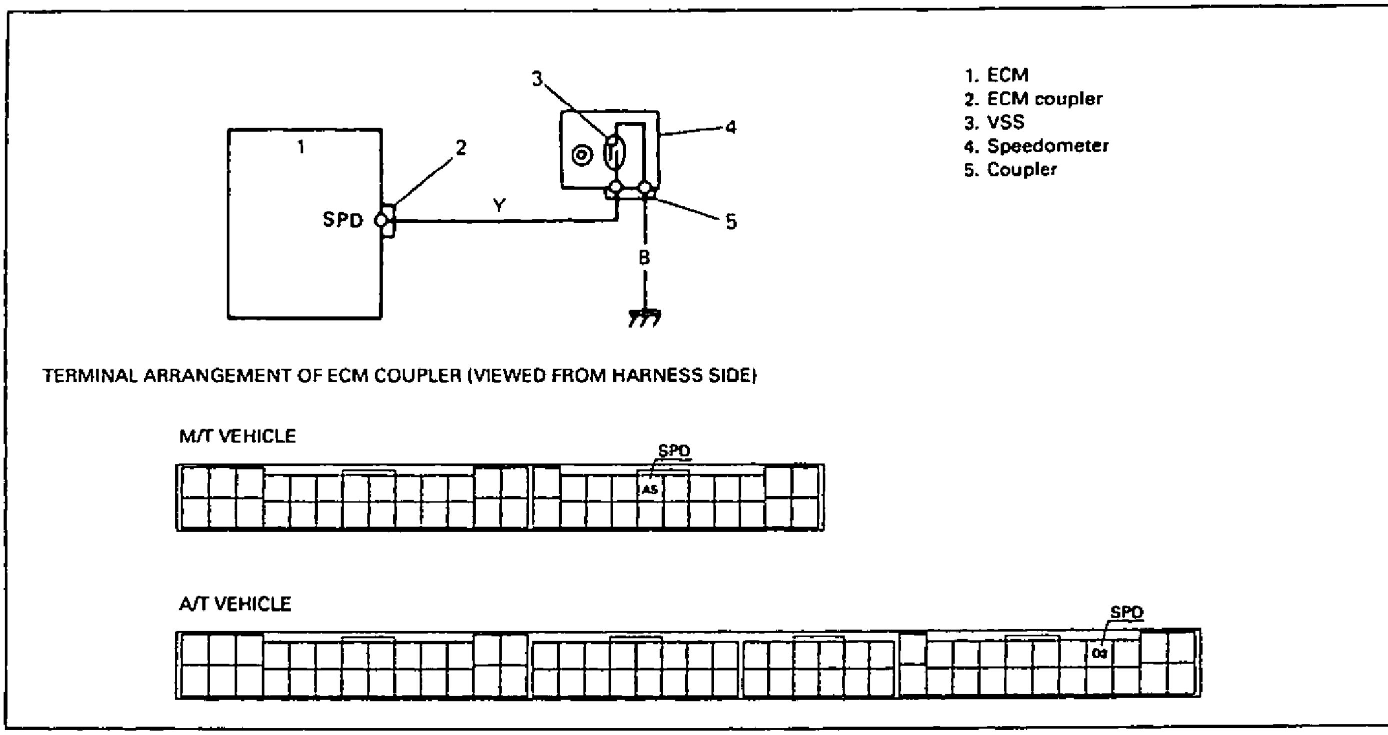
"Gr" wire open, "Gr" wire shorted to ground circuit, poor TP sensor-to-coupler connection or poor VTA connection.
If wire and connections are OK, intermittent trouble or faulty ECM.
Recheck referring to "Intermittent trouble".

NO

Faulty TP sensor.

6E1040

CODE NO. 24 VSS (VEHICLE SPEED SENSOR) CIRCUIT (VEHICLE SPEED SIGNAL NOT INPUTTED ALTHOUGH FUEL IS KEPT CUT FOR LONGER THAN 5 SECONDS)



6E1041 6E1042

NOTE:
Be sure to turn OFF ignition switch for this check.

Does speedometer indicate vehicle speed?

YES

1. Disconnect ECM coupler with ignition switch OFF.
2. Connect ohmmeter between SPD terminal of ECM coupler and body ground.
3. Hoist vehicle and lock rear left tire.
4. Turn rear right tire slowly. Does ohmmeter indicator deflect between 0 and ∞ a few times while tire is turned one revolution?

NO

Check speedometer cable and gears for damage.

(From step 4:)

NO

Check VSS.
Is it in good condition?

YES

Poor SPD connection. If connection is OK, intermittent trouble or faulty ECM.
Recheck referring to "Intermittent trouble".

(From Check VSS:)

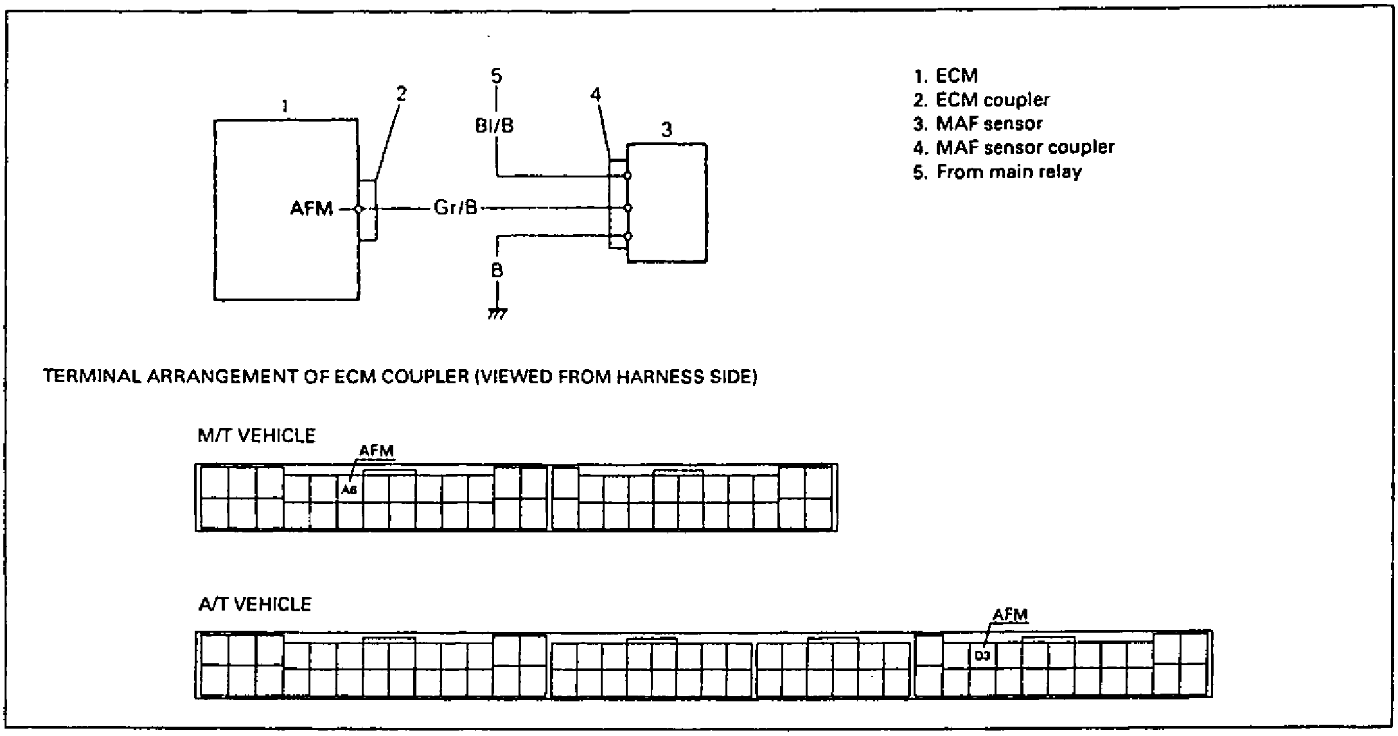
YES

"Y" wire open, "B" wire open, poor coupler-to-meter connection or poor "B" wire ground.

NO

Faulty VSS.

CODE NO. 33 MAF SENSOR (MASS AIR FLOW SENSOR) CIRCUIT (LARGE SIGNAL CURRENT FLOW, SIGNAL VOLTAGE HIGH)



6E1043 6E1044

1. Remove ECM and connect couplers to ECM.
2. Turn ignition switch ON and check voltage at AFM terminal.
   Is it within 1.0–1.6V?

YES

Start engine and check voltage at AFM terminal.
Does voltage rise within 5V range when engine speed is increased?

NO

"B" wire circuit open or "Gr/B" wire circuit shorted to power circuit.
If wires are OK, substitute a known-good MAF sensor and recheck.

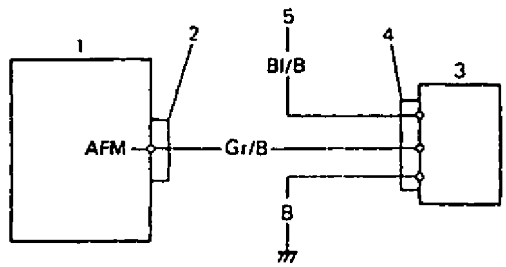
YES

Intermittent trouble or faulty ECM.
Recheck referring to "Intermittent trouble".

NO

Substitue a known-good MAF sensor and recheck.

CODE NO. 34 MAF SENSOR (MASS AIR FLOW SENSOR) CIRCUIT (SMALL SIGNAL CURRENT FLOW, SIGNAL VOLTAGE LOW)

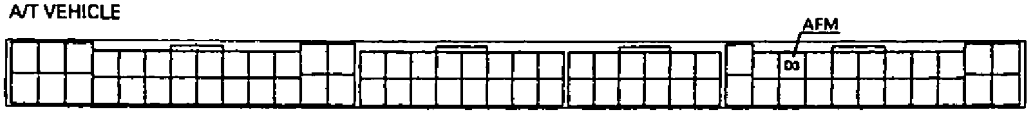


1. ECM
2. ECM coupler
3. MAF sensor
4. MAF sensor coupler
5. From main relay

TERMINAL ARRANGEMENT OF ECM COUPLER (VIEWED FROM HARNESS SIDE)

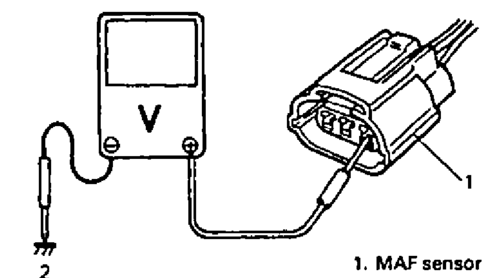
M/T VEHICLE

A/T VEHICLE



6E1045 6E1046

1. Disconnect MAF sensor coupler with ignition switch OFF.
2. With ignition switch ON, is voltage applied to "Bl/B" wire terminal of MAF sensor coupler about 10–14V?



1. MAF sensor
2. Engine ground

YES

1. Connect MAF sensor coupler with ignition switch OFF.
2. Remove ECM and connect couplers to ECM.
3. Turn ignition switch ON and check voltage at AFM terminal.
   Is it within 1.0–1.6V?

NO

"Bl/B" wire open.

NO

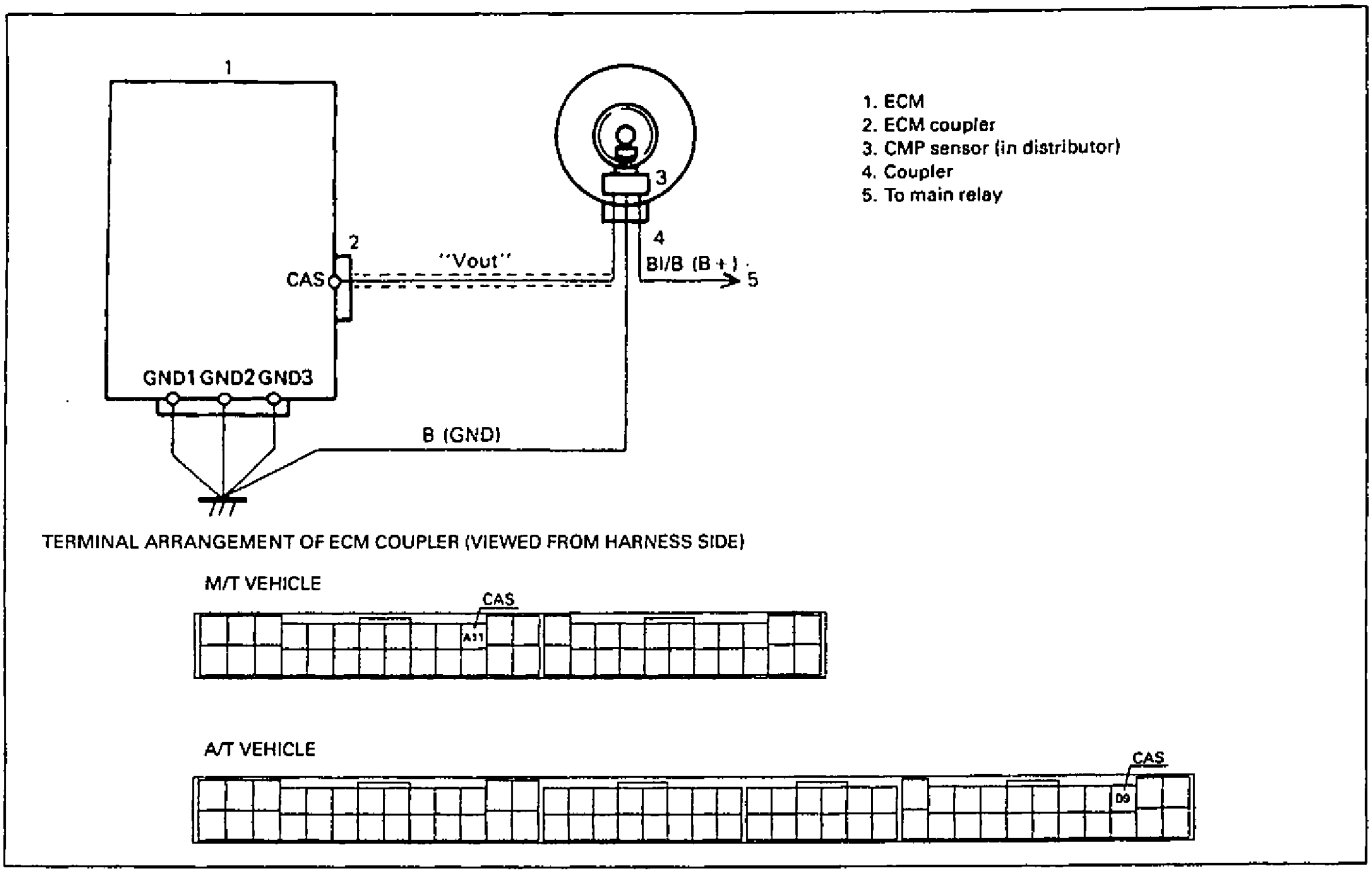
Intermittent trouble or faulty ECM.
Recheck referring to "Intermittent trouble".

YES

Poor AFM connection, "Gr/B" wire open, or poor MAF sensor-to-coupler connection.
If wire and connection are OK, substitute a known-good MAF sensor and recheck.

6E1047

CODE NO. 42 CMP SENSOR (CAMSHAFT POSITION SENSOR) CIRCUIT (SENSOR SIGNAL NOT INPUTTED FOR 3 SECONDS AT ENGINE CRANKING)

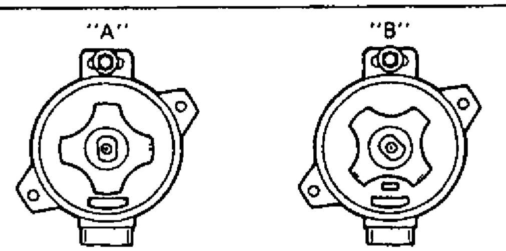


6E1048 6E1049

1. Remove ECM and connect couplers to ECM.
2. Remove distributor cap, rotor and cover. Don't remove signal rotor from shaft.
3. With ignition switch ON, check voltage at CAS terminal with signal rotor inserted between hall element and magnet ("A") and without it ("B") respectively, by turning crankshaft.

"A"	3–5V
"B"	0–1V

Is it in good condition?



Magnetic flux to hall element cut off

Magnetic flux applied to hall sensor

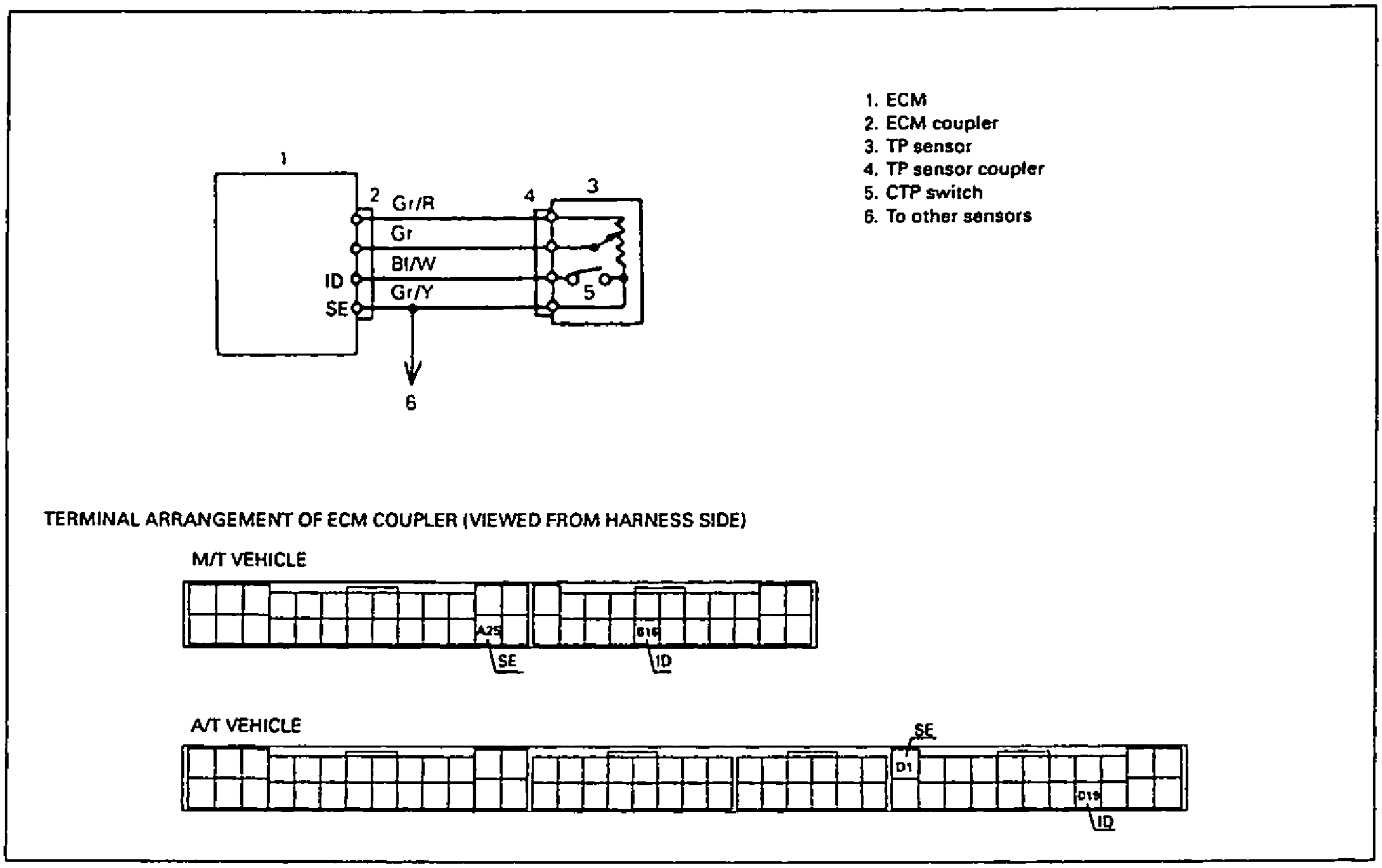
YES: Substitute a known-good ECM and recheck.

NO:

- 3–5V or more at both "A" and "B". → "Vout" wire open, "GND" circuit open, "Vin" circuit open or poor CMP sensor coupler connection. If wire and connection are OK, substitute a known-good CMP sensor and recheck.
- 0–1V at both "A" and "B". → Poor CAS connection or "Vout" wire short to ground. If wire and connection are OK, substitute a known-good CMP sensor and recheck.

6E1050 6E1051

CODE NO. 44 CTP SWITCH CIRCUIT (CIRCUIT OPEN OR TP SENSOR INSTALLATION ANGLE MALADJUSTED)



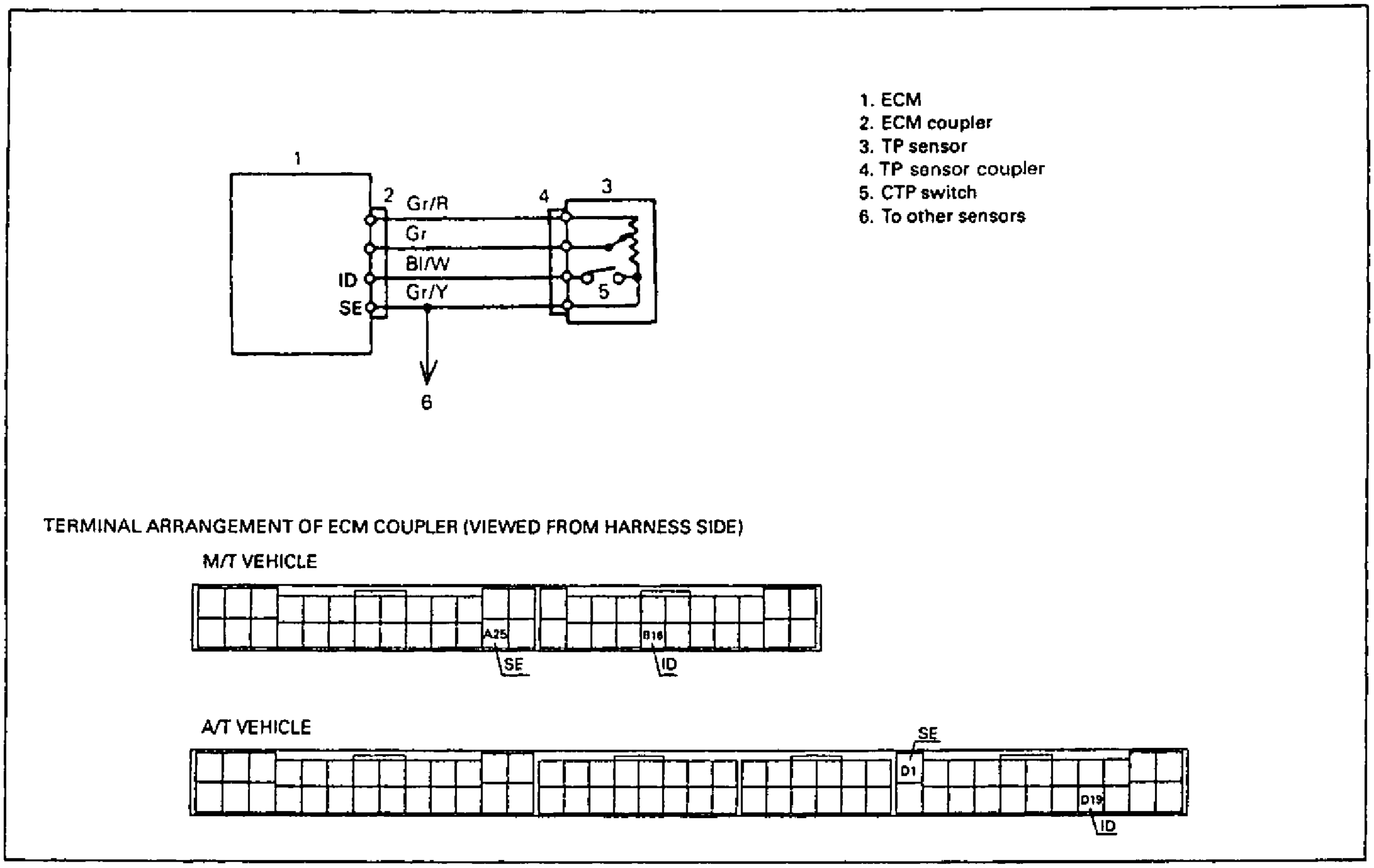
6E1052 6E1053

Check CTP switch in TP sensor. Is it in good condition?

YES → "Bl/W" wire open, poor ID connection, or poor TP sensor coupler connection. If wires and connections are OK, substitute a known-good ECM and recheck.

NO → Faulty CTP switch or TP sensor installation angle maladjusted.

CODE NO. 45 CTP SWITCH CIRCUIT (CIRCUIT SHORT OR TP SENSOR INSTALLATION ANGLE MALADJUSTED)



6E1054 6E1055

Check idle switch in TP sensor. Is it in good condition?

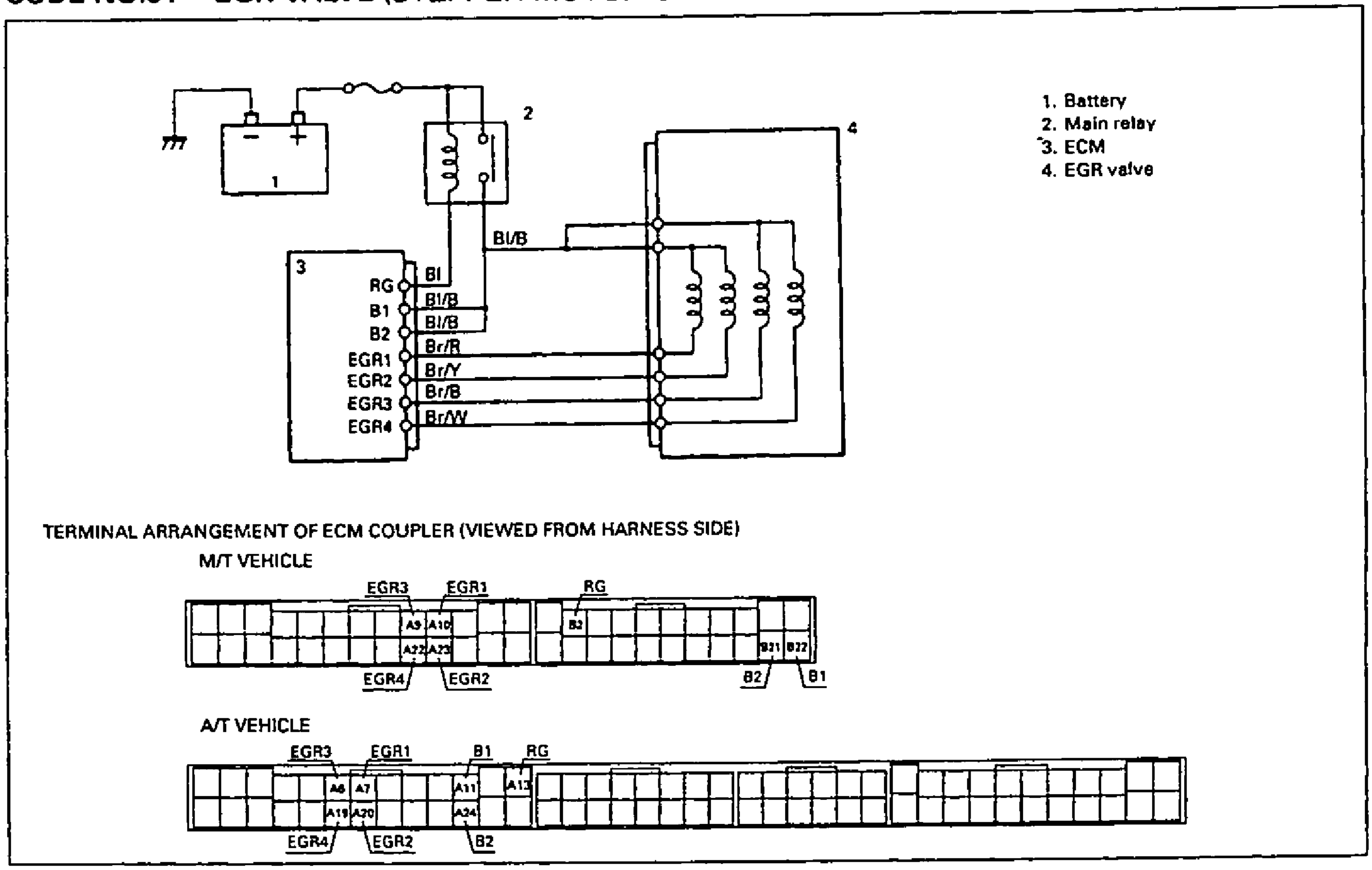
YES

"Bl/W" wire shorted to "Gr/Y" wire or ground. If wiring is OK, intermittent trouble or faulty ECM. Recheck referring to "Intermittent trouble".

NO

Faulty CTP switch or TP sensor installation angle maladjusted.

CODE NO.51 EGR VALVE (STEPPER MOTOR OR ITS CIRCUIT OPEN OR SHORT)

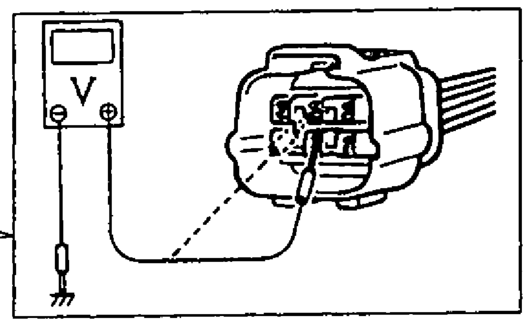


6E1056 6E1057

Does EGR stepper motor operate for about 1 second after ignition switch ON?

→ NO:

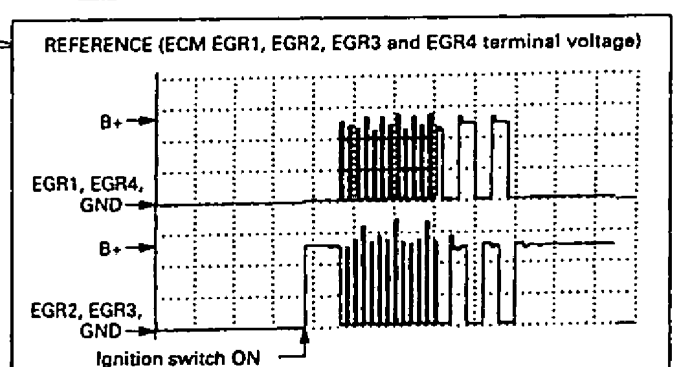
1. Disconnect EGR valve coupler with ignition switch OFF.
2. Check voltage between "Bl/B" wire terminals and body ground.
3. Are they about 10 – 14 V?



→ NO: "Bl/B" wire open

→ YES (from both):

Check voltage between EGR1, EGR2, EGR3 and EGR4 terminals of ECM coupler and body ground for about 1 second after ignition switch ON, Is each measured voltage about4–8.4V?



→ YES: Intermittent trouble or faulty ECM. Recheck referring to intermittent trouble.

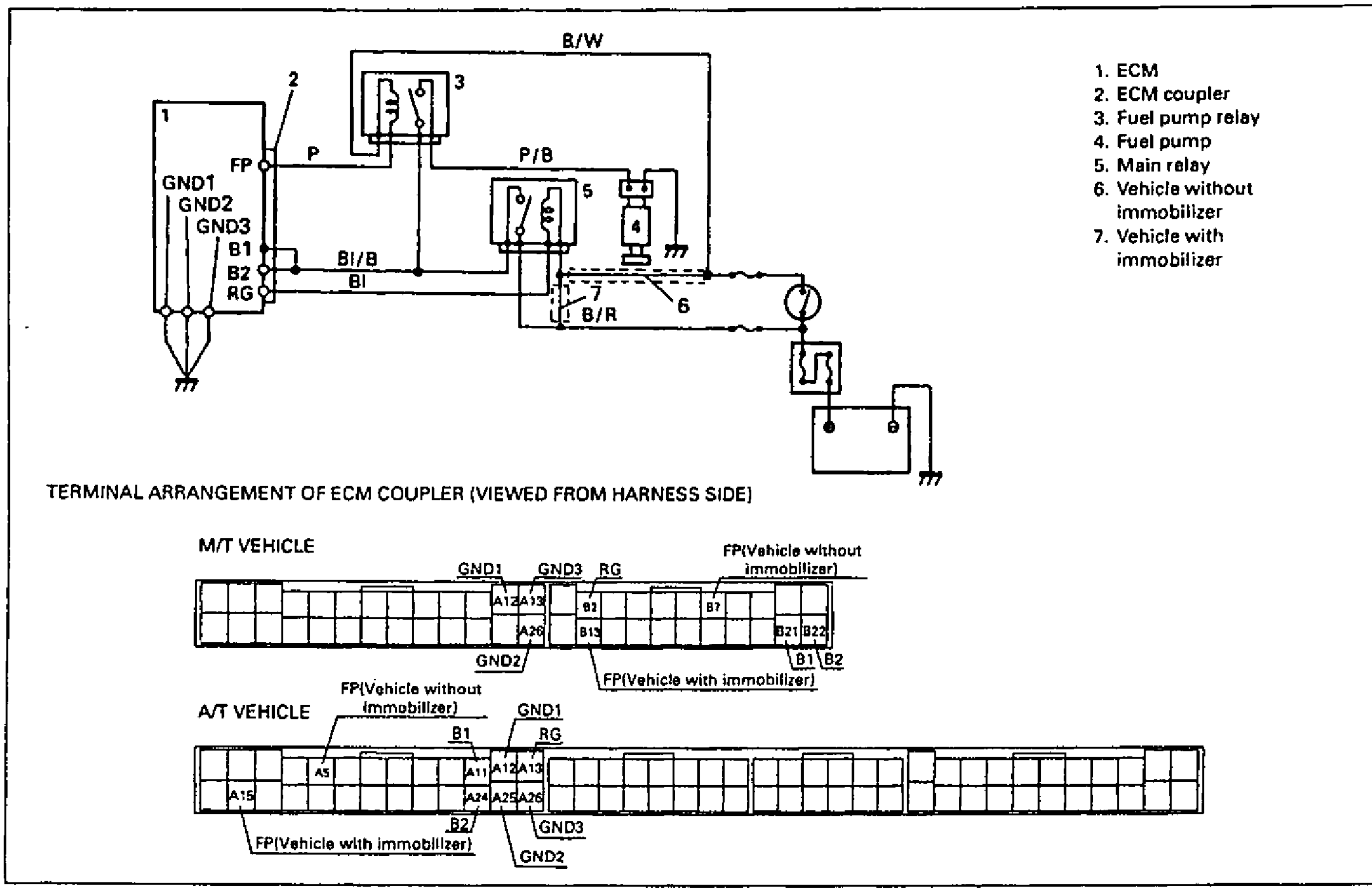
→ NO: Check EGR valve. Is it OK?

→ YES: "Br/R", "Br/Y", "Br/B" or "Br/W" wire open or shorted to ground or poor EGR1, EGR2, EGR3 or EGR4 connection of ECM coupler. If wire harness and connections are OK, intermittent trouble or faulty ECM. Recheck referring to intermittent trouble.

→ NO: Faulty EGR valve

6E1058 6E1059

B-1 FUEL PUMP CIRCUIT CHECK



6E1060 6E1061

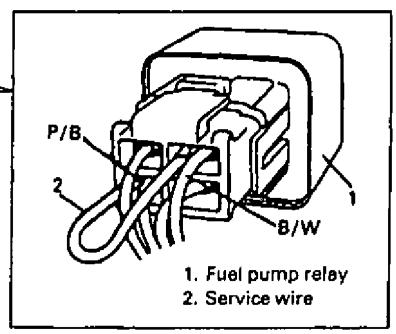
Is fuel pump heard to operate for 3 sec. after ignition switch ON?

NO

1. Turn OFF ignition switch.
2. Using service wire, connect "P/B" and "B/W" wire terminals.
3. Is fuel pump heard to operate at ignition switch ON?

YES

Fuel pump circuit in good condition.



YES

Check fuel pump relay.
Is it in good condition?

NO

"P/B" wire open, poor fuel pump coupler connection or faulty fuel pump.

YES

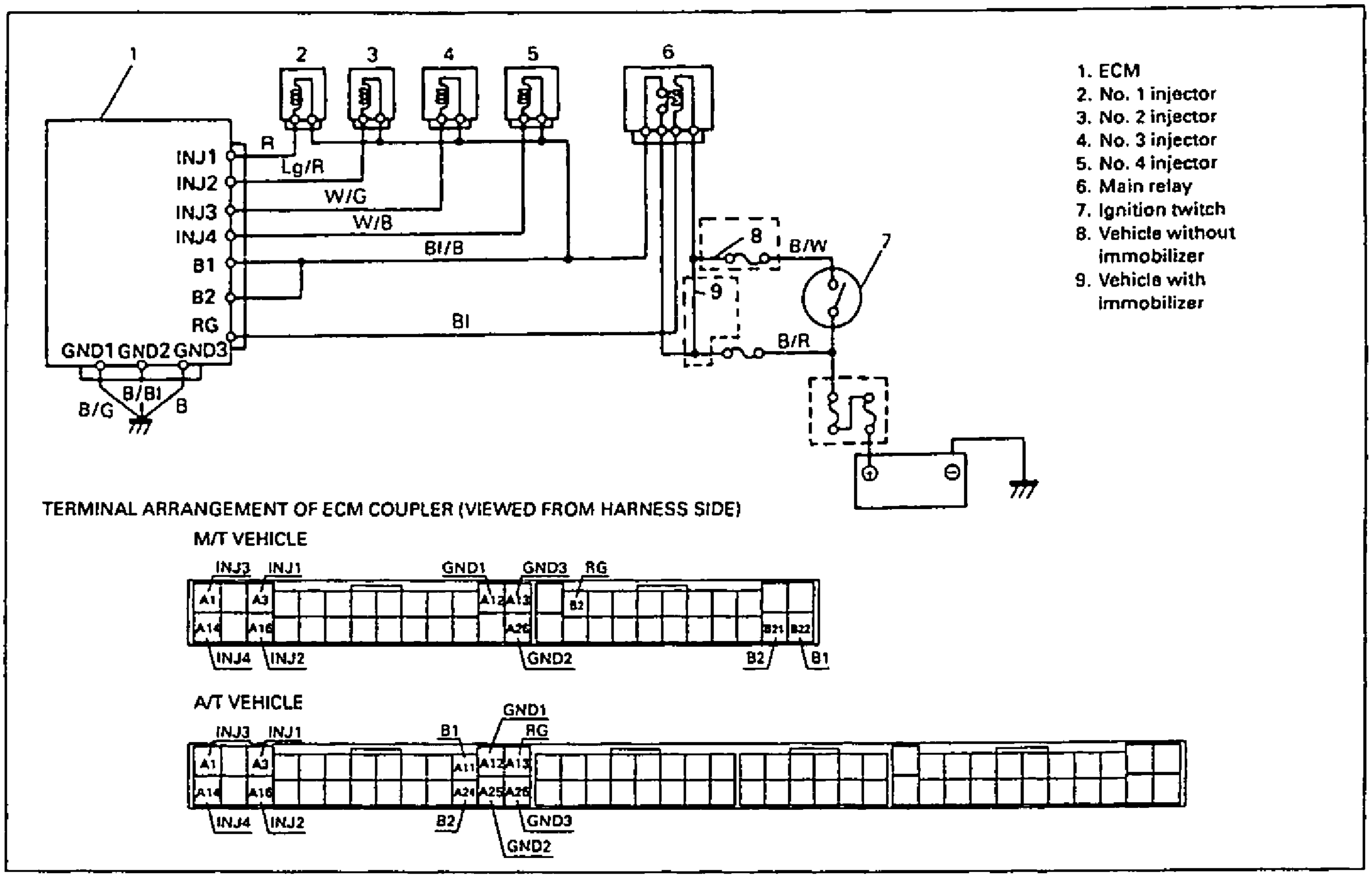
Poor relay coupler connection, "P" wire open or poor FP connection.
If wire and connection are OK, substitute a known-good ECM and recheck.
NOTE:
Before substituting a known-good ECM, check to make sure that resistance of coil in relay is as specified.

NO

Faulty fuel pump relay.

6E1062

B-2 FUEL INJECTOR CIRCUIT CHECK



6E1063 6E1064

Using sound scope, check each injector for operating sound at engine cranking.
Do all 4 injectors make operating sound?

YES → Fuel injector circuit is in good condition.

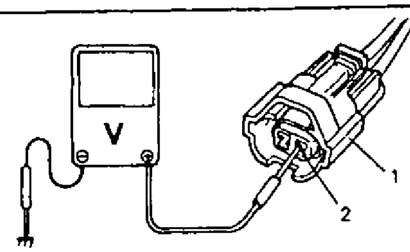
NO →

- One or more of 4 injectors make(s) no operating sound.
  → Check coupler connection and wire harness of injector not making operating sound and injector itself.
  If all above are OK, substitute a known-good ECM and recheck.
- None of 4 injectors makes operating sound.
  To ① on next page.

① None of 4 injectors makes operating sound.

↓

1. Disconnect coupler from No.1 injector with ignition switch OFF.
2. Check voltage at "Bl/B" wire terminal with ignition switch ON.
   Is it battery voltage?



1. Injector coupler
2. "Bl/B" wire terminal

YES ↓

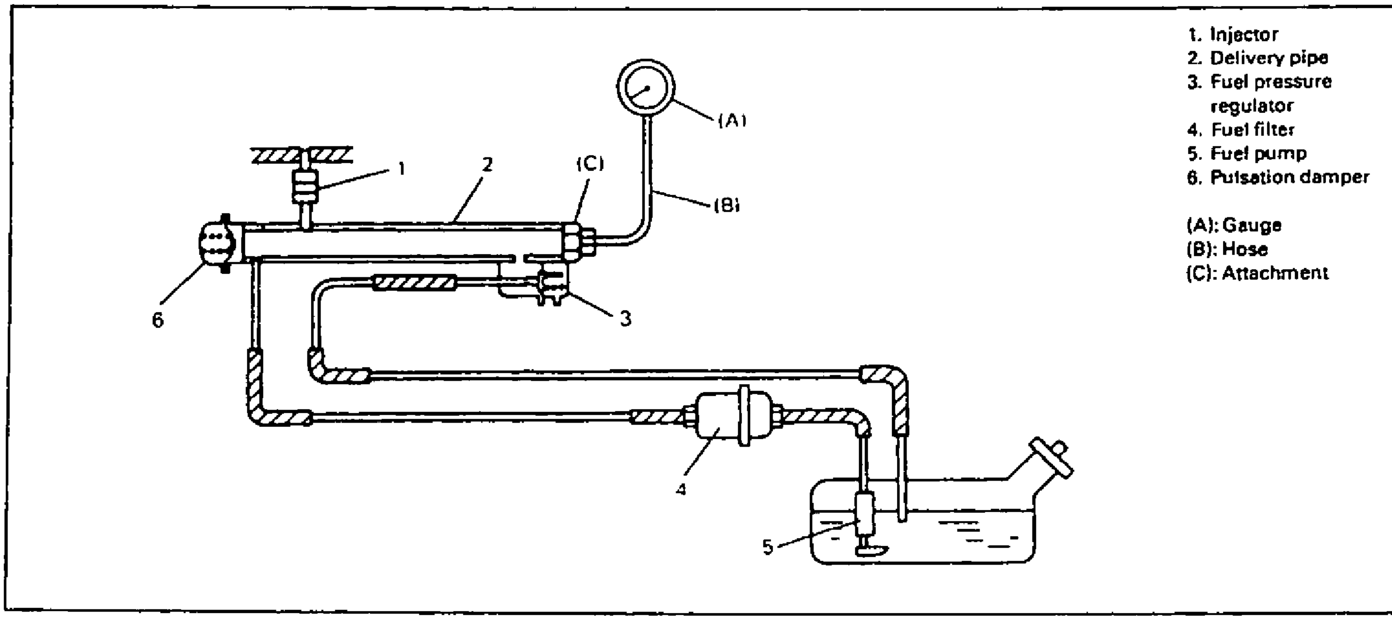
Disconnect ECM couplers with ignition switch OFF check all 4 injectors for resistance respectively.
No.1 injector : INJ1 and B1/B2
No.2 injector : INJ2 and B1/B2
No.3 injector : INJ3 and B1/B2
No.4 injector : INJ4 and B1/B2
If resistance is OK, substitute a known-good ECM and recheck.

NO ↓

Power circuit open.

6E1092

B-3 FUEL PRESSURE CHECK



6E1065

NOTE:
Before using following flow chart, check to make sure that battery voltage is higher than 11V. If battery voltage is low, pressure becomes lower than specification even if fuel pump and line are in good condition.

1. Install fuel pressure gauge.
2. Operate fuel pump.
   Is fuel pressure then 250 – 300 kPa (2.5 – 3.0 kg/cm^2, 35.6 – 42.7 psi)?
   Also, is 180 kPa (1.8 kg/cm^2, 25.6 psi) or higher fuel pressure retained for 1 mimute after fuel pump is stopped?

NO →

- No pressure
  To ① on next page.
- Pressure within spec. but not retained
  To ② on next page.
- Low pressure
  To ③ on next page.
- High pressure
  To ④ on next page.

YES ↓

1. Start engine and warm it up to normal operating temperatue.
2. Keep it running at specified idle speed.
   Is fuel pressure then within 210 – 260 kPa (2.1 – 2.6 kg/cm^2, 29.8 – 37.0 psi)?

YES → Normal fuel pressure.

NO →

- Clogged vacuum passage for fuel pressure regulator or
- Faulty fuel pressure regulator.

B-3 FUEL PRESSURE CHECK (continued)

① NO PRESSURE

With fuel pump operated and fuel return hose blocked by pinching it, is fuel pressure applied?

- NO: Shortage of fuel or fuel pump or its circuit defective (Refer to "Diagnostic Flow Chart B-1").
- YES: Faulty fuel pressure regulator

② PRESSURE WITHIN SPEC. BUT NOT RETAINED

Is there fuel leakage from fuel feed line hose, pipe or their joint?

- YES: Fuel leakage from hose, pipe or joint.
- NO:
  1. Disconnect fuel return hose from fuel pipe and connect new return hose to it.
  2. Put 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?

  - YES: Faulty fuel pressure regulator.
  - NO:
    - Fuel leakage from injector,
    - Faulty fuel pump (faulty check valve in fuel pump) or
    - Fuel leakage from fuel pressure regulator diaphragm.

③ LOW PRESSURE

1. Operate fuel pump.
2. With fuel return hose blocked by pinching it, check fuel pressure. Is it 400 kPa (4.0 kg/cm^2, 56.9 psi) or more?

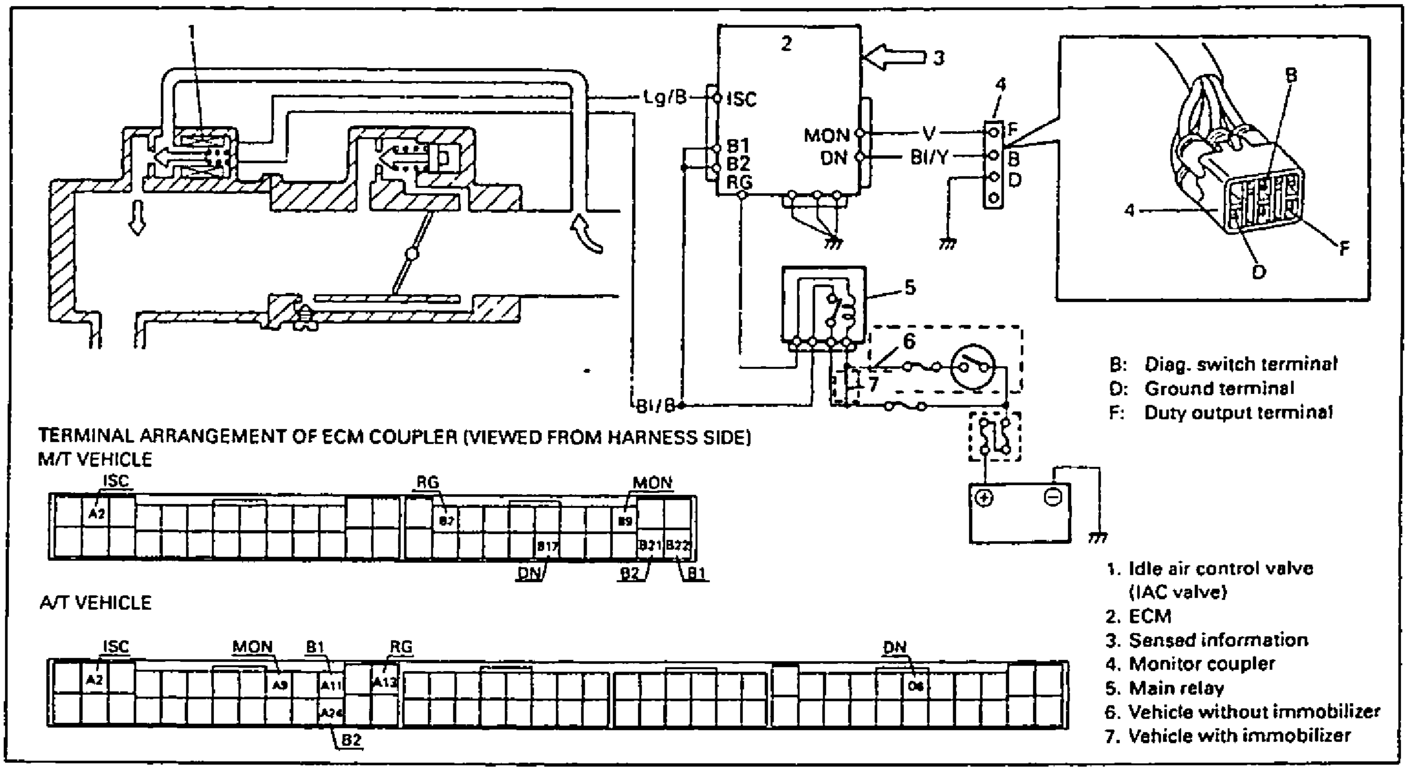
- NO:
  - Clogged fuel filter,
  - Restricted fuel feed hose or pipe,
  - Faulty fuel pump or
  - Fuel leakage from hose connection in fuel tank.
- YES: Faulty fuel Pressure regulator

④ HIGH PRESSURE

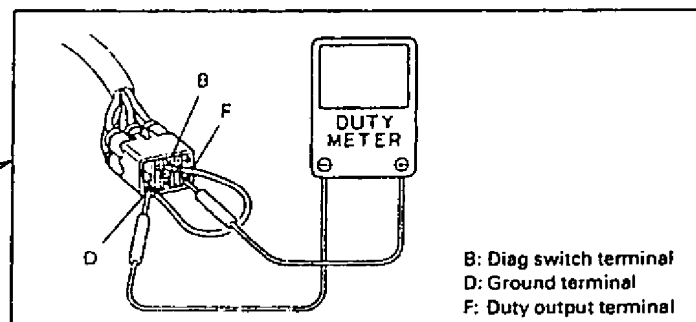
1. Disconnect fuel return hose from fuel pipe and connect new return hose to it.
2. Put the other end of new return hose into approved gasoline container.
3. Operate fuel pump. Is specified fuel pressure obtained then?

- NO: Faulty fuel pressure regulator.
- YES: Restricted fuel return hose or pipe.

B-4 IDLE AIR CONTROL SYSTEM CHECK



6E1066 6E1067



1. Warm up engine to normal operating temperature and keep it idling.
2. Using service wire, ground diagnosis switch terminal.
3. Is diagnostic trouble code No. 12 indicated?

- **YES** → Check idle air control duty (IAC duty) and idle speed. Are they within specification?
- **NO** → Go back to "Diagnostic Flow Chart".

Check idle air control duty (IAC duty) and idle speed. Are they within specification?

- **YES** → Is engine idle speed kept at 750 – 850 r/min even with headlights turned ON.
- **NO** →
  - High idle speed. To ① on next page.
  - Low idle speed. To ② on next page.
  - Idle speed is within specification but duty is not.
    1. Adjust IAC duty to specification.
    2. Proceed to next step. → Is engine idle speed kept at 750 – 850 r/min even with headlights turned ON.

Is engine idle speed kept at 750 – 850 r/min even with headlights turned ON.

- **YES** → System is in good condition.
- **NO** → Proceed to system circuit check ③ on next page.

6E1068

B-4 IDLE AIR CONTROL SYSTEM CHECK (continued)

① HIGH IDLE SPEED

Check IAC valve for its resistance and/or operation.
Is it in good condition?

- NO → Faulty IAC valve.
- YES → Does duty meter indicate less than about 28% (or more than about 72% for OFF duty meter)?
  - NO → Substitute a known-good ECM and recheck.
  - YES → Adjust idle speed and duty.

    NOTE:
    If not adjustable with idle speed adjusting screw, check fast idle air valve for air leakage or "Lg/B" circuit for short.

② LOW IDLE SPEED

Check IAC valve for its resistance and/or operation.
Is it in good condition?

- NO → Faulty IAC valve.
- YES → Does duty meter indicate less 90 – 100% (about 0 – 10% for OFF duty meter)?
  - NO → Substitute a known-good ECM and recheck.
  - YES → Proceed to system circuit check ③.

③ SYSTEM CIRCUIT CHECK

1. Disconnect ECM couplers with ignition switch OFF.
2. Is resistance between ISC and B1/B2 11–14 Ω?

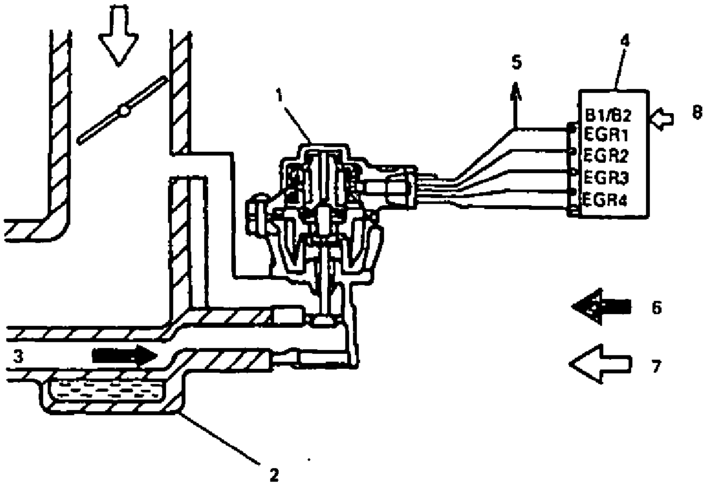
- YES → Poor coupler connection. If connection is OK, substitute a known-good ECM and recheck.
- NO →
  - Faulty IAC valve
  - Poor coupler connection or
  - Open wire harness

NOTE:
IAC duty can be checked by using analog type voltmeter with high impedance (MΩ/V minimum), although not accurate. IAC duty to voltage relation is as follows.

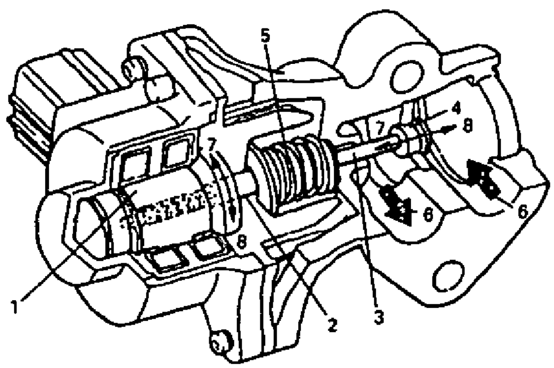
ON DUTY METER INDICATION	OFF DUTY METER INDICATION	VOLTMETER INDICATION
0 (%)	100 (%)	0 (V)
28	72	$0.28 \times V_B$
50	50	$0.5 \times V_B$
100	0	V_B

- **"OFF DUTY METER" is such duty meter that indicates approx. 100% when terminal voltage is approx. "0V".**
- **"V_B" represents battery voltage while engine of vehicle being checked is running.**

B-5 EGR SYSTEM CHECK
(Vehicle with EGR Stepper Motor)

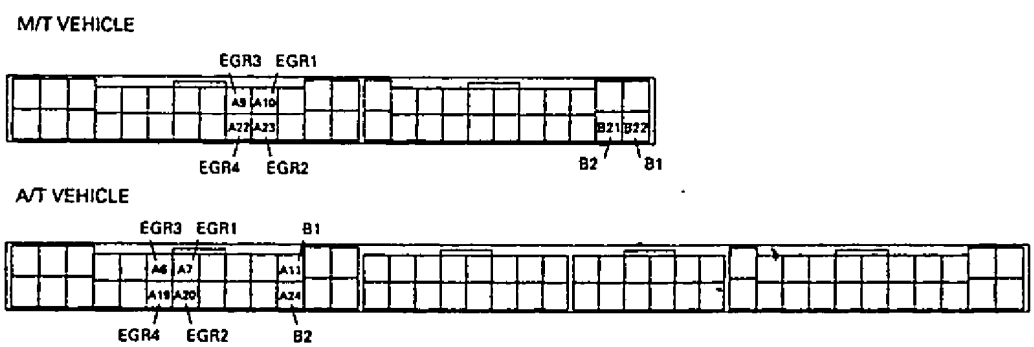


1. EGR valve
2. Intake manifold
3. From exhaust manifold
4. ECM
5. From main relay
6. Exhaust gas
7. Fresh air
8. Sensed information



1. Stepper motor
2. Rod (with thread)
3. Rod
4. Valve
5. Spring
6. Exhaust gas
7. Valve close
8. Valve open

TERMINAL ARRANGEMENT OF ECM COUPLER (VIEWED FROM HARNESS SIDE)



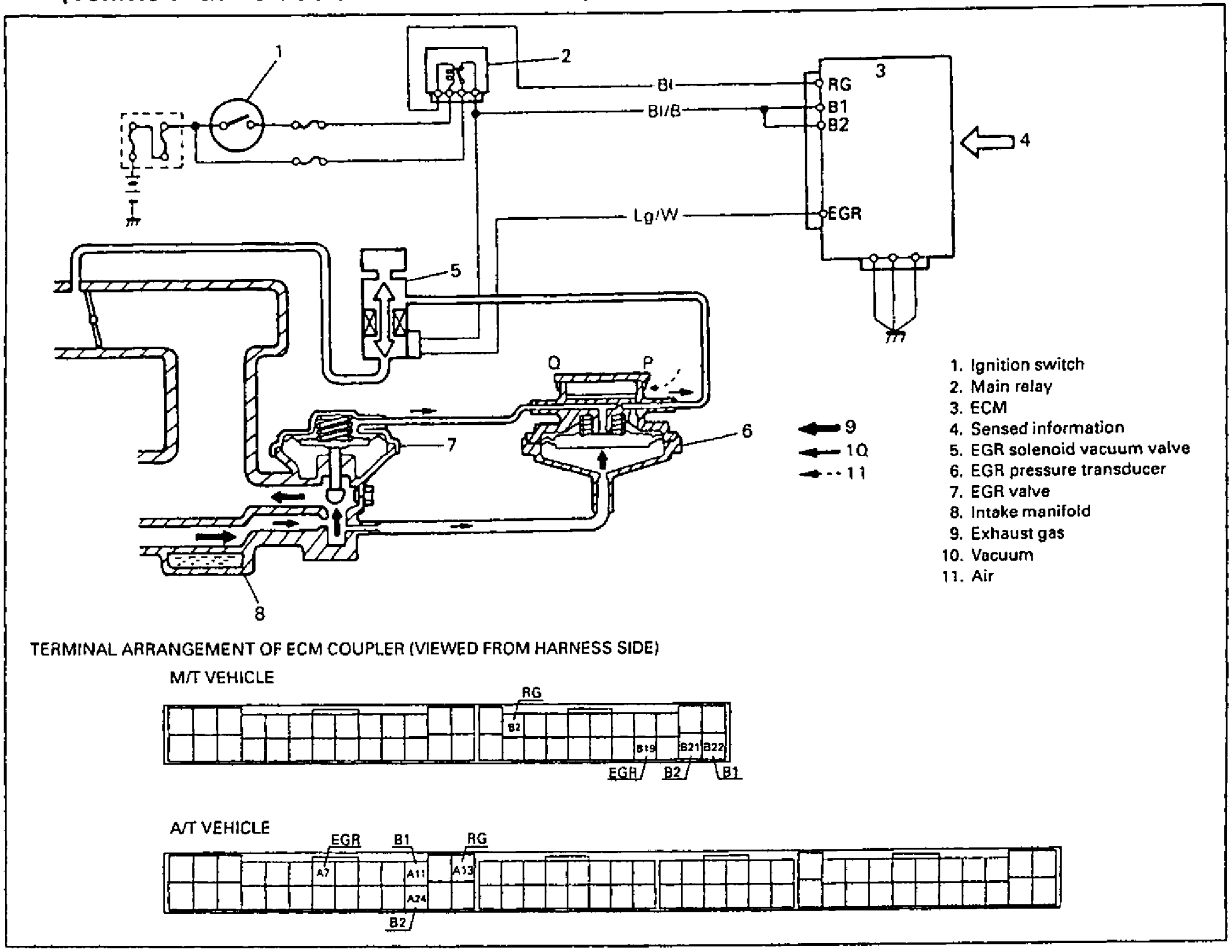
6E1069 6E1070 6E1071

Check EGR system by using tech-1.
Is it good condition?

YES → EGR system is in good condition.

NO → Clogged EGR pipe, stuck or faulty EGR valve or poor performance of ECT sensor, TP sensor.

B-5 EGR SYSTEM CHECK
(Vehicle with EGR Solenoid Vacuum Valve)



1. Ignition switch
2. Main relay
3. ECM
4. Sensed information
5. EGR solenoid vacuum valve
6. EGR pressure transducer
7. EGR valve
8. Intake manifold
9. Exhaust gas
10. Vacuum
11. Air

6E1072 6E1073

Check EGR system.
Is it in good condition?

- YES → EGR system in good condition.
- NO → Check vacuum hose, EGR valve and EGR pressure transducer. Are they in good condition?

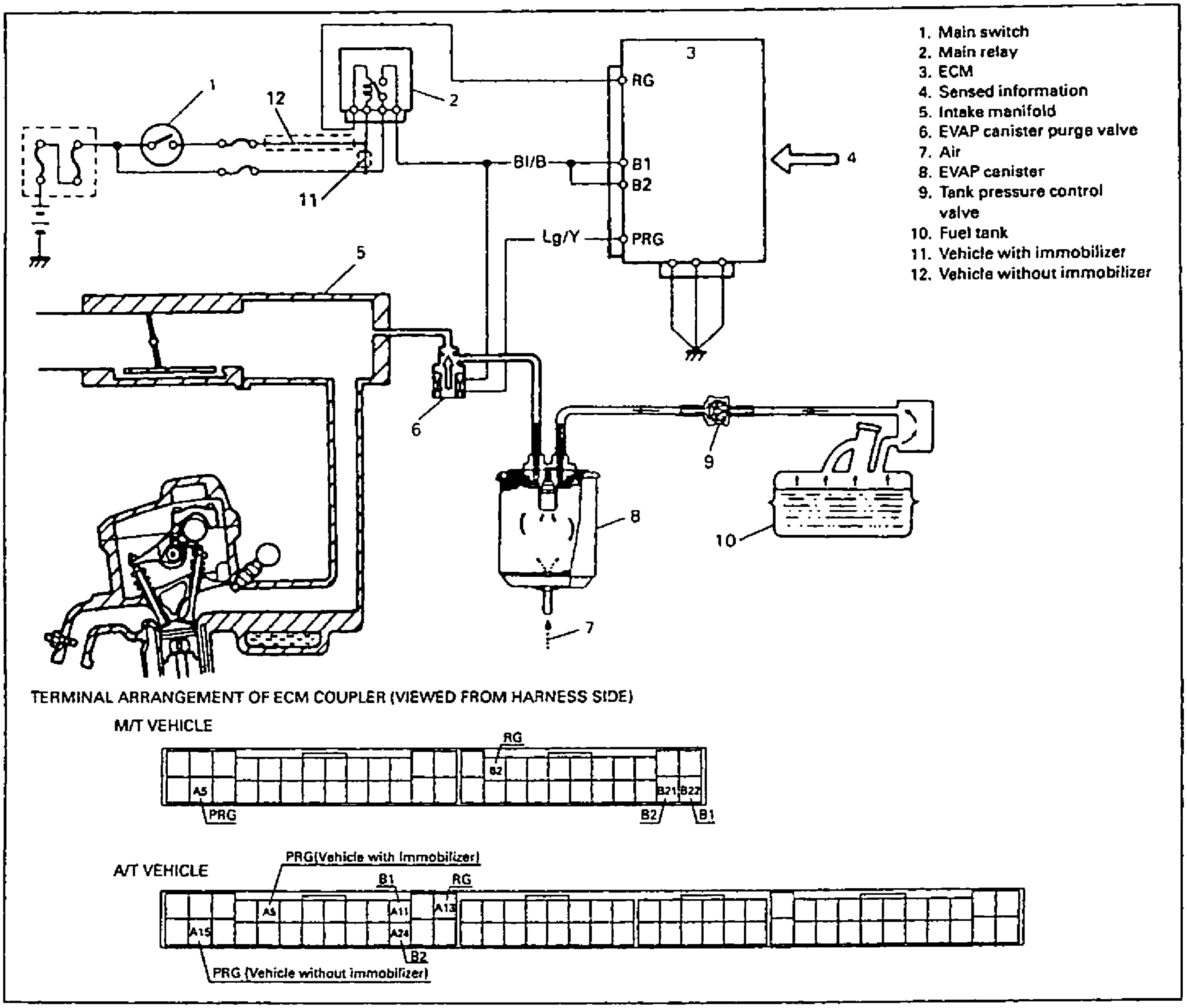
Check vacuum hose, EGR valve and EGR pressure transducer.
Are they in good condition?

- NO →
  - Vacuum hose misconnection, leakage, clog or deterioration,
  - Faulty EGR valve or
  - Faulty EGR pressure transducer.
- YES → Check EGR solenoid vacuum valve. Is it in good condition?

Check EGR solenoid vacuum valve.
Is it in good condition?

- NO → Faulty EGR solenoid vacuum valve
- YES →
  - "Lg/W" wire open,
  - "Lg/W" wire shorted to ground,
  - Poor solenoid vacuum valve coupler connection
  - Poor EGR connection or
  - Poor performance of ECT sensor
  - If wire, connection and sensor are OK, substitute a known-good ECM and recheck.

B-6 EVAPORATIVE EMISSION CONTROL SYSTEM CHECK



6E1074 6E1075

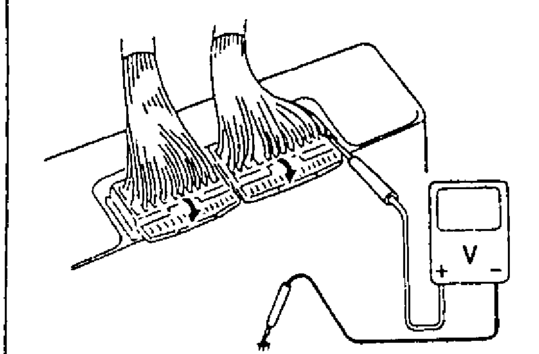
Check canister purge system for operation.
Is it in good condition?

NO → Check vacuum passage, hoses and EVAP canister purge valve. Are they in good condition?

- **YES** →
  - "Lg/Y" wire open,
  - "Lg/Y" wire shorted to ground,
  - Poor canister purge valve coupler connection,
  - Poor PRG connection or
  - Poor performance of ECT sensor

  If wire, connection and sensor are OK, substitute a known-good ECM and recheck.
- **NO** →
  - Vacuum passage clogged,
  - Vacuum leakage or
  - Faulty EVAP canister purge valve.

YES →
- Canister purge system in good condition check EVAP canister, tank pressure control valve and fuel filler cap.



6E1076

INSPECTION OF ECM AND ITS CIRCUITS

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

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

Voltage Check

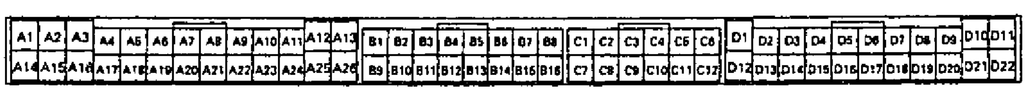
1) Remove ECM from body referring to ECM REMOVAL.
2) Connect ECM couplers to ECM.
3) Check voltage at each terminal of couplers connected.

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

TERMINAL ARRANGEMENT OF ECM COUPLER (VIEWED FROM HARNESS SIDE)

M/T VEHICLE

A/T VEHICLE

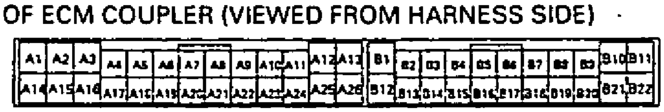


6E1077 6E1078

M/T VEHICLE

TERMINAL			CIRCUIT	NORMAL VOLTAGE	CONDITION
NAME	POSITION	WIRE COLLOR			
INJ3	A1	W/G	Injector No.3	10 – 14V	Ignition switch ON
ISC	A2	Lg/B	Idle air control valve	10 – 14V	Ignition switch ON
INJ1	A3	R	Injector No.1	10 – 14V	Ignition switch ON
–	A4	–	Blank	–	–
THW	A5	R/Y	ECT sensor	0.5 – 0.9 V	Ignition switch ON Engine coolant temp. :80°C(176°F)
AFM	A6	Gr/B	MAF sensor	1.0 – 1.6V	Ignition switch ON
				1.7 – 2.0V	With engine running at idle speed
VTA	A7	Gr	TP sensor	0.5 – 1.2V	Ignition switch ON Throttle valve at idle position
				3.4 – 4.7V	Ignition switch ON Throttle valve at full open position
VCC	A8	Gr/R	Power source for sensors	4.75 – 5.25V	Ignition switch ON
EGR3	A9	Br/B	EGR valve (stepper motor coil 3, if equipped)	10 – 14V	Over 1 second after ignition switch ON
EGR1	A10	Br/R	EGR valve (stepper motor coil 1, if equipped)	0 – 1V	Over 1 second after ignition switch ON
CAS	A11	W	CMP sensor	Indicator deflection repeated between 0–1V and 3–5V	Ignition switch ON Crankshaft turned slowly
GND1	A12	B or B/Bl	Ground	–	–
GND3	A13	B/Bl or B/O			
INJ4	A14	W/B	Injector No.4	10 – 14V	Ignition switch ON
PRG	A15	Lg/Y	EVAP canister purge valve	10 – 14V	Ignition switch ON
INJ2	A16	Lg/R	Injector No.2	10 – 14V	Ignition switch ON
OXH	A17	P	Heated oxygen sensor heater (if equipped)	10 – 14V	Ignition switch ON
				0 – 1V	Over 3 min, after engine started Engine running at idle speed
IG	A18	B/W	Ignition switch (vehicle with immobilizer)	10 – 14V	Ignition switch ON
–	A19	–	Blank	–	–
OX	A20	R/Bl	Heated oxygen sensor (if equipped)	Indicator deflection repeated between over and under 0.45V	While engine running at 2,000 r/min for 1 minute or longer after warmed up
CO	A21	Br/W	CO adjusting resistor (if equipped)	About 5V	Ignition switch ON CO resistor disconnected
EGR4	A22	Br/W	EGR valve (stepper motor coil 4, if equipped)	0 – 1V	Over 1 second after ignition switch ON
EGR2	A23	Br/Y	EGR valve (stepper motor coil 2, if equipped)	10 – 14V	Over 1 second after ignition switch ON
SDL	A24	V/W	Data link connector	4 – 5V	Ignition switch ON
SE	A25	Gr/Y	Sensor ground	–	–
GND2	A26	B/G	Ground	–	–

TERMINAL ARRANGEMENT OF ECM COUPLER (VIEWED FROM HARNESS SIDE)

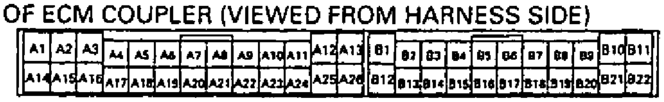


6E1079

M/T VEHICLE

TERMINAL			CIRCUIT	NORMAL VOLTAGE	CONDITION
NAME	POSITION	WIRE COLLOR			
–	B1	–	Blank	–	–
RG	B2	Bl	Main relay (vehicle with immobilizer)	0 – 1V	Ignition switch ON
				10 – 14V	Ignition switch OFF
			Main relay (vehicle without immobilizer)	0 – 1V	Ignition switch ON
ACS	B3	Y/B	Air conditioning circuit (if equipped)	10 – 14V	Ignition switch ON
				0 – 1V	With engine running and A/C ON
–	B4	–	Blank	–	–
SPD	B5	Y	Vehicle speed sensor (in speedometer)	Indicator deflection repeated between 0 – 1V and 4 – 5V	Ignition switch ON Rear left tire turned slowly with rear right tire locked
TS	B6	Bl/R	Test switch terminal	10 – 14V	Ignition switch ON
				0 – 1V	Ignition switch ON Test switch terminal grounded
FP	B7	P	Fuel pump relay (vehicle without immobilizer)	0 – 1V	For 3 seconds after ignition switch ON
				10 – 14V	After the above time
IGT	B8	O	Ignition trigger signal	0 – 1V	Ignition switch ON
				Between 0–3V	While engine cranking
MON	B9	V	Duty output terminal	–	–
STA	B10	B/Y	Engine start switch (Engine start signal)	6 – 12V	While engine cranking
				0V	Other than above
BB	B11	W	Power source for back-up circuit	10 – 14V	Ignition switch ON and OFF
–	B12	–	Blank	–	–
FP	B13	P	Fuel pump relay (vehicle with immobilizer)	0 – 1V	For 3 seconds after ignition switch ON
				10 – 14V	After the above time
ABS	B14	P/W	ABS control module	10 – 14V	Over 3 seconds after ignition switch ON
PSS	B15	Bl/O	Power steering pressure switch (if equipped)	10 – 14V	Ignition switch ON
				0 – 1V	With engine running at idle speed, turning steering wheel to the right or left as far as it stops
ID	B16	Bl/W	Closed throttle position switch (CTP switch)	0 – 1V	Ignition switch ON Throttle valve at idle position
				4 – 5V	Ignition switch ON Throttle valve opens larger than idle position
DN	B17	Bl/Y	Diag. switch terminal	10 – 14V	Ignition switch ON
				0 – 1V	Ignition switch ON Diag. switch terminal grounded
–	B18	–	Blank	–	–
EGR	B19	Lg/W	EGR solenoid vacuum valve (if equipped)	10 – 14V	Ignition switch ON
DNL	B20	V/Y	Malfunction indicator lamp ("CHECK ENGINE" light)	0 – 1V	Ignition switch ON
				10 – 14V	Engine running
B2	B21	Bl/B	Power source	10 – 14V	Ignition switch ON
B1	B22	Bl/B			

TERMINAL ARRANGEMENT OF ECM COUPLER (VIEWED FROM HARNESS SIDE)

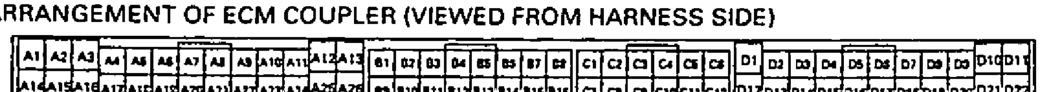


6E1080

A/T VEHICLE

TERMINAL			CIRCUIT	NORMAL VOLTAGE	CONDITION
NAME	POSITION	WIRE COLLOR			
INJ3	A1	W/G	Injector No.3	10 – 14V	Ignition switch ON
ISC	A2	Lg/B	Idle air control valve	10 – 14V	Ignition switch ON
INJ1	A3	R	Injector No.1	10 – 14V	Ignition switch ON
–	A4	–	Blank	–	–
PRG	A5	Lg/Y	EVAP canister purge valve (vehicle with immobilizer)	10 – 14V	Ignition switch ON
FP		P	Fuel pump relay (vehicle without immobilizer)	0 – 1V	For 3 seconds after ignition switch ON
				10 – 14V	After the above time
EGR3	A6	Br/B	EGR valve (EGR stepper motor coil 3, if equipped)	10 – 14V	Over 1 second after ignition switch ON
EGR1	A7	Br/R	EGR valve (EGR stepper motor coil 1, if equipped)	0 – 1V	Over 1 second after ignition switch ON
EGR		Lg/W	EGR solenoid vacuum valve (if equipped)	10 – 14V	Ignition switch ON
IGT	A8	O	Ignition trigger signal	0 – 1V	Ignition switch ON
				Between 0–3V	While engine cranking
MON	A9	V	Duty output terminal	–	–
BB	A10	W	Power source for back-up circuit	10 – 14V	Ignition switch ON and OFF
B1	A11	Bl/B	Power source	10 – 14V	Ignition switch ON
GND1	A12	B/O	Ground	–	–
RG	A13	Bl	Main relay (vehicle with immobilizer)	0 – 1V	Ignition switch ON
				10 – 14V	Ignition switch OFF
			Main relay (vehicle without immobilizer)	0 – 1V	Ignition switch ON
INJ4	A14	W/B	Injector No.4	10 – 14V	Ignition switch ON
FP	A15	P	Fuel pump relay (vehicle with immobilizer)	0 – 1V	For 3 seconds after ignition switch ON
				10 – 14V	After the above time
PRG		Lg/Y	EVAP canister purge valve (vehicle without immobilizer)	10 – 14V	Ignition switch ON
INJ2	A16	Lg/R	Injector No.2	10 – 14V	Ignition switch ON
DNL	A17	V/Y	Malfunction indicator lamp ("CHECK ENGINE" light)	0 – 1V	Ignition switch ON
				10 – 14V	Engine running
–	A18	–	Blank	–	–
EGR4	A19	Br/W	EGR valve (EGR stepper motor coil 4, if equipped)	0 – 1V	Over 1 second after ignition switch ON
EGR2	A20	Br/Y	EGR valve (EGR stepper motor coil 2, if equipped)	10 – 14V	Over 1 second after ignition switch ON
OXH	A21	P	Heated oxygen sensor heater (if equipped)	10 – 14V	Ignition switch ON
				0 – 1V	Over 3 min. after engine started Engine running at idle speed
–	A22	–	Blank	–	–
SDL	A23	V/W	Data link connector	4 – 5V	Ignition switch ON
B2	A24	Bl/B	Power source	10 – 14V	Ignition switch ON
GND2	A25	B/G	Ground	–	–
GND3	A26	B/O			

TERMINAL ARRANGEMENT OF ECM COUPLER (VIEWED FROM HARNESS SIDE)

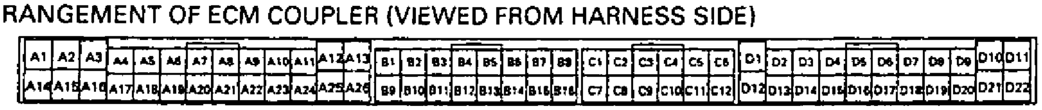


6E1081

A/T VEHICLE

TERMINAL			CIRCUIT	NORMAL VOLTAGE	CONDITION
NAME	POSITION	WIRE COLLOR			
S2	B1	G/R	Shift solenoid valve B	0 – 1V	Ignition switch ON
PWL	B2	P	"POWER" indicator light	0 – 2V	Ignition switch ON Mode selector switch in Power mode
				10 – 14V	Ignition switch ON Mode selector switch in Normal mode
ODL	B3	W/B	"OD/OFF" indicator light	0 – 2V	Ignition switch ON OD cut switch ON
				10 – 14V	Ignition switch ON OD cut switch OFF
LIGHT	B4	R/Y	Lighting switch	0 – 1V	Lighting switch OFF
				10 – 14V	Lighting switch ON (small or head)
PWR	B5	O	Mode selector switch	0 – 1V	Ignition switch ON Mode selector switch in Power mode
				10 – 14V	Ignition switch ON Mode selector switch in Normal mode
L4	B6	O/W	4WD low switch	0 – 1V	Ignition switch ON Transfer lever in 4L or N position
				10 – 14V	Ignition switch ON Transfer lever in 2H or 4H position
OD	B7	O/G	OD cut switch	0 – 1V	Ignition switch ON OD cut switch ON
				10 – 14V	Ignition switch ON OD cut switch OFF
SP	B8	W	A/T vehicle speed sensor (+)	-	-
S3	B9	G/Y	TCC solenoid valve	0 – 1V	Ignition switch ON
S1	B10	G/O	Shift solenoid valve A	10 – 14V	Ignition switch ON
R	B11	R	Transmission range switch ("R" range)	0 – 1V	Ignition switch ON Selector lever in other than "R" range
				10 – 14V	Ignition switch ON Selector lever in "R" range
N	B12	Bl/G	Transmission range switch ("N" range)	0 – 1V	Ignition switch ON Selector lever in other than "N" range
				10 – 14V	Ignition switch ON Selector lever in "N" range
D	B13	G	Transmission range switch ("D" range)	0 – 1V	Ignition switch ON Selector lever in other than "D" range
				10 – 14V	Ignition switch ON Selector lever in "D" range
2	B14	Y/G	Transmission range switch ("2" range)	0 – 1V	Ignition switch ON Selector lever in other than "2" range
				10 – 14V	Ignition switch ON Selector lever in "2" range
L	B15	Y/Bl	Transmission range switch ("L" range)	0 – 1V	Ignition switch ON Selector lever in other than "L" range
				10 – 14V	Ignition switch ON Selector lever in "L" range
SPG	B16	O	A/T vehicle speed sensor (–)	–	–

TERMINAL ARRANGEMENT OF ECM COUPLER (VIEWED FROM HARNESS SIDE)

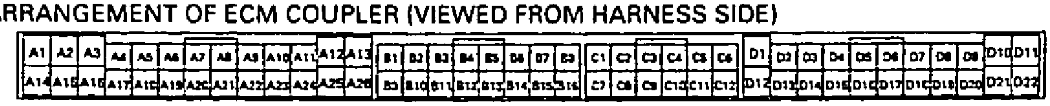


6E1082

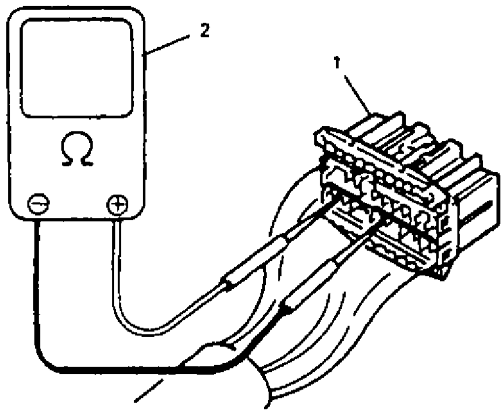
A/T VEHICLE

TERMINAL NAME	POSI-TION	WIRE COLLOR	CIRCUIT	NORMAL VOLTAGE	CONDITION
SE	D1	Gr/Y	Sensor ground	–	–
VCC	D2	Gr/R	Power source for sensors	4.75 – 5.25 V	Ignition switch ON
AFM	D3	Gr/B	MAF sensor	1.0 – 1.6V	Ignition switch ON
				1.7 – 2.0V	With engine running at idle speed
OX	D4	R/Bl	Heated oxygen sensor (if equipped)	Indicator deflection repeated between over and under 0.45V	While engine running at 2,000 r/min for 1 minute or longer after warmed up
CO	D5	Gr/W	CO adjusting resistor (if equipped)	About 5V	Ignition switch ON CO resistor disconnected
DN	D6	Bl/Y	Diag. switch terminal	10 – 14V	Ignition switch ON
				0 – 1V	Ignition switch ON Diag. switch terminal grounded
ACS	D7	Y/B	Air conditioning circuit (if equipped)	10 – 14V	Ignition switch ON
				0 – 1V	With engine running A/C ON
SPD	D8	Y	Vehicle speed sensor (in speedometer)	Indicator deflection repeated between 0 –1V and 4–5V	Ignition switch ON Rear left tire turned slowly with rear right tire locked
CAS	D9	W	CMP sensor	Indicator deflection repeated between 0–1V and 3–5V	Ignition switch ON Crank shaft turned slowly
STA	D10	B/Y	Engine start switch (Engine start signal)	6 – 12V	While engine cranking
				0V	Other than above
IG	D11	B/W	Ignition switch (vehicle with immobilizer)	10 – 14V	Ignition switch ON
–	D12	–	Blank	–	–
THW	D13	R/Y	Engine coolant temp. sensor	0.5 – 0.9V	Ignition switch ON Engine coolant temp.:80°C (176°F)
VTA	D14	Gr	TP sensor	0.5 – 1.2V	Ignition switch ON Throttle valve at idle position
				3.4 – 4.7V	Ignition switch ON Throttle valve at full open position
–	D15	–	Blank	–	–
TS	D16	Bl/R	Test switch terminal	10 – 14V	Ignition switch ON
				0 – 1V	Ignition switch ON Test switch terminal grounded
ABS	D17	P/W	ABS control module (if equipped)	10 – 14V	Over 3 seconds after ignition switch ON
PSS	D18	Bl/O	Power steering pressure switch (if equipped)	10 – 14V	Ignition switch ON
				0 – 1V	With engine running at idle speed, turning steering wheel to the right or left as far as it stops
ID	D19	Bl/W	Closed throttle position switch	0 – 1V	Ignition switch ON Throttle valve at idle position
				4 – 5V	Ignition switch ON Throttle valve opens larger than idle position
–	D20	–	Blank	–	–
BR	D21	G/W	Brake switch	10 – 14V	Brake pedal depressed
				0 – 1V	Brake pedal released
–	D22	–	Blank	–	–

TERMINAL ARRANGEMENT OF ECM COUPLER (VIEWED FROM HARNESS SIDE)



6E1083



1. ECM coupler disconnected
2. Ohmmeter

6E1084

Resistance Check

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

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

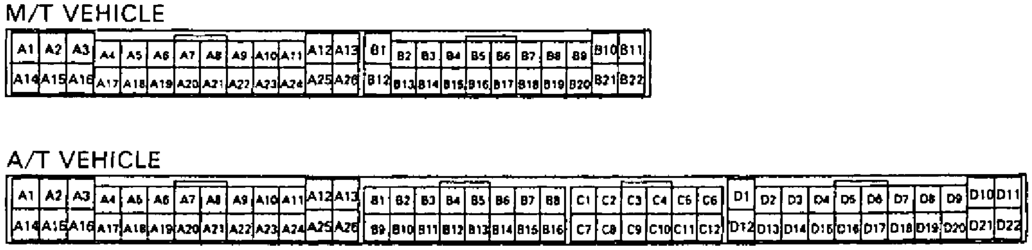
2) Check resistance between each pair of terminals of disconnected couplers as listed in following table.

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

TERMINAL ARRANGEMENT OF ECM COUPLER (VIEWED FROM HARNESS SIDE)

M/T VEHICLE

A/T VEHICLE



6E1085 6E1086

CIRCUIT		TERMINAL POSITION		STANDARD RESISTANCE	CONDITION
		M/T	A/T		
No.1 injector		A3 – B21/B22	A3 – A11/A24	12 – 17Ω	–
No.2 injector		A16 – B21/B22	A16 – A11/A24	12 – 17Ω	–
No.3 injector		A1 – B21/B22	A1 – A11/A24	12 – 17Ω	–
No.4 injector		A14 – B21/B22	A14 – A11/A24	12 – 17Ω	–
IAC valve		A2 – B21/B22	A2 – A11/A24	11 – 14Ω	–
EVAP canister purge valve	Vehicle with immobilizer	A15 – B21/B22	A5 – A11/A24	28 – 36Ω	–
	Vehicle without immobilizer		A15 –A11/A24		
EGR solenoid vacuum valve (if equipped)		B19 – B21/B22	A7 – A11/A24	30 – 38Ω	–
EGR valve (coil 1), if equipped		A10 – B21/B22	A7 – A11/A24	20 – 24Ω	–
EGR valve (coil 2), if equipped		A23 – B21/B22	A20 – A11/A24	20 – 24Ω	–
EGR valve (coil 3), if equipped		A9 – B21/B22	A6 – A11/A24	20 – 24Ω	–
EGR valve (coil 4), if equipped		A22 – B21/B22	A19 – A11/A24	20 – 24Ω	–

CIRCUIT	TERMINAL POSITION		STANDARD RESISTANCE	CONDITION
	M/T	A/T		
Heated oxygen sensor heater (vehicle with immobilizer)	A17 – A18	A21 – D11	11.7 – 14.3Ω	–
Heated oxygen sensor heater (if equipped) and main relay (vehicle without immobilizer)	A17 – B2	A21 – A13	67.7 – 98.3Ω	–
Fuel pump relay (vehicle with immobilizer)	B13 – A18	A15 – D11	56 – 84Ω	–
Fuel pump relay and main relay (vehicle without immobilizer)	B7 – B2	A5 – A13	112 – 168Ω	–
Main relay (vehicle with immobilizer)	B2 – B11	A13 – A10	56 – 84Ω	–
CTP switch	B16 – A25	D19 – D1	Continuity	Throttle valve at idle position
			∞ (infinity)	Throttle valve opens larger than idle position
TP sensor	A7 – A25	D14 – D1	0.3 – 2.0kΩ	Throttle valve at idle position
			2.0 – 6.5kΩ	Throttle valve at full open position
ECT sensor	A5 – A25	D13 – D1	0.29 – 0.35kΩ	Engine coolant temp. 80°C (176°F)
CO adjust resistor (vehicle without heated oxygen sensor only)	A21 – A25	D5 – D1	For resistance of CO resistor, refer to IDLE MIXTURE ADJUSTMENT	
Vehicle speed sensor (in speedometer)	B5 – Body ground	D8 – Body ground	Ohmmeter indicator deflects between 0 and ∞	Rear left wheel turned slowly with rear right wheel locked
Transmission range switch ("R" range) (vehicle with immobilizer)	–	B11 – D11	Continuity	Selector lever in "R" range
			About 10Ω	Selector lever in other than "R" range
Transmission range switch ("R" range) and fuel pump relay (vehicle without immobilizer)	–	B11 – A5	Continuity	Selector lever in "R" range
			Not continuity	Selector lever in other than "R" range
Transmission range switch ("N" range) (Vehicle with immobilizer)	–	B12 – D11	Continuity	Selector lever in "N" range
			Not continuity	Selector lever in other than "N" range
Transmission range switch ("N" range) and fuel pump relay (vehicle without immobilizer)	–	B12 – A5	Continuity	Selector lever in "N" range
			Not continuity	Selector lever in other than "N" range
Transmission range switch ("D" range) (vehicle with immobilizer)	–	B13 – D11	Continuity	Selector lever in "D" range
			Not continuity	Selector lever in other than "D" range
Transmission range switch ("D" range) and fuel pump relay (vehicle without immobilizer)	–	B13 – A5	Continuity	Selector lever in "D" range
			Not continuity	Selector lever in other than "D" range
Transmission range switch ("2" range) (vehicle with immobilizer)	–	B14 – D11	Continuity	Selector lever in "2" range
			Not continuity	Selector lever in other than "2" range
Transmission range switch ("2" range) and fuel pump relay (vehicle without immobilizer)	–	B14 – A5	Continuity	Selector lever in "2" range
			Not continuity	Selector lever in other than "2" range
Transmission range switch ("L" range) (vehicle with immobilizer)	–	B15 – D11	Continuity	Selector lever in "L" range
			Not continuity	Selector lever in other than "L" range
Transmission range switch ("L" range) and fuel pump relay (vehicle without immobilizer)	–	B15 – A5	Continuity	Selector lever in "L" range
			Not continuity	Selector lever in other than "L" range
A/T vehicle speed sensor	–	B8 – B16	369 – 451Ω	–
4WD low switch	–	B6 – Body ground	Continuity	Transfer lever in 4L or N position
			Not continuity	Transfer lever in 2H or 4H position

CIRCUIT	TERMINAL POSITION		STANDARD RESISTANCE	CONDITION
	M/T	A/T		
Mode selector switch	-	B5 - Body ground	Continuity	Mode selector switch in "POWER".
			Not continuity	Mode selector switch in "NORMAL".
OD cut switch	-	B7 - Body ground	Continuity	OD cut switch ON
			Not continuity	OD cut switch OFF
Shift solenoid valve A	-	B10 - Body ground	11 – 15Ω	–
Shift solenoid valve B	-	B1 - Body ground	11 – 15Ω	-
TCC solenoid valve	-	B9 - Body ground	11 – 15Ω	–

ON VEHICLE SERVICE

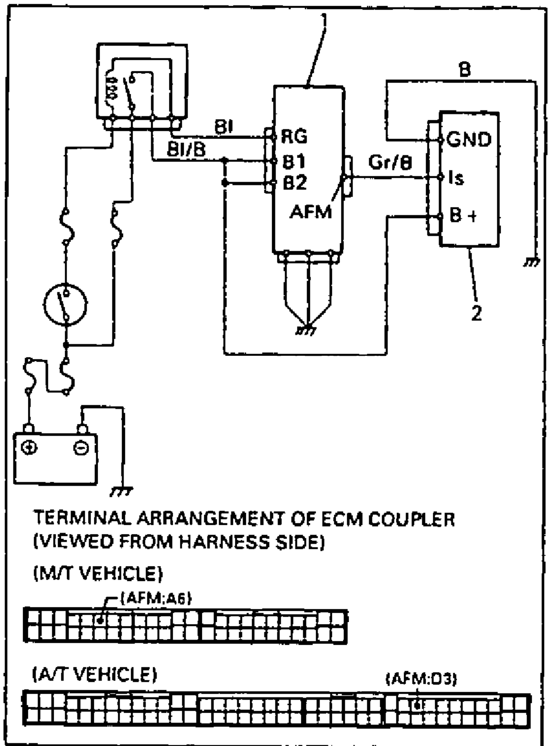
ELECTRONIC CONTROL SYSTEM

MASS AIR FLOW SENSOR (MAF SENSOR)

Inspection

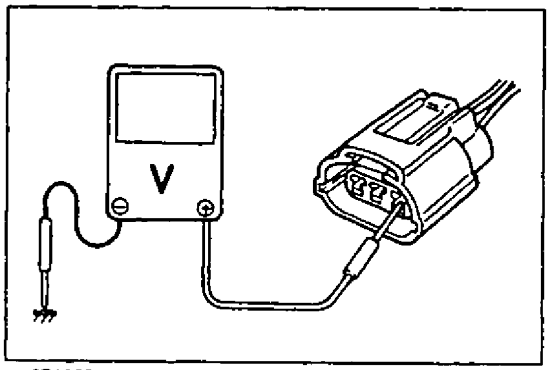
NOTE:

Use voltmeter with high-impedance (10 kΩ/V minimum) or digital type voltmeter.



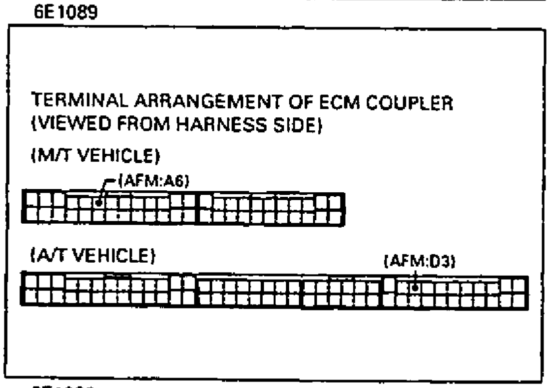
6E1087 6E1088

1) Remove ECM with bracket, relays, fuse box and wire harness previously outlined.
2) Connect couplers to ECM.



6E1089

3) Connect voltmeter to "B +" terminal of MAF sensor coupler disconnected and ground.
4) Turn ignition switch ON and check that voltage is battery voltage.
   If not, check if wire harness is open or connection is poor.



6E1088

5) Turn ignition switch OFF and connect MAF sensor coupler to MAF sensor.
6) Turn ignition switch ON and check voltage at AFM terminal.

   Voltage: 1.0 – 1.6V

7) Start engine and check that voltage is lower than 5V and it rises as engine speed increases.
   (Reference data: 1.7 – 2.0V at specified idle speed)

   If check result is not as specified above, cause may lie in wire harness, coupler connection, MAF sensor or ECM.

SECTION 7B1

AUTOMATIC TRANSMISSION

(4 A/T)

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

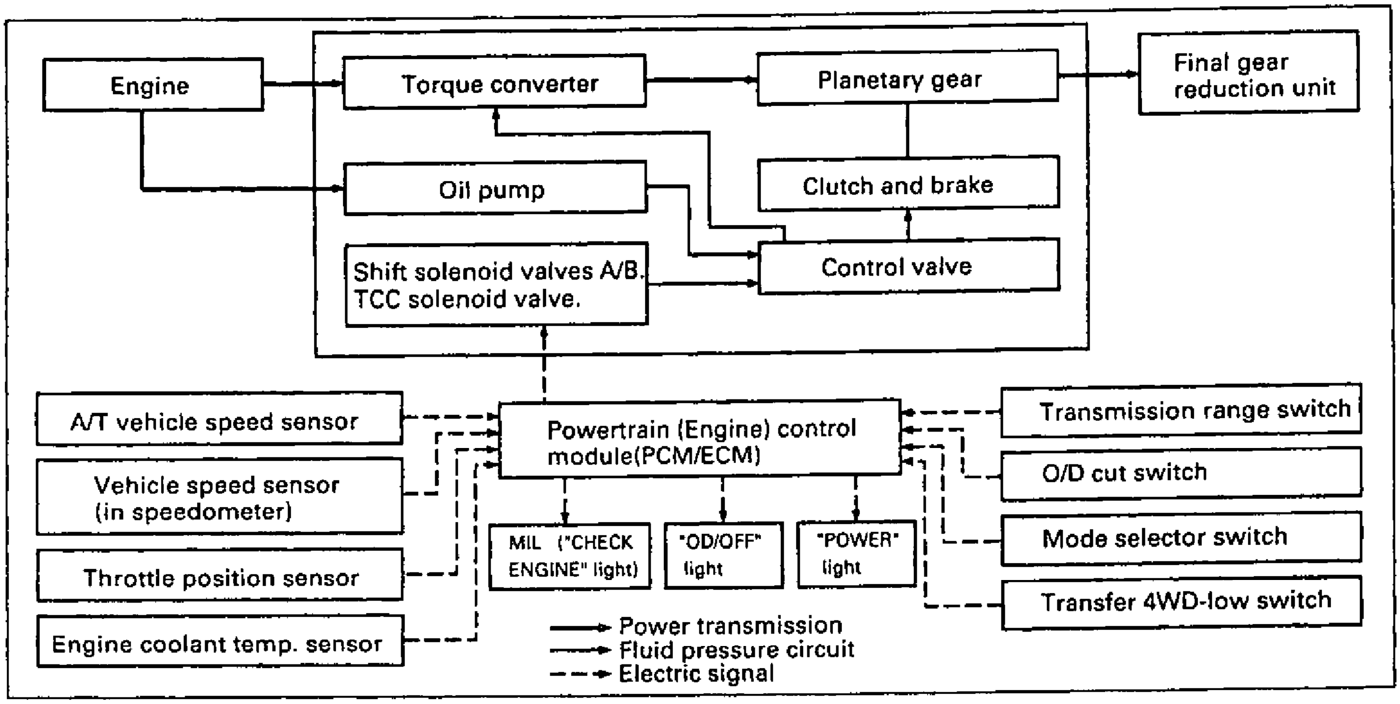
- **Service on or around Air Bag System Components or Wiring must be performed only by an authorized Suzuki dealer. Please observe all WARNINGS and SERVICE PRECAUTIONS in Section 9J under "On-Vehicle Service" and the Air Bag System Component and Wiring Location view in Section 9J before performing service 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.**
- **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 air bags may be deployed 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 FOREWORD of this manual.

CONTENTS

GENERAL DESCRIPTION

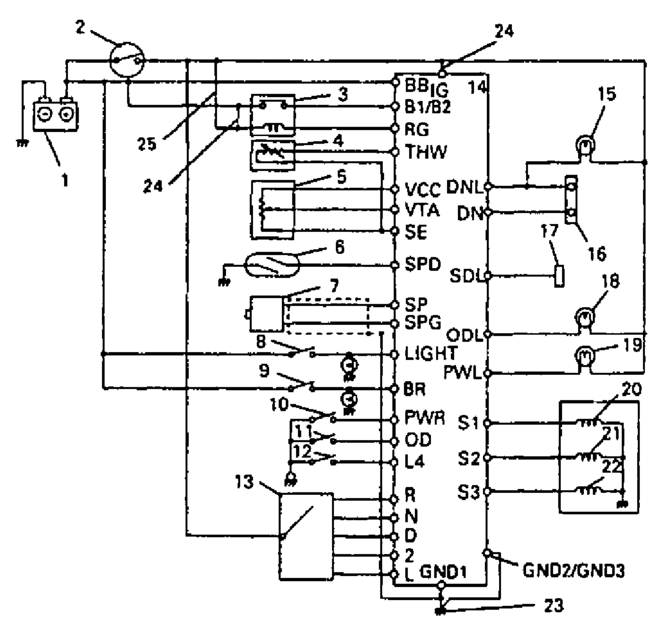
ELECTRONIC SHIFT CONTROL SYSTEM



7B1001

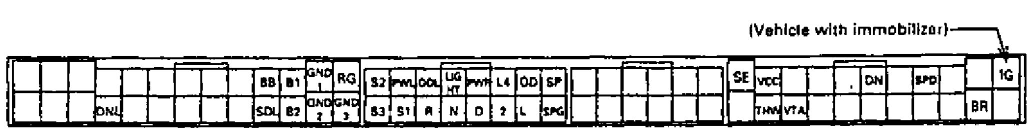
POWERTRAIN (ENGINE) CONTROL MODULE (PCM/ECM)

The PCM is an electronic circuit component that controls gear shift and TCC lock-up according to the signal from each sensor. It is a microcomputer consisting of an IC, transistor, diode, etc. It is installed to the underside of the instrument panel at the driver's seat side.

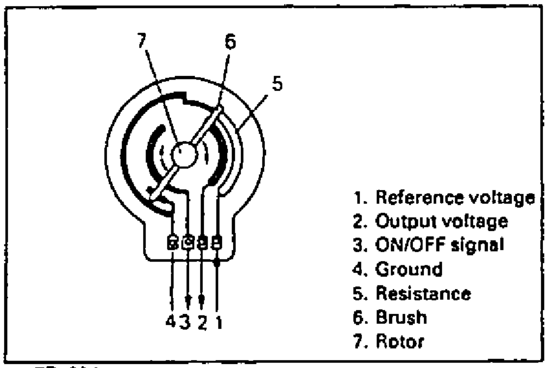


1. Battery
2. Ignition switch
3. Main relay
4. ECT sensor
5. TP sensor
6. VSS (in speedometer)
7. A/T VSS (in A/T)
8. Lighting switch
9. Brake switch
10. Mode selector switch
11. OD cut switch
12. 4WD low switch
13. Transmission range switch
14. PCM
15. MIL ("CHECK ENGINE" light)
16. Monitor coupler
17. DLC
18. "OD/OFF" indicator light
19. "POWER" indicator light
20. Shift solenoid valve A
21. Shift solenoid valve B
22. TCC solenoid valve
23. Engine ground
24. Vehicle with immobilizer
25. Vehicle without immobilizer

TERMINAL ARRANGEMENT OF PCM COUPLER (VIEWED FROM HARNESS SIDE)



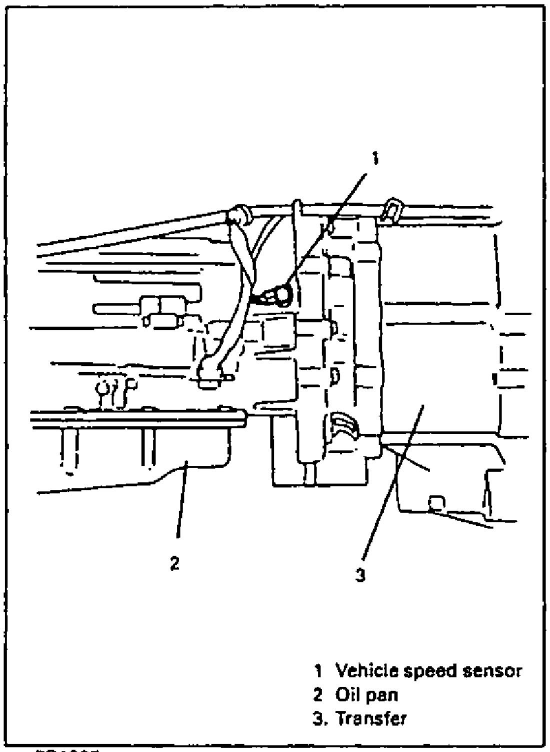
7B1002 7B1003



7B1004

Throttle Position Sensor

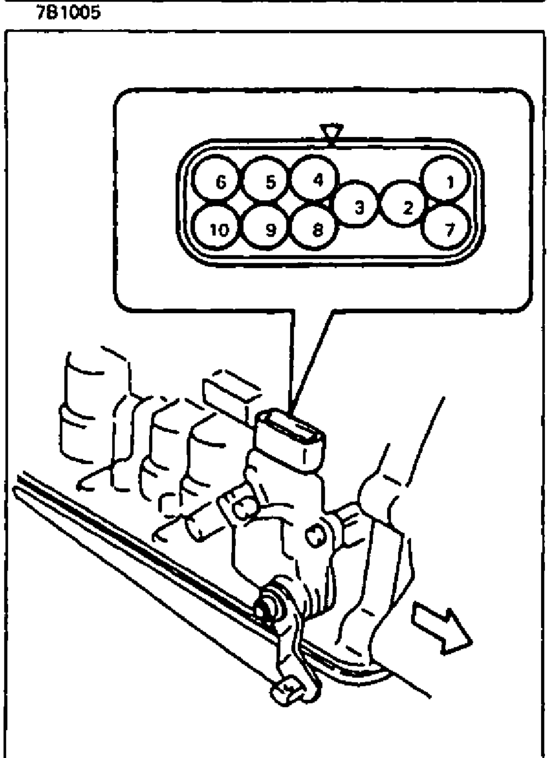
This sensor is installed to the throttle valve shaft. Throttle valve opening signal are transmitted from TP sensor to PCM as voltage signal.
PCM uses it as one of the signals to control transmission gear shift.



7B1005

Vehicle Speed Sensor

This sensor is a pulse generator type that detects revolution of the output shaft (vehicle speed) in the transmission case. The pulse generator is a noncontact sensor consisting of a permanent magnet, coil and gears.
As the gear of the output shaft turns, the magneflux from the permanent magnet varies and a voltage of the frequency corresponding to the rotor revolution occurs in the coil. This voltage is inputted to the PCM where PCM judges the output shaft revolution or the vehicle speed. The vehicle speed is also detected from the speed meter.

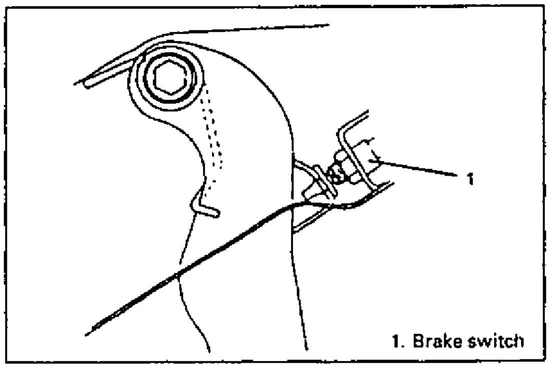


7B1006

Transmission Range Switch

A transmission range switch is provided so that the engine can be started only when the shift lever is in the "P" or "N" position.

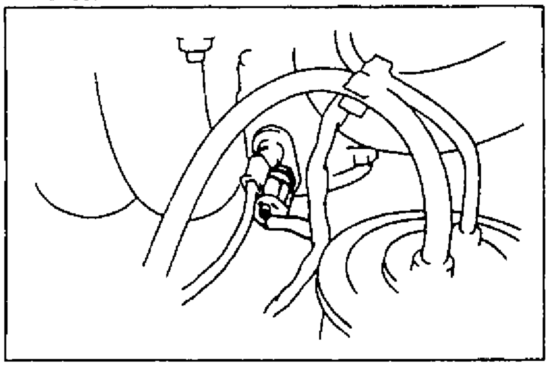
Terminal position	6	5	9	8	4	7	3	2	1
P	○	○	○	○					
R			○		○				
N	○	○	○			○			
D			○				○		
2			○					○	
L			○						○



7B1007

Brake Switch

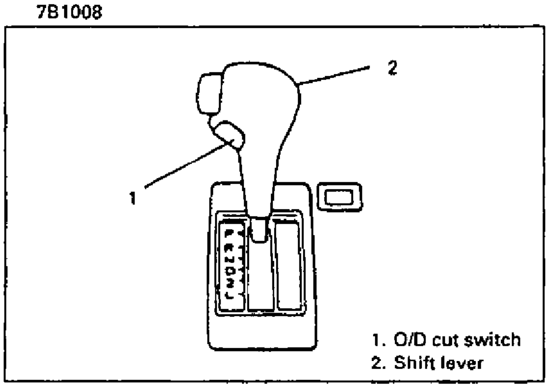
The same switch is used as the brake lamp switch. It disengages the TCC when the brake is depressed while the TCC is operating.



7B1008

Engine Coolant Temperature Sensor (ECT Sensor)

The coolant temperature sensor is used and it prevents gear change to the O/D gear and TCC operation when the engine coolant temperature is 30°C (86°F) or lower.

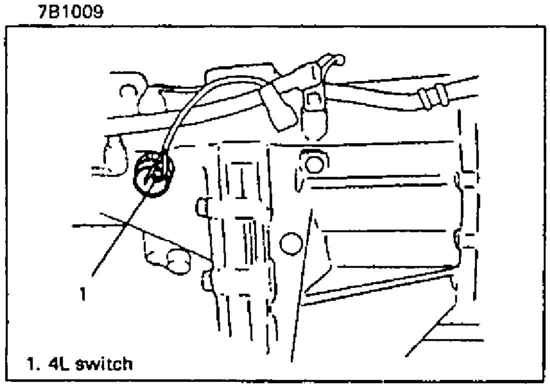


7B1009

O/D Cut Switch

The gear shift up or shift down to and from the O/D gear can be selected with this switch.

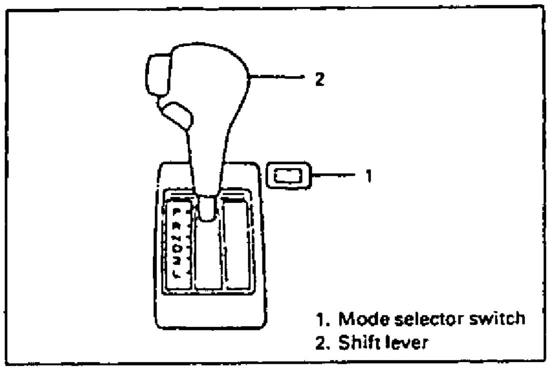
OD cut switch status	Switch position	"OD/OFF" light
ON (continuity)	Released	ON
OFF (not continuity)	Depressed	OFF



7B1010

Transfer 4L Switch

This switch detects that the 4-wheel drive low gear is engaged and prevents the gear change into O/D and lock-up.



1. Mode selector switch
2. Shift lever

7B1011

Mode Selector Switch

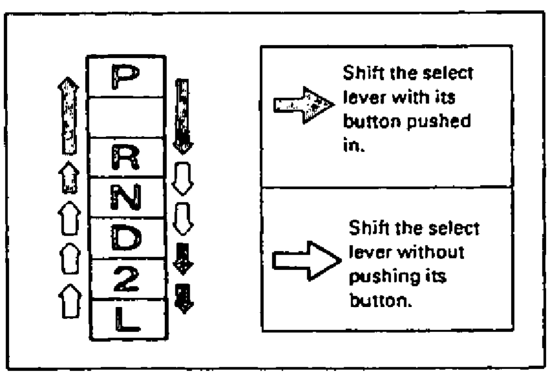
The gear shift timing, normal or power, can be selected by using this switch.

Fail Safe Function

This function is provided by the safe mechanism that assures safe driveability even when the shift solenoid valve or speed sensor fails.

The table below shows the gear position in each shift under a normal/abnormal condition.

Condition / Shift position	Normal	Shift solenoid valve-A abnormal	Shift solenoid valve-B abnormal	Shift solenoid valves-A & B abnormal
D	1st	3rd	1st	O/D
	2nd		O/D	
	3rd			
	O/D	O/D		
2	1st	3rd	1st	3rd
	2nd		3rd	
	(3rd)			
L	1st	1st	1st	1st
	(2nd)	(2nd)		



7B1012

Change Mechanism

The same select pattern shift lever is used as the floor type and frequently used "N" and "D" ranges are made selectable freely.

AUTOMATIC GEAR SHIFT DIAGRAM

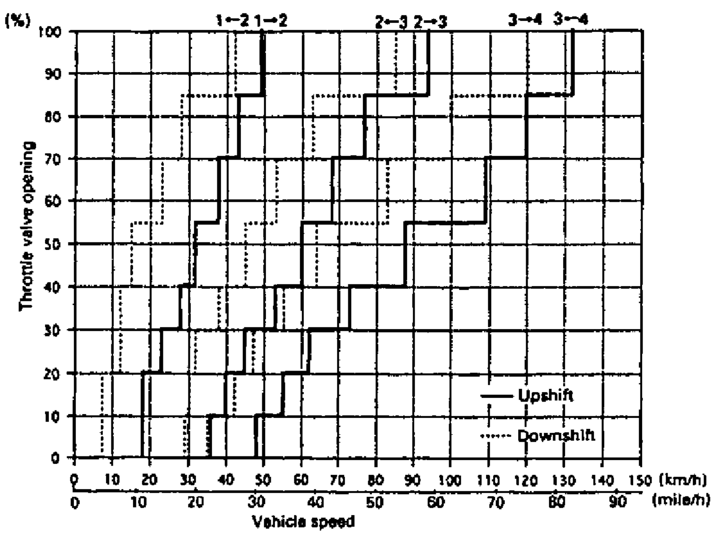
Automatic shift schedule as a result of shift control is shown below. In case that select lever shifted to L at a speed higher than 52 km/h (33 mile/h), 2nd gear operates first and then down shifts to 1st at a speed lower than that. No up shift is available in L.
The same as, the select lever shifted to 2 at a speed higher than 100 km/h (63 mile/h), 3rd gear operates first and then down shifts to 2nd at a speed lower than that. No up shift is available in 2.

Power Mode

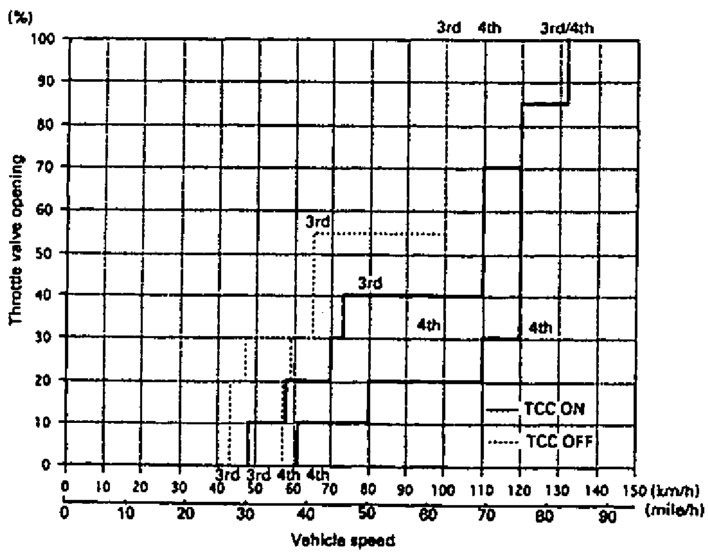
Unit: km/h (mile/h)

Throttle opening \ Shift	1 → 2	2 → 3	3 → 4	4 → 3	3 → 2	2 → 1
Full throttle	49 (31)	94 (59)	132 (83)	120 (75)	85 (53)	42 (26)
Closed throttle	18 (11)	36 (23)	48 (30)	35 (22)	29 (18)	7 (4)

Gear Shift Diagram



TCC Lock-up Diagram



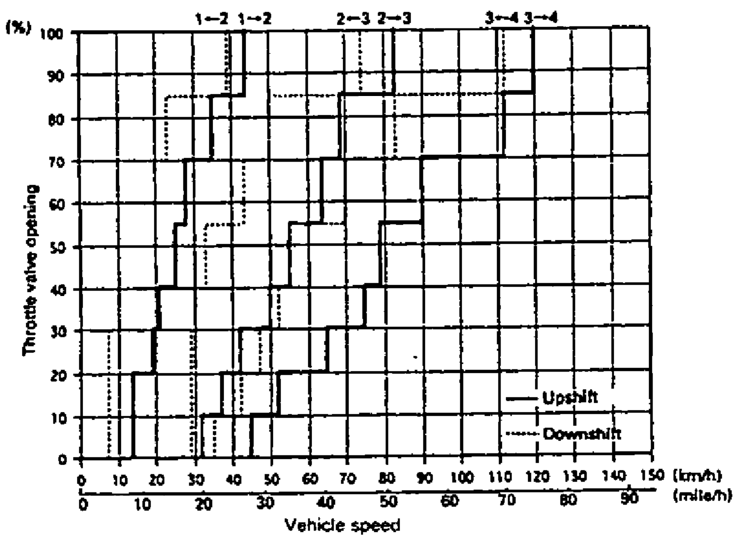
7B1013 7B1014

Normal Mode

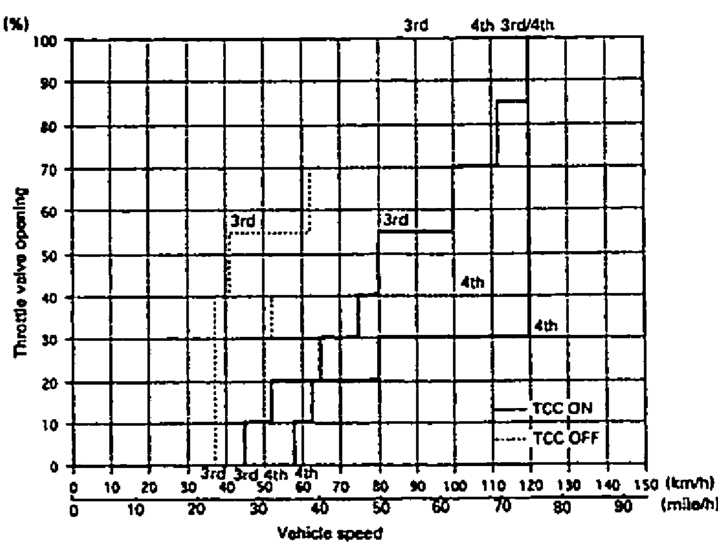
Unit: km/h
(mile/h)

Throttle opening \ Shift	1 → 2	2 → 3	3 → 4	4 → 3	3 → 2	2 → 1
Full throttle	44 (28)	83 (52)	120 (75)	112 (70)	74 (46)	39 (24)
Closed throttle	14 (9)	32 (20)	45 (28)	35 (22)	29 (18)	7 (4)

Gear Shift Diagram



TCC Lock-up Diagram



7B1015 7B1016

DIAGNOSIS

TRANSMISSION UNIT

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) Disconnect coupler of shift solenoid valves on transmission.

> WARNING:
> **To avoid the danger of being burned, do not touch the hot exhaust system when disconnecting shift solenoid valves coupler.**

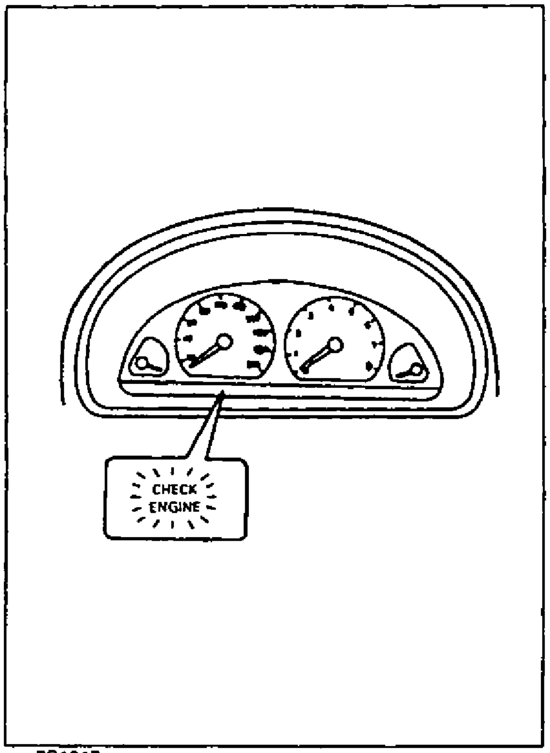
2) With selector lever in "P" range, start engine and warm it up.
3) With select lever in "L" range, start vehicle and accelerate to 20 km/h (12.5 mile/h). Check in this state that 1st gear is being used.
4) At 20 km/h (12.5 mile/h), shift select lever to 2 range and accelerate to 40 km/h (25 mile/h). Check in this state that 3rd gear is being used.
5) At 40 km/h (25 mile/h), shift select lever to D range and check that O/D gear is used when speed is higher than 40 km/h (25 mile/h).
6) After above checks, stop vehicle then engine, and connect solenoid valves coupler.

> WARNING:
> **To avoid the danger of being burned, do not touch the exhaust system when connecting shift solenoid valves coupler.**

7) Ground diagnosis switch terminal in monitor coupler, turn ON ignition switch and make sure that MIL ("CHECK ENGINE" light) indicates code No.12.

ELECTRONIC SHIFT CONTROL SYSTEM

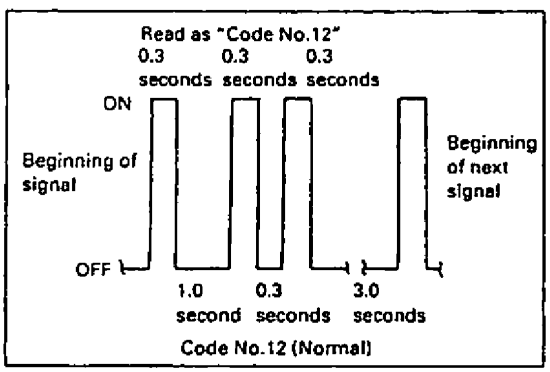
The powertrain (engine) control module (P(E)CM) with on-board diagnostic system (self-diagnosis function) operates as described below.
When diagnosing a trouble in the electronic shift control system, use "DIAGNOSTIC FLOW CHART" and "DIAGNOSTIC TROUBLE CODE TABLE" on the following page.



7B1017

ON-BOARD DIAGNOSTIC SYSTEM (SELF-DIAGNOSIS FUNCTION)

- When the engine is OFF and the ignition switch is turned ON, the malfunction indicator lamp ("CHECK ENGINE" light) lights for its bulb check of malfunction indicator lamp ("CHECK ENGINE" light).
- Should an abnormality have occurred in the electronic shift control system while the ignition switch is ON or the engine running, the area where the abnormality has occurred is stored in the P(E)CM memory and it remains in the memory till ignition switch is turned OFF.
- The affected area in the memory is indicated by flashing of malfunction indicator lamp ("CHECK ENGINE" light) when the diag. switch terminal is grounded.



7B1018

PRECAUTION IN IDENTIFYING DIAG. TROUBLE CODE

- Before checking the diag. trouble code, be sure not to turn OFF the ignition switch, disconnect the P(E)CM or battery negative cable. Or the memory will be erased.
- Each trouble code is indicated 3 times. Write it down so as not to forget it. When an abnormality exists in more than one area, their code Nos. are indicated from the smallest to larger numbers.

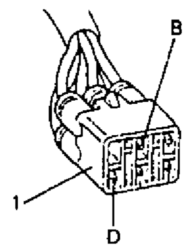
PRECAUTION ON TROUBLESHOOTING

- "Normal operating temperature" in the diagnostic flow chart means that the engine coolant temperature is 80°C (176°F) and A/T fluid temperature is 70–80°C (158–176°F).
- Do not connect an ohmmeter, voltmeter, etc. directly (with the coupler disconnected) to the P(E)CM terminal. It may cause damage to the P(E)CM.

DIAGNOSTIC FLOW CHART

START

1. Perform test driving.
2. After test driving, hold engine running in "P" position applied with parking brake.
3. Using service wire, ground diag. switch terminal and observe malfunction indicator lamp ("CHECK ENGINE" light).



1. Monitor coupler B: Diagnosis switch terminal D: Ground terminal

Malfunction indicator lamp ("CHECK ENGINE" light) doesn't operate properly. (doesn't light, doesn't blink or doesn't output code.)

→ Proceed to DIAGNOSTIC FLOW CHART in section 6E1.

Diagnostic trouble code indicated.

→ Are they A/T related code (refer to Diagnostic Trouble Code Table) only?

NO → Proceed to DIAGNOSTIC FLOW CHART in section 6E1.

YES → Record trouble code No., turn OFF ignition switch to erase diag. trouble code memory.

→ Check trouble code area and repair.

→ Is trouble corrected?

NO → START

YES → END

No trouble code indicated. (Code No.12 only)

→ Check according to flow chart for each symptom.

- No gear shift occurs. Proceed to Diag. flow chart A.
- Faulty shift point. Proceed to Diag. flow chart B.
- Gear does not shift to O/D. Proceed to Diag. flow chart C.
- No TCC lock-up occurs. Proceed to Diag. flow chart D.

7B1019

Diagnostic Trouble Code Table (A/T Related Code)

Code No.	Diagnostic Area	Diagnosis
12	–	Normal
61	Shift solenoid valve A	Shift solenoid valve A or its circuit open or shorted to power circuit.
62	Shift solenoid valve A	Shift solenoid valve A or its circuit shorted to ground.
63	Shift solenoid valve B	Shift solenoid valve B or its circuit open or shorted to power circuit.
64	Shift solenoid valve B	Shift solenoid valve B or its circuit shorted to ground.
65	TCC solenoid valve	TCC solenoid valve or its circuit open or shorted to power circuit.
66	TCC solenoid valve	TCC solenoid valve or its circuit shorted to ground.
72	Transmission range switch	Defective switch or its circuit (more than two transmission range switches of "R", "N", "D", "2" and "L" turned ON simultaneously or no transmission range switch turned ON while vehicle running).
75	A/T vehicle speed sensor	Defective sensor or its circuit. (open or short)

Fail-Safe Table

Code No.	Diagnostic Area	Fail-Safe Function
14 15	ECT sensor	After 15 min. from engine start, TCM release inhibitions of shift to OD gear and TCC lock-up.
21 22	TP sensor	Throttle opening is controlled as closed.
61 62	Shift solenoid valve A	Shift solenoid valve B. 1st, 2nd and 3rd gears ON, 4th (O/D) gear OFF. For shift position, refer to Fail-Safe Function in ELECTRONIC SHIFT CONTROL SYSTEM.
63 64	Shift solenoid valve B	Shift solenoid valve A. 1st gear ON, 2nd 3rd and 4th (O/D) gears OFF. For shift position, refer to Fail-Safe Function in ELECTRONIC SHIFT CONTROL SYSTEM.
65 66	TCC solenoid valve	TCC solenoid valve OFF.
72	Transmission range switch	Priority order is "L" → "2" → "N" → "D" → "R". (When two or more signals inputted same time) Transmission range switch is controlled as "D" range. (When no signal inputted)
75	A/T vehicle speed sensor	Signal from vehicle speed sensor (in speedometer) is used.

DIAGNOSTIC FLOW CHART A

NO GEAR SHIFT OCCURS

Warm up engine and transmission to normal operating temperature.

Check diag. trouble code.

Trouble code indicated. → Go back to "DIAG. FLOW CHART" on page 7B1-10.

No trouble code indicated.

Perform manual road test referring to p. 7B1-8. Is it OK?

NG → Transmission or manual select control system faulty.

OK

1. With solenoid valves coupler connected, turn ignition switch ON.
2. Conduct a road test in "D" range and check voltage at each solenoid terminal. For relationship between vehicle speed and each gear position, refer to gear shift diagram.

Vehicle speed	1st range	2nd range	3rd range	4th range
Shift solenoid –A (S_1)	Battery voltage	Battery voltage	0V	0V
Shift solenoid –B (S_2)	0V	Battery voltage	Battery voltage	0V

OK → Shift solenoid valve–A, B or transmission faulty.

NG

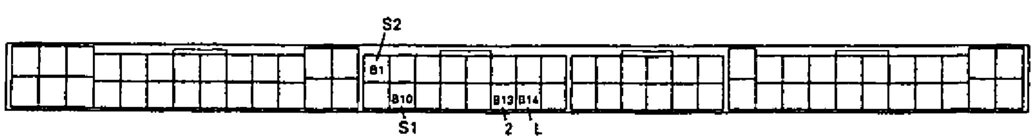
With P(E)CM coupler connected and select lever shifted to "D" range, check voltage at "L" and "2" range signal terminals. Voltage at each terminal should be 0V.

NG → Shift switch or its circuit faulty.

OK

Replace P(E)CM and recheck.

Terminal Arrangement of P(E)CM Coupler (Viewed from harness side)



S_1: Shift solenoid A (S_1) terminal
S_2: Shift solenoid B (S_2) terminal
L: "L" range signal terminal
2: "2" range signal terminal

7B1020

DIAGNOSTIC FLOW CHART B

FAULTY SHIFT POINT

↓

Warm up engine and transmission to normal operating temperature.

↓

Check diag. trouble code.

→ Trouble code indicated. → Go back to "DIAG. FLOW CHART" on p. 7B1-10.

↓ No trouble code indicated.

Check throttle position sensor referring to section 6E1.

→ NG → TP sensor maladjusted or faulty signal circuit.

↓ OK

1. With ignition switch OFF, connect P(E)CM coupler.
2. Check voltage at "PWR" terminal.

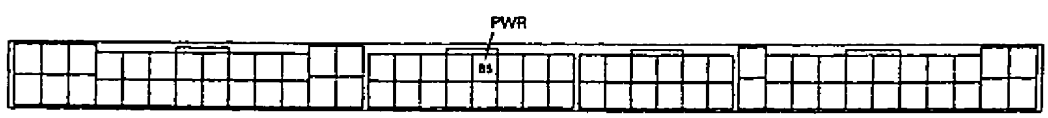
Mode selector switch position	"N" position	"P" position
Voltage	Battery voltage	0V

→ NG → Mode selector switch or its circuit faulty.

↓ OK

Replace P(E)CM and recheck.

Terminal Arrangement of P(E)CM Coupler (Viewed from harness side)



PWR : "PWR" terminal

7B1021

DIAGNOSTIC CHART C

NO GEAR SHIFT TO O/D

↓

Warm up engine and transmission to normal operating temperature.

↓

Check diag. trouble code.

→ Trouble code indicated. → Go back to "DIAG. FLOW CHART" in p. 7B1-10.

↓ No trouble code indicated.

Perform manual road test referring to p. 7B1-8.
Does gear shift to O/D (4th gear) occur in manual road test?

→ NG → Manual select control system or transmission faulty.

↓ OK

1. With ignition switch OFF, connect solenoid valves coupler.
2. Conduct road test in "D" range and check voltage at each solenoid terminal.

Vehicle speed	1st range	2nd range	3rd range	4th range
Shift solenoid –A (S_1)	Battery voltage	Battery voltage	0V	0V
Shift solenoid –B (S_2)	0V	Battery voltage	Battery voltage	0V

→ OK → Shift solenoid valve–A, B or transmission faulty.

↓ NG

1. With P(E)CM coupler connected, turn ignition switch ON.
2. With select lever shifted to "D" range, check voltage at "L" and "2" range signal terminals. It should be 0V.

→ NG → Shift switch or its circuit faulty.

↓ OK

With coupler connected, check voltage at "OD" terminal.

O/D cut switch position	OFF	ON
Voltage	Battery voltage	0V

→ NG → Faulty O/D cut switch or its circuit shorted.

↓ OK

To be continued

Continued

↓

Check ECT sensor referring to section 6E1. Is it good condition?

- NG → ECT sensor faulty.
- OK ↓

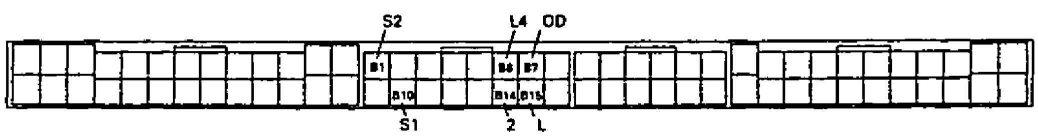
With coupler connected, check voltage at "L4" terminal.

Transfer gear position	4L or N position	2H or 4H position
Voltage	0V	Battery voltage

- NG → Faulty 4WD-L switch or its circuit shorted.
- OK ↓

Replace P(E)CM and recheck.

Terminal Arrangement of P(E)CM Coupler (Viewed from harness side)



S_1: Shift solenoid A (S_1) terminal
S_2: Shift solenoid B (S_2) terminal
L: "L" range signal terminal
2: "2" range signal terminal
L4: 4WD low switch terminal
OD: OD cut switch terminal

7B1022

DIAGNOSTIC FLOW CHART D

NO TCC LOCK-UP OCCURS.

↓

Warm up engine and transmission to normal operating temperature.

↓

Check diag. trouble code.

→ **Trouble code indicated.** → Go back to "DIAG. FLOW CHART" in p. 7B1-10.

↓ **No trouble code indicated.**

Conduct roat test under following conditions and check if battery voltage is obtained at "S_3" terminal.

- O/D cut switch ON. (O/D OFF light turn ON.)
- Normal mode in "D" range.
- Transfer "2H" gear position.
- Accelerate till vehicle speed reaches about 80 km/h and reduce throttle valve opening so that it is open less than 20%.

→ **OK** → Solenoid valve No.2 (TCC solenoid valve) or transmission faulty.

↓ **NG**

Check voltage at "BR" terminal.

Brake pedal	When released	When depressed
Voltage	0V	Battery voltage

→ **NG** → Faulty brake pedal switch or its circuit shorted.

↓ **OK**

Check ECT sensor referring to section 6E1. Is it good condition?

→ **NG** → ECT sensor faulty.

↓ **OK**

Check voltage at "L4" terminal.

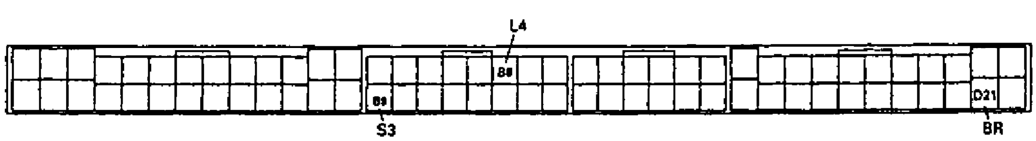
Transfer gear position	4L or N position	2H or 4H position
Voltage	0V	Battery voltage

→ **NG** → Faulty 4WD-L switch or its circuit shorted.

↓ **OK**

Replace P(E)CM and recheck.

Terminal Arrangement of P(E)CM Coupler (Viewed from harness side)



S_3: TCC control solenoid terminal
L4: 4WD low switch terminal
BR: Brake switch terminal

7B1023

GROUP2

Group2

SUZUKI

VITARA

SUPPLEMENTARY SERVICE MANUAL

FOREWORD

This SUPPLEMENTARY SERVICE MANUAL (GROUP 2) is a supplement to GROUP 1.

Applicable model:
SE416 vehicles on and after following body No.
(x) JSAETA02C01300001 (x)
(x) JSAETA02V01300001 (x)
(x) JSAETA01CTV300001 (x)
(x) JSAETA01VTV300001 (x)
TA01C-300001
TA01V-300001

Therefore, whenever servicing applicable model, consult GROUP 2 first. And for any section, item or description not found in GROUP 2, refer to GROUP 1.

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

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

RELATED SERVICE MANUAL
Refer to FOREWORD of GROUP 1

GROUP
1A
5
8

SANTANA MOTOR, S.A.
DEPARTAMENTO DE SERVICIO

IMPRESO POR SANTANA MOTOR, S.A. - 1997

SECTION 1A

HEATER AND VENTILATION

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.**
- **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 air bags may be deployed by reserve energy in the Sensing and Diagnostic module (SDM).

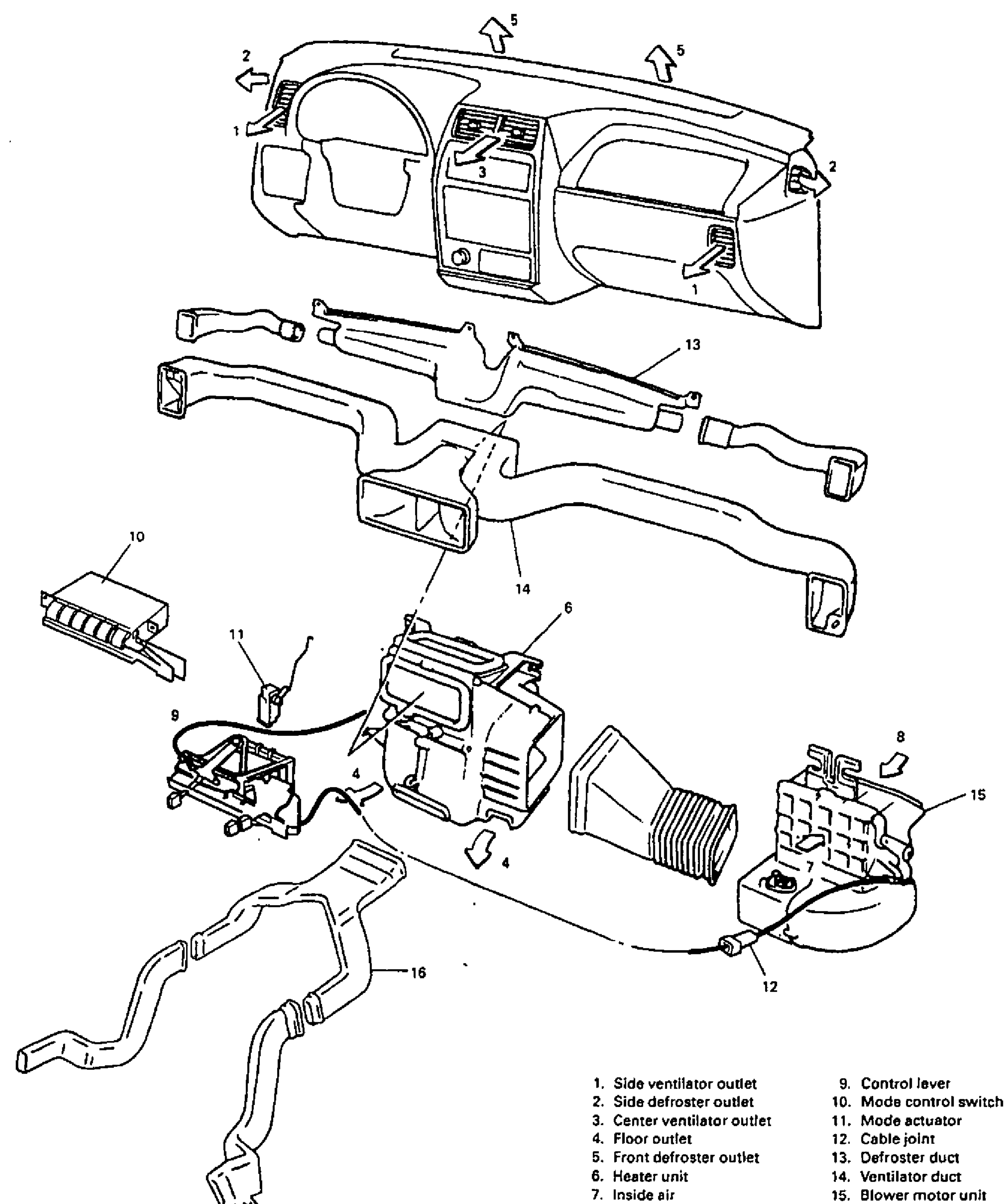
1A

NOTE:
- **For the descriptions (items) not found in this section, refer to SECTION 1A of the Service Manual mentioned in FOREWORD of this manual.**
- **The link mechanism of the heater varies depending on the specifications.**

CONTENTS

GENERAL DESCRIPTION

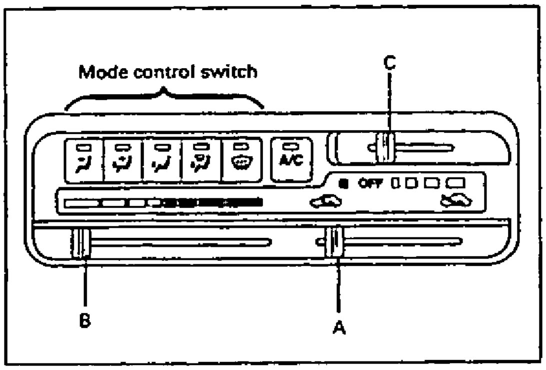
The heater, an in and out air selectable-type hot water heater, is so constructed that it is possible to assure an agreeable ventilation at all times by providing the ventilator air outlets at the center and both sides (right and left) of the instrument panel, the hot air outlet at a place close to the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



1. Side ventilator outlet
2. Side defroster outlet
3. Center ventilator outlet
4. Floor outlet
5. Front defroster outlet
6. Heater unit
7. Inside air
8. Outside air
9. Control lever
10. Mode control switch
11. Mode actuator
12. Cable joint
13. Defroster duct
14. Ventilator duct
15. Blower motor unit
16. Rear duct

1A-001

HEATER CONTROL OPERATION



1A-002

For mode selection, press mode control switch as desired. Then the mode actuator will move the link to change the mode.

	VENTILATION
	BI-LEVEL
	HEAT
	HEAT & DEFROSTER
	DEFROSTER

1A-003

MODE CONTROL SWITCH

BI-LEVEL ( ) is a position used to keep cooling the head and warming the feet.

	CIRCULATION
	FRESH AIR

1A-004

CONTROL LEVER A

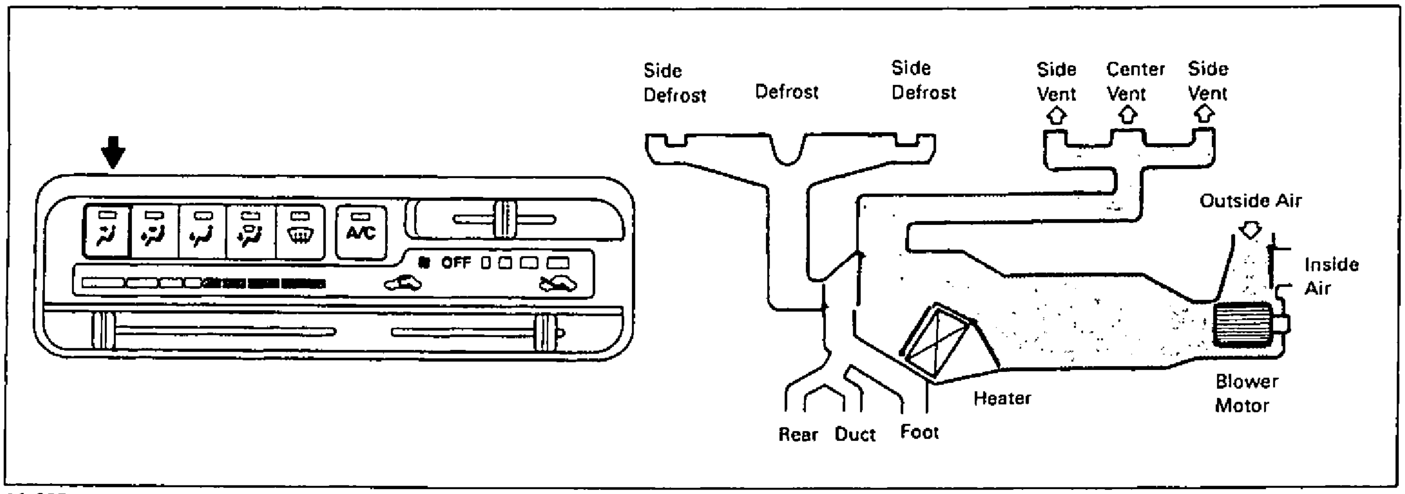
CONTROL LEVER B

A temperature control lever.
The temperature of air is controlled by this lever.
To make the heater warmer, set it to the "HOT" position.

CONTROL LEVER C

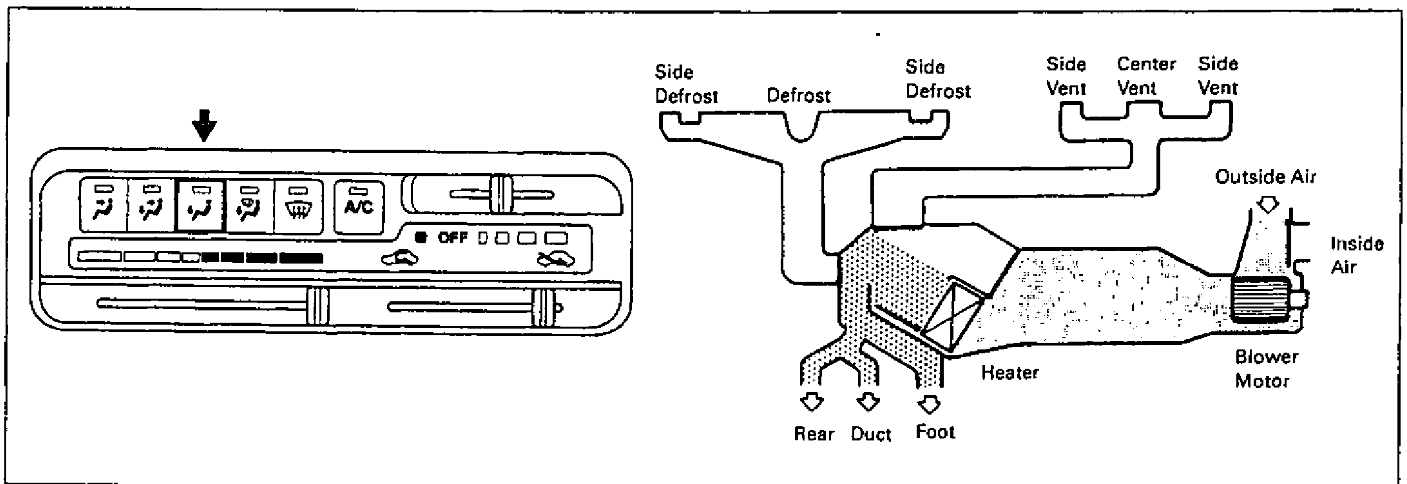
A blower speed selecting lever. The blower speed is increased as the lever is moved from left to right.

A. FORCED VENTILATION



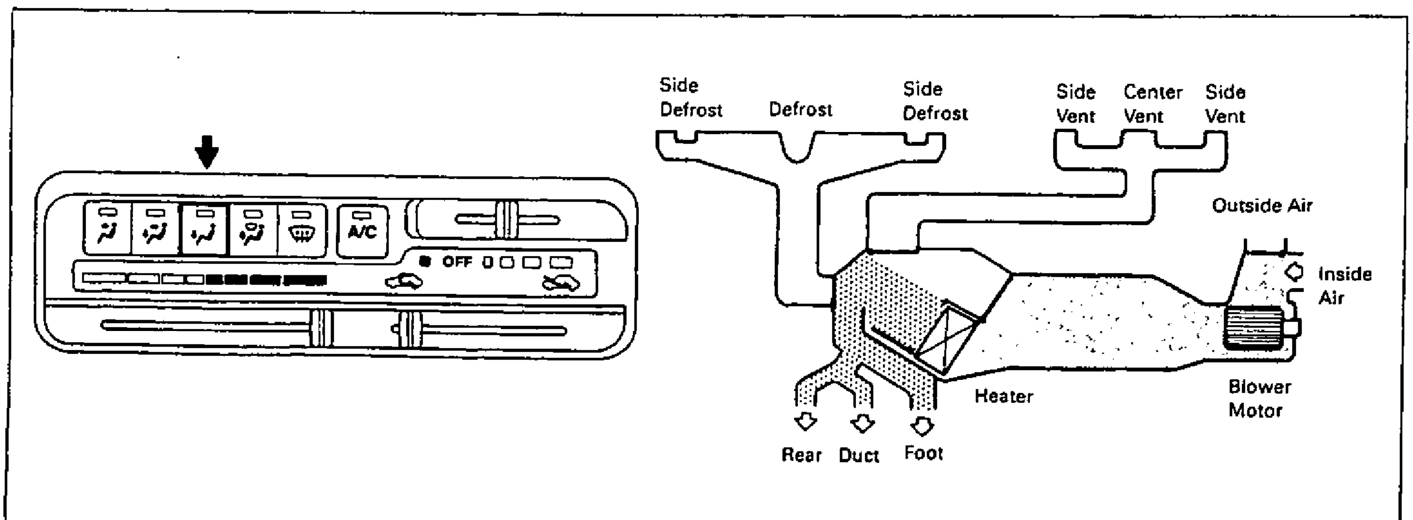
1A-005

B. OUTSIDE AIR-INTRODUCED HEATING



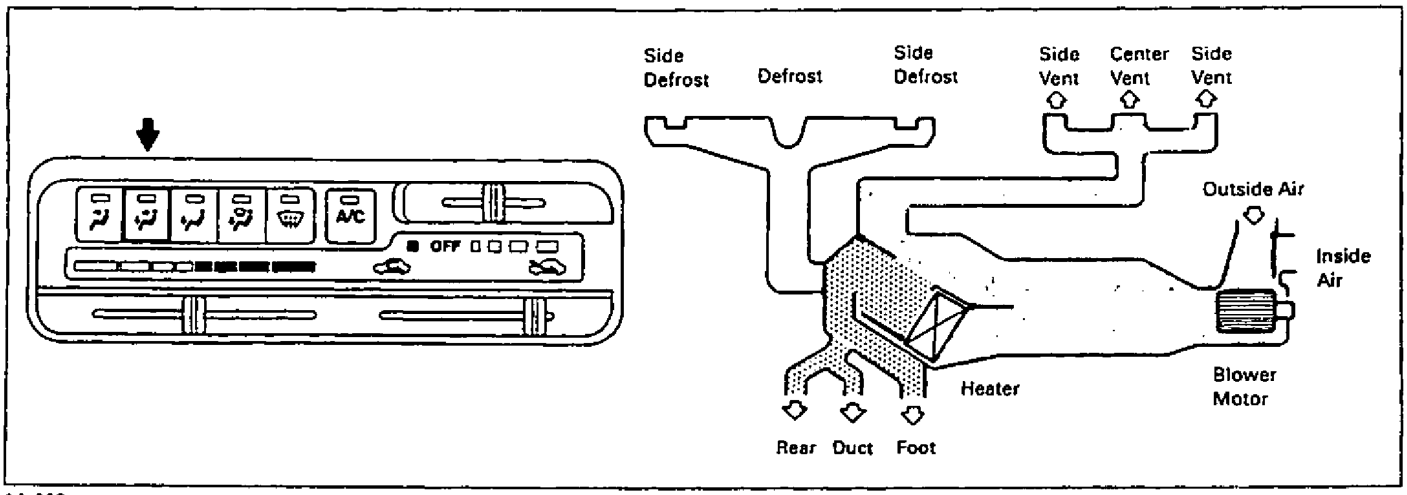
1A-006

C. INSIDE AIR-CIRCULATED HEATING



1A-007

D. HEAD-COOLED/FEET-WARMED HEATING

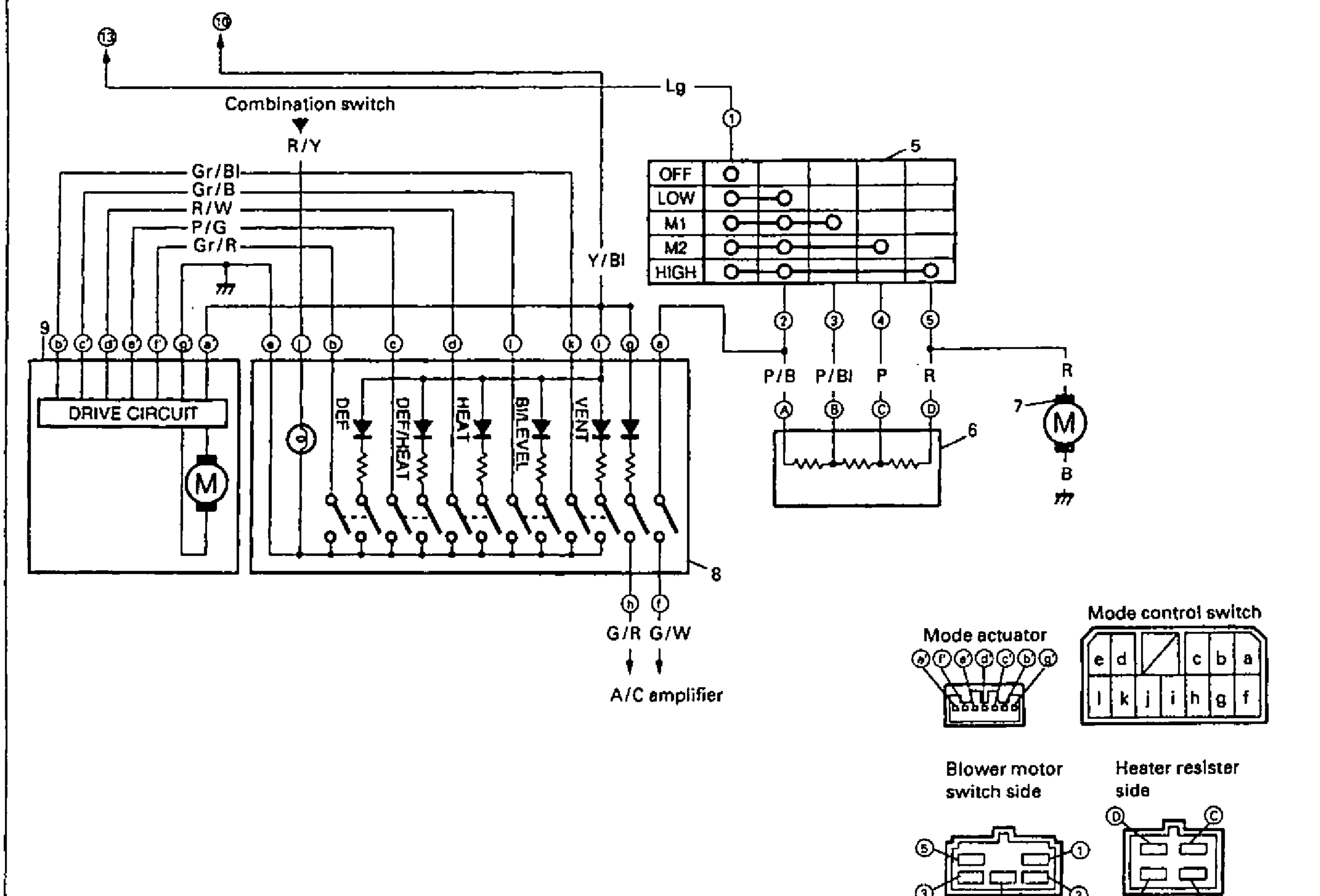


1A-008

TROUBLE DIAGNOSIS

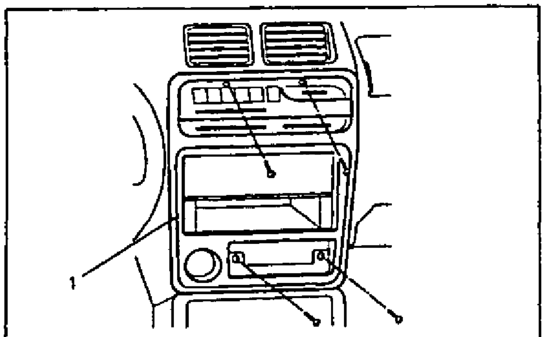
Trouble	Possible cause	Remedy
Heater blower won't work even when its switch is ON.	Blower fuse blown Blower resistor faulty Blower motor faulty Wiring or grounding faulty	Replace fuse to check for short. Check resistor. Replace motor. Repair as necessary.
Incorrect temperature output.	Control cables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

WIRING CIRCUIT



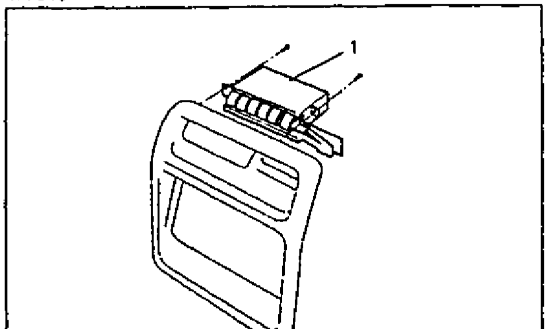
1. Battery
2. Main fuse
3. Main switch
4. Fuse box
5. Blower motor switch
6. Heater resister
7. Blower motor
8. Mode control switch
9. Mode actuator

1A-009



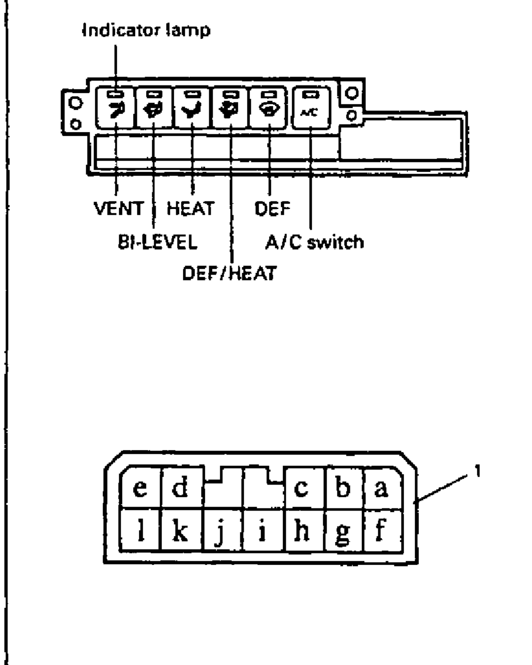
1. Center garnish

1A-010



1. Mode control switch

1A-011



1. Mode control switch coupler

1A-012

ON-VEHICLE SERVICE

MODE CONTROL SWITCH

REMOVAL

1) Disconnect negative (–) cable at battery.
2) If equipped with air bag system, disable air bag system. Refer to "Disabling Air Bag System" in Section 9J.
3) Pull off control lever knobs.
4) Remove ashtray and center garnish mounting screws.
5) Remove center garnish with mode control switch.
6) Remove mode control switch from center garnish.

INSPECTION

Mode Control Switch

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

Mode	Mode control switch terminals
VENT	e – k
BI-LEVEL	e – l
HEAT	e – d
DEF/HEAT	e – c
DEF	e – b

- With battery voltage (+) connected to terminal "i" and (–) to terminal "e", press each mode control button and check if indicator lamp lights.
- With battery voltage (+) connected to terminal "j" and (–) to terminal "e", check if illumination lamp lights.

A/C Switch (if equipped)

- Press A/C button and check if there is continuity between terminals "a" and "f".
- With battery voltage (+) connected to terminal "g" and (–) to terminal "h", press A/C button and check if indicator lamp lights.

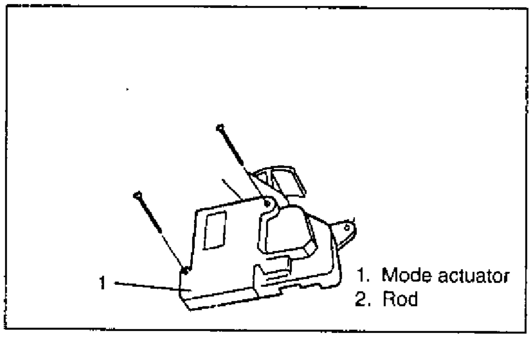
INSTALLATION

1) Install in reverse order of removal.
2) If equipped with air bag system, enable air bag system. Refer to "Enabling Air Bag System" in Section 9J.

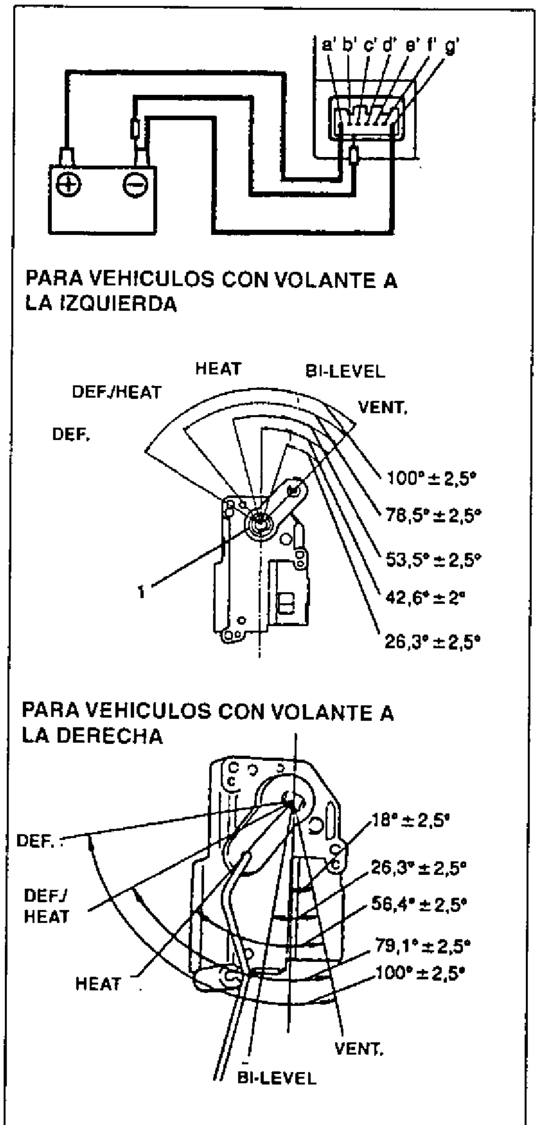
MODE ACTUATOR

REMOVAL

1) Disconnect negative (–) cable at battery.
2) If equipped with air bag system, disable air bag system. Refer to "Disabling Air Bag System" in Section 9J.
3) Remove ABS controller bracket with ABS controller and ICM (if equipped).



4) Disconnect mode actuator coupler.
5) Disconnect mode actuator rod from heater unit.
6) Remove mode actuator from heater unit.



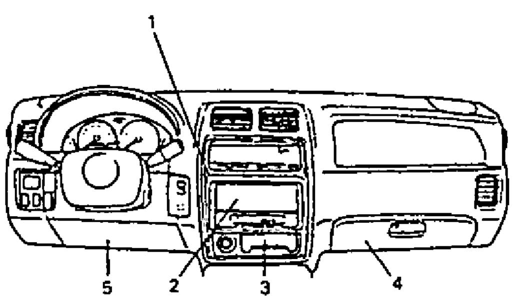
INSPECTION

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

MODE	TERMINAL	
	Left hand steering vehicle	Right hand steering vehicle
VENT	f'	b'
BI-LEVEL	e'	c'
HEAT	d'	d'
DEF/HEAT	c'	e'
DEF	b'	f'

INSTALLATION

1) Install in reverse order of removal.
2) If equipped with air bag system, enable air bag system. Refer to "Enabling Air Bag System" in Section 9J.



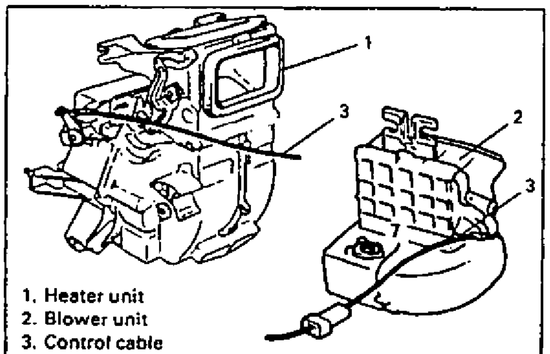
1. Center garnish
2. Instrument glove box compartment
3. Ashtray
4. Glove box
5. Column hole cover

1A-015

HEATER CONTROL LEVER ASSEMBLY

REMOVAL

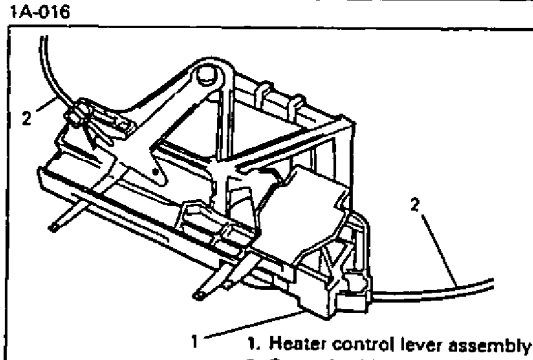
1) Disconnect negative (–) cable at battery.
2) If equipped with air bag system, disable air bag system. Refer to "Disabling Air Bag System" in Section 9J.
3) Pull off control lever knobs.
4) Remove ashtray and center garnish mounting screws.
5) Remove center garnish.
6) Remove glove box and column hole cover.
7) Remove instrument glove box compartment.



1. Heater unit
2. Blower unit
3. Control cable

1A-016

8) Disconnect control cables from blower motor unit and heater unit.
9) Disconnect heater blower motor switch connector.



1. Heater control lever assembly
2. Control cables

1A-017

10) Remove heater control lever assembly.

INSPECTION OF HEATER BLOWER MOTOR SWITCH

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

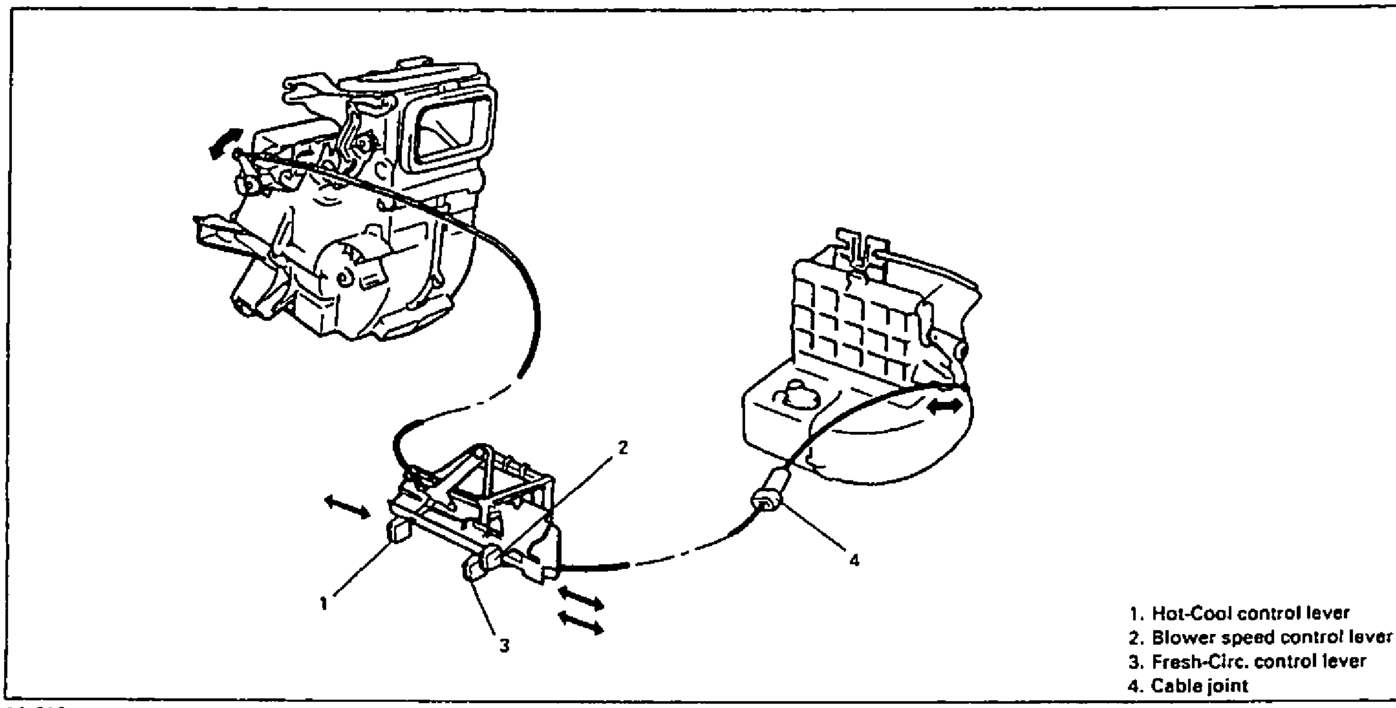
	Lg	P/B	P/Bl	P/G	P
LOW	○	○			
M1	○	○	○		
M2	○	○		○	
HIGH	○	○			○

Lg : Lightgreen
P : Pink
P/G : Pink/Green tracer
P/Bl : Pink with Blue tracer
P/B : Pink with Black tracer

INSTALLATION

1) Install in reverse order of removal.
2) If equipped with air bag, enable air bag system. Refer to "Enabling Air Bag System" in Section 9J.

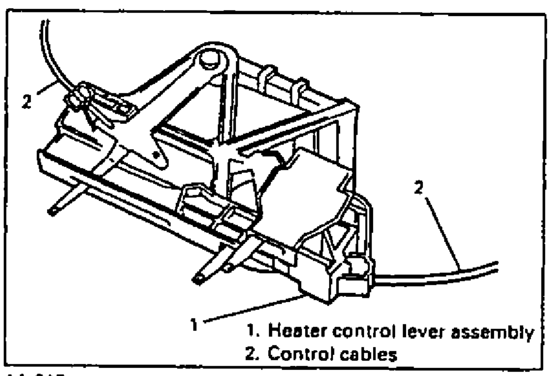
CONTROL CABLES



1A-018

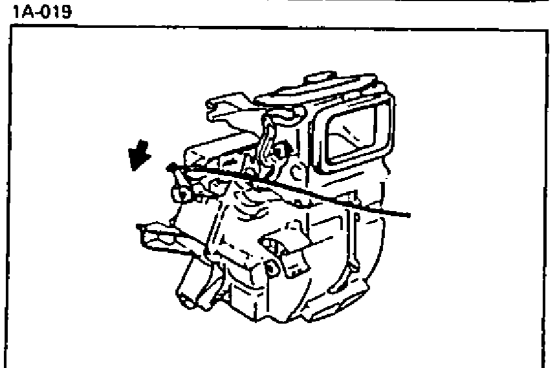
REMOVAL

1) Remove heater control lever assembly.
   Refer to "HEATER BLOWER MOTOR SWITCH" in this section.



1A-019

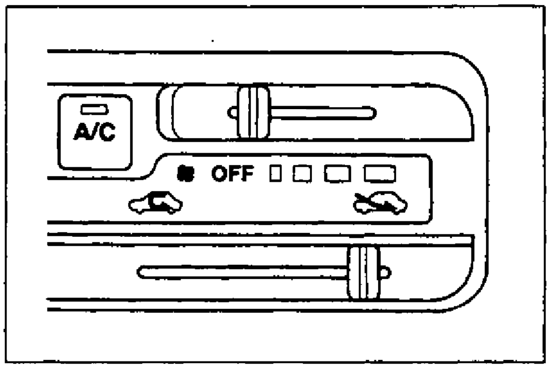
2) Disconnect control cables from control lever.



1A-020

A. Heater Control (HOT-COOL Selector) Cable

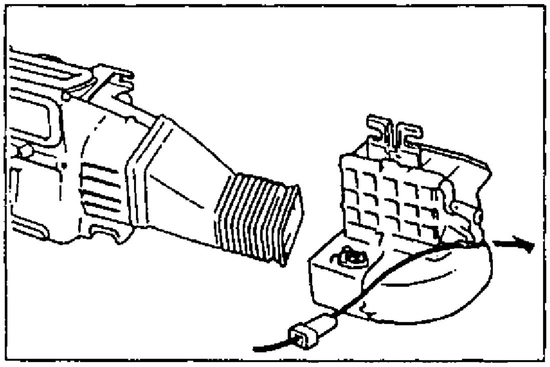
1) Move control lever to COOL position.
2) Push lever fully in arrow direction to fix cable in position, as shown.



1A-021

B. Fresh Air Control (FRESH-CIRC Selector) Cable

1) Move control lever to FRESH position.


1A-022

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

SECTION 5

BRAKES

NOTE:

- For the descriptions (items) not found in this section, refer to the same section of Service Manual mentioned in FOREWORD of this manual.
- All brake fasteners are important attaching parts in that they could affect the performance of vital parts and systems, and/or could result in major repair expense. They must be replaced with one of same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of all parts. There is to be no welding as it may result in extensive damage and weakening of the metal.

85F00-5-1-1

CONTENTS

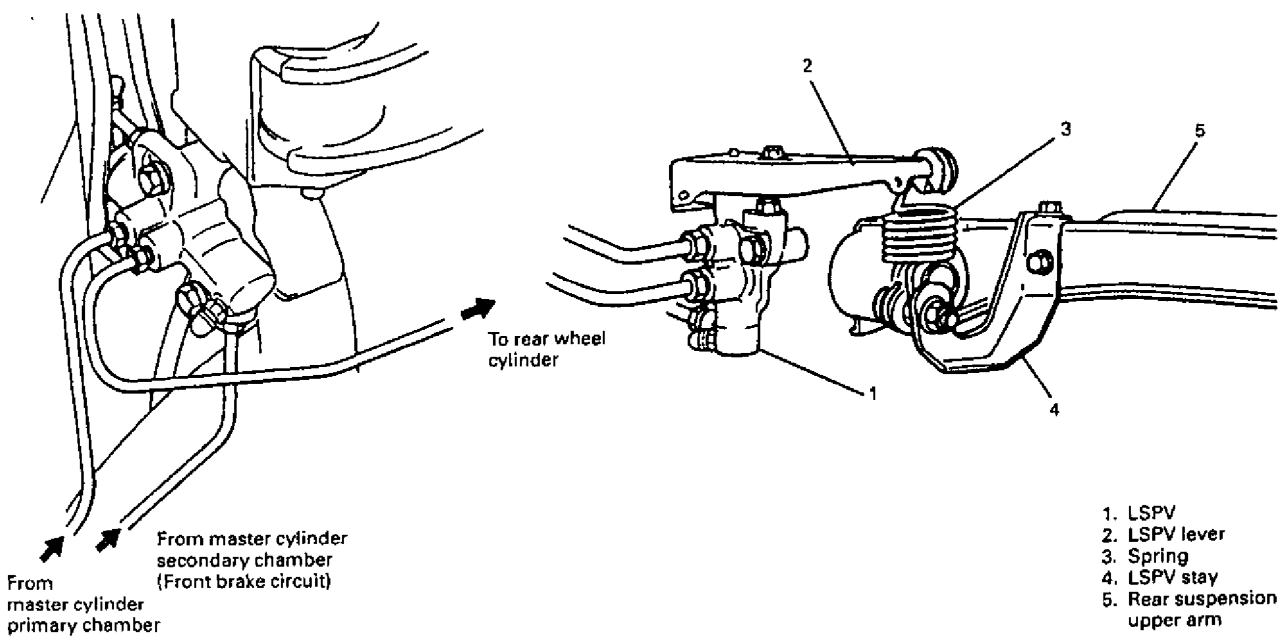
GENERAL DESCRIPTION

LSPV (Load Sensing Proportioning Valve) ASSEMBLY

As shown in figure below, LSPV is included within the brake circuit which connects the master cylinder and the rear wheel brake. It controls the hydraulic pressure applied to the rear wheel brake according to the loaded state of the vehicle (or weight of the load), whereby preventing the rear wheels from getting locked prematurely.

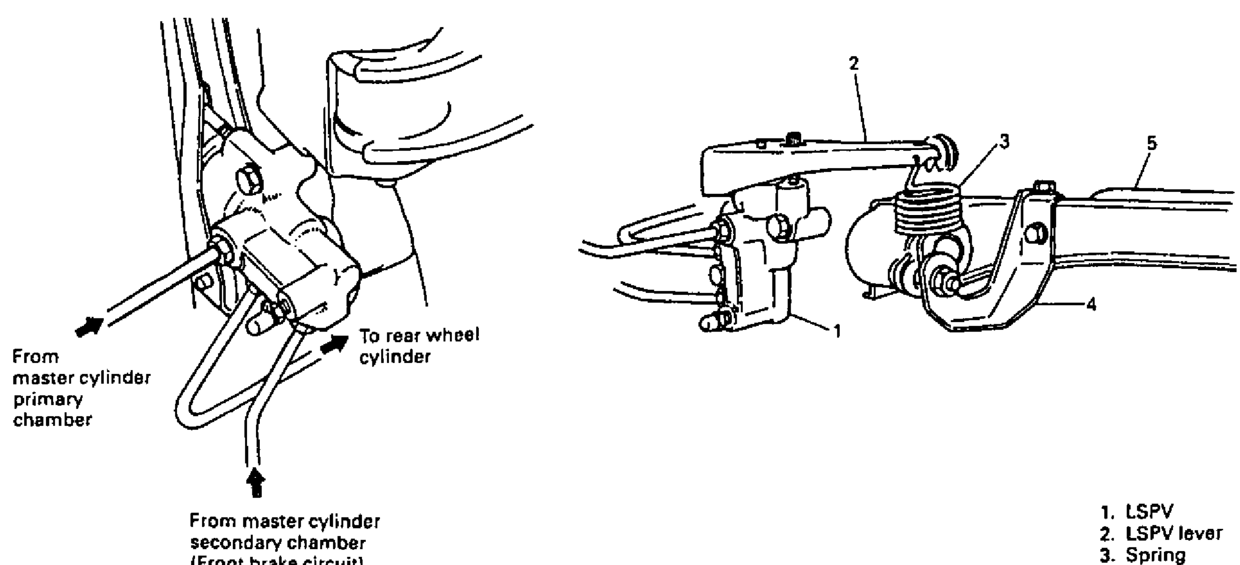
If the front hydraulic pressure fail to increase (failure in the front brake circuit), it is so designed that the fail-safe mechanism works and a hydraulic pressure higher than in normal condition is applied to rear wheel cylinders.

[3 Door Vehicle]



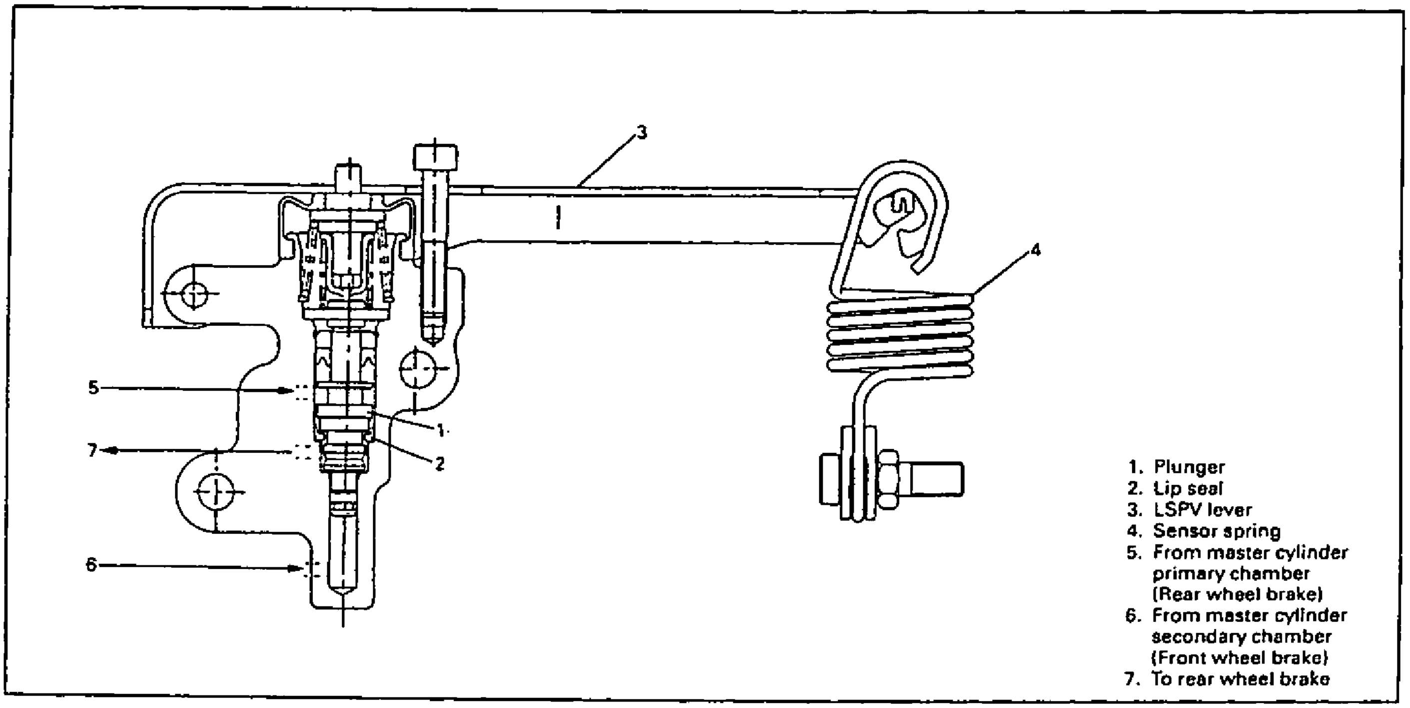
1. LSPV
2. LSPV lever
3. Spring
4. LSPV stay
5. Rear suspension upper arm

[5 Door Vehicle]



1. LSPV
2. LSPV lever
3. Spring
4. LSPV stay
5. Rear suspension upper arm

CONSTITUTION



85F00-5-13-2

OPERATION

LSPV is installed to the vehicle body, with the end of the lever at its top connected to the upper arm of the rear suspension by way of the sensor spring and the LSPV stay.

When some load is placed on the vehicle, the distance between the axle housing of the rear suspension and the vehicle body (chassis) (i.e. coil spring height) changes, whereby the sensor spring length also changes.

As the sensor spring length changes, the force affecting the plunger in LSPV by way of the lever changes so that the hydraulic characteristic suitable for the load weight becomes available.

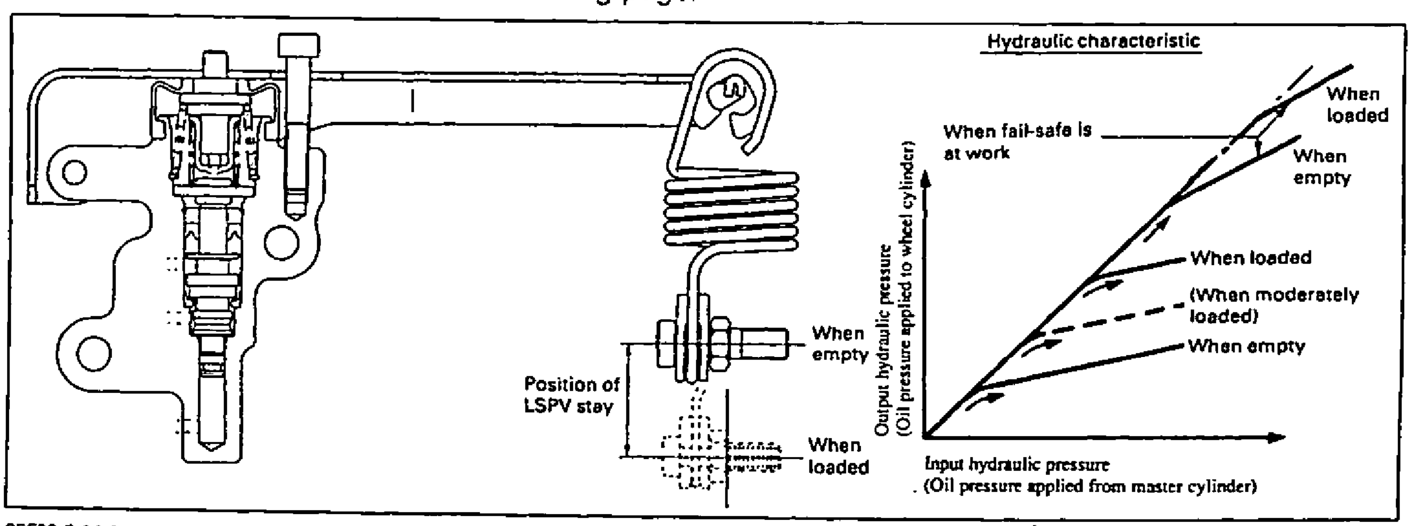
When empty

As the sensor spring is pulled by comparatively weak force, the force applied to the plunger is also small and the hydraulic characiteristic takes a low bend point as shown in the graph below.

When loaded

As the sensor spring is pulled by comparatively strong force, a larger force is applied to the plunger so that the hydraulic characteristic takes a higher bend point in the graph below.

The relationship between the force applied to the plunger and the bend point in the hydraulic characteristic graph is described on the following page.



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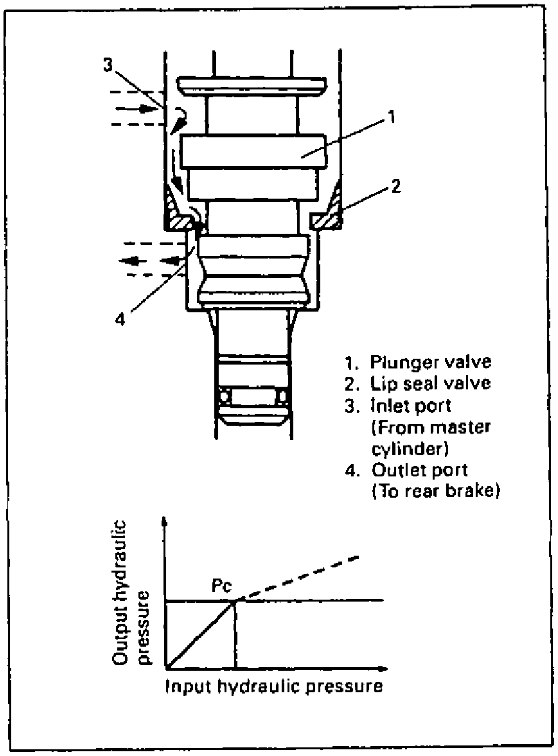

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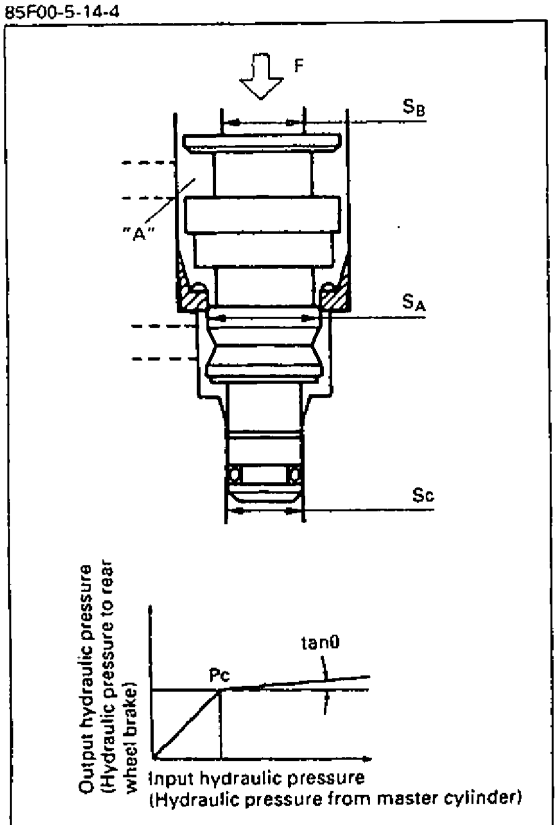
When LSPV not at work

Operation from the inoperative state till the input hydraulic pressure (fluid pressure from the master cylinder) reaches the bend point Pc in the graph as shown.
The input hydraulic pressure passes between the plunger and lip seal (valve) and without receiving any control, it is discharged through the outlet port.



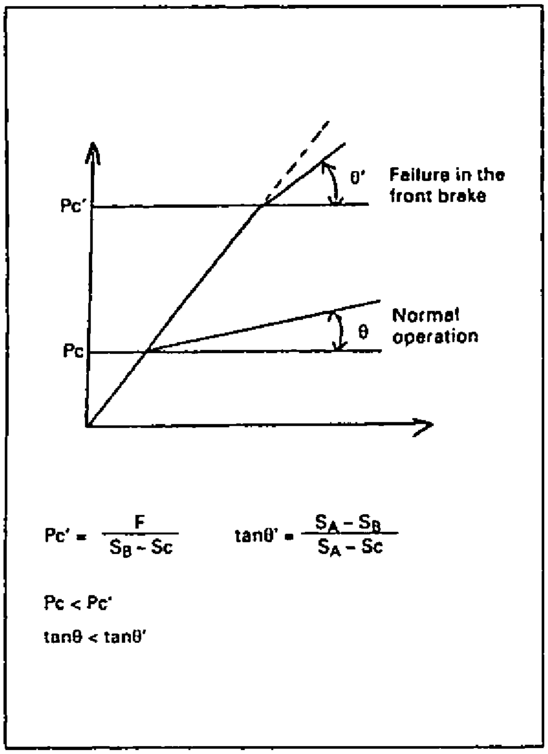
Reference:
The bend point Pc and gradient tanθ are obtained by using the following equations.

$$Pc = \frac{F}{S_B} \qquad \tan\theta = \frac{S_A - S_B - S_C}{S_A - S_C}$$

F :Force from sensor spring
S_A :Larger diameter sectional area of plunger
S_B :Smaller diameter sectional area of plunger
S_C :Sectional area of plunger to O-ring outer diameter contact

When LSPV at work

As the input hydraulic pressure increases, the force applied to the plunger grows stronger than the sensor spring force and moves the plunger upward in the figure and as a result, the valve closes the fluid passage. The hydraulic pressure then is represented by the bend point Pc in the graph.
As the incoming hydraulic pressure rises even higher, the hydraulic pressure "A" increases and pushes down the plunger, opening the fluid passage.
By repeating this operation (open/close), the valve controls the output hydraulic pressure (hydraulic pressure to the rear brake).
Therefore its characteristic is represented as a line with a certain gradient.



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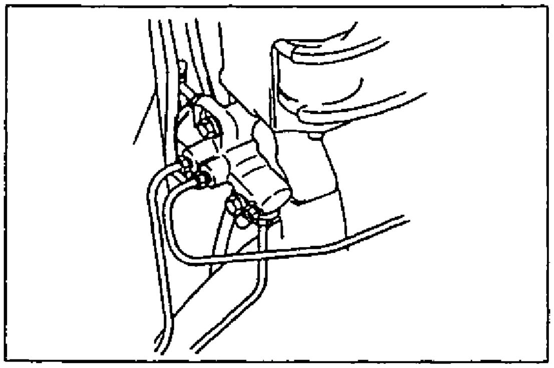
When fail-safe at work

When the hydraulic pressure is not applied to the front brake (secondary), the force to push up the plunger reduces by the amount corresponding to that of the front brake. This means that in order for the plunger to operate, a higher than normal hydraulic pressure is required for the rear brake (primary). Thus, a hydraulic pressure exceeding the normal level is supplied to the rear brake (rear wheel cylinder).

ON-VEHICLE SERVICE

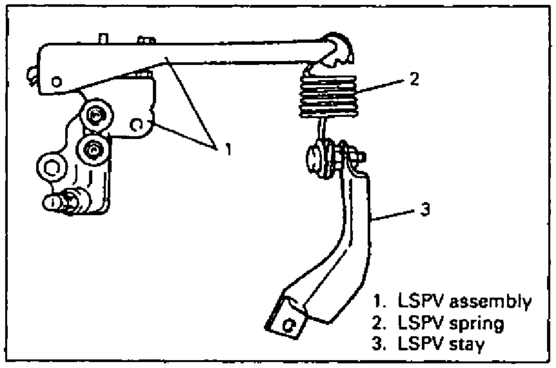
LSPV (Load Sensing Proportioning Valve) R & I

1. REMOVE AND INSTALL LSPV



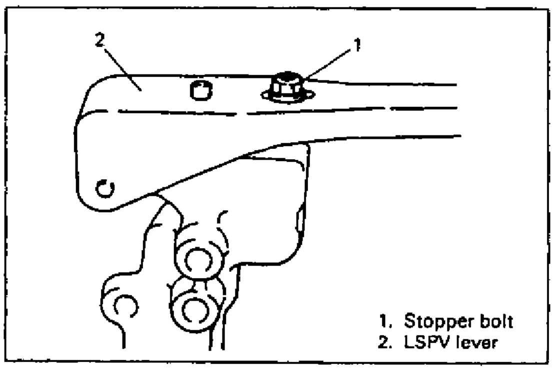
REMOVAL

1) Clean around reservoir cap and take out fluid with syringe or such.
2) Hoist vehicle.
3) Disconnect brake pipes from LSPV.
4) Remove LSPV assembly from vehicle body.



1. LSPV assembly
2. LSPV spring
3. LSPV stay

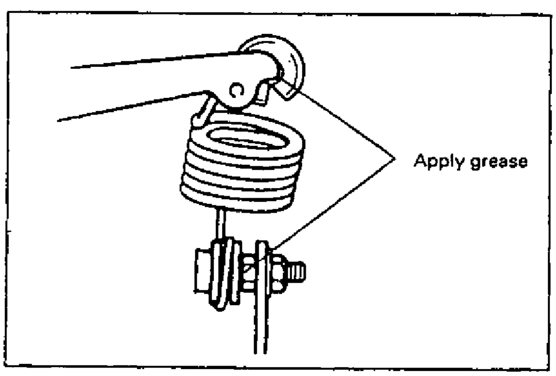
NOTE:
As shown in figure, LSPV assembly should be removed together with its spring and stay installed as they are.



1. Stopper bolt
2. LSPV lever

5) Remove spring and stay from lever.

> **CAUTION:**
> - **Stopper bolt of LSPV lever should not be loosened or tightened.**
> - **LSPV assembly must not be disassembled. Replace with new one if defective.**

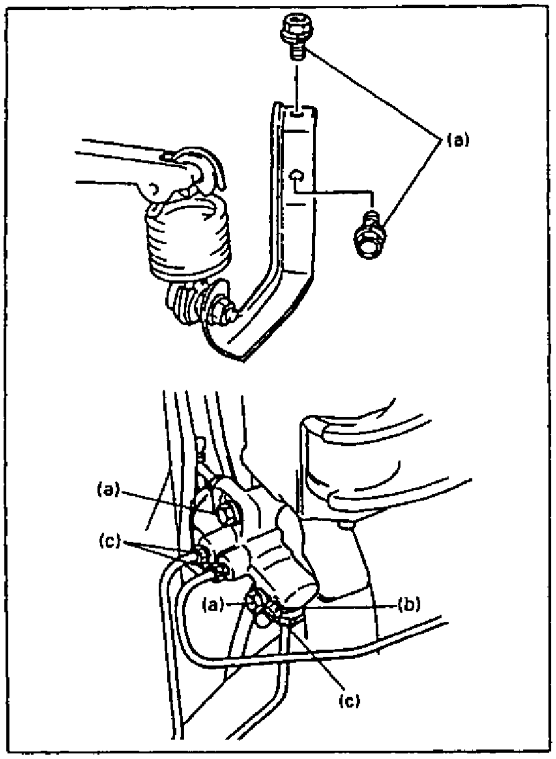


INSTALLATION

> **CAUTION:**
> **Refer to above CAUTION.**

Install by reversing removal procedure, noting the following.

1) Apply multi-purpose grease to upper and lower joint of coil spring.



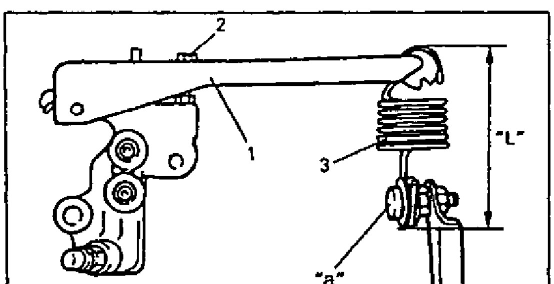
2) Torque each bolt and nut to specification as indicated as indicated spectively in figure.

Tightening Torque
(a): 23 N·m (2.3 kg-m, 16.5 lb-ft)
(b): 7.5 N·m (0.75 kg-m, 5.5 lb-ft)
(c): 16 N·m (1.6 kg-m, 11.5 lb-ft)

3) Upon completion of installation, fill reservoir tank with specified fluid and bleed air from brake system.

NOTE:
Make sure to bleed air from LSPV bleeder without fail.

4) After bleeding air, check that LSPV is installed properly, referring to following INSPECTION & ADJUSTMENT section.



1. LSPV lever
2. Stopper bolt
3. Coil spring

2. AFTER-INSTALLATION INSPECTION & ADJUSTMENT

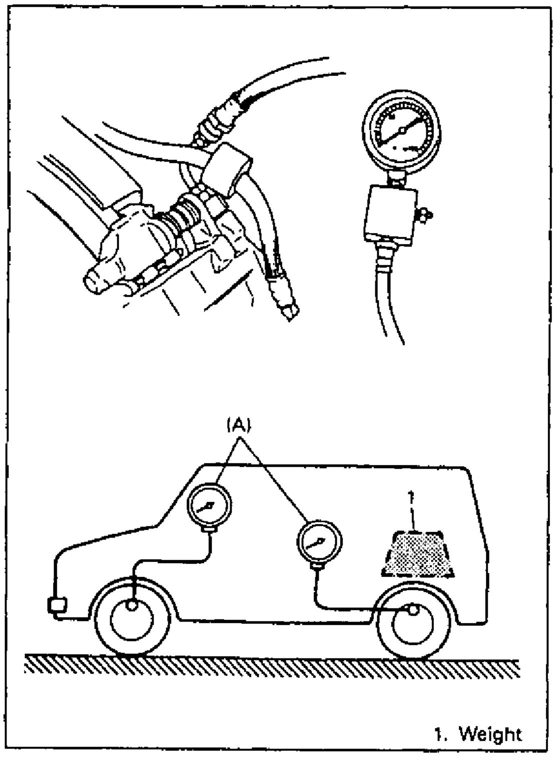
Confirm the following before inspection and adjustment.
- Fuel tank is filled with fuel fully.
- Vehicle is equipped with spare tire, tools, jack and jack handle.
- Vehicle is free from any other load.

With vehicle in above conditions;
1) Place it on level floor.
2) Push up LSPV lever with finger till it contacts stopper bolt and measure length of coil spring ("L" in figure) as it is pulled.
3) Spring length "L" should be as specified below.

Spring length "L"
3 Door vehicle: 103 mm (4.054 in.)
5 Door vehicle: 98 mm (3.858 in.)

4) If it isn't, adjust it to specification by changing bolt "a" tightening positions as shown in figure. After adjustment, tighten nut to specified torque.

NOTE:
Check to make sure that LSPV body and brake pipe joints are free from fluid leakage. Replace defective parts, if any.



3. FLUID PRESSURE TEST

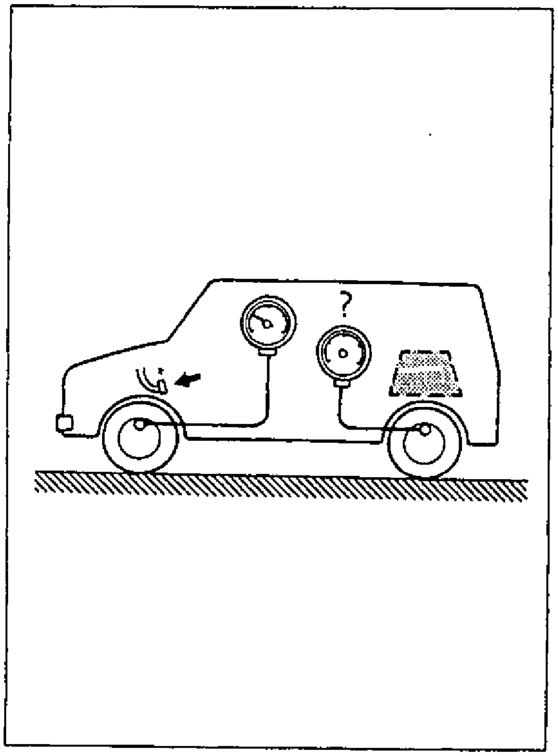
Test procedure for LSPV assembly is as follows.
Before testing, confirm the following.

- Fuel tank is filled with fuel fully.
- Vehicle is equipped with spare tire, tools, jack and jack handle.

1) Place vehicle on level floor and set 100 kg (221 lbs) weight slowly on axle housing center.
2) Install pressure gauge to front and rear brake.

Special Tool
(A): 09956-02310

NOTE:
Pressure gauge should be connected to bleeder of front (left side brake) and rear brakes.



3) Depress brake pedal gradually till fluid pressure of front brake becomes as specified below and check corresponding pressure of rear brake then. It should be within specification given below.

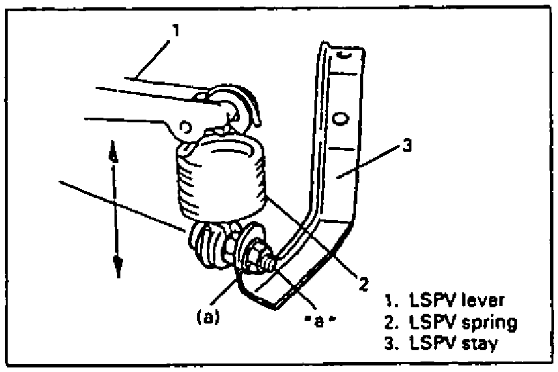
Front brake	Rear brake
5000 kPa 50 kg/cm^2 711 psi	2000 – 3200 kPa 23 – 29 kg/cm^2 327 – 412 psi

As done above, apply 100 kg/cm^2 pressure to front brake and check that rear brake pressure then is within specification as given below.

Front brake	Rear brake
10000 kPa 100 kg/cm^2 1422 psi	3500 – 4500 35 – 45 kg/cm^2 498 – 640 psi

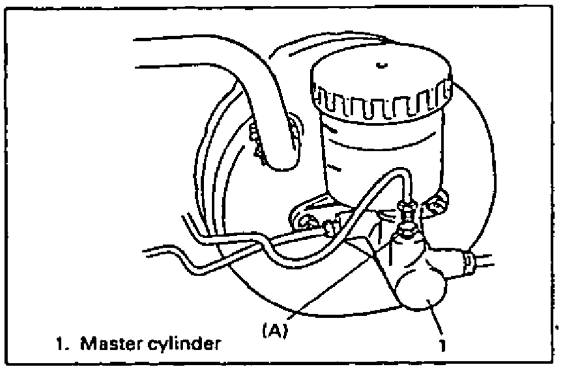
4) If rear brake pressure is not within specification, adjust it by changing bolt "a" tightening position as follows.
   - If rear brake pressure is higher than specification, move bolt "a" upward and if it is lower, downward.
   - Repeat steps 3) and 4) until rear brake pressure is within specification.

NOTE:
1 mm of bolt movement will result in about 2.4 kg / cm^2 difference in hydraulic pressure.



- After adjustment, be sure to torque nut to specification.

Tightening Torque
(a): 23 N·m (2.3 kg-m, 16.5 lb-ft)



5) Disconnect brake pipe (connecting between master cylinder and right front brake) from master cylinder. Tighten plug (special tool) to master cylinder as shown below.

Special Tool
(A): 09956-02210

Depress brake pedal. If rear brake pressure is 95 – 100 kg/cm^2 when front brake pressure is 100 kg/cm^2, it means that front fail-safe system functions properly.

Front brake	Rear brake
10000 kPa 100 kg/cm^2 1422 psi	9500 – 10000 kPa 95 – 100 kg/cm^2 1350 – 1422 psi

SECTION 8

BODY ELECTRICAL SYSTEM

NOTE:
For the descriptions (items) not found in this section of this manual, refer to the same section of service manuals mentioned in FOREWORD of this manual.

CONTENTS

8

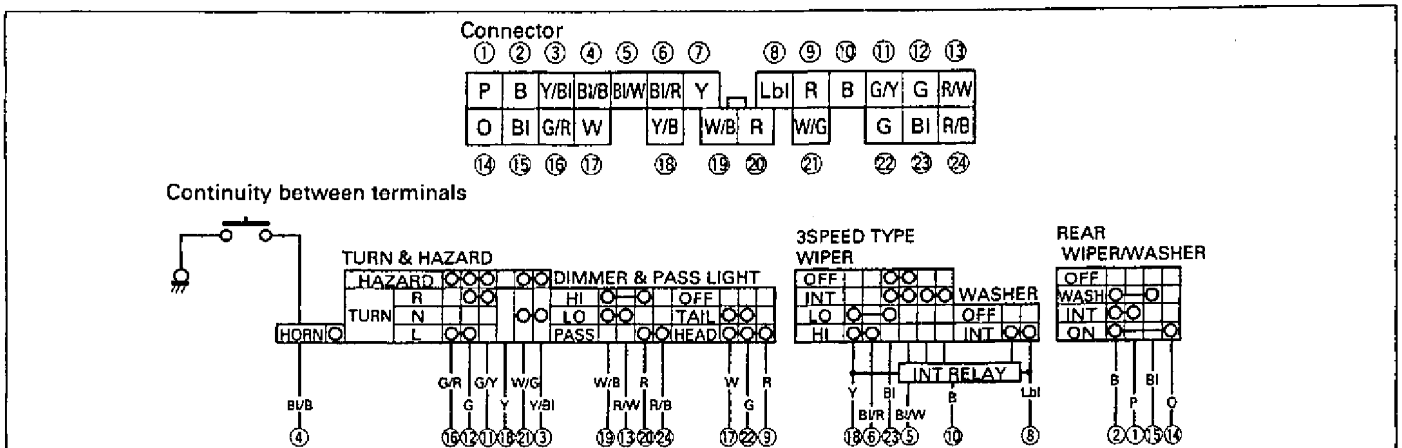
BODY ELECTRICAL SYSTEM

COMBINATION SWITCH

The turn signal/dimmer switch incorporates the turn signal, hazard warning, dimmer and passing light switches.

Inspection

1. Disconnect negative cable at battery.
2. Remove lower steering column cover.
3. Disconnect combination switch couplers.



B : Black	G/R : Green/Red	W/B : White/Black	Lbl : Light blue
Bl : Blue	G/Y : Green/Yellow	W/G : White/Green	Gr : Gray
Bl/B : Blue/Black	R : Red	Y : Yellow	O : Orange
Bl/R : Blue/Red	R/B : Red/Black	Y/B : Yellow/Black	P : Pink
Bl/W : Blue/White	R/W : Red/White	Y/Bl : Yellow/Blue	
G : Green	W : White		

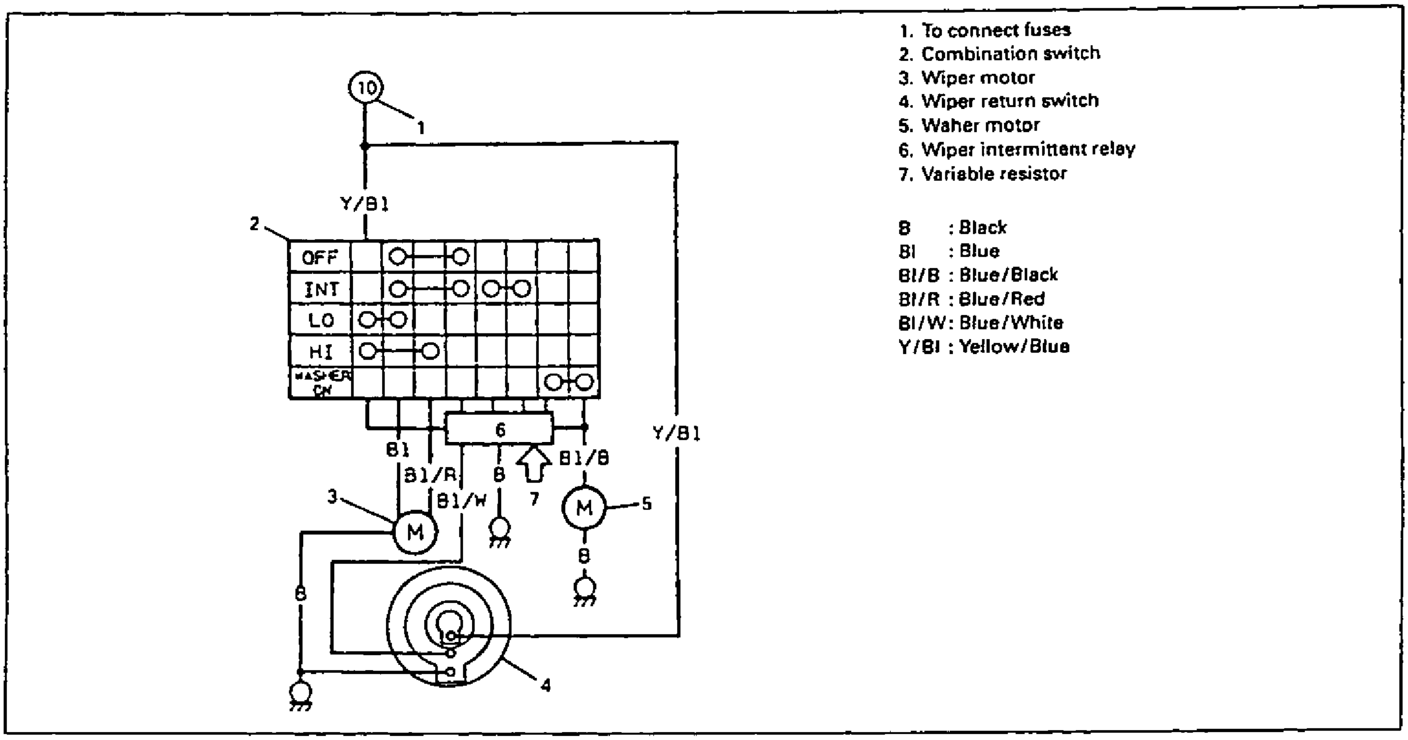
8-001

ON-VEHICLE SERVICE

WINDSHIELD WIPERS (FRONT WIPER)

The windshield wiper is 3-speed type with variable intermittent switch and the windshield washer is equipped with a separate-type washer pump.

WIRING CIRCUIT

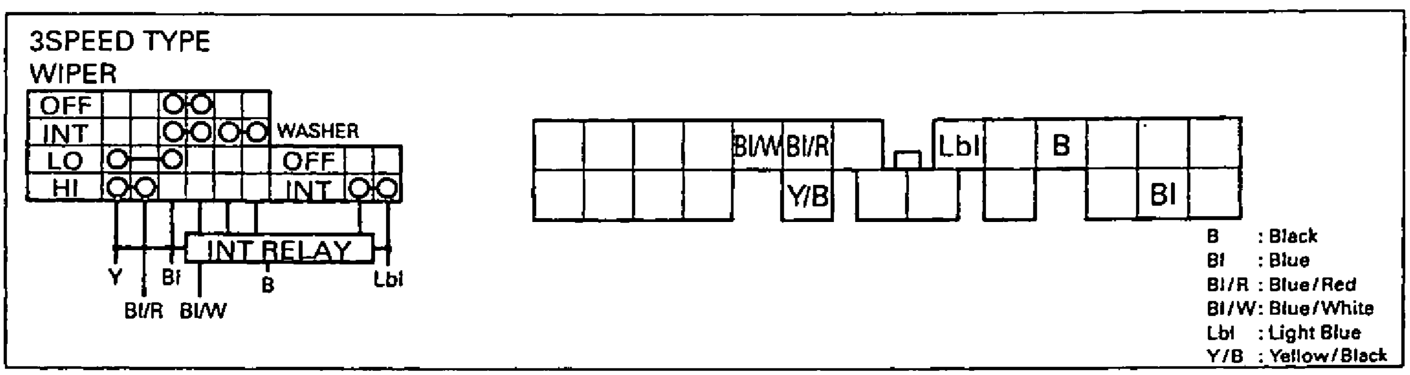


8-002

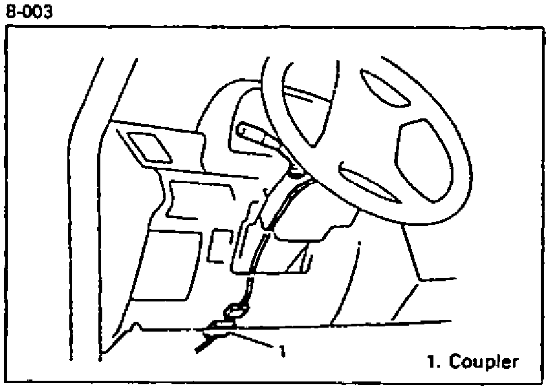
INSPECTION

A. Wiper/washer Switch

Use a circuit tester to check switch for each terminal-to-terminal continuity.



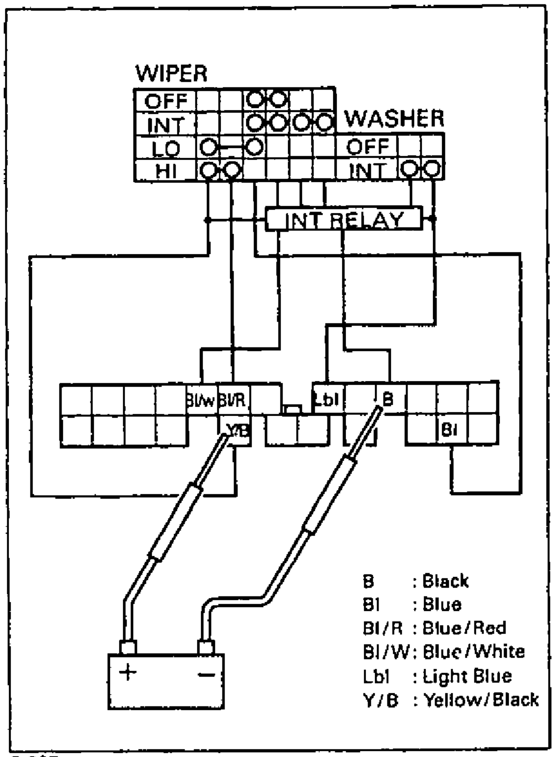
8-003



8-004

D. Intermittent Wiper Relay Circuit (If equipped)

1) Disconnect wiper & washer switch coupler.



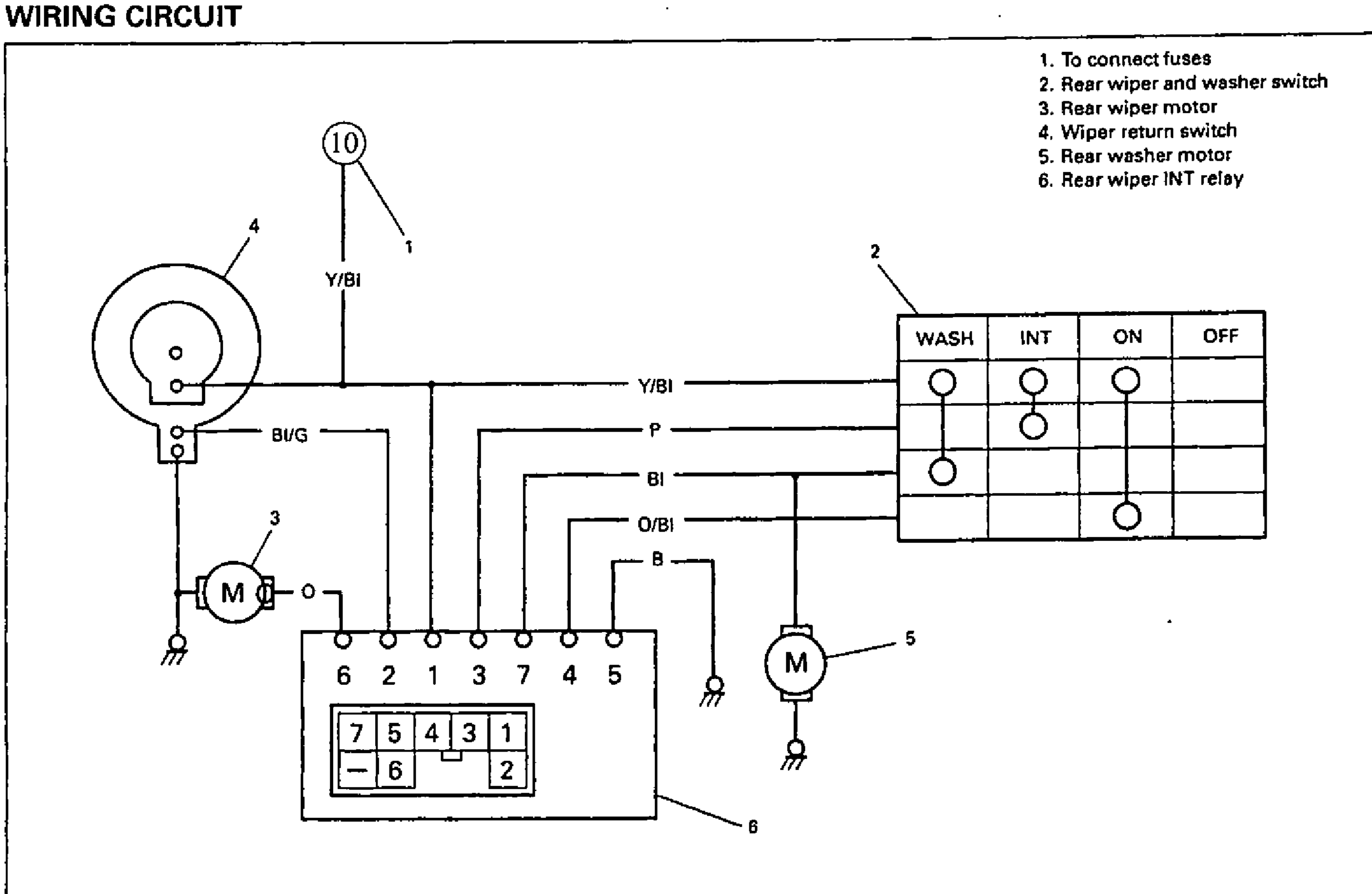
8-005

2) Turn wiper switch to "INT" position.
3) Connect (+) cord and (−) cord of 12 V battery to coupler terminals as shown left. If an operating sound is heard from relay, it is at work properly.

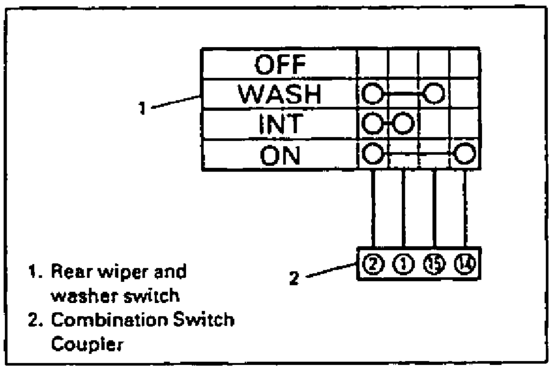
REAR WINDOW WIPER AND WASHER

The rear window wiper is of the one-speed type, and its washer is equipped with a separate-type washer pump.

WIRING CIRCUIT



8-006



8-007

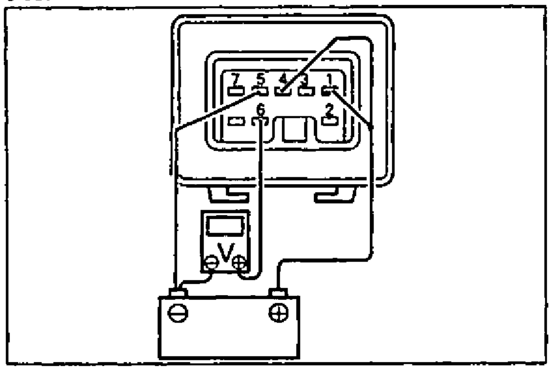
INSPECTION

A. Wiper And Washer switches

Use a circuit tester to check switches for continuity.

COUPLER

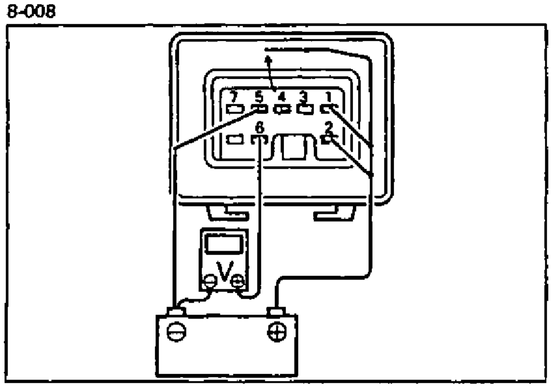
P	B	Y/Bl	Bl/B	Bl/W	Bl/R	Y		Lbl	R	B	G/Y	G	R/W
O	Bl	G/R	W		Y/B	W/B	R		W/G		G	Bl	R/B



8-008

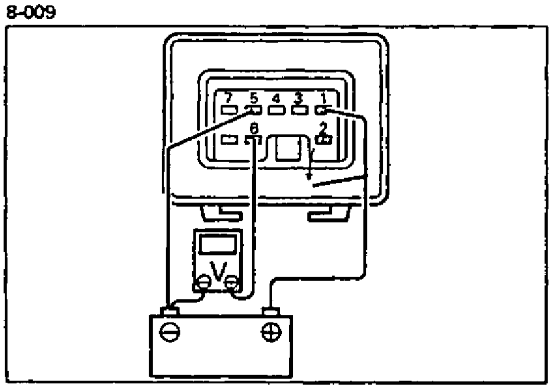
D. Rear Wiper Intermittent Relay ON circuit.

1) Connect positive terminal of battery to terminals ① and ④ of controller, negative terminal to terminal ⑤ of controller and check voltage between terminals ⑥ and ⑤ of controller.
   If measured voltage is battery voltage, controller is in good condition.
   If not, replace controller.



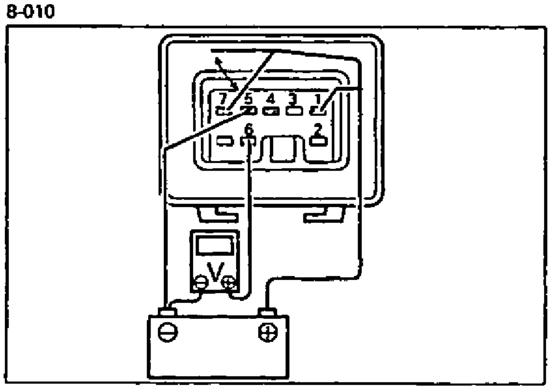
8-009

2) Connect positive terminal of battery to terminal ② of controller, then disconnect positive terminal from terminal ④ of controller and check voltage between terminals ⑥ and ⑤ of controller.
   If measured voltage is battery voltage, controller is in good condition.
   If not, replace controller.



8-010

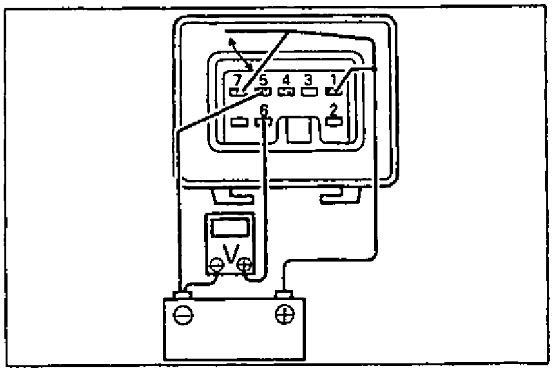
3) Disconnect positive terminal from terminal ② of controller and check voltage between terminals ⑥ and ⑤ of controller.
   If measured voltage is about 0V, controller is in good condition.
   If not replace controller.



8-011

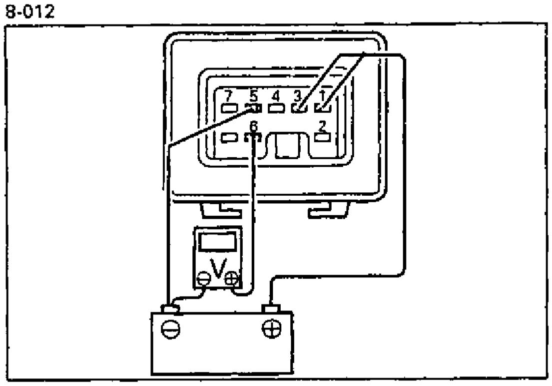
WASH circuit

1) Connect positive terminal of battery to terminal ① of controller and negative terminal to terminal ⑤ of controller. Then connect positive terminal to terminal ⑦ checking voltage between terminals ⑥ and ⑤ of controller.
   If measured voltage changes from about 0V to battery voltage in 0.6 to 1.5 seconds after connecting positive terminal to terminal ⑦, controller is in good condition. If not, replace controller.



8-012

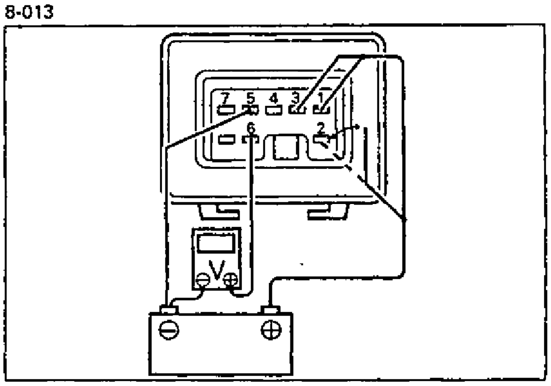
2) Disconnect positive terminal from terminal ⑦ checking voltage between terminal ⑥ and ⑤ of controller.
If measured voltage changes from battery voltage to about 0V 2.7 to 4.6 seconds after disconnecting positive terminal from terminal ⑦, controller is in good condition.
If not replace controller.



8-013

INT circuit

1) Connect positive terminal of battery to terminals ① of controller and negative terminal to terminal ⑤ of controller. Then positive terminal to terminal ③ of controller checking voltage between terminals ⑥ and ⑤ of controller.
If measured voltage changes from about 0V to battery voltage when connecting positive terminal to terminal ③, controller is in good condition.
If not replace controller.

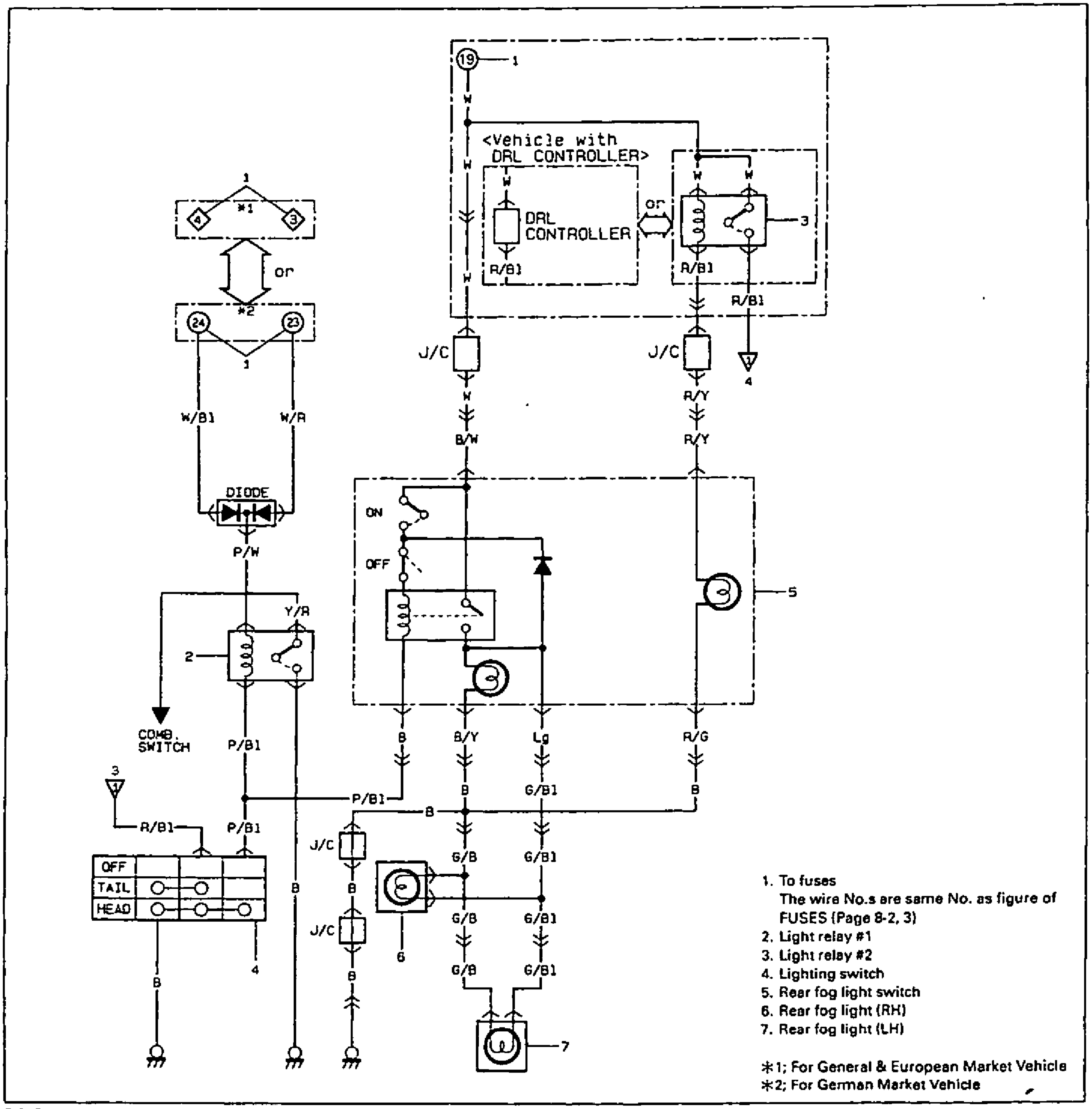


8-014

2) Connect positive terminal of battery to terminal ② of controller, then disconnect positive terminal from terminal ② of controller checking voltage between terminals ⑥ and ⑤ of controller.
If measured voltage changes from battery voltage to about 0V when disconnecting positive terminal from terminal ② and about 0V to battery voltage 8 ± 2 seconds after disconnecting positive terminal from terminal ②, controller is in good condition.
If not replace controller.

REAR FOG LIGHT (If equipped)

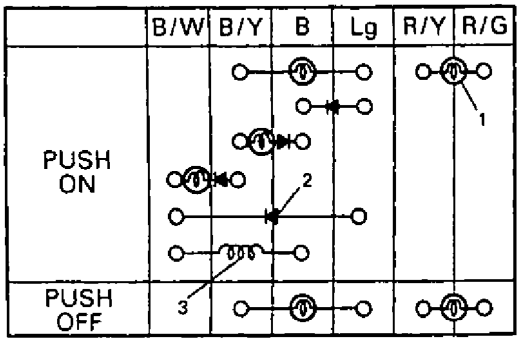
WIRING CIRCUIT



8-015

TROUBLE DIAGNOSIS

Trouble	Possible Cause	Correction
Lights do not light.	• Main fuse and/or fuses blown	Replace main fuse and/or fuses to check for short.
	• Light relay faulty	Replace light relay
	• Lighting switch faulty	Check switch.
	• Wiring or grounding faulty	Repair as necessary.



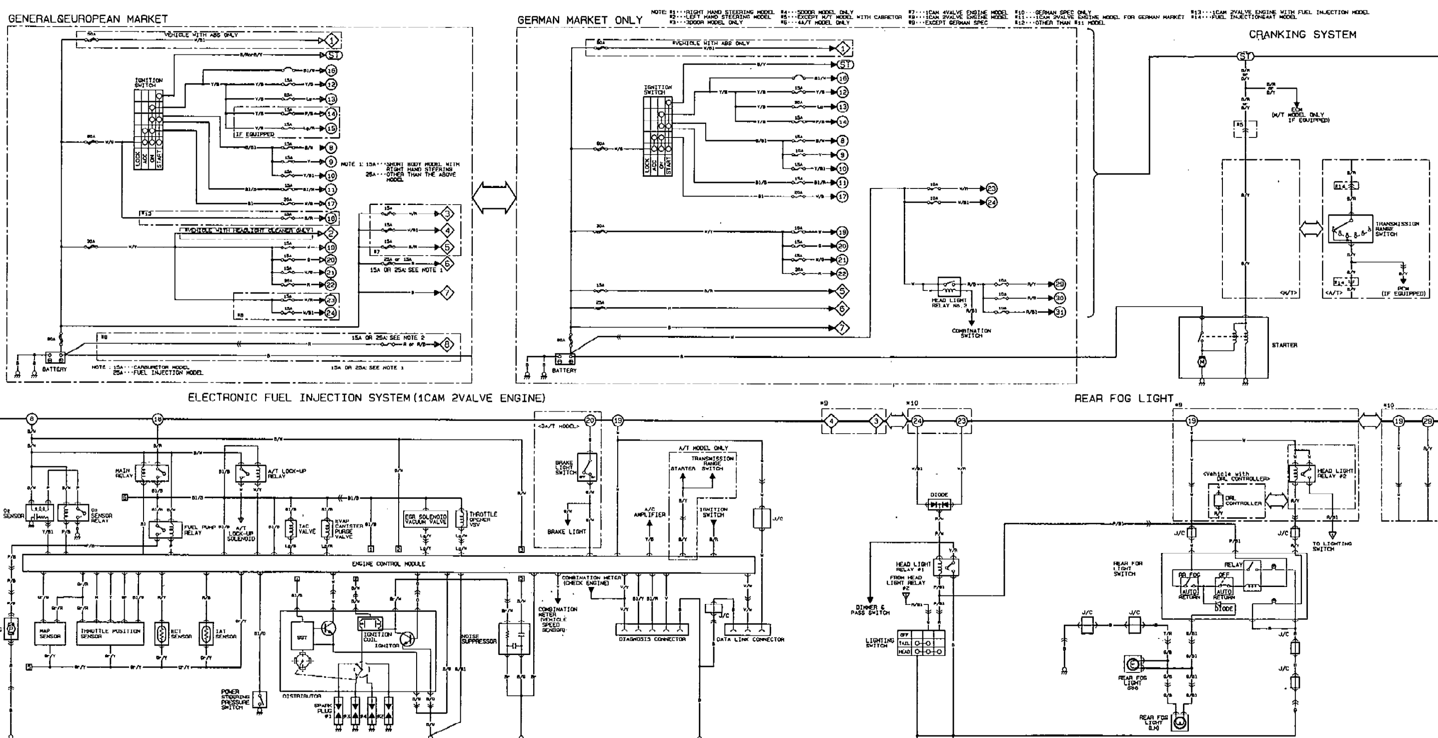
1. Rear fog light switch illumination lamp
2. Diode
3. Coil (in relay)

8-016

INSPECTION

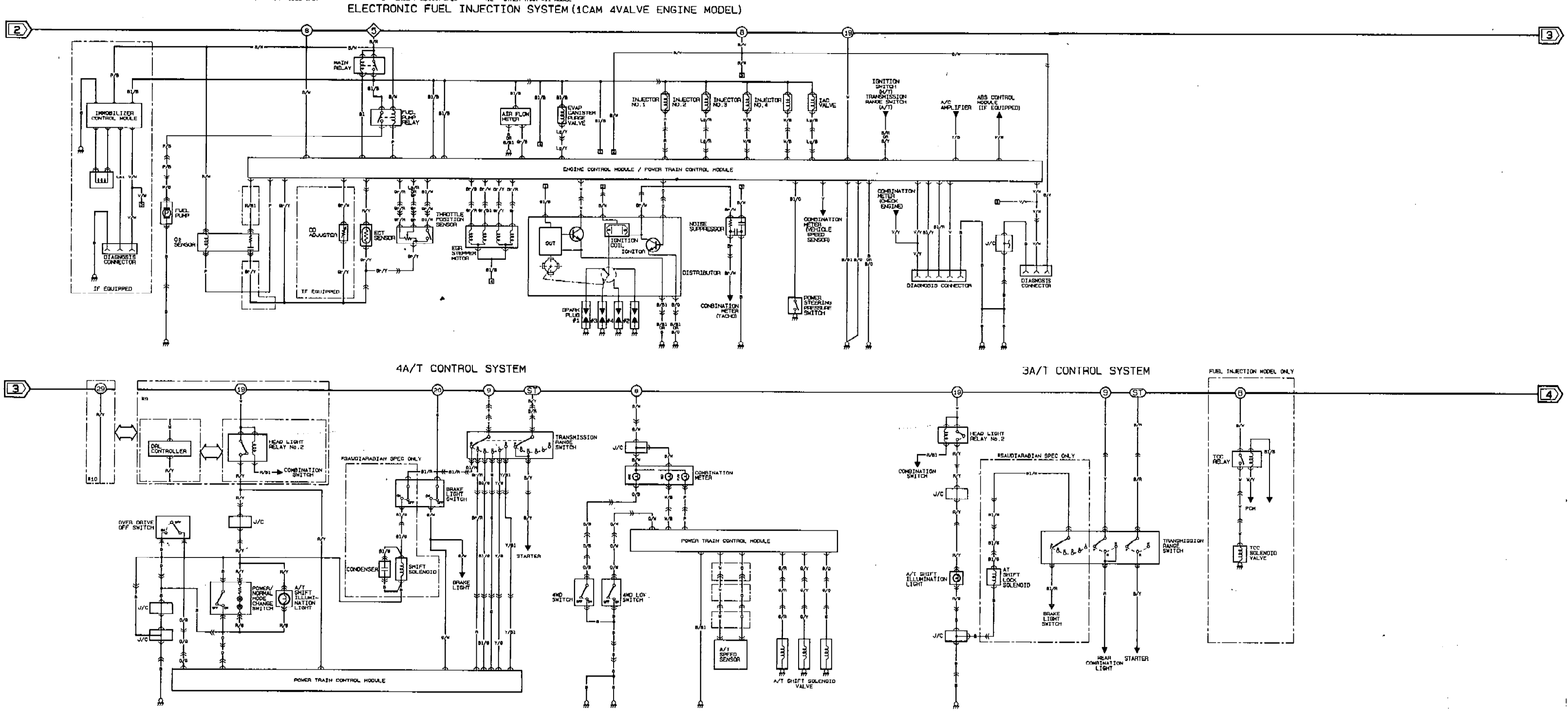
Use a circuit tester to check rear fog light switch for continuity. Hold the switch button (ON or OFF) pushed during checking switch according to left figure.

WIRING DIAGRAM



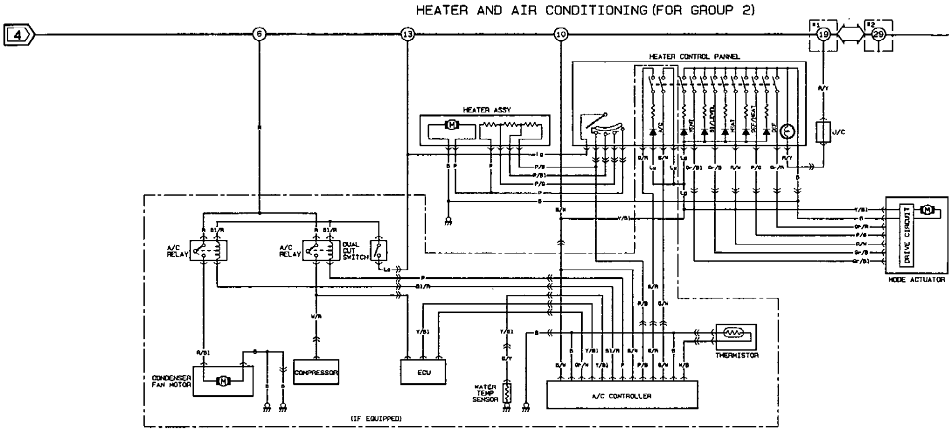
NOTE: *1···RIGHT HAND STEERING MODEL *2···LEFT HAND STEERING MODEL *3···3DOOR MODEL ONLY *4···5DOOR MODEL ONLY *5···EXCEPT M/T MODEL WITH CABRETOR *6···4A/T MODEL ONLY *7···1CAM 4VALVE ENGINE MODEL *8···1CAM 2VALVE ENGINE MODEL *9···EXCEPT GERMAN SPEC *10···GERMAN SPEC ONLY *11···1CAM 2VALVE ENGINE MODEL FOR GERMAN MARKET *12···OTHER THAN *11 MODEL *13···1CAM 2VALVE ENGINE WITH FUEL INJECTION MODEL *14···FUEL INJECTION&4AT MODEL

ELECTRONIC FUEL INJECTION SYSTEM (1CAM 4VALVE ENGINE MODEL)

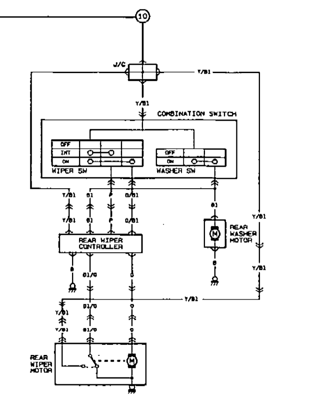


NOTE: *1···RIGHT HAND STEERING MODEL *2···LEFT HAND STEERING MODEL *3···3DOOR MODEL ONLY *4···5DOOR MODEL ONLY *5···EXCEPT M/T MODEL WITH CABRETOR *6···4A/T MODEL ONLY *7···1CAM 4VALVE ENGINE MODEL *8···1CAM 2VALVE ENGINE MODEL *9···EXCEPT GERMAN SPEC *10···GERMAN SPEC ONLY *11···1CAM 2VALVE ENGINE MODEL FOR GERMAN MARKET *12···OTHER THAN *11 MODEL *13···1CAM 2VALVE ENGINE WITH FUEL INJECTION MODEL *14···FUEL INJECTION&4AT MODEL

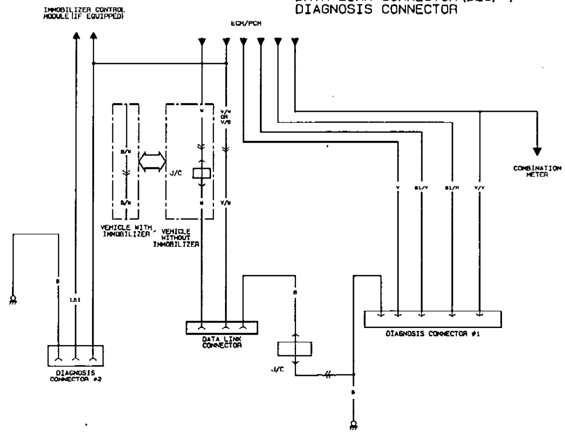
HEATER AND AIR CONDITIONING (FOR GROUP 2)



REAR WIPER AND WASHER<IF EQUIPPED> (FOR GROUP 2)



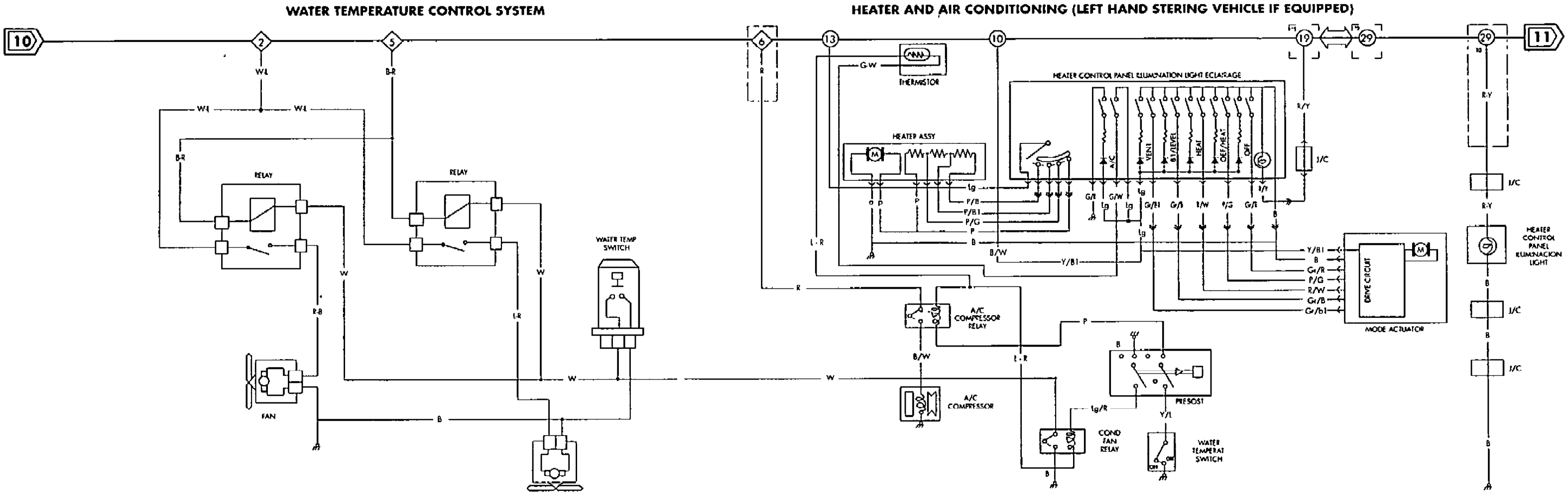
DATA LINK CONNECTOR (DLC) / DIAGNOSIS CONNECTOR



SUZUKI VITARA 1.9
T. DIESEL

WATER TEMPERATURE CONTROL SYSTEM

HEATER AND AIR CONDITIONING (LEFT HAND STERING VEHICLE IF EQUIPPED)



Editado por

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Dpto. de Servicios
Atención al Cliente

Noviembre, 1997

SANTANA MOTOR, S.A.

Impreso en España

SUZUKI

VITARA

SUPPLEMENTARY SERVICE MANUAL

USE THIS MANUAL IN ADDITION TO THOSE INDICATED IN THE PREFACE OF THIS PUBLICATION

SUZUKI
Caring for Customers
SANTANA MOTOR, S.A.
00000A01384-01E

FOREWORD

This SUPPLEMENTARY SERVICE MANUAL is a supplement to VITARA (SE416) series SERVICE MANUALs (SERVICE MANUAL 99500-60A10, SUPPLEMENTARY SERVICE MANUALs 99501-60A70, 99501-61A10 and 99501-61A40 or 00000A01271S) and has been prepared exclusively for the applicable model below.

Applicable model:

- VITARA (SE416) with the following VINs and onwards.
  VSEETV02VNA209752
  VSEETV02CNA206478
  VSEETW01VNA207794

Therefore, whenever servicing these models, consult this supplement first.
And for any section, item or description not found in this supplement, refer to the SERVICE MANUALs and SUPPLEMENTARY SERVICE MANUALs mentioned in next page.

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

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

SUZUKI MOTOR CORPORATION

OVERSEAS SERVICE DEPARTMENT

RELATED SERVICE MANUAL

Service manuals listed below are in the chronological order with the latest one at the top.
For efficient use of manuals, start with the 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.

SERVICE MANUAL RELATED TO THIS MANUAL	APPLICABILITY
VITARA (SE416) SUPPLEMENTARY SERVICE MANUAL (99501-61A40-01E OR 00000A01271S)	Refer to the "FOREWORD" of each supplementary service manual.
VITARA (SE416) SUPPLEMENTARY SERVICE MANUAL (99501-61A10-01E)	
VITARA (SE416) SUPPLEMENTARY SERVICE MANUAL (99501-60A70-01E)	
VITARA (SE416) SERVICE MANUAL (99500-60A10-01E)	This manual is the base manual for the above manuals.

0A

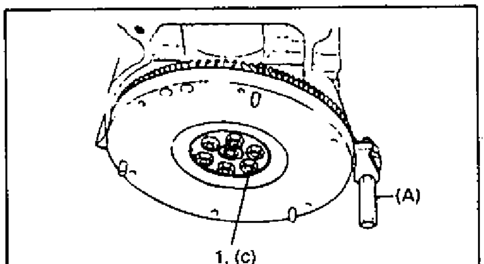
SECTION 0A

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 TORQUE SPECIFICATION are given as shown in figure below.

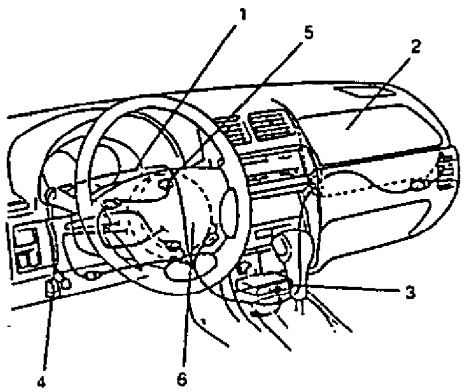


1. Flywheel bolts or drive plate bolts for A/T vehicle

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

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

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



1. Air bag wire harness
2. Passenger air bag (inflator) module
3. SDM
4. "AIR BAG" fuse box
5. Contact coil
6. Driver air bag (inflator) module

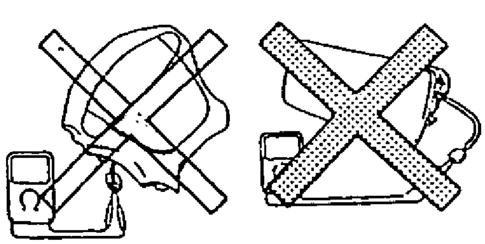
PRECAUTIONS

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

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

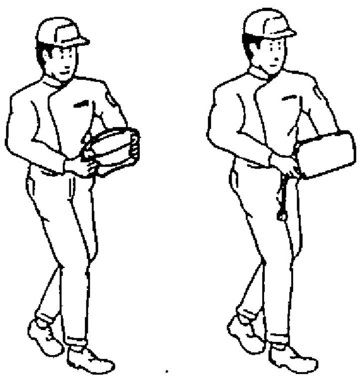
DIAGNOSIS

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

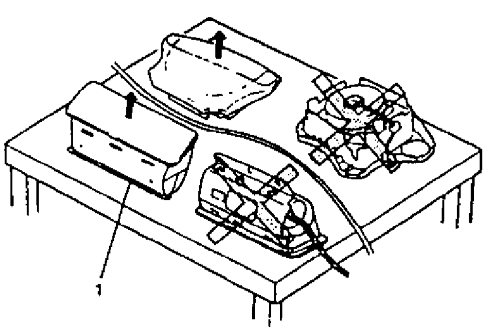


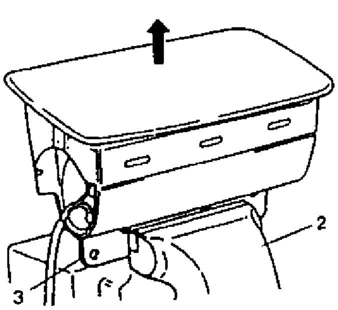
WARNING:
Never attempt to measure the resistance of the air bag (Inflator) modules (driver and passenger) and seat belt pretensioners (driver and passenger). It is very dangerous as the electric current from the tester may deploy the air bag or activate the pretensioner.

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



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





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

SERVICING AND HANDLING

WARNING:

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

Driver and Passenger Air Bag (Inflator) Modules

- **For handling and storage of a live air bag (inflator) module, select a place where the ambient temperature below 65°C (150°F), without high humidity and away from electric noise.**
- **When carrying a live air bag (inflator) module, make sure the bag opening is pointed away from you. In case of an accidental deployment, the bag will then deploy with minimal chance of injury. Never carry the air bag (inflator) module by the wires or connector on the underside of the module. When placing a live air bag (inflator) module on a bench or other surface, always face the bag up, away from the surface. As the live passenger air bag (inflator) module must be placed with its bag (trim cover) facing up, place it on the workbench with a slit or use the workbench vise to hold it securely at its lower mounting bracket. This is necessary so that a free space is provided to allow the air bag to expand in the unlikely event of accidental deployment. Otherwise, personal injury may result.**
- **Never dispose of live (undeployed) air bag (inflator) modules (driver and passenger). If disposal is necessary, be sure to deploy them according to deployment procedures described in "Air Bag System" section 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:

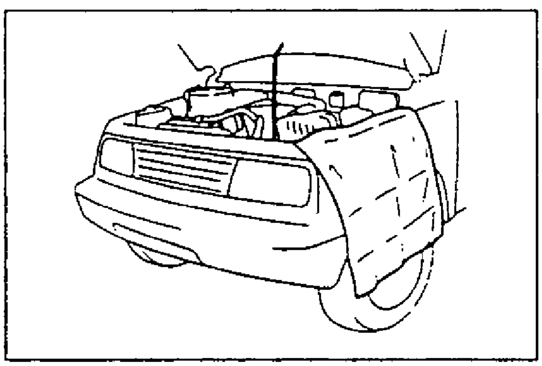
- Even when the accident was light enough not to cause air bags to activate, be sure to inspect system parts and other related parts according to instructions under "Repair and Inspection Required after an Accident" in "Air Bag System" section.
- When servicing parts other than air bag system, if shocks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

GENERAL PRECAUTIONS

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

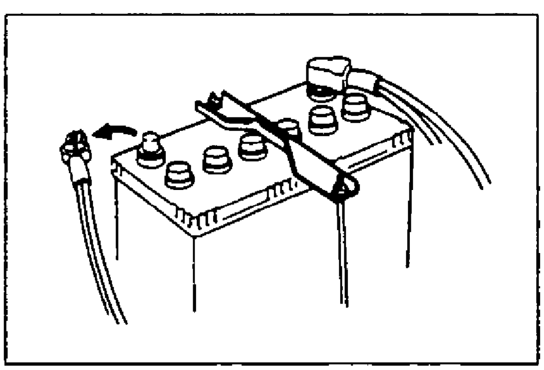
WARNING:

- **Whenever raising a vehicle for service, be sure to follow the instructions under "VEHICLE LIFTING POINTS" on SECTION 0A.**
- **When it is necessary to do service work with the engine running, make sure that the parking brake is set fully and the transmission is in Neutral (for manual transmission vehicles) or Park (for automatic transmission vehicles), Keep hands, hair, clothing, tools, etc. away from the fan and belts when the engine is running.**
- **When it is necessary to run the engine indoors, make sure that the exhaust gas is forced outdoors.**
- **Do not perform service work in areas where combustible materials can come in contact with a hot exhaust system. When working with toxic or flammable materials (such as gasoline and refrigerant), make sure that the area you work in is well-ventilated.**
- **To avoid getting burned, keep away from hot metal parts such as the radiator, exhaust manifold, tail-pipe, muffler, etc.**
- **New and used engine oil can be hazardous. Children and pets may be harmed by swallowing new or used oil. Keep new and used oil and used engine oil filters away from children and pets. Continuous contact with used engine oil has been found to cause [skin] cancer in laboratory animals. Brief contact with used oil may irritate skin. To minimize your exposure to used engine oil, wear a long-sleeve shirt and moisture-proof gloves (such as dishwashing gloves) when changing engine oil. If engine oil contacts your skin, wash thoroughly with soap and water. Launder any clothing or rags if wet with oil, recycle or properly dispose of used oil and filters.**
- **Make sure the bonnet is fully closed and latched before driving. If it is not, it can fly up unexpectedly during driving, obstructing your view and resulting in an accident.**

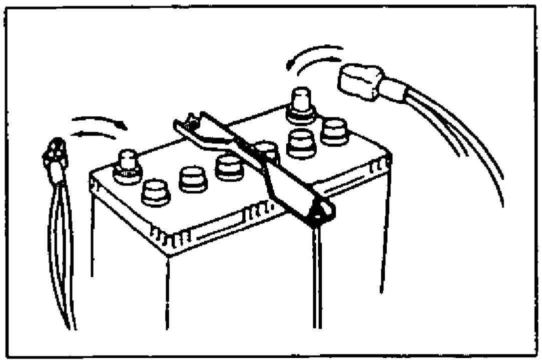


CAUTION:

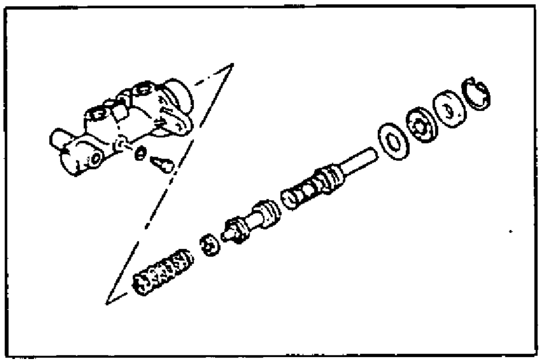
- **Before starting any service work, cover fenders, seats and any other parts that are likely to get scratched or stained during servicing. Also, be aware that what you wear (e.g., buttons) may cause damage to the vehicle's finish.**



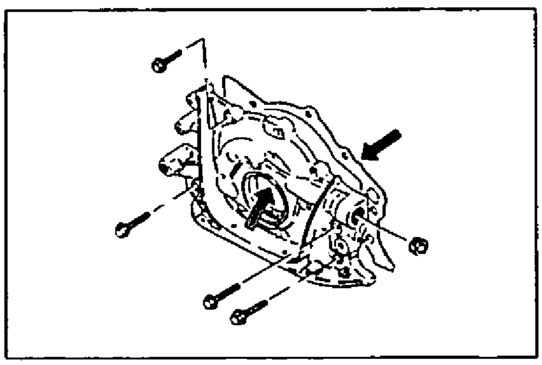
- **When performing service to electrical parts that does not require use of battery power, disconnect the negative cable of the battery.**



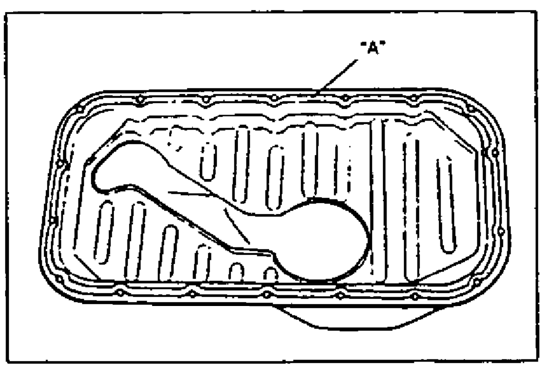
- When removing the battery, be sure to disconnect the negative cable first and then the positive cable. When reconnecting the battery, connect the positive cable first and then the negative cable, and replace the terminal cover.



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

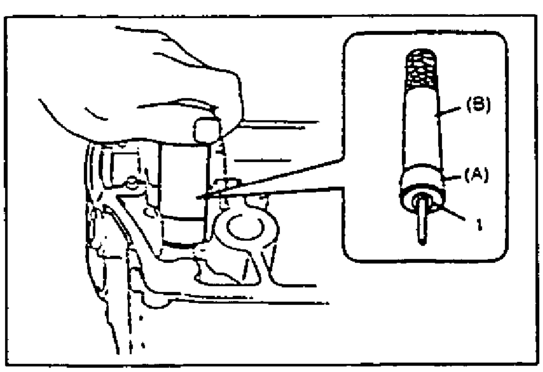


- Whenever you use oil seals, gaskets, packing, O-rings, locking washers, split pins, self-locking nuts, and certain other parts as specified, be sure to use new ones. Also, before installing new gaskets, packing, etc., be sure to remove any residual material from the mating surfaces.



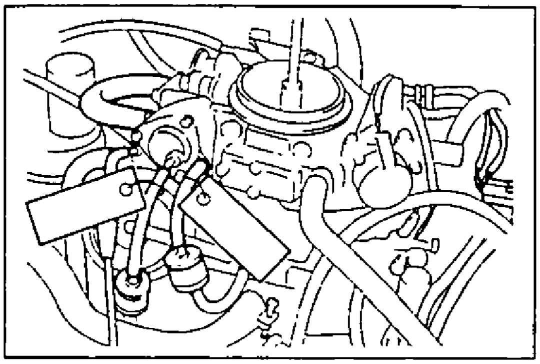
- Make sure that all parts used in reassembly are perfectly clean.
- When use of a certain type of lubricant, bond or sealant is specified, be sure to use the specified type.

"A": Sealant 99000-31150

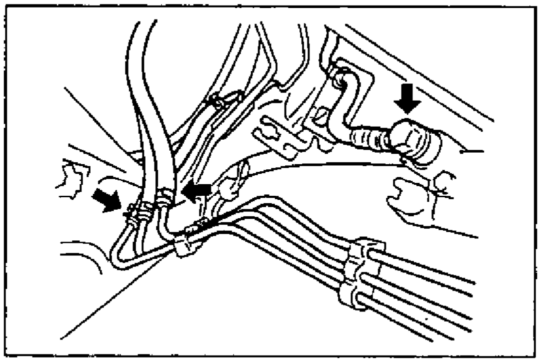


- Be sure to use special tools when instructed.

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



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



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

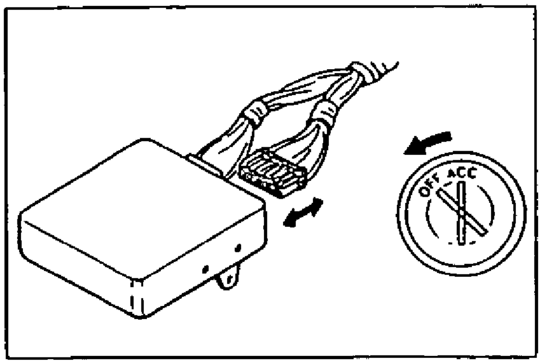
- For vehicles equipped with fuel injection systems, never disconnect the fuel line between the fuel pump and injector without first releasing the fuel pressure, or fuel can be sprayed out under pressure.

PRECAUTIONS FOR CATALYTIC CONVERTER

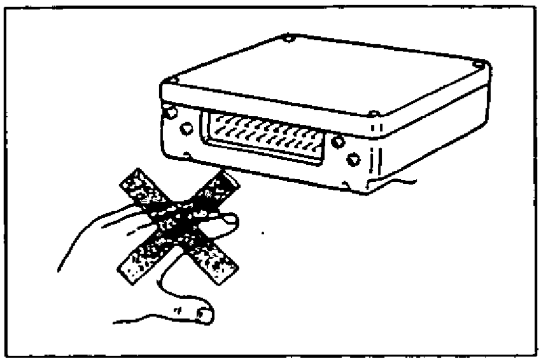
For vehicles equipped with a catalytic converter, use only unleaded gasoline and be careful not to let a large amount of unburned gasoline enter the converter or it can be damaged.

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

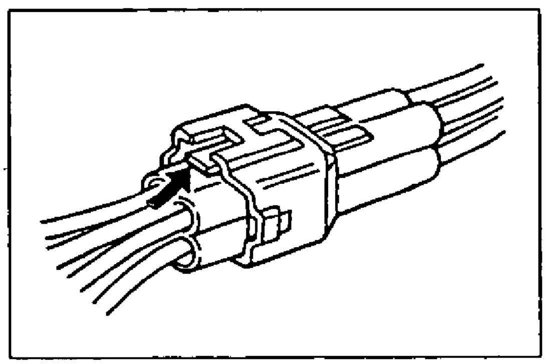
PRECAUTIONS FOR ELECTRICAL CIRCUIT SERVICE



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

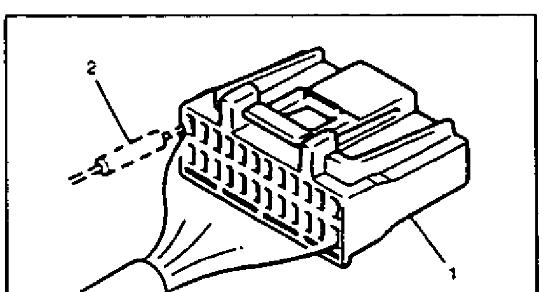


- Be careful not to touch the electrical terminals of parts which use microcomputers (e.g. electronic control unit like as ECM, PCM, P/S controller, etc.). The static electricity from your body can damage these parts.



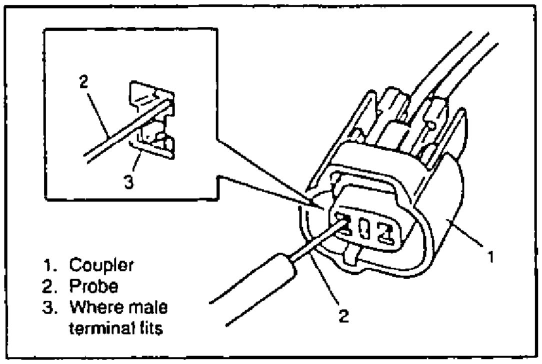
- When disconnecting couplers, don't pull wire harness but make sure to hold coupler itself. With lock type coupler, be sure to unlock before disconnection. Attempt to disconnect coupler without unlocking may result in damage to coupler. When connecting lock type coupler, insert it till clicking sound is heard and connect it securely.

- 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.



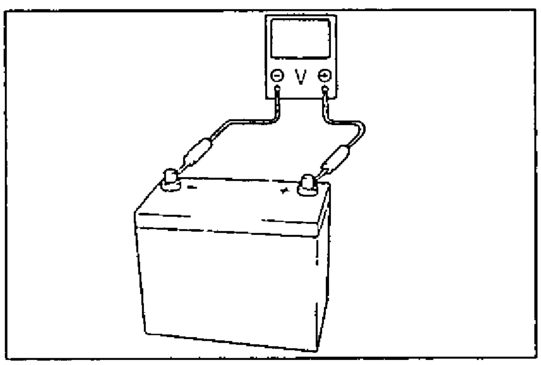
1. Coupler
2. Probe

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



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

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



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

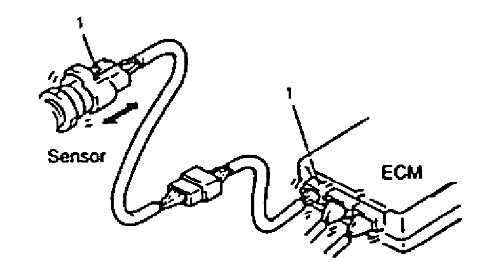
ELECTRICAL CIRCUIT INSPECTION PROCEDURE

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

OPEN CIRCUIT CHECK

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

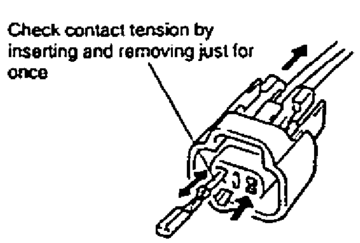
- Loose connection of connector
- Poor contact of terminal (due to dirt, corrosion or rust on it, poor contact tension, entry of foreign object etc.)
- Wire harness being open



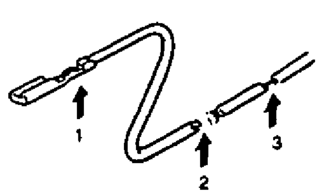
1. Check for loose connection

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

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

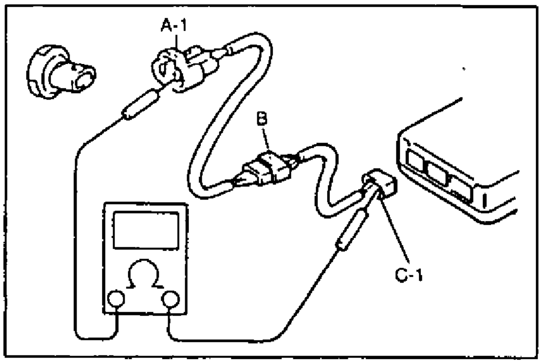


3) Using a test male terminal, check both terminals of the circuit being checked for contact tension of its female terminal.
   Check each terminal visually for poor contact (possibly caused by dirt, corrosion, rust entry of foreign object, etc.).
   At the same time, check to make sure that each terminal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



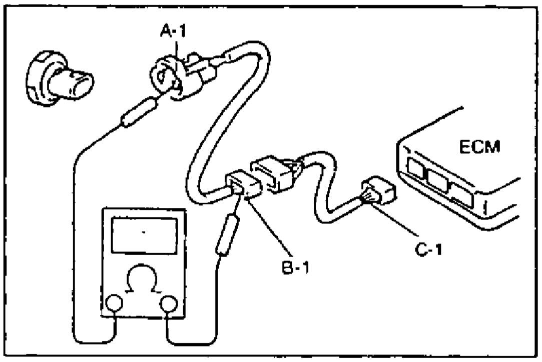
1. Looseness of crimping
2. Open
3. Thin wire (Single strand of wire)

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

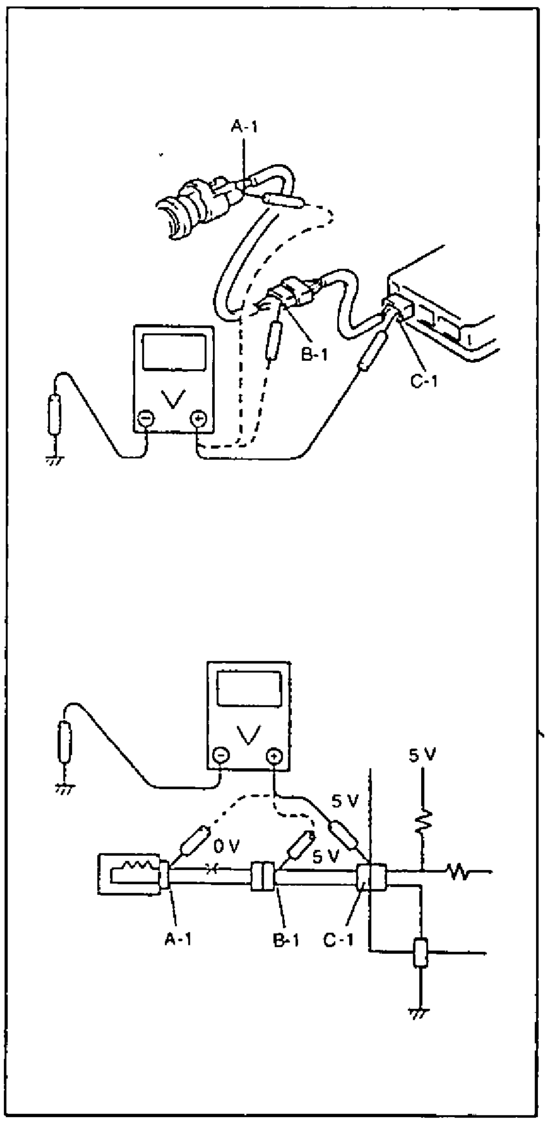


Continuity check

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



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



Voltage check

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

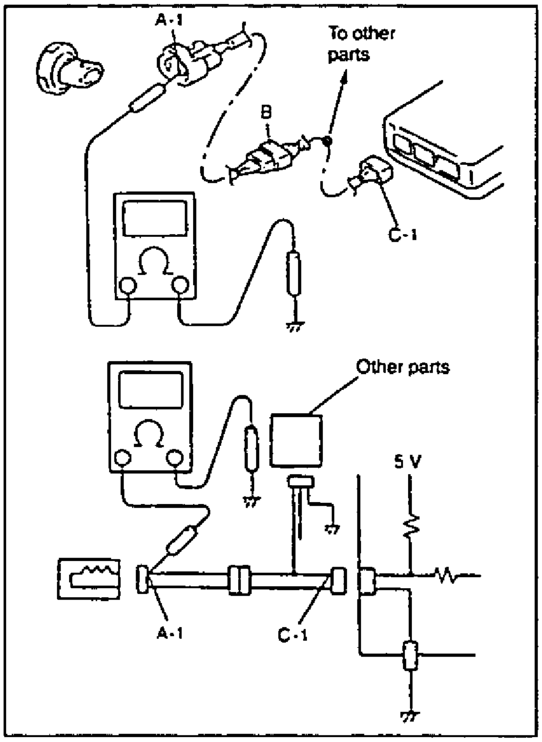
1) With all connectors connected and voltage applied to the circuit being checked, measure voltage between each terminal and body ground.

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

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

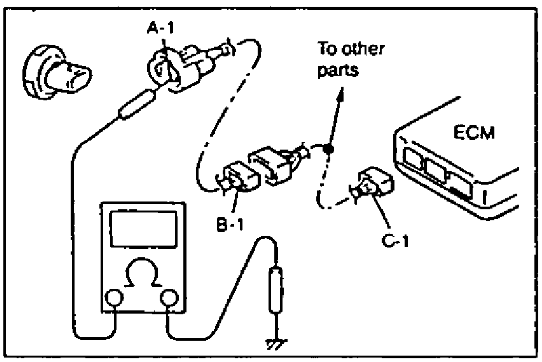


SHORT CIRCUIT CHECK (Wire harness to ground)

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

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

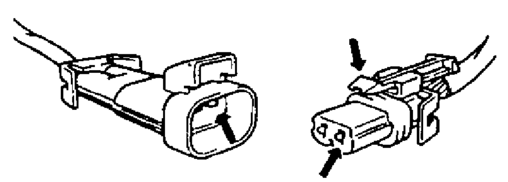
3) Measure resistance between terminal at one end of circuit (A-1 terminal in figure) and body ground. If continuity is indicated, it means that there is a short to ground between terminals A-1 and C-1 of the circuit.



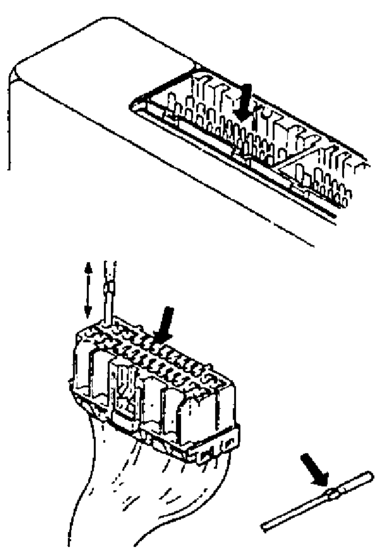
4) Disconnect the connector included in circuit (connector B) and measure resistance between A-1 and body ground.
   If continuity is indicated, it means that the circuit is shorted to the ground between terminals A-1 and B-1.

INTERMITTENT AND POOR CONNECTION

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

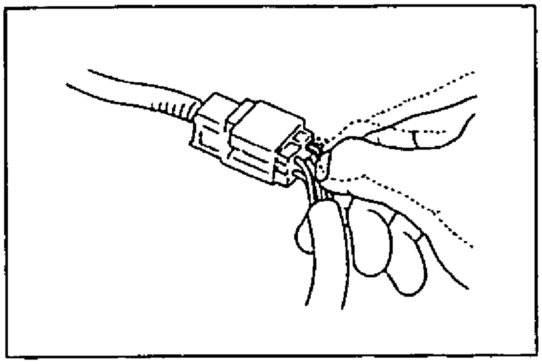


- Poor mating of connector halves, or terminals not fully seated in the connector body (backed out).
- Dirt or corrosion on the terminals. The terminals must be clean and free of any foreign material which could impede proper terminal contact.
  However, cleaning the terminal with a sand paper or the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

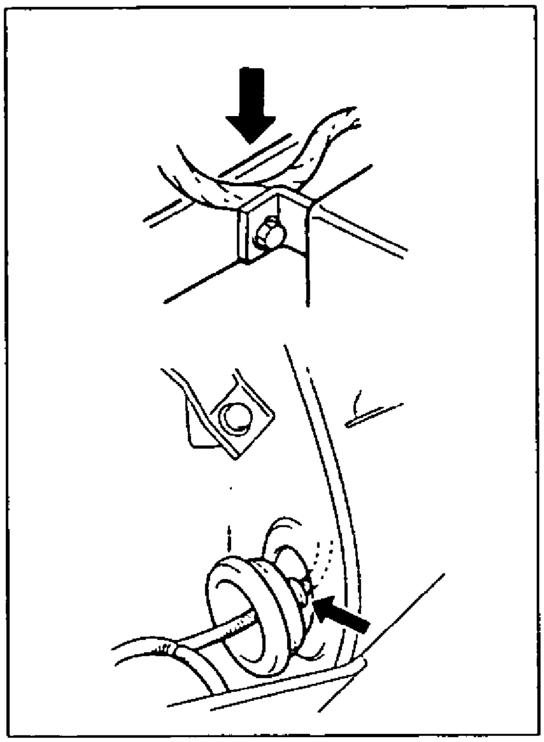


1. Check contact tension by inserting and removing just once.
2. Check each terminal for bend and proper alignment.

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



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

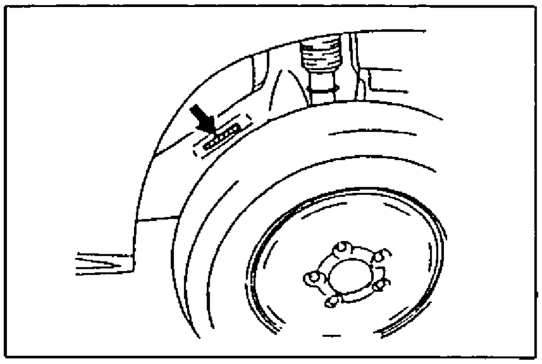


- Wire insulation which is rubbed through, causing an intermittent short as the bare area touches other wiring or parts of the vehicle.
- Wiring broken inside the insulation. This condition could cause continuity check to show a good circuit, but if only 1 or 2 strands of a multi-strand-type wire are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

PRECAUTION FOR INSTALLING MOBILE COMMUNICATION EQUIPMENT

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

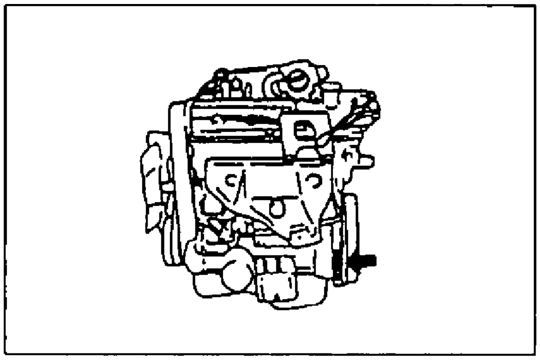
- Keep the antenna as far away as possible from the vehicle's electronic control unit.
- Keep the antenna feeder more than 20 cm (7.9 in.) away from electronic control unit and its wire harnesses.
- Do not run the antenna feeder parallel with other wire harnesses.
- Confirm that the antenna and feeder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



IDENTIFICATION INFORMATION

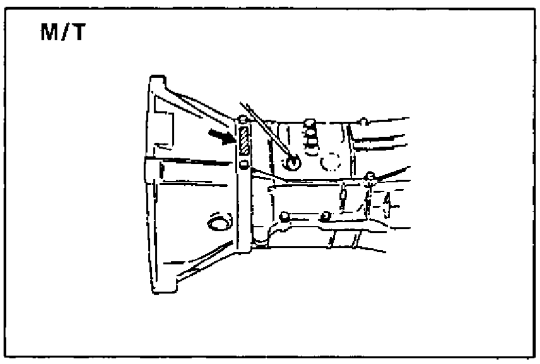
VEHICLE IDENTIFICATION NUMBER

The vehicle identification number is punched on the chassis inside the tire housing on the right front side.



ENGINE IDENTIFICATION NUMBER

The number is punched on the cylinder block.



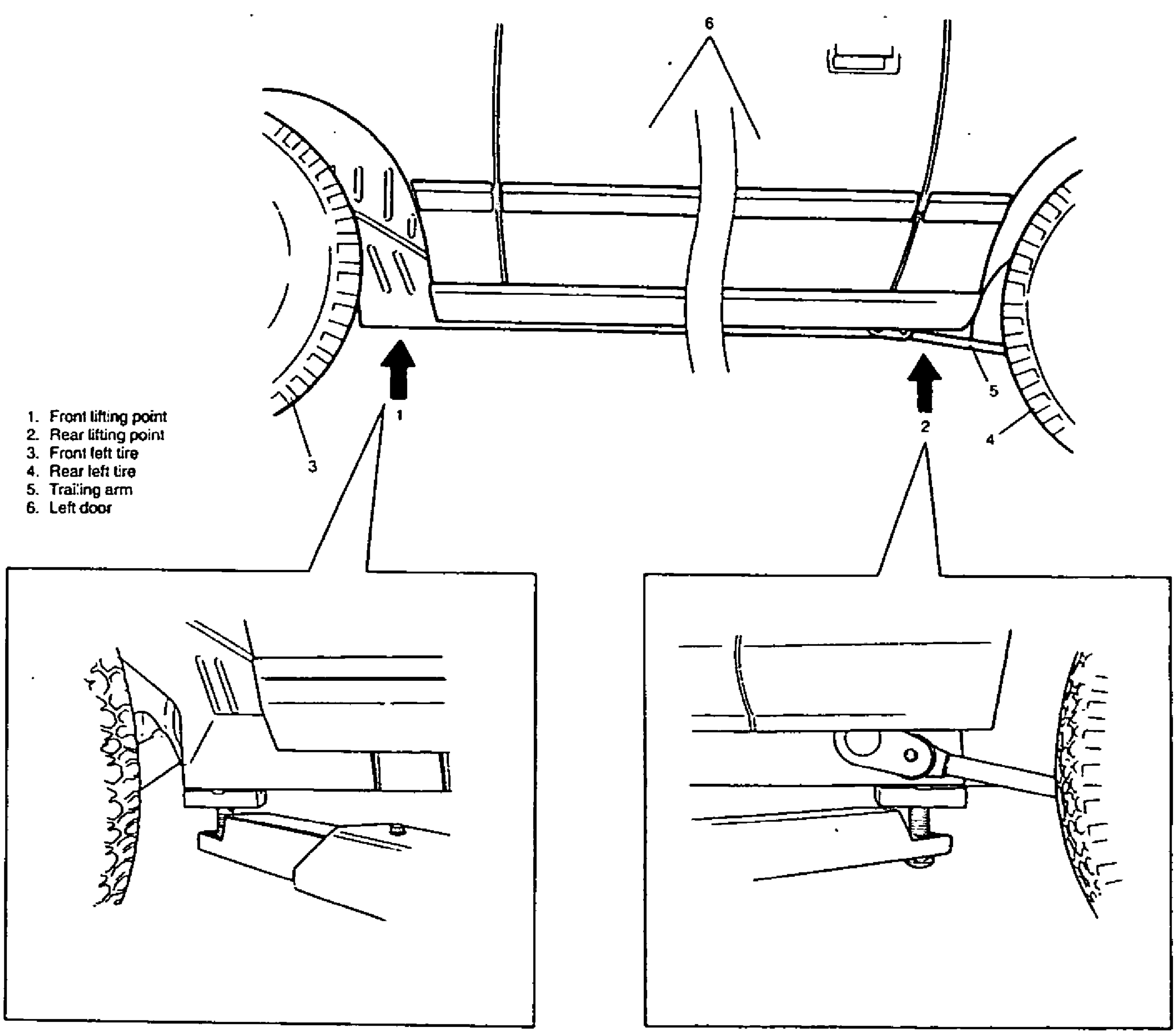
TRANSMISSION IDENTIFICATION NUMBER

The number is located on the transmission case.

VEHICLE LIFTING POINTS

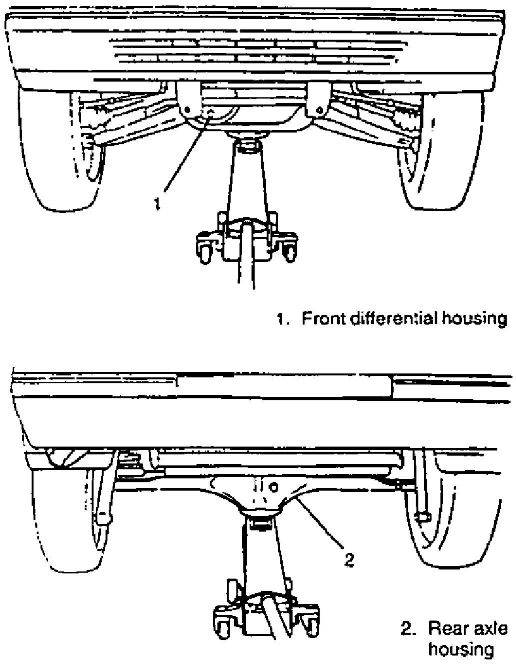
WARNING
- When using frame contact hoist, apply hoist as shown (right and left at the same position). Lift up the vehicle till 4 tires are a little off the ground and make sure that the vehicle will not fall off by trying to move vehicle body in both ways. Work can be started only after this confirmation.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

When using frame contact hoist:



1. Front lifting point
2. Rear lifting point
3. Front left tire
4. Rear left tire
5. Trailing arm
6. Left door

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 the front suspension frame or rear axle housing.

WARNING:

- **Never apply jack against suspension parts (i.e., stabilizer, etc.) or vehicle floor, or it may get deformed.**
- **If the vehicle to be jacked up only at the front or rear end, be sure to block the wheels on ground in order to ensure safety.**
  After the vehicle is jacked up, be sure to support it on stands. It is extremely dangerous to do any work on the vehicle raised on jack alone.

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

ABBREVIATIONS MAY BE USED IN THIS MANUAL

A

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

B

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

C

CKP Sensor : Crankshaft Position Sensor
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 ("CHECK ENGINE" Light)
M/T : Manual Transmission

N

NOx : Nitrogen Oxides

O

OBD : On-Board Diagnostic System (Self-Diagnosis Function)
O/D : Overdrive
OHC : Over Head Camshaft
O2S : Oxygen Sensor

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
TR Switch : Transmission Range Switch
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

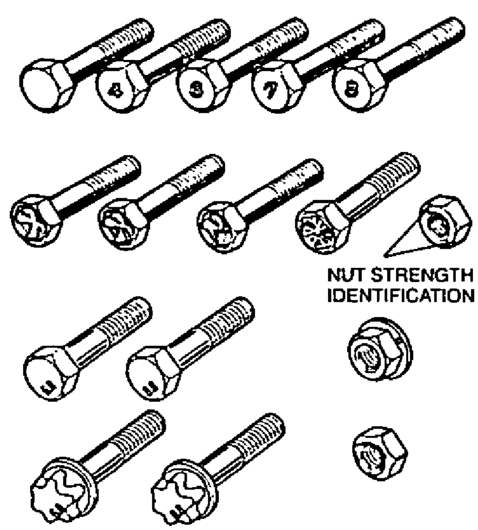
W

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

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.

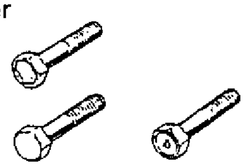
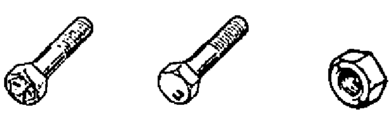
STANDARD TIGHTENING TORQUE

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  Self-lock nut	N·m	2.4	4.9	8.8	21	44	84	133	203	298
	kg-m	0.24	0.49	0.88	2.1	4.4	8.4	13.3	20.3	29.8
	lb-ft	2.0	3.5	6.5	15.5	32.0	61.0	96.5	147.0	215.5
A equivalent of 7T strength fastener 	N·m	2.3	4.5	10	23	50	85	135	210	240
	kg-m	0.23	0.45	1.0	2.3	5.0	8.5	13.5	21	24
	lb-ft	2.0	3.5	7.5	17.0	36.5	61.5	98.0	152.0	174.0
A equivalent of 8.8 strength fastener without flange 	N·m	3.1	6.3	11	27	56	105	168	258	373
	kg-m	0.31	0.63	1.1	2.7	5.6	10.5	16.8	25.8	37.3
	lb-ft	2.5	4.5	8.0	19.5	40.5	76.0	121.5	187.0	270.0
A equivalent of 8.8 strength fastener with flange 	N·m	3.2	6.5	12	29	59	113	175	270	395
	kg-m	0.32	0.65	1.2	2.9	5.9	11.3	17.5	27	39.5
	lb-ft	2.5	5.0	9.0	21.0	43.0	82.0	126.5	195.5	286.0

SECTION 0B

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

MAINTENANCE SCHEDULE UNDER NORMAL DRIVING CONDITIONS

Interval: This interval should be judged by odometer reading or months, whichever comes first.	This table includes services as scheduled up to 90,000 km (54,000 miles) mileage. Beyond 90,000 km (54,000 miles), carry out the same services at the same intervals respectively.						
	Km (x 1,000)	15	30	45	60	75	90
	Miles (x 1,000)	9	18	27	36	45	54
	Months	12	24	36	48	60	72
ENGINE							
1-1. Drive belt	V-rib belt (Flat type)	–	–	I	–	–	R
1-2. Camshaft timing belt		Replace every 100,000 km (60,000 miles).					
1-3. Valve lash (clearance)		–	I	–	I	–	I
1-4. Engine oil and oil filter	SG, SH, SJ	R	R	R	R	R	R
	SE, SF	Replace every 10,000 km (6,000 miles) or 8 months.					
1-5. Engine coolant		–	–	R	–	–	R
1-6. Exhaust system		–	I	–	I	–	I
IGNITION SYSTEM							
2-1. Spark plugs		–	–	R	–	–	R
2-2. Distributor cap and rotor		–	–	I	–	–	I
FUEL SYSTEM							
3-1. Air cleaner filter		I	I	R	I	I	R
3-2. Fuel lines and connections		–	I	–	I	–	I
3-3. Fuel filter		–	–	R	–	–	R
3-4. Fuel tank		–	–	I	–	–	I
EMISSION CONTROL SYSTEM							
4-1. PCV valve		–	–	–	–	–	I
4-2. Fuel evaporative emission control system		–	–	–	–	–	I

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

- **For Item 1-2 camshaft timing belt: This belt may be replaced every 90,000 km (54,000 miles) according to customer's maintenance convenience.**
- **For Sweden, item 2-1, 4-1 and 4-2 should be performed by odometer reading only.**
- **For Item 3-3 fuel filter, replace every 60,000 km if the local law requires.**

Interval: This interval should be judged by odometer reading or months, whichever comes first.	This table includes services as scheduled up to 90,000 km (54,000 miles) mileage. Beyond 90,000 km (54,000 miles), carry out the same services at the same intervals respectively.						
	Km (x 1,000)	15	30	45	60	75	90
	Miles (x 1,000)	9	18	27	36	45	54
	Months	12	24	36	48	60	72
CHASSIS AND BODY							
6-1. Clutch (pedal and fluid level)		–	I	–	I	–	I
6-2. Brake discs and pads (thickness, wear, damage)		I	I	I	I	I	I
Brake drums and shoes (wear, damage)		–	I	–	I	–	I
6-3. Brake hoses and pipes (leakage, damage, clamp)		–	I	–	I	–	I
6-4. Brake fluid		–	R	–	R	–	R
6-5. Brake lever and cable (damage, stroke, operation)		Inspect at first 15,000 km (9,000 miles) only					
6-6. Tires (wear, damage, rotation)		I	I	I	I	I	I
6-7. Wheel discs and free wheeling hubs (if equipped)		I	I	I	I	I	I
6-8. Suspension system (tightness, damage, rattle, breakage)		–	I	–	I	–	I
6-9. Propeller shafts and drive shafts		–	–	I	–	–	I
6-10. Manual transmission oil (leakage, level) (I: 1st 15,000 km only)		I	–	R	–	–	R
6-11. Automatic transmission (if equipped)	Fluid level	–	I	–	I	–	I
	Fluid change	Replace every 165,000 km (99,000 miles)					
	Fluid hose	–	–	–	R	–	–
6-12. Transfer oil		I	–	I	–	I	–
6-13. Differential oil (R: 1st 15,000 km only)		R or I	–	I	–	I	–
6-14. Steering system		–	I	–	I	–	I
6-15. Power steering (if equipped)		I	I	I	I	I	I
6-16. All latches, hinges and locks		–	I	–	I	–	I

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

MAINTENANCE RECOMMENDED UNDER SEVERE DRIVING CONDITIONS

If the vehicle is usually used under the conditions corresponding to any severe condition code given below, it is recommended that applicable maintenance operation be performed at the particular interval as given in the chart below.

Severe condition code

- **A – Repeated short trips**
- **B – Driving on rough and/or muddy roads**
- **C – Driving on dusty roads**
- **D – Driving in extremely cold weather and/or salted roads**
- **E – Repeated short trips in extremely cold weather**
- **F – ——————————**
- **G – ——————————**
- **H – Trailer towing (if admitted)**

Severe Condition Code	Maintenance	Maintenance Operation	Maintenance Interval
– B C D – – – –	ITEM 1-1 Drive belt (V-rib belt)	I	Every 15,000 km (9,000 miles) or 12 months
		R	Every 45,000 km (27,000 miles) or 36 months
A – C D E – – H	ITEM 1-4 Engine oil and oil filter	R	Every 5,000 km (3,000 miles) or 4 months
– B – – – – – –	ITEM 1-6 Exhaust pipe mountings	I	Every 15,000 km (9,000 miles) or 12 months
– – C – – – – –	ITEM 3-1 Air cleaner filter *1	I	Every 2,500 km (1,500 miles)
		R	Every 30,000 km (18,000 miles) or 24 months
A B C – E – – H	IMTE 2-1 Spark plugs	R	Every 10,000 km (6,000 miles) or 8 months
– B C D – – – H	ITEM 6-7 Wheel bearing	I	Every 15,000 km (9,000 miles) or 12 months
– B – – – – – –	ITEM 6-8 Suspension bolts and nuts	T	Every 15,000 km (9,000 miles) or 12 months
– B – D E – – H	ITEM 6-9 Propeller shafts and drive shafts	I	Every 15,000 km (9,000 miles) or 12 months
– B – – E – – H	ITEM 6-10, 6-12 and 6-13 Manual transmission, transfer and differential oil	R	Every 30,000 km (18,000 miles) or 24 months
– B – – E – – H	Automatic transmission fluid (if equipped)	R	Every 30,000 km (18,000 miles) or 24 months

NOTES:
"I": Inspect and correct, replace or lubricate if necessary
"T": Tighten to the specified torque
"R": Replace or change
• *1: Inspect or replace more frequently if necessary.

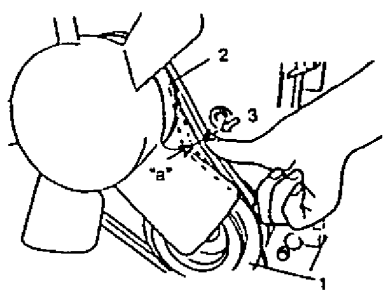
MAINTENANCE SERVICE

ENGINE

ITEM 1-1

Drive Belt Inspection and Replacement

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



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

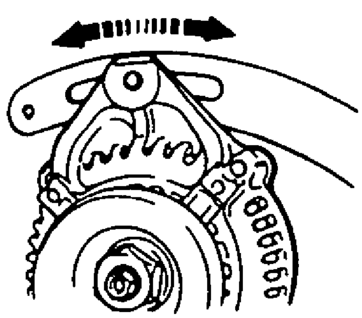
Water pump and generator drive belt

Inspection

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

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

   NOTE:
   When replacing belt with a new one, adjust belt tension to 5 – 6 mm (0.20 – 0.24 in.).

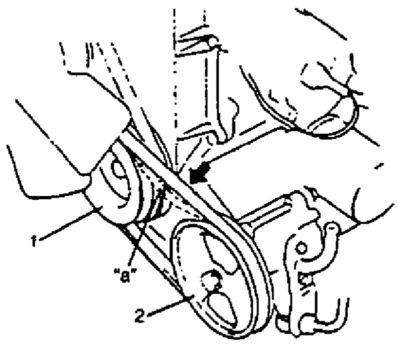


3) If belt is too tight or too loose, adjust it to specification by adjusting alternator position.
4) Tighten alternator adjusting bolt and pivot bolts.
5) Connect negative cable to battery.

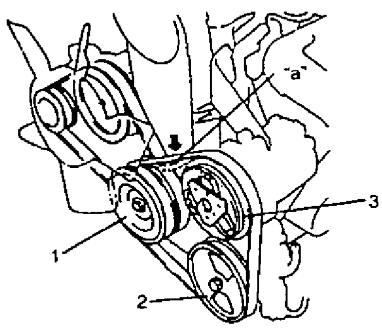
Replacement

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

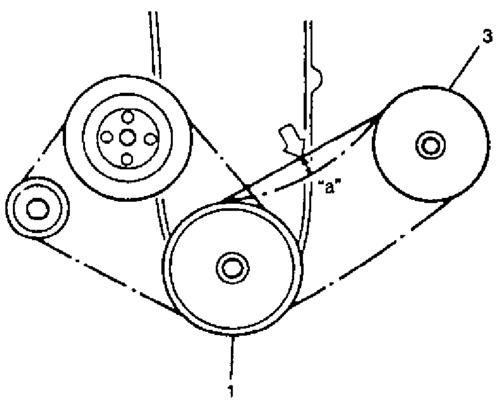
Vehicle with P/S



Vehicle with P/S and A/C



Vehicle with A/C



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

Power steering pump and/or A/C compressor drive belts (if equipped)

Inspection

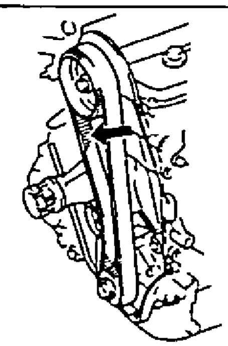
1) Disconnect negative cable at battery.
2) Inspect belt for cracks, cuts, deformation, wear and cleanliness. If any defect exists, replace.
   Check belt for tension.

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

   If belt tension is out of above specification, adjust it referring to "Power Steering System" or "Air Conditioning" section.
3) Connect negative cable to battery.

Replacement

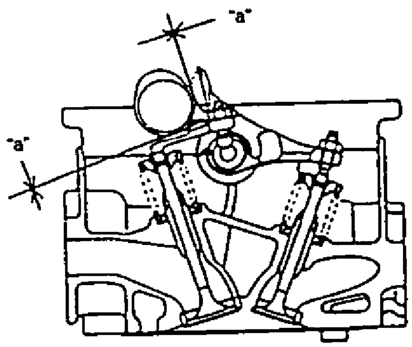
Replace belt referring to "Power Steering System" or "Air Conditioning" section for replacement procedure of belt.



ITEM 1-2

Camshaft Timing Belt Replacement

Replace timing belt referring to Section 6A1.



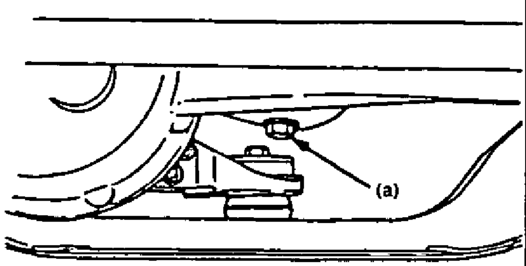
ITEM 1-3

Valve Lash Inspection (G16 engine only)

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

Valve lash (gap "a") 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.)

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



ITEM 1-4

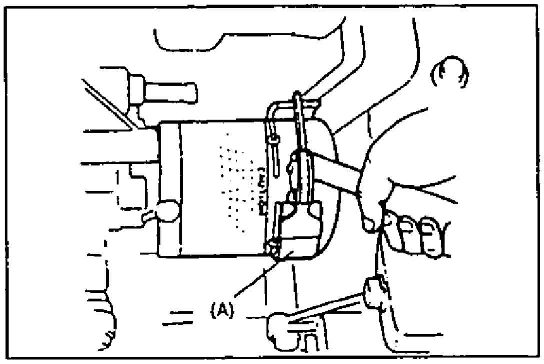
Engine Oil and Filter Change

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

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

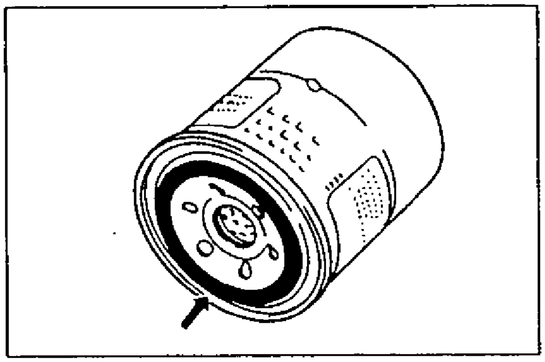
1) Drain engine oil by removing drain plug.
2) After draining oil, wipe drain plug clean. Reinstall drain plug, and tighten it securely as specified below.

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



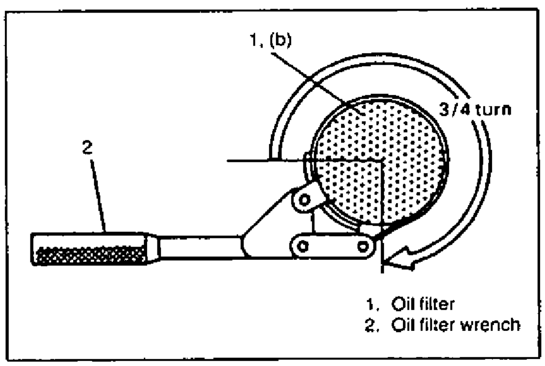
3) Loosen oil filter by using oil filter wrench (special tool).

Special Tool
(A): 09915-47330



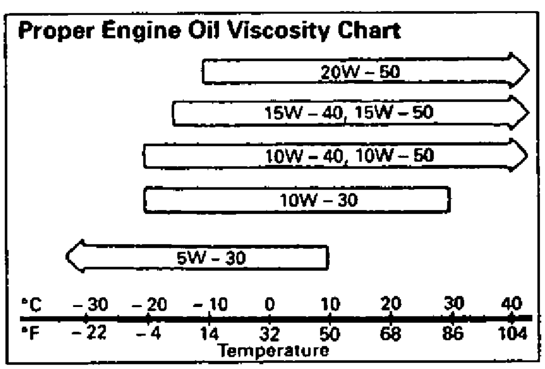
4) Apply engine oil to oil filter O-ring. Screw new filter on oil filter stand by hand until the filter O-ring contacts the mounting surface.

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



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

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



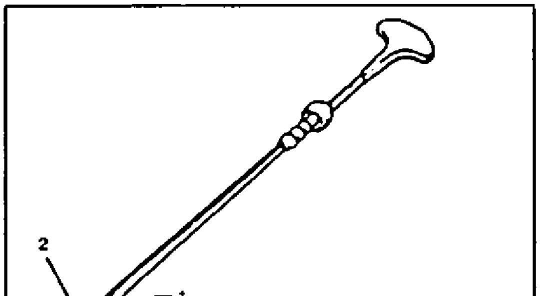
6) Replenish oil until oil level is brought to FULL level mark on dipstick. (oil pan and oil filter capacity). The filler inlet is at the top of the cylinder head cover.
It is recommended to use engine oil of SG, SH or SJ grade.

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

Oil pan capacity	About 4.0 liters (8.5/7.0 US/Imp pt.)
Oil filter capacity	About 0.2 liters (0.4/0.3 US/Imp pt.)
Others	About 0.3 liters (0.6/0.5 US/Imp pt.)
Total	About 4.5 liters (9.5/7.9 US/Imp pt.)

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

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



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

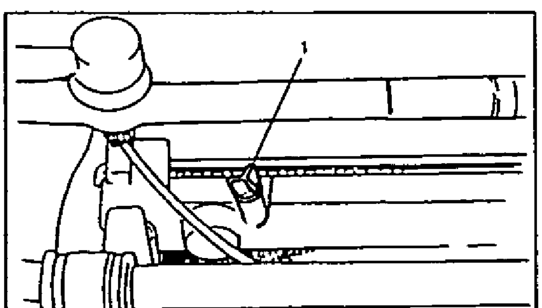
8) Start engine and run it for three minutes. Stop it and wait five minutes before checking oil level. Add oil, as necessary, to bring oil level to FULL level mark on dipstick.

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

ITEM 1-5
Engine Coolant Change

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

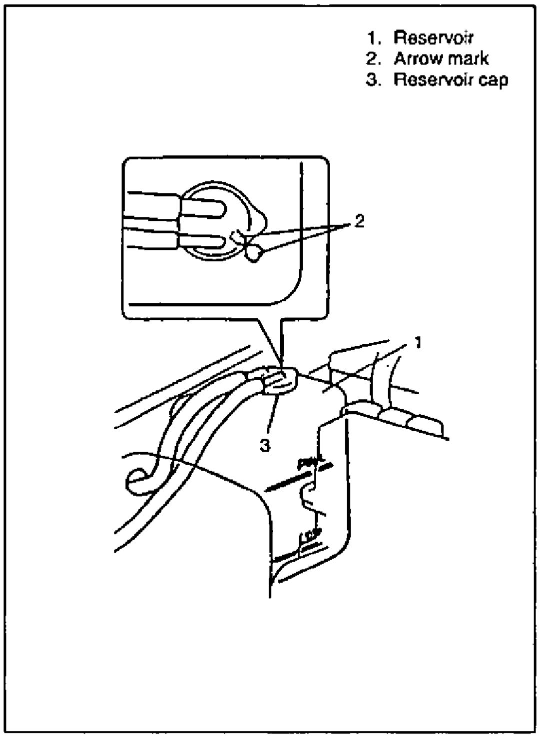
CAUTION:
When changing engine coolant, use mixture of 50% water and 50% ANTIFREEZE/ANTICORROSION COOLANT for the market where ambient temperature falls lower than –16°C (3°F) in winter, and mixture of 70% water and 30% ANTIFREEZE/ANTICORROSION COOLANT for the market where ambient temperature doesn't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



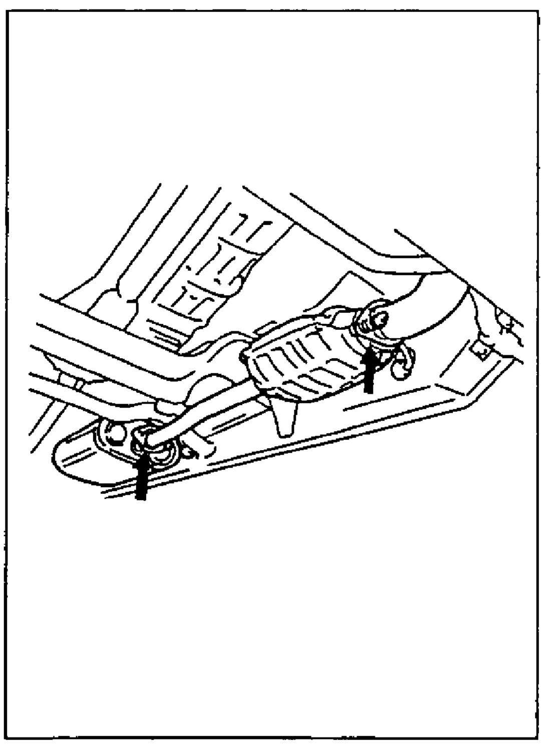
1. Drain plug

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

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



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



ITEM 1-6

Exhaust System Inspection

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

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

- Check rubber mountings for damage, deterioration, and out of position.
- Check exhaust system for leakage, loose connections, dents and damages.
  If bolts or nuts are loose, tighten them to specification.
- Check nearby body areas for damaged, missing, or mispositioned parts, open seams, holes, loose connections or other defects which could permit exhaust fumes to seep into the vehicle.

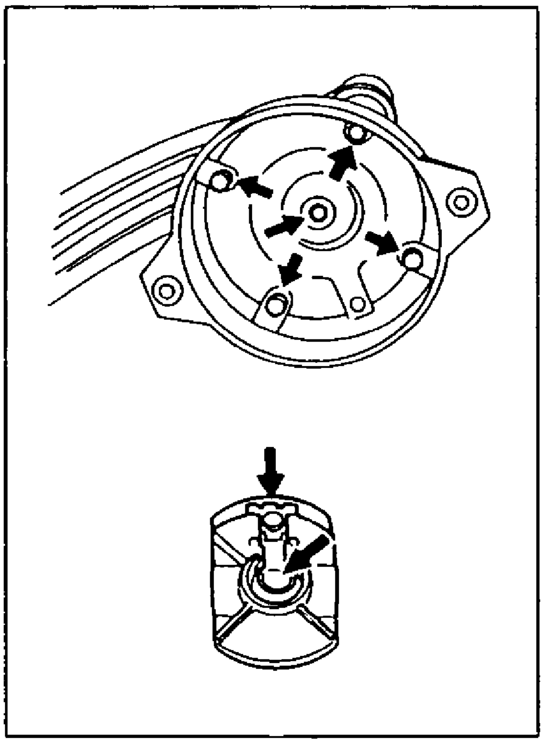
- Make sure that exhaust system components have enough clearance from the underbody to avoid overheating and possible damage to the floor carpet.
- Any defects should be fixed at once.

IGNITION SYSTEM

ITEM 2-1

Spark Plugs Replacement

Replace spark plugs with new ones referring to Section 6F.

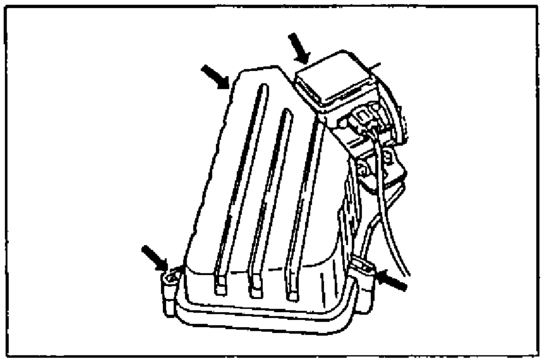


ITEM 2-2

Distributor Cap and Rotor Inspection

1) Inspect distributor cap and rubber caps for cracks.
2) Inspect center electrode and terminals for wear.
3) Inspect rotor for cracks, and its electrode for wear.
4) Repair or replace as necessary any component which is found to be in malcondition as described above.

NOTE:
Dust and stains found within distributor can be cleaned by using a dry, soft cloth.



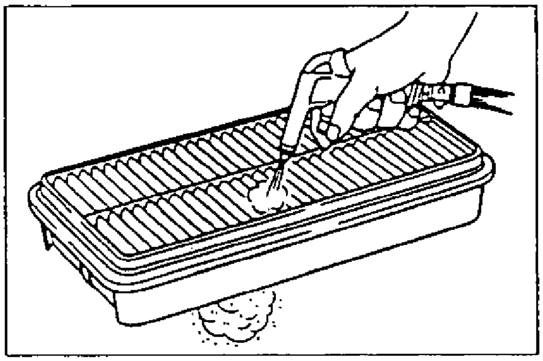
FUEL SYSTEM

ITEM 3-1

Air Cleaner Filter

Inspection

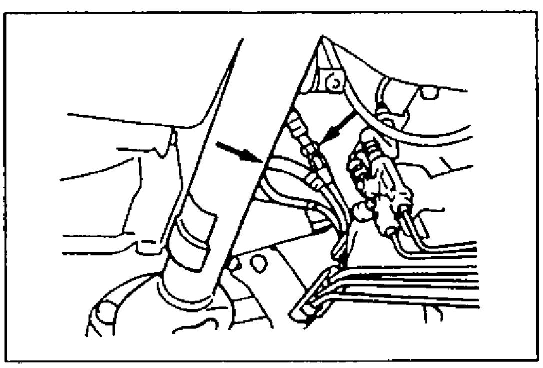
1) Remove air cleaner case bolts.
2) Take cleaner filter out of air cleaner case.
3) Check air cleaner filter for dirt. Replace excessively dirty filter.



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

Replacement

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



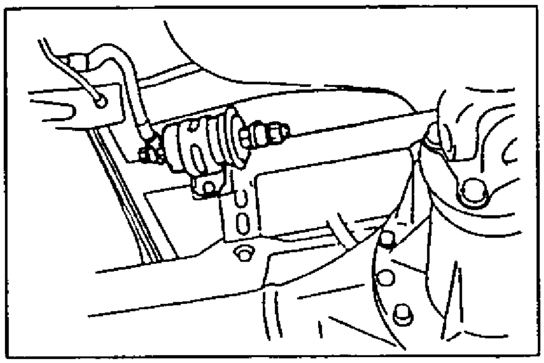
ITEM 3-2

Fuel Lines and Connections Inspection

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

ITEM 3-3
Fuel Filter Replacement

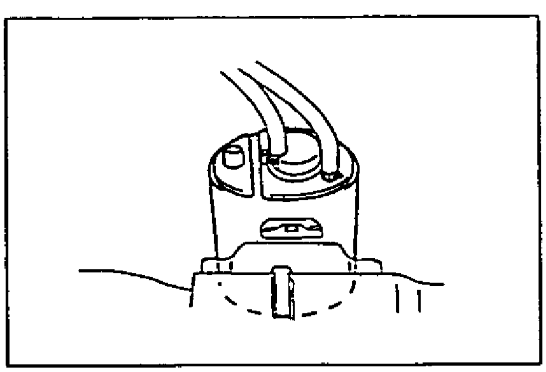
> **WARNING:**
> **This work must be performed in a well ventilated area and away from any open flames (such as gas hot water heaters).**



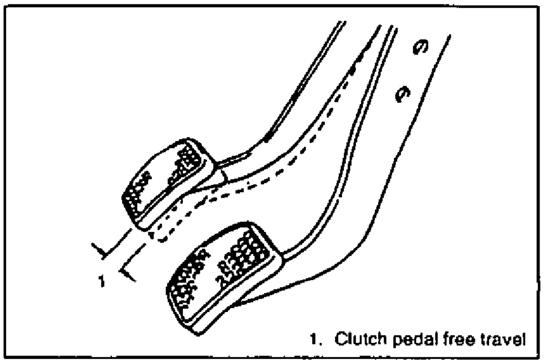
Fuel filter is located at the front part of fuel tank, inside the right-hand side of chassis.
Replace fuel filter with new one periodically, referring to Section 6C for proper procedure.

ITEM 3-4
Fuel Tank Inspection
Check fuel tank for damage, cracks, fuel leakage, corrosion and tank bolts looseness.
If a problem is found, repair or replace.

EMISSION CONTROL SYSTEM
ITEM 4-1
PCV (Positive Crankcase Ventilation) Valve Inspection
Check crankcase ventilation hose and PCV hose for leaks, cracks or clog, and PCV valve for stick or clog. Refer to On-vehicle service of Section 6E for PCV valve checking procedure.



ITEM 4-2
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 6E.
   If a malfunction is found, repair or replace.



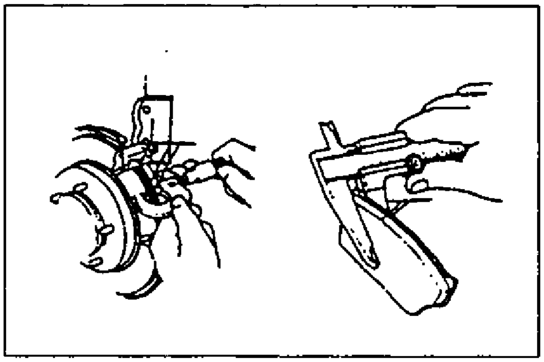
1. Clutch pedal free travel

CHASSIS AND BODY

ITEM 6-1

Clutch Pedal Inspection

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

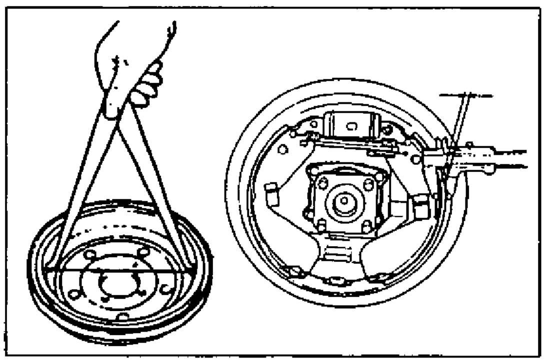


ITEM 6-2

Brake Discs, Pads, Brake Drums and Shoes Inspection

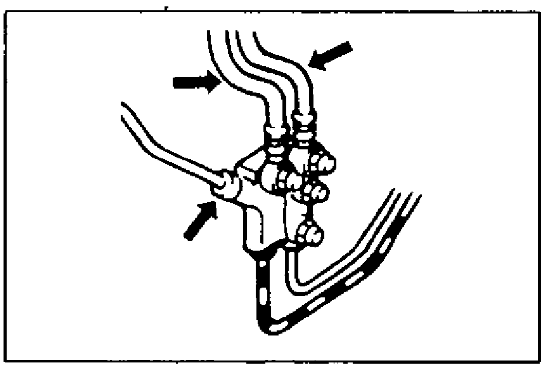
[Brake discs and pads]

1) Remove wheel and caliper but don't disconnect brake hose from caliper.
2) Check front disc brake pads and discs for excessive wear, damage and deflection. Replace parts as necessary. For details, refer to Section 5.
   Be sure to torque caliper pin bolts to specification.



[Brake drums and shoes]

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



ITEM 6-3

Brake Hoses and Pipes Inspection

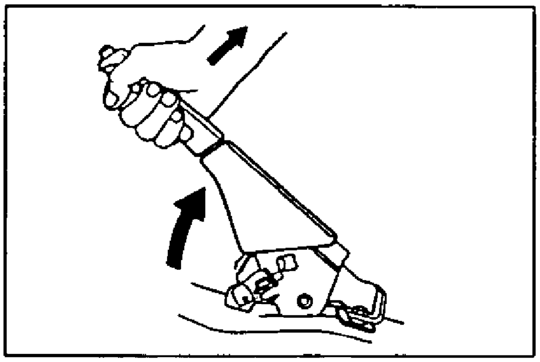
Check brake hoses and pipes for proper hookup, leaks, cracks, chafing and other damage.
Replace any of these parts as necessary.

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

ITEM 6-4

Brake Fluid Change

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

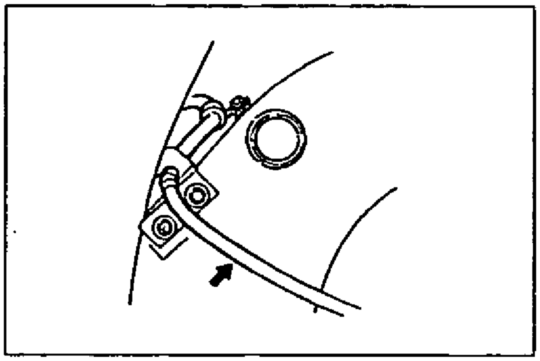


ITEM 6-5

Parking Brake Lever and Cable Inspection

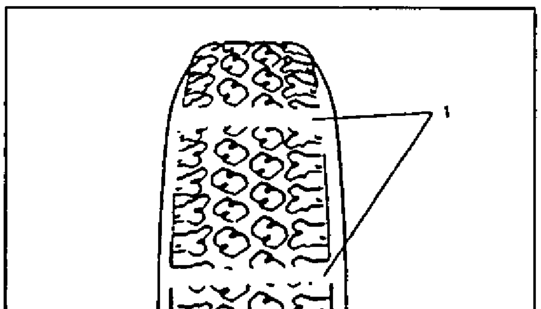
Parking brake lever

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



Parking brake cable

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



1. Wear indicator

ITEM 6-6

Tire Inspection and Rotation

1) Check tires for uneven or excessive wear, or damage.
   If defective, replace.
   Refer to Section 3 for details.
2) Check inflating pressure of each tire and adjust pressure to specification as necessary.
   Refer to Section 3F for details.

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

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

ITEM 6-7

Wheel Discs, Wheel Bearing and Free Wheeling Hubs (if equipped)

Wheel Discs Inspection

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

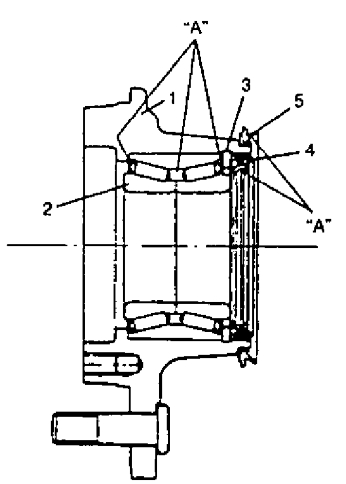
Free Wheeling Hub Inspection (if equipped)

This is applicable to the vehicle equipped with free wheeling hubs. Check free wheeling hub for proper operation (LOCK and FREE positions). (The same check on both right and left wheels.)
For checking procedure, refer to Section 3D.

Wheel Bearing Inspection

Inspection of wheel bearing

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



1. Wheel hub
2. Wheel bearing
3. Circlip
4. Wheel bearing oil seal
5. Wheel hub oil seal

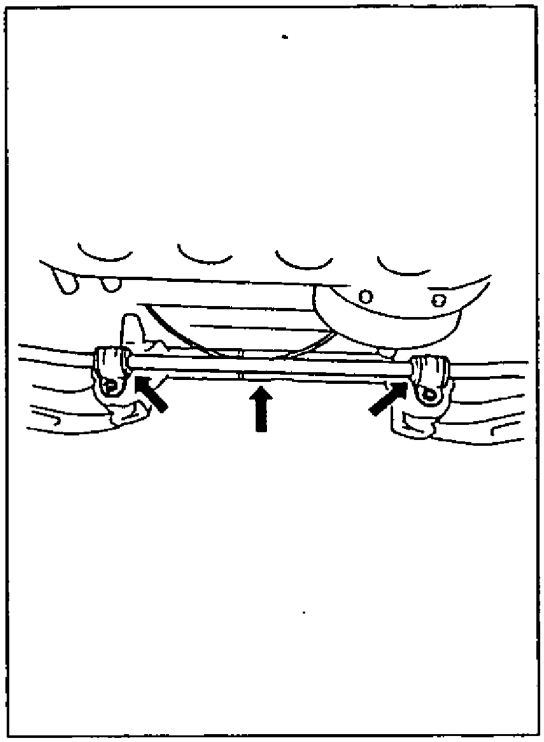
"A": Greasing points

Inspection of front wheel bearing grease

1) Remove wheel hub referring to Front Wheel Hub Removal in Section 3D.
2) Check grease around front wheel bearing rollers for deterioration and capacity.
   If grease is deteriorated, remove grease thoroughly and apply enough amount of new wheel bearing grease. If grease is found insufficient, add some more.
3) For reinstallation, refer to Wheel Hub Installation in Section 3D.

   NOTE:
   - **To reinstall bearing lock nut and lock plate, make sure to torque them to specification.**
   - **Be sure to tighten each bolt and nut to specified torque when reinstalling them.**

4) Upon completion of reinstalling all parts, check to make sure that front wheel bearing is not loose and wheel turns smoothly.



ITEM 6-8

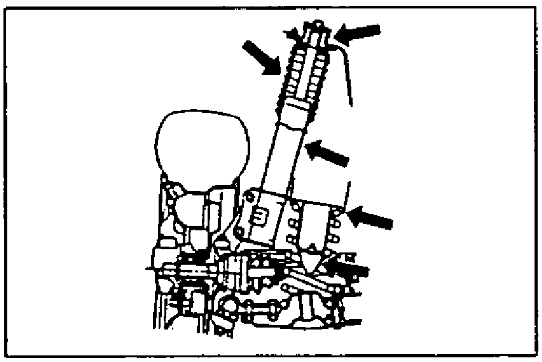
Suspension Inspection

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

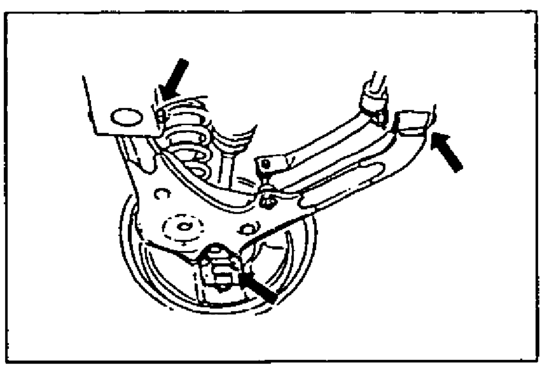
NOTE:
For details of check points, refer to tables of Tightening Torque Specification in Section 3D and 3E.

Front

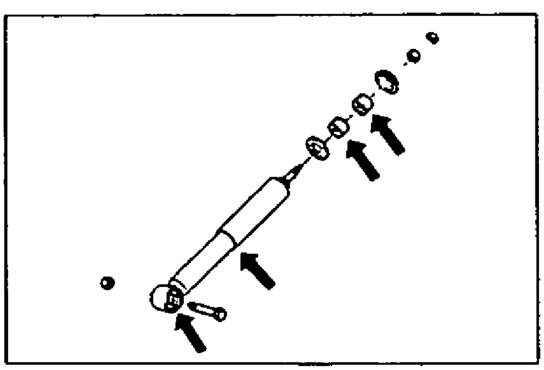
1) Check stabilizer bar for damage or deformation.
2) Check bushing for damage, wear or deterioration.



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

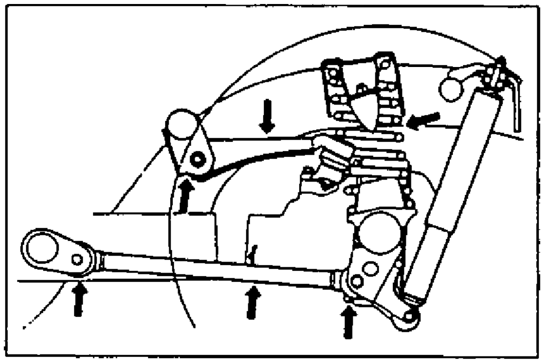


8) Check ball joint stud dust seal (boot) for leaks, detachment, tear or other damage. Check suspension arm bushing for damage, wear or deterioration.

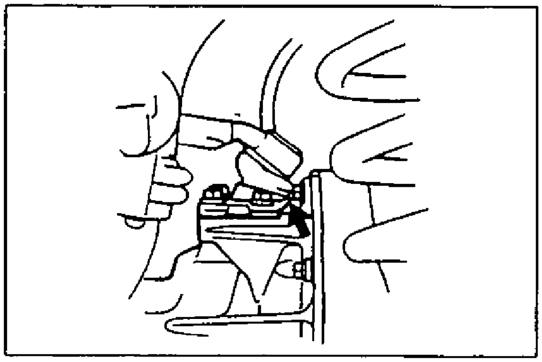


Rear

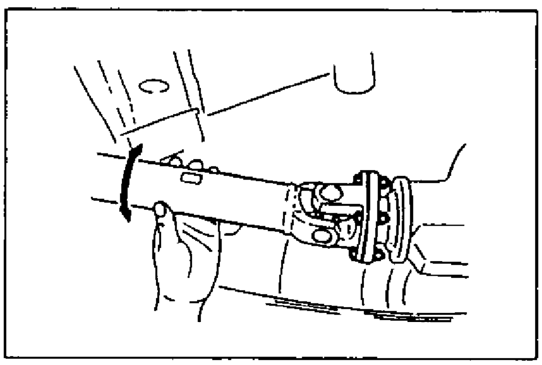
9) Check shock absorber for damage, deformation, oil leakage and operation.
10) Check bushings for wear and damage.



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



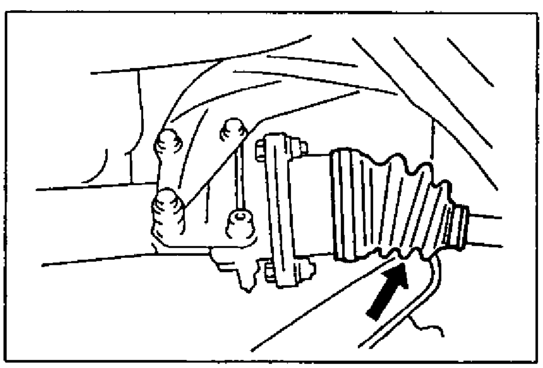
13) Check joint boot for breakage and damage.
14) Check other suspension parts for damage, loose or missing parts; also for parts showing signs of wear or lack of lubrication. Replace any parts found defective in steps 1) to 14).



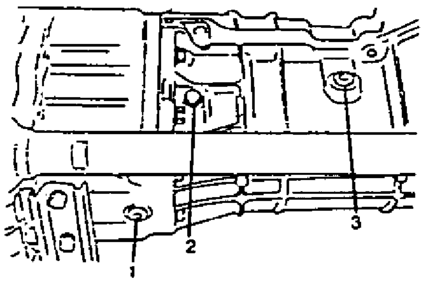
ITEM 6-9

Propeller Shafts and Drive Shafts Inspection

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



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



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

ITEM 6-10

Transmission Oil Inspection and Change (For Manual transmission)

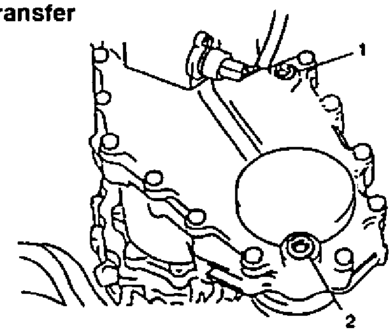
Inspection

1) Inspect transmission case for evidence of oil leakage.
   Repair leaky point if any.
2) Make sure that vehicle is placed level for oil level check.
3) Remove level plug of transmission.
4) Check oil level.
   Oil level can be checked roughly by means of level plug hole. That is, if oil flows out of level plug hole or if oil level is found up to hole when level plug is removed, oil is properly filled.
   If oil is found insufficient, pour specified amount of specified oil.
5) Tighten level plug to specified torque.
   Refer to Section 7A or 7A1 for installation and tightening torque.

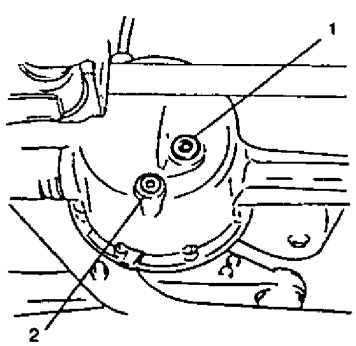
Change

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

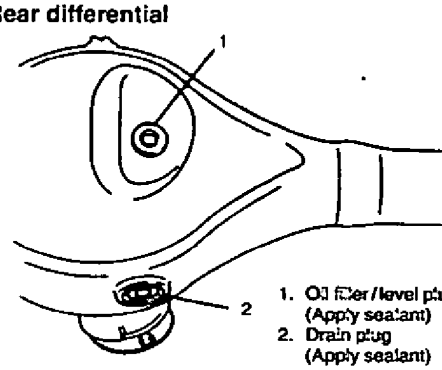
Transfer



Front differential



Rear differential



1. Oil filler/level plug (Apply sealant)
2. Drain plug (Apply sealant)

ITEM 6-12 and 6-13

Transfer and Differential Oil Inspection and Change

Inspection

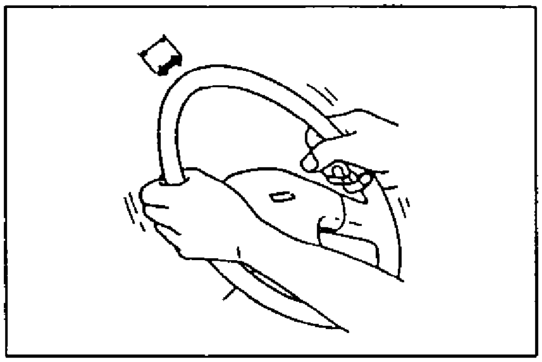
1) Check transfer case and differential for evidence of oil leakage.
   Repair leaky point if any.
2) Make sure that vehicle is placed level for oil level check.
3) Remove level plug of transfer and differentials (front and rear) and check oil level.
   Oil level can be checked roughly by means of level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

> **CAUTION:**
> **Hypoid gear oil must be used for differential.**

4) Tighten level plug to specified torque.
   Refer to Section 7A and 7E for tightening torque.

Change

Change transfer oil and differentials oil with new specified oil referring to Section 7A and 7E respectively.

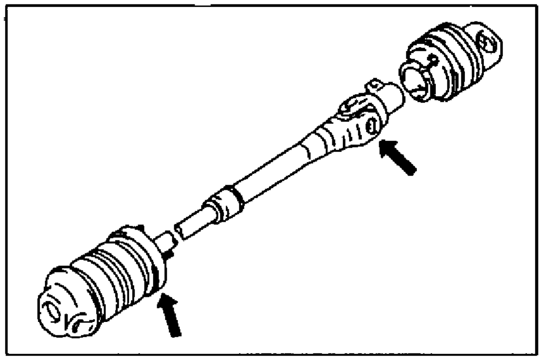


ITEM 6-14

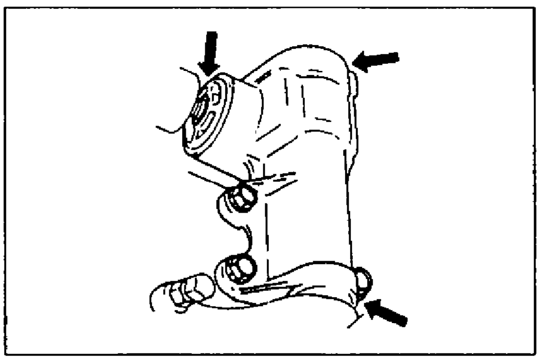
Steering System Inspection

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

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



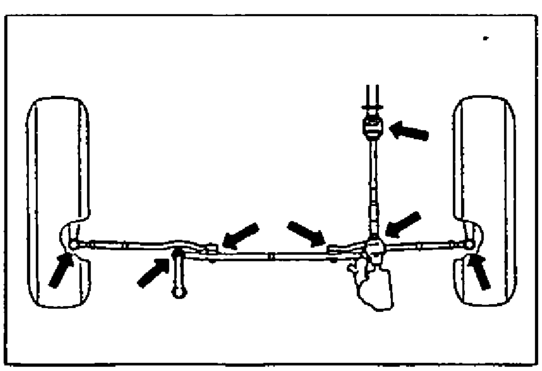
2) Check universal joints of steering shaft for rattle and damage. If rattle or damage is found, replace defective part with a new one.



3) Inspect steering gear box for evidence of oil leakage. If leakage is found, check oil level in gear box.

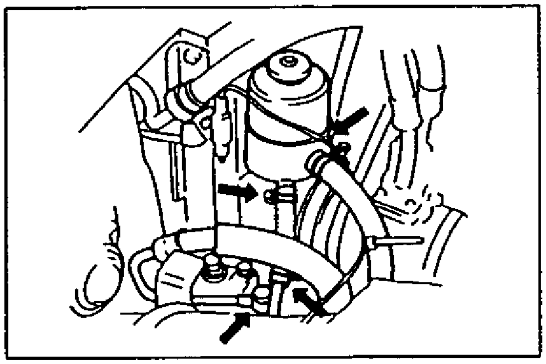
4) Check bolts and nuts for tightness and retighten them as necessary. Repair or replace defective parts, if any.
   Refer to table of TIGHTENING TORQUE SPECIFICATION of Section 3B2 and 3C2 for particular check points.

   NOTE:
   For details of the above steps 1) to 4), refer to Section 3B2 and 3C2.



5) Check boots of steering linkage for damage (leaks, detachment, tear, etc.). If damage is found, replace defective boot with new one.
6) Check wheel alignment.

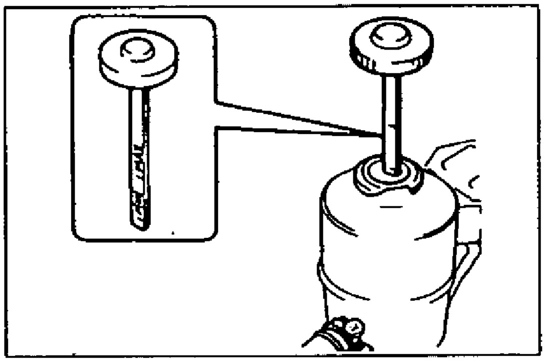
   NOTE:
   For details of wheel alignment, refer to WHEEL ALIGNMENT of Section 3A.



ITEM 6-15

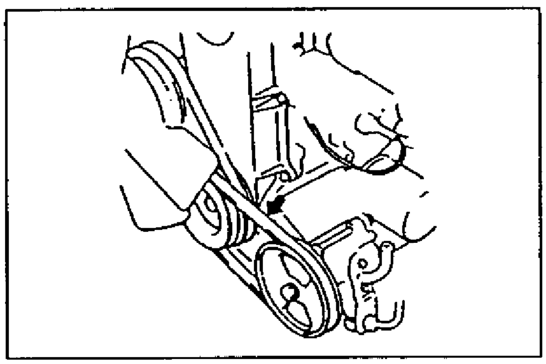
Power Steering (P/S) System Inspection (if equipped)

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

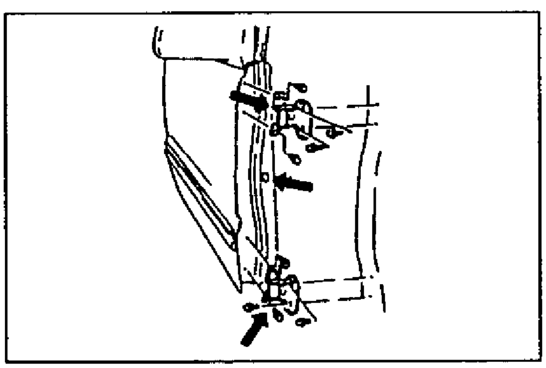


2) Remove fluid tank cap and check fluid level indicated on level gauge, which should be between MAX and MIN marks.
   If it is lower than MIN, fill fluid up MAX mark.

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



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



ITEM 6-16

All Hinges, Latches and Locks Inspection

Doors

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

Engine hood

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

FINAL INSPECTION

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

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

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

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

Accelerator Pedal Operation
Check that pedal operates smoothly without getting caught or interfered by and other part.

Engine Start
Check engine start for readiness.

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

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

Exhaust System Check
Check for leakage, cracks or loose supports.

Clutch (For Manual transmission)
Check for the following.
- Clutch is completely released when depressing clutch pedal.
- No slipping clutch occurs when releasing pedal and accelerating.
- Clutch itself is free from any abnormal condition.

Gearshift or Selector Lever (Transmission)
Check gear shift or selector lever for smooth shifting to all positions and for good performance of transmission in any position.
With automatic transmission equipped vehicle, also check that shift indicator indicates properly according to which position select lever is shifted to.

> **CAUTION:**
> **With automatic transmission equipped vehicle, make sure that vehicle is at complete stop when shifting selector lever to "P" range position and release all brakes.**

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

[Parking brake]
Check that lever has proper travel.

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

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

Steering

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

Engine

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

Body, Wheels and Power Transmitting System

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

Meters and Gauge

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

Lights

Check that all lights operate properly.

Windshield Defroster

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

RECOMMENDED FLUIDS AND LUBRICANTS

Engine oil	SG, SH or SJ (Refer to engine oil viscosity chart in item 1-4)
Engine coolant (Ethylene glycol base coolant)	"Antifreeze/Anticorrosion coolant"
Brake fluid	DOT 3
Manual transmission oil	Refer to Section 7A.
Transfer oil	
Differential oil (front & rear)	Refer to Section 7E or 7F.
Power steering fluid	An equivalent of DEXRON®-II, DEXRON®-IIE or DEXRON®-III
Door hinges	Engine oil or water resistance chassis grease
Hood latch assembly	
Key lock cylinder	Spray lubricant

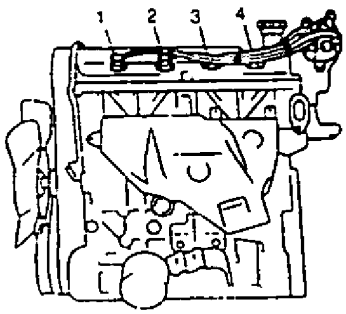
SECTION 6

6

ENGINE GENERAL INFORMATION AND DIAGNOSIS

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

CONTENTS



GENERAL INFORMATION

STATEMENT OF CLEANLINESS AND CARE

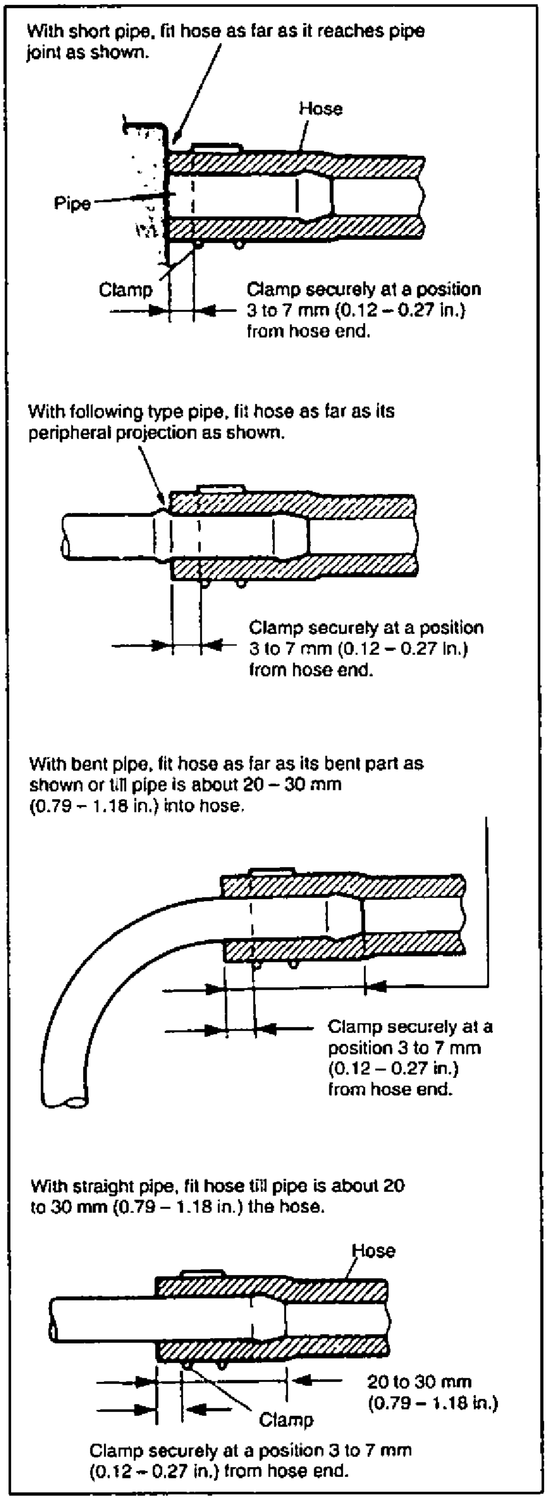
An automobile engine is a combination of many machined, honed, polished and lapped surfaces with tolerances that are measured in the thousands of an millimeter (ten thousands of inch). Accordingly, when any internal engine parts are serviced, care and cleanliness are important. Throughout this section,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

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

GENERAL INFORMATION ON ENGINE SERVICE

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

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



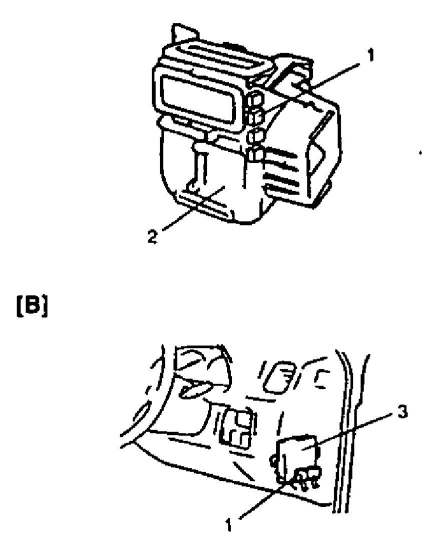
PRECAUTION ON FUEL SYSTEM SERVICE

- Work must be done with no smoking, in a well-ventilated area and away from any open flames.
- As fuel feed line (between fuel pump and fuel pressure regulator) is still under high fuel pressure even after engine was stopped, loosening or disconnecting fuel feed line directly may cause dangerous spout of fuel to occur where loosened or disconnected. Before loosening or disconnecting fuel feed line, make sure to release fuel pressure according to "FUEL PRESSURE RELIEF PROCEDURE".
  A small amount of fuel may be released after fuel line is disconnected.
  In order to reduce the chance of personal injury, cover fitting to be disconnected with a shop cloth. Put that cloth in an approved container when disconnection is completed.
- Never run engine with fuel pump relay disconnected when engine and exhaust system are hot.
- Fuel or fuel vapor hose connection varies with each type of pipe. When reconnecting fuel or fuel vapor hose, be sure to connect and clamp each hose correctly referring to figure "Hose Connection".
  After connecting, make sure that it has no twist or kink.
- When installing fuel filter union bolt or plug bolt on union bolt, always use new gasket and tighten it to specified torque. See Section 6C for specified torque.
- When installing injector, fuel feed pipe or fuel pressure regulator, lubricate its O-ring with spindle oil or gasoline.
- When connecting fuel pipe flare nut, first tighten flare nut by hand and then tighten it to specified torque, using back-up wrench.

FUEL PRESSURE RELIEF PROCEDURE

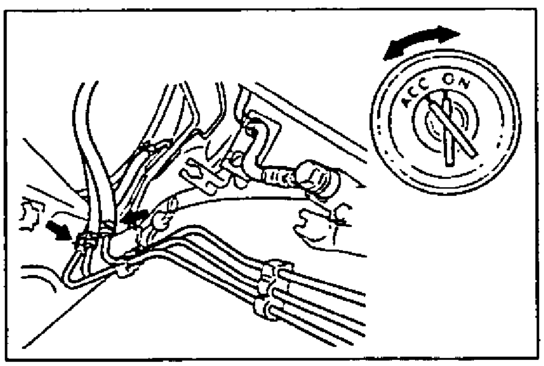
CAUTION:
This work must not be done when engine is hot. If done so, it may cause adverse effect to catalyst.

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



[A]: LH steering vehicle
[B]: RH steering vehicle
2. Heater unit
3. ECM

1) Place transmission gear shift lever in "Neutral", set parking brake, and block drive wheels.
2) Disconnect fuel pump relay (relay with Pink wire) (1) from its connector.
3) Remove fuel filler cap to release fuel vapor pressure in fuel tank and then reinstall it.
4) Start engine and run it till it stops for lack of fuel. Repeat cranking engine 2 – 3 times for about 3 seconds each time to dissipate fuel pressure in lines. Fuel connections are now safe for servicing.
5) Upon completion of servicing, connect fuel pump relay to its connector.



FUEL LEAKAGE CHECK PROCEDURE

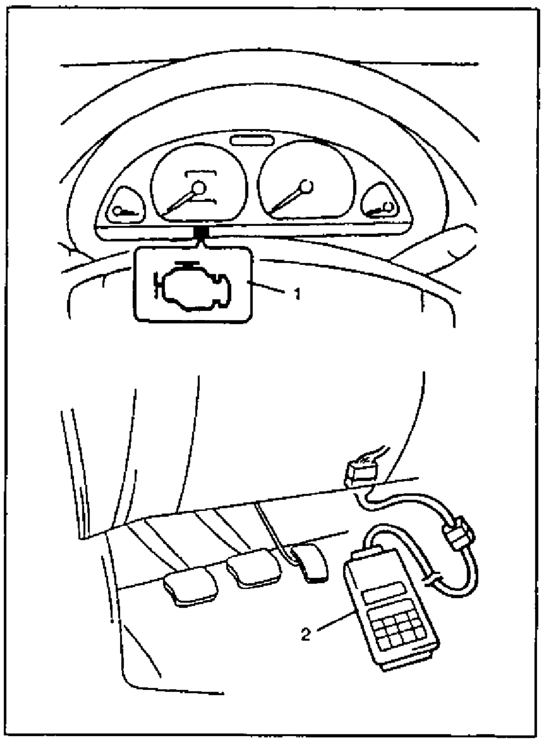
After performing any service on fuel system, check to make sure that there are no fuel leakages as follows.

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

ENGINE DIAGNOSIS

GENERAL DESCRIPTION

This vehicle is equipped with an engine and emission control system which are under control of ECM.
The engine and emission control system in this vehicle are controlled by ECM. ECM has an On-Board Diagnostic System which detects a malfunction in this system and abnormality of those parts that influence the engine exhaust emission. When diagnosing engine troubles, be sure to have full understanding of the outline of "On-Board Diagnostic System" and each item in "Precaution in Diagnosing Trouble" and execute diagnosis according to "ENGINE DIAGNOSTIC FLOW TABLE".
There is a close relationship between the engine mechanical, engine cooling system, ignition system, exhaust system, etc. and the engine and emission control system in their structure and operation. In case of an engine trouble, even when the malfunction indicator lamp (MIL) doesn't turn ON, it should be diagnosed according to this flow table.



ON-BOARD DIAGNOSTIC SYSTEM

ECM in this vehicle has following functions.

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

Warm-Up Cycle

A "warm-up cycle" means sufficient vehicle operation such that the coolant temperature has risen by at least 22°C (40°F) from engine starting and reaches a minimum temperature of 70°C (160°F).

Driving Cycle

A "driving cycle" consists of two parts, engine startup and engine shutoff.

2 Driving Cycles Detection Logic

The malfunction detected in the first driving cycle is stored in ECM memory (in the form of pending DTC) but the malfunction indicator lamp does not light at this time. It lights up at the second detection of same malfunction also in the next driving cycle.

Pending Diagnostic Trouble Code (DTC)

Pending DTC means a DTC detected and stored temporarily at 1 driving cycle of the DTC which is detected in the 2 driving 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 stores the engine and driving conditions (in the form of data as shown at the left) at the moment of the detection of a malfunction in its memory. This data is called "Freeze frame data".
Therefore, it is possible to know engine and driving conditions (e.g., whether the engine was warm or not, where the vehicle was running or stopped, where air/fuel mixture was lean or rich) when a malfunction was detected by checking the freeze frame data. Also, ECM has a function to store each freeze frame data for three different malfunctions in the order as the malfunction is detected. Utilizing this function, it is possible to know the order of malfunctions that have been detected. Its use is helpful when rechecking or diagnosing a trouble.

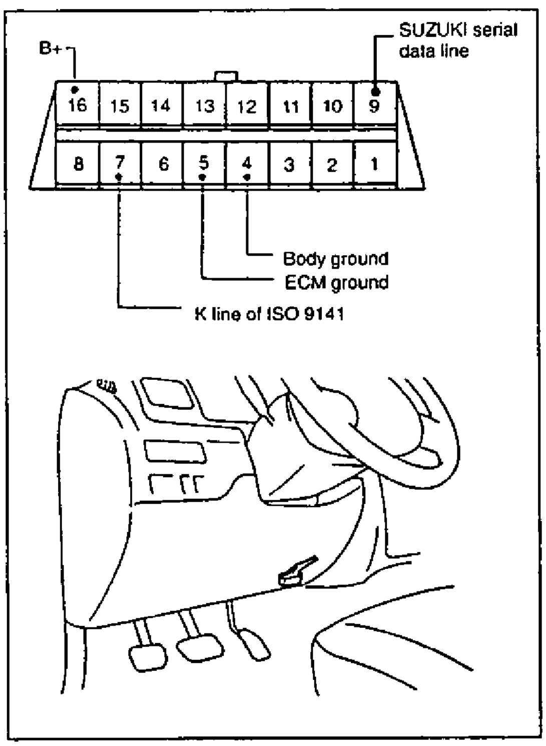
Priority of freeze frame data:
ECM has 4 frames where the freeze frame data can be stored. The first frame stores the freeze frame data of the malfunction which was detected first. However, the freeze frame data stored in this frame is updated according to the priority described below. (If malfunction as described in the upper square "1" below is detected while the freeze frame data in the lower square "2" has been stored, the freeze frame data "2" will be updated by the freeze frame data "1".)

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 in compliance with SAE J1962 in its installation position, the shape of connector and pin assignment.

Serial data line(K line of ISO 9141) is used for SUZUKI scan tool or generic scan tool to communicate with ECM.
SUZUKI serial data line is used for SUZUKI scan tool to communicate with control module (except of ECM; ABS control module, Airbag SDM and immobilizer control module).

PRECAUTION IN DIAGNOSING TROUBLE

- Don't disconnect couplers from ECM, battery cable from battery, ECM ground wire harness from engine or main fuse before confirming diagnostic information (DTC, freeze frame data, etc.) stored in ECM memory.
- Diagnostic information stored in ECM memory can be cleared as well as checked by using SUZUKI scan tool or generic scan tool. Before using scan tool, read its Operator's (Instruction) Manual carefully to have good understanding as to what functions are available and how to use it.
- Priorities for diagnosing troubles

  If two or more diagnostic trouble codes (DTCs) are stored, proceed to the flow table of the DTC which has detected earliest in the order and follow the instruction in that table.

  If no instructions are given, troubleshoot diagnostic trouble codes according to the following priorities.

  (1) Diagnostic trouble codes other than fuel trim malfunction (DTC P0171, P0172), EGR (DTC P0400), and misfire (DTC P0300 ~ P0304).

  (2) Fuel trim malfunction (DTC P0171, P0172) and EGR (DTC P0400).

  (3) Misfire (DTC P0300 ~ P0304)
- Be sure to read "Precautions for Electrical Circuit Service" in Section 0A before inspection and observe what is written there.
- ECM Replacement or Substitution

  When substituting a known-good ECM, check for following conditions. Neglecting this check may cause damage to known-good ECM.

  – Resistance value of all relays, actuators is as specified respectively.

  – MAF sensor, MDP sensor and TP sensor are in good condition and none of power circuits of these sensors is shorted to ground.

ENGINE DIAGNOSTIC FLOW TABLE

Refer to the following pages for the details of each step.

STEP	ACTION	YES	NO
1	Customer Complaint Analysis 1) Perform customer complaint analysis. Was customer complaint analysis performed?	Go to Step 2.	Perform customer complaint analysis.
2	Diagnostic Trouble Code (DTC) and Freeze Frame Data Check, Record and Clearance 1) Check for DTC referring to the next page. Is there any DTC(s)?	1) Print DTC and freeze frame data or write then down and clear by referring to "DTC Clearance" in this section. 2) Go to Step 3.	Go to Step 4.
3	Visual Inspection 1) Perform Visual inspection referring to the "Visual Inspection" in this section. Is there any faulty condition?	1) Repair or replace malfunction part. 2) Go to Step 11.	Go to Step 5.
4	Visual Inspection 1) Perform visual inspection referring to the "Visual Inspection" in this section. Is there any faulty condition?		Go to Step 8.
5	Trouble Symptom Confirmation 1) Confirm trouble symptom referring to the "Trouble Symptom Confirmation" in this section. Is trouble symptom identified?	Go to Step 6.	Go to Step 7.
6	Rechecking and Record of DTC/Freeze Frame Data 1) Recheck for DTC and freeze frame data referring to "DTC Check" in this section. Is there any DTC(s)?	Go to Step 9.	Go to Step 8.
7	Rechecking and Record of DTC/Freeze Frame Data 1) Recheck for DTC and freeze frame data referring to "DTC Check" in this section. Is there any malfunction DTC(s)?		Go to Step 10.
8	Engine Basic Inspection and Engine Diagnosis Table 1) Check and repair according to "Engine Basic Check" and "Engine Diagnosis Table" in this section. Are check and repair complete?	Go to Step 11.	1) Check and repair malfunction part(s). 2) Go to Step 11.
9	Troubleshooting for DTC 1) Check and repair according to applicable DTC diag. flow table in this section. Are check and repair complete?		
10	Check for Intermittent Problems 1) Check for intermittent problems referring to the next page. Is there any faulty condition?	1) Repair or replace malfunction part(s). 2) Go to Step 11.	Go to Step 11.
11	Final Confirmation Test 1) Clear DTC if any. 2) Perform final confirmation test referring to the next page. Is there any problem symptom, DTC or abnormal condition?	Go to Step 6.	End.

1. CUSTOMER COMPLAINT ANALYSIS

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

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

First, check DTC (including pending DTC), referring to "DTC check" section. If DTC is indicated, print it and freeze frame data or write them down and then clear them by referring to "DTC clearance" section. DTC indicates malfunction that occurred in the system but does not indicate whether it exists now or it occurred in the past and the normal condition has been restored now. To check which case applies, check the symptom in question according to Step 5 and recheck DTC according to Step 6 and 7.
Attempt to diagnose a trouble based on DTC in this step only or failure to clear the DTC (including pending DTC) in this step will lead to incorrect diagnosis, trouble diagnosis of a normal circuit or difficulty in troubleshooting.

3 and 4. VISUAL INSPECTION

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

5. TROUBLE SYMPTOM CONFIRMATION

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

6 and 7. DTC/FREEZE FRAME DATA RECHECK, RECORD AND CLEARANCE

Refer to "DTC CHECK" section for checking procedure.

8. ENGINE BASIC CHECK AND ENGINE DIAGNOSIS TABLE

Perform basic engine check according to the "Engine Basic Check Flow Table" first. When the end of the flow table has been reached, check the parts of the system suspected as a possible cause referring to "Engine Diagnosis Table" and based on symptoms appearing on the vehicle (symptoms obtained through steps of customer complaint analysis, trouble symptom confirmation and/or basic engine check) and repair or replace faulty parts, if any.

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

Based on the DTC indicated in Step 6 or 7 and referring to the applicable DTC diag. flow table in this section, locate the cause of the trouble, namely in a sensor, switch, wire harness, connector, actuator, ECM or other part and repair or replace faulty parts.

10. CHECK FOR INTERMITTENT PROBLEM

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

11. FINAL CONFIRMATION TEST

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

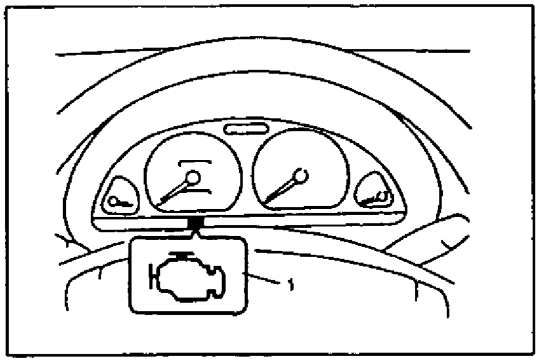
CUSTOMER PROBLEM INSPECTION FORM (EXAMPLE)

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

PROBLEM SYMPTOMS	
□Difficult Starting	**□Poor Driveability**
□No cranking □No initial combustion □Poor starting at (□Cold/□Warm/□Always) □Other ______	□Hesitation on acceleration □Back fire/After fire □Loss of power □Surging □Abnormal knocking □Other ______
□Poor Idling	**□Engine Stall when**
□Poor fast idle □Abnormal idling speed (□High □Low) (r/min.) □Unstable □Hunting (r/min. to r/min.) □Other ______	□Immediately after start □Accel. pedal is depressed □Accel. pedal is released □Load is applied □A/C □Electrical load □P/S □Other ______
□OTHERS:	

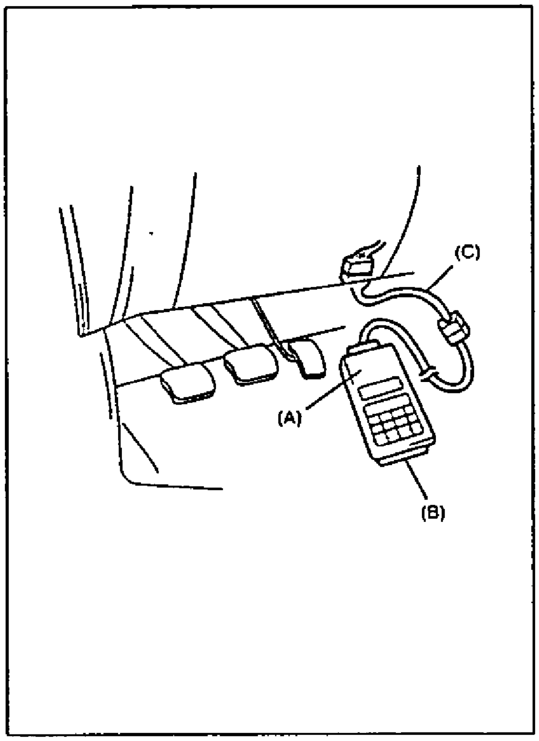
VEHICLE/ENVIRONMENTAL CONDITION WHEN PROBLEM OCCURS	
Environmental Condition	
Weather	□Fair □Cloudy □Rain □Snow □Always □Other ______ (°F/ °C)
Temperature	□Hot □Warm □Cool □Cold □Always
Frequency	□Always □Sometimes (times/ day, month) □Only once □Under certain condition
Road	□Urban □Suburbs □Highways □Mountainous (□Uphill □Downhill) □Paved road □Gravel □Other ______
Vehicle Condition	
Engine condition	□Cold □Warming up phase □Warmed up □Always □Other at starting □Immediately after start/ □Racing without load □Engine speed (r/min.)
Vehicle condition	□During driving: □Constant speed (km/h, mile/h) □Accelerating □Decelerating □Right hand corner □Left hand corner □When shifting (Lever position) □At stop □Other ( )
Malfunction indicator lamp condition	□Always ON □Sometimes ON □Always OFF □Good condition □Flashing
Diagnostic trouble code	First check: □No code □Malfunction code ( ) Second check: □No code □Malfunction code ( )

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



MALFUNCTION INDICATOR LAMP (MIL) CHECK

1) Turn ON ignition switch (but the engine at stop) and check that MIL lights.
   If MIL does not light up or dims, go to "Diagnostic Flow Table A-1" for troubleshooting.
2) Start engine and check that MIL turns OFF.
   If MIL remains ON, and no DTC is stored in ECM, go to "Diagnostic Flow Table A-2" for troubleshooting.



DIAGNOSTIC TROUBLE CODE (DTC) CHECK

1) Prepare generic scan tool or SUZUKI scan tool.
2) 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): 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 them or write them down. Refer to scan tool operator's manual for further details.
   If communication between scan tool and ECM is not possible, check if scan tool is communicable by connecting it to ECM in another car. If communication is possible in this case, scan tool is in good condition. Then check data link connector and serial data line (circuit) in the car with which communication was not possible.
5) After completing the check, turn ignition switch off and disconnect scan tool from data link connector.

DIAGNOSTIC TROUBLE CODE (DTC) CLEARANCE

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

NOTE:
DTC and freeze frame data stored in ECM memory are also cleared in following cases. Be careful not to clear them before keeping their record.
- **When power to ECM is cut off (by disconnecting battery cable, removing fuse or disconnecting ECM connectors).**
- **When the same malfunction (DTC) is not detected again during 40 engine warm-up cycles (see P.6-7).**

DIAGNOSTIC TROUBLE CODE (DTC) TABLE

DTC NO.	DETECTED ITEM	DETECTING CONDITION (DTC will set when detecting:)	MIL
P0100	Mass air flow circuit malfunction	Sensor output too low (or MAF sensor circuit shorted to ground)	1 driving cycle
		Sensor output too high (or MAF sensor circuit open)	
P0110	Intake air temp. circuit malfunction	High temperature-low voltage (or IAT sensor circuit shorted to ground)	1 driving cycle
		Low temperature-high voltage (or IAT sensor circuit open)	
P0115	Engine coolant temp. circuit malfunction	High temperature-low voltage (or ECT sensor circuit shorted to ground)	1 driving cycle
		Low temperature-high voltage (or ECT sensor circuit open)	
P0120	Throttle position circuit malfunction	Low voltage (or TP sensor circuit shorted to ground)	1 driving cycle
		High voltage (or TP sensor circuit open)	
P0121	Throttle position circuit performance problem	Poor performance of TP sensor	2 driving cycles
P0130	HO2S-1 circuit low voltage	Max. output voltage of HO2S-1 is lower than specification (or HO2S-1 circuit open)	2 driving cycles
	HO2S-1 circuit high voltage	Min. output voltage of HO2S-1 is higher than specification	
P0133	HO2S-1 circuit slow response	Response time of HO2S-1 output voltage is longer than specification	2 driving cycles
P0134	HO2S-1 no activity detected	Output voltage of HO2S-1 fails to go above specification (or HO2S-1 circuit shorted to ground)	2 driving cycles
P0135	HO2S-1 heater circuit malfunction	Terminal voltage is out of specification or electric current of heater is out of specification at heater ON	2 driving cycles
P0136	HO2S-2 circuit malfunction	HO2S-2 output voltage is out of specification on average (or HO2S-2 circuit open or short)	2 driving cycles
P0141	HO2S-2 heater circuit malfunction	Terminal voltage is out of specification or electric current of heater is out of specification at heater ON	2 driving cycles
P0171	Fuel system too lean	Total 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	Total trim (short and long terms added) is smaller than specification for specified time or longer. (Fuel trim toward lean side is large.)	2 driving cycles

DTC NO.	DETECTED ITEM	DETECTING CONDITION (DTC will set when detecting:)	MIL
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 blinks during actual misfire and remain continuously illuminated otherwise.
		Misfire of such level as to deteriorate emission but not to cause damage to three way catalyst.	2 driving cycles
P0335	Crankshaft position sensor circuit malfunction	No signal during engine running and CMP sensor signal inputting.	1 driving cycle
P0340	Camshaft position sensor circuit malfunction	No signal for 3 sec. during engine cranking.	1 driving cycle
P0400	Exhaust gas recirculation flow malfunction	Excessive or insufficient EGR flow.	2 driving cycles
P0403	EGR valve circuit malfunction	EGR valve electrical circuit open or short.	1 driving cycle
P0420	Catalyst system efficiency below threshold	Output wave forms of HO2S-1 and HO2S-2 are similar.	2 driving cycles
P0443	Evaporative emission control system purge control valve circuit malfunction	Monitor signal of EVAP canister purge valve is different from command signal (circuit open or short).	2 driving cycles
P0460	Fuel level sensor circuit high input	Fuel level sensor circuit open (high voltage).	2 driving cycles
P0500	Vehicle speed sensor malfunction	No signal during fuel cut.	2 driving cycles
P0505	Idle air control system malfunction	Difference between desired idle speed and actual idle speed continues to exceed specified value for longer than specified time.	2 driving cycles
P0601	Internal control module memory check sum error	Data write error when written in to ECM.	1 driving cycle
P1408	Manifold differential pressure sensor circuit malfunction	Manifold differential pressure sensor output voltage is higher or lower than specified value (or sensor circuit shorted to ground or open).	2 driving cycles
P1450	Barometric pressure sensor circuit malfunction	Barometric pressure is lower or higher than specification.	1 driving cycle
P1451	Barometric pressure sensor performance problem	Difference between intake manifold pressure and barometric pressure is larger than specification.	2 driving cycles
P1500	Engine starter signal circuit malfunction	Engine starts with no starter signal or signal input during long period after start.	2 driving cycles

DTC NO.	DETECTED ITEM	DETECTING CONDITION (DTC will set when detecting:)	MIL
P1510	ECM back-up power supply malfunction	No back-up power after starting engine.	1 driving cycle
P1620	ECU code not registered	Refer to Section 8G.	
P1621	No ECU code transmitted from Immobilizer Control Module		
P1622	Fault in ECM		
P1623	ECU code not matched		

FAIL-SAFE TABLE

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

DTC NO.	TROUBLE AREA	FAIL SAFE OPERATION
P0100	MAF SENSOR	• Injector drive time (fuel injection volume) is determined according to throttle valve opening and engine speed. • EGR valve stops. • Air flow of IAC valve is limited.
P0110	IAT SENSOR	Each control is performed on the basis of 23°C intake air temp.
P0115	ECT SENSOR	Each control is performed on the basis of 30.1°C engine coolant temp.
P0120 P0121	TP SENSOR	Each control is except 4-A/T performed on the basis of 124.5° throttle valve opening.
P0460	FUEL LEVEL SENSOR	Each control is performed in the basis of full fuel level.
P0500	VEHICLE SPEED SENSOR	Air flow of IAC valve is limited.
P1450	BAROMETRIC PRESSURE SENSOR	Each control is performed based on 760 mmHg barometric pressure.

SCAN TOOL DATA

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

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

SCAN TOOL DATA	CONDITION		NORMAL CONDITION/ REFERENCE VALUE	OTHER
COOLANT TEMP. (Engine Coolant Temp.)	At specified idle speed after warming up.		80 – 90°C (176 – 194°F)	
INTAKE AIR TEMP.	At specified idle speed after warming up.		Environmental temp. +20°C −5°C (+36°F −9°F)	
DESIRE IDLE (Desired idle speed)	At idling with no load after warming up.		797 rpm	✻
CLOSED THROT POS (Closed Throttle Position)	Ignition switch ON	Accelerator pedal released.	ON	✻
		Accelerator pedal depressed.	OFF	
IAC FLOW DUTY	At specified idle speed after warming up.		25 – 31%	✻
ENGINE SPEED	At idling with no load after warming up.		Desired idle speed ± 50 rpm	
SHORT FT B1 (Short Term Fuel Trim)	At specified idle speed after warming up.		–25 – 32%	
LONG FT B1 (Long Term Fuel Trim)	At specified idle speed after warming up.		–16.4 – 20.8%	
IGNITION ADVANCE	At specified idle speed with no load after warming up.		6 – 10°	
BATTERY VOLTAGE	Ignition switch ON/engine stopped.		10 – 14 V	✻
MAF (Mass Air Flow Rate)	At specified idle speed with no load after warming up.		2.5 ± 0.8 g/s 0.33 ± 0.11 lb/min.	
	At 2500 r/min with no load after warming up.		7.2 ± 1.0 g/s 0.95 ± 0.13 lb/min.	
INJ PULSE WIDTH (Fuel Injection Pulse Width)	At specified idle speed with no load after warming up.		3.5 ± 0.8 msec	✻
	At 2500 r/min with no load after warming up.		3.2 ± 0.8 msec	
THROTTLE POS (Absolute Throttle Position)	Ignition switch ON/ warmed up engine stopped.	Accelerator pedal released.	17 ± 5%	
		Accelerator pedal depressed fully.	86 ± 10%	
TP SENSOR VOLT (TP Sensor Output Voltage)	Ignition switch ON/ warmed up engine stopped.	Accelerator pedal released.	0.88 ± 0.16 V	✻
		Accelerator pedal depressed fully.	4.28 ± 0.20 V	
O2S B1 S1 (HO2S-1 Output Voltage)	At specified idle speed after warming up.		0.01 – 0.95 V	
O2S B1 S2 (HO2S-2 Output Voltage)	When engine is running at 2000 r/min. for 3 min. or longer after warming up.		0.01 – 0.95 V	
FUEL SYSTEM (Fuel System Status)	At specified idle speed after warming up.		Closed	
CALC LOAD (Calculated Load Value)	At specified idle speed with no load after warming up.		10 – 25%	
	At 2500 r/min. with no load after warming up.		10 – 25%	

SCAN TOOL DATA	CONDITION	NORMAL CONDITION/ REFERENCE VALUE	OTHER
TOTAL FUEL TRIM	At specified idle speed after warming up.	–35 – +35%	✻
MAP (Intake Manifold Absolute Pressure)	At specified idle speed after warming up.	25.8 – 51.6 kPa, 7.9 – 15.7 in.Hg	
CANIST PRG DUTY (EVAP Canister Purge Flow Duty)	At specified idle speed after warming up.	0 %	✻
Vehicle Speed.	At stop.	0 km/h 0 MPH	
FUEL CUT	When engine is at fuel cut condition.	ON	✻
	Other than fuel cut condition.	OFF	
EGR VALVE	At specified idle speed after warming up.	0%	✻
A/C SWITCH (if equipped)	When A/C not operating.	OFF	✻
	When A/C operating.	ON	
PSP SWITCH (if equipped)	Engine running at idle speed and steering wheel at straight-ahead position.	OFF	✻
	Engine running at idle speed and steering wheel turned to the right or left as far as it stops.	ON	
FUEL TANK LEVEL	Ignition switch ON.	0 – 100 %	✻

SCAN TOOL DATA DEFINITIONS

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

It is detected by engine coolant temp. sensor.

INTAKE AIR TEMP (°C/°F)

It is detected by intake air temp. sensor.

DESIRE IDLE (DESIRED IDLE SPEED RPM)

The desired idle speed is an ECM internal parameter which indicates the ECM requested idle. If the engine is not running, the number is not valid.

CLOSED THROT POS (CLOSED THROTTLE POSITION ON/OFF)

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

IAC FLOW DUTY (%)

This parameter indicates IAC valve opening rate which controls bypass air flow.

ENGINE SPEED (RPM)

It is computed by reference pulses from the Camshaft Position 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.

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

Ignition timing of No.1 cylinder is commanded by ECM. The actual ignition timing should be checked by using the timing light.

BATTERY VOLTAGE (V)

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

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

It represents total mass of air entering intake manifold which is measured by mass air flow sensor.

INJ PULSE WIDTH (FUEL INJECTION PULSE WIDTH, msec)

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

THROTTLE POS (ABSOLUTE THROTTLE POSITION, %)

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

TP SENSOR VOLT (TP SENSOR OUTPUT VOLTAGE, V)

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

OXYGEN SENSOR B1 S1 (HO2S-1 OUTPUT VOLTAGE, V)

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

OXYGEN SENSOR B1 S2 (HO2S-2 OUTPUT VOLTAGE, V)

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

FUEL SYSTEM (FUEL SYSTEM STATUS)

Air/fuel ratio feedback loop status displayed as one of the followings.

OPEN: Open loop-has not yet satisfied conditions to go closed loop.

CLOSED: Closed loop-using oxygen sensor(s) as feedback for fuel control.

OPEN-DRIVE COND: Open loop due to driving conditions (Power enrichment, etc.).

OPEN SYS FAULT: Open loop due to detected system fault.

CLOSED-ONE O2S: Closed loop, but fault with at least one oxygen sensor-may be using single oxygen sensor for fuel control.

CALC LOAD (CALCULATED LOAD VALUE, %)

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

TOTAL FUEL TRIM (%)

The value of total fuel trim is obtained by putting values of short term fuel trim and long term fuel trim together. This value indicates how much correction is necessary to keep the air/fuel mixture stoichiometrical.

MAP (MANIFOLD ABSOLUTE PRESSURE, mmHg, kPaA)

It is indicated as difference between values detected by barometric pressure sensor and manifold differential pressure sensor (manifold absolute pressure).

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

This parameter indicates valve ON (valve open) time rate within a certain set cycle of EVAP canister purge valve which controls the amount of EVAP purge.

VEHICLE SPEED (km/h, MPH)

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

FUEL CUT (ON/OFF)

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

EGR VALVE (%)

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

A/C SWITCH (ON/OFF)

ON: Command for operation being output from A/C amplifier to compressor.
OFF: Command for operation not being output.

PSP SWITCH (ON/OFF)

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

FUEL TANK LEVEL (%)

This parameter indicates approximate fuel level in the fuel tank.

FUEL PUMP (ON/OFF)

ON is displayed when the ECM activates the fuel pump via the fuel pump relay.

BAROMETRIC PRESS (kPa, inHg)

This parameter represents a measurement of barometric air pressure and is used for altitude correction of the fuel injection quantity and IAC valve control.

ELECTRIC LOAD (ON/OFF)

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

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
• Battery ----- fluid level, corrosion of terminal	Section 0B
• Drive belt ----- tension, damage	Section 0B
• Throttle cable ----- play (after warm up engine), installation	
• Vacuum hoses of air intake system ----- disconnection, looseness, deterioration, bend	Section 0B Section 6E1
• Connectors of electric wire harness --- disconnection, friction	
• Fuses ----- burning	
• Parts ----- installation, bolt ----- looseness	
• Parts ----- deformation	Section 8
• Other parts that can be checked visually	
Also add following items at engine start, if possible	
• Malfunction indicator lamp	Section 6
• Charge warning lamp	Section 6H
• Engine oil pressure warning lamp	Section 8 (Section 6A1 for pressure check)
Operation	
• Engine coolant temp. meter	Section 8
• Fuel level meter	Section 8
• Abnormal air being inhaled from air intake system	
• Exhaust system ----- leakage of exhaust gas, noise	
• Other parts that can be checked visually	

ENGINE BASIC CHECK

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

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Check battery voltage. Is it 11 V or more?	Go to Step 3.	Charge or replace battery.
3	Is engine cranked?	Go to Step 4.	Go to "DIAGNOSIS" in Section 6G.
4	Does engine start?	Go to Step 5.	Go to Step 7.
5	Check engine idle speed/IAC duty referring to "Idle speed/IAC Duty Inspection" in Section 6E. Is check result as specified?	Go to Step 6.	Go to "Engine Diagnosis Table" in this section.
6	Check ignition timing referring to "Ignition Timing Inspection" in Section 6F. Is check result as specified?	Go to "Engine Diagnosis Table" in this section.	Adjust ignition timing or check input signals related to ignition system.
7	Check immobilizer indicator lamp for flashing. Does lamp flash?	Go to "Diagnosis" in Section 8G.	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 3 seconds and then OFF. Repeat this a few times. Is fuel return pressure (returning sounds) felt from fuel return hose when ignition switch is turned ON?	Go to Step 10.	Go to Step 9.
9	Check fuel pump for operating. 1) Was fuel pump operating sound heard from fuel filler for about 3 seconds after ignition switch ON and stop?	Go to "Diag. Flow Table B-3".	Go to "Diag. Flow Table B-1".
10	Check ignition spark referring to "Ignition Spark Test" in Section 6F. Is it in good condition?	Go to Step 11.	Go to "DIAGNOSIS" in Section 6F.
11	Check fuel injector referring to "Fuel Injector Inspection" in Section 6E. Is it in good condition?	Go to "Engine Diagnosis Table" in this section.	Go to "Diag. Flow Table B-2".

ENGINE DIAGNOSIS TABLE

Perform troubleshooting referring to following table when ECM (PCM) has detected no DTC and no abnormality has been found in visual inspection and engine basic inspection previously.

Condition	Possible Cause	Correction
Hard starting (Engine cranks OK)	Faulty idle air control system	"DTC P0505 DIAG. FLOW TABLE" in this section.
	Faulty ECT sensor or MAF sensor	ECT sensor or MAF sensor in Section 6E.
	Faulty ECM (PCM)	Inspection of ECM (PCM) and its circuit in this section.
	Low compression	Compression check in Section 6A1.
	Compression leak from valve seat	Valves inspection in Section 6A1.
	Sticky valve stem	Valves inspection in Section 6A1.
	Weak or damaged valve springs	Valves spring inspection in Section 6A1.
	Compression leak at cylinder head gasket	Cylinder head inspection in Section 6A1.
	Sticking or damaged piston ring	Piston ring inspection in Section 6A1.
	Worn piston, ring or cylinder	Cylinders, pistons and piston rings inspection in Section 6A1.
	Malfunctioning PCV valve	PCV system inspection in Section 6E.
Engine has no power	Engine overheating	Refer to "OVERHEATING" in this table.
	Defective spark plug	Spark plugs in Section 6F.
	Faulty ignition coil with ignitor	Ignition coil in Section 6F.
	Fuel pressure out of specification (dirty fuel filter, dirty or clogged fuel hose or pipe, malfunctioning fuel pressure regulator, malfunctioning fuel pump)	"DIAG. FLOW TABLE B-3" in this section.
	Maladjusted TP sensor installation angle	TP sensor in Section 6E.
	Faulty EGR system	"DTC P0400 DIAG. FLOW TABLE" in this section.
	Faulty injector	Fuel injection in Section 6E.
	Faulty TP sensor, ECT sensor or MAF sensor	TP sensor, ECT sensor or MAF sensor in Section 6E.
	Faulty ECM (PCM)	Inspection of ECM (PCM) and its circuit in this section.
	Low compression	Refer to the same item in "HARD STARTING" of this table.
	Dragging brakes	Diagnosis in Section 5.
	Slipping clutch	Diagnosis in Section 7C.

Condition	Possible Cause	Correction
Improper engine idling or engine fails to idle	Faulty spark plug	Spark plugs in Section 6F.
	Faulty ignition coil with ignitor	Ignition coil in Section 6F.
	Fuel pressure out of specification	"DIAG. FLOW TABLE B-3" in this section.
	Engine overheating	Refer to "OVERHEATING" in this table.
	Maladjusted TP sensor installation angle if adjustable	TP sensor in Section 6E.
	Faulty idle air control system	"DTC P0505 DIAG. FLOW TABLE" in this section.
	Faulty evaporative emission control system	"DTC P0443 DIAG. FLOW TABLE" in this section.
	Faulty EGR system	"DTC P0400 DIAG. FLOW TABLE" in this section.
	Faulty injector	Fuel injection in Section 6E.
	Faulty ECT sensor, TP sensor or MAF sensor	ECT sensor, TP sensor or MAF sensor in Section 6E.
	Faulty ECM (PCM)	Inspection of ECM (PCM) and its circuit in this section.
	Low compression	Refer to the same item in "HARD STARTING" of this table.
	Malfunctioning PCV valve	PCV system inspection in Section 6E.
Engine hesitates (Momentary lack of response as the accelerator is depressed. Can occur at all vehicle speeds. Usually most severe when first trying to make the vehicle move, as from a stop sign.)	Spark plug faulty or plug gap as out of adjustment	Spark plugs in Section 6F.
	Fuel pressure out of specification (clogged fuel filter, faulty fuel pressure regulator, clogged fuel filter, hose or pipe)	"DIAG. FLOW TABLE B-3" in this section.
	Engine overheating	Refer to "OVERHEATING" in this table.
	Faulty EGR system	"DTC P0440 DIAG. FLOW TABLE" in this section.
	Faulty injector	Fuel injector in Section 6E.
	Faulty TP sensor, ECT sensor or MAF sensor	TP sensor, ECT sensor or MAF sensor in Section 6E.
	Faulty ECM (PCM)	Inspection of ECM (PCM) and its circuit in this section.
	Low compression	Refer to the same item in "HARD STARTING" of this table.

Condition	Possible Cause	Correction
Surges (Engine power variation under steady throttle or cruise. Feels like the vehicle speeds up and down with no change in the accelerator pedal.)	Defective spark plug (excess carbon deposits, improper gap, and burned electrodes, etc.)	Spark plugs in Section 6F.
	Variable fuel pressure (clogged fuel filter, kinky or damaged fuel hose and line, faulty fuel pressure regulator)	"DIAG. FLOW TABLE B-3" in this section.
	Faulty EGR system	"DTC P0400 DIAG. FLOW TABLE" in this section.
	Faulty MAF sensor	MAF sensor in Section 6E.
	Faulty injector	Fuel injector in Section 6E.
	Faulty ECM (PCM)	Inspection of ECM (PCM) and its circuit in this section.
Excessive detonation (The engine makes sharp metallic knocks that change with throttle opening. Sounds like pop com popping.)	Engine overheating	Refer to "OVERHEATING" in this table.
	Faulty spark plug	Spark plugs in Section 6F.
	Improper ignition timing	Ignition timing in Section 6F.
	Clogged fuel filter and fuel lines	Fuel pressure check in Section 6E.
	Faulty EGR system	"DTC P0400 DIAG. FLOW TABLE" in this section.
	Faulty ECT sensor or MAF sensor	ECT sensor or MAF sensor in Section 6E.
	Faulty injector	Fuel injector in Section 6E.
	Faulty ECM (PCM)	Inspection of ECM (PCM) and its circuit in this section.
	Excessive combustion chamber	Piston and cylinder head cleaning in Section 6A1.
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.
	Dragging brakes	Diagnosis in Section 5.
	Slipping clutch	Diagnosis in Section 7C.
	Blower cylinder head gasket	Cylinder head inspection in Section 6A1.

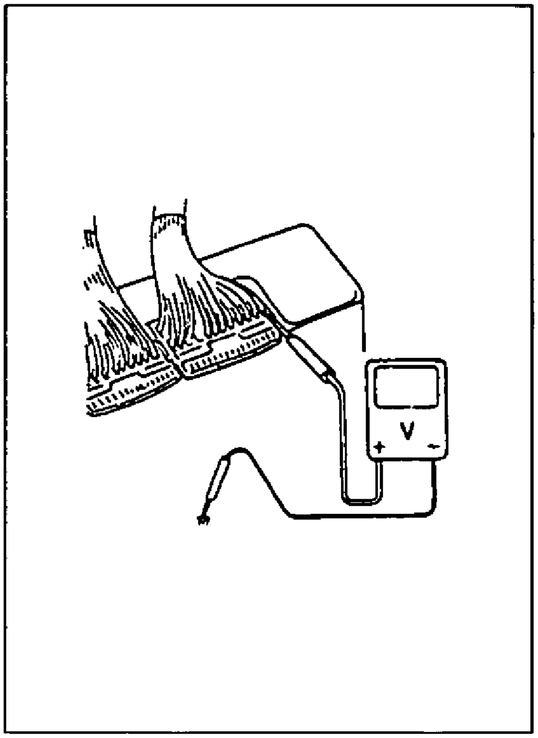
Condition	Possible Cause	Correction
Poor gasoline mileage	Faulty spark plug (improper gap, heavy deposits, and burned electrodes, etc.)	Spark plugs in Section 6F.
	Fuel pressure out of specification	"DIAG. FLOW TABLE B-3" in this section.
	Faulty TP sensor, ECT sensor or MAF sensor	TP sensor, ECT sensor or MAF sensor in Section 6E.
	Faulty EGR system	"DTC P0400 DIAG. FLOW TABLE" in this section.
	Faulty injector	Fuel injector in Section 6E.
	Faulty ECM (PCM)	Inspection of ECM (PCM) and its circuit in this section.
	Low compression	Refer to the same item in "HARD STARTING" of this table.
	Poor valve seating	Valves inspection in Section 6A1.
	Dragging brakes	Diagnosis in Section 5.
	Slipping clutch	Diagnosis in Section 7C.
	Thermostat out of order	Thermostat in Section 6B.
	Improper tire pressure	Diagnosis in Section 3.
Excessive engine oil consumption	Sticky piston ring	Piston cleaning in Section 6A1.
	Worn piston and cylinder	Cylinders, pistons and piston rings inspection in Section 6A1.
	Worn piston ring groove and ring	Pistons and piston rings inspection in Section 6A1.
	Improper location of piston ring gap	Pistons installation in Section 6A1.
	Worn or damaged valve stem seal	Valves and cylinder head in Section 6A1.
	Worn valve stem	Valves inspection in Section 6A1.
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 6A1.
	Functional deterioration of oil pump	Oil pump in Section 6A1.
	Worn oil pump relief valve	Oil pump in Section 6A1.
	Excessive clearance in various sliding parts	"INSPECTION" for each parts in Section 6A1.

Condition	Possible Cause	Correction
Engine noise (Note: Before checking the mechanical noise, make sure the followings: Ignition timing is properly adjusted, specified spark plug is used, specified fuel is used.)	Worn valve stem and guide	Valves inspection in Section 6A1.
	Weak or broken valve spring	Valve springs inspection in Section 6A1.
	Warped or bent valve	Valve inspection in Section 6A1.
	Loose camshaft housing bolts	Camshafts in Section 6A1.
	Worn piston, ring and cylinder bore	Pistons and cylinders inspection in Section 6A1.
	Worn crankpin bearing	Crankpin and connecting rod bearing inspection in Section 6A1.
	Worn crankpin	Crankpin and connecting rod bearing inspection in Section 6A1.
	Loose connecting rod nuts	Connecting rod installation in Section 6A1.
	Low oil pressure	Refer to "LOW OIL PRESSURE" of this table.
	Worn crankshaft journal bearing	Crankshaft and bearing inspection in Section 6A1.
	Worn crankshaft journal	Crankshaft and bearing inspection in Section 6A1.
	Loose lower crankcase (bearing cap) bolts	Crankshaft installation in Section 6A1.
	Excessive crankshaft thrust play	Crankshaft inspection in Section 6A1.

INSPECTION OF ECM AND ITS CIRCUITS

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

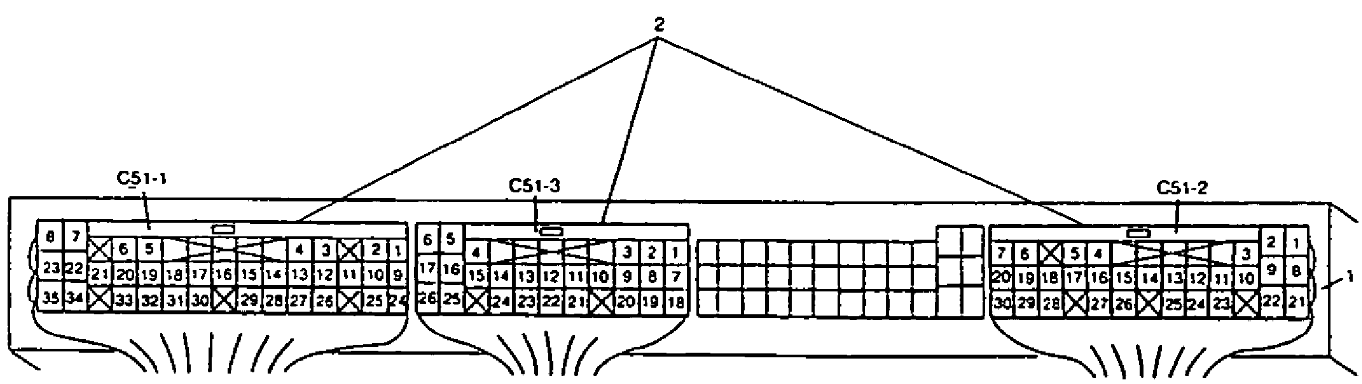
> **CAUTION:**
> **ECM cannot be checked by itself. It is strictly prohibited to connect voltmeter or ohmmeter to ECM with couplers disconnected from it.**



Voltage Check

1) Check voltage at each terminal of couplers connected.

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

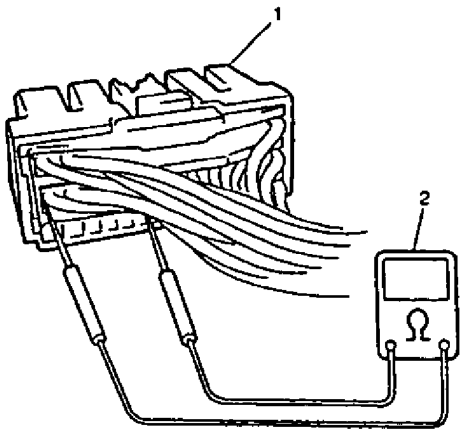


1. ECM
2. ECM connector
   (Viewed from harness side)

TERMINAL		CIRCUIT	NORMAL VOLTAGE	CONDITION
C51-1	1	——	——	——
	2	Power source for back up	10 – 14 V	Ignition switch ON and OFF
	3	Heater of HO2S-2	10 – 14 V	Ignition switch ON
			0 – 2 V	At specified condition
	4	——	——	——
	5	Immobilizer indicator lamp	0 – 2.5 V	Ignition switch ON, engine stops
			10 – 14 V	Engine running
	6	——	——	——
	7	Malfunction indicator lamp	0 – 2.5 V	Ignition switch ON, engine stops
			10 – 14 V	Engine running
	8	——	——	——
	9	Main relay	10 – 14 V	Ignition switch OFF
			0 – 2 V	Ignition switch ON or for 4 seconds after ignition switch OFF
	10	——	——	——
	11	——	——	——
	12	Data link connector	4 – 6 V	Ignition switch ON
	13	Data link connector	10 – 14 V	Ignition switch ON
	14	——	——	——
	15	——	——	——
	16	——	——	——
	17	A/C signal (if equipped)	10 – 14 V	Ignition switch ON, A/C switch or heater blower switch OFF
			0 – 1 V	Ignition switch ON, A/C switch ON and heater blower switch ON
	18	——	——	——
	19	——	——	——
	20	——	——	——
	21	——	——	——
	22	——	——	——
	23	Fuel pump relay	0 – 2.5 V	For 3 sec. after ignition switch ON or while engine running
			10 – 14 V	After 3 sec. from ignition switch ON with engine stopped
	24	——	——	——
	25	——	——	——
	26	Heated oxygen sensor-2	0.01 – 0.95 V	While engine running at 2000 r/min. for 3 min. or longer after warming up
	27	——	——	——
	28	Fuel level sensor	0 – 6 V	Ignition switch ON Voltage depends on fuel level
	29	——	——	——
	30	——	——	——
	31	——	——	——
	32	——	——	——
	33	——	——	——
	34	——	——	——
	35	——	——	——

TERMINAL		CIRCUIT	NORMAL VOLTAGE	CONDITION
C51-3	1	Intake air temp. sensor	2.2 – 3.0 V	Ignition switch ON, Sensor ambient temp.: 20°C, 68°F
	2	Engine coolant temp. sensor	0.5 – 0.9 V	Ignition switch ON, Engine coolant temp.: 80°C, 176°F
	3	——	——	——
	4	Power source	10 – 14 V	Ignition switch ON
	5	——	——	——
	6	Ground	——	——
	7	Power steering pressure switch	10 – 14 V	Ignition switch ON
			0 – 1 V	With engine running at idle speed, turning steering wheel to the right or left as far as it stops
	8	Manifold differential pressure sensor	4 – 5 V	Ignition switch ON
	9	Throttle position sensor	0.5 – 1.2 V	Ignition switch ON, Throttle valve at idle position
			3.4 – 4.7 V	Ignition switch ON, Throttle valve at full open position
	10	Mass air flow sensor	1.0 – 1.6 V	Ignition switch ON and engine stops
			1.7 – 2.0 V	With engine running at idle speed
	11	Heated oxygen sensor-1	Deflects between over and under 0.45 V	While engine running at 2,000 r/min. for 1 min. or longer after warmed up
	12	——	——	——
	13	——	——	——
	14	Power source for manifold differential pressure sensor	4.75 – 5.25 V	Ignition switch ON
	15	Power source	10 – 14 V	Ignition switch ON
	16	——	——	——
	17	Ground	——	——
	18	Engine start signal	6 – 14 V	While engine cranking
			0 – 1 V	Other than above
	19	——	——	——
	20	Ignition switch	10 – 14 V	Ignition switch ON
	21	——	——	——
	22	——	——	——
	23	——	——	——
	24	Closed throttle position (idle) switch	——	——
	25	Ground for IAT, ECT, TP and MDP sensors	——	——
	26	——	——	——

TERMINAL		CIRCUIT	NORMAL VOLTAGE	CONDITION
C51-2	1	Fuel injector No.2	10 – 14 V	Ignition switch ON
	2	Fuel injector No.1		
	3	——	——	——
	4	Heater of HO2S-1	10 – 14 V	Ignition switch ON
			0 – 2 V	At specified idle speed after engine warmed up
	5	——	——	——
	6	——	——	——
	7	——	——	——
	8	Fuel injector No.4	10 – 14 V	Ignition switch ON
	9	Fuel injector No.3		
	10	IAC valve	10 – 14 V	Ignition switch ON
	11	——	——	——
	12	——	——	——
	13	EGR valve (stepper motor coil 4)	0 – 1 V	Ignition switch ON
	14	EGR valve (stepper motor coil 3)	10 – 14 V	
	15	EGR valve (stepper motor coil 2)	10 – 14 V	
	16	EGR valve (stepper motor coil 1)	0 – 1 V	
	17	EVAP canister purge valve	10 – 14 V	
	18	——	——	——
	19	Crankshaft position sensor (+)	——	——
	20	Crankshaft position sensor (–)	——	——
	21	——	——	——
	22	——	——	——
	23	——	——	——
	24	Ignition coil	0 – 1 V	Ignition switch ON
			Between 0 – 1 V and 4 – 5 V	While engine cranking
	25	Vehicle speed sensor	Deflects between 0 – 1 V and over 4 V	Ignition switch ON, rear right tire turned slowly with rear left tire locked
	26	Camshaft position sensor	Deflects between 0 – 1 V and 4 – 6 V	Ignition switch ON, crankshaft turned slowly
	27	——	——	——
	28	Ground	——	——
	29	——	——	——
	30	——	——	——



1. ECM coupler disconnected
2. Ohmmeter

Resistance Check

1) Disconnect couplers from ECM with ignition switch OFF.

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

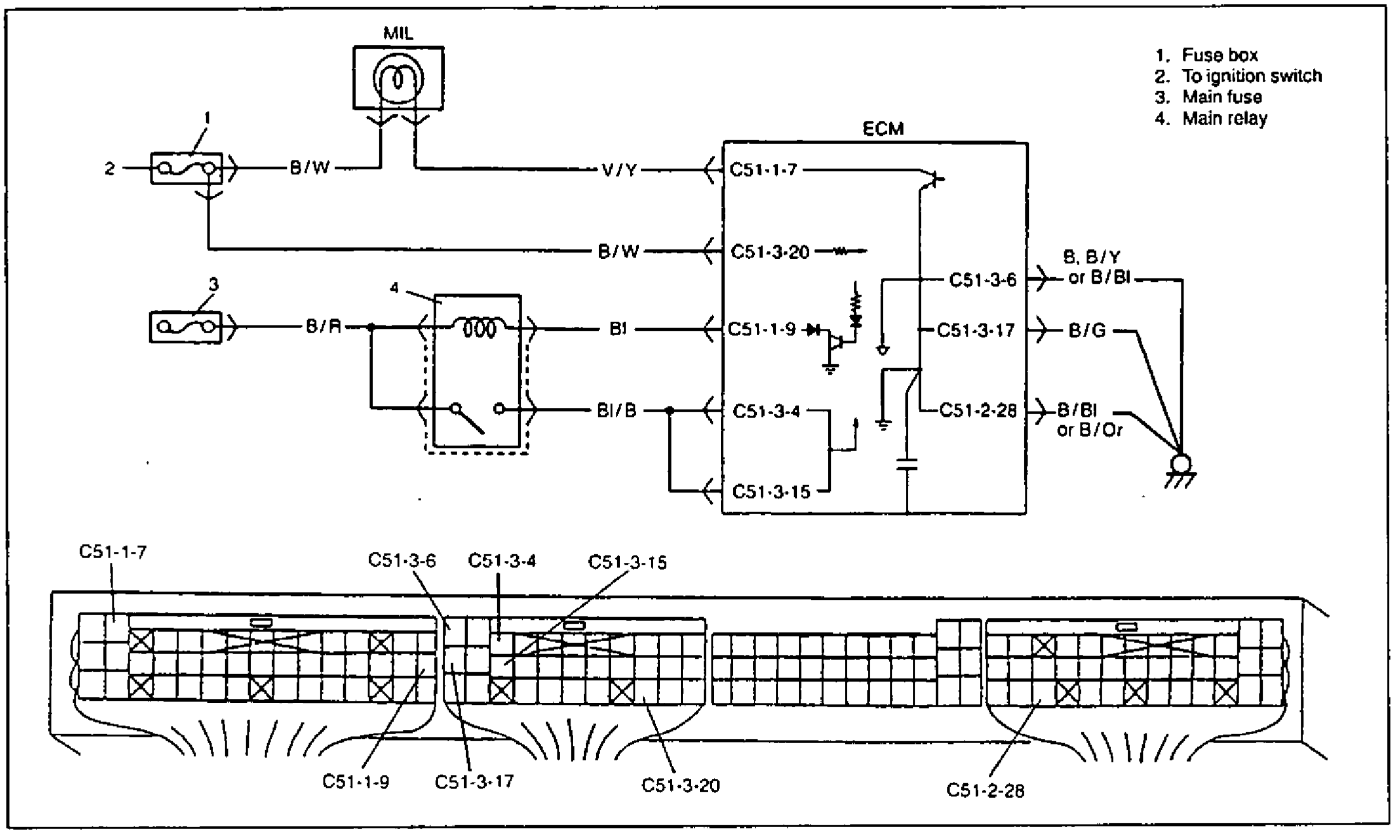
2) Check resistance between each pair of terminals of disconnected couplers as listed in the following table.

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

TERMINALS	CIRCUIT	STANDARD RESISTANCE	CONDITION
C51-1-3 and C51-3-20	Heater of HO2S-2	11.7 – 14.3 Ω	—
C51-1-9 and C51-1-2	Main relay	60 – 90 Ω	—
C51-1-23 and C51-3-20	Fuel pump relay	60 – 90 Ω	—
C51-3-6 and Body ground	Ground	Continuity	—
C51-3-17 and Body ground	Ground	Continuity	—
C51-2-1- and C51-3-4	Fuel injector No.2	12 – 17 Ω	—
C51-2-2 and C51-3-4	Fuel injector No.1		
C51-2-4 and C51-3-20	Heater of HO2S-1	5.4 – 6.4 Ω	—
C51-2-8 and C51-3-4	Fuel injector No.4	12 – 17 Ω	—
C51-2-9 and C51-3-4	Fuel injector No.3		
C51-2-10 and C51-3-4	IAC valve	11 – 14 Ω	—
C51-2-13 and C51-3-4	EGR valve (stepper motor coil 4)	20 – 24 Ω	—
C51-2-14 and C51-3-4	EGR valve (stepper motor coil 3)		
C51-2-15 and C51-3-4	EGR valve (stepper motor coil 2)		
C51-2-16 and C51-3-4	EGR valve (stepper motor coil 1)		
C51-2-17 and C51-3-4	EVAP canister purge valve	30 – 34 Ω	—
C51-2-28 and Body ground	Ground	Continuity	—

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

WIRING DIAGRAM



CIRCUIT DESCRIPTION

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

INSPECTION

STEP	ACTION	YES	NO
1	MIL Power Supply Check: 1) Turn ignition switch ON. Do other indicator/warning lights in combination meter comes ON?	Go to Step 2.	"IG" fuse blown, main fuse blown, Ignition switch malfunction, "B/W" circuit between "IG" fuse and combination meter or poor coupler connection at combination meter.
2	ECM Power and Ground Circuit Check: Does engine start?	Go to Step 3.	Go to TABLE A-3 ECM 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. 2) Check for proper connection to ECM at terminal C51-1-7. 3) If OK, then using service wire, ground terminal C51-1-7 in connector disconnected. Does MIL turn on at ignition switch ON?	Substitute a known-good ECM 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

STEP	ACTION	YES	NO
1	DTC check: 1) With ignition switch OFF, install scan tool. 2) Start engine and check DTC. Is there any DTC(s).	Go to Step 2 of "ENGINE DIAG. FLOW TABLE" in this section.	Go to Step 2.
2	MIL circuit check: (1) With ignition switch OFF, disconnect couplers from ECM. Does MIL turn ON at ignition switch ON?	"V/Y" wire shorted to ground circuit.	Substitute a known-good ECM and recheck.

ENGINE DIAGNOSIS 6-35

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

WIRING DIAGRAM/CIRCUIT DESCRIPTION

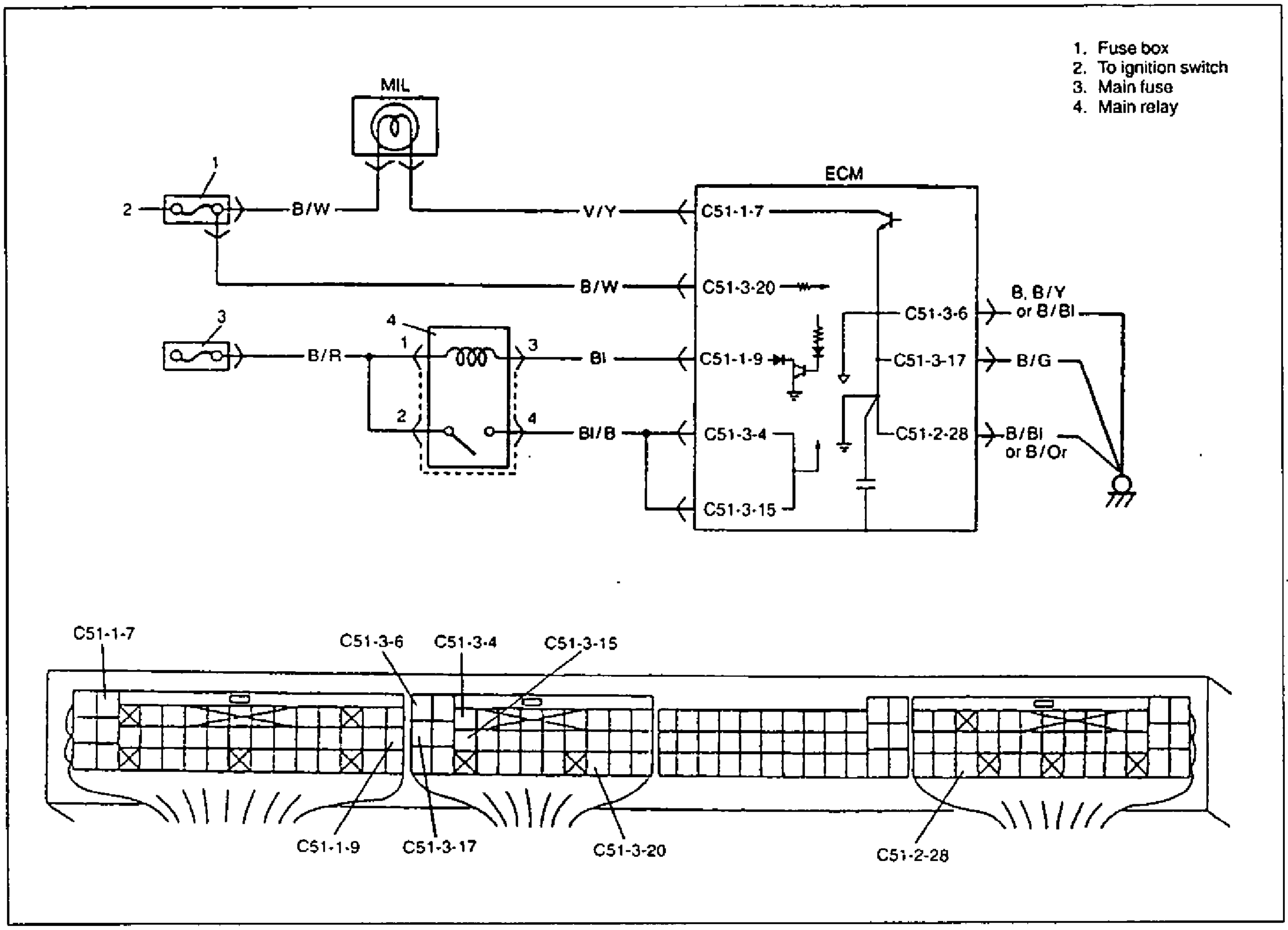
Refer to TABLE A-1.

INSPECTION

STEP	ACTION	YES	NO
1	DTC check: 1) With ignition switch OFF, install scan tool. 2) Start engine and check DTC. Is there any DTC(s).	Go to Step 2 of "ENGINE DIAG. FLOW TABLE" in this section.	Go to Step 2.
2	MIL circuit check: (1) With ignition switch OFF, disconnect couplers from ECM. Does MIL turn ON at ignition switch ON?	"V/Y" wire shorted to ground circuit.	Substitute a known-good ECM and recheck.

TABLE A-3 ECM POWER AND GROUND CIRCUIT CHECK – MIL DOESN'T LIGHT AT IGNITION SWITCH ON AND ENGINE DOESN'T START THOUGH IT IS CRANKED UP.

WIRING DIAGRAM



CIRCUIT DESCRIPTION

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

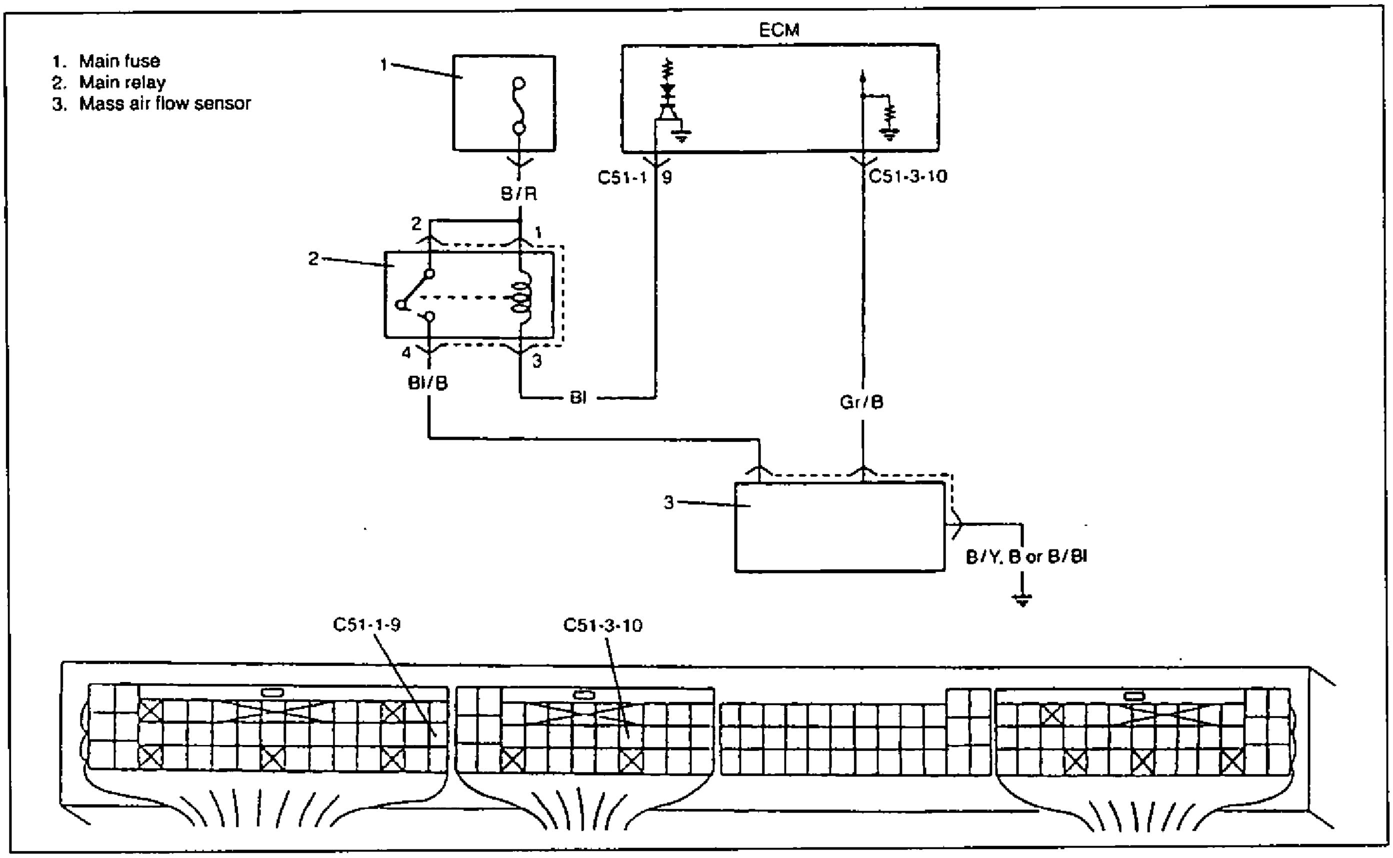
TABLE A-3

INSPECTION

STEP	ACTION	YES	NO
1	Main Relay Operating Sound check: Is operating sound of main relay heard at ignition switch ON?	Go to Step 5.	Go to Step 2.
2	Fuse check: Is main "FI" fuse in good condition?	Go to Step 3.	Check for short in circuits connected to this fuse.
3	Main Relay check: 1) Turn OFF ignition switch and remove main relay. 2) Check for proper connection to main relay at terminal 3 and 4. 3) If OK, check main relay for resistance and operation referring to "Main Relay Inspection" in Section 6E. Is check result satisfactory?	Go to Step 4.	Replace main relay.
4	ECM Power Circuit check: 1) Turn OFF ignition switch, disconnect connectors from ECM and install main relay. 2) Check for proper connection to ECM at terminals C51-3-20, C51-1-9, C51-3-15 and C51-3-4. 3) If OK, then measure voltage between terminal C51-3-20 and ground, C51-1-9 and ground with ignition switch ON. Is each voltage 10 – 14 V?	Go to Step 5.	"B/W", "Bl" or "B/R" circuit open.
5	ECM Power Circuit check: 1) Using service wire, ground terminal C51-1-9 and measure voltage between terminal C51-3-4 and ground at ignition switch ON. Is it 10 – 14 V?	Check ground circuits "B (or B/Y or B/I)", "B/G" and "B/Bl (or B/Or)" for open. If OK, then substitute a known-good ECM and recheck.	Go to Step 6.
6	Is operating sound of main relay heard in Step 1?	Go to Step 7.	"B/R" or "Bl/B" wire open.
7	Main Relay check: 1) Check main relay according to procedure in Step 3. Is main relay in good condition?	"B/R" or "Bl/B" wire open.	Replace main relay.

DTC P0100 MASS AIR FLOW CIRCUIT MALFUNCTION

WIRING DIAGRAM



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Either the following conditions A or B are detected for 5 sec. continuously. A: 1) Engine running 2) Less than 0.64 mA MAF sensor output current continues for 100 msec. B: 1) Engine running 2) More than 3 sec. after ignition switch ON and more than 4.90 mA MAF sensor output current continues for 100 msec.	• MAF sensor circuit open or short • MAF sensor • ECM

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

- **Intake air temp.: –8°C, 18°F or higher**
- **Engine coolant temp.: –8 – 110°C (18 – 230°F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

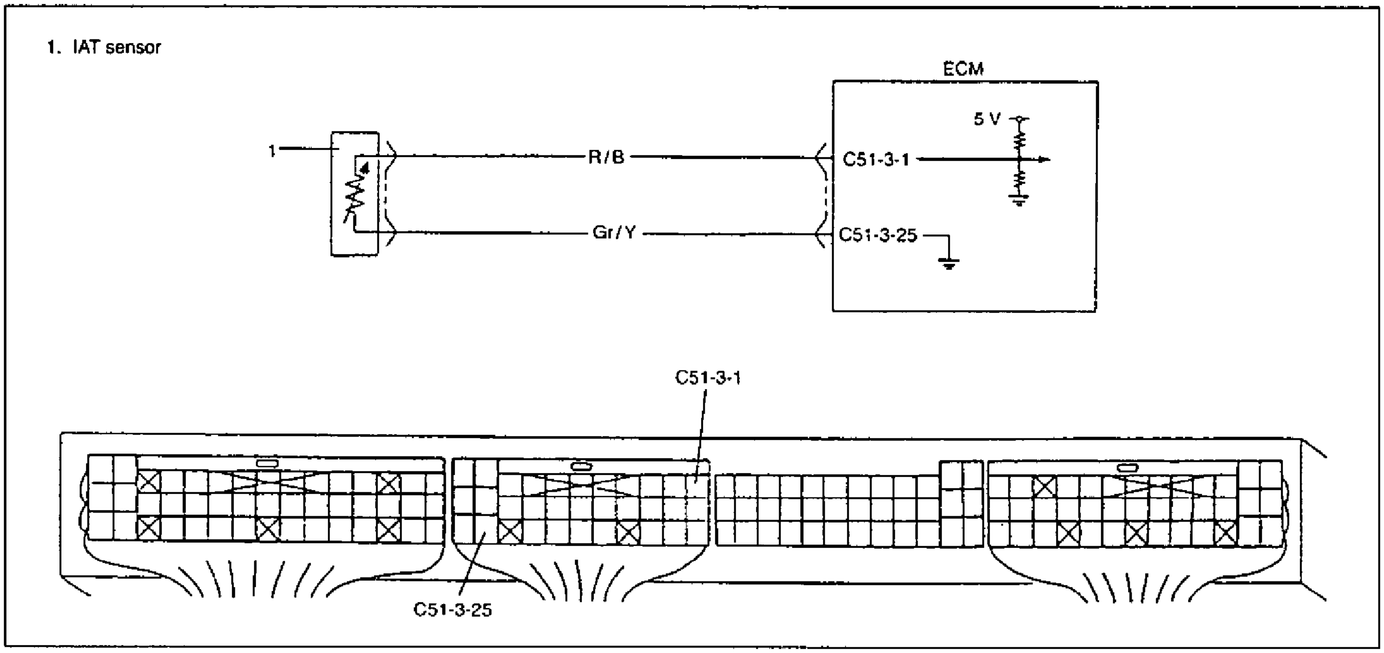
1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool and run engine at idle speed for 20 sec. or more.
3) Check DTC and pending DTC by using scan tool.

TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	MAF sensor check: 1) Connect scan tool to DLC with ignition switch OFF. 2) Start engine and check MAF value displayed on scan tool. (Refer to "Scan Tool Data" for normal value.) Is normal value indicated?	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A.	Go to Step 3.
3	MAF sensor power supply check: 1) With ignition switch OFF, disconnect MAF sensor coupler. 2) With ignition switch ON, check voltage between "Bl/B" wire terminal of MAF sensor coupler and ground. Is voltage 10 – 14 V?	Go to Step 4.	Faulty "Bl/B" wire.
4	MAF sensor output voltage check: 1) With ignition switch OFF, connect MAF sensor coupler. 2) With ignition switch ON leaving engine OFF, check voltage between C51-3-10 and ground. Is voltage 1.0 – 1.6 V?	Go to Step 5.	"Gr/B" wire open or shorted to power circuit, "B/Y (or B or B/Bl)" wire open. Poor MAF sensor coupler terminal connection. If wire and connection are OK, substitute a known-good MAF sensor and recheck.
5	MAF sensor performance check: 1) Start engine and check voltage between C51-3-10 and ground. Does voltage rise within 5 V range when engine speed is increased?	Poor C51-3-10 connection. Substitute a known-good ECM and recheck.	Substitute a known-good MAF sensor and recheck.

DTC P0110 INTAKE AIR TEMP. (IAT) CIRCUIT MALFUNCTION

WIRING DIAGRAM



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Following conditions are detected. • Engine running • High intake air temperature or Low temperature (<–40°C (–40°F) or > 137.4°C (279°F))	• IAT sensor circuit short • IAT sensor • ECM

DTC CONFIRMATION PROCEDURE

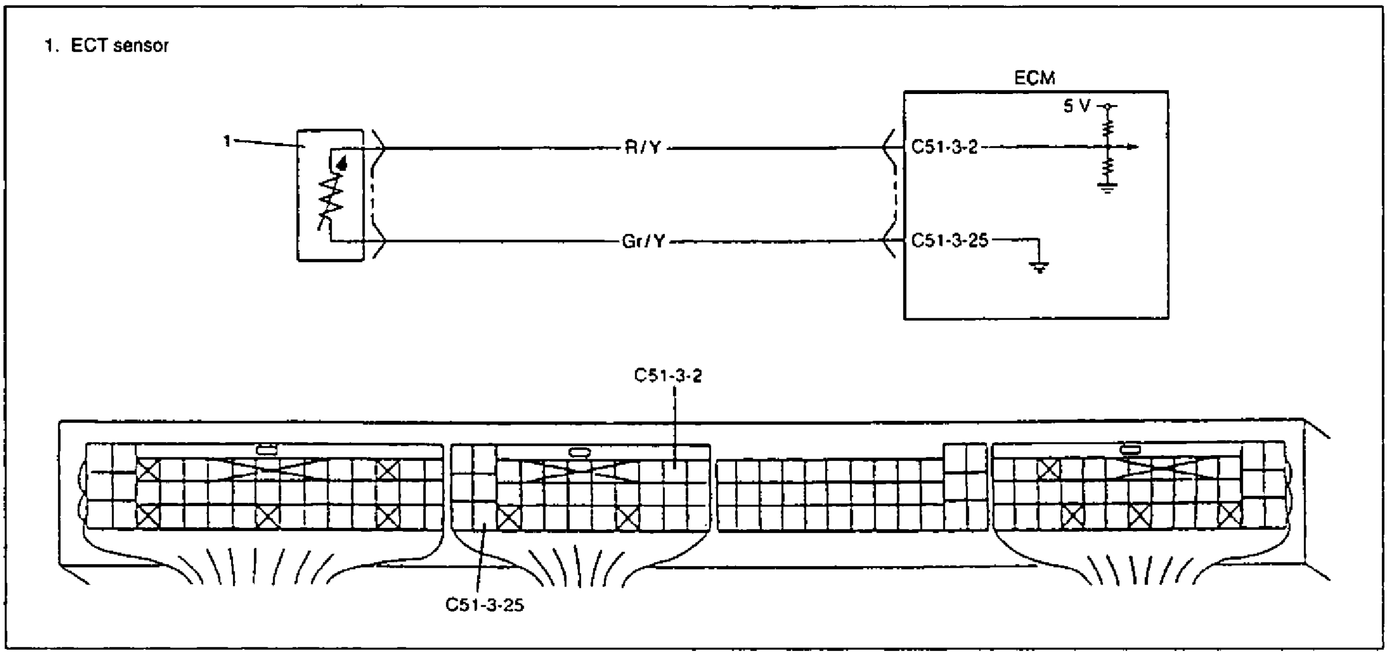
1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool and run engine at idle speed for 10 sec. or more.
3) Check DTC and pending DTC by using scan tool.

TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Check IAT Sensor and Its Circuit. 1) Connect scan tool with ignition switch OFF. 2) Turn ignition switch ON. 3) Check intake air temp. displayed on scan tool. Is –40°C (–40°F) or 150°C (302°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 "R/B" and "Gr/Y" wire terminals. 3) If OK, then with ignition switch ON, is voltage applied to "R/B" wire terminal about 4 – 6 V?	Go to Step 5.	"R/B" wire open or shorted to power, or poor C51-3-1 connection. If wire and connection are OK, substitute a known-good ECM and recheck.
4	Does scan tool indicate –40°C (–40°F) at Step 2?	Go to Step 6.	Go to Step 5.
5	IAT sensor circuit check: 1) Disconnect IAT sensor connector. 2) Check intake air temp. displayed on scan tool. Is –40°C (–40°F) indicated?	Replace IAT sensor.	"LBl" wire shorted to ground. If wire is OK, substitute a known-good ECM and recheck.
6	Check Wire Harness. 1) Using service wire, connect IAT sensor connector terminals. 2) Turn ignition switch ON and check intake air temp. displayed on scan tool. Is 150°C (302°F) indicated?	Replace IAT sensor.	"Gy/Y" wire open or poor C51-3-25 connection. If wire and connection are OK, substitute a known-good ECM and recheck.

DTC P0115 ENGINE COOLANT TEMP. CIRCUIT MALFUNCTION

WIRING DIAGRAM



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Following conditions are detected for 5 sec. continuously. • Engine running • High engine coolant temperature or Low temperature (<–40°C (–40°F) or > 137.4°C (279°F))	• ECT sensor circuit short • ECT sensor • ECM

DTC CONFIRMATION PROCEDURE

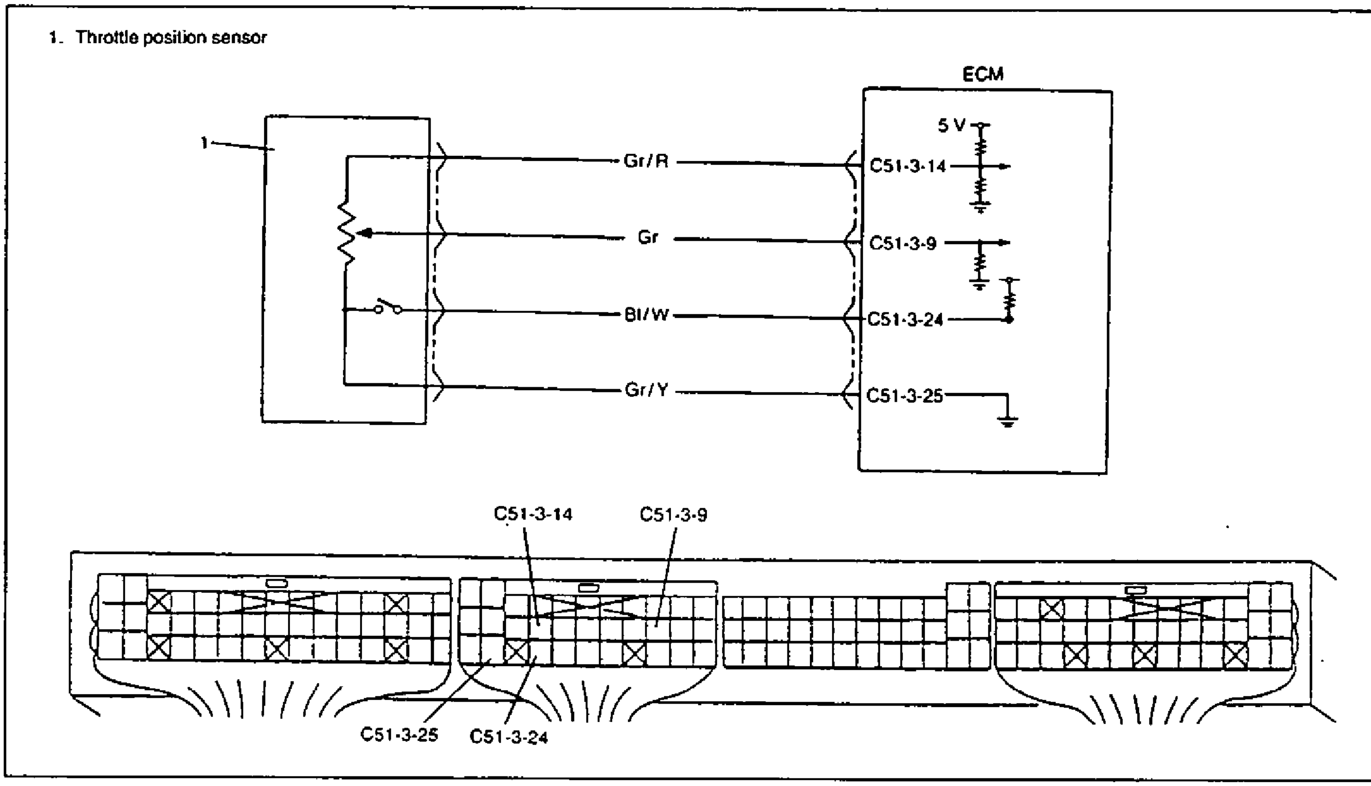
1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool and run engine at idle speed for 10 sec. or more.
3) Check DTC and pending DTC by using scan tool.

TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Check ECT Sensor and Its Circuit. 1) Connect scan tool with ignition switch OFF. 2) Turn ignition switch ON. 3) Check engine coolant temp. displayed on scan tool. Is −40°C (−40°F) or 164°C (327°F) indicated?	Go to Step 3.	Intermittent rouble. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A.
3	Check Wire Harness. 1) Disconnect ECT sensor connector with ignition switch OFF. 2) Check for proper connection to ECT sensor at "R/Y" and "Gr/Y" wire terminals. 3) If OK, then with ignition switch ON, is voltage applied to "R/Y" wire terminal about 4 – 6 V?	Go to Step 5.	"R/Y" wire open or shorted to power, or poor C51-3-2 connection. If wire and connection are OK, substitute a known-good ECM and recheck.
4	Does scan tool indicate −40°C (−40°F) at Step 2?	Go to Step 6.	Go to Step 5.
5	Check Wire Harness. 1) Disconnect ECT sensor connector. 2) Check engine coolant temp. displayed on scan tool. Is −40°C (−40°F) indicated?	Replace ECT sensor.	"R/Y" wire shorted to ground. If wire is OK, substitute a known-good ECM and recheck.
6	Check Wire Harness. 1) Using service wire, connect ECT sensor connector terminals. 2) Turn ignition switch ON and check engine coolant temp. displayed on scan tool. Is 164°C (327°F) indicated?	Replace ECT sensor.	"Gr/Y" wire open or poor C51-3-23 connection. If wire and connection are OK, substitute a known-good ECM and recheck.

DTC P0120 THROTTLE POSITION CIRCUIT MALFUNCTION

WIRING DIAGRAM



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Following conditions are detected for 5 sec. continuously. • Engine running • Signal voltage low or high (Throttle valve opening <3.9 deg or > 119.1 deg)	• TP sensor circuit open or short • TP sensor • ECM

DTC CONFIRMATION PROCEDURE

1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool and run engine at idle speed for 10 sec. or more.
3) Check DTC and pending DTC by using scan tool.

TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Check TP Sensor and Its Circuit. 1) Connect scan tool to DLC with ignition switch OFF and then turn ignition switch ON. 2) Check throttle valve opening percentage displayed on scan tool while opening throttle valve from idle position to full open position. Is it displayed about 17% or 80%?	Go to Step 3.	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A.
3	Check Wire Harness. 1) Disconnect connector from TP sensor with ignition switch OFF. 2) Check for proper connection to TP sensor at each terminals "Gr/R" and "Gr". 3) If OK, then with ignition switch ON, check voltage at terminal between "Gr/R" and "Gr/Y" of TP sensor. Is voltage about 4 – 6 V?	Go to Step 4.	"Gr/R" wire open, "Gr/R" wire shorted to ground or power circuit. "Gr/Y" wire open, poor C51-3-25 connection, or poor C51-3-14 or C51-3-25 connection. If wire and connection are OK, substitute a known-good ECM and recheck.
4	Check TP Sensor. 1) Check resistance between terminals of TP sensor referring to "TP Sensor Inspection" in Section 6E. Are measured values within specifications?	"Gr" wire open/ shorted to ground or power circuit or poor C51-3-9 connection. If OK, substitute a known-good ECM and recheck.	Replace TP sensor.

DTC P0121 THROTTLE POSITION CIRCUIT PERFORMANCE PROBLEM

WIRING DIAGRAM

Refer to DTC P0120.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Throttle opening change is smaller than specification while intake air volume changes and engine is running at constant speed. (2 driving cycles detection logic)	• TP sensor • ECM

DTC CONFIRMATION PROCEDURE

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

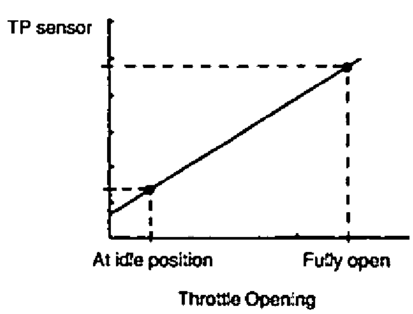
NOTE:
Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.
- **Intake air temp.: –8°C, 18°F or higher**
- **Engine coolant temp.: –8 – 110°C (18 – 230°F)**
- **Altitude barometric pressure: 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool and start engine.
3) Increase vehicle speed to 60 km/h (40 mph).
4) Keep driving above vehicle speed for 5 min. (Change of vehicle speed is permitted in this step).
5) Stop vehicle and run engine at idle speed for 1 min.
6) Increase vehicle speed till engine speed is reached 2,000 – 3,000 r/min in proper gear.
7) Keep driving at that engine speed for 30 sec. or more (Engine speed is kept constant in this step).
8) Stop vehicle.
9) Repeat step 6) to 8).
10) Check DTC and pending DTC by using scan tool.

TROUBLESHOOTING (DTC P0121)

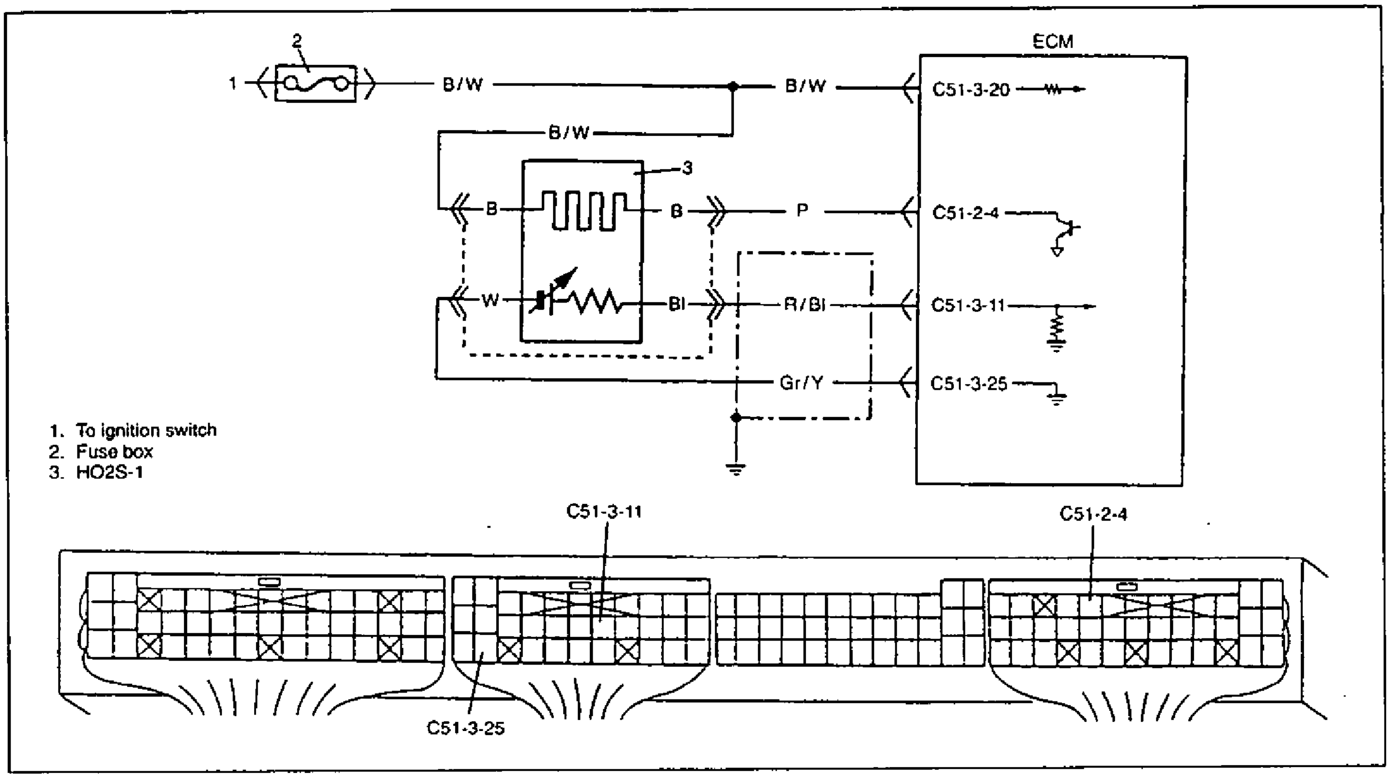
STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Is there a DTC related to TP sensor (DTC P0120)?	Go to applicable DTC Diag. Flow Table.	Go to Step 3.
3	Check TP sensor and Its Circuit. When using SUZUKI scan tool: 1) Turn ignition switch OFF and connect SUZUKI scan tool to DLC. 2) Turn ignition switch ON and check TP sensor output voltage when throttle valve is at idle position and fully opened. When not using SUZUKI scan tool: 1) Turn ignition switch ON. 2) Check voltage at terminal C51-3-9 of ECM connector connected, when throttle valve is at idle position and fully opened. Does voltage vary within specified value linearly as shown in figure?	If voltmeter was used, check terminal C51-3-9 for poor connection. If OK, substitute a known-good ECM and recheck.	Go to Step 4.
4	Check TP Sensor. 1) Turn ignition switch OFF. 2) Disconnect TP sensor connector. 3) Check for proper connection to TP sensor at each terminal. 4) If OK, check TP sensor for resistance referring to "TP sensor Inspection" in Section 6E. Is check result satisfactory?	High resistance in "Gr/R", "Gr" or "Gr/Y" circuit. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.	Replace TP sensor.

Fig. for Step 3



DTC P0130 HO2S-1 CIRCUIT MALFUNCTION

WIRING DIAGRAM



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Following conditions are detected in idle state while running under driving conditions described for DTC CONFIRMATION PROCEDURE. P0130 (LOW VOLTAGE): • 4.5 V or more HO2S circuit voltage is detected, when 5 V power is connected to HO2S circuit in ECM or • Max. output voltage of HO2S is 0.6 V or lower on average and its minimum voltage on average is 0.3 V or lower. (2 driving cycles detection logic) P0130 (HIGH VOLTAGE): • Min. output voltage of HO2S is over 3.0 V or • Max. output voltage of HO2S is 0.74 V or higher on average and its min. voltage on average is 0.33 V or higher. (2 driving cycles detection logic)	• HO2S-1 or its circuit. • Fuel system • ECM

DTC CONFIRMATION PROCEDURE

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

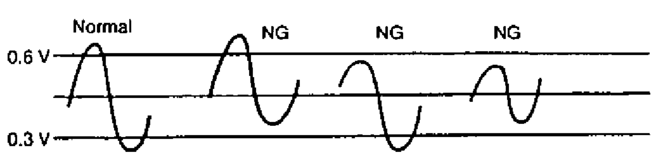
NOTE:
Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.
- **Intake air temp.: –8°C, 18°F or higher**
- **Engine coolant temp.: –8 – 110°C (18 – 230°F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool and start engine.
3) Increase vehicle speed to 55 km/h (35 mph) or more.
4) Keep driving above vehicle speed for 2 min. or more (Change of vehicle speed is permitted in this step).
5) Stop vehicle, and run engine at idle speed for 1 min.
6) Check if DTC and pending DTC exists by using scan tool. If not, check if oxygen sensor monitoring test has completed by using scan tool. If not in both of above checks (i.e., no pending DTC and oxygen sensor monitoring test not completed), check vehicle condition (environmental) and repeat step 3) through 6).

TROUBLESHOOTING (DTC P0130)

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	HO2S-1 output voltage check: 1) Connect scan tool to DLC with ignition switch OFF. 2) Warm up engine to normal operating temperature and keep it at 2000 r/min. for 60 sec. 3) Repeat racing engine (Repeat depressing accelerator pedal 5 to 6 times continuously to enrich A/F mixture and take foot off from pedal to enlean and check HO2S output voltage displayed on scan tool. See Fig. 1. Is over 0.6 V and below 0.3 V indicated?	Go to Step 4.	Go to Step 3.
3	HO2S-1 check: 1) With ignition switch OFF, disconnect HO2S-1 connector. 2) Check for proper connection to HO2S-1 at each terminal. 3) If OK, connect voltmeter "Bl" and "W" wire terminal of HO2S-1 connector. 4) Start engine and check voltmeter while repeating racing engine. Is over 0.6 V and below 0.3 V indicated?	"R/Bl" or "Gr/Y" circuit open or short. If wire and connections are OK, substitute a known-good ECM and recheck.	Replace HO2S-1 and recheck.
4	Short term fuel trim check: 1) Run engine at 2000 r/min. for 60 sec. 2) With engine idling, check short term fuel trim displayed on scan tool. Is it within –20 to +20%?	Intermittent trouble or faulty ECM. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A.	Go to DTC P0171/ P0172 Diag. Flow Table.

Fig. 1 for Step 2



DTC P0133 HO2S-1 CIRCUIT SLOW RESPONSE

WIRING DIAGRAM

Refer to DTC P0130.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Following conditions are detected in idle state while running under driving conditions described for DTC CONFIRMATION PROCEDURE. Hi/Lo cycle (TRANS TIME displayed on scan tool) of HO2S-1 output voltage is longer than specification or response rates of Hi → Lo and Lo → Hi (TRANS TIME displayed as R → L threshold V or L → R threshold V on scan tool) are longer than specification. (2 driving cycle detection logic)	• HO2S-1 • ECM

DTC CONFIRMATION PROCEDURE

Refer to DTC P0130.

TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	1) Replace HO2S-1 and recheck. Is DTC P0133 detected?	Substitute a known-good ECM and recheck.	HO2S-1 malfunction.

DTC P0134 HO2S-1 NO ACTIVITY DETECTED

WIRING DIAGRAM

Refer to DTC P0130.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Following conditions are detected in vehicle running state while running under driving conditions described for DTC CONFIRMATION PROCEDURE. Output voltage of HO2S-1 does not exceed 0.45 V for specified time. (2 driving cycle detection logic)	• HO2S-1 or its circuit • Fuel system • ECM

DTC CONFIRMATION PROCEDURE

Refer to DTC P0130.

TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	HO2S-1 output voltage check: 1) Connect scan tool to DLC with ignition switch OFF. 2) Warm up engine to normal operating temperature and keep it at 2000 r/min. for 60 sec. 3) Repeat racing engine (Repeat depressing accelerator pedal 5 to 6 times continuously to enrich A/F mixture and take foot off from pedal to enlean and check HO2S output voltage displayed on scan tool.). Is over 0.6 V and below 0.3 V indicated?	Go to Step 4.	Go to Step 3.
3	HO2S-1 check: 1) With ignition switch OFF, disconnect HO2S-1 connector. 2) Check for proper connection to HO2S-1 at each terminal. 3) If OK, connect voltmeter between "Bl" and "W" wire terminal of HO2S-1 connector. 4) Start engine and check voltmeter while repeating racing engine. Is over 0.6 V and below 0.3 V indicated?	"R/Bl" or "Gr/Y" circuit open or short. If wire and connections are OK, substitute a known-good ECM and recheck.	Replace HO2S-1.
4	Short term fuel trim check: 1) Run engine at 2000 r/min. for 60 sec. 2) With engine idling, check short term fuel trim displayed on scan tool. Is it within −20 to +20%?	Intermittent trouble or faulty ECM. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A.	Go to DTC P0171/ P0172 Diag. Flow Table.

DTC P0135 HO2S-1 HEATER CIRCUIT MALFUNCTION

WIRING DIAGRAM

Refer to DTC P0130.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Following condition is detected when HO2S heater is electrically live. • Current of HO2S heater is 4.03 A or more or less than 0.15 A, or • Voltage of HO2S heater is 13.84 V or higher or lower than 10.03 V. (2 driving cycle detection logic)	• HO2S-1 heater circuit • HO2S-1 heater • ECM

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

- **Intake air temp.: –8°C, 18°F or higher**
- **Engine coolant temp.: –8 – 110°C (18 – 230°F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

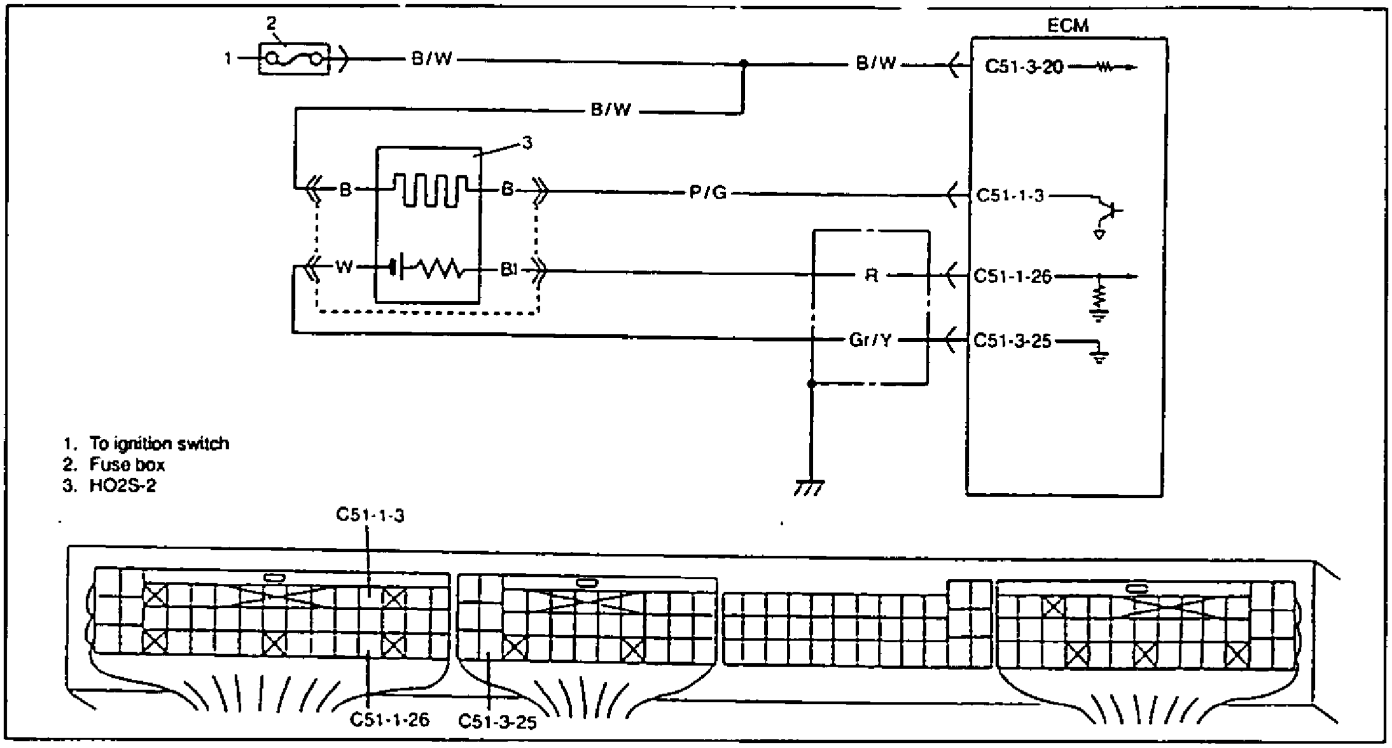
1) Connect scan tool with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool and run engine at idle speed for 5 min.
3) Check DTC and pending DTC by using scan tool.

TROUBLESHOOTING (DTC P0135)

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	HO2S-1 heater check: 1) Disconnect HO2S-1 coupler with ignition switch OFF. 2) Check resistance between "B" and "B" wire terminal of HO2S-1 coupler. Resistance: 5.4 – 6.4 Ω (at 20°C, 68°F) Is it within above specification?	Go to Step 3.	Replace HO2S-1.
3	HO2S-1 heater power supply check: 1) Connect HO2S coupler. 2) Check voltage between C51-2-4 terminal of ECM coupler and body ground with ignition switch ON. Is it 10 – 14 V?	Go to Step 4.	"B/W" or "P" wire open, poor HO2S coupler connection "P" wire shorted to ground.. If wire and connections are OK, substitute a known-good ECM and recheck.
4	HO2S-1 heater operation check: 1) Warm up engine, and check voltage between C51-2-4 terminal of ECM coupler and body ground with engine idling. Is it 0 – 1 V?	Intermittent trouble. Check intermittent referring to "Intermittent and Poor Connection" in Section 0A.	Poor C51-2-4 connection of ECM coupler. If connection is OK, substitute a known-good ECM and recheck.

DTC P0136 HO2S-2 CIRCUIT MALFUNCTION

WIRING DIAGRAM



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
DTC will set when any one of following conditions is detected. • 4.5 V or more HO2S circuit voltage is detected when 5 V power is connected to HO2S circuit in ECM. • While running with A/F feed back, average output voltage during specified time is too high or too low. or • while running with A/F feed back, max output voltage during specified time is lower than specified value or min. output voltage during specified time is higher than specified value. (2 driving cycle detection logic)	• HO2S-2 or its circuit • Fuel system • ECM

DTC CONFIRMATION PROCEDURE

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

NOTE:
Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.
- **Intake air temp.: –8°C, 18°F or higher**
- **Engine coolant temp.: –8 – 110°C (18 – 230°F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) Connect scan tool with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data in ECM memory by using scan tool and start engine.
3) Increase vehicle speed to 55 km/h (40 mph) or more.
4) Keep driving above vehicle speed till engine is warmed up completely (Change of vehicle speed is permitted in this step.).
5) Keep driving 50 – 60 km/h (30 – 40 mph) for 8 min. or more.
6) Stop vehicle and check if DTC and pending DTC exists by using scan tool. If not, check if oxygen sensor monitoring test has completed by using scan tool. If not in both of above checks (i.e., no pending DTC and oxygen sensor monitoring test not completed), check vehicle conditions (environmental) and repeat Steps 3) through 6).

TROUBLESHOOTING (DTC P0136)

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	HO2S-2 Output Voltage check: 1) Connect scan tool to DLC with ignition switch OFF. 2) Drive vehicle about 35 mph, 55 km/h for 2 min. or more. 3) Stop vehicle and check HO2S-2 output voltage displayed on scan tool while repeating racing engine. Is over and below 0.3 V indicated?	Go to Step 4.	Go to Step 3.
3	HO2S-2 check: 1) With ignition switch OFF, disconnect HO2S-2 coupler. 2) Connect voltmeter between "Bl" and "W" wire terminal of HO2S-2 coupler. 3) Start engine and check voltmeter while repeating racing engine. Is over and below 0.3 V indicated?	"R" or "Gr/Y" circuit open/short. If wire and connection are OK, substitute a known-good ECM and recheck.	Replace HO2S-2.
4	Short term fuel trim check: 1) Run engine at 2000 r/min. for 60 sec. 2) With engine idling, check short term fuel trim displayed on scan tool. Is it within –20 to +20%?	Intermittent trouble or faulty ECM. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A.	Go to DTC P0171/P0172 Diag. Flow Table.

DTC P0141 HO2S-2 HEATER CIRCUIT MALFUNCTION

WIRING DIAGRAM

Refer to DTC P0136.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Following condition is detected when HO2S-2 heater operates. • Current of HO2S-2 heater is more than 4.03 A or less than 0.15 A, or • Voltage of HO2S-2 heater is more than 13.8 V or less than 11.06 V. (2 driving cycle detection logic)	• HO2S-2 heater or its circuit • ECM

DTC CONFIRMATION PROCEDURE

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

NOTE:
Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.
- **Intake air temp.: –8°C, 18°F or higher**
- **Engine coolant temp.: –8 – 110°C (18 – 230°F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) Connect scan tool with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data in ECM memory by using scan tool and start engine.
3) Increase vehicle speed to 50 – 60 km/h (30 – 40 mph).
4) Keep driving above vehicle speed for 5 min. (Change of vehicle speed is permitted in this step).
5) Stop vehicle and check if DTC and pending DTC exists by using scan tool. If not, check if oxygen sensor heater monitoring test has completed by using scan tool. If not in both of above checks (i.e., no pending DTC and oxygen sensor heater monitoring test not completed), check vehicle conditions (environmental) and repeat Steps 3) through 5).

TROUBLESHOOTING (DTC P0141)

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	HO2S-2 heater check: 1) Disconnect HO2S-2 coupler with ignition switch OFF. 2) Check resistance between "B" and "B" wire terminal of HO2S-2 connector. Is it within 11.7 – 14.3 Ω (at 20°C, 68°F)?	Go to Step 3.	Replace HO2S-2.
3	HO2S-2 Power Supply check: 1) Connect HO2S-2 connector. 2) Check voltage between C51-1-3 terminal of ECM connector and body ground with ignition switch ON. Is it 10 – 14 V?	Go to Step 4.	"B/W" or "P/G" circuit open/shorted to ground. If wire and connections are OK, substitute a known-good ECM and recheck.
4	HO2S-2 heater operation check: 1) Drive vehicle about 30 – 40 mph (50 – 60 km/h) for 2 min. or more. 2) Stop vehicle and check voltage between C51-1-3 terminal of ECM connector and body ground with engine idling. Is it 0 – 1 V?	Intermittent trouble. Check intermittent referring to "Intermittent and Poor Connection" in Section 0A.	Poor C51-1-3 connection. If connection is OK, substitute a known-good ECM and recheck.

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

SYSTEM DIAGRAM

Refer to Section 6E1.

DTC DETECTING CONDITION AND POSSIBLE CAUSE

DTC DETECTING CONDITION	POSSIBLE CAUSE
When running after engine warmed • Short term fuel trim exceeding 15% or long term fuel trim exceeding 20% and total trim exceeding 43% is detected. —— Fuel system too lean • Short term fuel trim less than −11% or long term fuel trim less than −11% and total trim less than −30% is detected. —— Fuel trim too rich (2 driving cycle detection logic)	• Vacuum leaks (air inhaling) • Exhaust gas leakage • Fuel pressure out of specification • Heated oxygen sensor malfunction • EGR system malfunction • MAF sensor poor performance • ECT sensor poor performance • Fuel level sensor.

DTC CONFIRMATION PROCEDURE

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

NOTE:
Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.
- **Intake air temp. at start: −8 – 60°C (18 – 140°F)**
- **Engine coolant temp. at start: −8 – 95°C (18 – 203°F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**
- **Intake air temp.: −8°C, 18°F or higher**
- **Engine coolant temp.: 110°C, 230°F or lower**

1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool and warm up engine completely.
3) Increase vehicle speed to 50 – 60 km/h (30 – 40 mph).
4) Keep driving above vehicle speed for 3 min. or more.
5) Stop vehicle and check DTC and pending DTC by using scan tool.

TROUBLESHOOTING (DTC P0171/P0172)

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Is there DTC(s) other than "DTC P0171/P0172"?	Go to applicable DTC FLOW TABLE.	Go to Step 3.
3	Check intake system and exhaust system for leakage. Are intake system and exhaust system in good condition?	Go to Step 4.	Repair or replace.
4	Check fuel pressure referring to TABLE B-3 in this section. Is check result satisfactory?	Go to Step 5.	Repair or replace.
5	Check fuel injectors referring to "FUEL INJECTOR INSPECTION" in "ENGINE AND EMISSION CONTROL SYSTEM" section. Is check result satisfactory?	Go to Step 6.	Faulty injector(s).
6	Check fuel level sensor referring to DTC P0460 Diag. Flow Table. Is check result satisfactory?	Go to Step 7.	Faulty fuel level sensor or its circuit.
7	Check MAF sensor for performance referring to "ENGINE AND EMISSION CONTROL SYSTEM" section. Is check result satisfactory?	Go to Step 8.	Faulty MAF sensor or its circuit.
8	Check ECT sensor referring to "ENGINE AND EMISSION CONTROL SYSTEM" section. Is check result satisfactory?	Go to Step 9.	Faulty ECT sensor.
9	Check HO2S-1 referring to DTC P0130 Diag. Flow Table. Is check result satisfactory?	Substitute a known-good ECM and recheck.	Faulty HO2S-1.

DTC P0300 RANDOM MISFIRE DETECTED
DTC P0301 CYLINDER 1 MISFIRE DETECTED
DTC P0302 CYLINDER 2 MISFIRE DETECTED
DTC P0303 CYLINDER 3 MISFIRE DETECTED
DTC P0304 CYLINDER 4 MISFIRE DETECTED

SYSTEM DESCRIPTION

ECM (PCM) measures the angle speed of the crankshaft based on the pulse signal from the CKP sensor and CMP sensor for each cylinder. If it detects a large change in the angle speed of the crankshaft, it concludes occurrence of a misfire. When the number of misfire is counted by the ECM (PCM) beyond the DTC detecting condition, it determines the cylinder where the misfire occurred and outputs it as DTC.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION		TROUBLE AREA
DTC P0300	• Misfire which causes catalyst to overheat during 200 engine revolutions is detected at 2 or more cylinders. (MIL flashes as long as this misfire occurs continuously.) • Misfire which affects exhaust emission adversely during 1000 engine revolutions is detected at 2 or more cylinders (2 driving cycle detection logic)	• Ignition system • Fuel injector and its circuit • Fuel line pressure • Engine compression • Abnormal air drawn in • EGR system • Fuel level sensor • Valve clearance • Valve timing
DTC P0301, P0302, P0303, P0304	• Misfire which causes catalyst to overheat during 200 engine revolutions is detected at 1 cylinder. (MIL flashes as long as this misfire occurs continuously.) • Misfire which affects exhaust emission adversely during 1000 engine revolutions is detected at 1 cylinder (2 driving cycle detection logic)	

DTC CONFIRMATION PROCEDURE

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

NOTE:
Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.
- **Intake air temp.: –8 – 70°C (18 – 158°F)**
- **Engine coolant temp.: –8°C, 18°F or higher**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

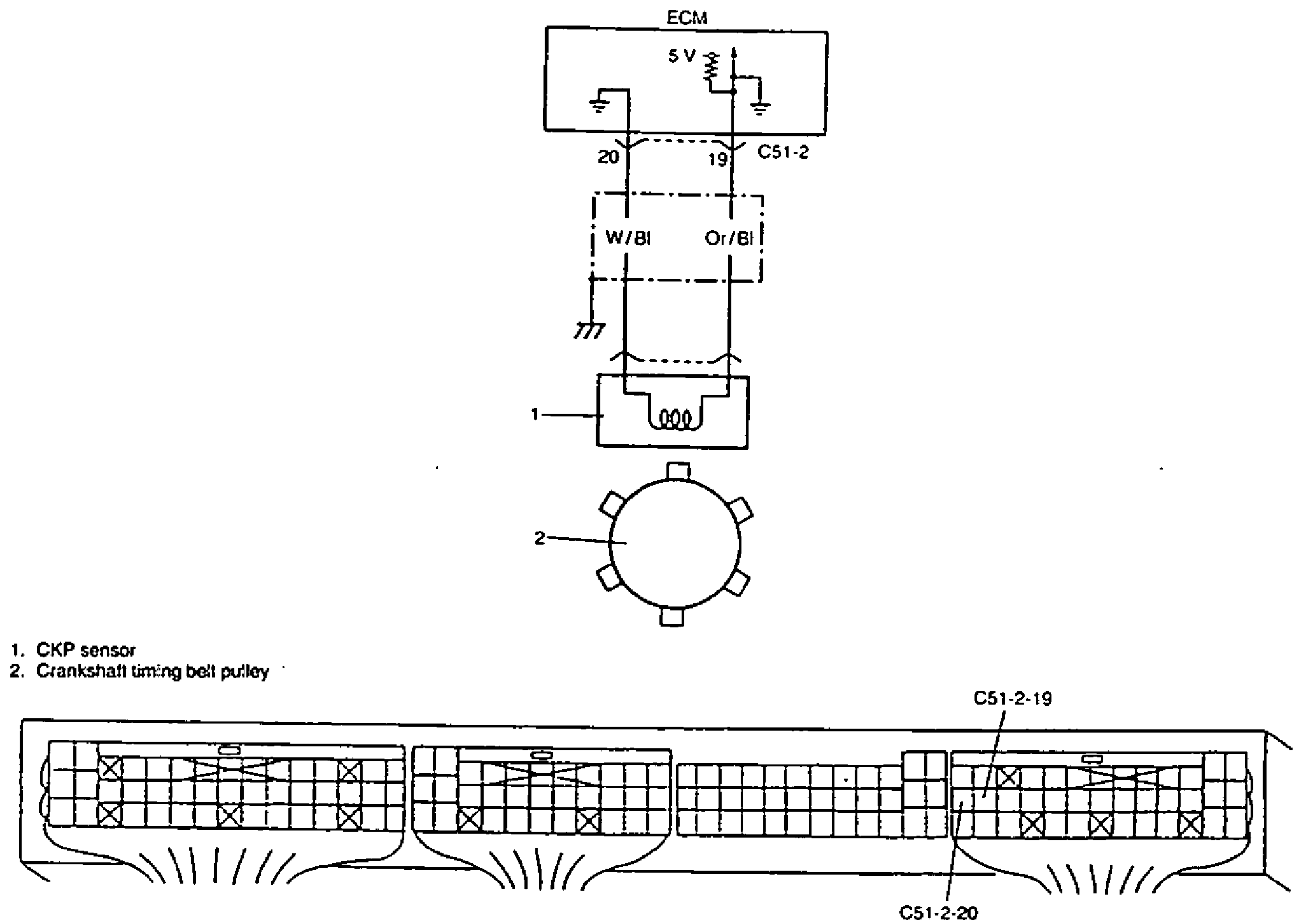
1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool and start engine.
3) Increase vehicle speed to speed recorded as freeze frame data (V) ± 5 km/h when detecting misfire.
4) Keep driving above vehicle speed for 5 min.
5) Stop vehicle and check DTC (or pending DTC) by using scan tool.

TROUBLESHOOTING (DTC P0300/P0301/P0302/P0303/P0304)

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Ignition system inspection: 1) Check spark plug and ignition spark of cylinder where misfire occurs, referring to "IGNITION SYSTEM" section. Is it in good condition?	Go to Step 3.	Faulty ignition coil, wire harness, or other system parts.
3	Fuel injector circuit inspection: 1) Using sound scope, check each injector operating sound at engine cranking or idling. Do all injectors make operating sound?	Go to Step 4.	Check coupler connection and wire harness of injector not making operating sound and injector itself. If OK, substitute a known-good ECM and recheck.
4	Fuel pressure inspection: 1) Check fuel pressure referring to TABLE B-3 in this section. Is check result satisfactory?	Go to Step 5.	Repair or replace.
5	Fuel injector inspection: 1) Check fuel injector(s) referring to "ENGINE AND EMISSION CONTROL SYSTEM" section. Is check result satisfactory?	Go to Step 6.	Replace.
6	Ignition timing inspection: 1) Check ignition timing referring to "IGNITION SYSTEM" section. Is check result satisfactory?	Go to Step 7.	Adjust or check system related parts.
7	EGR system inspection: 1) Check EGR system referring to "ENGINE AND EMISSION CONTROL SYSTEM" section. Is check result satisfactory?	Go to Step 8.	Repair or replace.
8	Fuel level sensor inspection: 1) Check fuel level sensor referring to DTC P0460 Diag. Flow Table. Is check result satisfactory?	Go to Step 9.	Repair or replace.
9	Check engine mechanical parts or system which can cause engine rough idle or poor performance. – Engine compression (See "ENGINE MECHANICAL" section). – Valve lash (See "ENGINE MECHANICAL" section). – Valve timing (Timing belt installation. See "ENGINE MECHANICAL" section). Are they in good condition?	Check wire harness and connection of ECM ground, ignition system and fuel injector for intermittent open and short.	Repair or replace.

DTC P0335 CRANKSHAFT POSITION SENSOR CIRCUIT MALFUNCTION

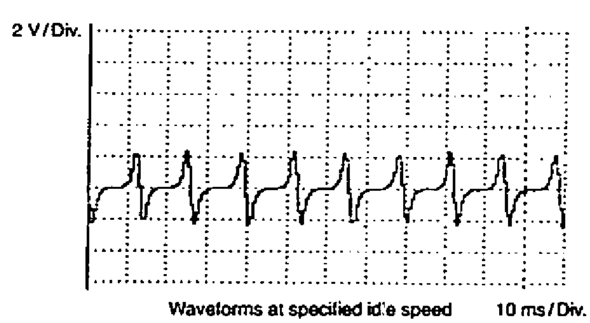
WIRING DIAGRAM



Reference

Connect oscilloscope between terminals C51-2-19 (+) and C51-2-20 (–) of ECM connector connected to ECM and check CKP sensor signal.

Oscilloscope Waveforms G16 Engine



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
CKP sensor signal is not input while 20 pulses of CMP sensor signal are input after engine start.	• CKP sensor circuit • CKP sensor • ECM

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

- **Intake air temp.: –8°C, 18°F or higher**
- **Engine coolant temp.: –8 – 110°C (18 – 230°F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool and run engine at idle speed for 10 sec.
3) Check DTC and pending DTC by using scan tool.

TROUBLESHOOTING (DTC P0335)

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	CKP sensor and its circuit resistance check: 1) With ignition switch OFF, disconnect ECM coupler (C51-2). 2) Check for proper connection to ECM at C51-2-19 and C51-2-20 terminals. 3) If OK, check resistance of followings. Resistance between C51-2-19 and C51-2-20 terminals: 360 – 460 Ω at 20°C, 68°F Resistance between each terminal and ground: 1 MΩ or more Is check result satisfactory?	Go to Step 4.	Go to Step 3.
3	CKP sensor resistance check: 1) With ignition switch OFF, disconnect CKP sensor coupler. 2) Check resistance between terminals of CKP sensor coupler and between each terminal and ground. (See Fig.) Were measured resistance values as specified in Step 2?	Faulty "W/Bl" wire or "Or/Bl" wire.	Faulty CKP sensor.
4	CKP sensor visual inspection: 1) Check visually CKP sensor and signal rotor (crankshaft timing belt pulley for the followings. (See Fig.) – Damage – No foreign material attached – Correct installation Are they in good condition?	Intermittent trouble or faulty ECM. Recheck for intermittent referring to "Intermittent and Poor Connection" in Section 0A.	Replace or reinstall.

Fig. for Step 3

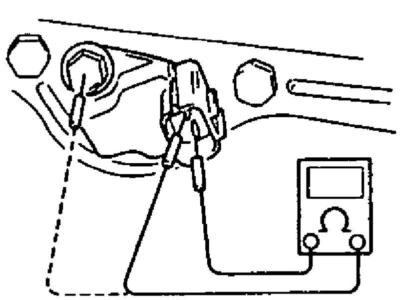
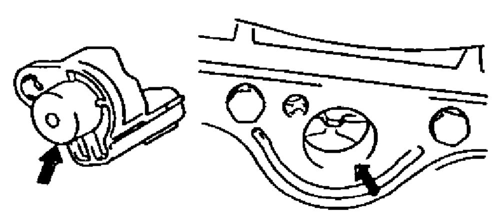
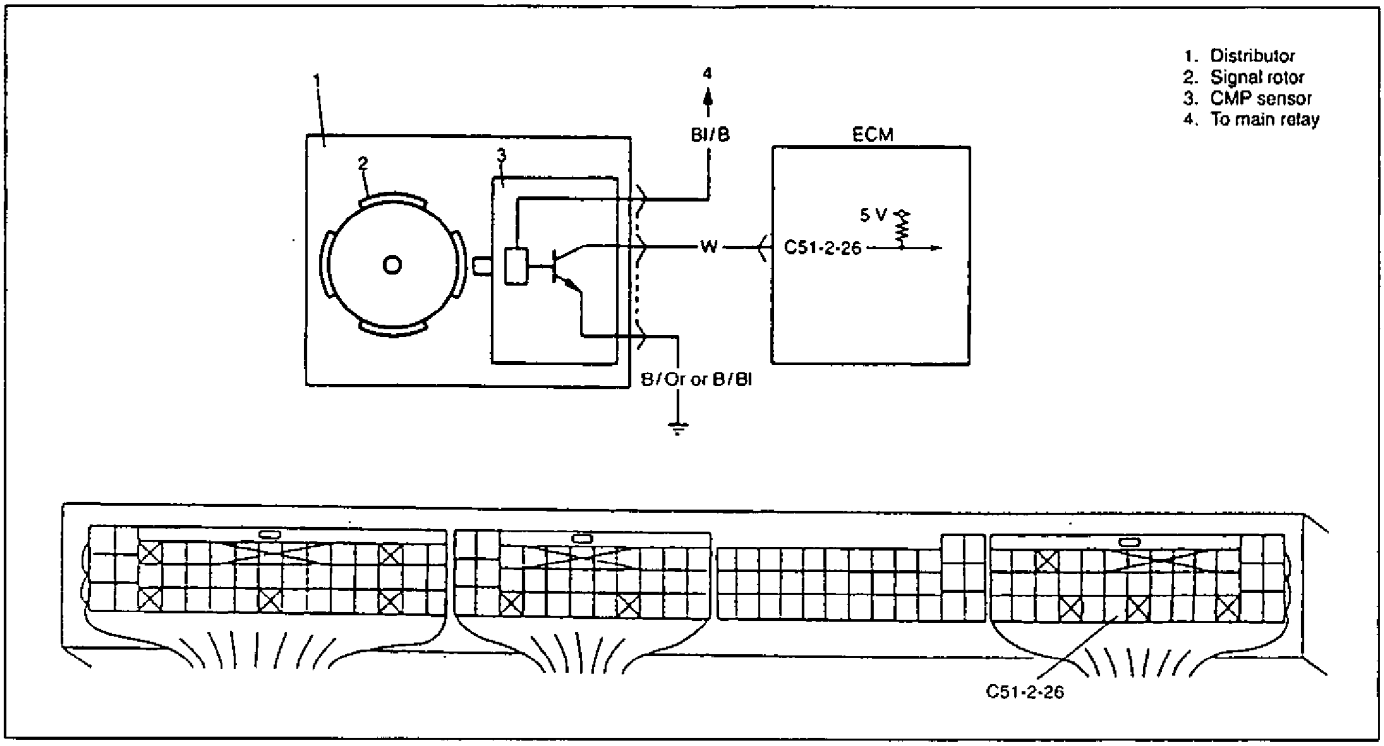


Fig. for Step 4



DTC P0340 CAMSHAFT POSITION SENSOR CIRCUIT MALFUNCTION

WIRING DIAGRAM



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
• CMP sensor signal is not inputted for 3 sec. even though engine start signal is being inputted.	• CMP sensor circuit • CMP sensor • Engine starter signal circuit • ECM

DTC CONFIRMATION PROCEDURE

NOTE:

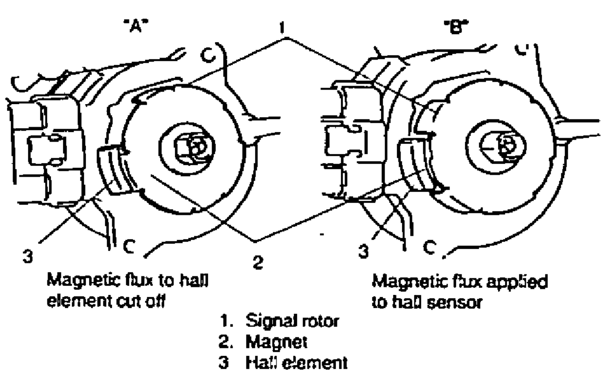
Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

- **Intake air temp.: –8°C, 18°F or higher**
- **Engine coolant temp.: –8 – 110°C (18 – 230°F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool.
3) Crank engine for 3 seconds or more and keep it at idle for 1 min. if engine start.
4) Check DTC and pending DTC by using scan tool.

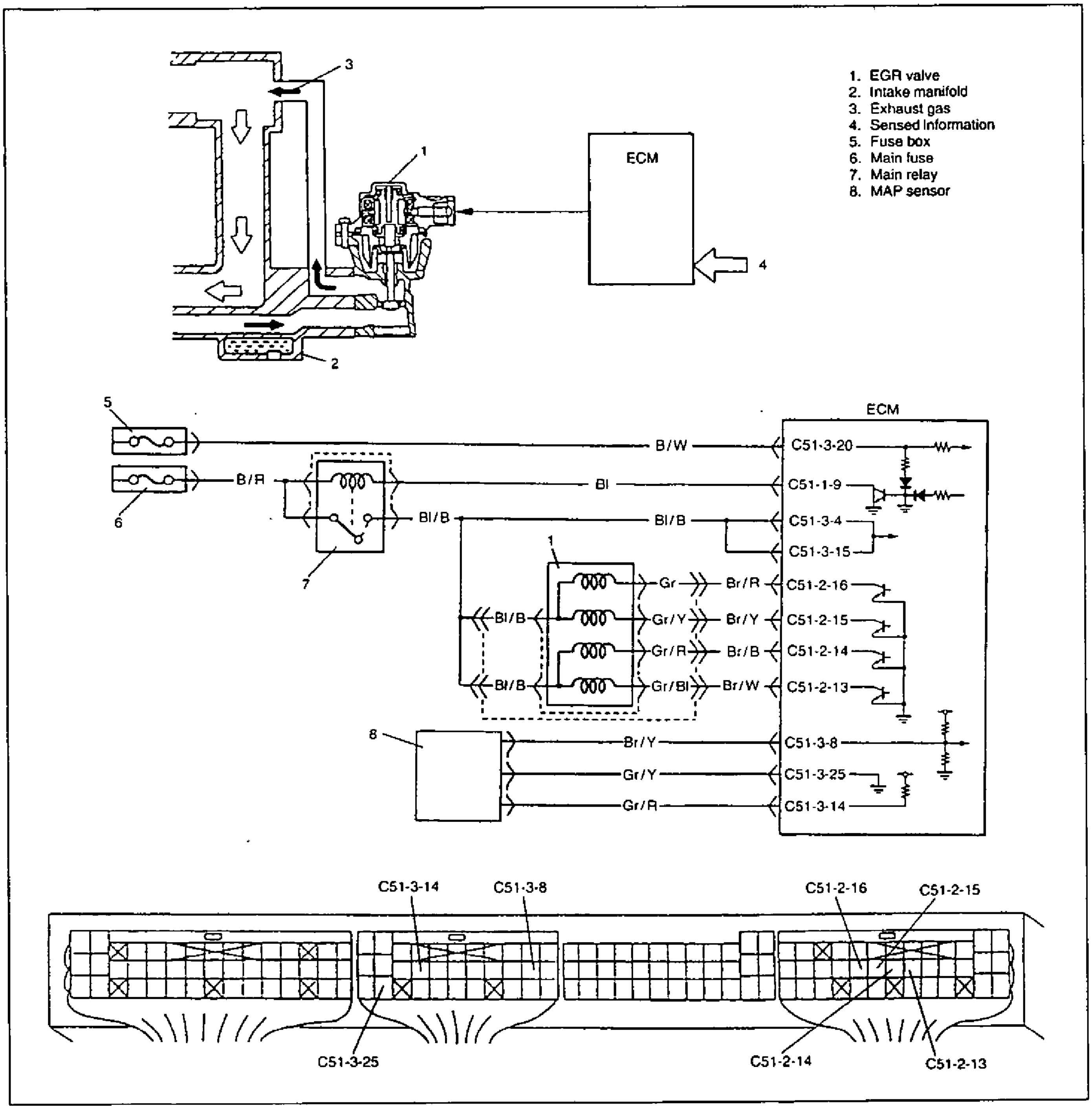
STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Is engine cranked?	Go to Step 3.	Go to "CRANKING SYSTEM" section.
3	Is there DTC P1500 (Engine starter signal circuit)?	Go to DTC P1500 Diag. Flow Table.	Go to Step 4.
4	1) Remove distributor cap, rotor and cover. Don't remove signal rotor from shaft. 2) With ignition switch ON, check voltage C51-2-26 terminal with signal rotor inserted between hall element and magnet ("A") and without it ("B") respectively, by turning crankshaft. "A": 3 – 5.25 V "B": 0 – 1 V Is it in good condition?	Substitute a known-good ECM and recheck.	Go to Step 5.
5	Is it 0 – 1 V at both "A" and "B" in Step 4?	Poor C51-2-26 connection or "W" wire short to ground. If wire and connection are OK, substitute a known-good CMP sensor and recheck.	"W" wire open, "B/Bl" or "B/Or" wire open, "Bl/B" wire open or poor CMP sensor coupler connection. If wire and connection are OK, substitute a known-good CMP sensor and recheck.

Fig. for Step 4



DTC P0400 EXHAUST GAS RECIRCULATION FLOW MALFUNCTION

SYSTEM/WIRING DIAGRAM



DTC DETECTING CONDITION AND TROUBLE AREA

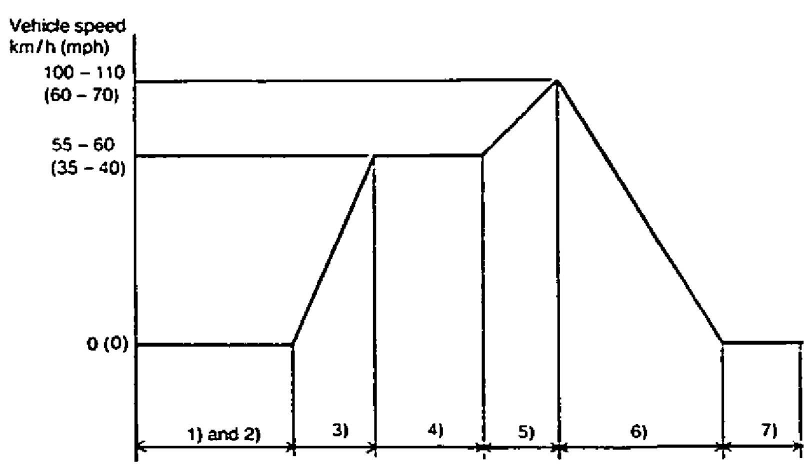
DTC DETECTING CONDITION	TROUBLE AREA
During deceleration (engine speed high with closed throttle position) in which fuel cut is involved, difference in intake manifold pressure between when EGR valve is opened and when it is closed is smaller than specified value. (2 driving cycle detection logic)	• EGR valve • EGR passage • Manifold differential pressure sensor • ECM

DTC CONFIRMATION PROCEDURE

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

NOTE:
Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.
- **Intake air temp.: –8°C, 18°F or higher**
- **Engine coolant temp.: –8 – 110°C (18 – 230°F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool and warm up engine completely.
3) Increase vehicle speed to 55 – 60 km/h (35 – 40 mph).
4) Keep driving above vehicle speed for 7 min. or more.
5) Increase vehicle speed to 100 – 110 km/h (60 – 70 mph).
6) Release accelerator pedal and with engine brake applied, keep vehicle coasting and then stop vehicle.
7) Check if DTC and pending DTC exists by using scan tool. If not, check if EGR system monitoring test has completed by using scan tool. If not in both of above checks (i.e., no pending DTC and EGR system monitoring test not completed), check vehicle conditions (environmental) and repeat Steps 3) through 6).

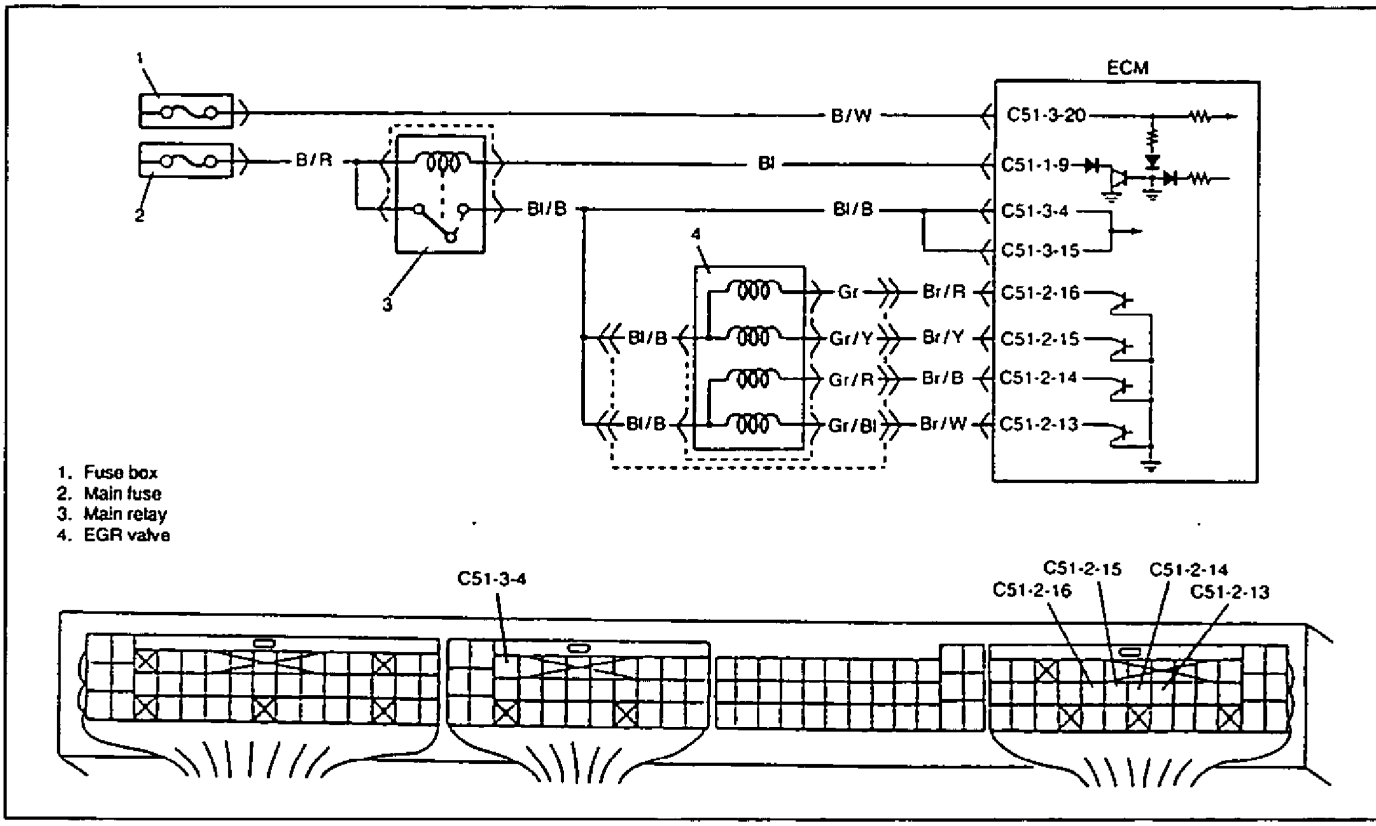


TROUBLESHOOTING (DTC P0400)

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Is there DTC P0403 (EGR circuit malfunction)?	Go to DTC P0403 Diag. Flow Table.	Go to Step 3.
3	Do you have SUZUKI scan tool?	Go to Step 4.	Go to Step 6.
4	EGR valve operation check: 1) With ignition switch OFF, install SUZUKI scan tool. 2) Check EGR system referring to Section 6E. Is it in good condition?	Go to Step 5.	Go to Step 6.
5	MDP sensor check: 1) Check MDP sensor for performance referring to Section 6E. Is check result satisfactory?	Intermittent trouble or faulty ECM. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Repair or replace.
6	EGR valve power supply circuit check: 1) With ignition switch OFF, disconnect EGR valve coupler. 2) With ignition switch ON, check voltage between “Bl/B” wire terminals of EGR valve coupler and ground. Is each voltage 10 – 14 V?	Go to Step 7.	Faulty “Bl/B” wire.
7	EGR valve stepper motor coil circuit check: 1) With ignition switch OFF, connect EGR valve coupler and disconnect ECM couplers. 2) Check resistance between C51-3-4 and C51-2-13, C51-2-14, C51-2-15, C51-2-16. Is each resistance 20 – 24 Ω at 20°C, 68°F?	Go to Step 8.	Faulty “Br/R” – “Gr”, “Br/Y” – “Gr/Y”, “Br/B” – “Gr/R”, “Br/W” – “Gr/Bl” wire or EGR valve.
8	MDP sensor check: 1) Check MDP sensor for performance referring to Section 6E. 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.

DTC P0403 EXHAUST GAS RECIRCULATION CIRCUIT MALFUNCTION

WIRING DIAGRAM



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Low voltage is detected at EGR valve stepping motor electrical circuit for specified time continuously. (Circuit open or short).	• EGR valve (stepping motor) or its circuit • ECM

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

- **Intake air temp.: –8°C, 18°F or higher**
- **Engine coolant temp.: –8 – 110°C (18 – 230°F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

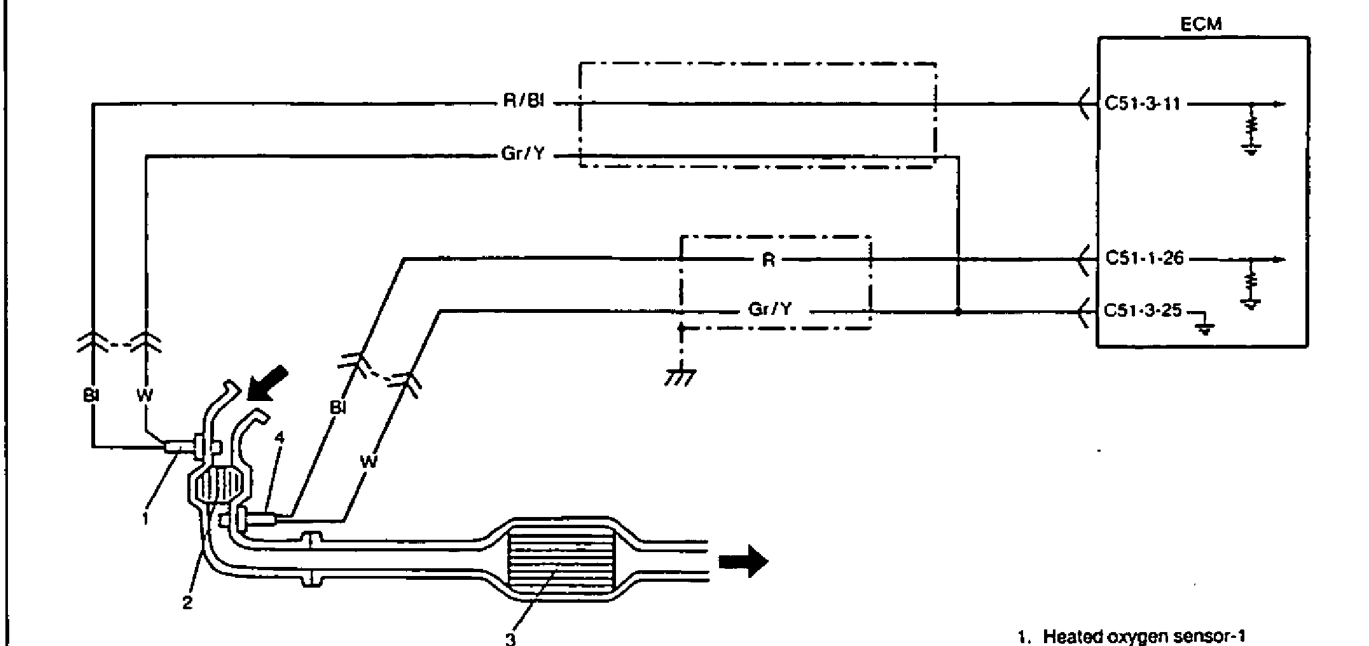
1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool.
3) Start engine and run it for 10 sec.
4) Check DTC and pending DTC by using scan tool.

TROUBLESHOOTING (DTC P0403)

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	EGR Valve check 1) With ignition switch OFF, disconnect connector from EGR valve. 2) Check for proper connection to EGR valve at each terminal. 3) If OK, check EGR valve for resistance referring to "EGR Valve Inspection" in Section 6E. Is check result as specified?	Go to Step 3.	EGR valve malfunction.
3	Wire Harness check 1) Connect connector to EGR valve. 2) Disconnect connector from ECM. 3) Check for proper connection to ECM at system related terminals. 4) If OK, check for resistance between following terminals of ECM connector disconnected. C51-2-13 and C51-3-4, C51-2-14 and C51-3-4, C51-2-15 and C51-3-4, C51-2-16 and C51-3-4: 20 – 24 Ω at 20°C, 68°F C51-2-13 and ground, C51-2-14 and ground, C51-2-15 and ground, C51-2-16 and ground: Infinity (∞) Is check result as specified?	Intermittent trouble or faulty ECM. Recheck referring to "Intermittent and Poor Connection" in Section 0A.	"Bl/B", "Br/R" – "Gr", "Br/Y" – "Gr/Y", "Br/B" – "Gr/R", "Br/W" – "Gr/Bl" circuit open or shorted to ground.

DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD

SYSTEM DIAGRAM



1. Heated oxygen sensor-1
2. Warm-up three way catalytic converter
3. Three way catalytic converter
4. Heated oxygen sensor-2

CIRCUIT DESCRIPTION

Exhaust oxygen concentration at the pre-warm-up three way catalystic converter (WU-TWC) and the post-WU-TWC is detected from HO2S-1 and HO2S-2 respectively and accordingly ECM controls the closed loop which then controls the fuel injection volume. While the above control is going on and if WU-TWC is in good condition, the output voltage of HO2S-2 is maintained at specified level. As WU-TWC becomes deteriorated, even when the above control is going on, the exhaust gas which has passed WU-TWC then passes HO2S-2 at the exhaust oxygen concentration similar to that of the pre-catalyst without being oxygenated or converted. Thus, waveforms of HO2S-1 and HO2S-2 output voltages become alike. ECM judges deterioration of WU-TWC by comparing waveforms of HO2S-1 and HO2S-2.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
While running under conditions described for DTC CONFIRMATION PROCEDURE, output waveform of HO2S-1 becomes similar to that of HO2S-2. (2 driving cycle detection logic)	• Exhaust gas leakage • Three way catalytic convertor • Heated oxygen sensor-2 or its circuit • ECM

DTC CONFIRMATION PROCEDURE

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

NOTE:
Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.
- **Intake air temp.: –8°C, 18°F or higher**
- **Engine coolant temp.: –8 – 110°C (18 – 230°F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

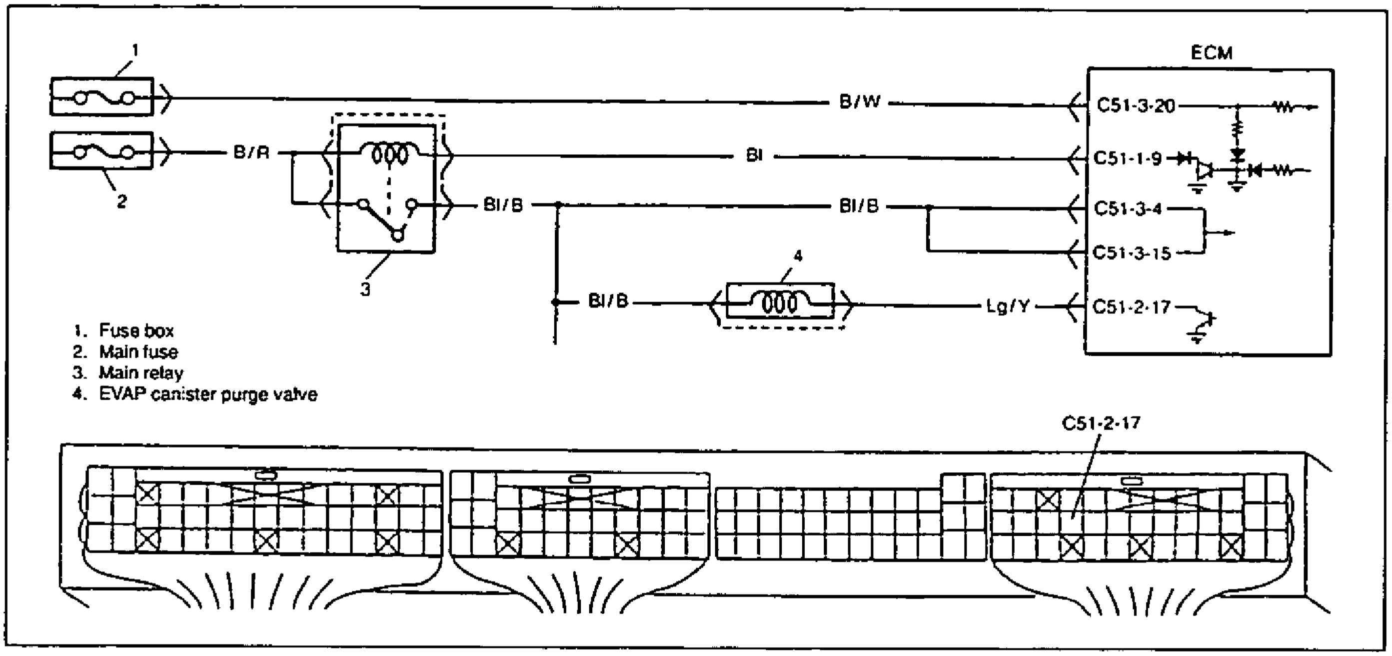
1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool.
3) Increase vehicle speed to 80 – 90 km/h (50 – 56 mph).
4) Keep above vehicle speed for 5 min. or more (Throttle valve opening is kept constant in this step).
5) Stop vehicle and check if DTC and pending DTC exists by using scan tool. If not, check if catalyst monitoring test has completed by using scan tool. If not in both of above checks (i.e., no pending DTC and catalyst monitoring test not completed), check vehicle condition (environmental) and repeat Step 3) through 5).

TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Exhaust system visual inspection: 1) Check exhaust system for leaks, damage and loose connection. Is it in good condition?	Go to Step 3.	Repair or replace.
3	HO2S-2 Output Voltage check: 1) Check output voltage of HO2S-2 referring Step 3 of DTC P0136 Diag. Flow Table. Is check result satisfactory?	Replace three way catalytic converter.	Check "R" and "Gr/Y" wires for open and short, and connections for poor connection. If wires and connections are OK, replace HO2S-2.

DTC P0443 EVAP CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT MALFUNCTION

WIRING DIAGRAM



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Monitor signal of EVAP canister purge valve is different from command signal. (Circuit open or short) (2 driving cycle detection logic)	• EVAP canister purge valve and its circuit • ECM

DTC CONFIRMATION PROCEDURE

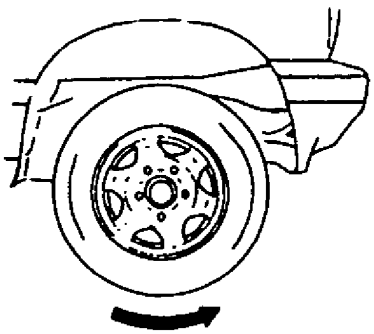
WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester, on a level road.**

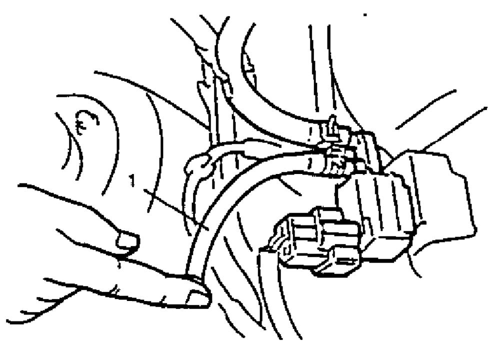
NOTE:
Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.
- **Intake air temp.: −8°C, 18°F or higher**
- **Engine coolant temp.: −8 – 110°C (18 – 230°F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool.
3) Start engine and warm up it completely.
4) Increase vehicle speed to 55 km/h (35 mph) or more.
5) Keep driving above vehicle speed for 20 min. or more (Change of vehicle speed is permitted in this step).
6) Release accelerator pedal, stop vehicle and run engine at idle speed for 2 min.
7) Check DTC and pending DTC by using scan tool.

TROUBLESHOOTING (DTC P0443)

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Check EVAP canister purge system for operation referring to "EVAP Canister Purge System Check" in this section. Is check result satisfactory?	Intermittent trouble or faulty ECM. Check for intermittent referring to "Intermit tent and Poor Connection" in Section 0A.	Go to Step 3.
3	Check EVAP canister purge valve for resistance referring to "EVAP Canister Purge Valve Inspection" in this section. Is resistance as specified?	"Lg/Y" or "Bl/B" circuit open or short. If wire and connections are OK, substitute a known-good ECM and recheck.	Replace EVAP canister purge valve.



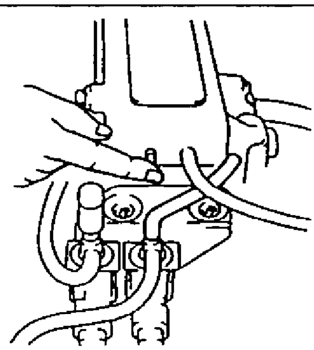


EVAP Canister Purge System Check

1) Warm up engine to normal operating temperature.
2) Hoist vehicle so that all wheels rotate freely.
3) Set M/T in "Neutral" position and parking brake.
4) Disconnect purge hose (1) from EVAP canister.
5) Place finger against the end of disconnected hose and check that vacuum is not felt there when engine is running at idle speed.
6) Release parking brake lever, set transfer in "2H" and M/T in "1st".

> **WARNING:**
> **Make sure that transfer is set to "2H" range position for this check. If it is set to "4H" or "4L" position, front and rear wheels turn at high speed and a very dangerous situation may occur.**

7) Also check that vacuum is felt when engine speed is increased to higher than about 1,500 r/min. and keep it for 3 min. or more. If check result is not described in steps 5) and 7), check EVAP canister purge valve, wire harness and vacuum passage.

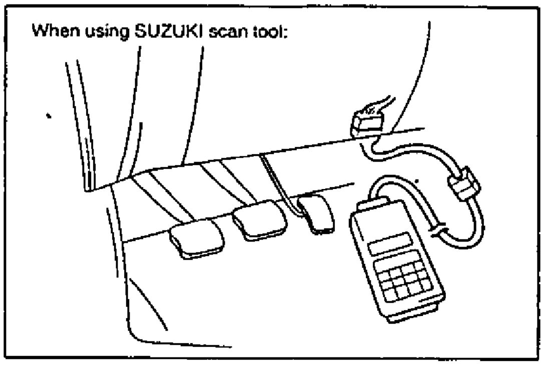


Vacuum Passage Inspection

Start engine and run it at idle speed. With finger placed against vacuum nozzle, check that vacuum is applied.
If it is not applied, clean vacuum passage by blowing compressed air.

Vacuum Hose Inspection

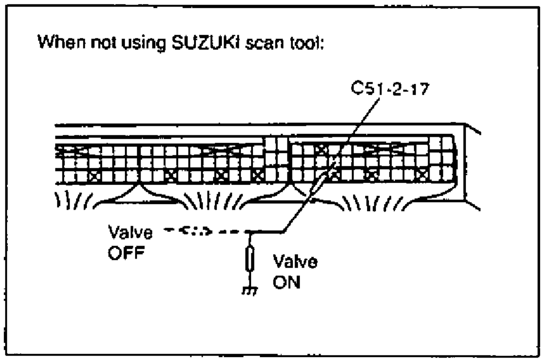
Check hoses for connection, leakage, clog and deterioration. Replace as necessary.



EVAP Canister Purge Valve and Its Circuit Check

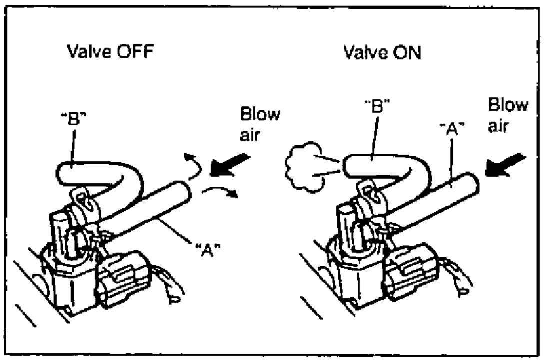
When using SUZUKI scan tool:

1) Connect SUZUKI scan tool to DLC with ignition switch OFF and disconnect vacuum hoses from each pipe.
2) Turn ignition switch ON, clear DTC and select "MISC TEST" mode on SUZUKI scan tool.

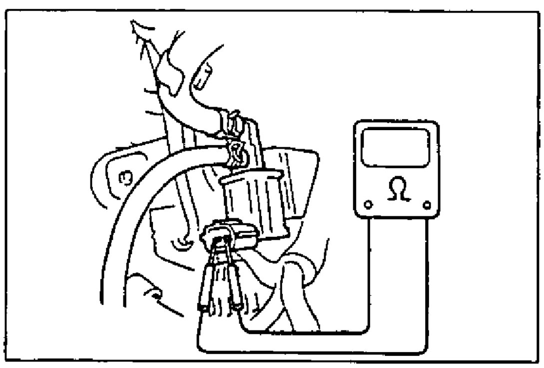


When not using SUZUKI scan tool:

1) Disconnect vacuum hoses from each pipe.
2) Turn ignition switch ON.
   Using service wire, ground C51-2-17 terminal of ECM connector (valve ON) and unground it (valve OFF).



3) Check purge valve for operation and vacuum passage for clog when valve is switched ON and OFF by using SUZUKI scan tool or service wire.
   Valve OFF: When blowing into hose "A", air should not come out of hose "B".
   Valve ON: When blowing into hose "A", air should come out of hose "B".
   If check result is not described, check vacuum hoses, purge valve, wire harness and connections.

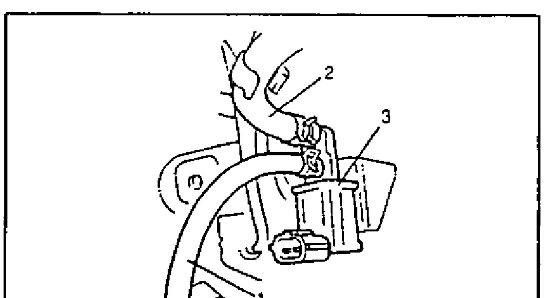


EVAP Canister Purge Valve Inspection

1) With ignition switch OFF, disconnect coupler from canister purge valve.
2) Check resistance between two terminals of EVAP canister purge valve.

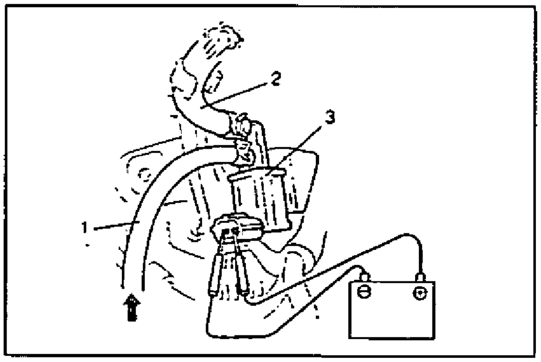
   Resistance of EVAP canister purge valve:
   30 – 34 Ω at 20°C (68°F)

   If resistance is as specified, proceed to next operation check. If not, replace.



3. EVAP canister purge valve

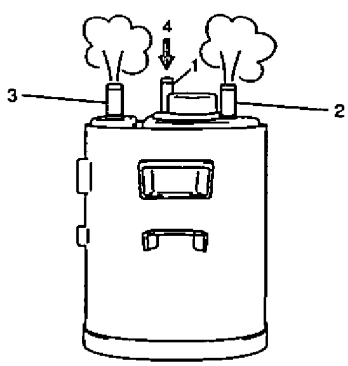
3) Disconnect vacuum hoses from intake manifold and its EVAP canister.
4) With coupler disconnected, blow into hose "A" (1). Air should not come out of hose "B" (2).



5) Connect 12 V-battery to EVAP canister purge valve (3) terminals.
   In this state, blow hose "A" (1).
   Air should come out of hose "B" (2).

> **WARNING:**
> **Do not suck the air through valve. Fuel vapor inside valve is harmful.**

   If check result is not as described, replace EVAP canister purge valve.
6) Connect vacuum hoses.
7) Connect EVAP canister purge valve coupler securely.



1. Tank pipe
2. Purge pipe
3. Air pipe
4. Blow air

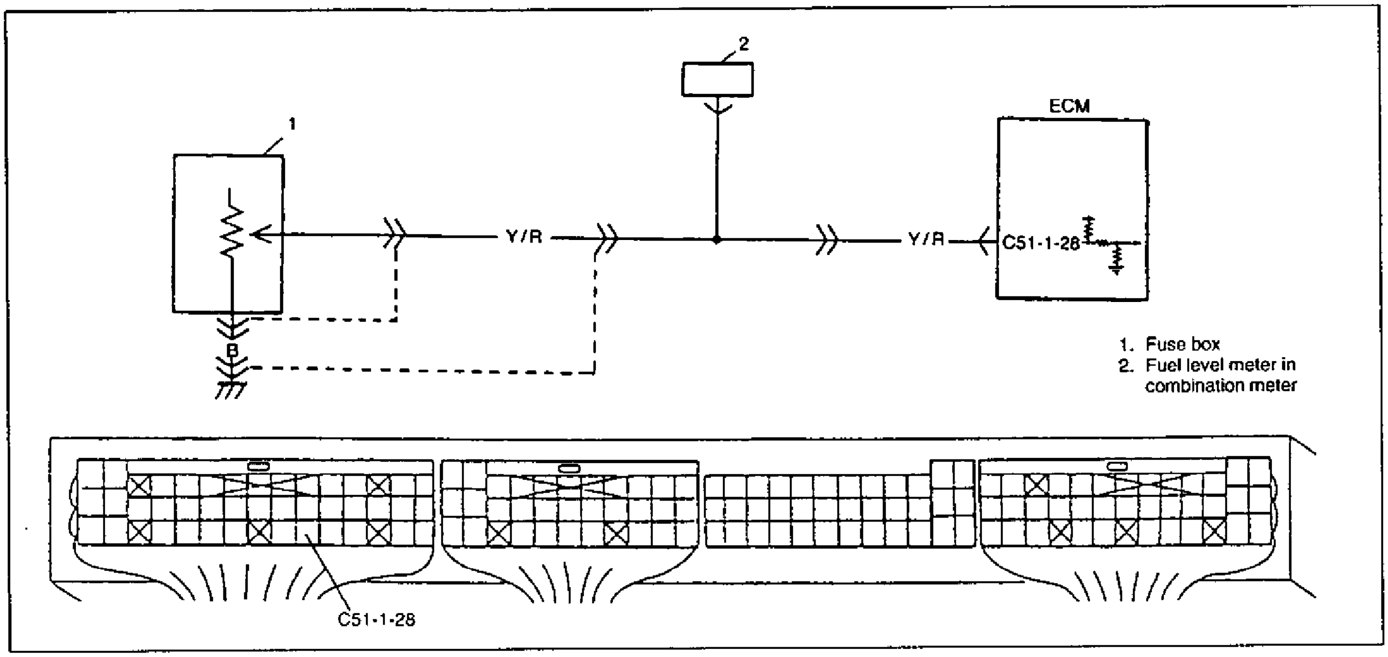
EVAP Canister Check

> **WARNING:**
> **DO NOT SUCK nozzles on EVAP canister. Fuel vapor inside EVAP canister is harmful.**

1) Disconnect vacuum hoses from EVAP canister.
2) When air is blown into tank pipe, there should be no restriction of flow through purge pipe and air pipe.
3) If operation differs from above description, EVAP canister must be replaced.
4) Connect hoses to canister.

DTC P0460 FUEL LEVEL SENSOR CIRCUIT HIGH INPUT

WIRING DIAGRAM



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Fuel level sensor output voltage higher than specified value is detected for specified time. (2 driving cycle detection logic)	• Fuel level gauge or its circuit • Fuel level sensor or its circuit • ECM

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

- **Intake air temp.: –8°C, 18°F or higher**
- **Engine coolant temp.: –8 – 110°C (18 – 230°F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

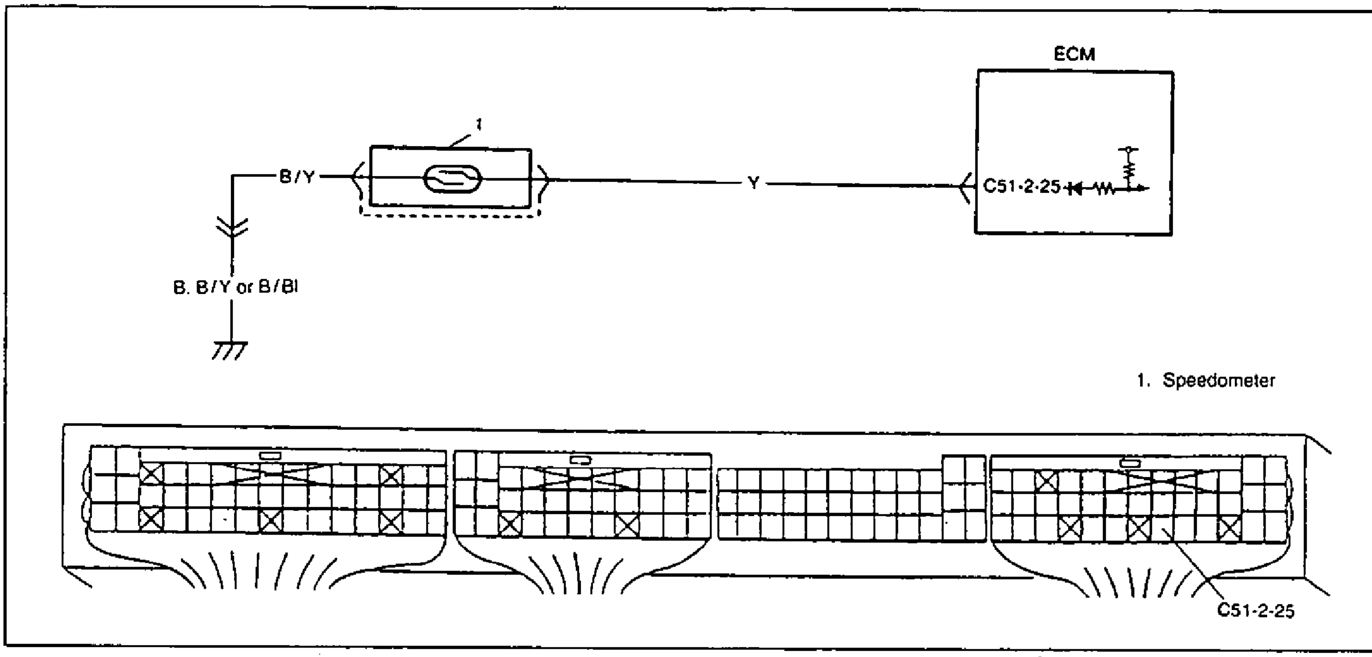
1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool and run engine for 1 min.
3) Check DTC and pending DTC by using scan tool.

TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Does fuel level meter in combination meter indicate "E" (Empty)?	Replenish fuel tank with fuel and go to Step 3.	Go to Step 3.
3	Check Fuel Level Sensor and Its Circuit. 1) Check voltage between terminal C51-1-28 and ground with ignition switch ON. Is it about 7.1 V or more?	Go to Step 4.	Intermittent trouble or faulty ECM. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A.
4	Is voltage in Step 3 "9 – 14 V"?	"Y/R" wire shorted to power circuit or fuel level meter malfunction.	Go to Step 5.
5	Check Fuel Level Sensor. 1) Turn ignition switch OFF and disconnect fuel level sensor connector. 2) Check for proper connection to fuel level sensor at terminals. 3) If OK, then check resistance between "Y/R" wire and "B" wire terminals of fuel level sensor connector. Empty: About 113 – 127 Ω 1/2: About 32.5 Ω (reference value) Full: About 1 – 5 Ω Is value close to one of above values indicated?	"Y/R" circuit open. If wire and connection are OK, substitute a known-good ECM and recheck.	Check "Y/R" wires connections. If OK, replace fuel level sensor.

DTC P0500 VEHICLE SPEED SENSOR MALFUNCTION

WIRING DIAGRAM



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Vehicle speed signal not inputted although fuel is kept cut for longer than 5 seconds (2 driving cycle detection logic)	• Vehicle speed sensor circuit open or short • Vehicle speed sensor • Speedometer cable, drive gear or driven gear • ECM

DTC CONFIRMATION PROCEDURE

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

NOTE:
Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.
- **Intake air temp.: –8°C, 18°F or higher**
- **Engine coolant temp.: –8 – 110°C (18 – 230°F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

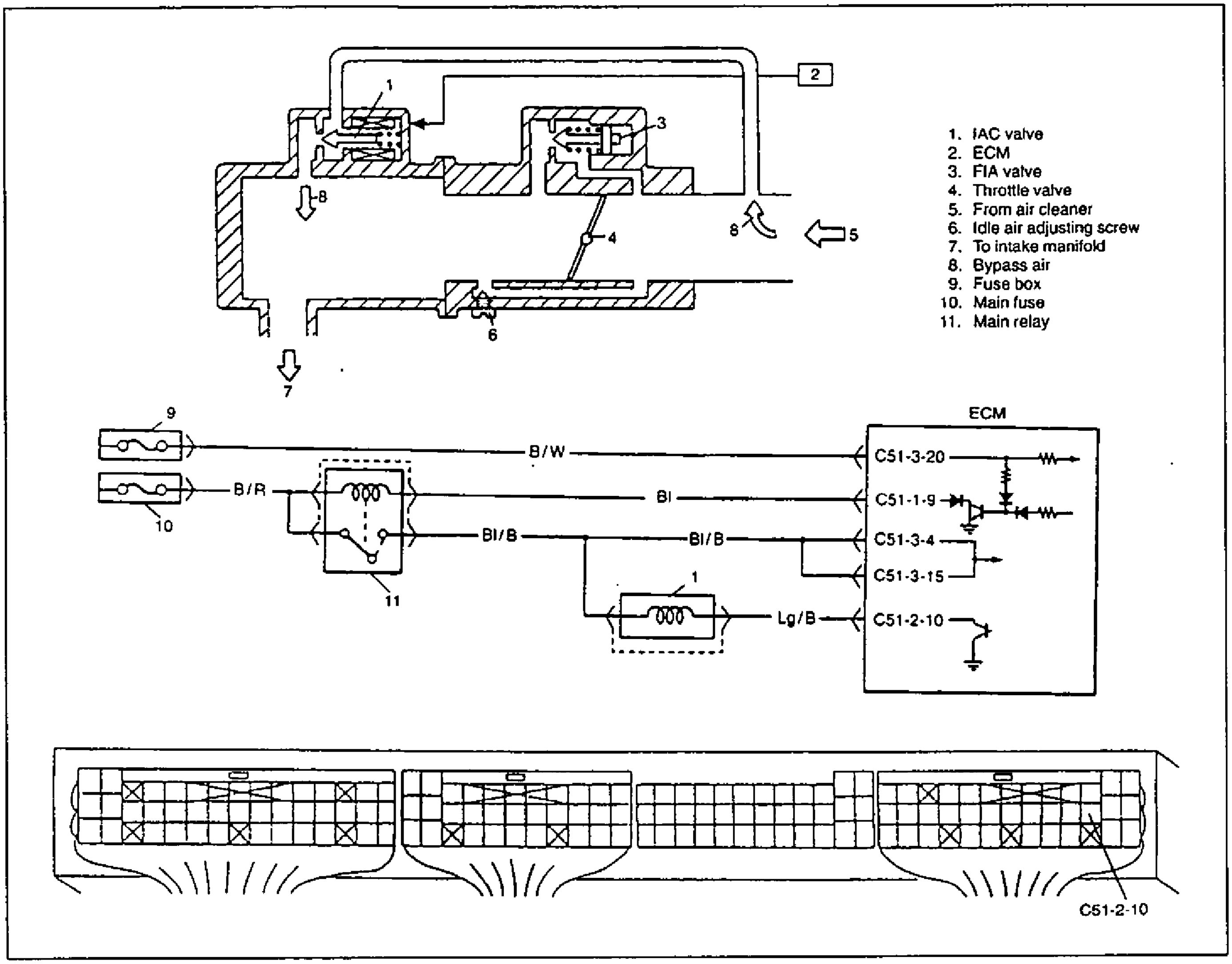
1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool and warm up engine completely.
3) Increase vehicle speed to 80 km/h (50 mph) in 3rd gear.
4) Release accelerator pedal and with engine brake applied, keep vehicle coasting and then stop vehicle.
5) Check DTC and pending DTC by using scan tool.

TROUBLESHOOTING (DTC P0500)

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.	Check speedometer cable and gears for damage.
3	VSS signal harness check: 1) Disconnect ECM coupler with ignition switch OFF. 2) Connect ohmmeter between C51-2-25 terminal of ECM coupler and body ground. 3) Hoist vehicle and lock rear left tire. 4) Turn rear right tire slowly. Does ohmmeter indicator deflect between continuity and infinity a few times while tire is turned one full revolution?	Faulty "Y" wire or poor C51-2-25 connection. If wire and connection are OK, intermittent trouble or faulty ECM. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A.	Go to Step 4.
4	Check VSS referring to "VSS INSPECTION" in "ENGINE AND EMISSION CONTROL SYSTEM" section. Is it in good condition?	"Y" wire open, poor coupler-to-meter connection or poor ground circuit. If wire and connection are OK, substitute a known-good ECM and recheck.	Faulty VSS.

DTC P0505 IDLE AIR CONTROL SYSTEM MALFUNCTION

SYSTEM/WIRING DIAGRAM



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
• Engine idle speed is 100 r/min. or more lower than target idle speed for longer than 20 sec. continuously. or • Engine idle speed is 200 r/min or more higher than target idle speed for longer than 20 sec. continuously. (2 driving cycle detection logic)	• IAC valve or its circuit • Fast idle air valve • Abnormal air drawn in air intake system

DTC CONFIRMATION PROCEDURE

NOTE:

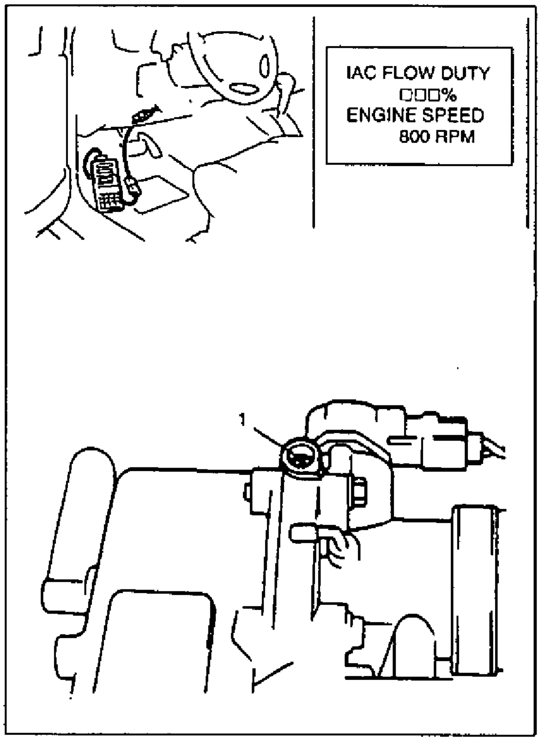
Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

- **Intake air temp.: –8°C, 18°F or higher**
- **Engine coolant temp.: –8 – 110°C (18 – 230°F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool and warm up engine completely.
3) Run engine at idle speed for 1 min.
4) Check DTC and pending DTC by using scan tool.

TROUBLESHOOTING (P0505)

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Idle speed and idle air control duty check: 1) Check engine idle speed and idle air control duty referring to "Idle Speed/Idle Air Control Duty Inspection" in Section 6E1. Are they within specification?	Go to Step 5.	Go to Step 3.
3	Do they indicate high idle speed and low duty or low idle speed and high duty at Step 2?	Go to Step 4.	Substitute a known-good ECM.
4	Adjust idle speed and IAC duty. Is it adjustable with idle air adjusting screw?	Go to Step 5.	Go to Step 6.
5	Is engine idle speed kept at specified idle speed even when with head lights turned ON?	Intermittent trouble or faulty ECM. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A.	Go to Step 7.
6	Check idle air adjusting screw and its passage, FIA valve and abnormal air inhaling. Are they in good condition?	Go to Step 7.	Faulty idle air adjusting screw, clogged idle air adjusting screw air passage, FIA valve or abnormal air inhalling.
7	Check IAC valve and its circuit. Are they in good condition?	Substitute a known-good ECM.	IAC valve or its circuit faulty.



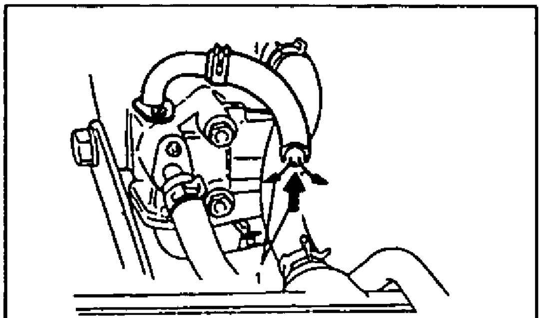
Idle Air Adjusting Screw and Its Passage Check

1) Connect SUZUKI scan tool to DLC with ignition switch OFF.
2) Warm up engine to normal operating temperature and keep it idle speed.
3) Check that "IAC DUTY" value displayed on SUZUKI scan tool increases when idle air adjusting screw (1) is tightened and reduces when loosened.
   If check result is as described above, idle air adjusting screw and its passage are in good condition.
   If not, idle air adjusting screw is faulty or air passage is clogged.

Fast Idle Air Valve

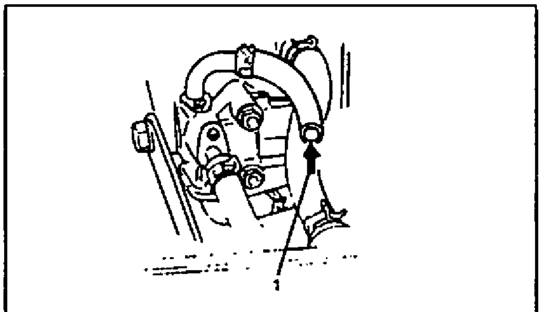
1) Disconnect IAC valve coupler with ignition switch OFF.
2) Check that with cold engine started, as cooling water temperature rises, engine idle speed reduces gradually.
   If check result is as described above, fast idle air valve is in good condition.
   If not, fast idle air valve, air passage or coolant passage is faulty.

IAC Valve And Its Circuit Check



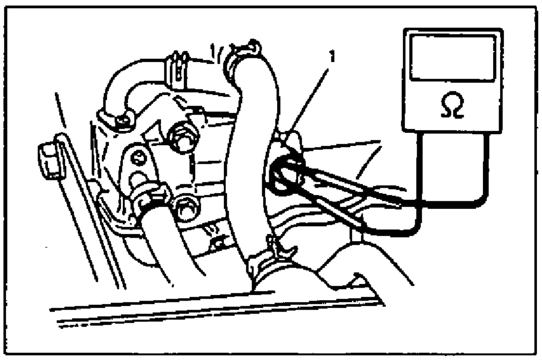
1. Blown air rejected

1) Disconnect IAC valve hose from air intake pipe.
2) Turn ON ignition switch. Try blowing air into hose and check that air will not go in (hard to blow).



1. Blown air accepted

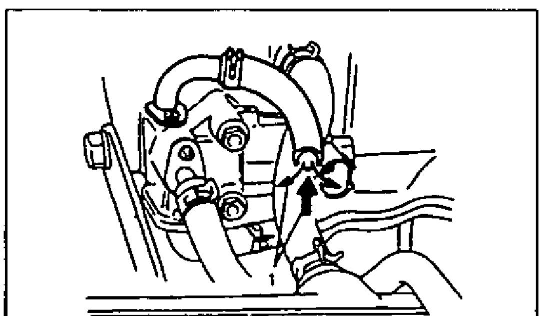
3) Using service wire, ground C51-2-10 terminal of ECM coupler with ignition switch OFF.
4) Turn ON ignition switch. Try blowing air into hose and check that air can be blown into air hose.
   If check results are describe above and C51-2-10 terminal to ECM connection is OK, IAC valve and its circuit are in good condition.
   If not proceed to step 5).



5) With ignition switch "OFF", disconnect IAC valve coupler.
6) Check resistance between each two terminals of IAC valve (1).

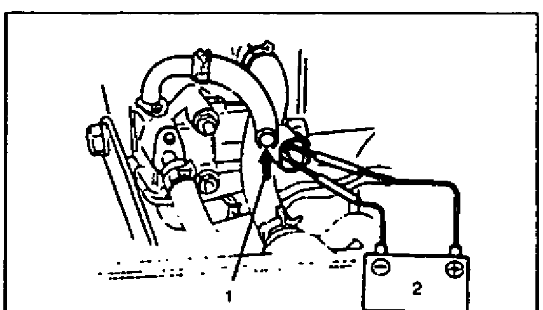
   Resistance: 11 – 14 Ω at 20°C, 68°F

   If it is within specification, proceed to step 7).
   If not, replace.



1. Blown air rejected

7) Disconnect IAC valve air hose from air intake case. Try blowing air into air hose and check that air will not go in (hard to blow).



1. Blown air accepted

8) Connect 12 V-battery (2) to IAC valve terminals and check that air can be blown into air hose.
   If check results are described above, check IAC valve harness.
   If not, replace IAC valve.
9) Connect hose and coupler securely.

DTC P0601 INTERNAL CONTROL MODULE MEMORY CHECK SUM ERROR

SYSTEM DESCRIPTION

Internal control module is installed in ECM.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Data write error or check sum error	ECM

DTC CONFIRMATION PROCEDURE

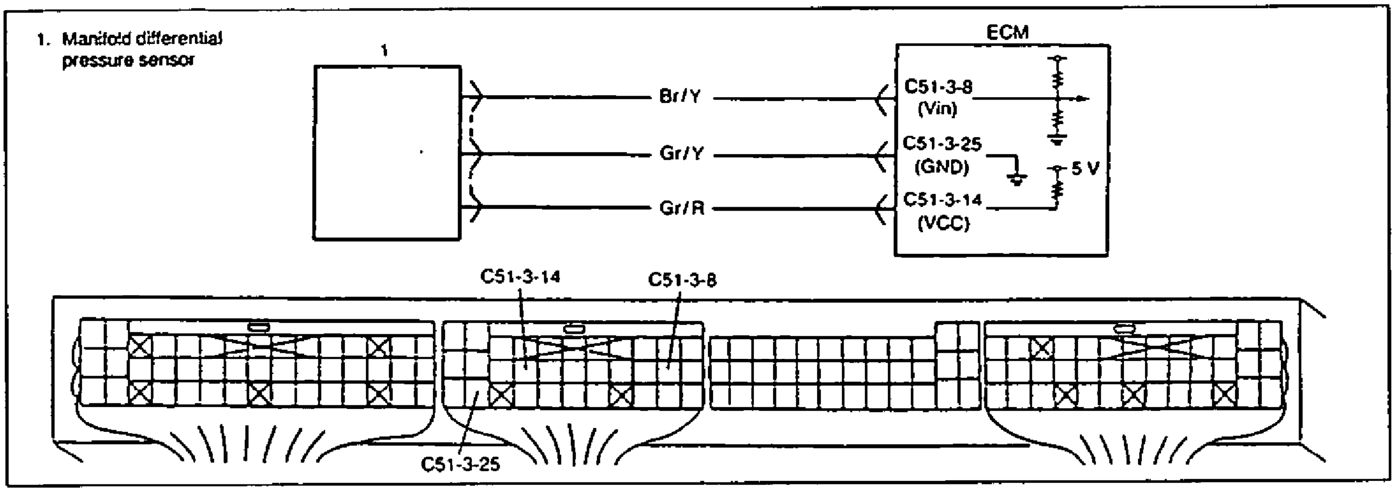
1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool.
3) Start engine and run it at idle if possible.
4) Check DTC and pending DTC by using scan tool.

TROUBLESHOOTING

Substitute a known-good ECM and recheck.

DTC P1408 MANIFOLD DIFFERENTIAL PRESSURE SENSOR CIRCUIT MALFUNCTION

WIRING DIAGRAM



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
• While engine is running after being warmed up and with throttle opening smaller than specification, higher than 4.6 V manifold differential pressure sensor output voltage is detected for specified time or with throttle opening larger than specification, lower than 0.2 V manifold differential pressure output voltage is detected for specified time. (2 driving cycle detection logic)	• Manifold differential pressure sensor • Manifold differential pressure sensor vacuum passage • ECM

DTC CONFIRMATION PROCEDURE

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

NOTE:
Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.
- **Intake air temp.: 5°C, 41°F or higher**
- **Engine coolant temp.: –8 – 110°C (18 – 230°F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool and warm up engine completely.
3) Run engine at idle speed for 1 min.
4) Increase vehicle speed to 80 km/h (50 mph).
5) Keep driving above vehicle speed for 1 min. (Change of vehicle speed is permitted in this step.)
6) Stop vehicle and check DTC and pending DTC by using scan tool.

TROUBLESHOOTING (DTC P1408)

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	MDP sensor signal check: Check voltage between C51-3-8 and C51-3-25 under following conditions. With ignition switch ON leaving engine OFF: 0.2 V or higher At idling: 4.6 V or lower Is check result as specified?	Intermittent trouble or faulty ECM. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A.	Go to Step 3.
3	MDP sensor check: 1) Disconnect connector from MDP sensor. 2) Check for proper connection to MDP sensor at each terminal. 3) If OK, check MDP sensor for performance referring to "MAP Sensor Inspection" in Section 6E. Is check result satisfactory?	"Br/Y", "Gr/Y" or "Gr/R" circuit open/short. If wire and connections are OK, substitute a known-good ECM and recheck.	Replace MDP sensor.

DTC P1450 BAROMETRIC PRESSURE SENSOR CIRCUIT MALFUNCTION
DTC P1451 BAROMETRIC PRESSURE SENSOR PERFORMANCE PROBLEM

SYSTEM DESCRIPTION

Barometric pressure sensor is installed in ECM.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
DTC P1450: Barometric pressure out of specification is detected.	• Barometric pressure sensor in ECM
DTC P1451: While running under conditions described for DTC CONFIRMATION PROCEDURE, barometric pressure value compared with intake manifold vacuum value in fuel cut state is not as specified. (DTC P1451: 2 driving cycle detection logic)	• Manifold differential pressure sensor performance problem • Barometric pressure sensor in ECM

DTC CONFIRMATION PROCEDURE (DTC P1450)

1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC by using scan tool and run engine for 1 min.
3) Check DTC and pending DTC by using scan tool.

DTC CONFIRMATION PROCEDURE (DTC P1451)

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

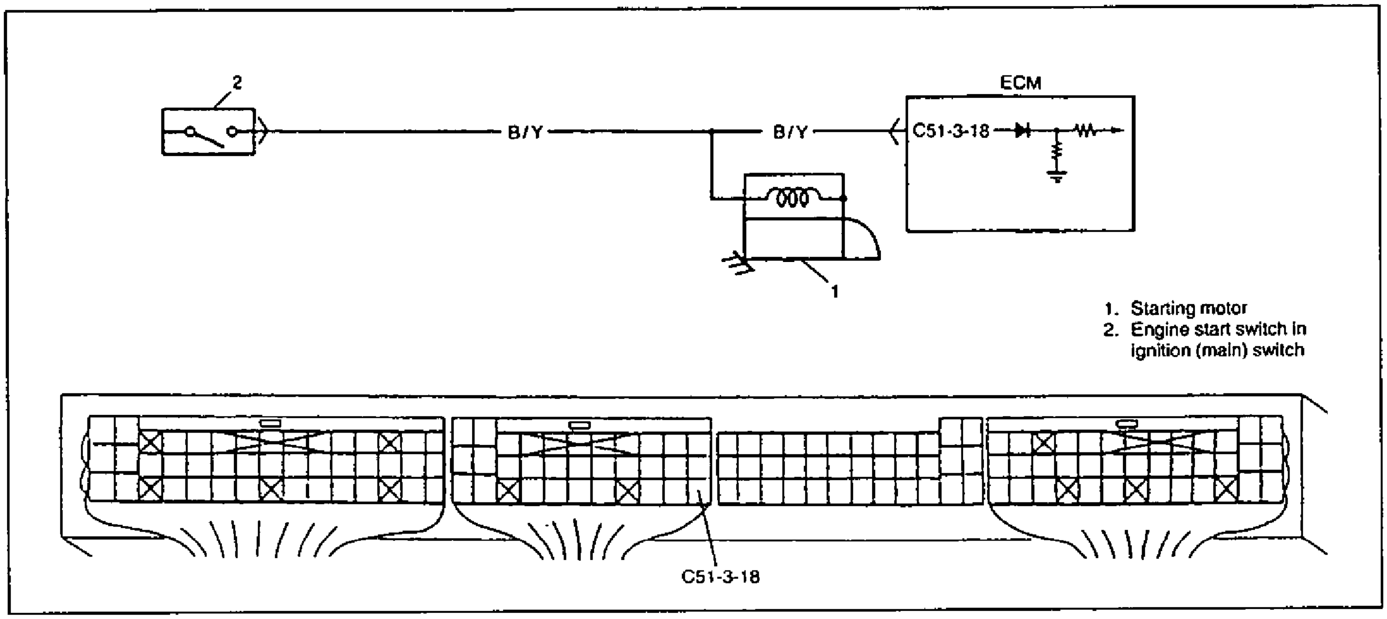
1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool and warm up engine to normal operating temperature.
3) Increase engine speed to 3,000 r/min. in 3rd gear in case of M/T.
4) Release accelerator pedal and with engine brake applied, keep vehicle coasting for 5 sec. or more. (Keep fuel cut condition for 5 sec. or more) If fuel cut condition is not kept for 5 sec. or more, coast down a slope in engine speed 1600 – 3000 r/min. for 5 sec. or more.
5) Stop vehicle and run engine at idle.
6) Repeat steps 3) ~ 5) 2 times.
7) Check DTC and pending DTC by using scan tool.

TROUBLESHOOTING (DTC P1450/P1451)

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Is DTC P1451?	Go to Step 3.	Substitute a known-good ECM and recheck.
3	MDP sensor check: 1) Check MDP sensor and its circuit referring to Steps 2 and 3 of DTC P1408 Diag. Flow Table. Is check result satisfactory?	Substitute a known-good ECM and recheck.	MDP sensor or its circuit malfunction.

DTC P1500 ENGINE STARTER SIGNAL CIRCUIT MALFUNCTION

WIRING DIAGRAM



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Engine starts even though vehicle is at stop and engine start signal is not inputted. Engine start signal is inputted for specified time while engine is running. (2 driving cycle detection logic)	• Engine start signal circuit • ECM

DTC CONFIRMATION PROCEDURE

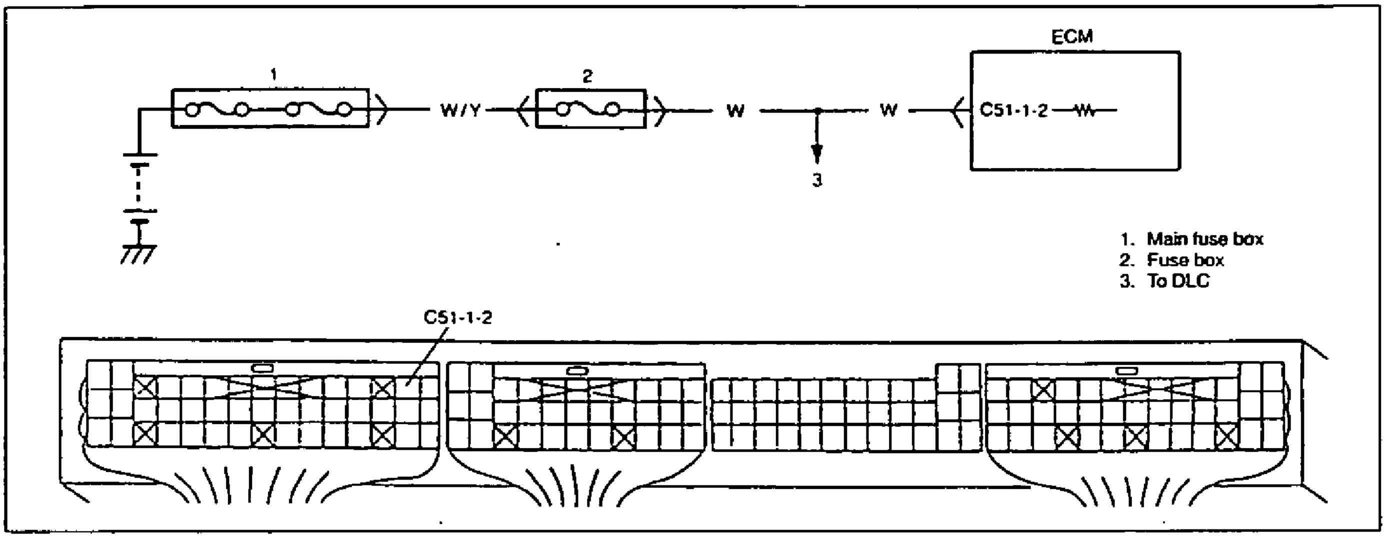
1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC by using scan tool, then start engine and run it for 3 min. or more.
3) Check DTC and pending DTC by using scan tool.

TROUBLESHOOTING (DTC P1500)

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Check for voltage at terminal C51-3-18 of ECM connector connected, under following condition. While engine cranking : 6 – 14 V After starting engine : 0 – 1 V Is voltage as specified?	Poor C51-3-18 connection or intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A. If wire and connections are OK, substitute a known-good ECM and recheck.	"B/Y" circuit open.

DTC P1510 ECM BACK-UP POWER SUPPLY MALFUNCTION

WIRING DIAGRAM



CIRCUIT DESCRIPTION

Battery voltage is supplied to keep DTC memory, values that ECM has learned to control engine, etc. in ECM even when ignition switch is turned OFF.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Back-up circuit voltage lower than specification is detected while engine is running.	• ECM back-up circuit • ECM

DTC CONFIRMATION PROCEDURE

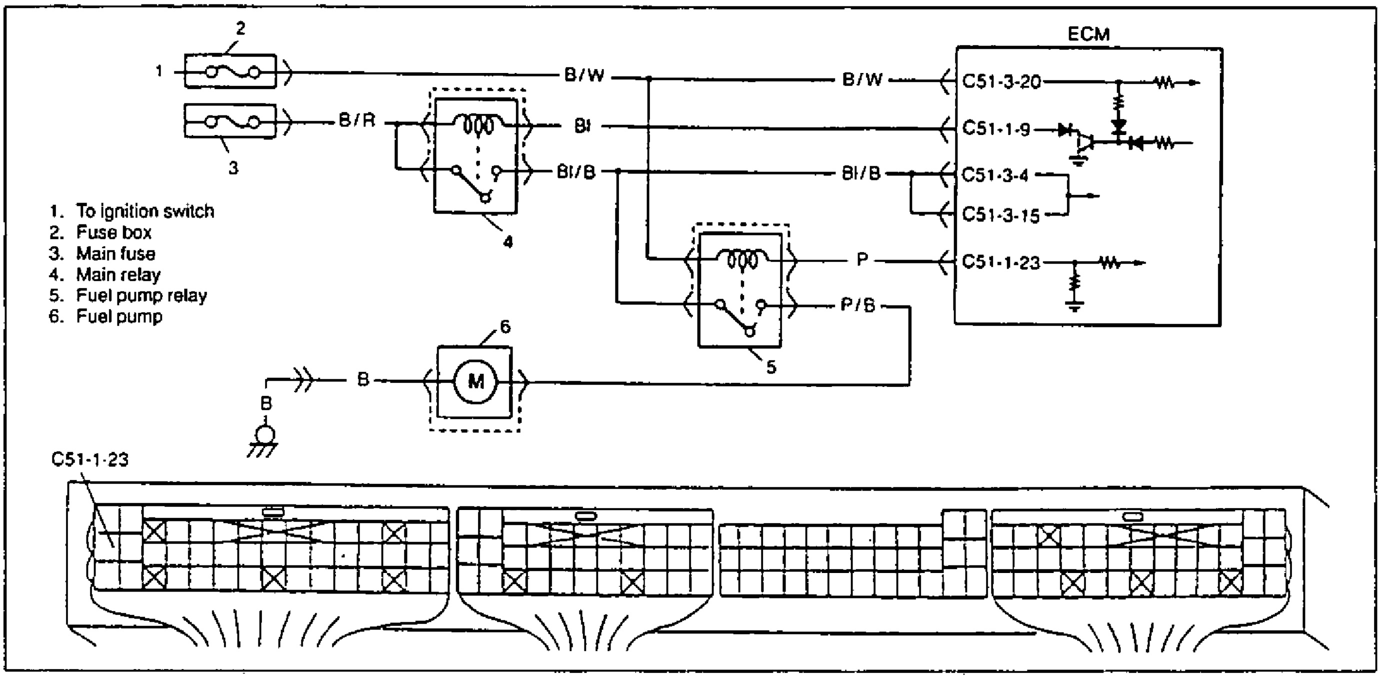
1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool and run engine at idle speed for 1 min.
3) Check DTC and pending DTC by using scan tool.

TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Battery voltage supply circuit check: While engine running, check voltage between C51-1-2 and ground. Is voltage 10 – 14 V?	Poor C51-1-2 connection or intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A. If wire and connections are OK, substitute a known-good ECM and recheck.	"W" circuit open or short.

TABLE B-1 FUEL PUMP CIRCUIT INSPECTION

WIRING DIAGRAM



INSPECTION

STEP	ACTION	YES	NO
1	Fuel pump operation check: 1) Remove fuel filler cap. 2) Turn ON ignition switch. Is fuel pump operation sound heard for 3 sec. after ignition switch ON?	Fuel pump circuit is in good condition.	Go to Step 2.
2	Fuel pump circuit check: 1) With ignition switch OFF, remove fuel pump relay from connector. 2) Check for proper connection to relay at each terminal. 3) If OK, using service wire (2), connect terminals "P/B" wire and "Bl/B" wire of relay connector (1). 4) Turn ON ignition switch **CAUTION: Check to make sure that connection is made between correct terminals. Wrong connection can cause damage to ECM, wire harness etc.** Is fuel pump heard to operate at ignition switch ON?	Go to Step 3.	"Bl/B", "P/B" or "B" circuit open or fuel pump malfunction.
3	Fuel pump relay check: 1) Check fuel pump relay referring to "Fuel Pump Relay Inspection" in Section 6E. Is it in good condition?	"B/W" or "P" circuit open.	Replace fuel pump.

Fig. for Step 2

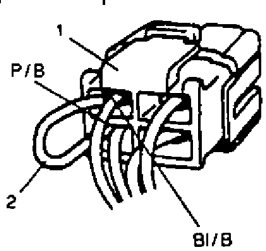
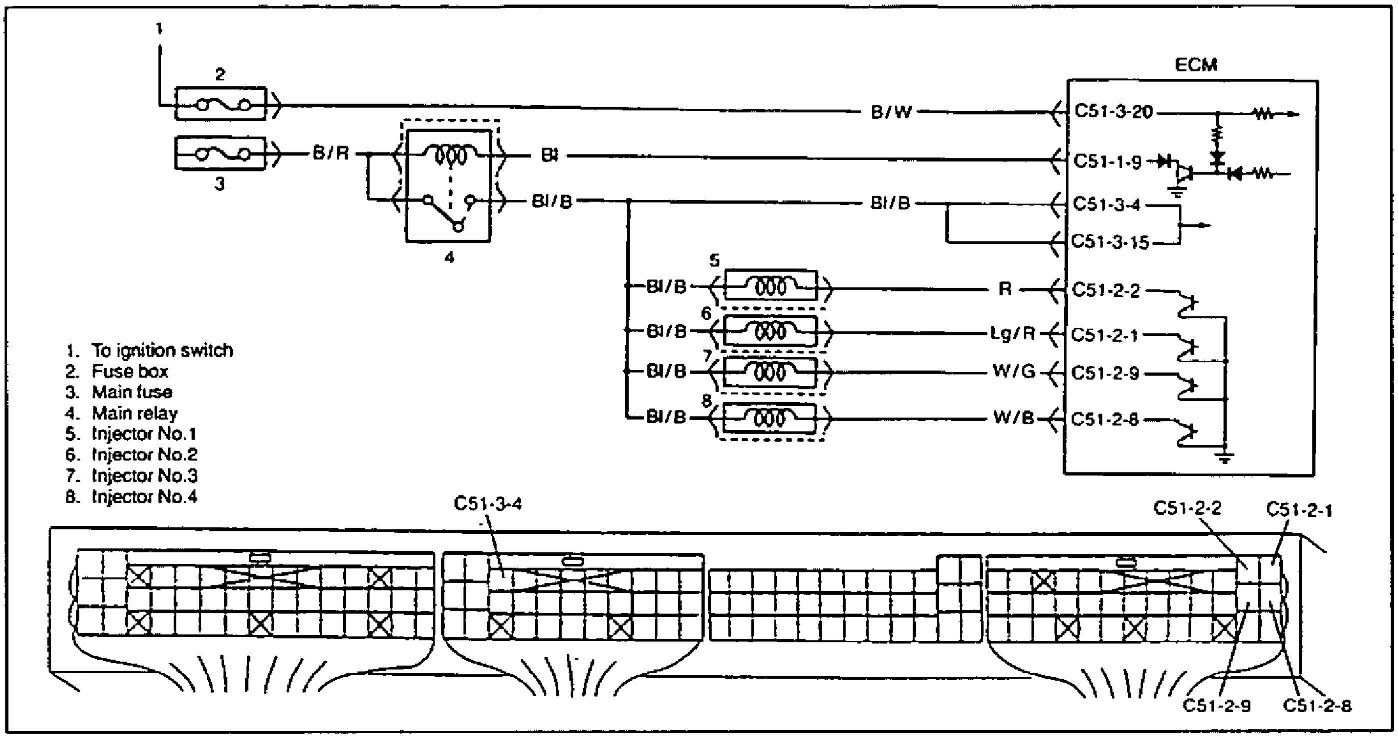


TABLE B-2 FUEL INJECTORS AND CIRCUIT INSPECTION

WIRING DIAGRAM

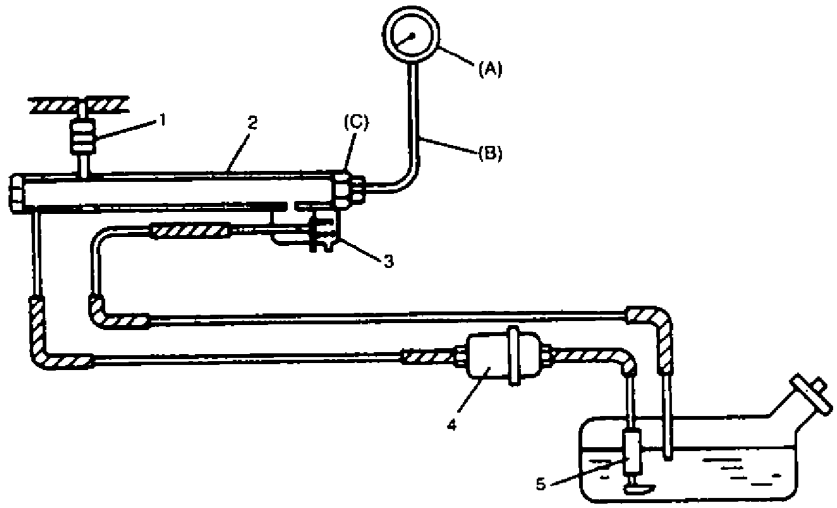


INSPECTION

STEP	ACTION	YES	NO
1	Check Injector for Operating Sound. Using sound scope, check each injector for operating sound at engine cranking. Do all 4 injectors make operating sound?	Go to Step 2.	Go to Step 3.
2	Wire Harness check: 1) Disconnect connectors from ECM. 2) Check for resistance between following terminals of ECM connector disconnected. C51-2-1 – C51-3-4 C51-2-2 – C51-3-4 C51-2-8 – C51-3-4 C51-2-9 – C51-3-4 13 – 16 Ω at 20°C, 68°F Is check result as specified?	Fuel injector circuit is in good condition.	"R", "Lg/R", "W/G" and "W/B" shorted each other.
3	Does none of 4 injectors make operating sound at Step 1?	Go to Step 4.	Check coupler connection and wire harness of injector not making operating sound and injector itself (Refer to "Fuel Injector Inspection" in Section 6E).
4	Check power circuit of injectors for open and short. Is it normal?	Check all 4 injectors for resistance respectively. If resistance is OK, substitute a known-good ECM and recheck.	Power circuit open or short.

TABLE B-3 FUEL PRESSURE INSPECTION

SYSTEM DIAGRAM



INSPECTION

NOTE:

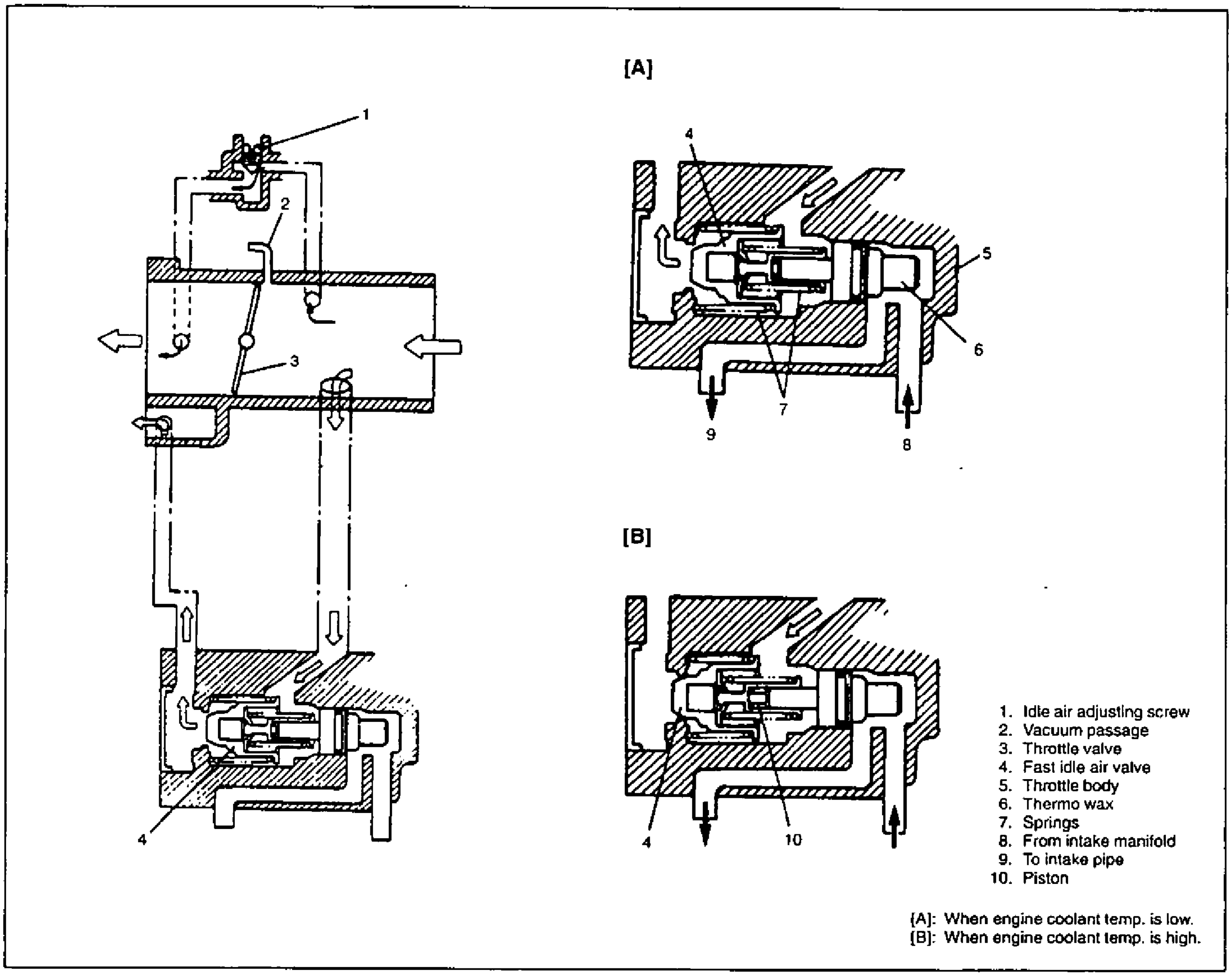
Before using following flow table, check to make sure that battery voltage is higher than 11 V. If battery voltage is low, pressure becomes lower than specification even if fuel pump and line are in good condition.

STEP	ACTION	YES	NO
1	1) Install fuel pressure gauge, referring to "Fuel Pressure Inspection" in Section 6E1. 2) Operate fuel pump. Is fuel pressure then 250 – 300 kPa (2.5 – 3.0 kg/cm^2, 35.6 – 42.7 psi)?	Go to Step 2.	Go to Step 5.
2	Is 180 kPa (1.8 kg/cm^2, 25.6 psi) or higher fuel pressure retained for 1 minute after fuel pump is stopped at Step 1?	Go to Step 3.	Go to Step 4.
3	1) Start engine and warm it up to normal operating temperature. 2) Keep it running at specified idle speed. Is fuel pressure then within 210 – 260 kPa (2.1 – 2.6 kg/cm^2, 29.8 – 37.0 psi)?	Normal fuel pressure.	Clogged vacuum passage for fuel pressure regulator or faulty fuel pressure regulator.
4	Is there fuel leakage from fuel feed line hose, pipe or joint?	Fuel leakage from hose, pipe or joint.	Go to Step 10.
5	Was fuel pressure higher than spec. in Step 1?	Go to Step 6.	Go to Step 7.
6	1) Disconnect fuel return hose from fuel pipe and connect new hose to it. 2) Put the other end of new return hose into approved gasoline container. 3) Operate fuel pump. Is specified fuel pressure obtained then?	Restricted fuel return hose or pipe.	Faulty fuel pressure regulator.
7	Was no fuel pressure applied in Step 1?	Go to Step 8.	Go to Step 9. **(Low pressure is measured.)**

STEP	ACTION	YES	NO
8	With fuel pump operated and fuel return hose blocked by pinching it, is fuel pressure applied?	Faulty fuel pressure regulator.	Shortage of fuel or fuel pump or its circuit defective (Refer to Table B-1 "Fuel Pump Circuit Inspection").
9	1) Operate fuel pump. 2) With fuel return hose blocked by pinching it, check fuel pressure. Is it 450 kPa (4.5 kg/cm^2, 64.0 psi) or more?	Faulty fuel pressure regulator.	Clogged fuel filter, restricted fuel feed hose or pipe, faulty fuel pump or fuel leakage from hose connection in fuel tank.
10	1) Disconnect fuel return hose from fuel pipe and connect new hose to it. 2) Put the other end of new return hose into approved gasoline container. 3) Check again if specified fuel pressure is retained. While doing so, does fuel come out return hose?	Faulty fuel pressure regulator.	Fuel leakage from injector, faulty fuel pump (faulty check valve in fuel pump) or fuel leakage from fuel pressure regulator diaphragm.

TABLE B-4 FAST IDLE AIR VALVE (FIA VALVE) SYSTEM INSPECTION

SYSTEM DIAGRAM

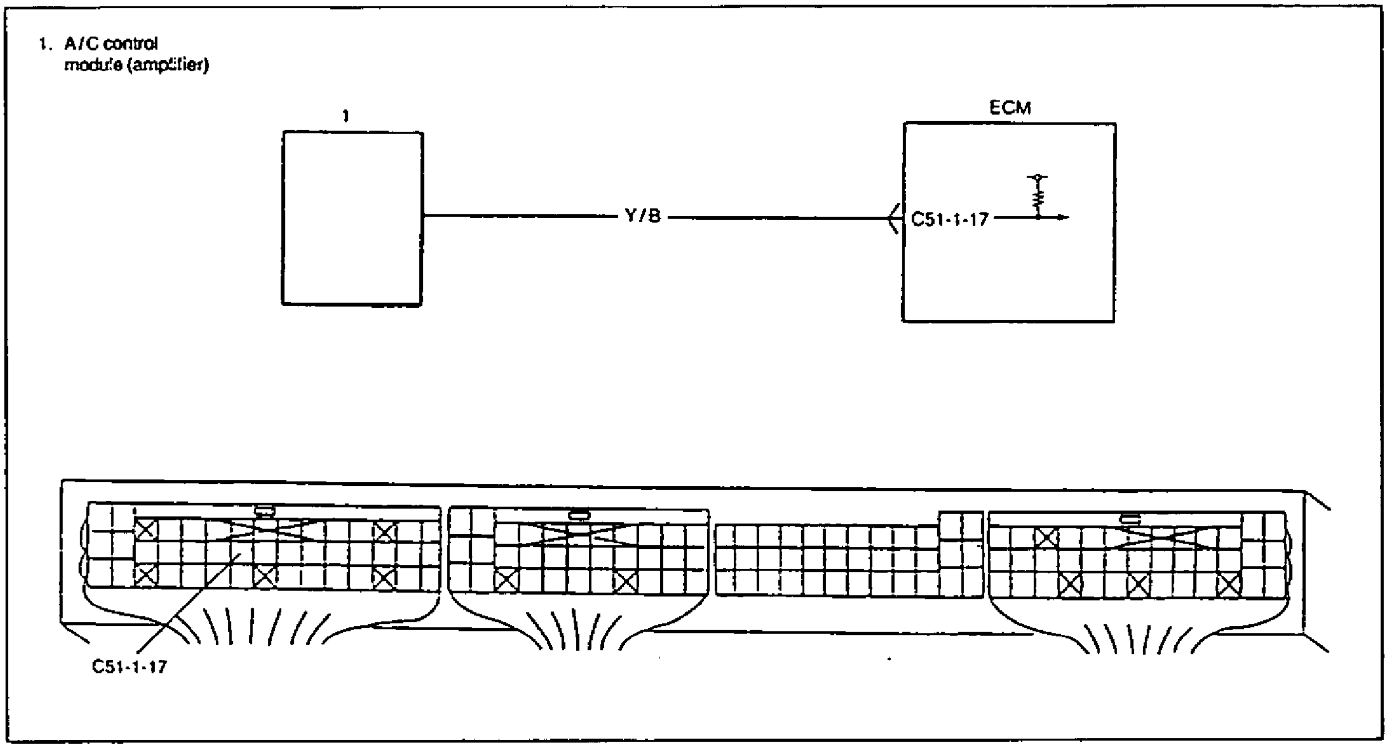


INSPECTION

STEP	ACTION	YES	NO
1	1) Disconnect IAC valve coupler with ignition switch OFF. 2) Check that engine idle speed reduces gradually as engine coolant temp. rises when cold engine (engine coolant temp. < 30°C) is started and kept running at idle speed. Is check result as described above?	Fast idle air valve, air passage and coolant passage is in good condition.	Faulty fast air valve, air passage or coolant passage.

TABLE B-5 A/C SIGNAL CIRCUITS INSPECTION (IF EQUIPPED)

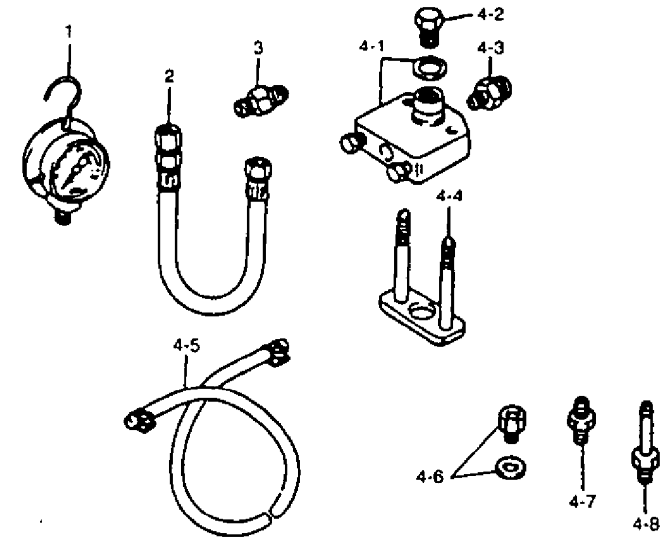
WIRING DIAGRAM



INSPECTION

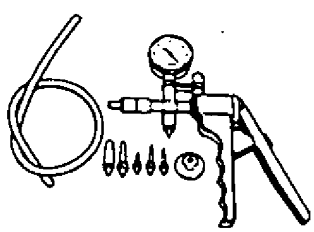
STEP	ACTION	YES	NO
1	Check A/C Signal Circuit. 1) Check voltage at terminal C51-1-17 with ignition switch ON. A/C switch and/or heater blower switch OFF (A/C is not operating): 10 – 14 V Both A/C switch and heater blower switch ON: 0 – 1.5 V Are check result as specified?	A/C control signal circuits are in good condition.	"Y/B" circuit open or short, evaporative temperature is below 1°C (34°F) or faulty A/C system.

SPECIAL TOOLS

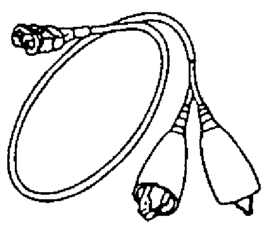


1. Pressure gauge
   09912-58441
2. Pressure hose
   09912-58431
3. Attachment
   09919-46010
4. Checking tool set
   09912-58421

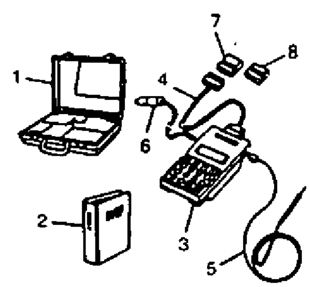
4-1. Tool body & washer
4-2. Body plug
4-3. Body attachment
4-4. Holder
4-5. Return hose & clamp
4-6. Body attachment-2 & washer
4-7. Hose attachment-1
4-8. Hose attachment-2



09917-47010
Vacuum pump gauge

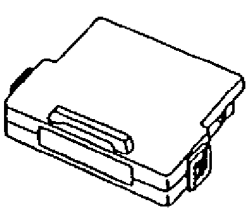


09930-88530
Injector test lead

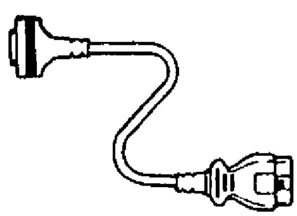


1. Storage case
2. Operator's manual
3. Tech 1A
4. DLC cable
5. Test lead/probe
6. Power source cable
7. DLC cable adaptor
8. Self–test adaptor

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



Mass storage cartridge



09931-76030
14/16 pin DLC cable

SECTION 6A1

ENGINE MECHANICAL
(1-CAM 16-VALVES)

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

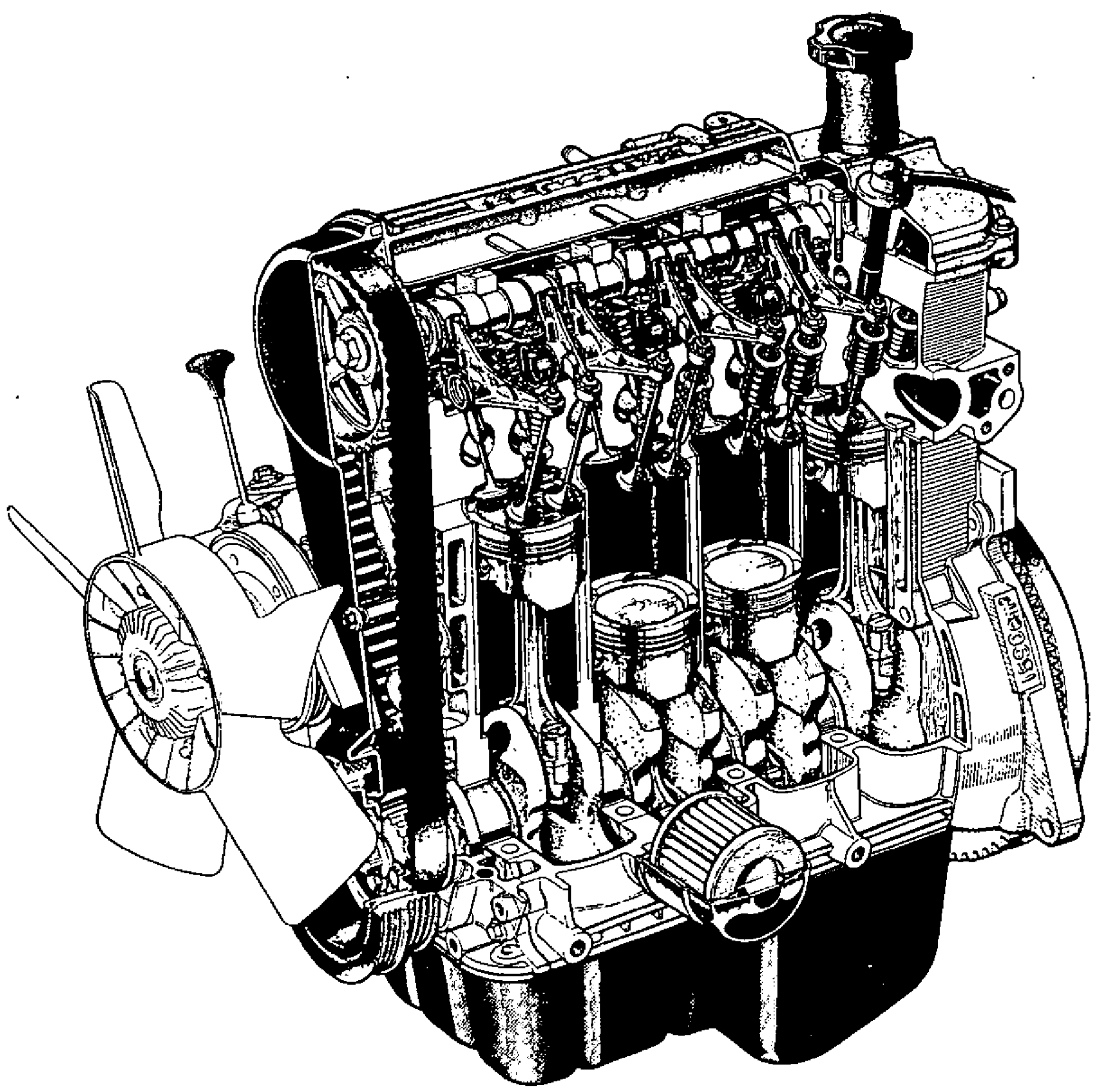
NOTE:
For what each abbreviation stands for (i.e., full term), refer to SECTION 0A.

GENERAL DESCRIPTION

ENGINE

The engine is a water-cooled, in line 4 cylinders, 4 stroke cycle gasoline unit equipped with its S.O.H.C. (Single Overhead Camshaft) valve mechanism arranged for "V"-type valve configuration and 16 valves (IN 2 and EX 2/one cylinder).

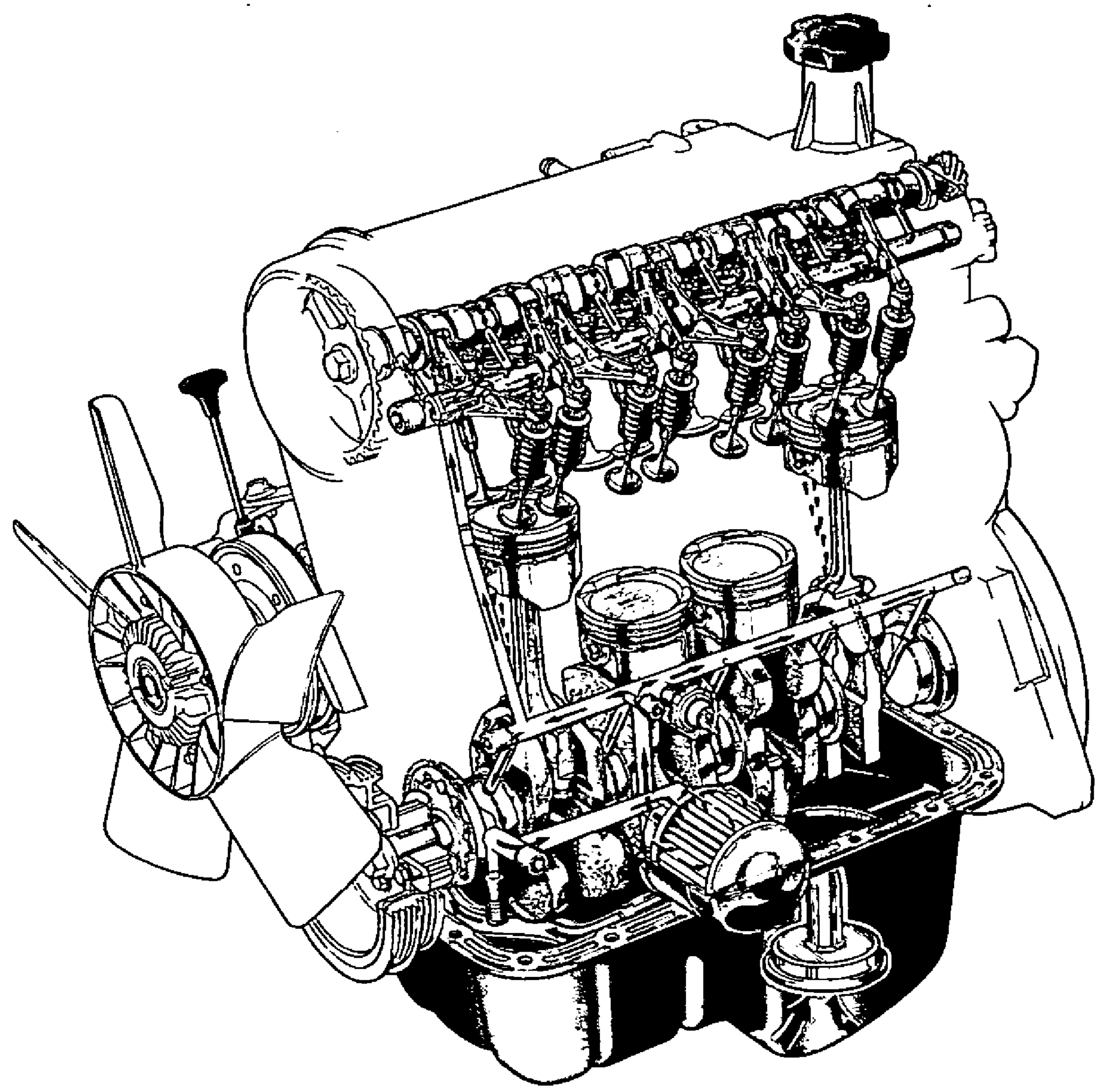
The single overhead camshaft is mounted over the cylinder head: it is driven from crankshaft through timing belt and opens and closes its valves via the rocker arms.



ENGINE LUBRICATION

The oil pump is of a trochoid type, and mounted on crankshaft at crankshaft pulley side.
Oil is drawn up through oil pump strainer and passed through pump to oil filter.
The filtered oil flows into two paths in cylinder block.
In one path, oil reaches crankshaft journal bearings.
Oil from crankshaft journal bearings is supplied to connecting rod bearings by means of intersecting passages drilled in crankshaft, and then injected from a small hole provided on big end of connecting rod to lubricate piston, rings, and cylinder wall.
In another path, oil goes up to cylinder head and lubricates camshaft journals, rocker arms, camshaft, etc., passing through oil gallery in rocker arm shaft.

An oil relief valve is provided on oil pump. This valve starts relieving oil pressure when the pressure comes over about 400 kPa (4.0 kg/cm^2, 56.9 psi). Relieved oil drains back to oil pan.



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

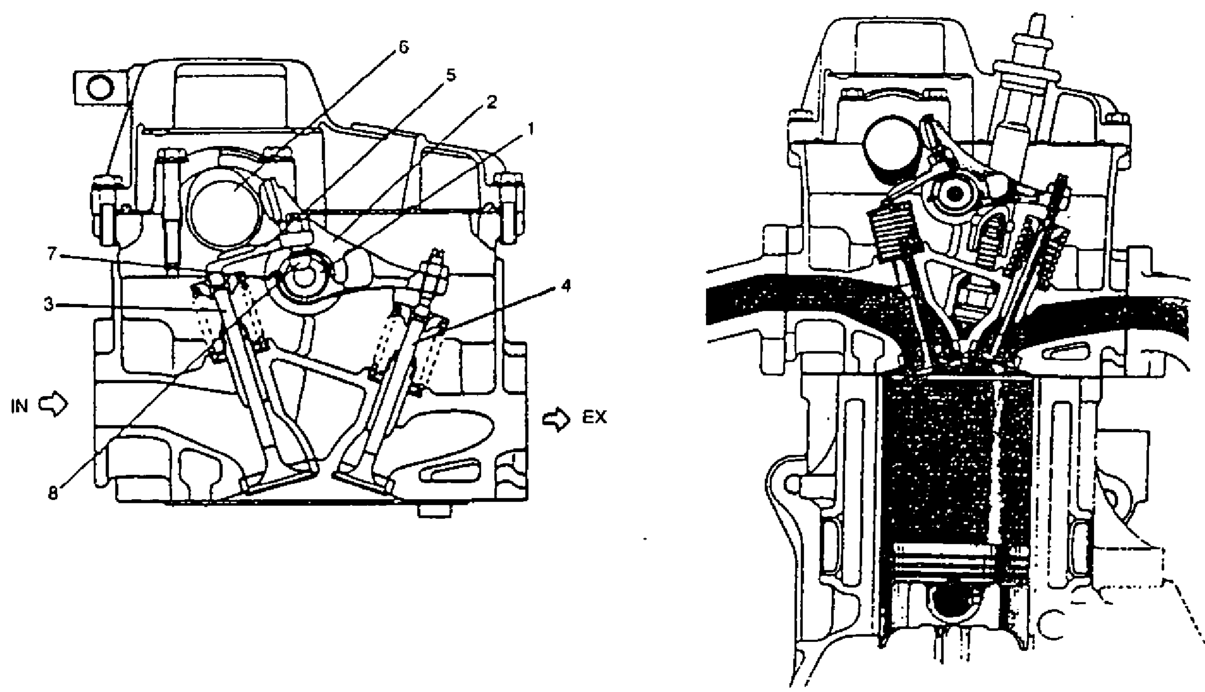
A monoblock casting crankshaft is supported by 5 main bearings which are of precision insert type. Four crank pins on the crankshaft are positioned 180° apart.

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 see-saw 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

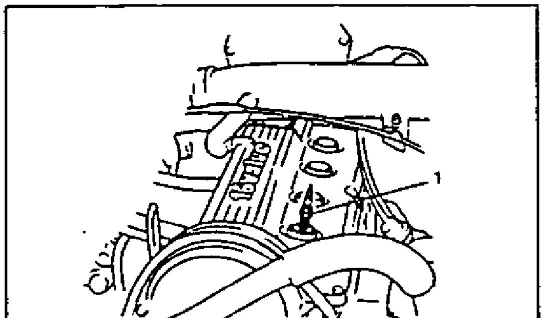
ON-VEHICLE SERVICE

COMPRESSION CHECK

Check compression pressure on all four cylinders as follows:

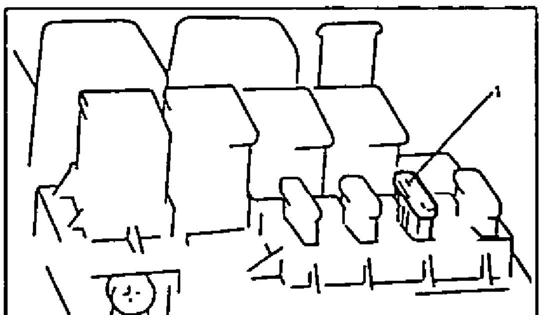
1) Warm up engine.
2) Stop engine after warming up.

   NOTE:
   After warming up engine, place transmission gear shift lever in "Neutral", and set parking brake and block drive wheels.



1. Spark plug

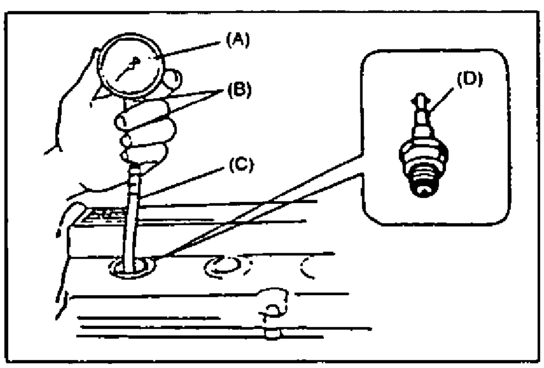
3) Remove all spark plugs.



1. ECM fuse (FI)

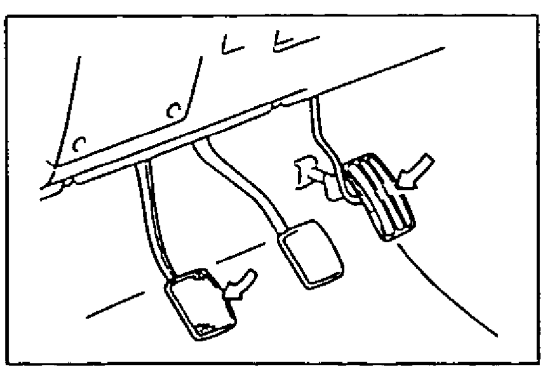
4) Disconnect ECM fuse (FI) from main fuse box.

> **WARNING:**
> **Failure in disconnecting ECM fuse (FI) can cause spark to occur in engine room possibly resulting in a dangerous explosion.**



5) Install special tool (Compression gauge) into spark plug hole.

   Special Tool
   (A): 09915-64510-001
   (B): 09915-64510-002
   (C): 09915-64530
   (D): 09915-67010

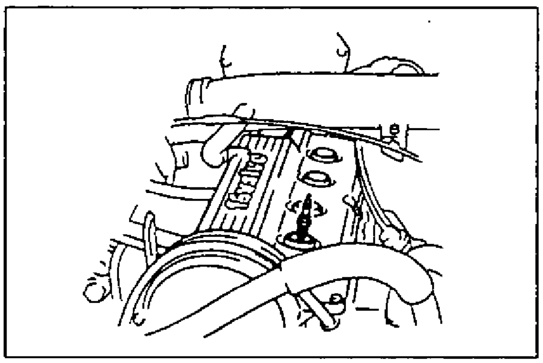


6) Disengage clutch to lighten starting load on engine, and depress accelerator pedal all the way to make throttle valve full-open.

7) Crank engine with fully charged battery, and read the highest pressure on compression gauge.

NOTE:
For measuring compression pressure, crank engine at least 250 r/min. by using fully charged battery.

	Compression pressure
Standard	1400 kPa (14.0 kg/cm², 199.0 psi)
Limit	1200 kPa (12.0 kg/cm², 170.0 psi)
Max. difference between any two cylinders	100 kPa (1.0 kg/cm², 14.2 psi)



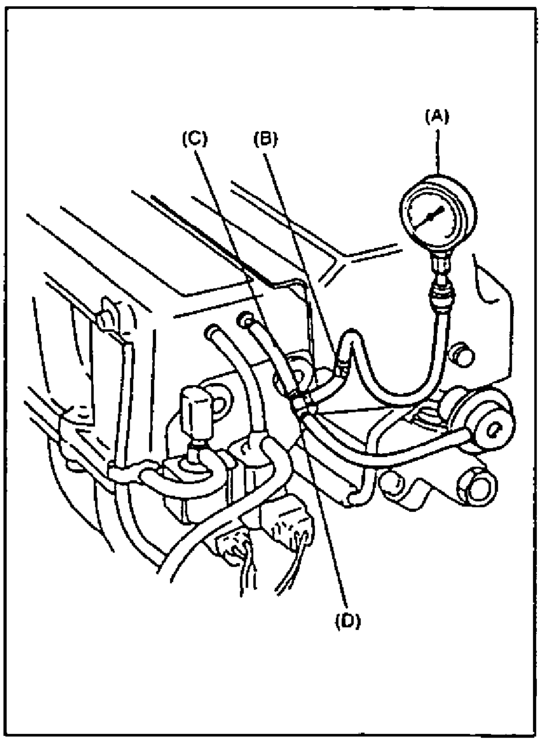
8) Carry out steps 5) through 7) on each cylinder to obtain four readings.
9) After checking, connect ignition coil coupler securely and install spark plugs.

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", and set parking brake and block drive wheels.



2) With engine stopped, disconnect fuel pressure regulator vacuum hose from intake surge tank and connect 3-way joint, hoses and special tool (vacuum gauge and joint) between intake surge tank and vacuum hose disconnected.

   Special Tool
   (A): 09915-67310
   (B): 09918-08210

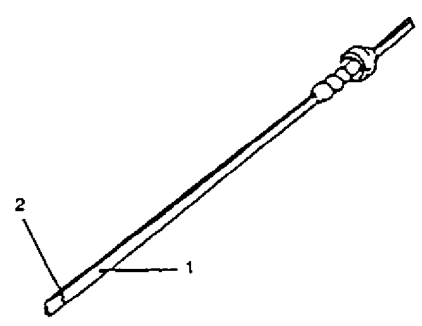
   SUZUKI GENUINE PARTS
   (C): Hose 09343-03087
   (D): 3-way joint 09367-04002

3) Run engine at specified idle speed, and read vacuum gauge. Vacuum should be within following specification.

   Vacuum specification (at sea level):
   52.6 – 72.3 kPa (40 – 55 cmHg, 15.7 – 21.6 in.Hg) at specified idling speed

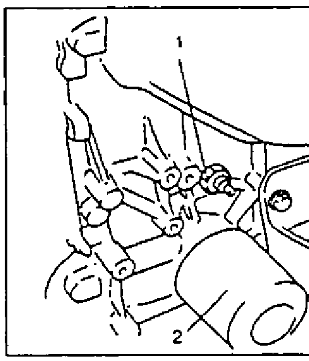
4) After checking, connect vacuum hose to intake surge tank.

OIL PRESSURE CHECK



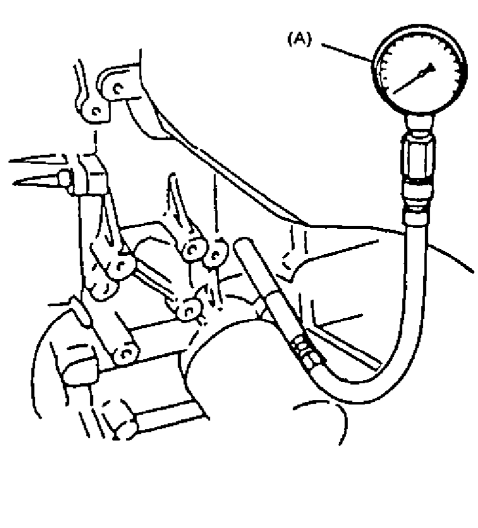
1. Full level mark (hole)
2. Low level mark (hole)

NOTE:
Prior to checking oil pressure, check following items.
- **Oil level in oil pan.**
  If oil level is low, add oil up to Full level mark (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. Oil pressure switch
2. Oil filter

1) Remove oil pressure switch from cylinder block.



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

   Special Tool
   (A): 09915-77310

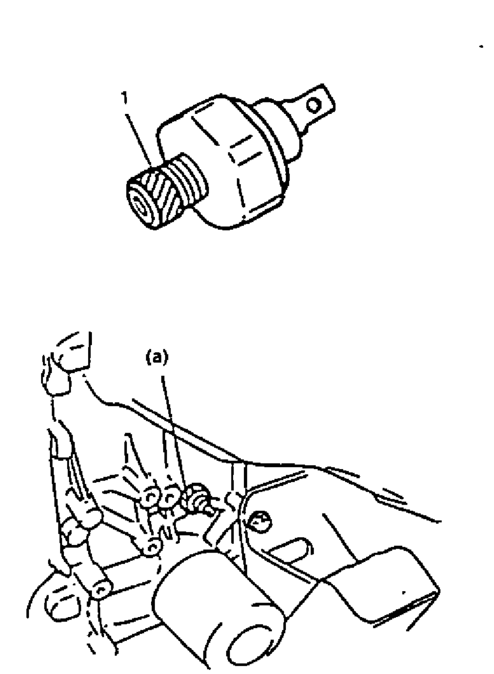
3) Start engine and warm it up to normal operating temperature.

   NOTE:
   Be sure to place transmission gear shift lever in "Neutral", and set parking brake and block drive wheels.

4) After warming up, raise engine speed to 4,000 r/min. and measure oil pressure.

   Oil pressure specification:
   330 – 430 kPa (3.3 – 4.3 kg/cm², 46.9 – 61.1 psi) at 4,000 r/min. (rpm)

5) Stop engine and remove oil pressure gauge.



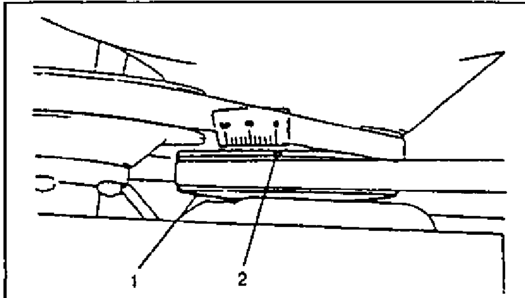
1. Sealing tape

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

NOTE:
If sealing tape edge is bulged out from screw threads of switch, cut it off.

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

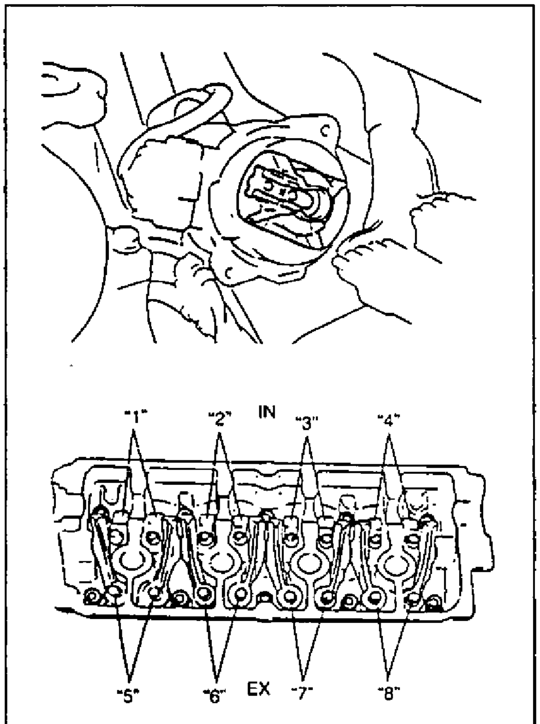
7) Start engine and check oil pressure switch for oil leakage.



1. Crankshaft pulley
2. V mark

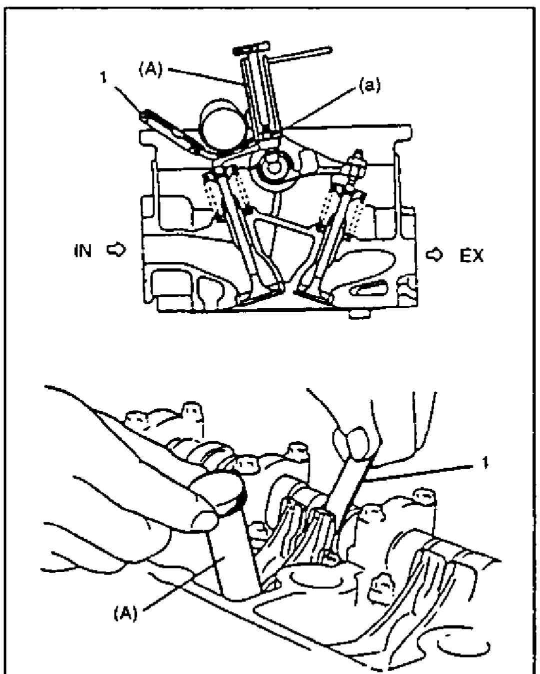
VALVE LASH (CLEARANCE)

1) Disconnect negative cable at battery.
2) Remove cylinder head cover referring to item "Cylinder Head Cover".
3) Using 17 mm socket, turn crankshaft pulley clockwise until "V" mark (in white paint) on pulley aligns with "0" (zero) calibrated on timing belt cover.



4) Remove distributor cap and check rotor position. If it is positioned as shown in figure (i.e. No. 1 piston is at TDC of compression stroke), check valve lashes at valves "1", "2", "5" and "7". If it is at ignition position of No.4 cylinder, check valve lashes at valves "3", "4", "6" and "8".

NOTE:
When checking valve clearance, insert thickness gauge between camshaft and cam-riding face of rocker arm.



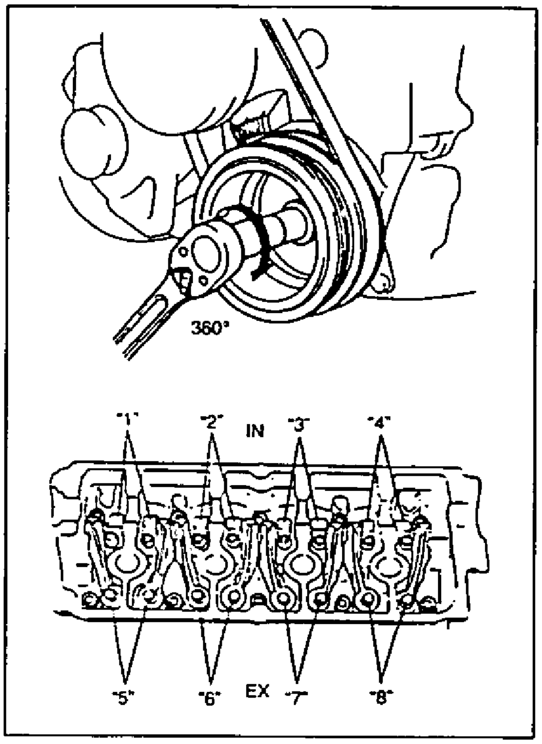
1. Thickness gauge

5) If valve lash is out of specification, adjust it to specification by turning adjusting screw after loosening lock nut.
After adjustment, tighten lock nut to specified torque while holding adjusting screw stationary, and then make sure again that valve lash is within specification.

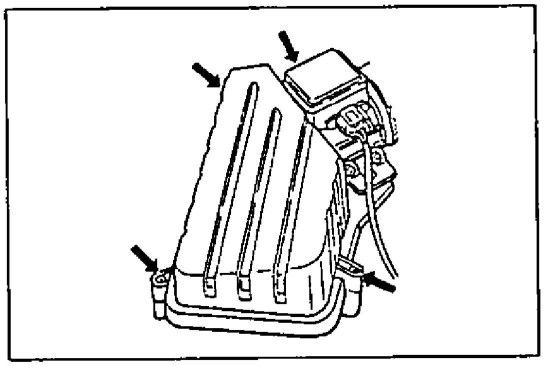
		When cold (Coolant temperature is 15 – 25°C or 59 – 77°F)	When hot (Coolant temperature is 60 – 68°C or 140 – 154°F)
Valve clearance specification	Intake	0.13 – 0.17 mm (0.005 – 0.007 in.)	0.17 – 0.21 mm (0.007 – 0.008 in.)
	Exhaust		

Special Tool
(A): 09917-18210

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



6) After checking and adjusting valve lashes at valves "1", "2", "5" and "7", (or "3", "4", "6" and "8") rotate crankshaft exactly one full turn (360°) and check the same at valves "3", "4", "6" and "8" (or "1", "2", "5" and "7"). Adjust them as necessary.
7) After checking and adjusting all valves, reverse removal procedure for installation.



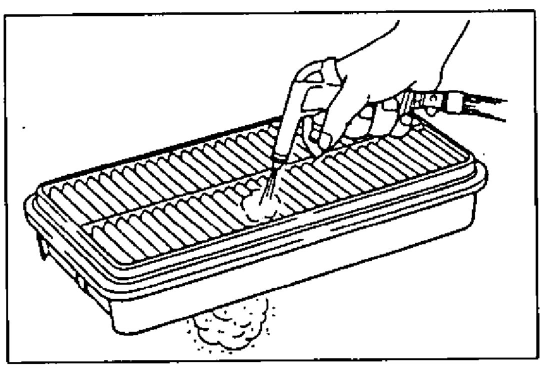
AIR CLEANER ELEMENT

REMOVAL

1) Remove air cleaner case bolts.
2) Remove air cleaner element from case.

INSPECT

Check air cleaner element for dirt. Replace excessively dirty element.

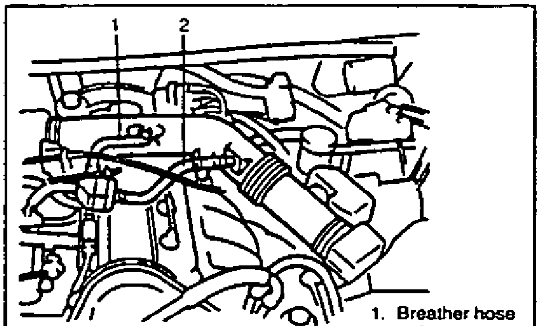


CLEAN

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

INSTALLATION

Reverse removal procedure for installation.



1. Breather hose
2. IAC valve hose

AIR INLET PIPE

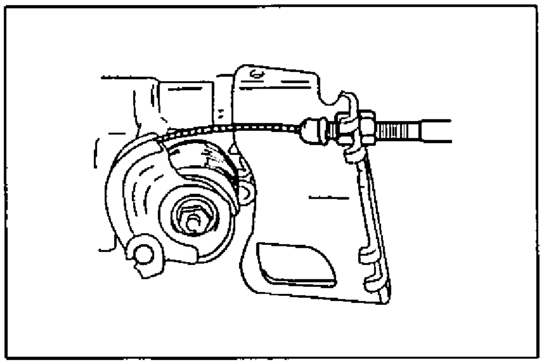
REMOVAL

1) Disconnect negative cable at battery.
2) Disconnect IAC valve hose and breather hose from air intake pipe.
3) Remove air intake pipe.

INSTALLATION

Reverse removal procedure for installation, noting following.

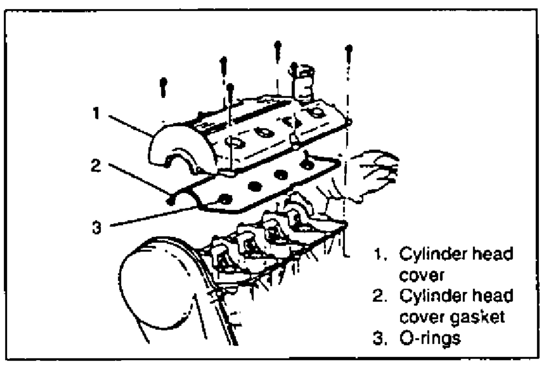
- Clamp each hose securely.



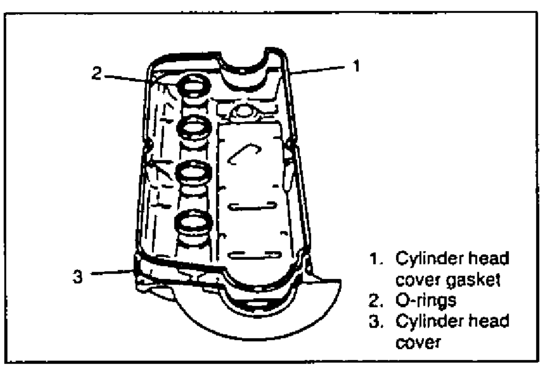
CYLINDER HEAD COVER

REMOVAL

1) Disconnect negative cable at battery.
2) Remove throttle cover.
3) Disconnect accelerator cable from throttle body and PCV hose from head cover.
4) Remove air intake pipe as previously outlined.
5) Remove air intake pipe bracket.
6) Disconnect high-tension cords from spark plugs.



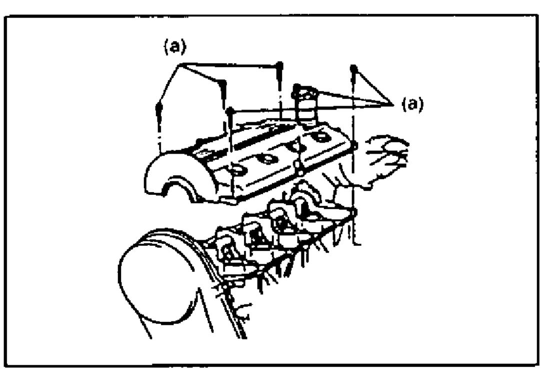
7) Remove cylinder head cover with cylinder head cover gasket and O-rings.



INSTALLATION

1) Install O-rings and cylinder head cover gasket to cylinder head cover.

NOTE:
Be sure to check each of these parts for deterioration or any damage before installation and replace if found defective.

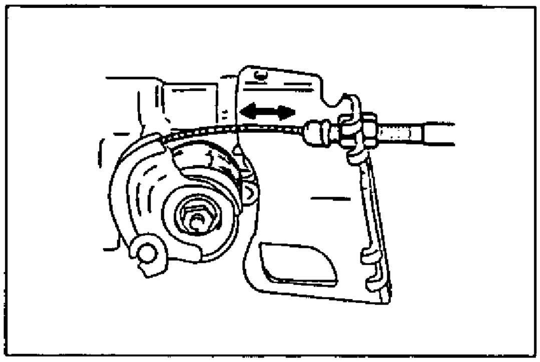


2) Install cylinder head cover to cylinder head and tighten cover bolts to specified torque.

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

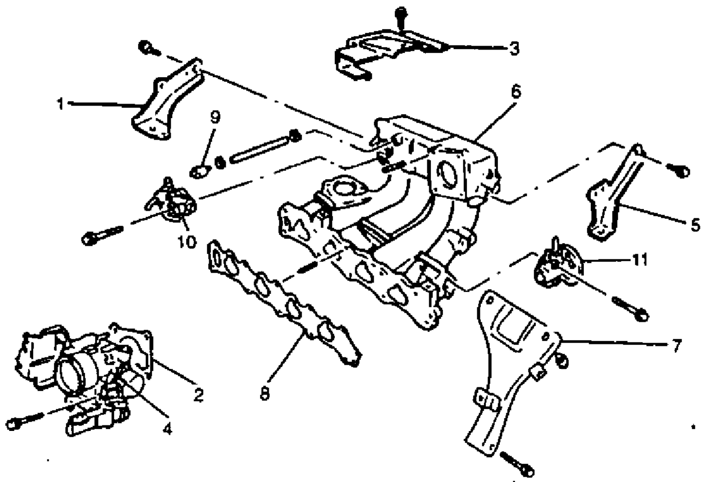
NOTE:
When installing cylinder head cover, use care so that cylinder head cover gasket or O-rings will not get out of place or fall off.

3) Connect high-tension cords to spark plugs.
4) Install air intake pipe bracket and air intake pipe.
5) Connect air and water hoses and clamp them securely.



6) Connect accelerator cable to throttle body and then PCV hose to PCV valve.
   Adjust accelerator cable play, referring to Section 6E1.
7) Install throttle cover.
8) Connect negative cable at battery.

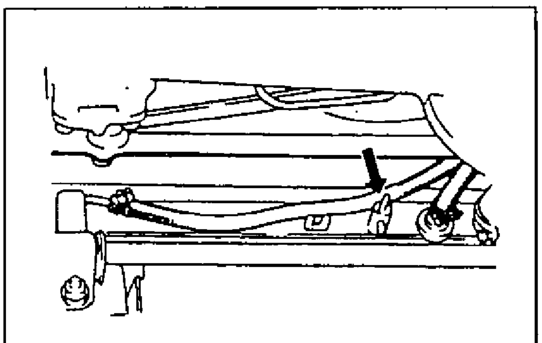
THROTTLE BODY AND INTAKE MANIFOLD



1. Intake manifold No.1 stiffener
2. Gasket
3. Throttle cover
4. Throttle body
5. No.2 stiffener
6. Intake manifold
7. Intake manifold stiffener
8. Gasket
9. PCV valve
10. IAC valve
11. EGR valve

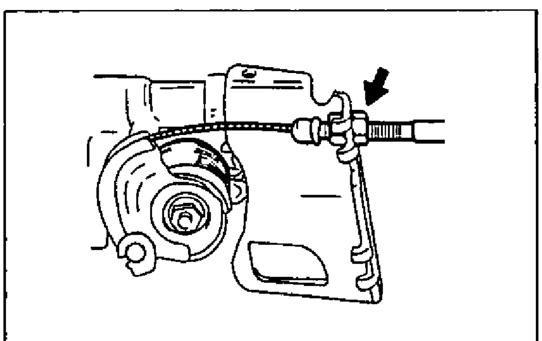
REMOVAL

1) Relieve fuel pressure according to procedure described in Section 6.
2) Disconnect negative cable at battery.

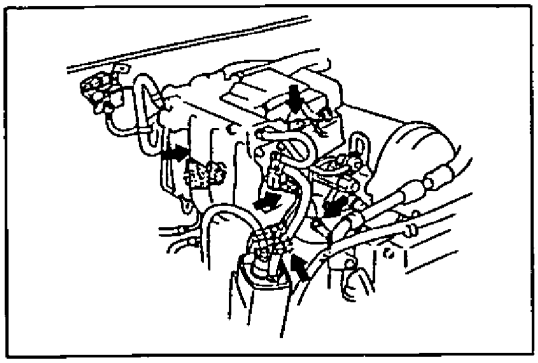


3) Drain cooling system.

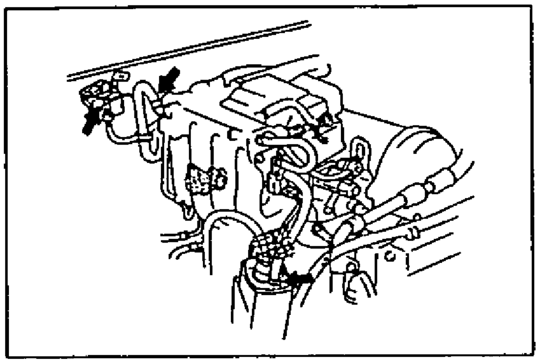
> **WARNING:**
> **To help avoid danger of being burned, do not remove drain plug and radiator cap while engine and radiator are still hot. Scalding fluid and steam can be blown out under pressure if plug and cap are taken off too soon.**



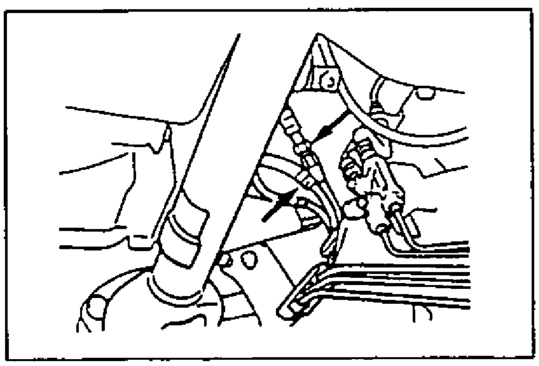
4) Remove air intake pipe.
5) Disconnect accelerator cable from throttle body, and PCV hose from PCV valve.



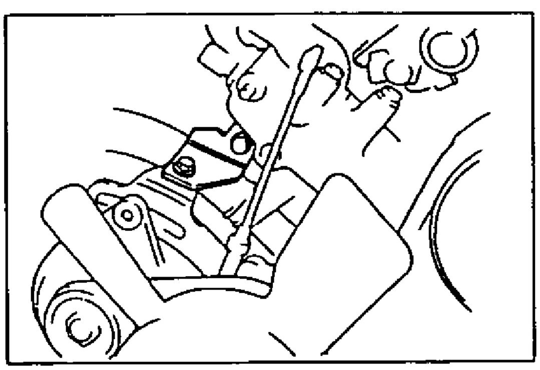
6) Disconnect following electric lead wires:
   - EGR valve
   - Ground wires from intake surge tank
   - Coolant (Water) temperature gauge
   - Engine coolant temperature sensor
   - Injectors, TP sensor and IAC valve lead wires at the coupler
   - EVAP canister purge valve
   - A/C coolant (water) temperature switch (if equipped)



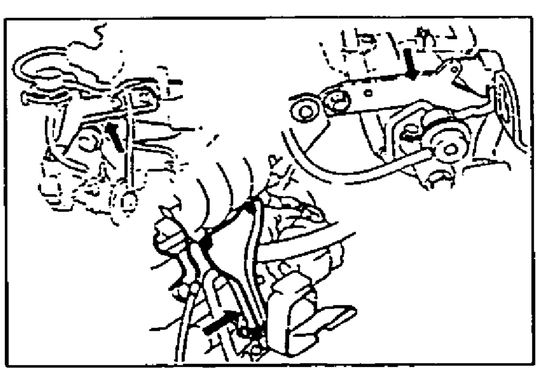
7) Disconnect following hoses:
   - Brake booster hose from intake surge tank
   - Canister purge hose from EVAP canister
   - Engine cooling water (coolant) hose (outlet side) from IAC valve
   - Radiator inlet hose from thermostat cap
   - Manifold differential pressure sensor hose from intake surge tank



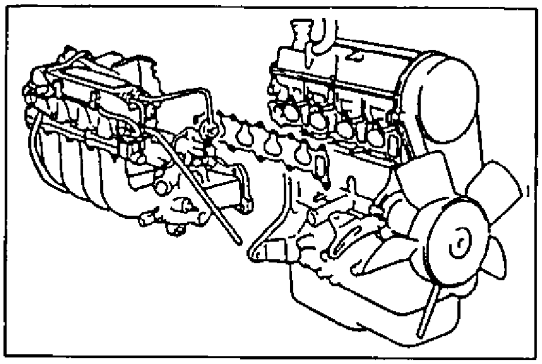
8) Disconnect fuel feed hose joint. Use back-up wrench while loosening and tightening flare nut.
   Disconnect fuel return hose from pipe.



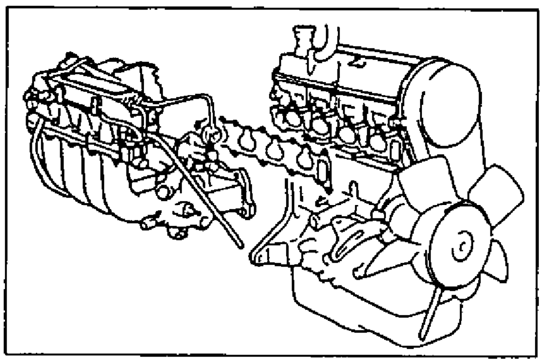
9) Remove generator adjust arm stiffener.



10) Remove intake manifold stiffener, No. 1 stiffener and No. 2 stiffener.
11) Disconnect bypass hose of engine coolant from intake manifold.



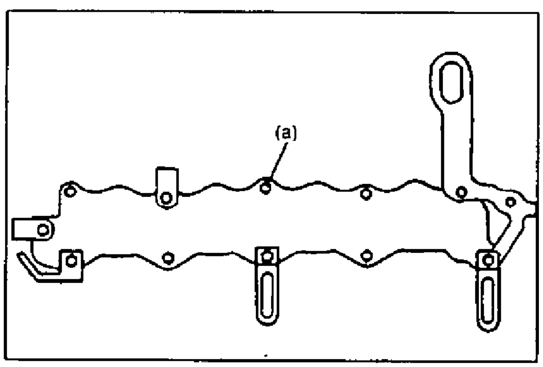
12) Remove engine hook.
13) Remove intake manifold and throttle body from cylinder head, and then its gasket.



INSTALLATION

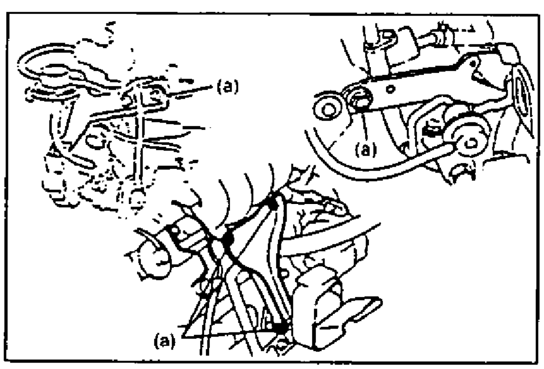
Reverse removal procedure for installation noting the followings.

- Use new intake manifold gasket.



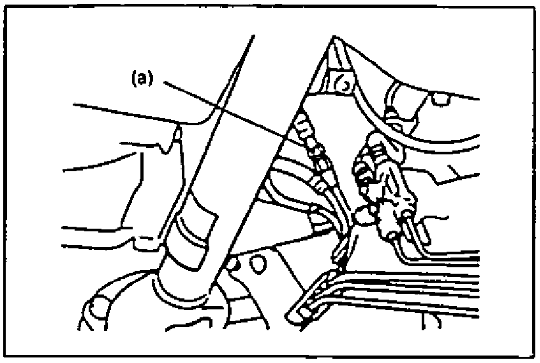
- When installing intake manifold, install clamps and engine hook at positions as shown in figure.

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



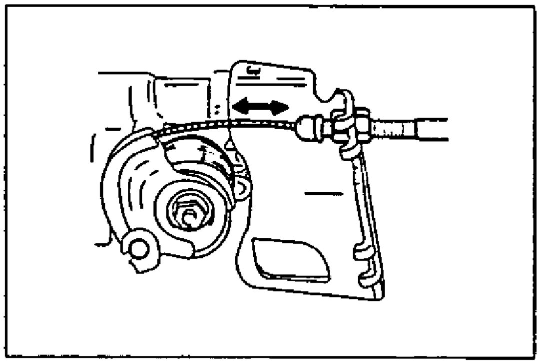
- Tighten stiffeners bolts to specified torque.

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



- Tighten fuel feed pipe flare nut to specified torque. Be sure to use back-up wrench.

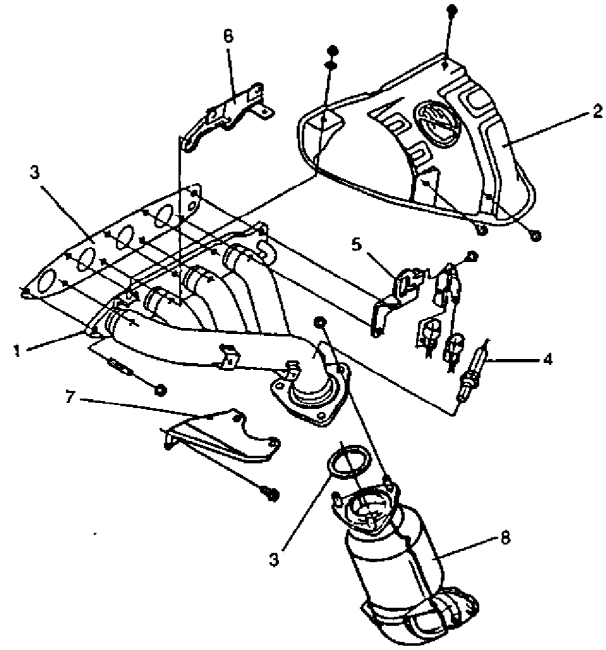
Tightening Torque
(a): 45 N·m (4.5 kg-m, 32.5 lb-ft)



- Adjust accelerator cable play, referring to Section 6E.

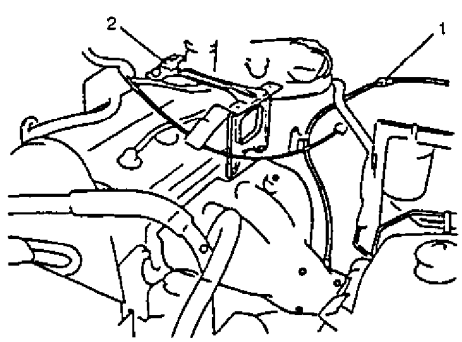
- Check to ensure that all removed parts are back in place. Reinstall any necessary parts which have not been reinstalled.
- Refill cooling system, referring to "ENGINE COOLING" section.
- Upon completion of installation, turn ignition switch ON but engine OFF and check for fuel leaks.
- Finally, start engine and check for engine coolant leaks.

EXHAUST MANIFOLD



1. Exhaust manifold
2. Upper cover
3. Gasket
4. Heated oxygen sensor
5. Engine hook
6. Intake pipe bracket stay
7. Exhaust pipe bracket
8. Exhaust No.1 pipe

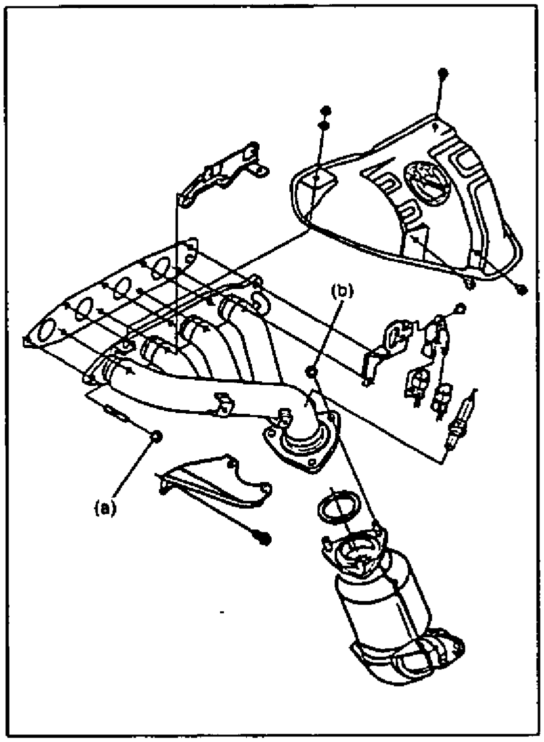
WARNING:
To avoid danger of being burned, do not service exhaust system while it is still hot. Service should be performed after system cools down.



1. Heated oxygen sensor coupler
2. Bracket

REMOVAL

1) Disconnect negative cable at battery.
2) Remove air intake pipe as previously outlined and remove its bracket.
3) Remove coupler stay from engine hook.
4) Disconnect heated oxygen sensor-1 coupler and detach it from its stay.
5) Remove upper cover of exhaust manifold.
6) Remove exhaust pipe nuts and exhaust pipe bracket.
7) Remove intake pipe bracket stay and engine hook.
8) Remove exhaust manifold and its gasket from cylinder head.



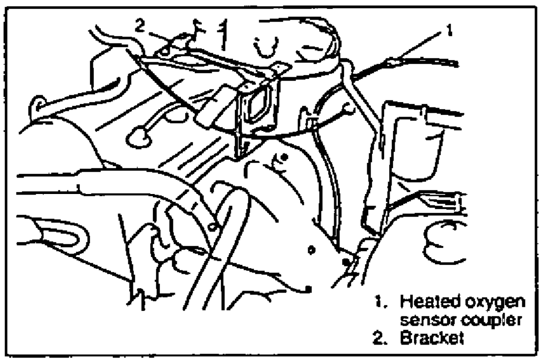
INSTALLATION

1) Install new gasket to cylinder head.
2) Install pipe gasket to exhaust pipe.
   Before installing pipe gasket, check it for deterioration or damage, and replace as necessary.
3) Install exhaust manifold, intake pipe bracket stay and engine hook.
   Tighten nuts to specified torque.

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

4) Install exhaust pipe bracket and its bolt.
5) Use new lock nuts if used.
   Tighten pipe fasteners to specified torque.

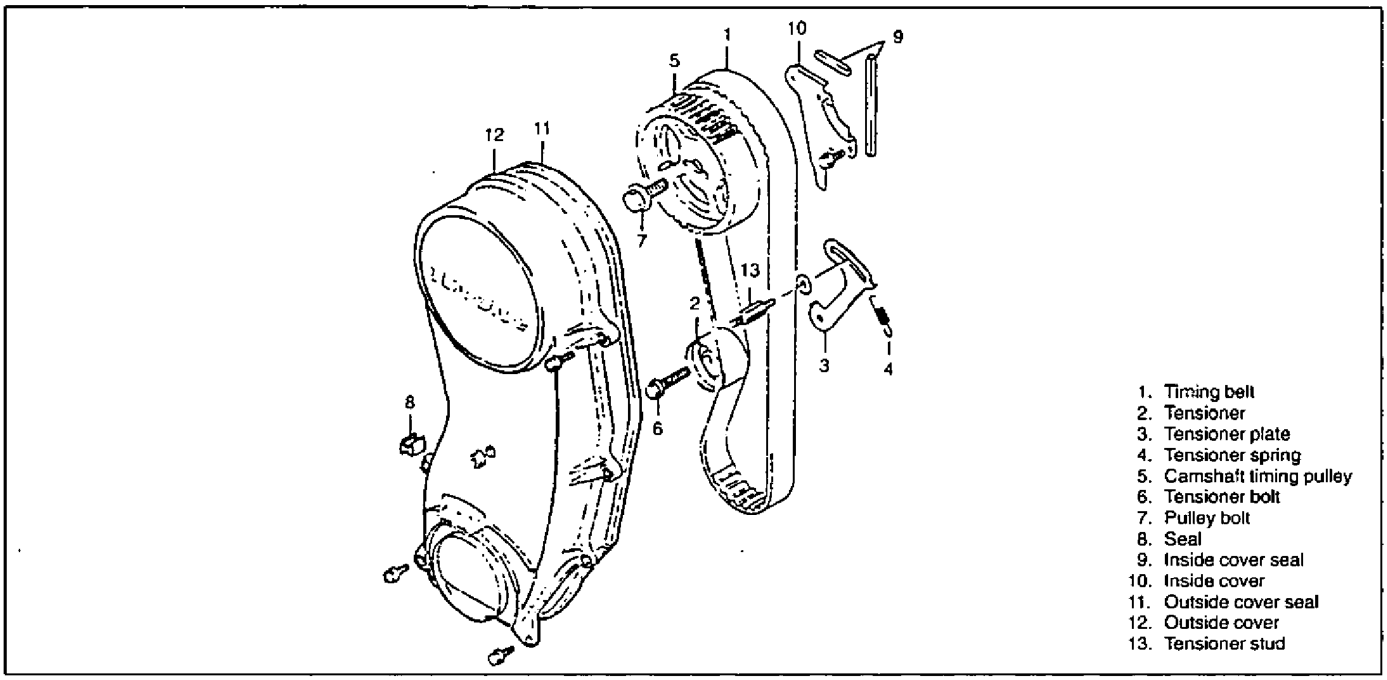
   Tightening Torque
   (b): 50 N·m (5.0 kg-m, 36.5 lb-ft)

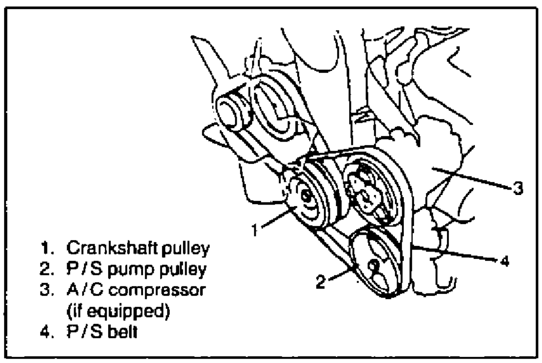


1. Heated oxygen sensor coupler
2. Bracket

6) Install upper cover to exhaust manifold.
7) Connect heated oxygen sensor-1 coupler and clamp its wire securely.
8) Install coupler stay to engine hook.
9) Install air intake pipe and its bracket.
10) Connect negative cable at battery.
11) Check exhaust system for exhaust gas leakage.

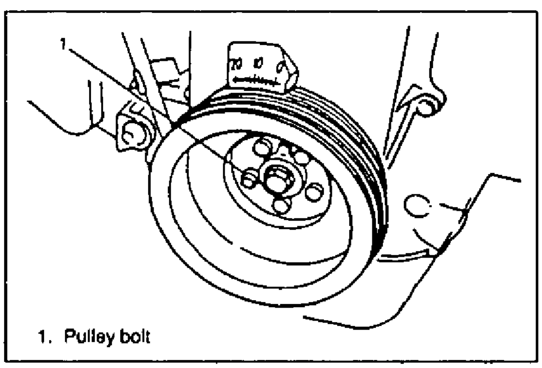
TIMING BELT AND BELT TENSIONER



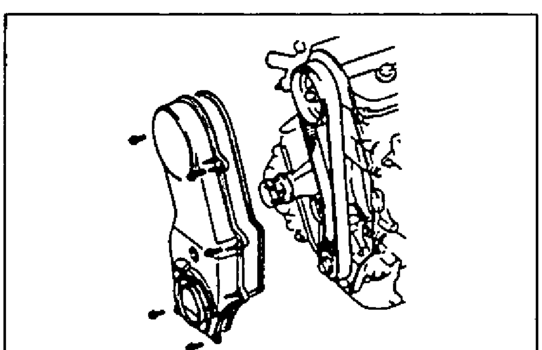


REMOVAL

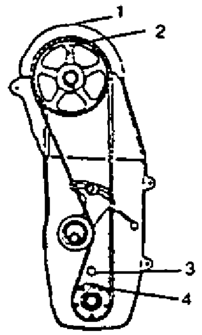
1) Disconnect negative cable at battery.
2) Remove power steering pump belt or A/C compressor belt, if equipped.
3) Remove radiator cooling fan, water pump pulley, water pump drive belt and fan shroud.
   If it is hard to remove fan shroud, drain engine coolant and then disconnect radiator inlet hose from radiator.



4) Remove crankshaft pulley by removing 5 pulley bolts.

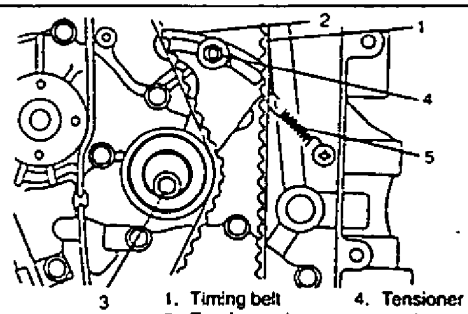


5) Remove timing belt outside cover.



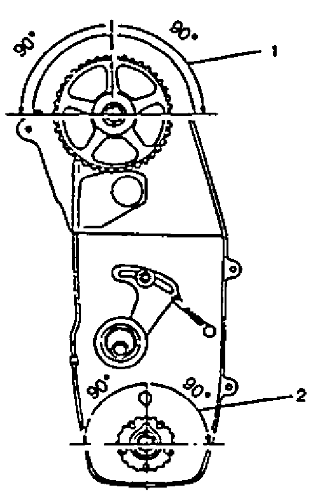
1. "V" mark on cylinder head cover
2. Timing mark by "E" on camshaft timing belt pulley
3. Arrow mark on oil pump case
4. Punch mark on crankshaft timing belt pulley

6) For installation of timing belt, align 4 timing marks as shown in figure by turning crankshaft.



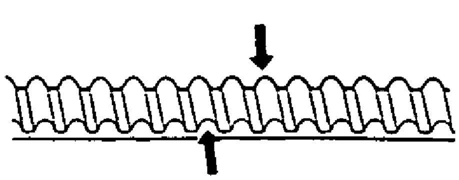
1. Timing belt
2. Tensioner plate
3. Tensioner bolt
4. Tensioner stud
5. Spring

7) Remove timing belt tensioner, tensioner plate, tensioner spring and timing belt.

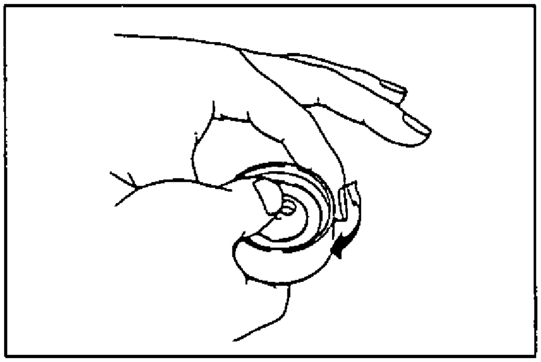


1. Camshaft allowable turning range - - - By timing mark, within 90° from "V" mark on head cover on both right and left.
2. Crankshaft allowable turning range - - - By punch mark, within 90° from arrow mark on oil pump case on both right and left.

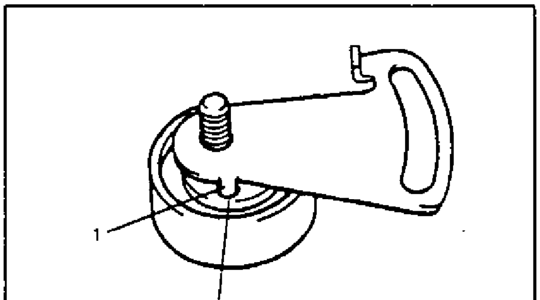
CAUTION:
- **After timing belt is removed, never turn camshaft and crankshaft independently more than such an extent as shown in figure. If turned, interference may occur among piston and valves, and parts related to piston and valves may be damaged.**
- **Never bend timing belt.**



INSPECTION
- Inspect timing belt for wear or crack.
  Replace it as necessary.



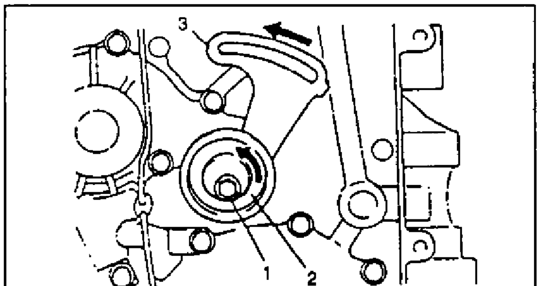
• Inspect tensioner for smooth rotation.



1. Lug
2. Hole

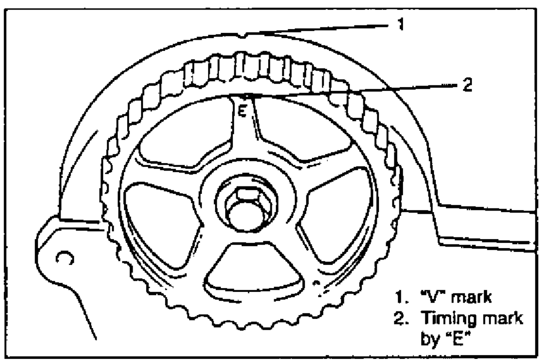
INSTALLATION

1) Install tensioner plate to tensioner.
   Insert lug of tensioner plate into hole in tensioner.



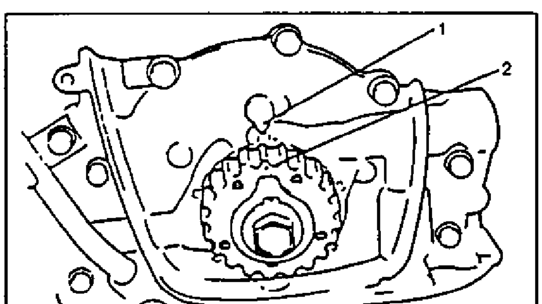
1. Tensioner bolt
2. Tensioner
3. Tensioner plate

2) Install tensioner and tensioner plate.
   Do not tighten tensioner bolt with wrench yet. Hand tighten only at this time.
   Check to ensure that plate movement in arrow direction as shown in figure causes tensioner to move in the same direction.
   If no associated movement between plate and tensioner occurs, remove tensioner and plate again and reinsert plate lug into tensioner hole.



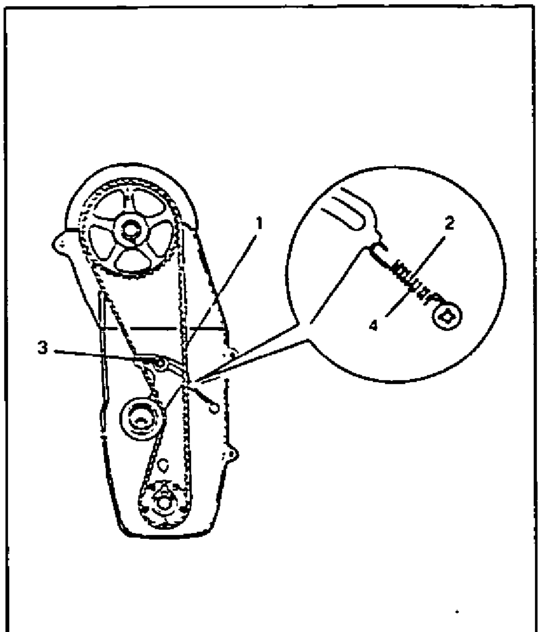
1. "V" mark
2. Timing mark by "E"

3) Check that timing mark on camshaft timing belt pulley is aligned with "V" mark on cylinder head cover. If not, align two marks by turning camshaft but be careful not to turn it more than its allowable turning range which is described on page 6A1-23.



1. Arrow mark
2. Punch mark

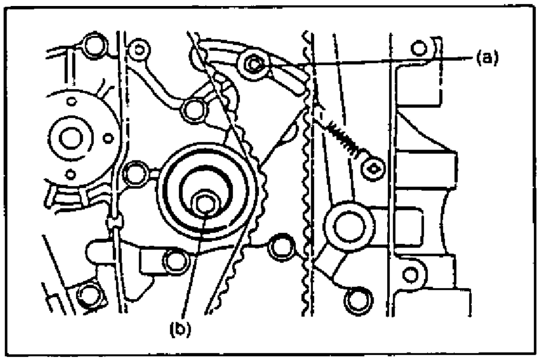
4) Check that punch mark on crankshaft timing belt pulley is aligned with arrow mark on oil pump case. If not, align two marks by turning crankshaft but be careful not to turn it more than its allowable turning range which is described on page 6A1-23.



1. Drive side of belt
2. Tensioner spring
3. Tensioner stud
4. Damper

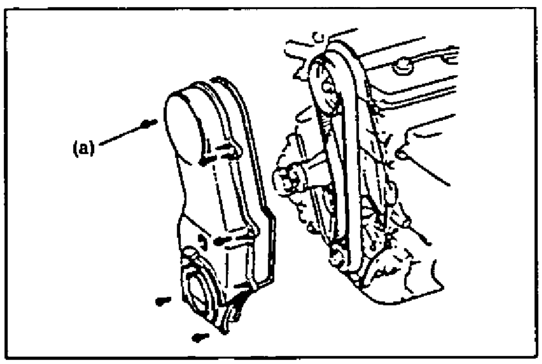
5) Install timing belt and tensioner spring.
With two sets of marks aligned and tensioner plate pushed up, install timing belt on two pulleys in such a way that drive side of belt is free from any slack.
And then install tensioner spring as shown in figure, and hand-tighten tensioner stud.

NOTE:
- **When installing timing belt, match arrow mark (⇨) on timing belt with rotating direction of crankshaft.**
- **In this state, No. 4 piston is at top dead center of compression stroke.**



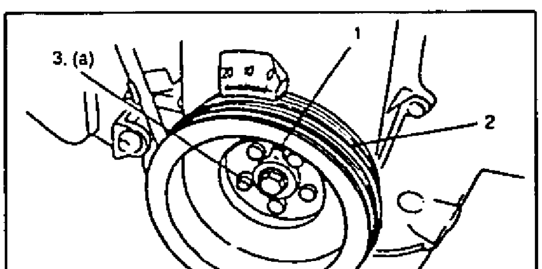
6) To take up slack of timing belt, turn crankshaft two rotations clockwise after installing it. After making sure that belt is free from slack, tighten tensioner stud first and then tensioner bolt to each specified torque.
Then confirm again that two sets of marks are aligned respectively.

Tightening Torque
(a): 11 N·m (1.1 kg-m, 8.0 lb-ft)
(b): 25 N·m (2.5 kg-m, 18.0 lb-ft)



7) Install timing belt outside cover.
Before installing, make sure that seal is between water pump and oil pump case.

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



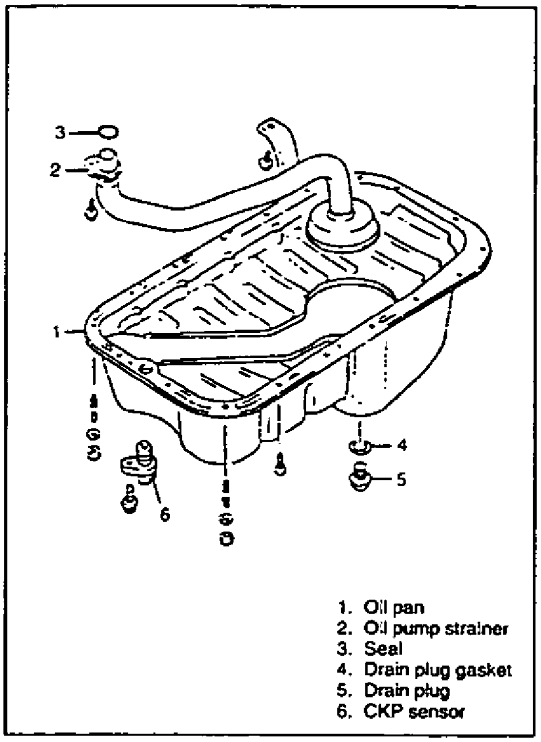
1. Key
2. Crankshaft pulley
3. Pulley bolt

8) Install crankshaft pulley.
Fit keyway of pulley to key on crank timing belt pulley, and tighten 5 bolts to specified torque.

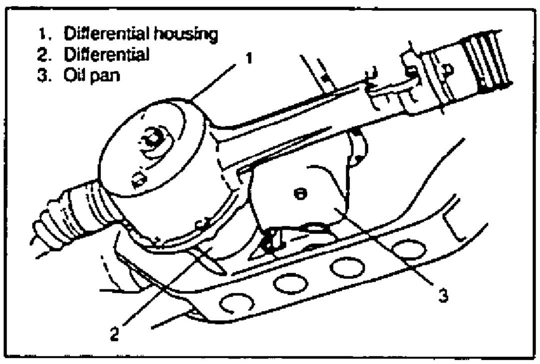
Tightening Torque
(a): 16 N·m (1.6 kg-m, 11.5 lb-ft)

9) Install radiator fan shroud, water pump pulley, cooling fan and water pump drive belt.
   Adjust water pump drive belt tension, referring to "ENGINE COOLING" section.
10) Install power steering pump belt or A/C compressor belt, if equipped.
   Adjust its belt tension, referring to Section 0B.

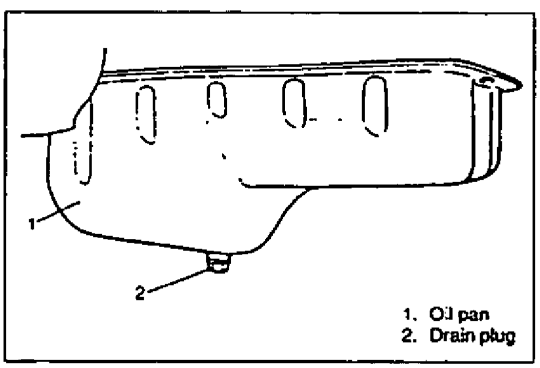
OIL PAN AND OIL PUMP STRAINER



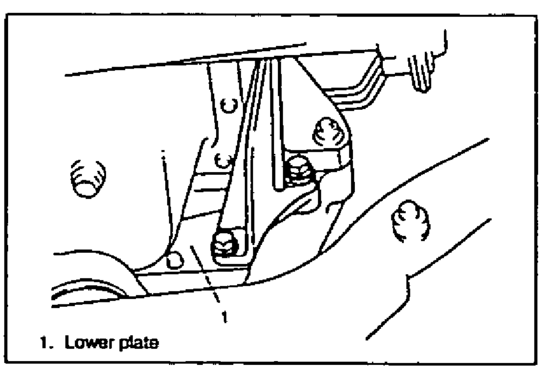
REMOVAL



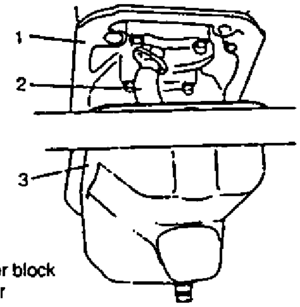
1) Raise vehicle.
2) Remove front differential housing with differential, referring to "DIFFERENTIAL" section.



3) Disconnect CKP sensor coupler and remove CKP sensor by removing its bolt.
4) Drain engine oil by removing drain plug.

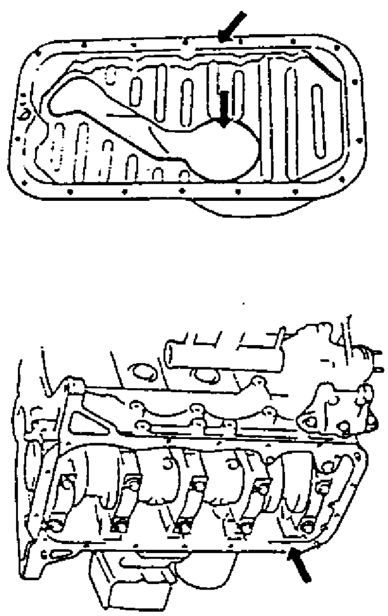


5) Remove transmission left side stiffener and then clutch housing lower plate.



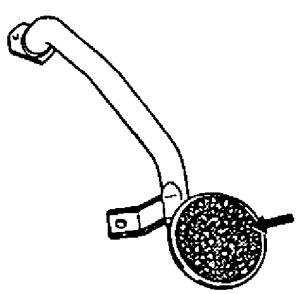
1. Cylinder block
2. Strainer
3. Oil pan

6) Remove oil pan and then oil pump strainer.

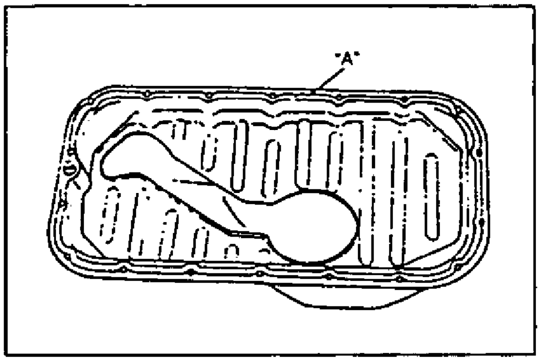


CLEANING

- Clean mating surfaces of oil pan and cylinder block.
  Remove oil, old sealant, and dusts from mating surfaces and oil pan inside.



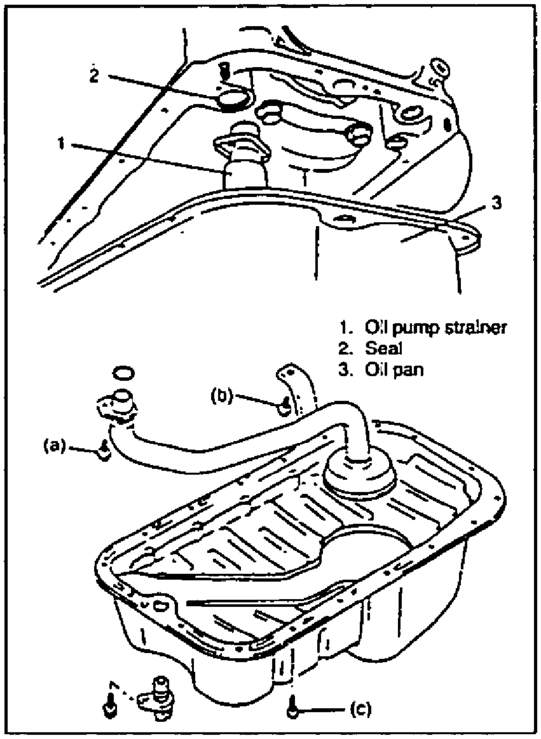
- Clean oil pump strainer screen.



INSTALLATION

1) Apply sealant to oil pan mating surface continuously as shown in figure.

   "A" Sealant: 99000-31150



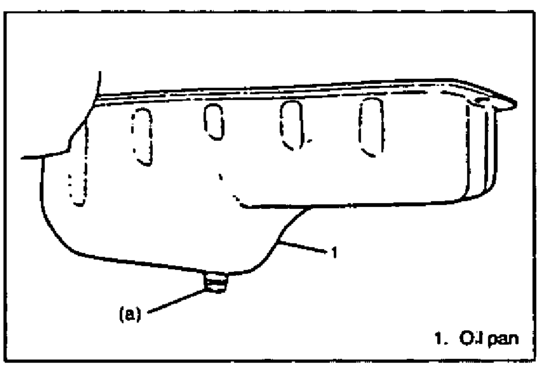
1. Oil pump strainer
2. Seal
3. Oil pan

2) Install oil pump strainer and oil pan.
   Install seal in the position as shown in figure.
   With oil pump strainer inserted into oil pan, install strainer 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)
   (b): 11 N·m (1.1 kg-m, 8.0 lb-ft)

   After fitting oil pan to cylinder block, run in securing bolts and start tightening at the center: move wrench outward, tightening one bolt at a time.
   Tighten bolts to specified torque.

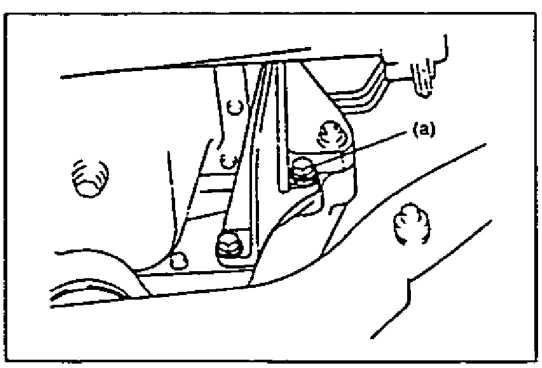
   Tightening Torque
   (c): 11 N·m (1.1 kg-m, 8.0 lb-ft)



1. Oil pan

3) Install gasket and drain plug to oil pan.
   Tighten drain plug to specified torque.

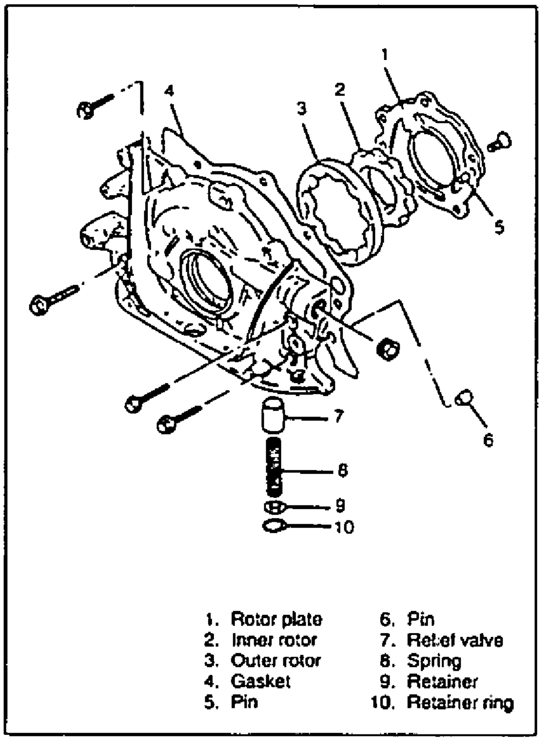
   Tightening Torque
   (a): 35 N·m (3.5 kg-m, 25.5 lb-ft)



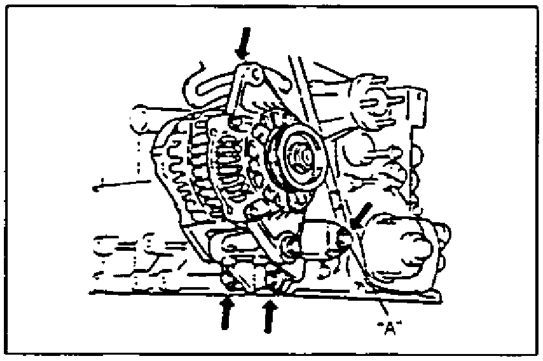
4) Install clutch housing lower plate and transmission left side stiffener.

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

5) Install CKP sensor and connect its coupler.
6) Install front differential housing with differential according to installation procedure described in "DIFFERENTIAL" section.
7) Refill front differential housing with gear oil, referring to "DIFFERENTIAL" section.
8) Refill engine with engine oil, referring to item "ENGINE OIL CHANGE" in Section 0B.



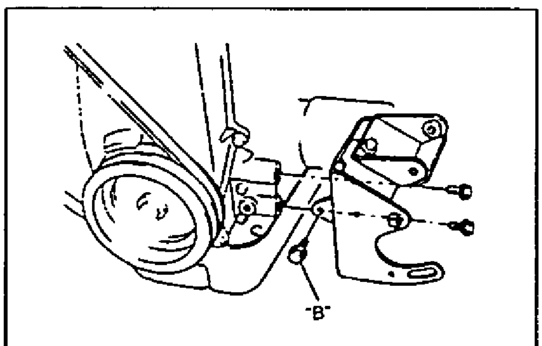
OIL PUMP



REMOVAL

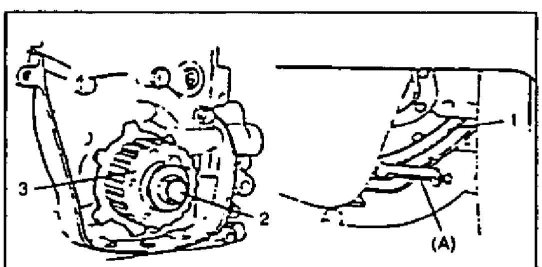
1) Disconnect negative cable at battery.
2) Remove timing belt as previously outlined.
3) Remove generator and its bracket.

   NOTE:
   When installing bracket, fasten bolt "A" first.



4) Remove power steering pump bracket or A/C compressor bracket, if equipped.

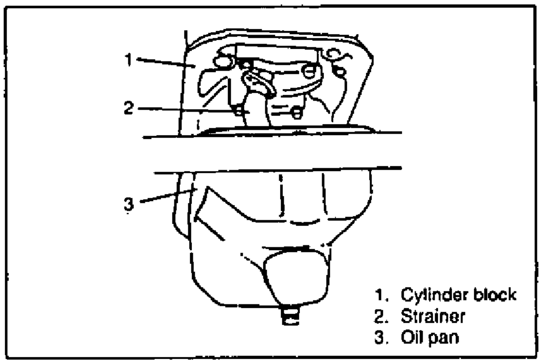
   NOTE:
   When installing bracket, fasten bolt "B" first.



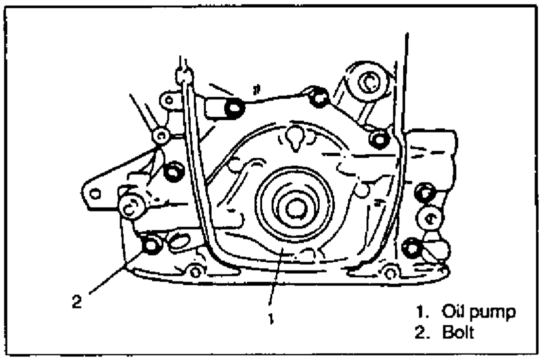
1. Flywheel
2. Pulley bolt
3. Crank timing belt pulley

5) Remove crankshaft timing belt pulley and timing belt guide.
   To lock crankshaft, engage special tool (gear stopper) with flywheel ring gear.
   With crankshaft locked, remove crankshaft timing belt pulley bolt.

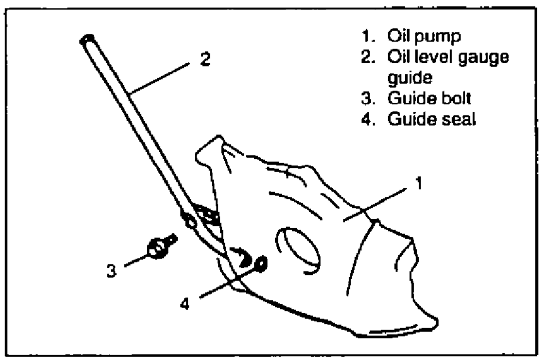
   Special Tool
   (A): 09927-56010



6) Remove oil pan and oil pump strainer as previously outlined.

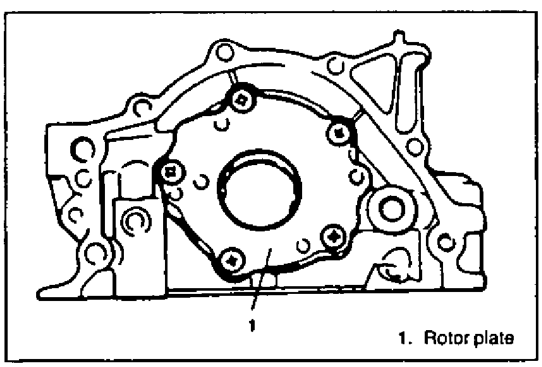


7) Remove oil pump assembly after removing bolts.

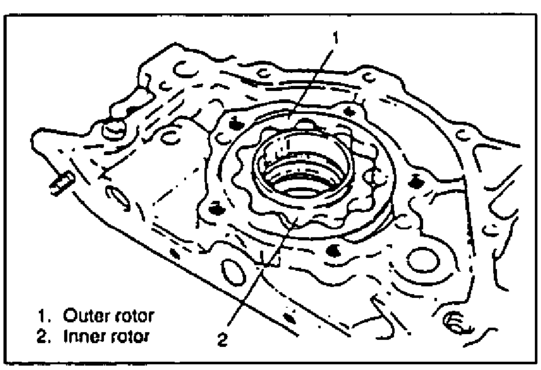


DISASSEMBLY

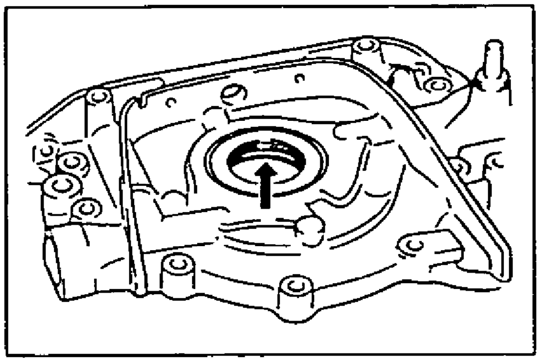
1) Remove oil level gauge guide bolt and pull out guide from oil pump.



2) Remove rotor plate.

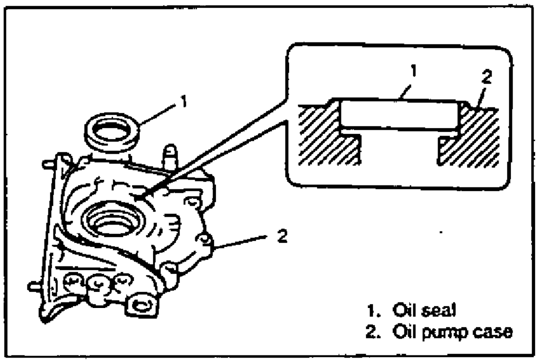


3) Remove outer rotor and inner rotor.

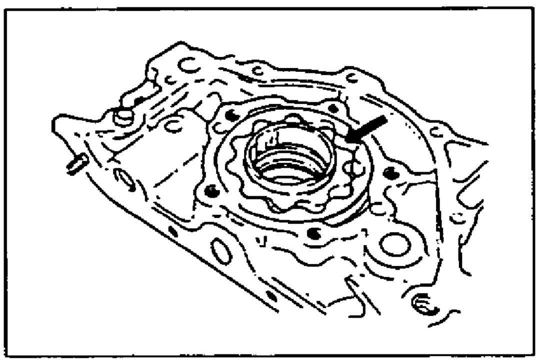


INSPECTION

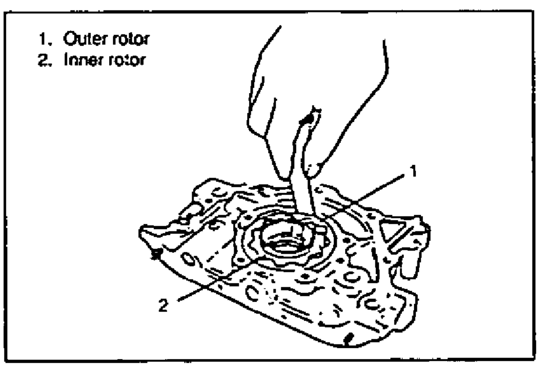
- Check oil seal lip for fault or other damage. Replace as necessary.



NOTE:
When installing oil seal, press-fit it till its end face is flush with oil pump case end face.



- Check outer and inner rotors, rotor plate, and oil pump case for excessive wear or damage.

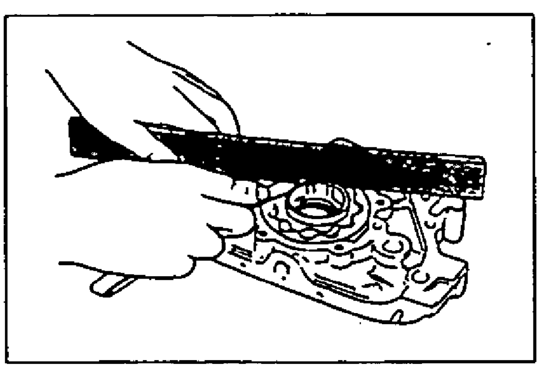


MEASUREMENT

- **Radial clearance**

Check radial clearance between outer rotor and case, using thickness gauge.
If clearance exceeds its limit, replace outer rotor or case.

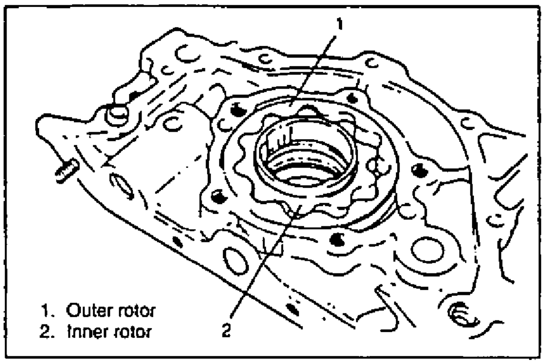
Limit on radial clearance between outer rotor and case: 0.310 mm (0.0122 in.)



- **Side clearance**

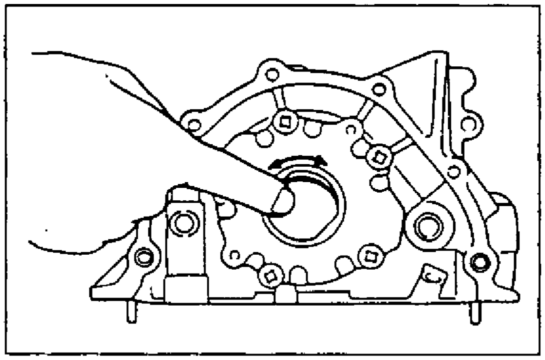
Using straight edge and thickness gauge, measure side clearance.

Limit on side clearance: 0.15 mm (0.0059 in.)

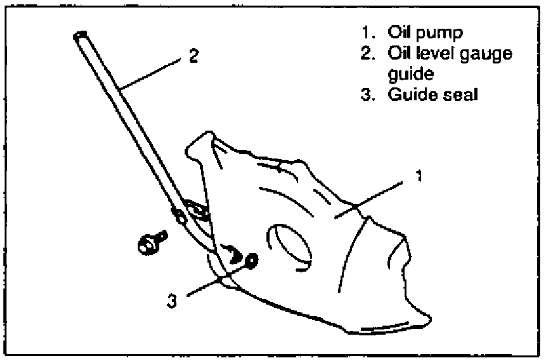


ASSEMBLY

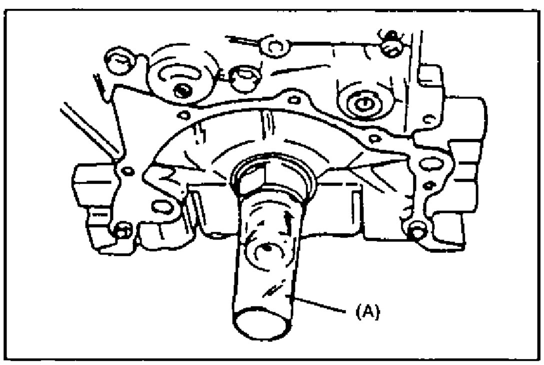
1) Wash, clean and then dry all disassembled parts.
2) Apply thin coat of engine oil to inner and outer rotors, oil seal lip portion, and inside surfaces of oil pump case and plate.
3) Install outer and inner rotors to pump case.



4) Install rotor plate. Tighten 5 screw securely.
   After installing plate, check to be sure that gears turn smoothly by hand.



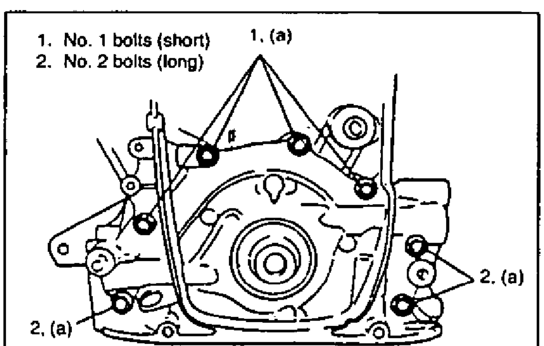
5) Apply engine oil to guide seal and install guide seal and guide.



INSTALLATION

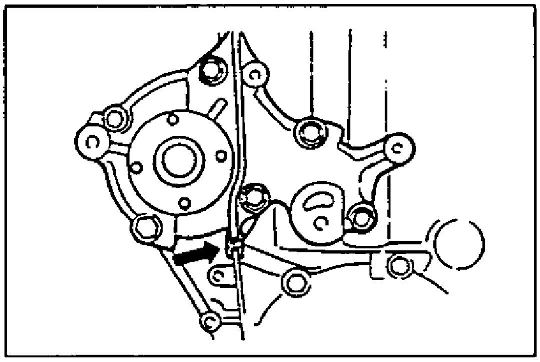
1) Install two oil pump pins and oil pump gasket to cylinder block. Use a new gasket.
2) To prevent oil seal lip from being damaged or upturned when installing oil pump to crankshaft, fit special tool (Oil seal guide) to crankshaft, and apply engine oil to special tool.

   Special Tool
   (A): 09926-18210

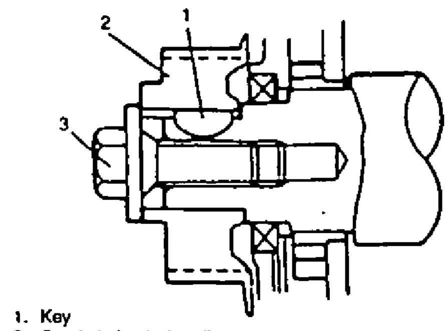


3) Install oil pump to cylinder block.
   As there are 2 types of oil pump bolts, refer to figure for their correct use and tighten them to specified torque.

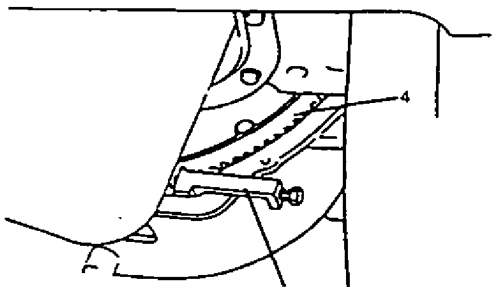
   Tightening Torque
   (a): 11 N·m (1.1 kg-m, 8.0 lb-ft)



4) Install rubber seal between oil pump and water pump.



1. Key
2. Crank timing belt pulley
3. Pulley bolt



4. Flywheel (Drive plate for A/T)
(A)

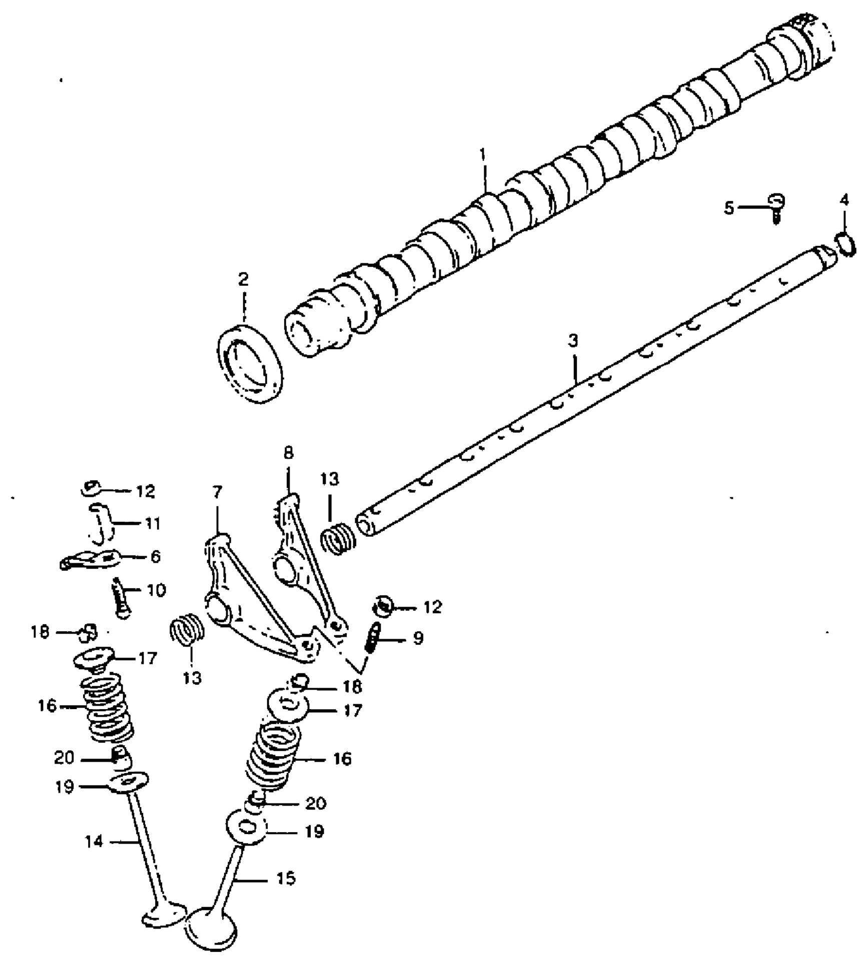
5) Install timing pulley key and crank timing belt pulley. Refer to figure for proper installation of these parts.
   With crankshaft locked, tighten crank timing belt pulley bolt to specified torque.

   Tightening Torque
   (a): 130 N·m (13.0 kg-m, 94.0 lb-ft)

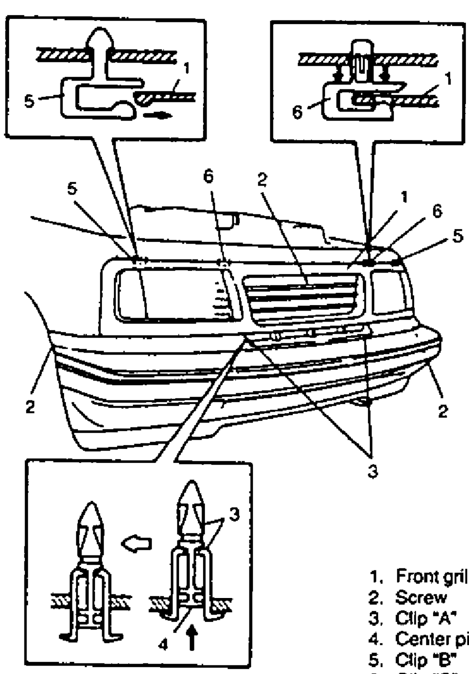
   Special Tool
   (A): 09927-56010

6) Install timing belt, tensioner, oil pump strainer, oil pan and other parts as previously outlined.
7) Check to ensure that all removed parts are back in place. Reinstall any necessary parts which have not been reinstalled.
8) Adjust water pump drive belt tension, referring to "ENGINE COOLING" section.
9) Adjust power steering pump belt tension or A/C compressor belt tension, if equipped.
   Refer to Section 0B.
10) Refill engine with engine oil, referring to item "ENGINE OIL CHANGE" in Section 0B.
11) Refill front differential housing with gear oil, referring to "DIFFERENTIAL" section.
12) Connect negative cable at battery.
13) After completing installation, check oil pressure by running engine.

ROCKER ARMS, ROCKER ARM SHAFT AND CAMSHAFT



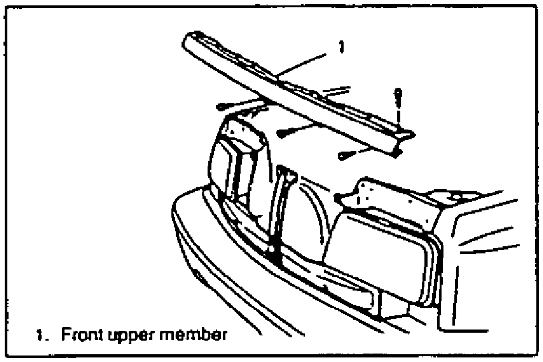
1. Camshaft
2. Camshaft oil seal
3. Rocker arm shaft
4. O-ring
5. Rocker shaft bolt
6. Rocker arm (IN)
7. Rocker arm No.1 (EX)
8. Rocker arm No.2 (EX)
9. Valve adjusting screw
10. Valve adjusting screw
11. Clip
12. Lock nut
13. Rocker arm spring
14. Intake valve
15. Exhaust valve
16. Valve spring
17. Valve spring retainer
18. Valve cotter
19. Valve spring seat
20. Valve stem seal



1. Front grille
2. Screw
3. Clip "A"
4. Center pin
5. Clip "B"
6. Clip "C"

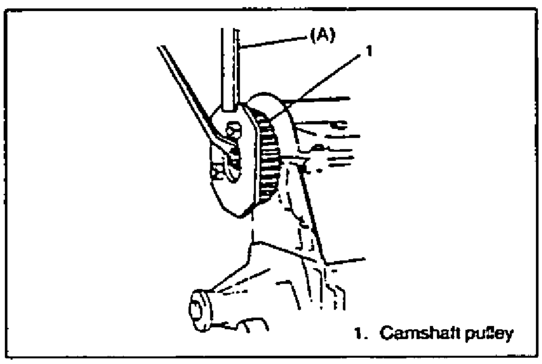
REMOVAL

1) Disconnect negative cable at battery.
2) Remove front grill.



3) Removal engine hood lock from front upper member and disconnect lead wire from horn.
4) Remove front upper member from body.

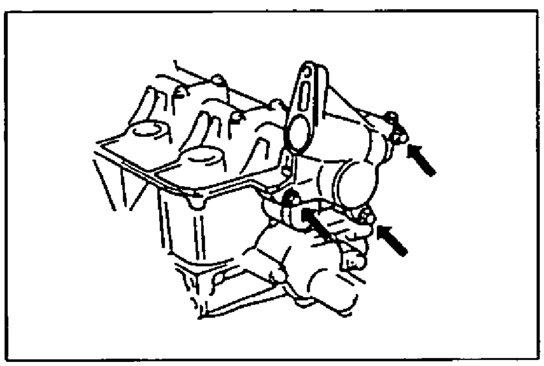
5) Remove radiator referring to "ENGINE COOLING" section.
6) Remove timing belt as previously outlined.



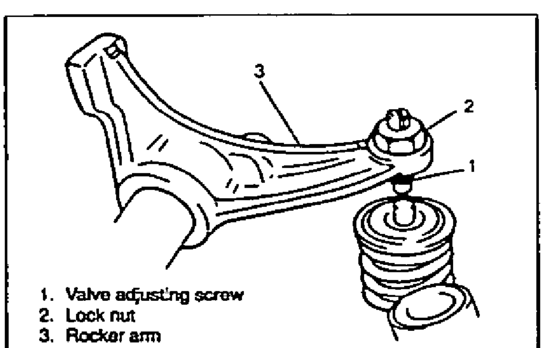
7) Remove camshaft timing belt pulley by using special tool.

Special Tool
(A): 09917-68220

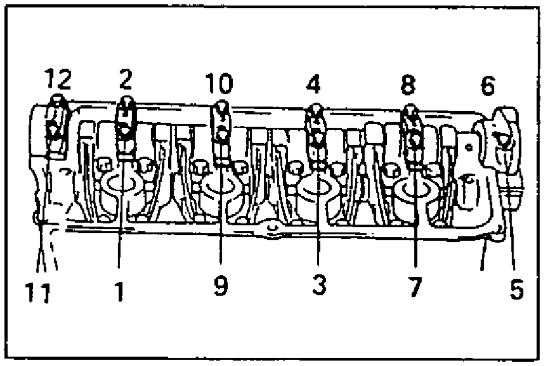
8) Remove cylinder head cover as previously outlined.



9) Remove distributor and then distributor case from cylinder head.
Place a container or rag under distributor case, for a small amount of oil flows out during removal of case.

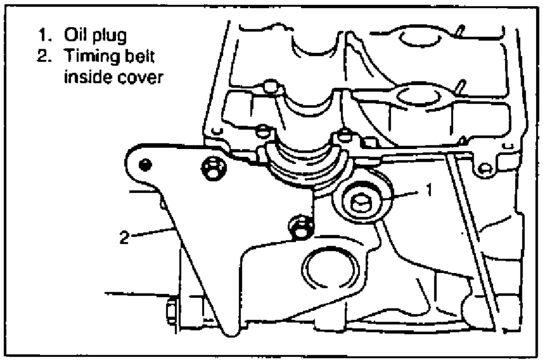


10) After loosening all valve adjusting screw lock nuts, turn adjusting screws back all the way to allow all rocker arms to move freely.

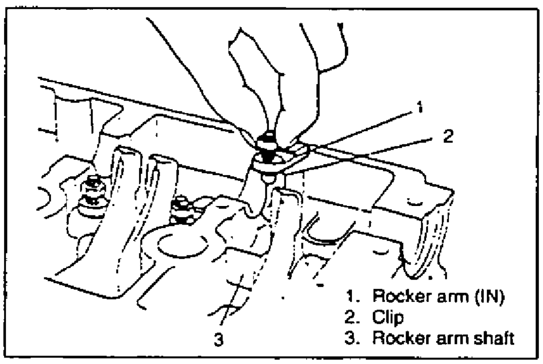


11) Remove camshaft housing and camshaft.

    NOTE:
    To remove camshaft housing bolts, loosen them in such order as indicated in figure, a little at a time.

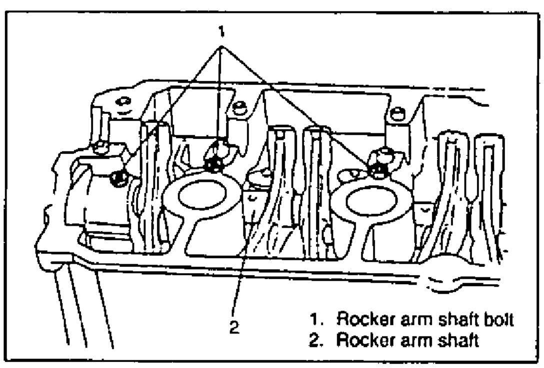


12) Remove rocker arm shaft plug and timing belt inside cover.

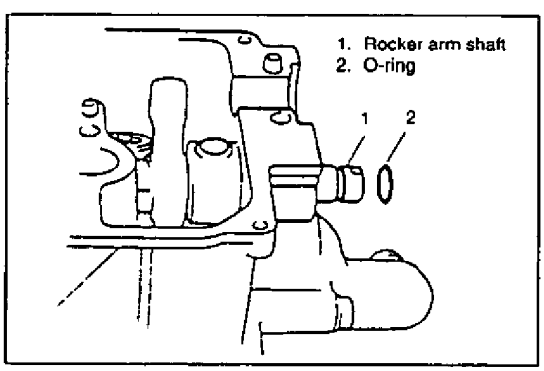


13) Remove intake rocker arm with clip from rocker arm shaft.

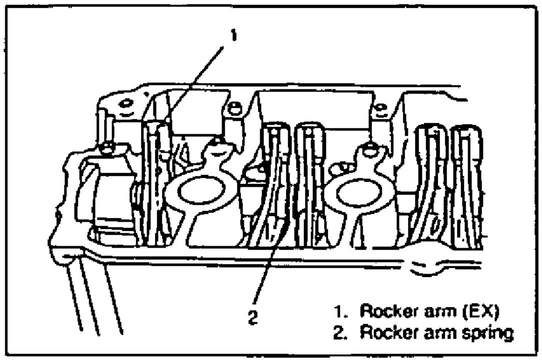
    NOTE:
    Do not bend clip when removing intake rocker arm.



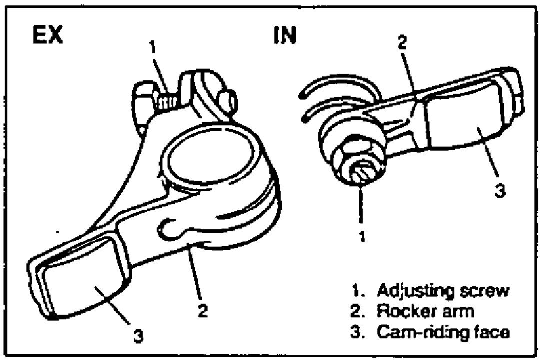
14) Remove rocker arm shaft bolts.



15) Push off rocker arm shaft end to distributor side and remove O-ring from shaft.



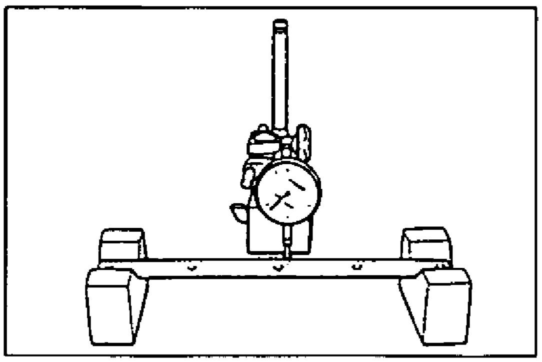
16) Remove exhaust rocker arms and rocker arm spring by pulling rocker arm shaft to front side.



INSPECTION

Adjusting Screw and Rocker Arm

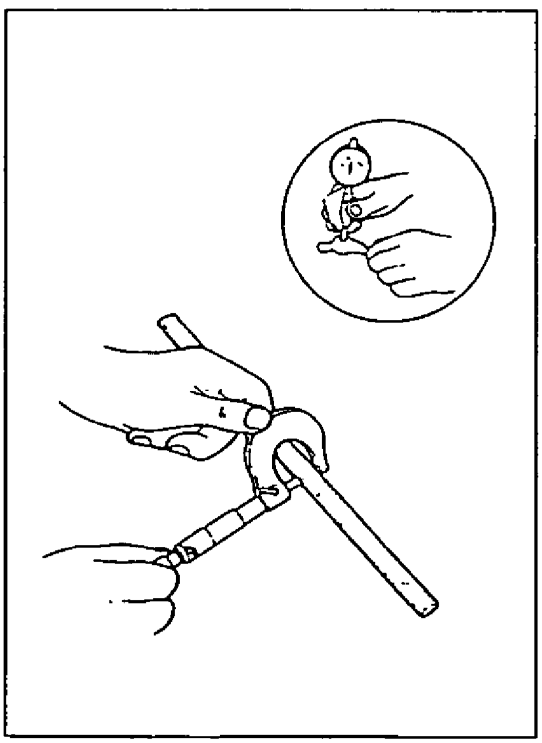
If tip of adjusting screw is badly worn, replace it.
Rocker arm must be replaced if its cam-riding face is badly worn.



Rocker Arm Shaft Runout

Using "V" blocks and dial gauge, check runout. If runout exceeds its limit, replace rocker arm shaft.

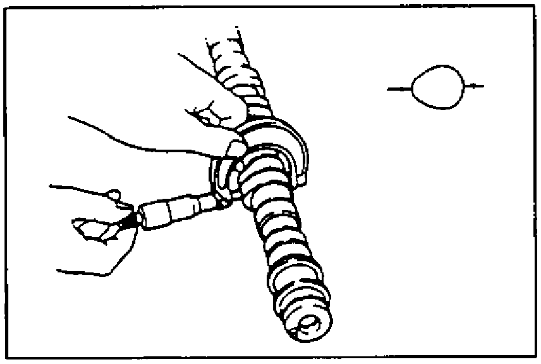
Runout limit: 0.20 mm (0.008 in.)



Rocker Arm-to-Rocker Arm Shaft Clearance

Using a micrometer and a bore gauge, measure rocker shaft dia. and rocker arm I.D.
Difference between two readings is arm-to-shaft clearance on which a limit is specified.
If limit is exceeded, replace shaft or arm, or both.

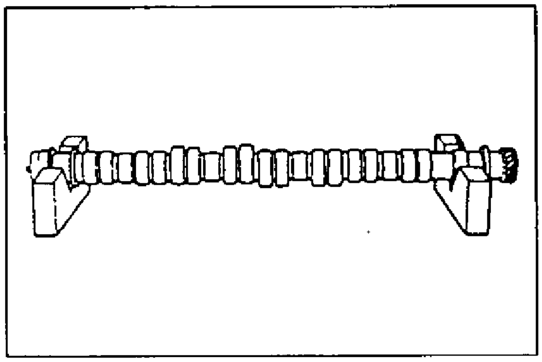
Item	Standard	Limit
Rocker arm I.D.	15.985 – 16.005 mm (0.629 – 0.630 in.)	——
Rocker arm shaft dia.	15.969 – 15.984 mm (0.6287 – 0.6293 in.)	——
Arm-to-shaft clearance	0.001 – 0.036 mm (0.0001 – 0.0014 in.)	0.09 mm (0.0035 in.)



Cam Wear

Using a micrometer, measured height of cam. If measured height is below limit, replace camshaft.

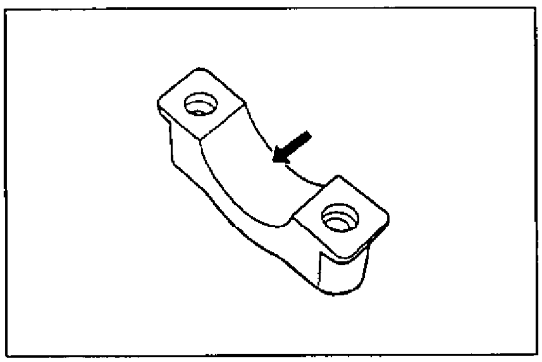
Cam height	Standard	Limit
Intake cam	36.171 – 36.331 mm (1.4241 – 1.4303 in.)	36.071 mm (1.4202 in.)
Exhaust cam	36.356 – 36.516 mm (1.4314 – 1.4376 in.)	36.256 mm (1.4275 in.)



Camshaft Runout

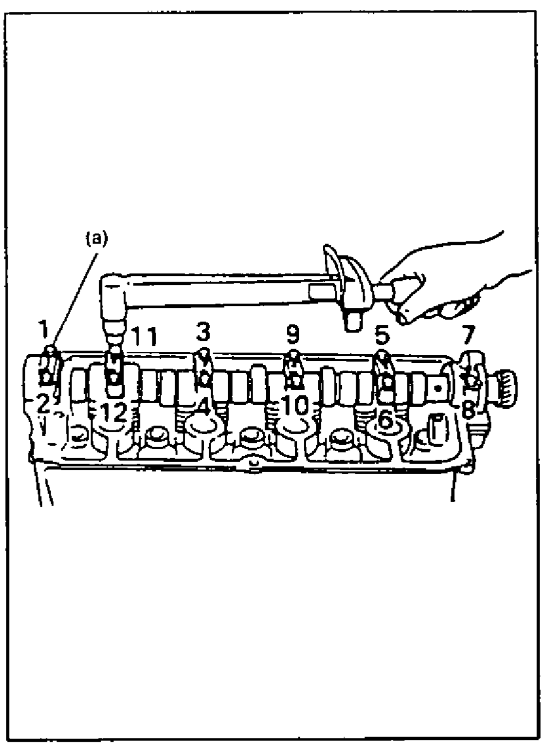
Hold camshaft between two "V" blocks, and measure runout by using a dial gauge.
If runout exceeds the limit, replace camshaft.

Runout limit: 0.10 mm (0.0039 in.)



Camshaft Journal Wear

Check camshaft journals and camshaft housings for pitting, scratches, wear or damage.
If any malcondition is found, replace camshaft or cylinder head with housing. Never replace cylinder head without replacing housing.

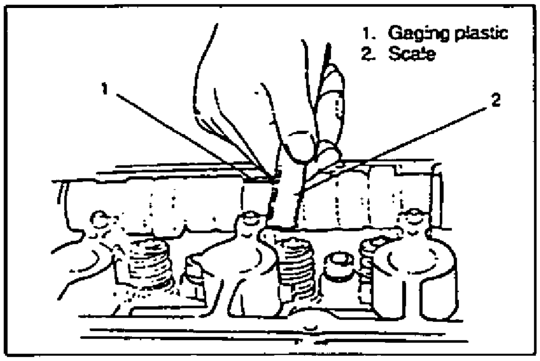


Check clearance by using gaging plastic.
The procedure is as follows.

1) Clean housing and camshaft journals.
2) Install camshaft to cylinder head.
3) Place a piece of gaging plastic the full width of journal of camshaft (parallel to camshaft).
4) Install camshaft housing, referring to page 6A1-42.
5) Tighten camshaft housing bolts in such order as indicated in figure a little at a time till they are tightened to specified torque.

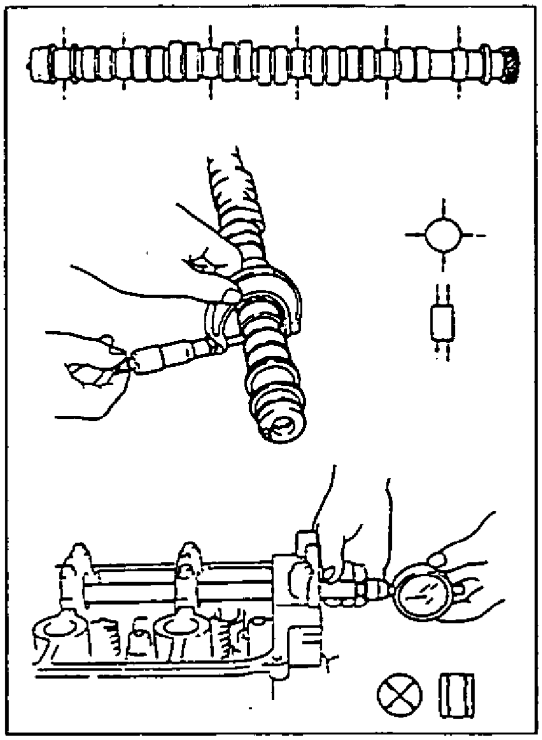
Tightening Torque
(a): 11 N·m (1.1kg-m, 8.0 lb-ft)

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



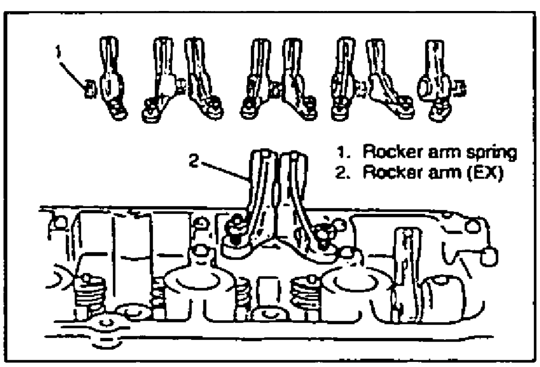
6) Remove housing and using scale on gaging plastic envelope, measure gaging plastic width at its widest point.

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



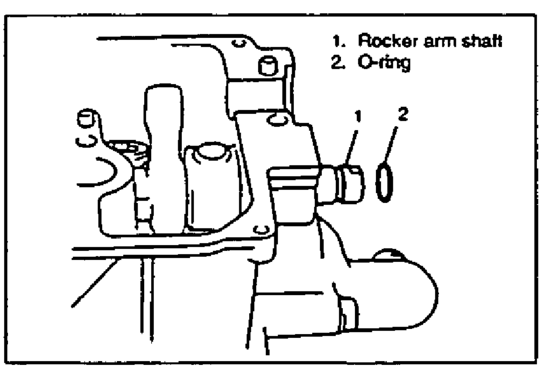
If measured camshaft journal clearance exceeds limit, measure journal (housing) bore and outside diameter of camshaft journal. Replace camshaft or cylinder head assembly whichever the difference from specification is greater.

Item	Standard
Camshaft journal bore dia.	28.000 – 28.021 mm (1.1024 – 1.1031 in.)
Camshaft journal O.D.	27.939 – 27.960 mm (1.1000 – 1.1008 in.)

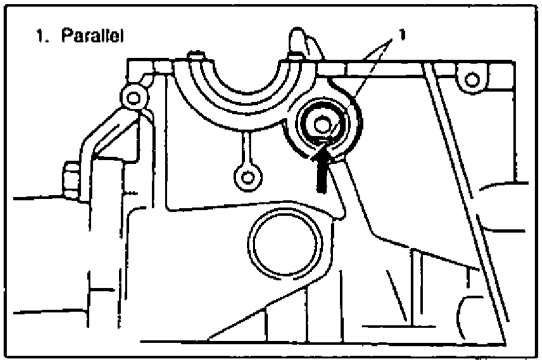


INSTALLATION

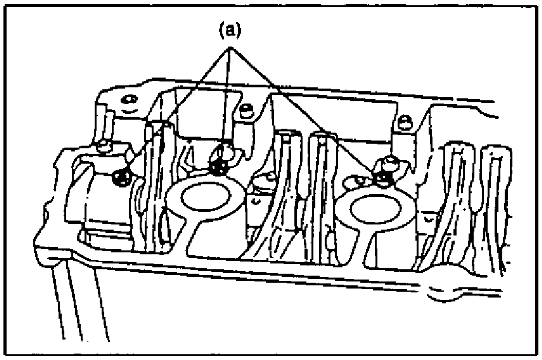
1) Apply engine oil to rocker arm shaft and rocker arms.
2) Install rocker arm shaft, rocker arm (exhaust side) and rocker arm spring.



3) Check O-ring for damage or deterioration. With O-ring groove in rocker arm shaft exposed to transmission side once, install O-ring to rocker arm shaft.

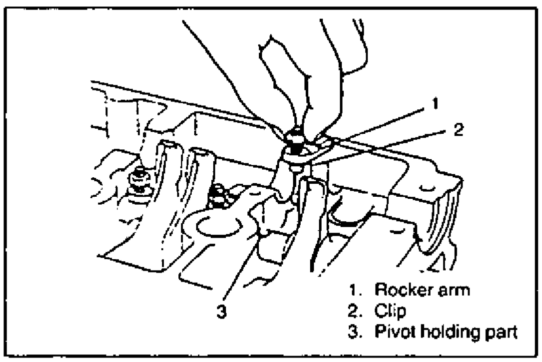


4) Set rocker arm shaft so that its cut part faces down and becomes in parallel with head cover mating surface.

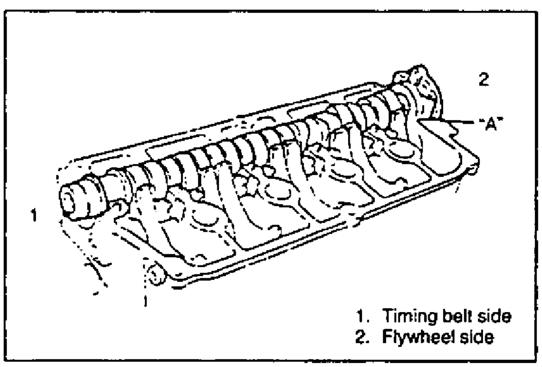


5) Install rocker arm shaft bolts and tighten them to specified torque.

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

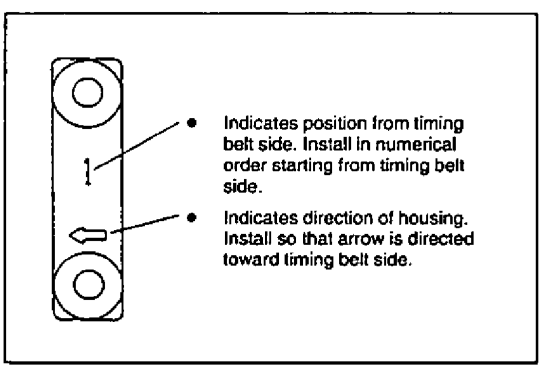


6) Fill small amount of engine oil into arm pivot holding part of rocker arm shaft. Install rocker arm (intake side) with clips to rocker arm shaft.

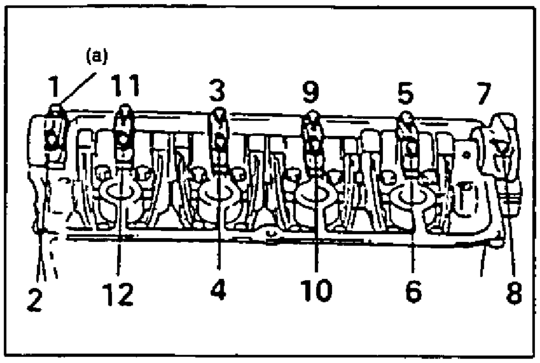


7) Apply engine oil to cams and journals on camshaft and put camshaft on cylinder head. Install camshaft housing to camshaft and cylinder head.
   - Apply engine oil to sliding surface of each housing against camshaft journal.
   - Apply sealant to mating surface of No.6 housing which will mate with cylinder head.

   "A" Sealant: 99000-31110

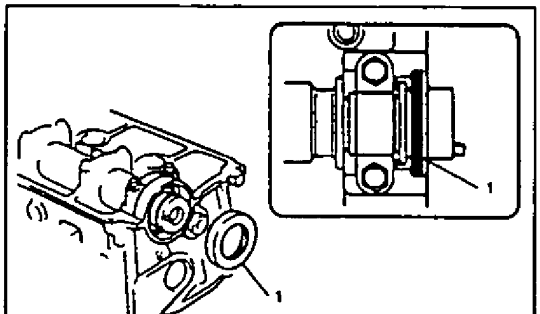


   - Embossed marks are provided on each camshaft housing, indicating position and direction for installation.
     Install housing as indicated by these marks.
   - As camshaft housing No. 1 retains camshaft in proper position as to thrust direction, make sure to first fit No. 1 housing to No. 1 journal of camshaft securely.



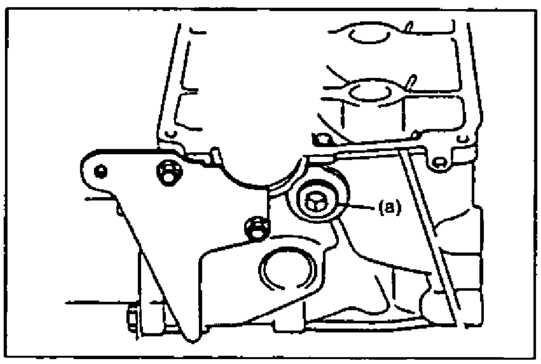
- After applying engine oil to housing bolts, tighten them temporarily first. Then tighten them by following sequence as indicated in figure.
  Tighten a little at a time and evenly among bolts and repeat tightening sequence three to four times before they are tightened to specified torque.

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



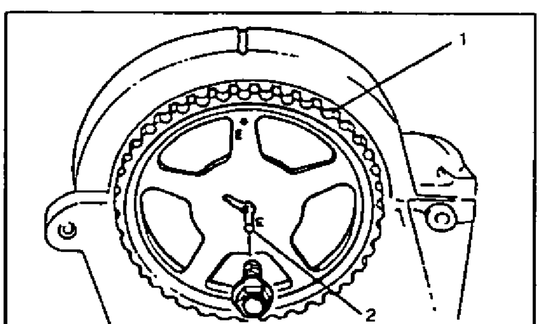
1. Camshaft oil seal

8) Install camshaft oil seal.
   After applying engine oil to oil seal lip, press-fit camshaft oil seal till oil seal surface becomes flush with housing surface.



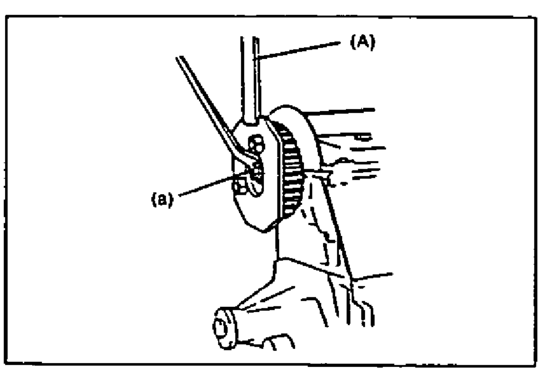
9) Install rocker arm shaft plug and timing belt inside cover. Then tighten rocker arm shaft plug to specified torque.

   Tightening Torque
   (a): 33 N·m (3.3 kg-m, 24.0 lb-ft)



1. Camshaft timing belt pulley 2. Dwell pin

10) Install camshaft timing belt pulley to camshaft while fitting pin on camshaft into slot at "E" mark.

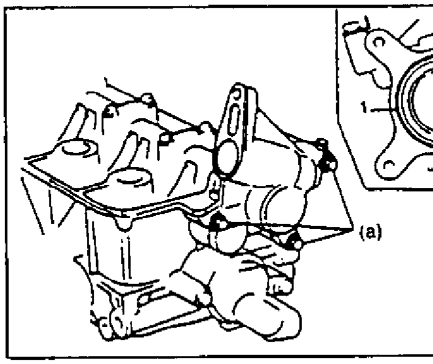


11) Using special tool, tighten pulley bolt to specified torque.

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

    Special Tool
    (A): 09917-68220

12) Install belt tensioner, timing belt, outside cover, crankshaft pulley and water pump belt as previously outlined.



1. O-ring

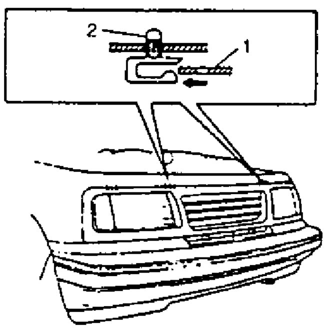
13) After applying sealant to part "A" as shown in figure at the left, install distributor case to cylinder head and tighten its fixing bolts to specified torque.

"A" Sealant: 99000-31110

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

14) Install distributor assembly, referring to Section 6F.

15) Adjust valve clearance as previously outlined.
16) Install cylinder head cover and air intake pipe.
17) Install radiator and refill cooling system referring to "ENGINE COOLING" section.

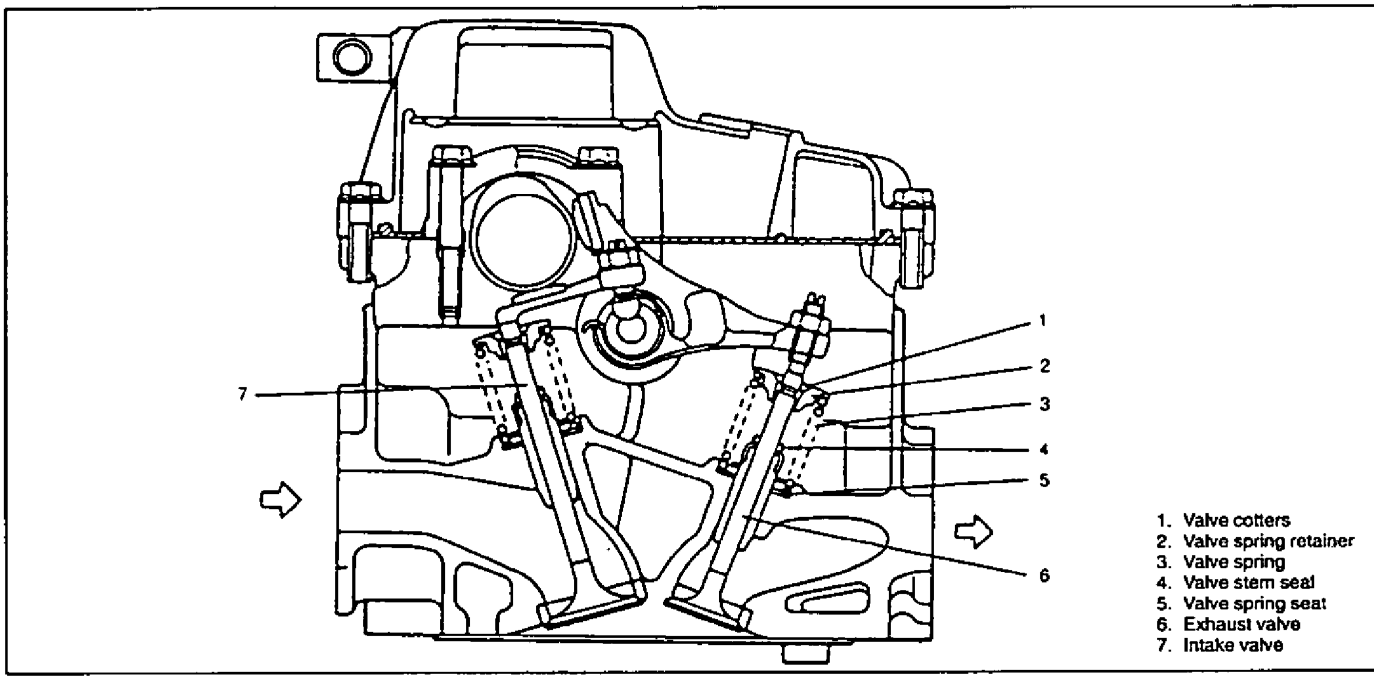


1. Front grill
2. Clamp

18) Install hood lock to front upper member, connect lead wire to horn and then install front upper member to body.
19) Install front grill.
Clamp as shown in figure should be removed from front grill and installed to body first. Then install front grill to clamp.

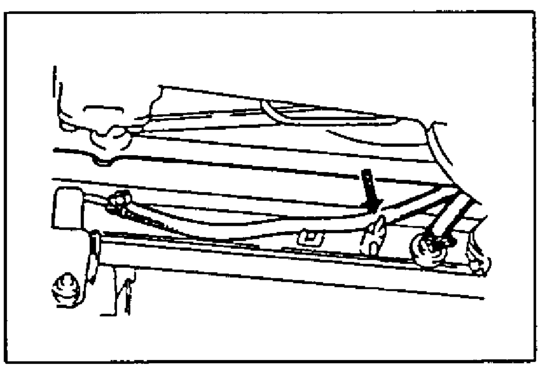
20) Connect negative cable at battery.
21) Upon completion of installation, verify that there is no coolant leakage at each connection.
22) Adjust ignition timing. Refer to Section 6F for adjustment.

VALVES AND CYLINDER HEAD

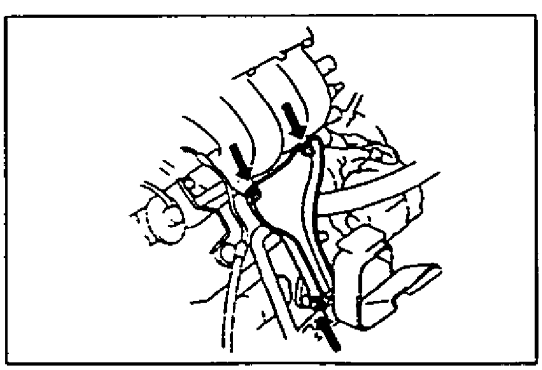


REMOVAL

1) Relieve fuel pressure according to procedure described in Section 6.
2) Disconnect negative cable at battery.



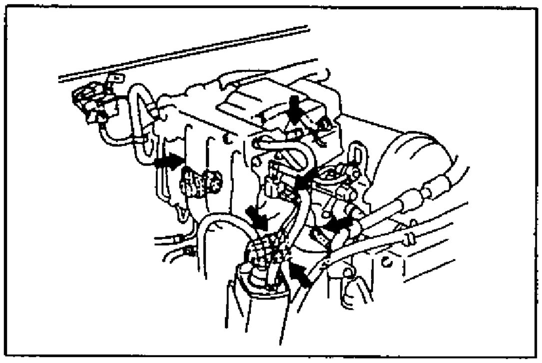
3) Drain cooling system.



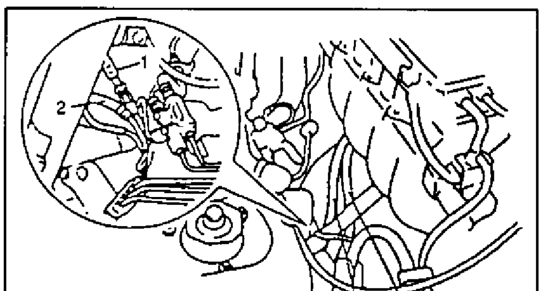
4) Remove intake manifold stiffener.

5) Disconnect following electric wires:
   - Distributor
   - Ground wires from surge tank
   - EGR valve
   - EVAP canister purge valve
   - Coolant (Water) temp. gauge
   - ECT sensor
   - Injectors, TP sensor and IAC valve wires at the coupler
   - Heated oxygen sensor-1
   - Heated oxygen sensor-2
   - A/C Coolant (Water) temp. sensor (if equipped)

   and then release above wire harnessers from clamps.

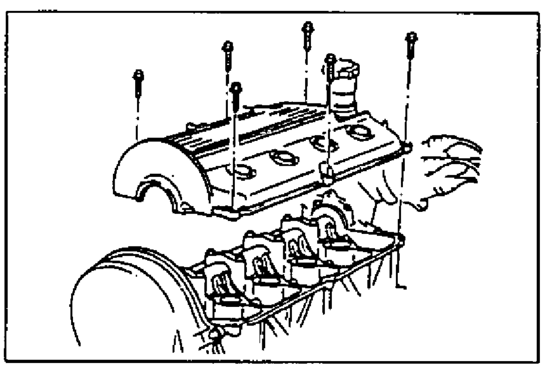


6) Disconnect following hoses:
   - Canister purge hose from EVAP canister
   - Brake booster hose from intake surge tank
   - Manifold differential pressure sensor hose from intake surge tank
   - Engine cooling water (coolant) hose (outlet side) from IAC valve
   - Radiator inlet hose from thermostat cap



1. Fuel feed hose
2. Fuel return hose

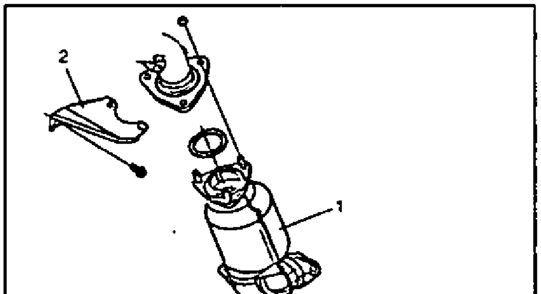
7) Disconnect fuel feed and return hoses from each pipe.



8) Remove cylinder head cover as previously outlined. Loosen all valve lash adjusting screws fully.

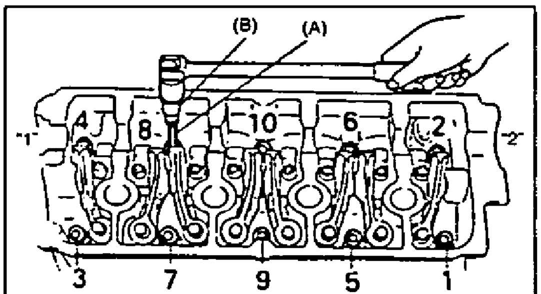
9) Disconnect engine cooling water (coolant) hoses:
   - Radiator inlet hose
   - Heater inlet hose
   - IAC valve outlet
   - Bypass hose

10) Remove timing belt and crankshaft as previously outlined.



1. Exhaust No.1 pipe
2. Exhaust pipe bracket

11) Remove exhaust pipe bracket and disconnect exhaust No.1 pipe from exhaust manifold.



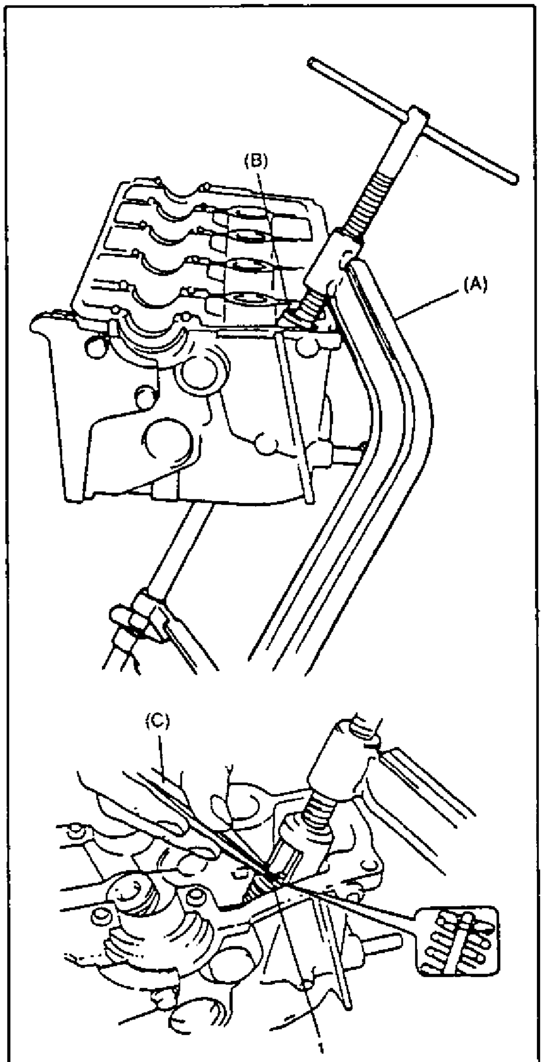
"1": Camshaft pulley side
"2": Distributor side

12) Loosen cylinder head bolts in such order as indicated in figure and remove them.

Special Tool
(A): 09900-00415
(B): 09900-00411

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 and distributor, using lifting device.



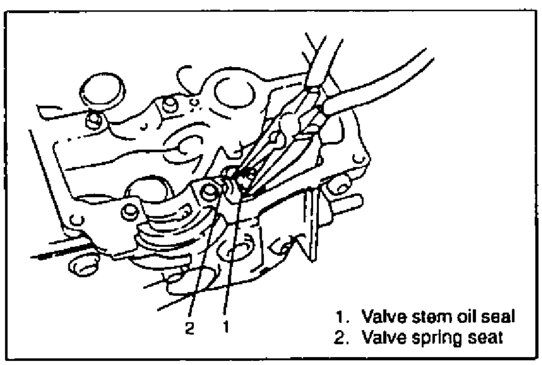
1. Valve cotters

DISASSEMBLY

1) For ease in servicing cylinder head, remove distributor gear case, intake manifold with throttle body and exhaust manifold from cylinder head.
2) Remove camshaft as previously outlined and remove rocker arms and washers by pulling its shaft out to transmission side.
3) Using special tool (Valve lifter), compress valve springs and then remove valve cotters by using special tool (Forceps) as shown.

   Special Tool
   (A): 09916-14510
   (B): 09916-14910
   (C): 09916-84510

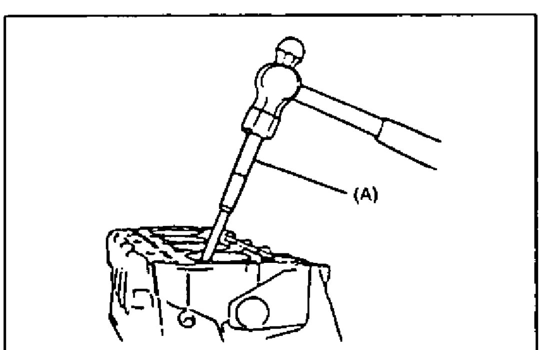
4) Release special tool, and remove spring retainer and valve spring.
5) Remove valve from combustion chamber side.



1. Valve stem oil seal
2. Valve spring seat

6) Remove valve stem oil seal from valve guide, and then valve spring seat.

   NOTE:
   Do not reuse oil seal once disassembled. Be sure to use new oil seal when assembling.

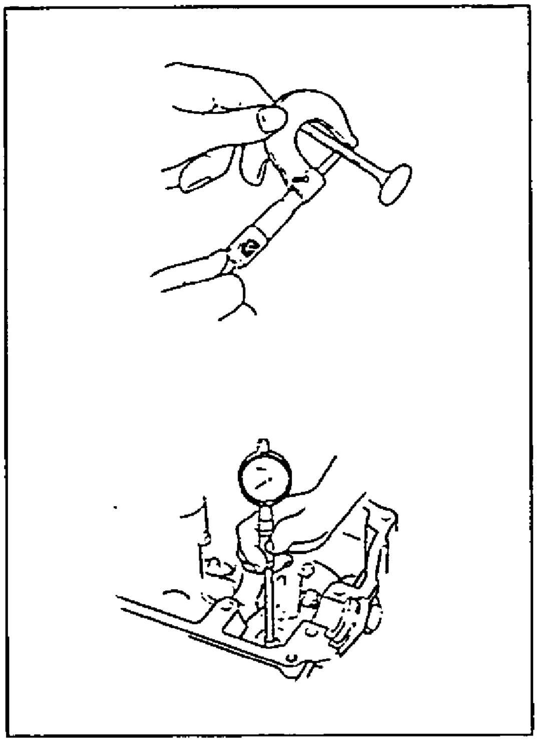


7) Using special tool (Valve guide remover), drive valve guide out from combustion chamber side to valve spring side.

   Special Tool
   (A): 09916-44910

   NOTE:
   Do not reuse valve guide once disassembled. Be sure to use new valve guide (Oversize) when assembling.

8) Place disassembled parts except valve stem seal and valve guide in order, so that they can be installed in their original position.

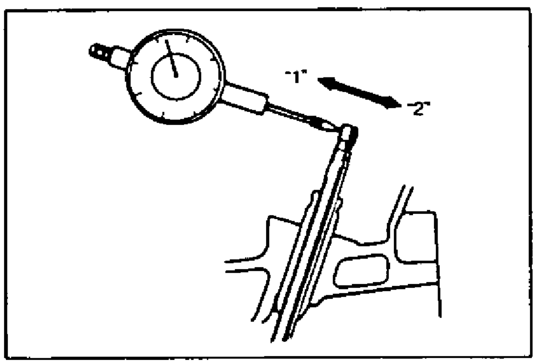


INSPECTION

Valve Guides

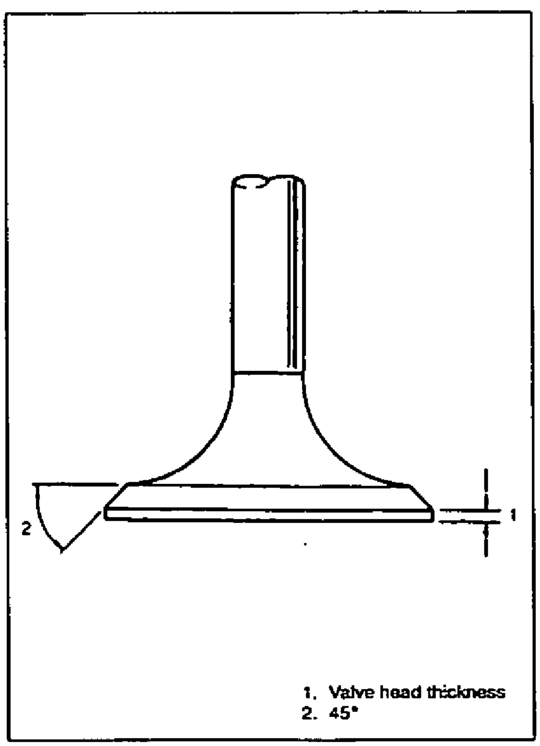
Using a micrometer and bore gauge, take diameter readings on valve stems and guides to check stem-to-guide clearance.
Be sure to take reading at more than one place along the length of each stem and guide.
If clearance exceeds limit, replace valve and valve guide.

Item		Standard	Limit
Valve stem diameter	In	5.465 – 5.480 mm (0.2152 – 0.2157 in.)	–
	Ex	5.440 – 5.455 mm (0.2142 – 0.2148 in.)	–
Valve guide I.D.	In Ex	5.500 – 5.512 mm (0.2166 – 0.2170 in.)	–
Stem-to-guide clearance	In	0.020 – 0.047 mm (0.0008 – 0.0018 in.)	0.07 mm (0.0027 in.)
	Ex	0.045 – 0.072 mm (0.0018 – 0.0028 in.)	0.09 mm (0.0035 in.)



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.

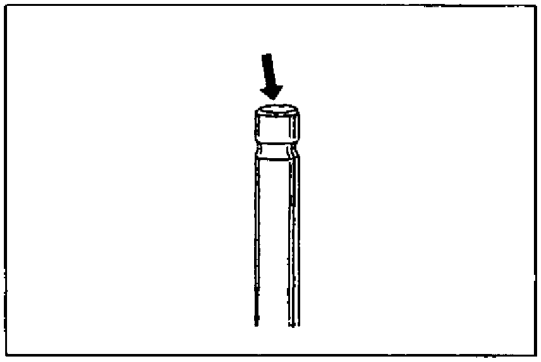
Valve stem end deflection limit	In	0.14 mm (0.005 in.)
	Ex	0.18 mm (0.007 in.)



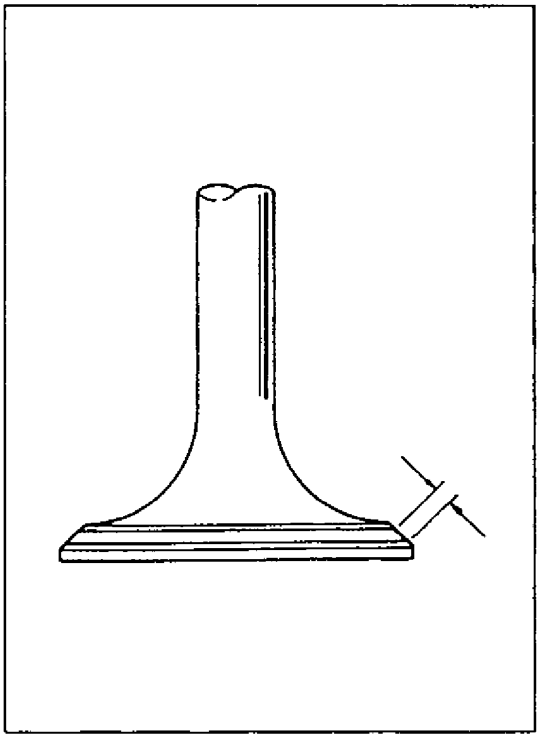
Valves

- 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 of valve head. If measured thickness exceeds limit, replace valve.

Valve head thickness		
	Standard	Limit
In	0.8 – 1.2 mm (0.03 – 0.047 in.)	0.6 mm (0.024 in.)
Ex		0.7 mm (0.027 in.)

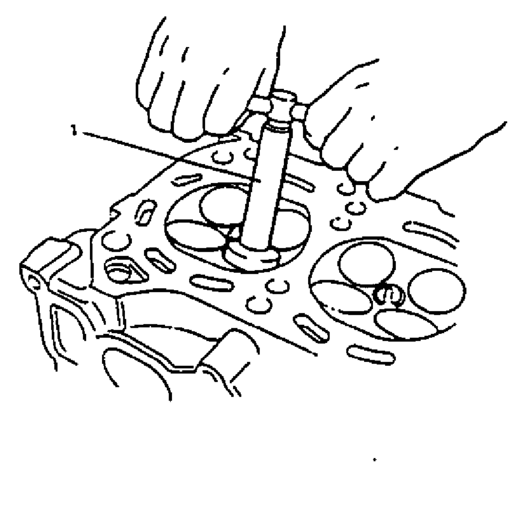


- Inspect valve stem end face for pitting and wear. If pitting or wear is found there, valve stem end may be resurfaced, but not so much as to grind off its chamfer. When it is worn so much that its chamfer is gone, replace valve.



- Seating contact width:
  Create contact pattern on each valve in the usual manner, i.e., by giving uniform coat of marking compound to valve seat and by rotatingly tapping seat with valve head. Valve lapper (tool used in valve lapping) must be used.
  Pattern produced on seating face of valve must be a continuous ring without any break, and the width of pattern must be within specified range.

Standard seating width revealed by contact pattern on valve face	In	1.1 – 1.3 mm (0.0433 – 0.0512 in.)
	Ex	



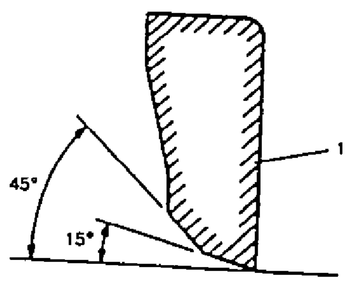
1. Valve seat cutter

- Valve seat repair:

  A valve seat not producing a uniform contact with its valve or showing width of seating contact that is out of specified range must be repaired by regrinding or by cutting and regrinding and finished by lapping.

  1) EXHAUST VALVE SEAT: Use valve seat cutters to make two cuts as illustrated in figure. Two cutters must be used: the first for making 15° angle, and the second for making 45° angle. The second cut must be made to produce desired seat width.

     Seat width for exhaust valve seat:
     1.1 – 1.3 mm (0.0433 – 0.0512 in.)

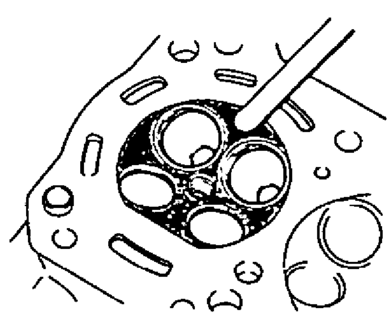


1. Valve seat

  2) INTAKE VALVE SEAT: Cutting sequence is the same as for exhaust valve seats.

     Seat width for intake valve seat:
     1.1 – 1.3 mm (0.0433 – 0.0512 in.)

  3) VALVE LAPPING: Lap valve on seat in two steps, first with coarse size lapping compound applied to face and the second with fine-size compound, each time using valve lapper according to usual lapping method.

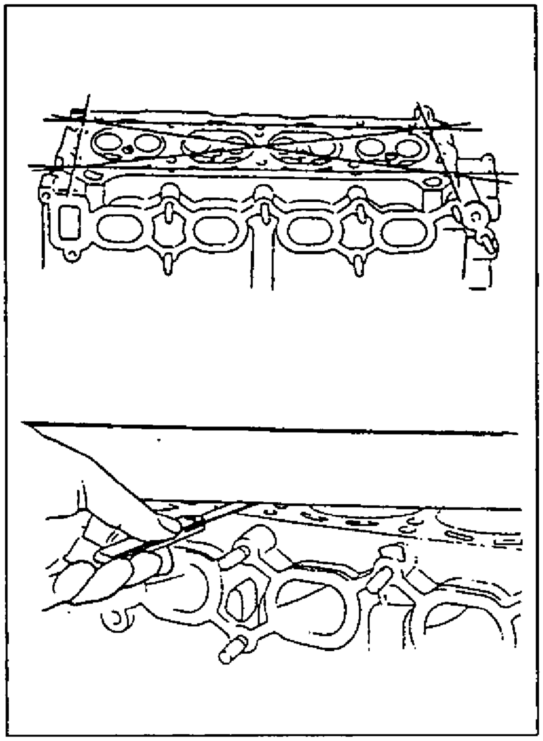


Cylinder Head

- Remove all carbon from combustion chambers.

NOTE:
Do not use any sharp-edged tool to scrape off carbon. Be careful not to scuff or nick metal surfaces when decarbonating. The same applies to valves and valve seats, too.

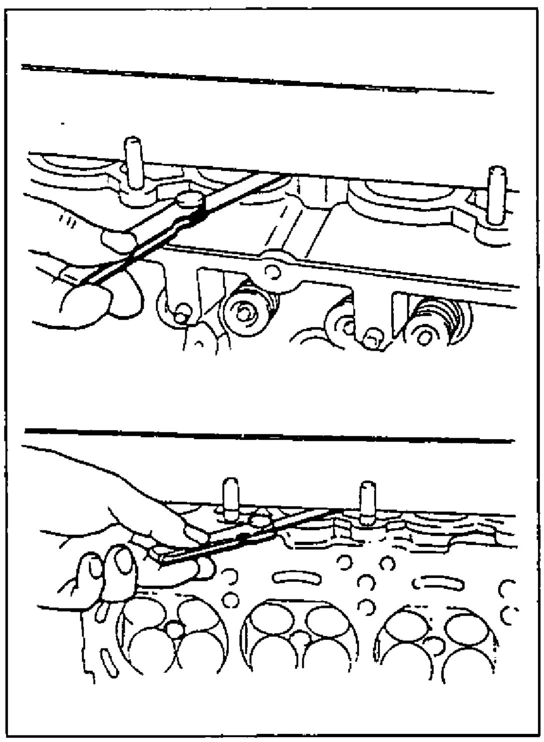
- Check cylinder head for cracks in intake and exhaust ports, combustion chambers, and head surface.



- Flatness of gasketed surface:

  Using a straightedge and thickness gauge, check surface at a total of 6 locations. If distortion limit, given below, is exceeded, correct gasketed surface with a surface plate and abrasive paper of about #400 (Waterproof silicon carbide abrasive paper): place paper on and over surface plate, and rub gasketed surface against paper to grind off high spots. Should this fail to reduce thickness gauge readings to within limit, replace cylinder head. Leakage of combustion gases from this gasketed joint is often due to warped gasketed surface: such leakage results in reduced power output.

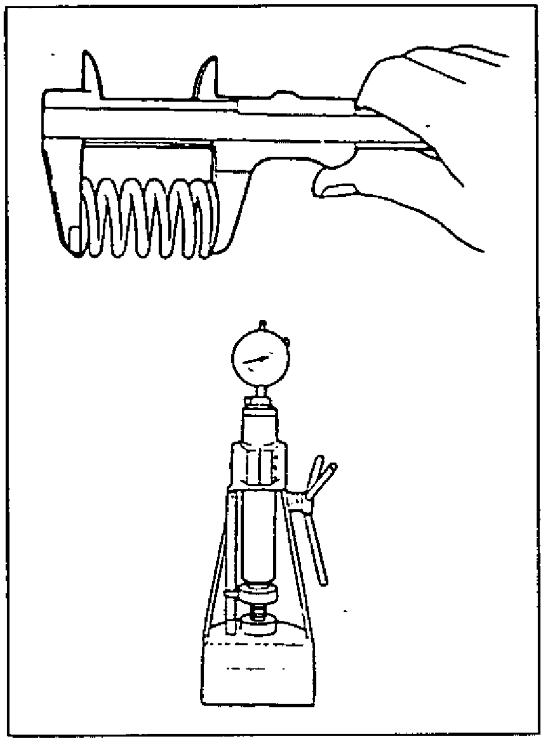
  Limit of distortion: 0.05 mm (0.002 in.)



- Distortion of manifold seating faces:

  Check seating faces of cylinder head for manifolds, using a straightedge and thickness gauge, in order to determine whether these faces should be corrected or cylinder head replaced.

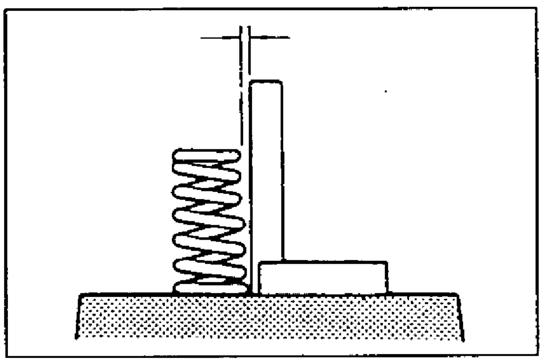
  Limit of distortion: 0.10 mm (0.004 in.)



Valve Springs

- Referring to data given below, check to be sure that each spring is in sound condition, free of any evidence of breakage or weakening. Remember, weakened valve springs can cause chatter, not to mention possibility of reducing power output due to gas leakage caused by decreased seating pressure.

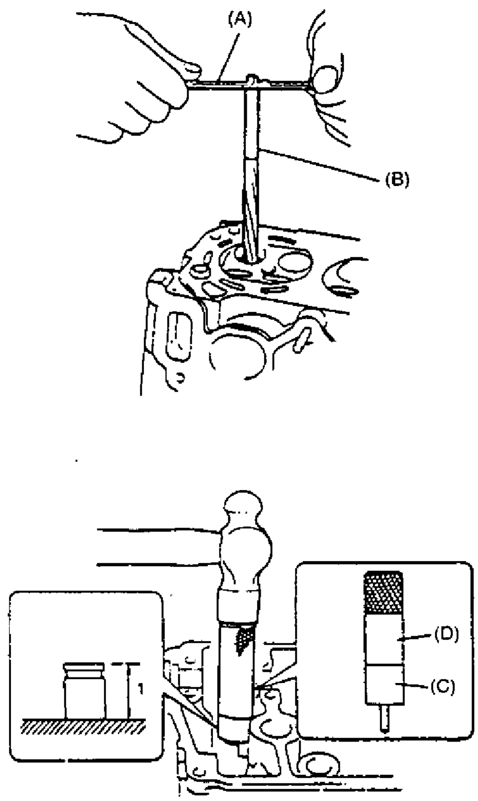
Item	Standard	Limit
Valve spring free length	36.83 mm (1.4500 in.)	35.67 mm (1.4043 in.)
Valve spring preload	10.7 – 12.5 kg for 31.5 mm (23.6 – 27.5 lb/ 1.24 in.)	9.3 kg for 31.5 mm (20.5 lb/ 1.24 in.)



- Spring squareness:

  Use a square and surface plate to check each spring for squareness in terms of clearance between end of valve spring and square. Valve springs found to exhibit a larger clearance than limit given below must be replaced.

  Valve spring squareness limit: 2.0 mm (0.079 in.)



1. Valve guide protrusion (11.5 mm)

ASSEMBLY

1) Before installing valve guide into cylinder head, ream guide hole with special tool (11 mm reamer) so remove burrs and make it truly round.

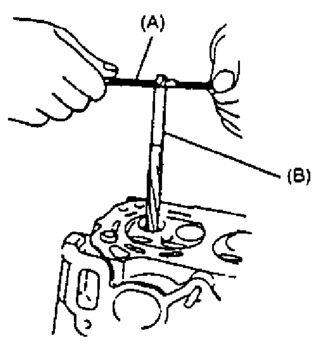
   Special Tool
   (A): 09916-34541
   (B): 09916-38210

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.**

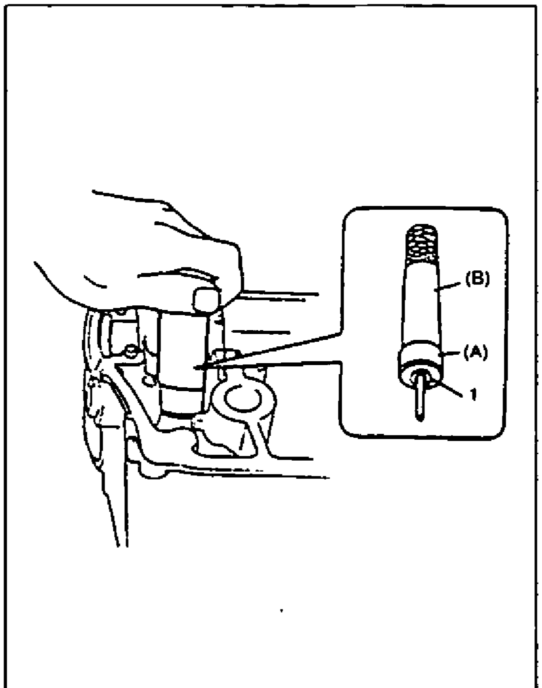
   Valve guide oversize: 0.03 mm (0.0012 in.)
   Valve guide protrusion (In and Ex): 11.5 mm (0.45 in.)



3) Ream valve guide bore with special tool (5.5 mm reamer). After reaming, clean bore.

   Special Tool
   (A): 09916-34541
   (B): 09916-34550

4) Install valve spring seat to cylinder head.

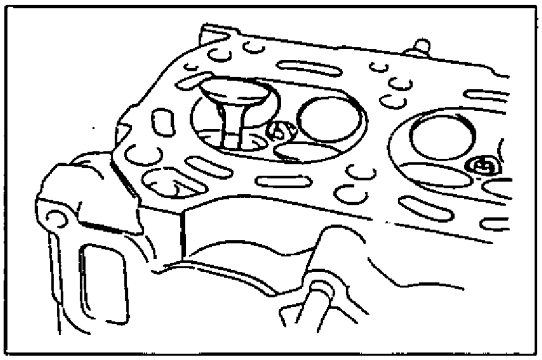


1. Valve stem seal

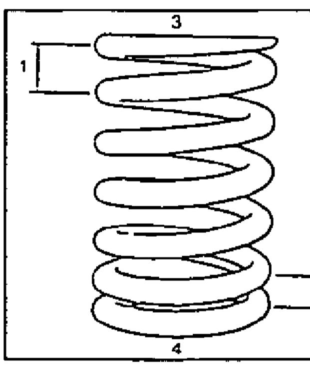
5) Install new valve stem seal to valve guide.
   After applying engine oil to seal and spindle of special tool (Valve guide installer handle), fit oil seal to spindle, and then install seal to valve guide by pushing special tool by hand.
   After installing, check to be sure that seal is properly fixed to valve guide.

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

   NOTE:
   - **Do not reuse seal once disassembled. Be sure to install new seal.**
   - **When installing, never tap or hit special tool with a hammer or else. Install seal to guide only by pushing special tool by hand. Tapping or hitting special tool may cause damage to seal.**

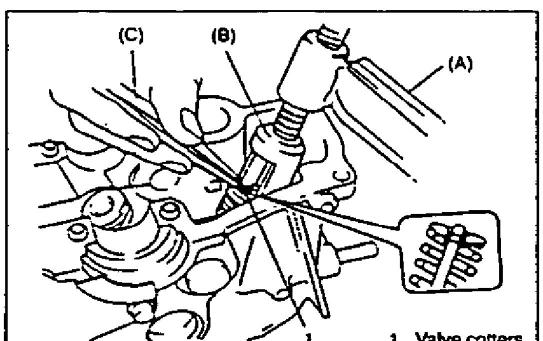


6) Install valve to valve guide.
   Before installing valve to valve guide, apply engine oil to stem seal, valve guide bore, and valve stem.



1. Large-pitch
2. Small-pitch
3. Valve spring retainer side
4. Valve spring seat side

7) Install valve spring and spring retainer.
   Each valve spring has top end (large-pitch end) and bottom end (small-pitch end). Be sure to position spring in place with its bottom end (small-pitch end) facing the bottom (valve spring seat side).

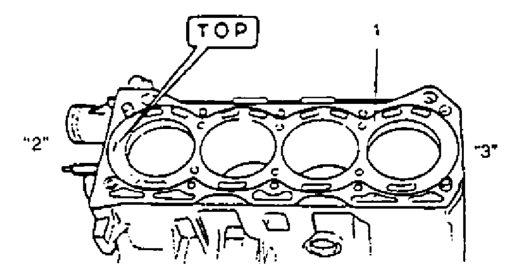


1. Valve cotters

8) Using special tool (Valve lifter), compress valve spring and fit two valve cotters into groove in valve stem.

   Special Tool
   (A): 09916-14510
   (B): 09916-14910
   (C): 09916-84510

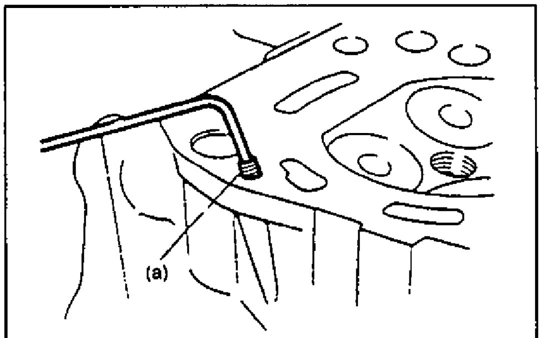
9) Install rocker arms, washers, rocker arm shaft and camshaft as previously outlined.
10) Install distributor gear case, intake manifold and exhaust manifold.



1. Cylinder head gasket
2. Crankshaft pulley side
3. Flywheel side

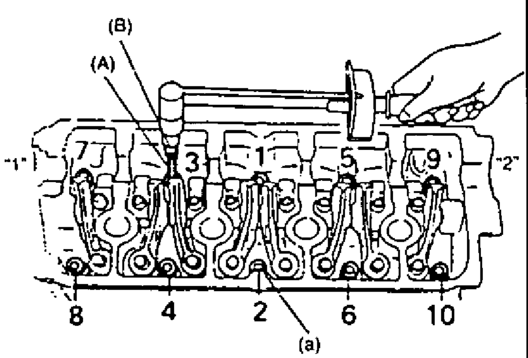
INSTALLATION

1) Remove oil gasket and oil on mating surfaces and install new head gasket as shown in figure, that is, "TOP" mark provided on gasket comes to crankshaft pulley side, facing up (toward cylinder head side).



2) Check to make sure that oil jet (venturi plug) is installed and if it is, that it is not clogged.
   When installing it, be sure to tighten to specified torque.

   Tightening Torque
   (a): 3.5 N·m (0.35 kg-m, 2.5 lb-ft)



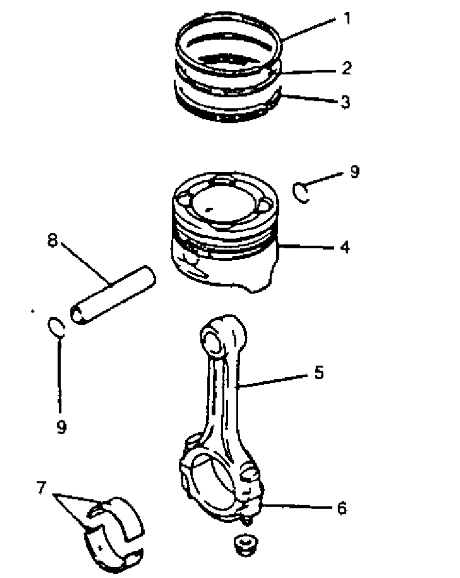
"1": Camshaft pulley side
"2": Distributor side

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 in reverse order of tightening.
   d) 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)

   Special Tool
   (A): 09900-00415
   (B): 09900-00411

4) Reverse removal procedure for installation.
5) Adjust water pump drive belt tension, referring to "ENGINE COOLING" section.
6) Adjust power steering pump belt tension or A/C compressor belt tension, if equipped.
   Refer to Section 0B.
7) Adjust intake and exhaust valve lashes as previously outlined.
8) Adjust accelerator cable play referring 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) Adjust ignition timing referring to Section 6F.
13) Verify that there is no fuel leakage, coolant leakage and exhaust gas leakage at each connection.

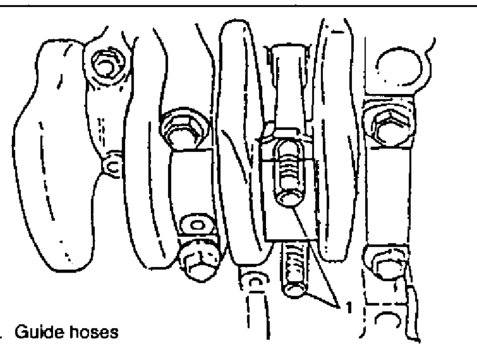


1. Top ring
2. 2nd ring
3. Oil ring
4. Piston
5. Connecting rod
6. Connecting rod bearing cap
7. Connecting rod bearing
8. Piston pin
9. Piston pin circlip

PISTON, PISTON RINGS, CONNECTING RODS AND CYLINDERS

REMOVAL

1) Remove cylinder head from cylinder block as previously outlined.
2) Drain engine oil.
3) Remove oil pan and oil pump strainer as previously outlined.
4) Mark cylinder number on all pistons, connecting rods and rod bearing caps, using silver pencil or quick drying paint.

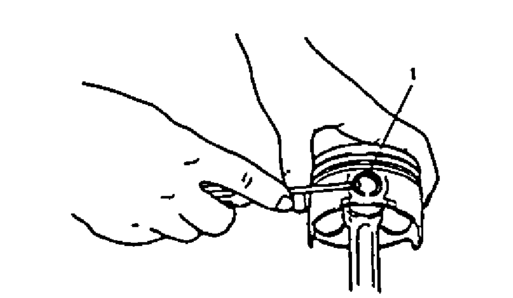


1. Guide hoses

5) Remove rod bearing caps.
6) Install guide hose over threads of rod bolts. This is to prevent damage to bearing journal and rod bolt threads when removing connecting rod.
7) Decarbon top of cylinder bore before removing piston from cylinder.
8) Push piston and connecting rod assembly out through the top of cylinder bore.

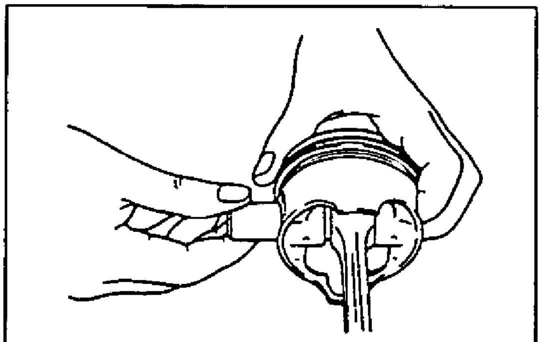
DISASSEMBLY

1) Using piston ring expander, remove two compression rings (Top and 2nd) and oil ring from piston.



1. Piston pin circlip

2) Remove piston pin from connecting rod.
   - Ease out piston pin circlips, as shown.



   - Force piston pin out.

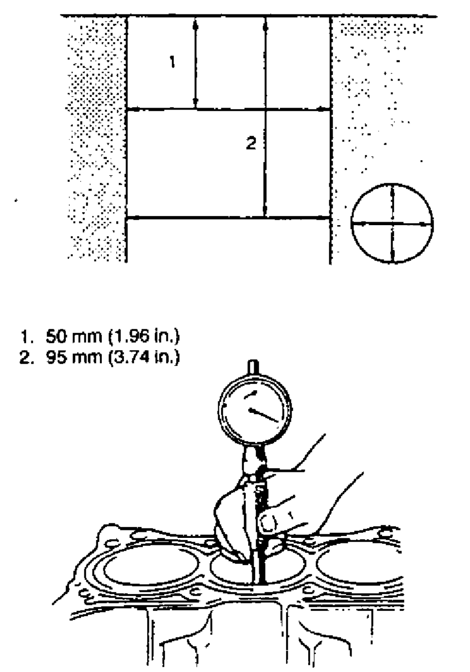
CLEANING

Clean carbon from piston head and ring grooves, using a suitable tool.

INSPECTION

Cylinders

- Inspect cylinder walls for scratches, roughness, or ridges which indicate excessive wear. If cylinder bore is very rough or deeply scratched, or ridged, rebore cylinder and use oversize piston.



1. 50 mm (1.96 in.)
2. 95 mm (3.74 in.)

- Using a cylinder gauge, measure cylinder bore in thrust and axial directions at two positions as shown in figure.
  If any of following conditions is noted, rebore cylinder.
  1) Cylinder bore dia. exceeds limit.
  2) Difference of measurements at two positions exceeds taper limit.
  3) Difference between thrust and axial measurements exceeds out-of-round limit.

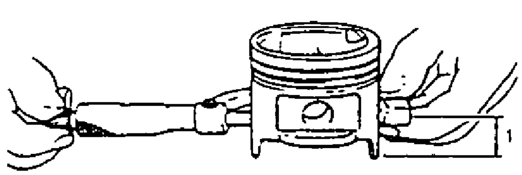
  Cylinder bore dia. limit: 75.15 mm (2.9586 in.)
  Tapper and out-of-round limit: 0.10 mm (0.0039 in.)

  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.

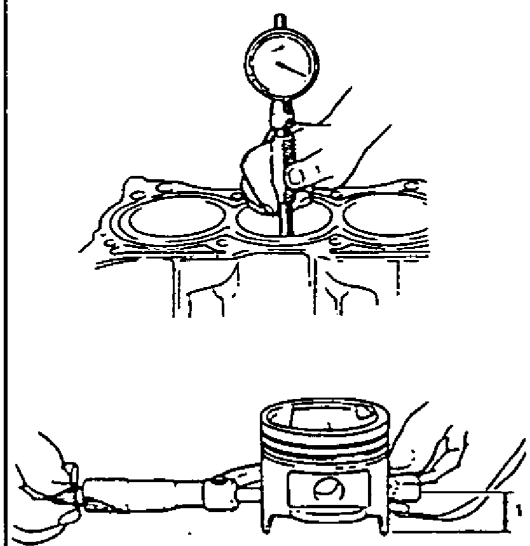
Pistons

- 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 15 mm (0.59 in.) from piston skirt end in the direction perpendicular to piston pin.

Piston diameter	Standard	74.970 – 74.990 mm (2.9516 – 2.9523 in.)
	Oversize: 0.25 mm (0.0098 in.)	75.220 – 75.230 mm (2.9614 – 2.9618 in.)
	0.50 mm (0.0196 in.)	75.470 – 75.480 mm (2.9712 – 2.9716 in.)



1. 15 mm (0.59 in.)



1. 15 mm (0.59 in.)

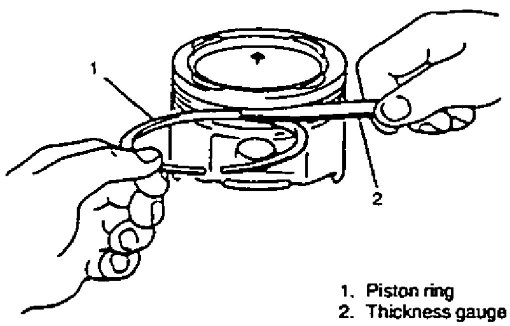
- Piston clearance:

  Measure cylinder bore diameter and piston diameter to find their difference which is piston clearance. Piston clearance should be within specification as given below. If it is out of specification, re-bore cylinder and use oversize piston.

  Piston clearance: 0.02 – 0.04 mm (0.0008 – 0.0015 in.)

  NOTE:

  Cylinder bore diameters used here are measured in thrust direction at two positions.



1. Piston ring
2. Thickness gauge

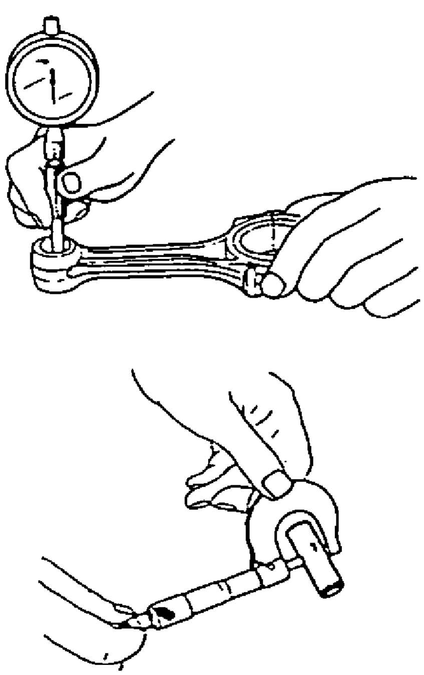
- Ring groove clearance:

  Before checking, piston grooves must be clean, dry and free of carbon.

  Fit new piston ring into piston groove, and measure clearance between ring and ring land by using thickness gauge.

  If clearance is out of specification, replace piston.

  Ring groove clearance:
  Top: 0.03 – 0.07 mm (0.0012 – 0.0027 in.)
  2nd: 0.02 – 0.06 mm (0.0008 – 0.0023 in.)



Piston Pin

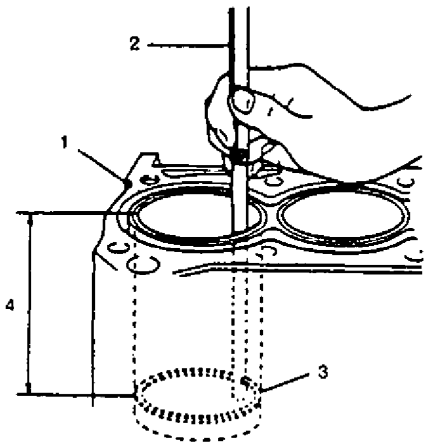
- Check piston pin, connecting rod small end bore and piston bore for wear or damage, paying particular attention to condition of small end bore bush. If pin, connecting rod small end bore or piston bore is badly worn or damaged, replace pin, connecting rod or piston.
- Piston pin clearance:

  Check piston pin clearance in small end. Replace connecting rod if its small end is badly worn or damaged or if measured clearance exceeds limit.

Item	Standard	Limit
Piston clearance in small end	0.003 – 0.016 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 (0.7479 – 0.7480 in.)



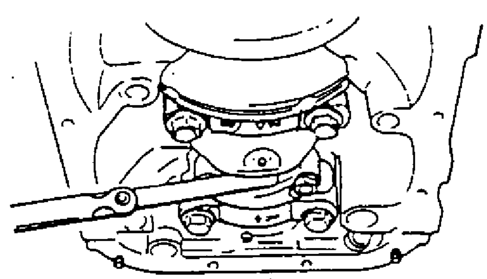
1. Cylinder block
2. Feeler gauge
3. Piston ring
4. 120 mm (4.72 in.)

Piston Rings

To measure end gap, insert piston ring into cylinder bore and then measure the gap by using thickness gauge.
If measured gap is out of specification, replace ring.

NOTE:
Decarbon and clean top of cylinder bore before inserting piston ring.

Item		Standard	Limit
Piston ring end gap	Top ring	0.2 – 0.35 mm (0.0079 – 0.0137 in.)	0.7 mm (0.0275 in.)
	2nd ring	0.2 – 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.

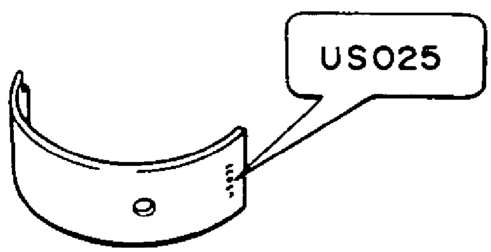
  Limit on bow: 0.05 mm (0.0020 in.)
  Limit on twist: 0.10 mm (0.0039 in.)

Crank Pin and Connecting Rod Bearings

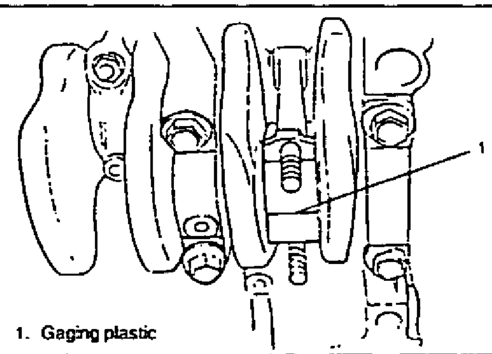
- Inspect crank pin for uneven wear or damage. Measure crank pin for out-of-round or taper with a micrometer. If crank pin is damaged, or out-of-round or taper is out of limit, replace crankshaft or regrind crank pin to undersize and use undersize bearing.

Connecting rod bearing size	Crank pin diameter
Standard	43.982 – 44.000 mm (1.7316 – 1.7322 in.)
0.25 mm (0.0098 in.)	43.732 – 43.750 mm (1.7218 – 1.7224 in.)

Out-of-round and taper limit: 0.01 mm (0.0004 in.)

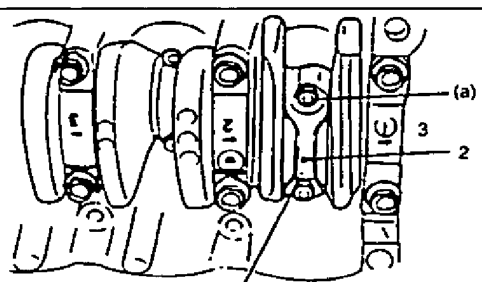


- Rod bearing:
  Inspect bearing shells for signs of fusion, pitting, burn or flaking and observe contact pattern. Bearing shells found in defective condition must be replaced.
  Two kinds of rod bearing are available; standard size bearing and 0.25 mm undersize bearing. To distinguish them, 0. 25 mm undersize bearing has the stamped number (US025) on its backside as indicated in figure, but standard size one has no number.



1. Gaging plastic

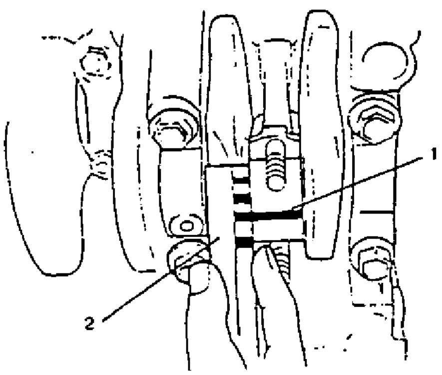
- Rod bearing clearance:
  1) Before checking bearing clearance, clean bearing and crank pin.
  2) Install bearing in connecting rod and bearing cap.
  3) Place a piece of gaging plastic to full width of crankpin as contacted by bearing (parallel to crankshaft), avoiding oil hole.



1. Rod bearing cap
2. Arrow mark
3. Crankshaft pulley side

  4) Install rod bearing cap to connecting rod.
     When installing cap, be sure to point arrow mark on cap to crankshaft pulley side, as shown in figure. After applying engine oil to rod bolts, tighten cap nuts to specified torque. DO NOT turn crankshaft with gaging plastic installed.

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



1. Gaging plastic
2. Scale

5) Remove cap and using a scale on gaging plastic envelope, measure gaging plastic width at the widest point (clearance). If clearance exceeds its limit, use a new standard size bearing and remeasure clearance.

Item	Standard	Limit
Bearing clearance	0.020 – 0.050 mm (0.0008 – 0.0019 in.)	0.080 mm (0.0031 in.)

6) If clearance can not be brought to within its limit even by using a new standard size bearing, regrind crankpin to undersize and use 0.25 mm undersize bearing.

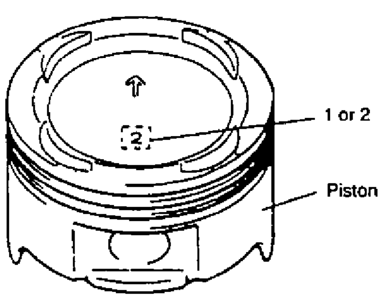
ASSEMBLY

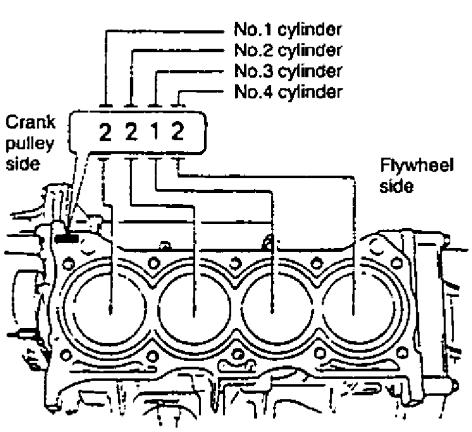
NOTE:

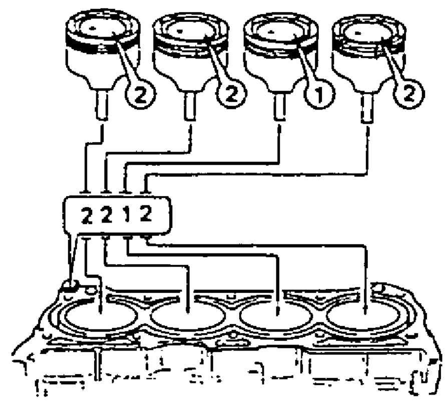
Two sizes of piston are available as standard size spare part so as to ensure proper piston-to-cylinder clearance. When installing a standard size piston, make sure to match piston with cylinder as follows.

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.



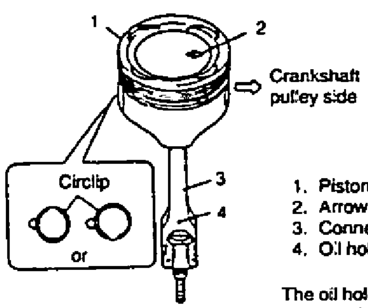




c) Stamped number on piston and that on cylinder block should correspond. That is, install number 2 stamped piston to cylinder which is identified with number 2 and a number 1 piston to cylinder with number 1.

Piston		Cylinder		Piston-to-cylinder clearance
Number at the top (mark)	Outer diameter	Number (mark)	Bore diameter	
1	74.98 – 74.99 mm (2.9520 – 2.9524 in.)	1	75.01 – 75.02 mm (2.9531 – 2.9535 in.)	0.02 – 0.04 mm (0.0008 – 0.0015 in.)
2	74.97 – 74.98 mm (2.9516 – 2.9520 in.)	2	75.00 – 75.01 mm (2.9528 – 2.9531 in.)	0.02 – 0.04 mm (0.0008 – 0.0015 in.)

Also, a letter A, B or C is stamped on piston head but ordinarily it is not necessary to discriminate each piston by this letter.

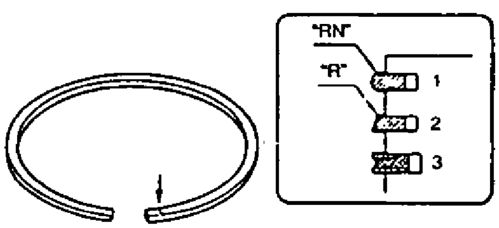


1. Piston
2. Arrow mark
3. Connecting rod
4. Oil hole

The oil hole should come on intake side

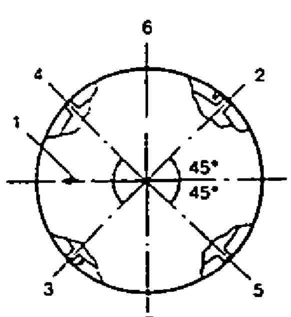
1) Install piston pin to piston and connecting rod:
After applying engine oil to piston pin and piston pin holes in piston and connecting rod, fit connecting rod to piston as shown in figure and insert piston pin to piston and connecting rod, and install piston pin circlips.

NOTE:
Circlip should be installed with its cut part facing either up or down as shown in figure.



1. 1st ring
2. 2nd ring
3. Oil ring

2) Install piston rings to piston:
- As indicated in figure at the left, 1st and 2nd rings have "RN", "T" or "R" mark respectively. When installing these piston rings to piston, direct marked side of each ring toward top of piston.
- 1st ring differs from 2nd ring in thickness, shape and color of surface contacting cylinder wall.
Distinguish 1st ring from 2nd ring by referring to figure.
- When installing oil ring, install spacer first and then two rails.



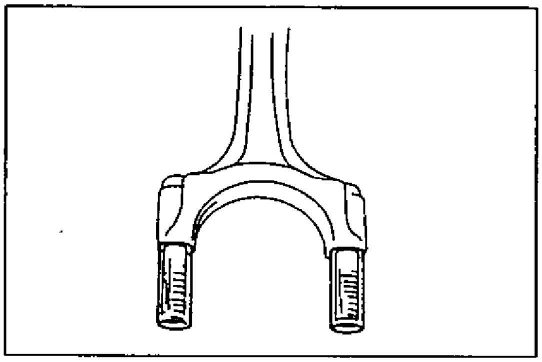
1. Arrow mark
2. 1st ring end gap
3. 2nd ring end gap and oil ring spacer gap
4. Oil ring upper rail gap
5. Oil ring lower rail gap
6. Intake side
7. Exhaust side

3) After installing three rings (1st, 2nd and oil rings), distribute their end gaps as shown in figure.

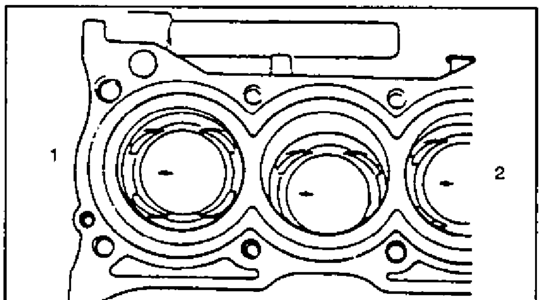
INSTALLATION OR CONNECTION

1) Apply engine oil to pistons, rings, cylinder walls, connecting rod bearings and crankpins.

NOTE:
Do not apply oil between connecting rod and bearing or between bearing cap and bearing.

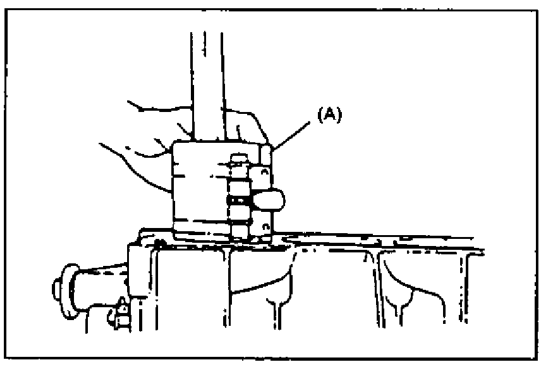


2) Install guide hoses over connecting rod bolts.
These guide hoses protect crankpin and threads of rod bolt from damage during installation of connecting rod and piston assembly.



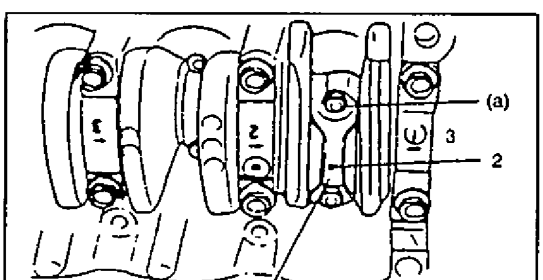
1. Crankshaft pulley side
2. Flywheel side

3) When installing piston and connecting rod assembly into cylinder bore, point arrow mark on piston head to crankshaft pulley side.



4) Install piston and connecting rod assembly into cylinder bore. Use special tool (Piston ring compressor) to compress rings. Guide connecting rod into place on crankshaft.
Using a hammer handle, tap piston head to install piston into bore. Hold ring compressor firmly against cylinder block until all piston rings have entered cylinder bore.

Special Tool
(A): 09916-77310



1. Rod bearing cap
2. Arrow mark
3. Crankshaft pulley side

5) Install bearing cap.
Point arrow mark on cap to crankshaft pulley side.
Tighten cap nuts to specification.

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

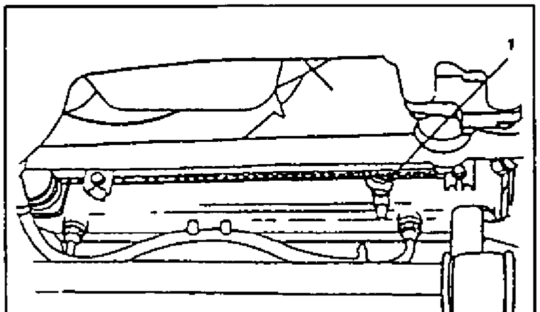
6) Reverse removal procedure for installation, as previously outlined.
7) Adjust water pump drive belt tension, referring to Section 6B.
8) Adjust power steering pump belt tension or A/C compressor belt tension, if equipped.
   Refer to Section 0B.
9) Adjust accelerator cable play by referring to Section 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, referring to item "ENGINE OIL CHANGE" in Section 0B.
12) Refill cooling system referring to Section 6B.
13) Refill front differential housing with gear oil, referring to "DIFFERENTIAL" section.
14) Connect negative cable at battery.
15) Check ignition timing and adjust as necessary, referring to Section 6F.
16) Verify that there is no fuel leakage, coolant leakage, oil leakage and exhaust gas leakage at each connection.

UNIT REPAIR OVERHAUL

ENGINE ASSEMBLY

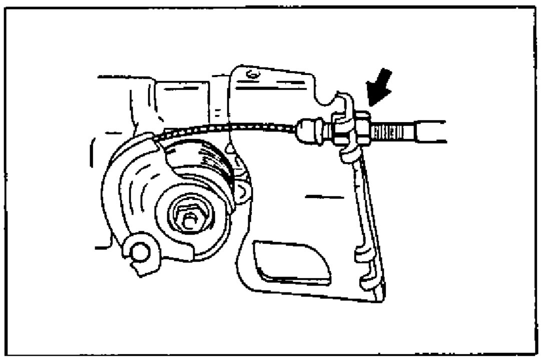
REMOVAL

1) Release fuel pressure in fuel feed line by referring to Section 6.
2) Remove battery.
3) Remove engine hood.

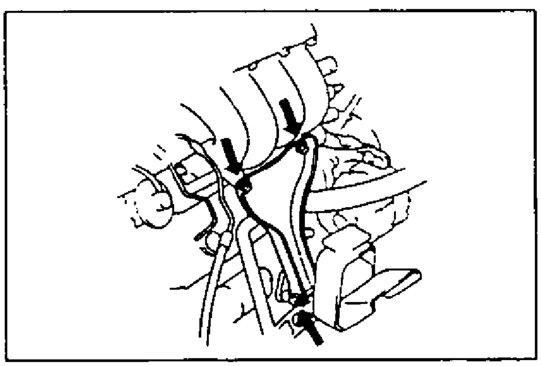


1. Drain plug

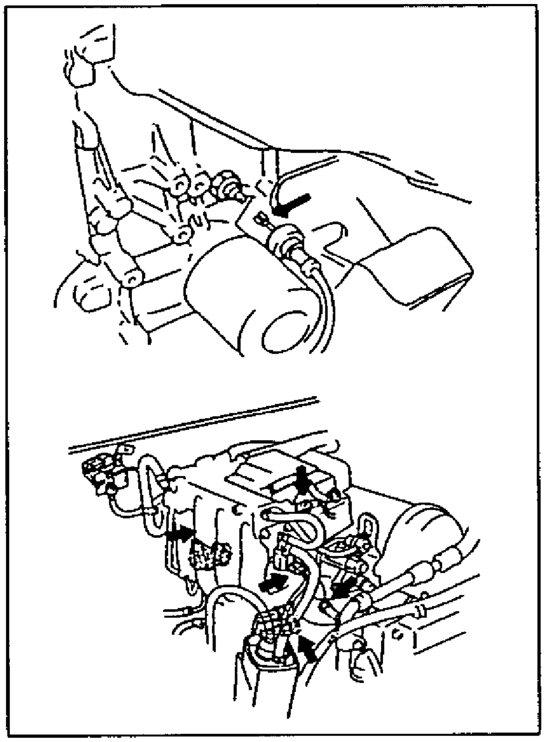
4) Drain cooling system.
5) Remove radiator fan and fan shroud, referring to Section 6B.
6) Remove air intake pipe with hoses.



7) Disconnect accelerator cable from throttle body.

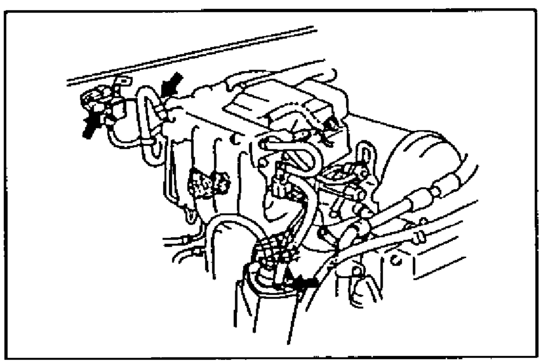


8) Remove intake manifold stiffener and then release wire harnesses from clamps.
9) Remove starter motor.

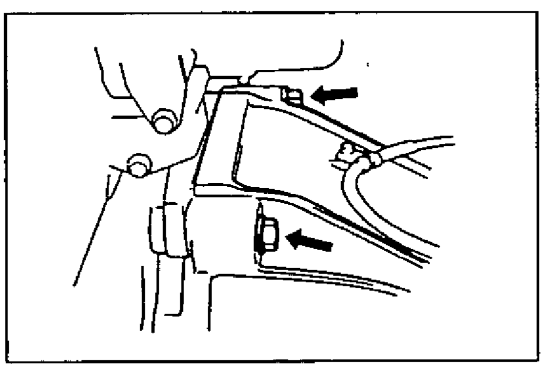


10) Disconnect following electric wires:
- Distributor
- Ground wires from surge tank
- Engine oil pressure switch
- EGR valve
- EVAP solenoid purge valve
- Coolant (Water) temp. gauge
- Engine coolant temp. sensor
- A/C coolant (water) temp. switch
- Injectors, TP sensor and IAC valve wires at the coupler
- Heated oxygen sensor-1
- Generator

and then release wire harnesses from clamps.

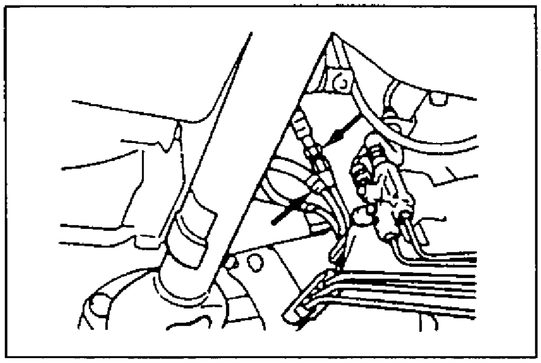


11) Disconnect following hoses:
- Canister purge hose from EVAP canister
- Brake booster hose from surge tank
- Radiator outlet hose from inlet pipe
- Heater inlet and outlet hose from heater unit
- Manifold differential pressure sensor hose from intake surge tank

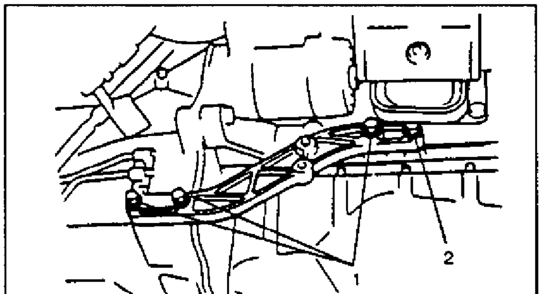


12) Loosen bolts fastening cylinder block and transmission.

13) Hoist vehicle.
14) Drain engine oil.

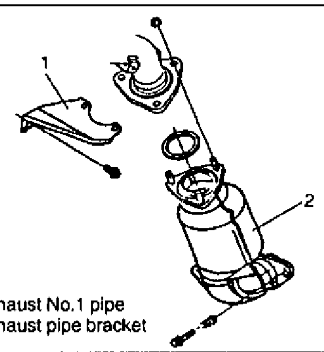


15) Disconnect fuel feed and return hoses from pipes.



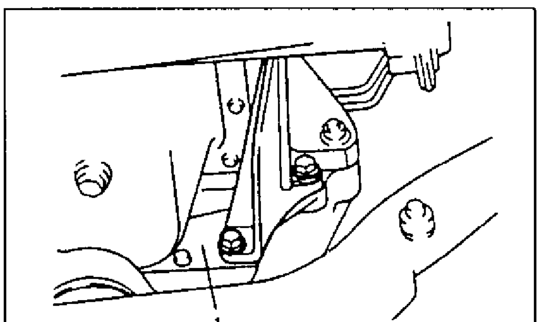
1. Right side transmission stiffener bolts (remove)
2. Right side transmission stiffener bolt (loosen)

16) Remove right side transmission stiffener bolts (3 pcs.).



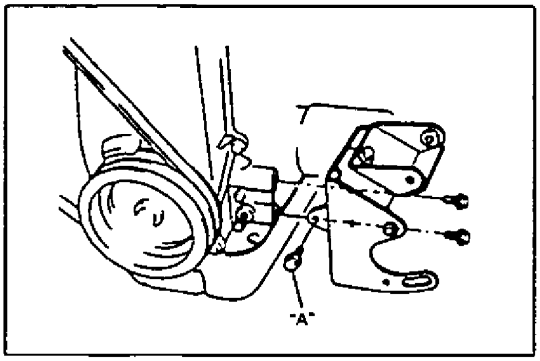
1. Exhaust No.1 pipe
2. Exhaust pipe bracket

17) Remove exhaust pipe bracket and exhaust No.1 pipe with heated oxygen sensor-2.



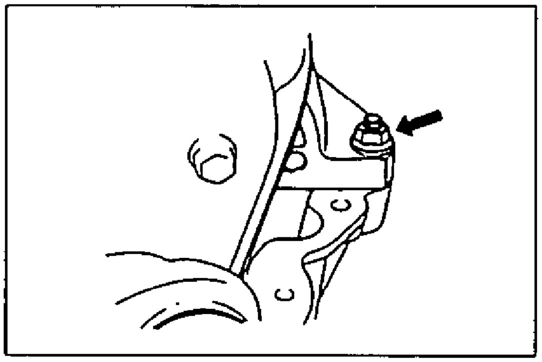
1. Lower plate

18) Remove clutch housing lower plate.

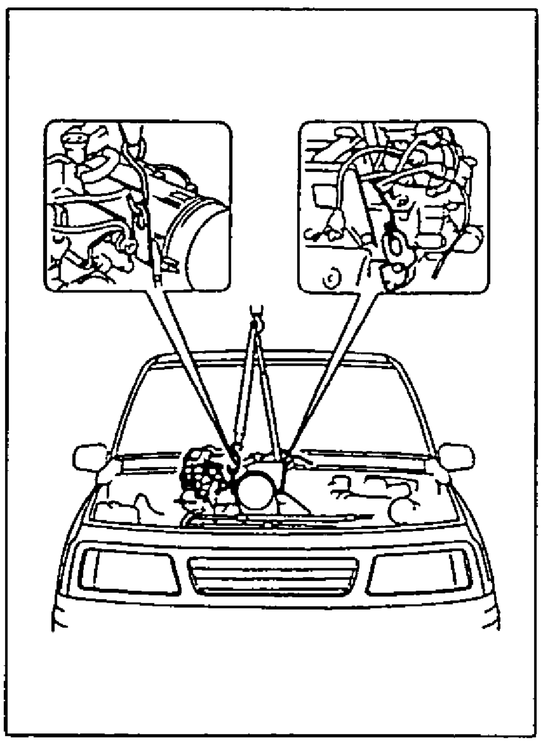


20) With hoses connected, detach power steering pump and/or A/C compressor with bracket from cylinder block, if equipped.

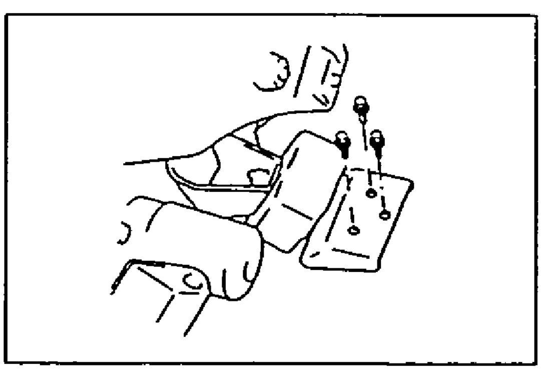
NOTE:
When installing bracket fasten bolt "A" first, then fasten other bolts.



21) Remove nuts fastening cylinder block and transmission.
22) Lower vehicle.
23) Support transmission with jack.

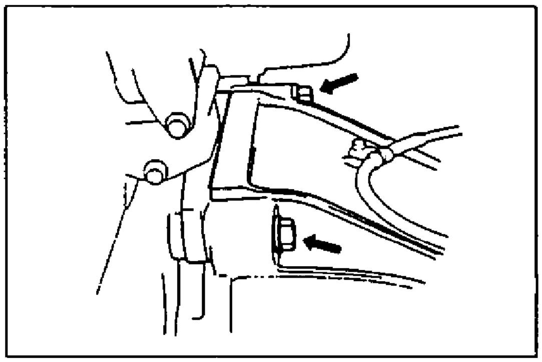


24) Install lifting device.

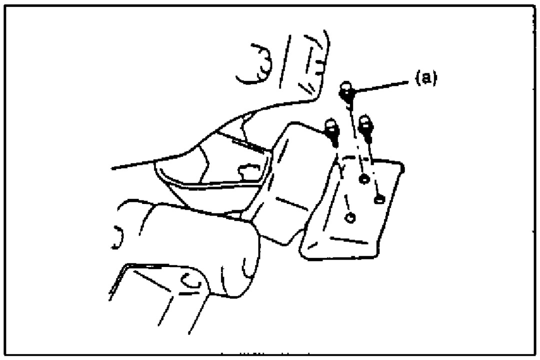


25) Remove right and left engine mounting bracket bolts.
26) Before lifting engine, check to ensure all hoses, electric wires and cables are disconnected from engine.
27) Remove engine assembly from chassis and transmission by sliding towards the front side, and then carefully hoist engine assembly.

INSTALLATION

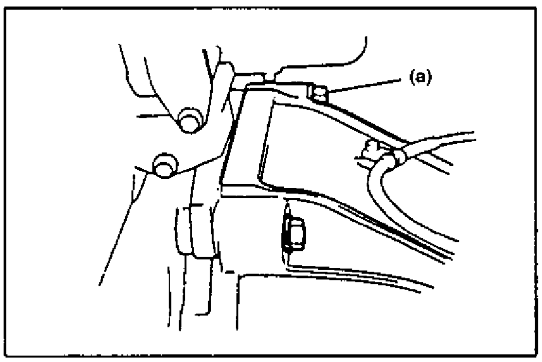


1) Lower engine assembly into engine compartment and connect engine to transmission.
   Hand-tighten bolts and nuts fastening cylinder block and transmission.



2) Tighten right and left engine mounting bracket bolts.

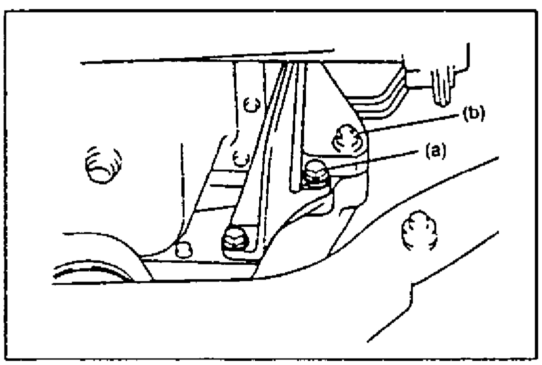
   Tighting Torque
   (a): 50 N·m (5.0 kg-m, 36.5 lb-ft)



3) Tighten bolts fastening cylinder block and transmission to specified torque.

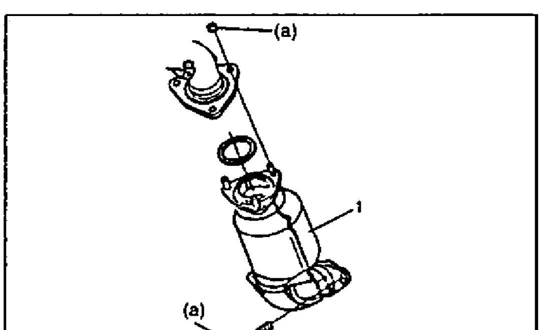
   Tightening Torque
   (a): 85 N·m (8.5 kg-m, 61.5 lb-ft)

4) Remove lifting device.



5) Reverse removal procedure for installation, noting the following.
   - Tighten nuts fastening cylinder block and transmission and transmission stiffener bolts to specified torque.

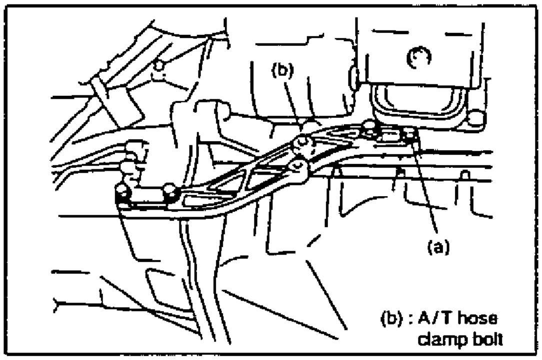
     Tightening Torque
     (a): 50 N·m (5.0 kg-m, 36.5 lb-ft)
     (b): 85 N·m (8.5 kg-m, 61.5 lb-ft)



1. Exhaust No.1 pipe

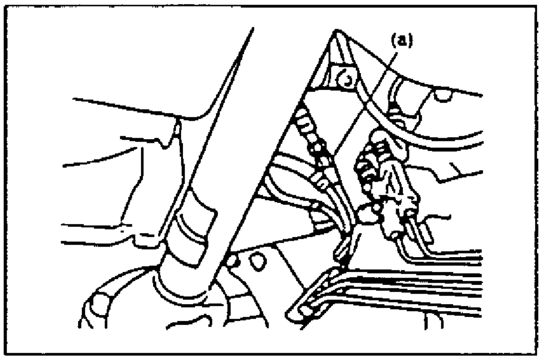
   - Tighten nuts and bolts of exhaust pipes to specified torque.

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



- Tighten transmission stiffener bolts (right side) to specified torque.

  Tightening Torque
  (a): 50 N·m (5.0 kg-m, 36.5 lb-ft)
  (b): 29 N·m (2.9 kg-m, 21.0 lb-ft)

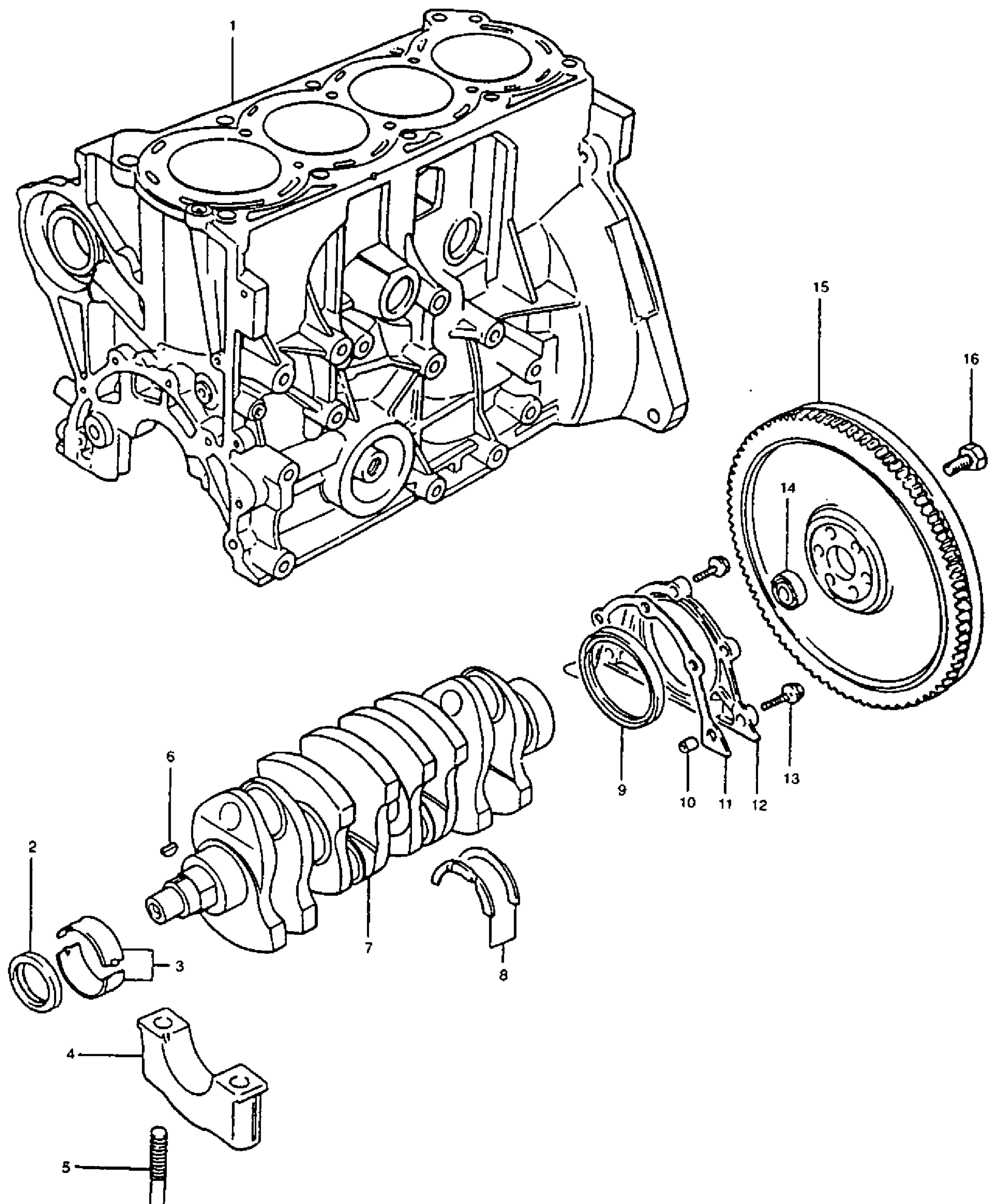


- Tighten flare nut of fuel feed pipe to specified torque. Be sure to use back-up wrench.

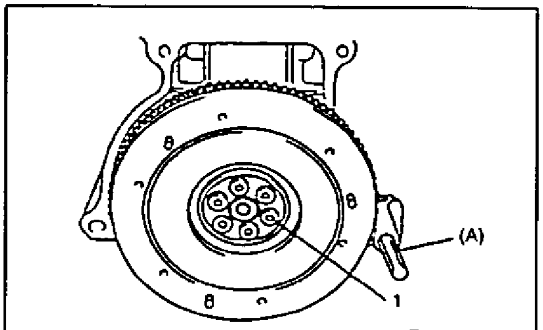
  Tightening Torque
  (a): 45 N·m (4.5 kg-m, 32.5 lb-ft)

6) Adjust water pump drive belt tension, referring to Section 6B.
7) Adjust power steering pump belt tension or A/C compressor belt tension, if equipped.
   Refer to Section 0B.
8) Adjust accelerator cable play, referring 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 engine with engine oil, referring to item "ENGINE OIL CHANGE" in Section 0B.
11) Refill cooling system referring to Section 6B.
12) Verify that there is no fuel leakage, coolant leakage and exhaust gas leakage at each connection.

MAIN BEARINGS, CRANKSHAFT AND CYLINDER BLOCK



1. Cylinder block
2. Front oil seal
3. Main bearing
4. Bearing cap
5. Cap bolt
6. Timing pulley key
7. Crankshaft
8. Thrust bearing
9. Rear oil seal
10. Pin
11. Oil seal housing gasket
12. Oil seal housing
13. Housing bolt
14. Input shaft bearing
15. Flywheel
16. Flywheel bolt

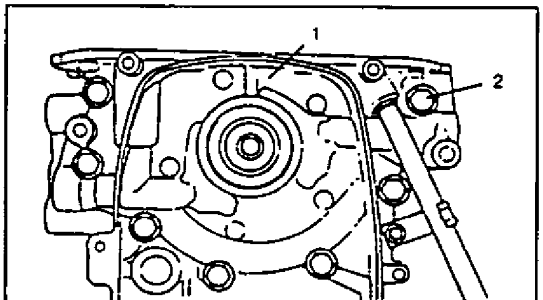


1. Flywheel bolt

REMOVAL

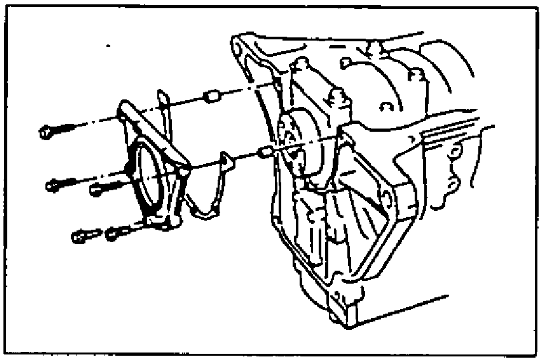
1) Remove engine assembly from body as previously outlined.
2) Remove clutch cover, clutch disc and flywheel.

Special Tool
(A): 09924-17810

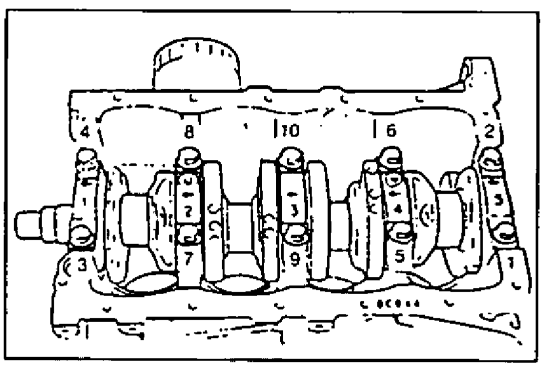


1. Oil pump
2. Bolt

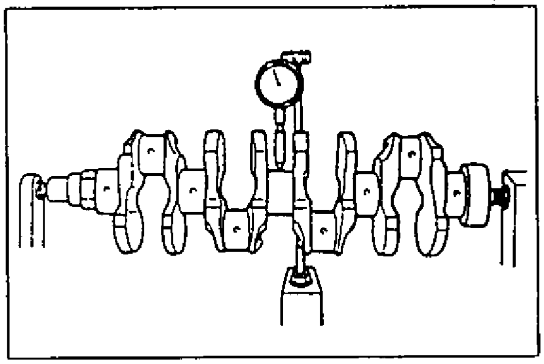
3) Remove crankshaft pulley, timing belt and crankshaft timing pulley.
4) Remove cylinder head assembly.
5) Remove oil pan and oil pump strainer.
6) Remove oil pump.



7) Remove oil seal housing.
8) Remove connecting rod bearing caps.



9) Loosen crankshaft bearing cap bolts in such order as indicated in figure a little at a time and remove bearing caps.
10) Remove crankshaft from cylinder block.



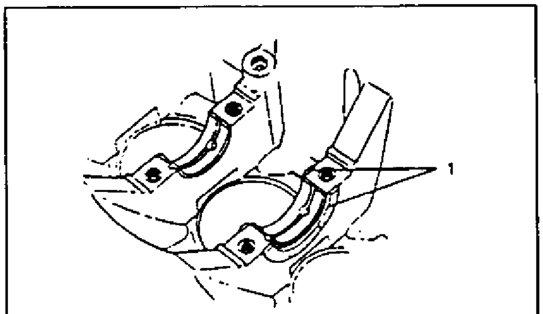
INSPECTION

Crankshaft

Crankshaft runout

Using a dial gauge, measure runout at center journal. Rotate crankshaft slowly. If runout exceeds its limit, replace crankshaft.

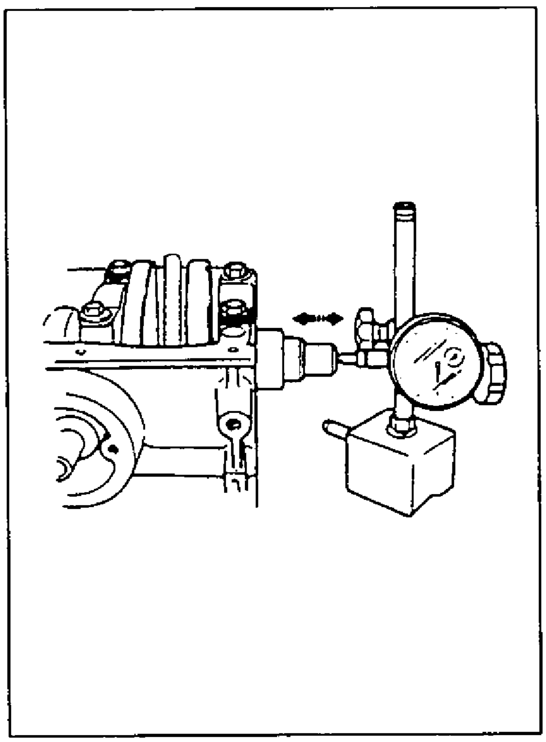
Limit on runout: 0.06 mm (0.0023 in.)



1. Thrust bearing

Crankshaft thrust play

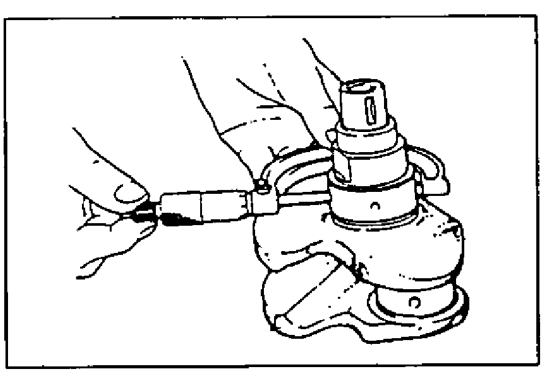
Measure this play with crankshaft set in cylinder block in the normal manner, that is, with thrust bearing and journal bearing caps installed.



Use a dial gauge to read displacement in axial (thrust) direction of crankshaft.
If its limit is exceeded, replace thrust bearing with new standard one or oversize one to obtain standard thrust play.

Item	Standard	Limit
Crankshaft thrust play	0.11 – 0.31 mm (0.0044 – 0.0122 in.)	0.38 mm (0.0149 in.)

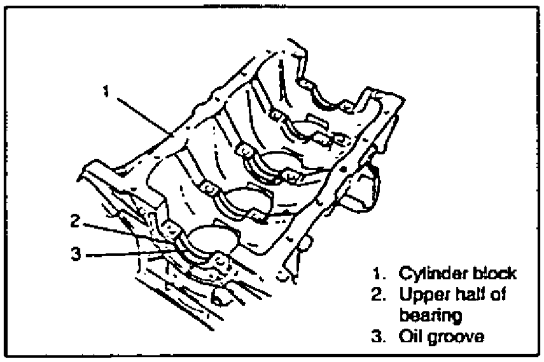
<table>
<tr><td rowspan="2">Thickness of crank-shaft thrust bearing</td><td colspan="2">Standard</td><td>2.500 mm (0.0984 in.)</td></tr>
<tr><td>Oversize:</td><td>0.125 mm (0.0049 in.)</td><td>2.563 mm (0.1009 in.)</td></tr>
</table>



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.

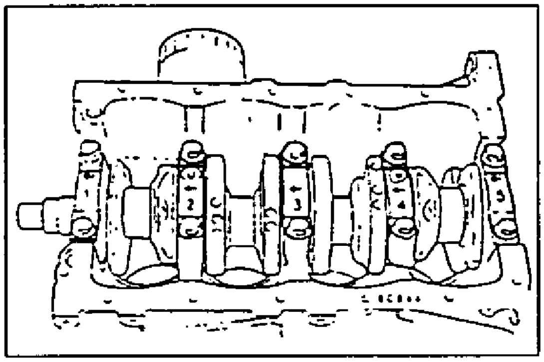
Limit on out-of-round and taper: 0.01 mm (0.0004 in.)



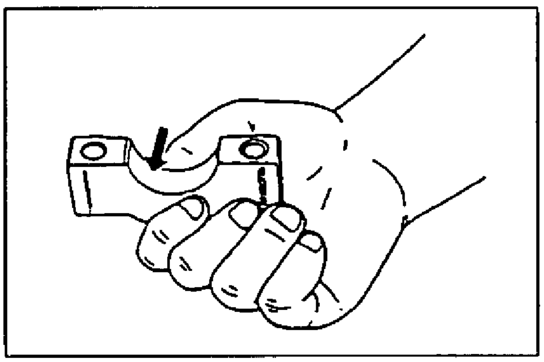
Main Bearings

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 has oil groove as shown in figure. Install this half with oil groove to cylinder block.

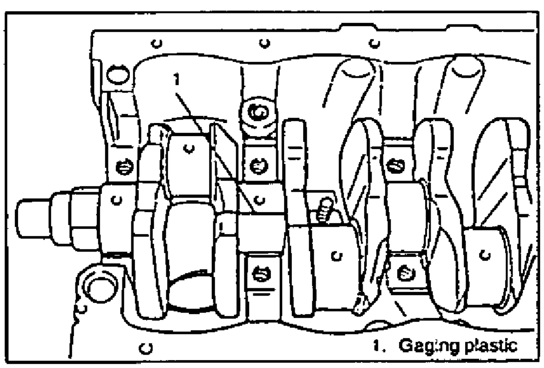


- On each main bearing cap, arrow mark and number are embossed as shown in figure.
  When installing each bearing cap to cylinder block, point arrow mark toward crankshaft pulley side and install each cap from that side to flywheel side in ascending order of numbers "1", "2", "3", "4" and "5". Tighten cap bolts to specified torque.



Inspection

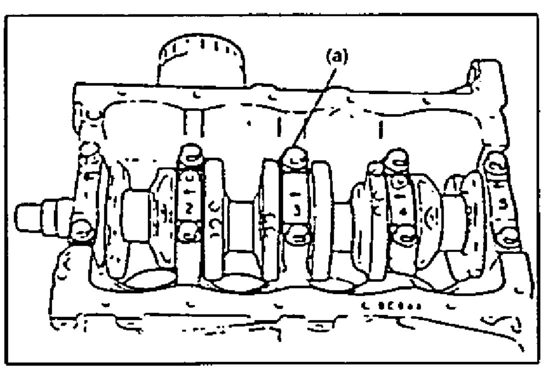
Check bearings for pitting, scratches, wear or damage.
If any malcondition is found, replace both upper and lower halves. Never replace one half without replacing the other half.



Main bearing clearance

Check clearance by using gaging plastic according to following procedure.

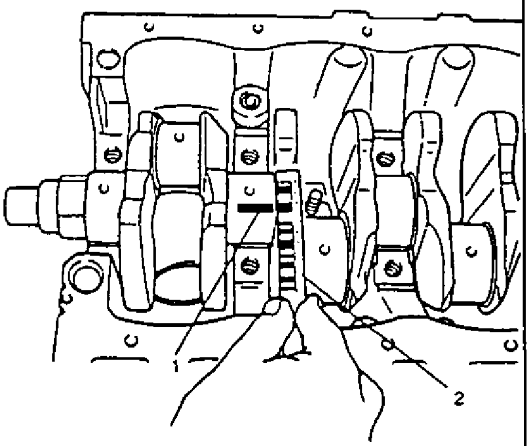
1) Remove bearing caps.
2) Clean bearings and main journals.
3) Place a piece of gaging plastic to full width of bearing (parallel to crankshaft) on journal, avoiding oil hole.



4) Install bearing cap as previously outlined and evenly toque cap bolts to specified torque.
   Bearing cap MUST be torqued to specification in order to assure proper reading of clearance.

   Tightening Torque
   (a): 54 N·m (5.4 kg-m, 39.0 lb-ft)

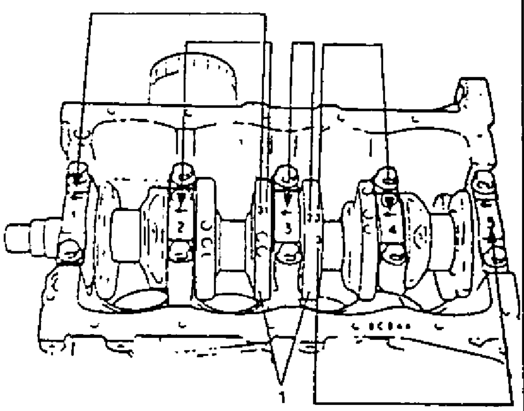
   NOTE:
   Do not rotate crankshaft while gaging plastic is installed.



1. Gaging plastic
2. Scale

5) Remove cap and using scale on gaging plastic envelope, measure gaging plastic width at its widest point. If clearance exceeds its limit, replace bearing. Always replace both upper and lower inserts as a unit.
   A new standard bearing may produce proper clearance. If not, it will be necessary to regrind crankshaft journal for use of 0.25 mm undersize bearing.
   After selecting new bearing, recheck clearance.

	Standard	Limit
Bearing clearance	0.020 – 0.040 mm (0.0008 – 0.0016 in.)	0.060 mm (0.0023 in.)



1. Crank webs of No.2 and No.3 cylinders

Selection of main bearings

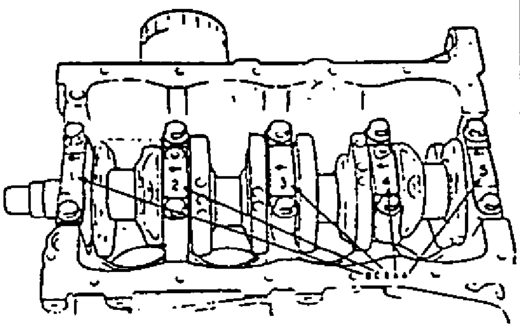
STANDARD BEARING:

If bearing is in malcondition, or bearing clearance is out of specification, select a new standard bearing according to following procedure and install it.

1) First check journal diameter by using following procedure.
   As shown in figure, crank webs of No.2 and No.3 cylinders have five stamped numerals.
   Three kinds of numerals ("1", "2" and "3") represent following journal diameters.

Numeral stamped	Journal diameter
1	51.994 – 52.000 mm (2.0470 – 2.0472 in.)
2	51.988 – 51.994 mm (2.0468 – 2.0470 in.)
3	51.982 – 51.988 mm (2.0465 – 2.0468 in.)

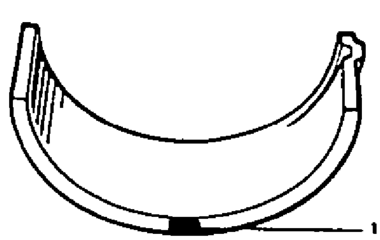
The first, second, third, fourth and fifth (left to right) stamped numerals represent journal diameters at bearing caps "1", "2", "3", "4" and "5" respectively.
For example, in figure, the first (leftmost) numeral "3" indicates that journal dia. at bearing cap "1" is within 51.982 – 51.988 mm, and second one "1" indicate that journal dia. at cap "2" is within 51.994 – 52.000 mm.



2) Next, check bearing cap bore diameter without bearing. On mating surface of cylinder block, four alphabets are stamped as shown in figure.
Three kinds of alphabets ("A", "B" and "C") represent following cap bore diameters.

Alphabet stamped	Bearing cap bore diameter (without bearing)
A	56.000 – 56.006 mm (2.2047 – 2.2050 in.)
B	56.006 – 56.012 mm (2.2050 – 2.2052 in.)
C	56.012 – 56.018 mm (2.2052 – 2.2054 in.)

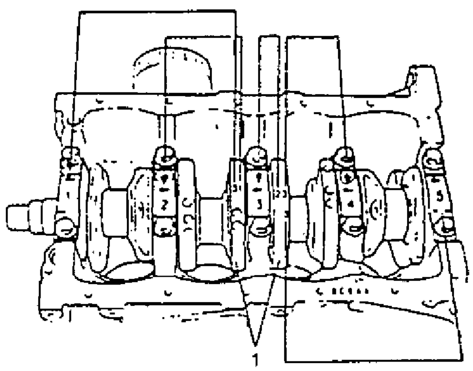
The first, second, third, fourth and fifth (left to right) stamped alphabets represent cap bore diameters of bearing caps "1", "2", "3", "4" and "5", respectively.
For example, in figure, the first (leftmost) alphabet "B" indicates that cap bore dia. of bearing cap "1" is within 56.006 – 56.012 mm, and the fifth (rightmost) alphabet "A" indicates that cap bore dia. of cap "5" is within 56.000 – 56.006 mm.



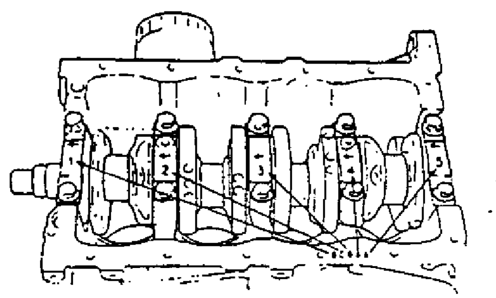
1. Paint

3) There are five kinds of standard bearings differing in thickness. To distinguish them, they are painted in following colors at the position as indicated in figure.
Each color indicates following thickness at the center of bearing.

Color painted	Bearing thickness
Green	1.996 – 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.)

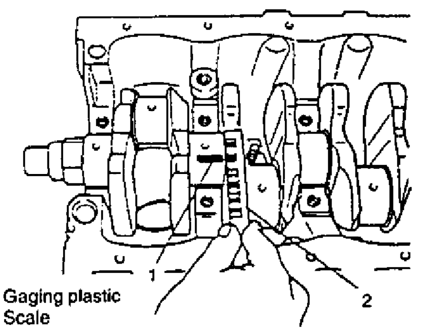


1. Crank webs of No.2 and No.3 cylinders



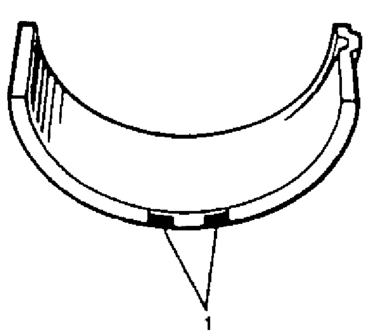
4) From numerals stamped on crank webs of No.2 and No.3 cylinders and the alphabets stamped on mating surface of cylinder block, determine new standard bearing to be installed to journal, by referring to table given below.
For example, if numeral stamped on crank web is "1" and alphabet stamped on mating surface is "B", install a new standard bearing painted in "Black" to its journal.

		Numeral stamped on crank web (Journal diameter)		
		1	2	3
Alphabet stamped on mating surface (Bearing cap bore dia.)	A	Green	Black	Colorless
	B	Black	Colorless	Yellow
	C	Colorless	Yellow	Blue
		New standard bearing to be installed.		



1. Gaging plastic
2. Scale

5) Using gaging plastic, check bearing clearance with newly selected standard bearing.
If clearance still exceeds its limit, use next thicker bearing and recheck clearance.
6) When replacing crankshaft or cylinder block due to any reason, select new standard bearings to be installed by referring to numerals stamped on new crankshaft or alphabets stamped on mating surface of new cylinder block.



1. Paint

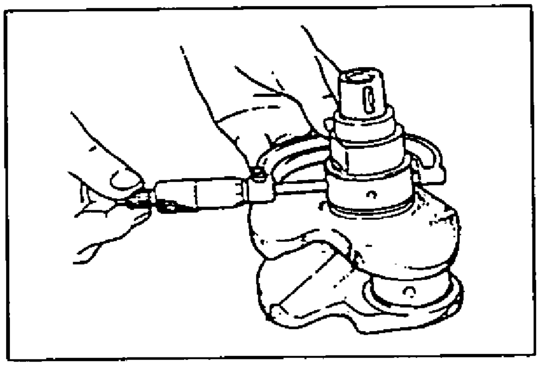
UNDERSIZE BEARING (0.25 mm):

- 0.25 mm undersize bearing is available, in five kinds varying in thickness.
  To distinguish them, each bearing is painted in following colors at such position as indicated in figure.
  Each color represents following 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.)

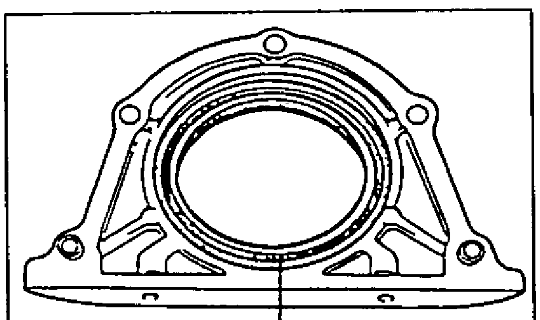
- If necessary, regrind crankshaft journal and select under-size bearing to use with it as follows.
  1) Regrind journal to following finished diameter.

  Finished diameter: 51.732 – 51.750 mm (2.0367 – 2.0373 in.)



2) Using micrometer, measure reground journal diameter. Measurement should be taken in two directions perpendicular to each other in order to check for out-of-round.
3) Using journal diameter measured above and alphabets stamped on mating surface of cylinder block, select an under-size bearing by referring to table given below. Check bearing clearance with newly selected under-size bearing.

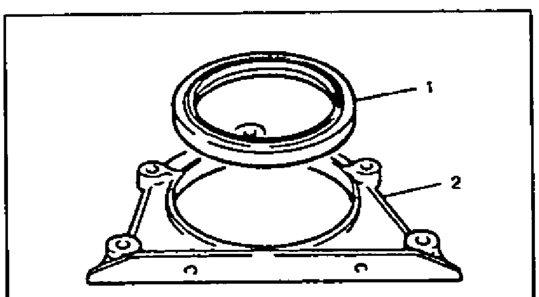
		Measured journal diameter		
		51.744 – 51.750 mm (2.0371 – 2.0373 in.)	51.738 – 51.744 mm (2.0369 – 2.0371 in.)	51.732 – 51.738 mm (2.0367 – 2.0369 in.)
Alphabets stamped on mating surface of cylinder block	A	Green & Red	Black & Red	Red only
	B	Black & Red	Red only	Yellow & Red
	C	Red only	Yellow & Red	Blue & Red
		Under-size bearing to be installed		



1. Rear oil seal

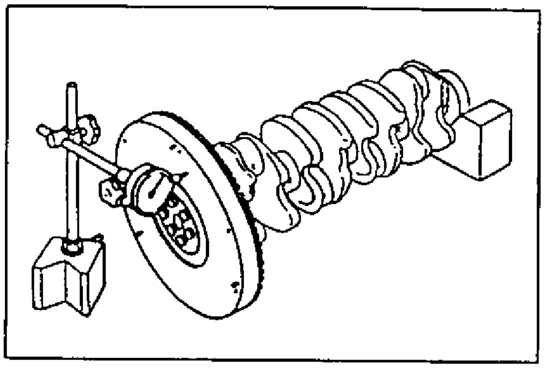
Rear Oil Seal

Carefully inspect oil seal for wear or damage. If its lip is worn or damaged, replace it.



1. Oil seal
2. Oil seal housing

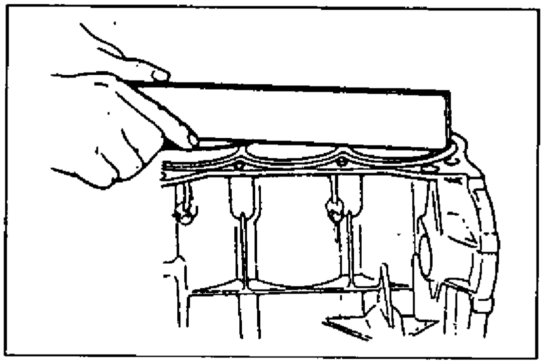
For oil seal installation, press-fit rear oil seal so that oil seal housing end face is flush with oil seal end face.



Flywheel

- If ring gear is damaged, cracked or worn, replace flywheel.
- If the surface contacting clutch disc is damaged, or excessively worn, replace flywheel.
- Check flywheel for face runout with dial gauge.
  If runout exceeds its limit, replace flywheel.

Limit on runout: 0.2 mm (0.0078 in.)



Cylinder Block

Distortion of gasketed surface

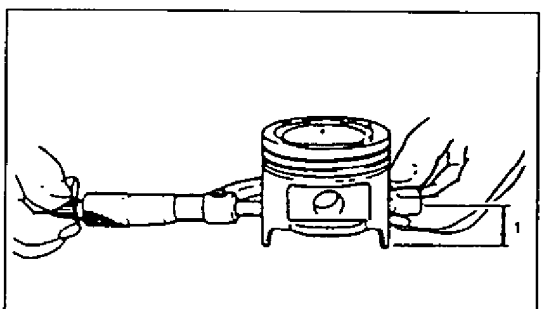
Using straightedge and thickness gauge, check gasketed surface for distortion and, if flatness exceeds its limit, correct it.

Item	Standard	Limit
Flatness	0.03 mm (0.0012 in.)	0.06 mm (0.0024 in.)

Honing or reboring cylinders

1) When any cylinder needs reboring, all other cylinders must also be rebored at the same time.
2) Select oversized piston according to amount of cylinder wear.

Size	Piston diameter
O/S 0.25	75.220 – 75.230 mm (2.9614 – 2.9618 in.)
O/S 0.50	75.470 – 75.480 mm (2.9712 – 2.9716 in.)



1. 15 mm (0.59 in.)

3) Using micrometer, measure piston diameter.

4) Calculate cylinder bore diameter to be rebored.

$D = A + B - C$

D: Cylinder bore diameter to be rebored.

A: Piston diameter as measured.

B: Piston clearance = 0.02 – 0.04 mm (0.0008 – 0.0015 in.)

C: Allowance for honing = 0.02 mm (0.0008 in.)

5) Rebore and hone cylinder to calculated dimension.

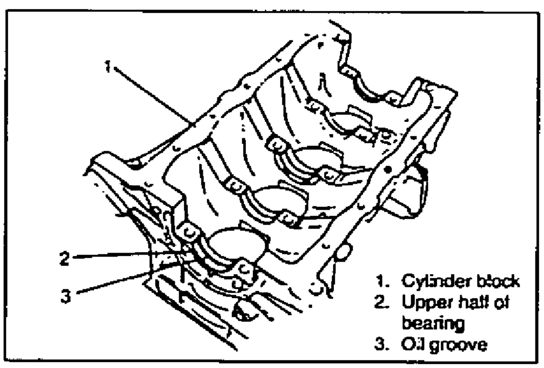
NOTE:
Before reboring, install all main bearing caps in place and tighten to specification to avoid distortion of bearing bores.

6) Measure piston clearance after honing.

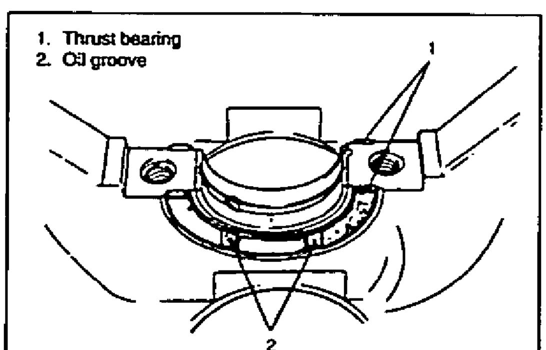
INSTALLATION

NOTE:

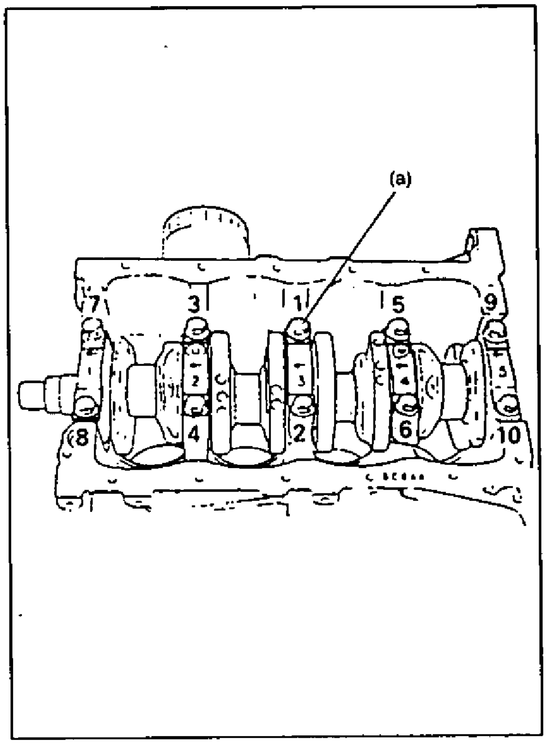
- **All parts to be installed must be perfectly clean.**
- **Be sure to oil crankshaft journals, journal bearings, thrust bearings, crankpins, connecting rod bearings, pistons, piston rings and cylinder bores.**
- **Journal bearings, bearing caps, connecting rods, rod bearings, rod bearing caps, pistons and piston rings are in combination sets. Do not disturb such combination and make sure that each part goes back to where it came from, when installing.**



1) Install main bearings to cylinder block.
One of two halves of main bearing, has an oil groove. Install it to cylinder block, and the other half without oil groove to bearing cap.
Make sure that two halves are painted in the same color.



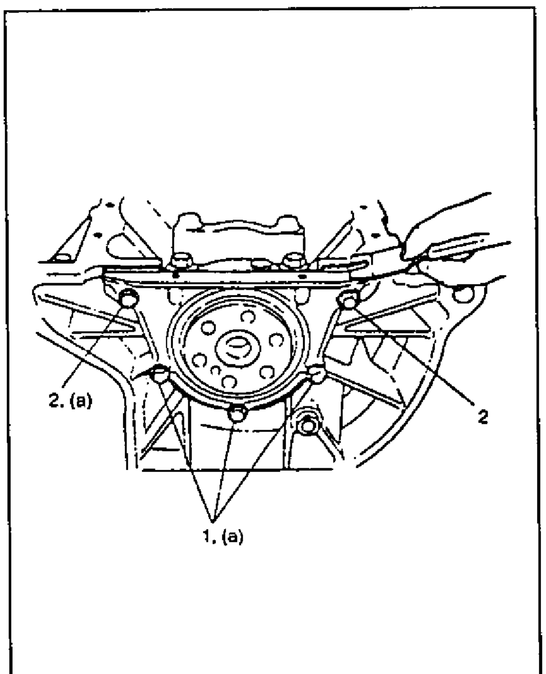
2) Install thrust bearings to cylinder block between No.2 and No.3 cylinders. Face oil groove sides to crank webs.



3) Install crankshaft to cylinder block.
4) Install bearing cap to cylinder block, making sure to point arrow mark (on each cap) to crankshaft pulley side. Fit them sequentially in ascending order, 1, 2, 3, 4 and 5, starting from pulley side.
   After installing bearing cap stiffeners, tighten bearing cap bolts in such order as shown in figure a little at a time and repeat it till they are tightened to specified torque.

   Tightening Torque
   (a): 54 N·m (5.4 kg-m, 39.0 lb-ft)

   NOTE:
   After tightening cap bolts, check to be sure that crankshaft rotates smoothly when turning it by 8.0 N·m (0.8 kg-m, 5.8 lb-ft) torque or below.



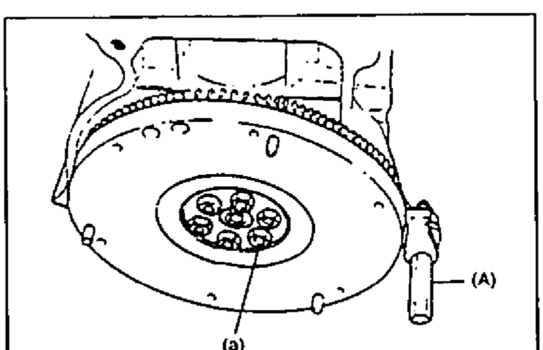
1. Short bolts
2. Long bolts

5) Install new gasket and oil seal housing.
   Do not reuse gasket removed in disassembly. Apply engine oil to oil seal lip before installation. Tighten housing bolts to specification.

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

   NOTE:
   As there are 2 types of housing bolts, refer to figure for their correct use.

   After installing oil seal housing, gasket edges might bulge out; if so, cut them off to make them flush with cylinder block and oil seal housing.
6) Install oil pump.
   Refer to item "Oil pump" for installation of oil pump.

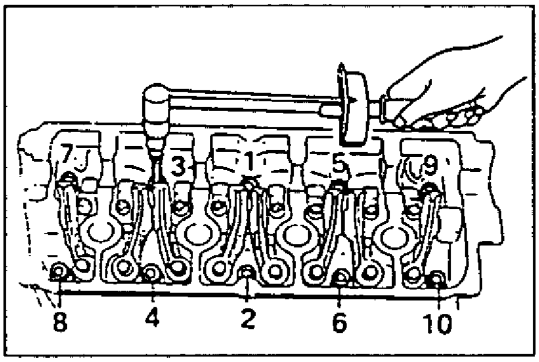


7) Install flywheel (M/T model) or drive plate (A/T model).
   Using special tool, lock flywheel or drive plate, and torque its bolts to specification.

   Special Tool
   (A): 09924-17810

   Tightening Torque
   (a): 78 N·m (7.8 kg-m, 56.5 lb-ft)

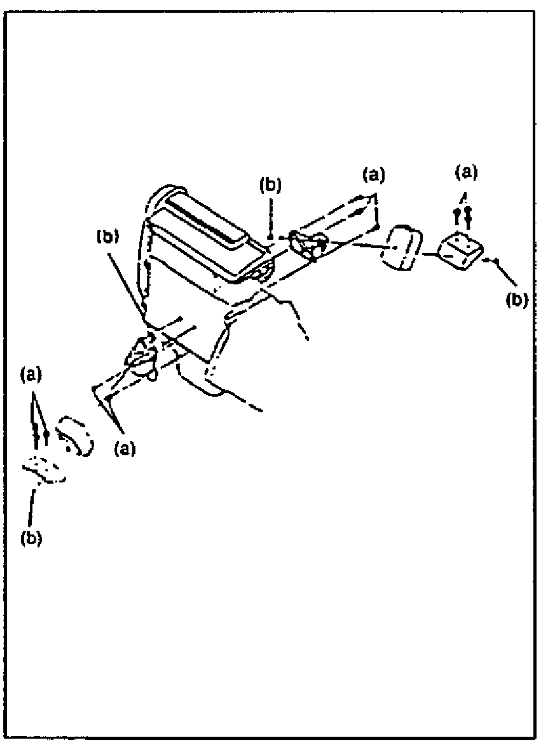
8) Install pistons and connecting rods as previously outlined.
9) Install oil pump strainer and oil pan as previously outlined.



10) Install cylinder head assembly to cylinder block as previously outlined.

    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 camshaft, crankshaft timing belt pulley, timing belt, crankshaft pulley, water pump pulley, etc., as previously outlined.
12) Install clutch to flywheel. For clutch installation, reffer to "CLUTCH" section.

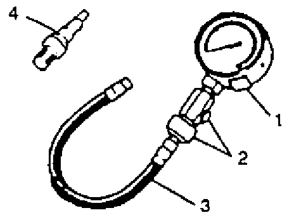
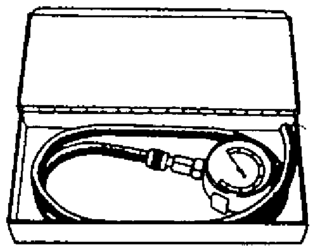
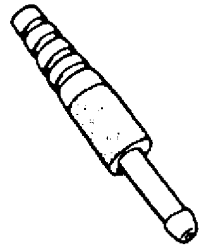
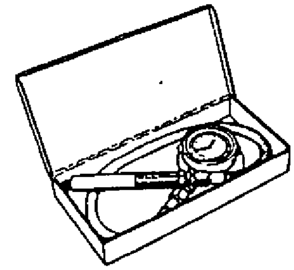
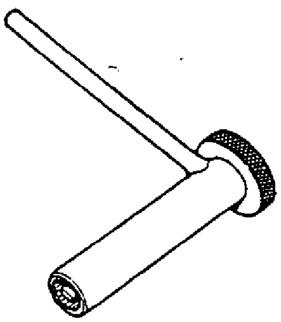
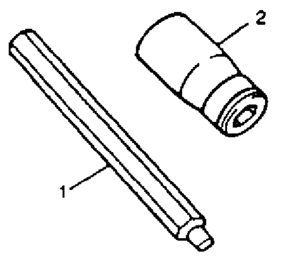
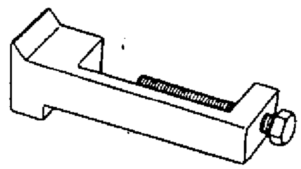
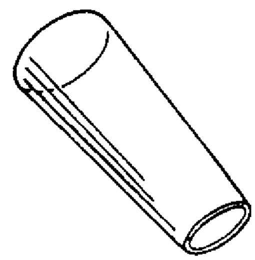
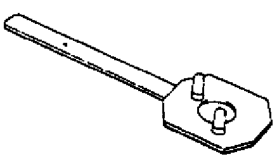
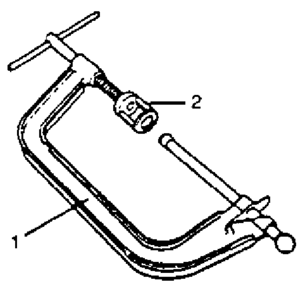
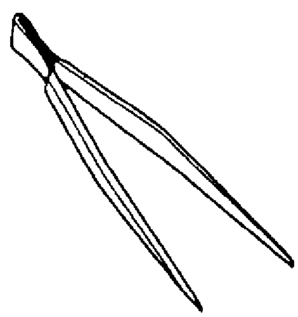
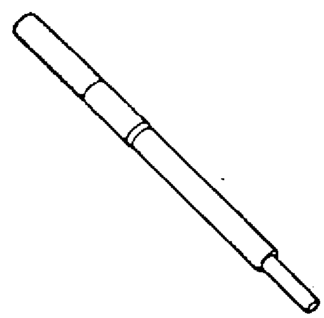
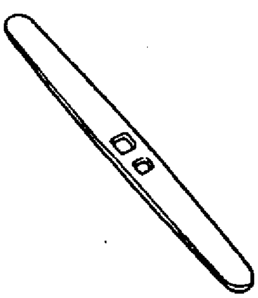
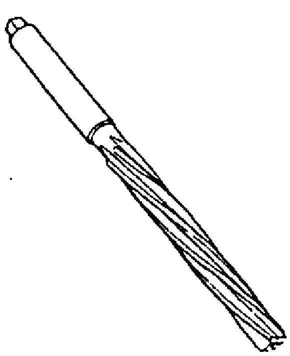
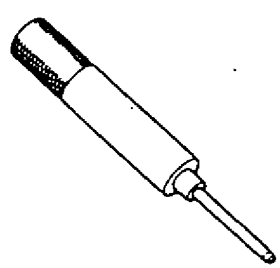
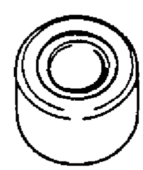


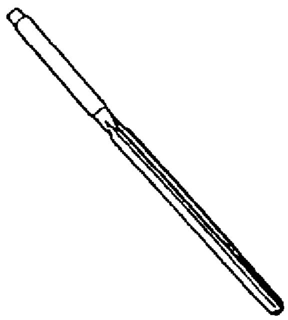
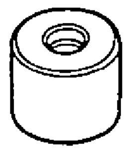
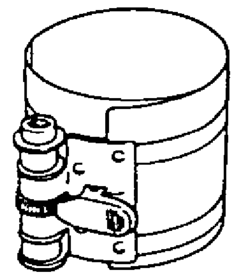
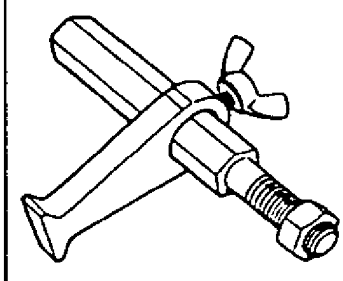
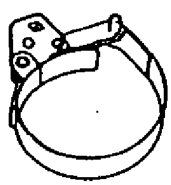
13) Install engine mountings and brackets.

    Tightening Torque
    (a): 50 N·m (5.0 kg-m, 36.5 lb-ft)
    (b): 45 N·m (4.5 kg-m, 32.5 lb-ft)

14) Install engine assembly to vehicle as previously outlined.

SPECIAL TOOLS

 1. 09915-64510-001 Compression gauge 2. 09915-64510-002 Connector 3. 09915-64530 Hose 4. 09915-67010 Attachment	 09915-67310 Vacuum gauge	 09918-08210 Vacuum gauge hose joint	 09915-77310 Oil pressure gauge
 09917-18210 Tappet adjuster wrench	 1. 09900-00415 8 mm hexagon wrench bit 2. 09900-00411 Hexagon wrench socket	 09927-56010 Gear stopper	 09926-18210 Oil seal guide (Vinyl resin)
 09917-68220 Camshaft pulley holder	 1. 09916-14510 Valve lifter 2. 09916-14910 Valve lifter attachment	 09916-84510 Forceps	 09916-44910 Valve guide remover
 09916-34541 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 distributor case and cylinder block.

TIGHTENING TORQUE SPECIFICATIONS

FASTENING PARTS	TIGHTENING TORQUE		
	N·m	kg-m	lb-ft
Oil pressure switch	14	1.4	10.5
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
Intake manifold stiffener bolts	50	5.0	36.5
Fuel feed pipe flare nut	45	4.5	32.5
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	23	2.3	17.0
Crankshaft pulley bolt	16	1.6	11.5
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
Oil pan drain plug	35	3.5	25.5
Transmission stiffener bolts	50	5.0	36.5
Oil pump rotor plate screws Oil pump case bolts	11	1.1	8.0
Crankshaft timing belt pulley bolt	130	13.0	94.0
Camshaft housing bolts Rocker arm shaft bolts	11	1.1	8.0
Rocker arm shaft plug	33	3.3	24.0
Camshaft timing belt pulley bolt	60	6.0	43.5
Cylinder head venturi plug	5	0.5	4.0
Cylinder head bolts	68	6.8	49.5
Connecting rod bearing cap nuts	35	3.5	25.5
Bolt and nuts fastening T/M and cylinder block	85	8.5	61.5
Torque converter bolts (A/T)	65	6.5	47.0
Crankshaft main bearing cap bolts	54	5.4	39.0
Flywheel bolts (Drive plate bolts for A/T)	78	7.8	56.5
Engine mounting & bracket bolts and nuts	Refer to p. 6A1-85.		

SECTION 6C

ENGINE FUEL

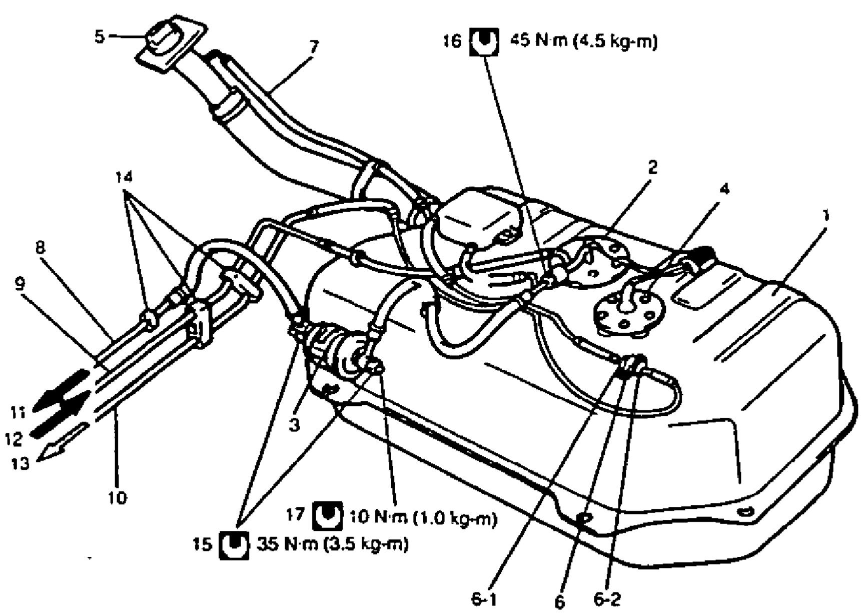
CONTENTS

CAUTION:
THE ENGINE OF THIS VEHICLE REQUIRES THE USE OF UNLEADED FUEL ONLY. USE OF LEADED AND/OR LOW LEAD FUEL CAN RESULT IN ENGINE DAMAGE AND REDUCE THE EFFECTIVENESS OF THE EMISSION CONTROL SYSTEMS.

GENERAL DESCRIPTION

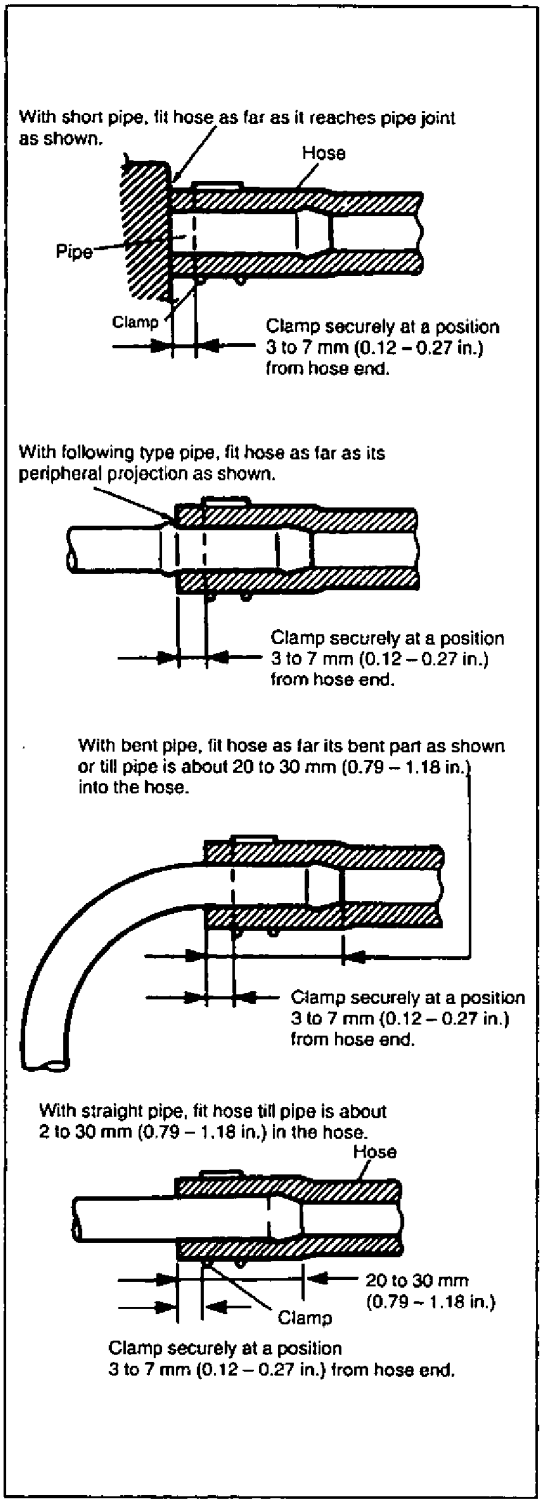
FUEL SYSTEM

The main components of the fuel system are fuel tank, fuel pump, fuel filter and fuel level gauge and it includes three lines, fuel feed line, fuel return line and fuel vapor line.
For the details of fuel flow and fuel vapor flow, refer to SECTION 6E "ENGINE AND EMISSION CONTROL SYSTEM".



1. Fuel tank
2. Fuel pump
3. Fuel filter
4. Fuel level gauge
5. Fuel filler cap
6. Tank pressure control valve
6-1. Black side
6-2. Orange side
7. Breather hose
8. Fuel feed line
9. Fuel return line
10. Fuel vapor line
11. To throttle body
12. From fuel pressure regulator
13. To canister
14. Clamp
15. Fuel filter union bolt
16. Fuel pipe flare nut
17. Plug bolt (For fuel pressure gauge mounting)

ON-VEHICLE SERVICE



WARNING:

Before attempting service of any type on fuel system, following cautions should be always observed.

- **Disconnect negative cable at battery.**
- **DO NOT smoke, and place "NO SMOKING" signs near work area.**
- **Be sure to have CO_2 fire extinguisher handy.**
- **Be sure to perform work in a well-ventilated area and away from any open flames (such as gas hot heater).**
- **Wear safety glasses.**
- **To release fuel vapor pressure in fuel tank, remove fuel filler cap from fuel filler neck and then reinstall it.**
- **As fuel feed line is still under high fuel pressure even after engine was stopped, loosening or disconnecting fuel feed line directly may cause dangerous spout of fuel to occur where loosened or disconnected. Before loosening or disconnecting fuel feed line, make sure to release fuel pressure according to procedure described on Section 6.**
- **A small amount of fuel may be released after the fuel line is disconnected.**
  In order to reduce the chance of personal injury, cover the fitting to be disconnected with a shop cloth. Put that cloth in an approved container when disconnection is completed.
- **Note that fuel hose connection varies with each type of pipe. Be sure to connect and clamp each hose correctly referring to the following.**

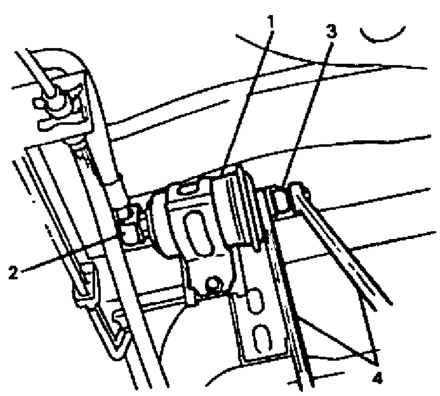
FUEL FILTER

REMOVAL

1) Relieve fuel pressure in fuel feed line referring to Section 6.

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

2) Disconnect negative cable at battery.
3) Hoist vehicle.

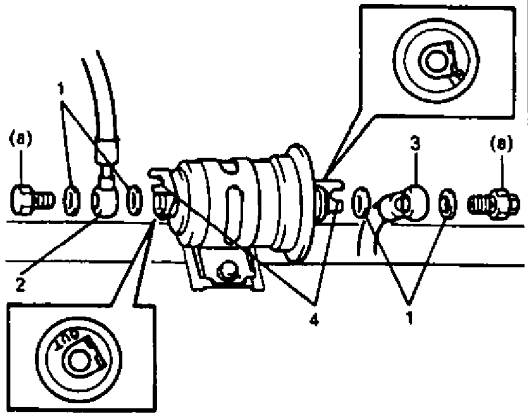


1. Fuel filter
2. Outlet pipe
3. Inlet pipe
4. Wrenches

4) Disconnect inlet and outlet pipes from fuel filter by using two wrenches.

> **WARNING:**
> **A small amount of fuel may be released after fuel line is disconnected. In order to reduce the chance of personal injury, cover the fitting to be disconnected with a shop cloth. Be sure to put that cloth in an approved container when disconnection is completed.**

5) Remove fuel filter from chassis frame.



1. Gasket
2. Outlet pipe
3. Inlet pipe
4. Recess

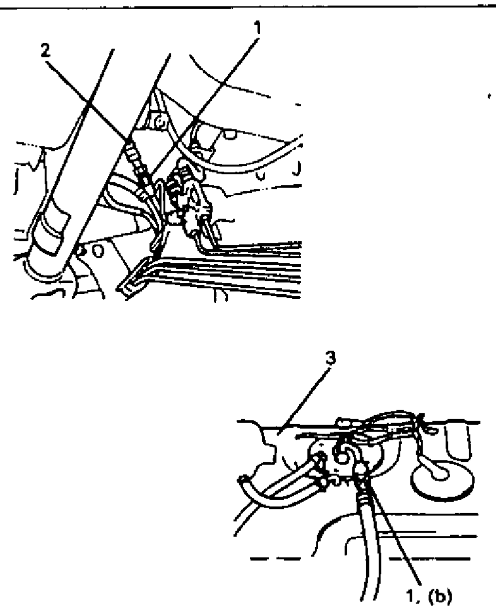
INSTALLATION

Reverse removal procedure noting the following.

- Use new gaskets.
- Make sure that gasketed surfaces are free from any damage.
- Inlet and outlet pipes should come into recess of plate as shown.
- Tighten union bolts to specified torque.

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

- Upon completion of installation, verify that there is no fuel leakage at each connection according to procedure described in Section 6.



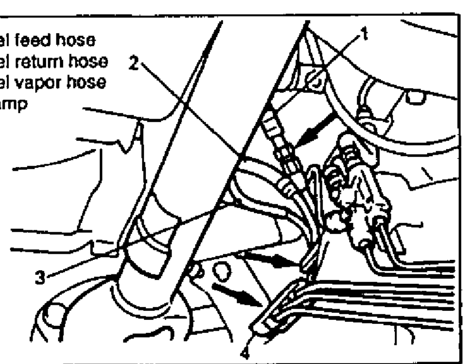
1. Flare nut
2. To throttle body
3. Fuel tank

FUEL LINES

Due to the fact that fuel feed line is under high pressure, this system requires special consideration for service.
The feed pipe uses screw couplings.
Any time these fittings are loosened to service or replace components, ensure that:

- Backup wrench is used while loosening and tightening fitting.
- Tighten fittings (flare nut) to specified torque.

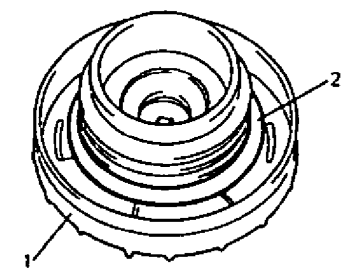
Tightening Torque
(b): 45 N·m (4.5 kg-m, 32.5 lb-ft)



1. Fuel feed hose
2. Fuel return hose
3. Fuel vapor hose
4. Clamp

INSPECTION

Visually inspect fuel lines for evidence of fuel leakage, hose cracking and deterioration, or damage. Make sure all clamps are secure. Replace parts as needed.



1. Fuel filler cap
2. Gasket

FUEL FILLER CAP

Remove cap, and check gasket for even filler neck imprint, and deterioration or any damage.
If gasket is in malcondition, replace cap.

NOTE:
If cap requires replacement, only a cap with the same features should be used. Failure to use correct cap can result in serious malfunction of the system.

FUEL TANK

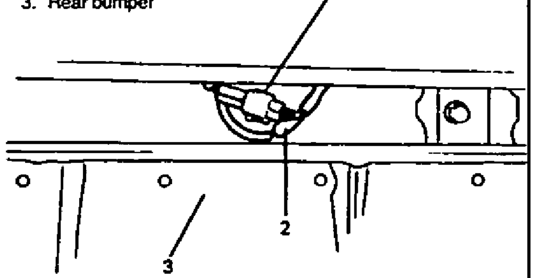
REMOVAL

1) Relieve fuel pressure in fuel feed line referring to Section 6.

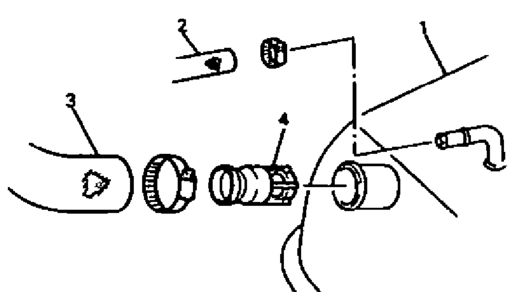
> **CAUTION:**
> **This work must not be done when engine is hot.**
> **If done so, it may cause adverse effect to catalyst.**

2) Disconnect negative cable at battery.

1. Fuel pump coupler
2. Fuel level gauge coupler
3. Rear bumper



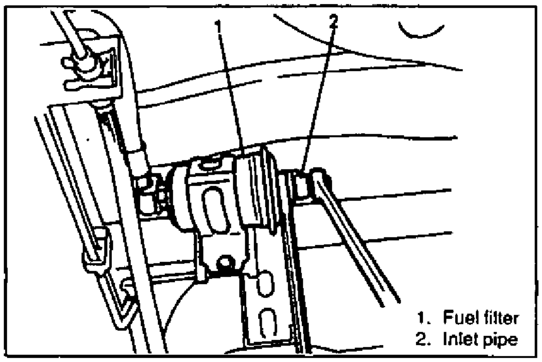
3) Disconnect fuel level gauge, fuel pump lead wire couplers and release harness clamp after removing rear bumper.



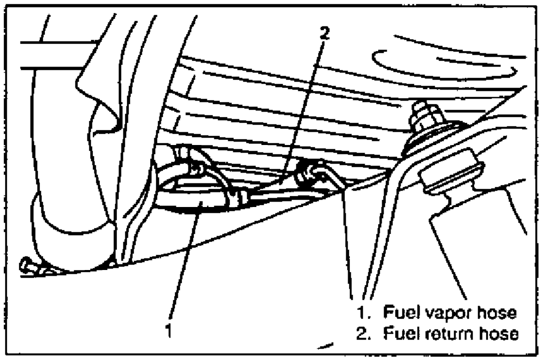
1. Tank
2. Breather hose
3. Filler hose
4. Inlet valve

4) Remove fuel tank filler hose cover.
   Then disconnect filler hose and breather hose from fuel tank.
5) Remove fuel tank inlet valve.
6) Due to absence of fuel tank drain plug, drain fuel tank by pumping fuel out through fuel tank filler.
   Use hand operated pump device to drain fuel tank.

> **CAUTION:**
> **Never drain or store fuel in an open container due to possibility of fire or explosion.**



7) Disconnect fuel filter inlet pipe from filter.



8) Disconnect fuel vapor hose and return hose from pipes.
9) Disconnect fuel pump, fuel level gauge lead wire couplers.
10) Remove fuel tank and protector from vehicle.

INSPECTION

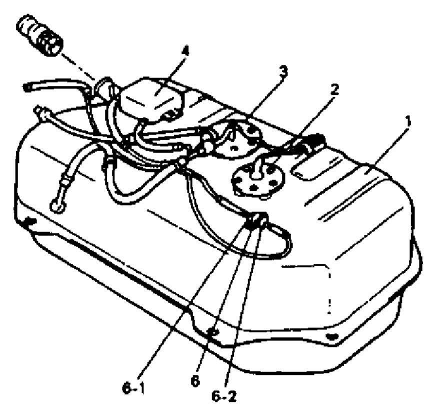
After removing fuel tank, check hoses and pipes connected to fuel tank for leaks, loose connections, deterioration or damage. Also check fuel pump and level gauge gaskets for leaks, visually inspect fuel tank for leaks and damage.
Replace any damaged or malconditioned parts.

FUEL TANK PURGING PROCEDURE

CAUTION:
This purging procedure will NOT remove all fuel vapor.
Do not attempt any repair on tank where heat or flame is required, as an explosion resulting in personal injury could occur.

The following procedure is used for purging the fuel tank.

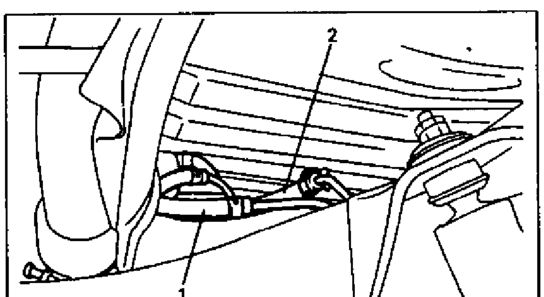
1) After removing fuel tank, remove all hoses, tank pressure control valve, fuel separator, fuel pump and fuel level gauge from fuel tank.
2) Drain all remaining fuel from tank.
3) Move tank to flushing area.
4) Fill tank with warm water or tap water, and agitate vigorously and drain. Repeat this washing until inside of tank is clean.
   Replace tank if its inside is rusty.
5) Completely flush out remaining water after washing.



1. Fuel tank
2. Fuel level gauge
3. Fuel pump
4. Fuel separator
5. Fuel cut valve
6. Tank pressure control valve
6-1. Black side
6-2. Orange side

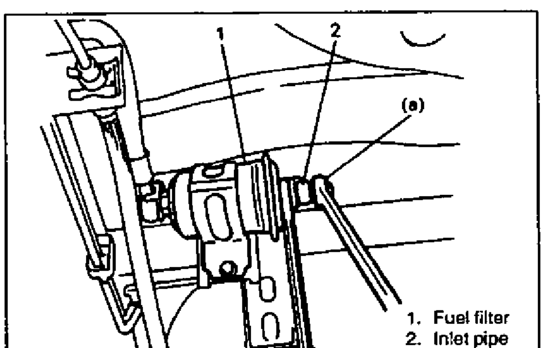
INSTALLATION

1) Install fuel pump, fuel level gauge, fuel cut valve to fuel tank. Use new gaskets and O-ring.
2) Install fuel separator, inlet valve and tank pressure control valve to fuel tank directing tank pressure control valve black nozzle toward fuel separator.
3) Connect fuel hoses to fuel tank, fuel pump, tank pressure control valve and separator.
   After connecting, clamp hoses securely, referring to p.6C-2.
4) Install fuel tank and protector to vehicle.
5) Connect fuel filler hose and breather hose to fuel filler neck. Clamp them securely.
6) Install fuel filler hose cover.



1. Fuel vapor hose
2. Fuel return hose

7) Connect fuel vapor hose and return hose to fuel pipe. Clamp them securely.



1. Fuel filter
2. Inlet pipe

8) Connect fuel filter inlet pipe to fuel filter.
   Use new gaskets and tighten union bolt to specification.

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

9) Connect fuel pump and level gauge couplers.
10) Install rear bumper cover.
11) Connect negative cable to battery.
12) Upon completion of installation, check fuel system for leakage.

SECTION 6E

ENGINE AND EMISSION CONTROL SYSTEM (SEQUENTIAL MULTIPORT FUEL INJECTION)

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).**

6E

CONTENTS

GENERAL DESCRIPTION

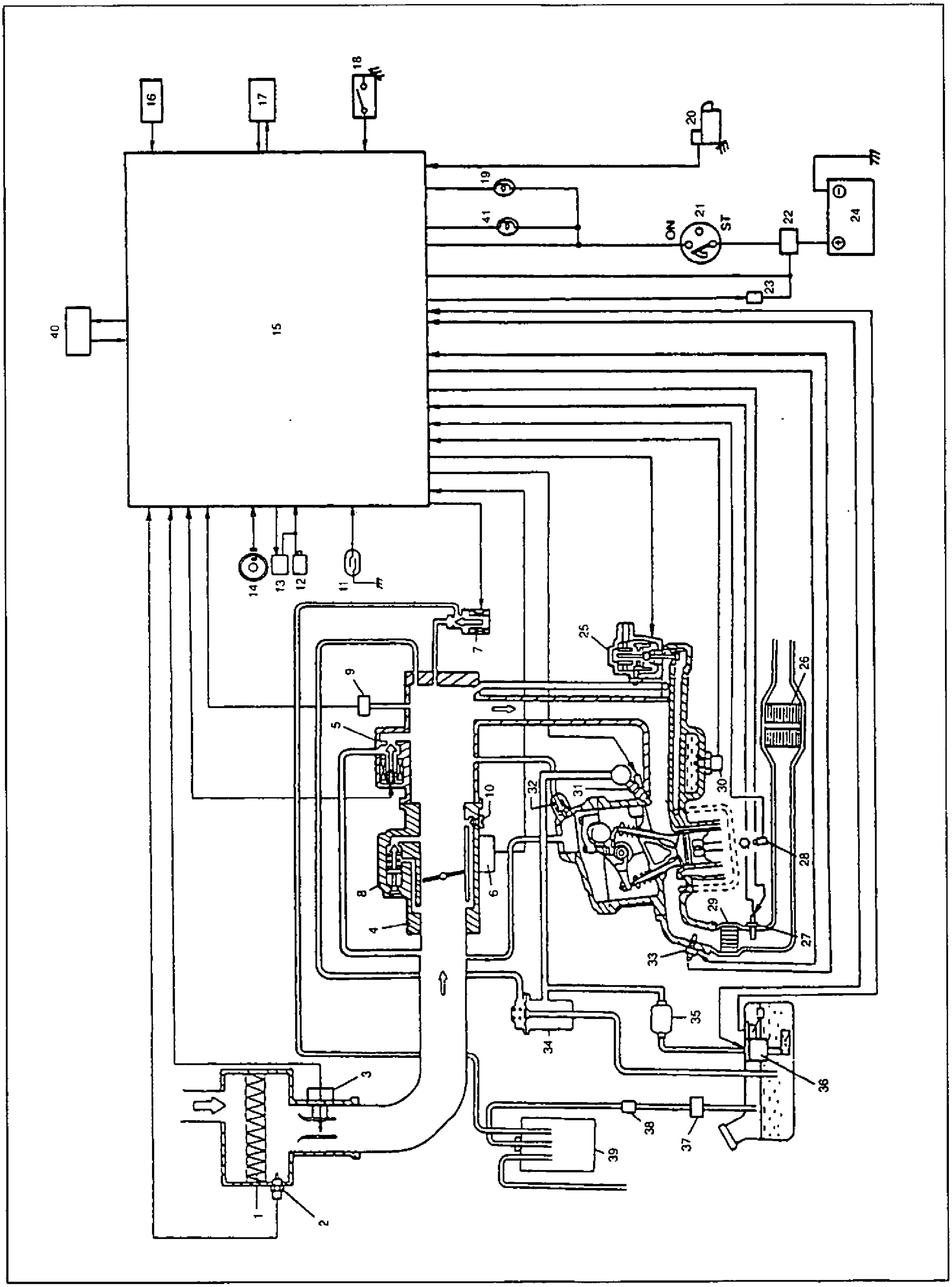
The engine and emission control system has 4 major sub-systems: air intake system, fuel delivery system, electronic control system and emission control system.

Air intake system includes air cleaner, mass air flow sensor, throttle body, fast idle air valve idle air control valve and intake manifold.

Fuel delivery system includes fuel pump, delivery pipe, fuel pressure regulator, fuel injectors, etc.

Electronic control system includes ECM, various sensors and controlled devices.

Emission control system includes EGR, EVAP and PCV systems.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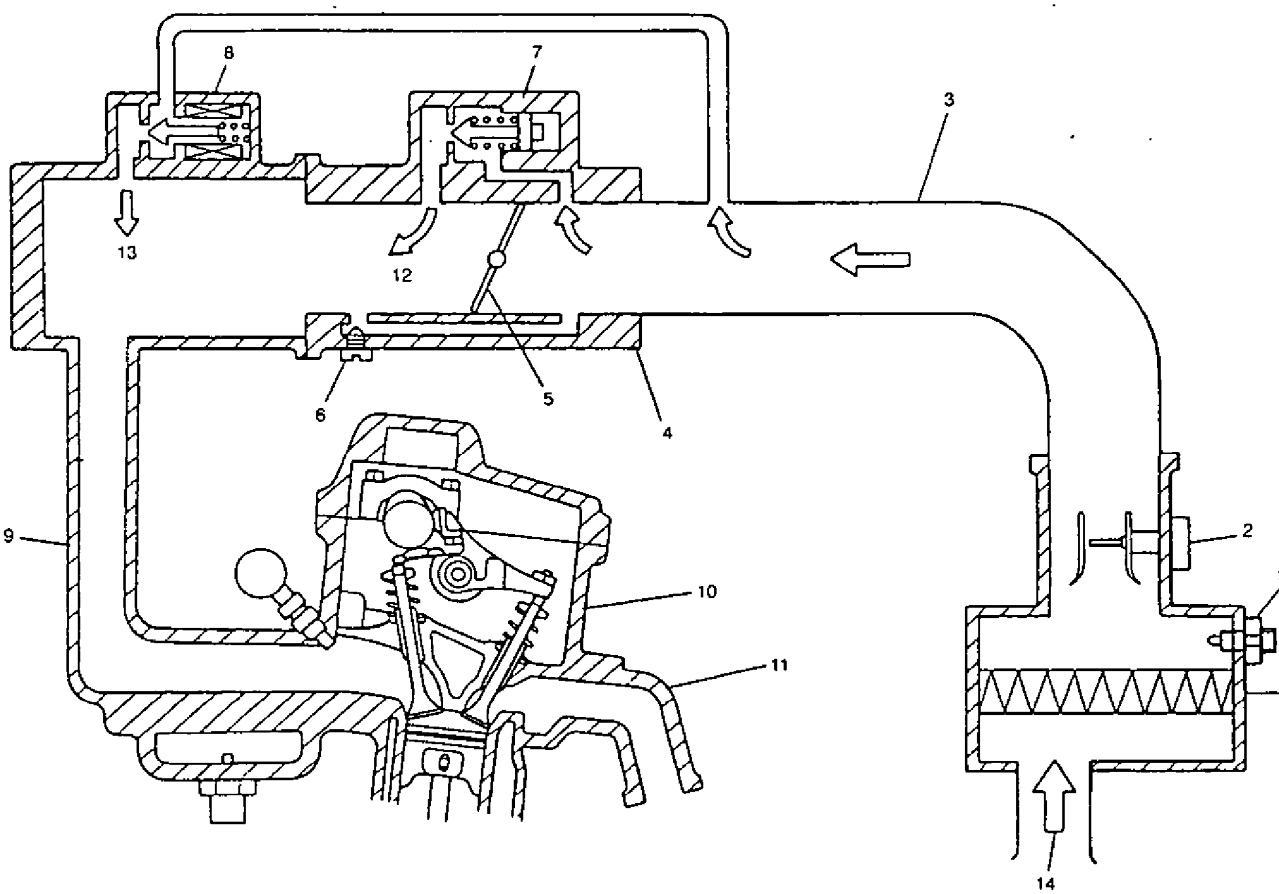
1. Air cleaner
2. Intake air temp. sensor
3. Mass air flow sensor
4. Throttle body
5. Idle air control valve
6. Throttle position sensor
7. EVAP canister purge valve
8. Fast idle air valve
9. Manifold differential pressure sensor
10. Idle speed adjusting screw
11. Vehicle speed sensor
12. Ignition coil
13. Igniter
14. Camshaft position sensor
15. ECM (Engine control module)
16. ABS control module (if equipped)
17. A/C control module (amplifier) (if equipped)
18. Power steering pressure switch (if equipped)
19. Malfunction indicator lamp
20. Starter
21. Ignition switch
22. Main fuse
23. Main relay
24. Battery
25. EGR valve
26. Three way catalytic converter
27. Heated oxygen sensor-2
28. Crankshaft position sensor
29. Warm up-three way catalytic converter
30. Engine coolant temp. sensor
31. Fuel injectors
32. PCV valve
33. Heated oxygen sensor-1
34. Fuel pressure regulator
35 Fuel filter
36. Fuel pump
37. Fuel separator
38. Check valve
39. EVAP canister
40. Data link connector
41. Immobilizer indicator lamp
42. Fuel level sensor

AIR INTAKE SYSTEM

The main components of the air intake system are air cleaner, mass air flow sensor, air intake pipe, throttle body, fast idle air valve, idle air control valve and intake manifold.
The air (by the amount corresponding to the throttle valve opening and engine speed) is filtered by the air cleaner, passes through the throttle body, is distributed by the intake manifold and finally drawn into each combustion chamber.

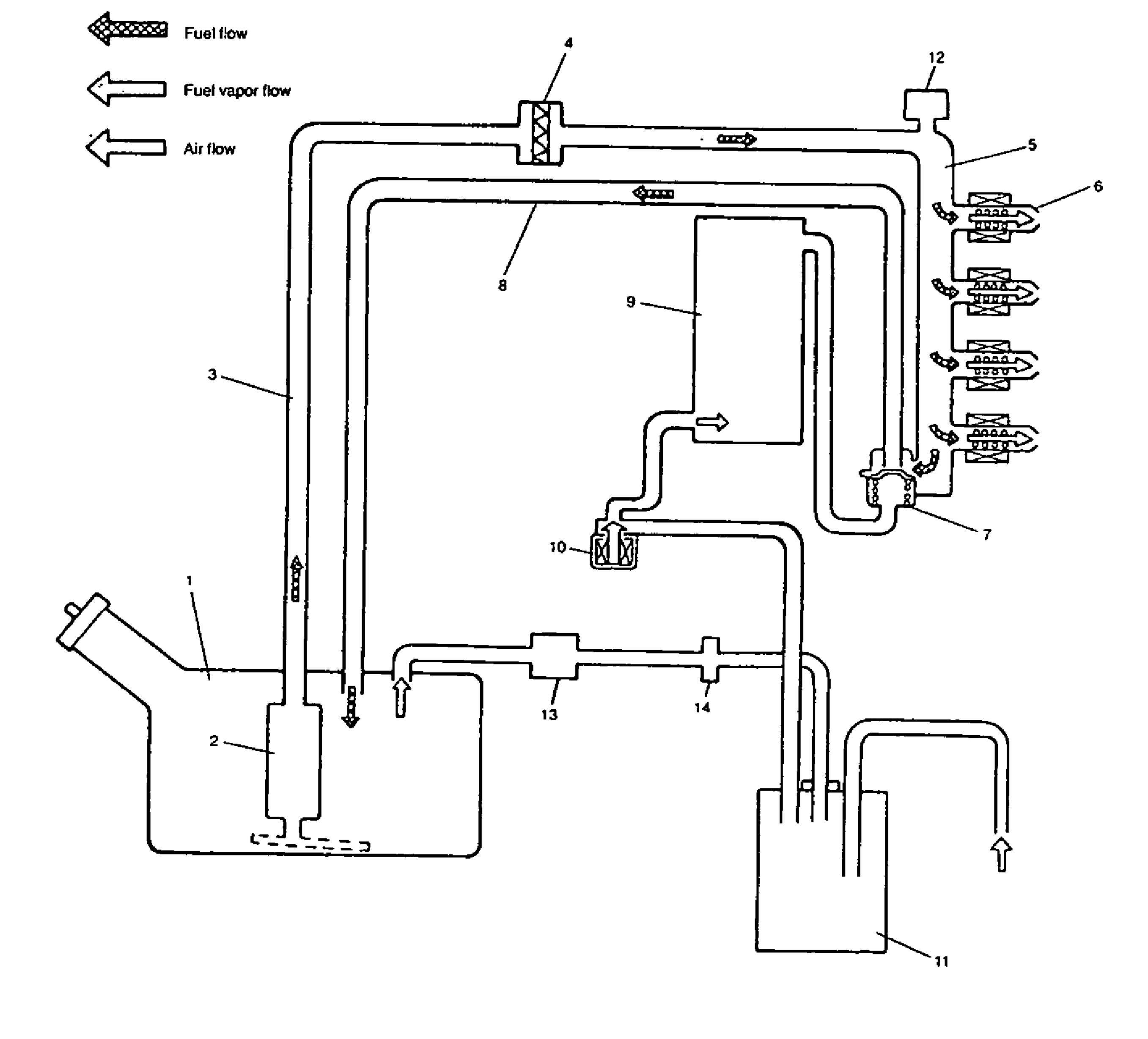
When the engine is idling, when it is cold or when the idle air control valve is opened according to the signal from ECM, the air bypasses the throttle valve through bypass passage which varies in each case and is finally drawn into the intake manifold.



1. Air cleaner
2. Mass air flow sensor (MAF sensor)
3. Air intake pipe
4. Throttle body
5. Throttle valve
6. Idle air adjusting screw
7. Fast idle air valve (FIA valve)
8. Idle air control valve (IAC valve)
9. Intake manifold
10. Cylinder head
11. Exhaust manifold
12. Air flow when engine cold
13. Air flow when idle air control valve open
14. Fresh air
15. Intake air temperature sensor

FUEL DELIVERY SYSTEM

The fuel delivery system consists of the fuel tank, fuel pump, fuel filter, fuel pressure regulator, delivery pipe, fuel pulsation damper and fuel injectors.
The fuel in the fuel tank is pumped up by the fuel pump, filtered by the fuel filter and fed under pressure to each injector through the delivery pipe.
As the fuel pressure applied to the injector (the fuel pressure in the fuel feed line) is always kept a certain amount higher than the pressure in the intake manifold by the fuel pressure regulator, the fuel is injected into the intake port of the cylinder head when the injector opens according to the injection signal from ECM.
The fuel relieved by the fuel pressure regulator returns through the fuel return line to the fuel tank.

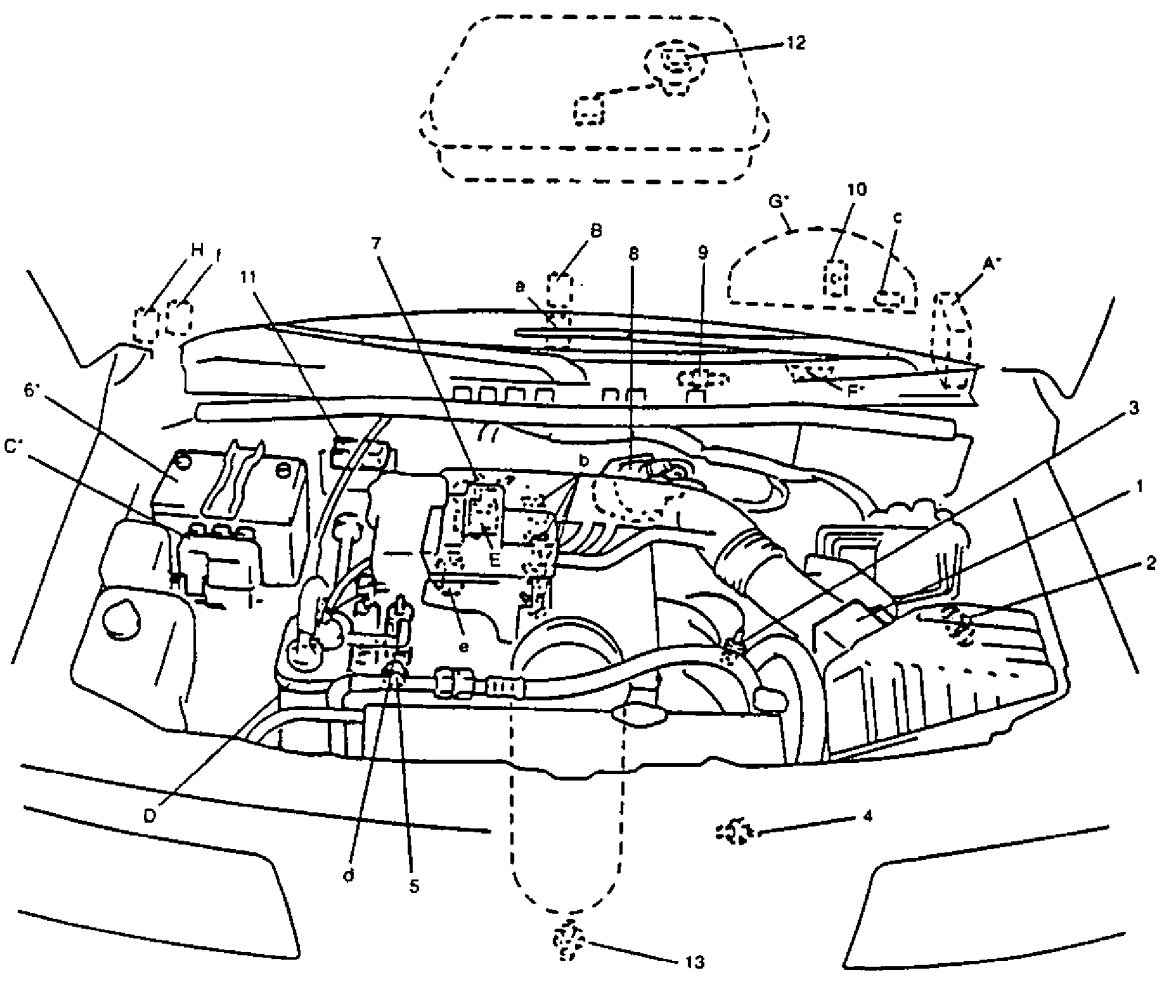


1. Fuel tank
2. Fuel pump
3. Fuel feed line
4. Fuel filter
5. Fuel delivery pipe
6. Fuel injectors
7. Fuel pressure regulator
8. Fuel return line
9. Intake manifold
10. EVAP canister purge valve
11. EVAP canister
12. Fuel pulsation damper
13. Fuel separator
14. Check valve

ELECTRONIC CONTROL SYSTEM

The electronic control system consists of 1) various sensors which detect the state of engine and driving conditions, 2) ECM which controls various devices according to the signals from the sensors and 3) various controlled devices.
Functionally, it is divided into the following sub systems:

- Fuel injection control system
- Heated oxygen sensor heater control system
- Idle air control system
- Fuel pump control system
- Evaporative emission control system
- Ignition control system
- EGR system

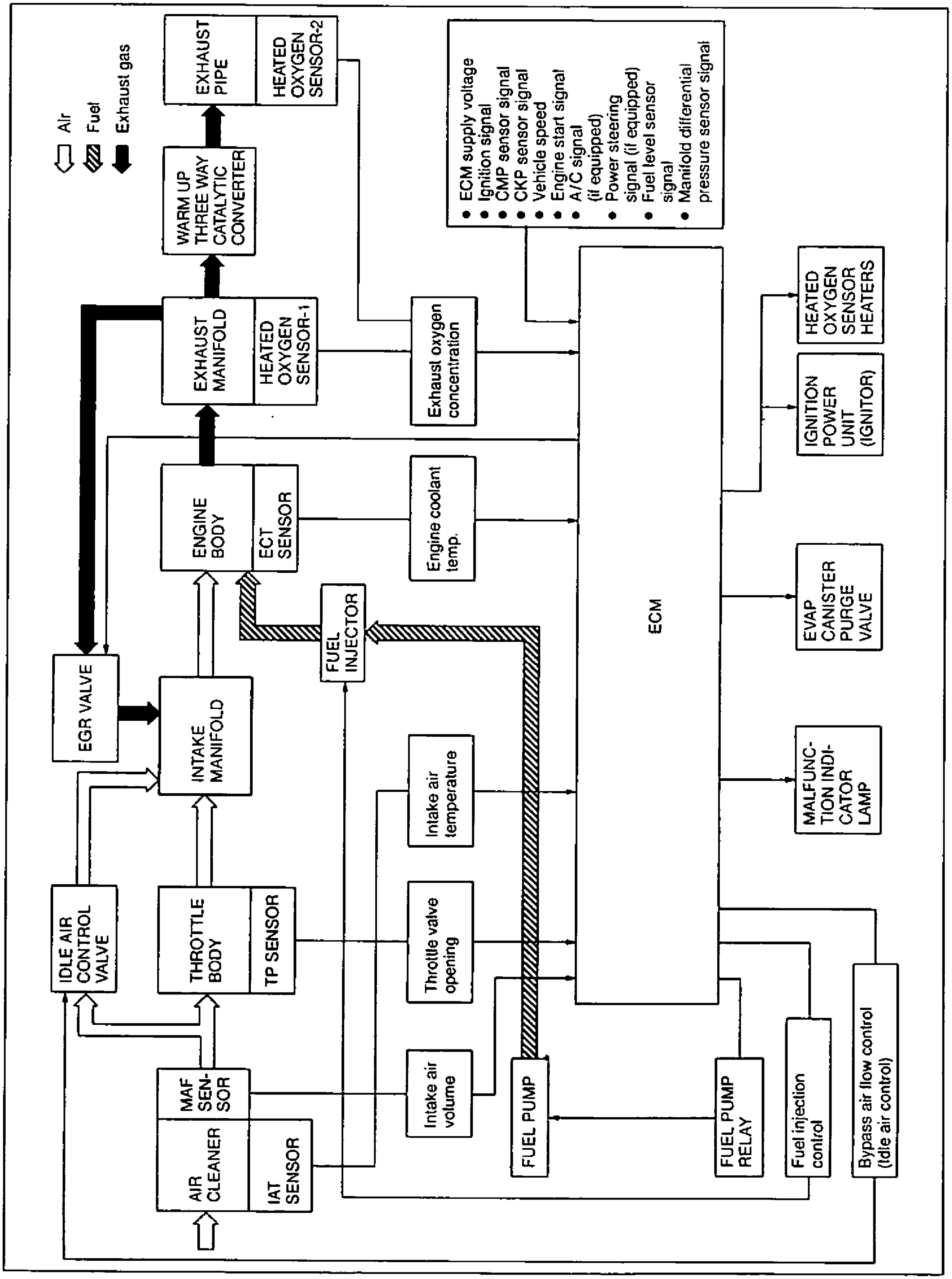


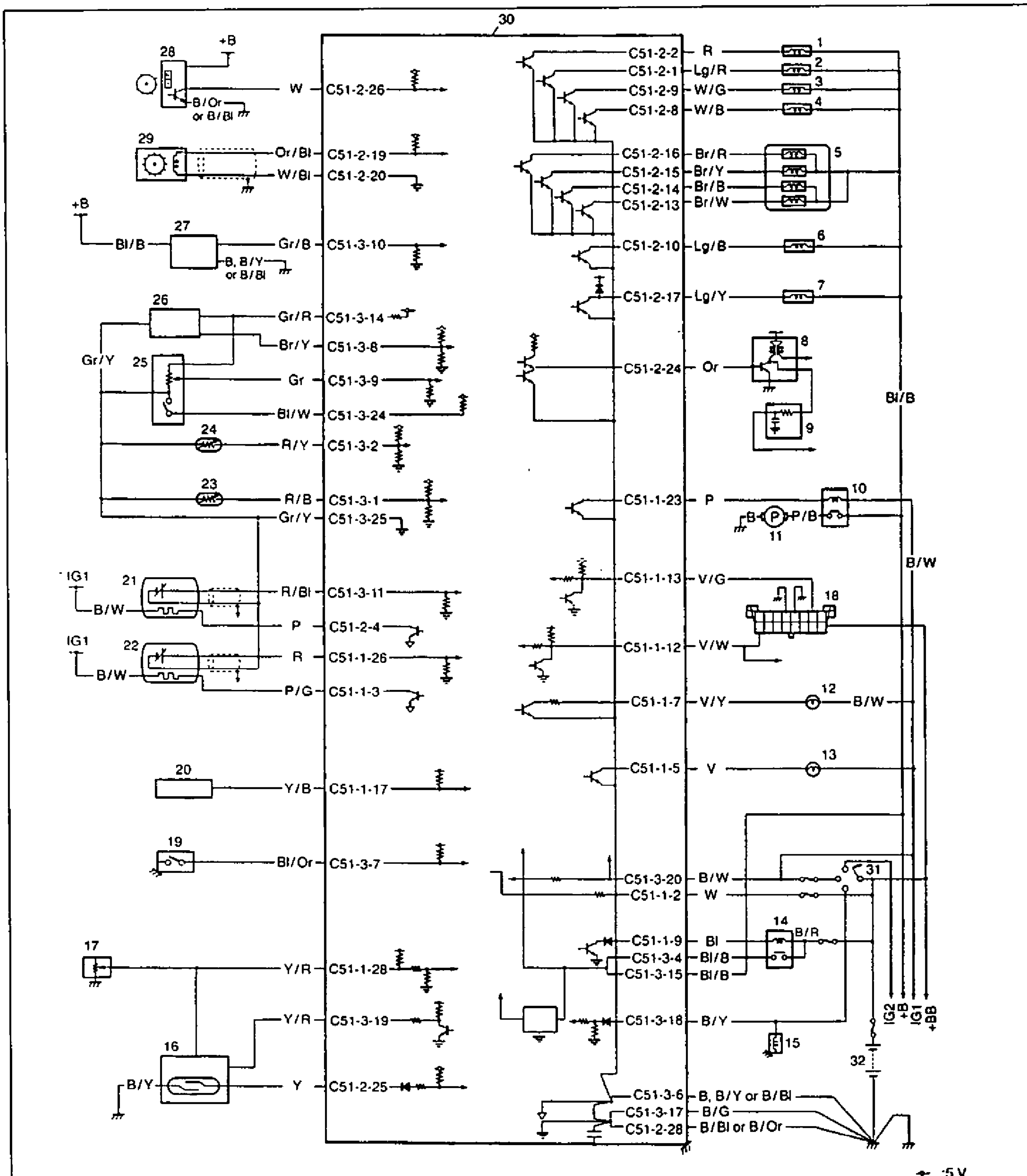
INFORMATION SENSORS
1. MAF sensor
2. IAT sensor
3. Heated oxygen sensor-1
4. PSP switch (if equipped)
5. ECT sensor
6. Battery
7. TP sensor
8. CMP sensor/Ignitor/Ignition coil (in distributor)
9. Heated oxygen sensor-2
10. VSS
11. Manifold differential pressure sensor
12. Fuel level sensor (gauge)
13. CKP sensor

CONTROLLED DEVICES
a : Fuel pump relay (left-hand steering)
b : Injector
c : MIL
d : EVAP canister purge valve
e : Idle air control valve
f : Fuel pump relay (right-hand steering)

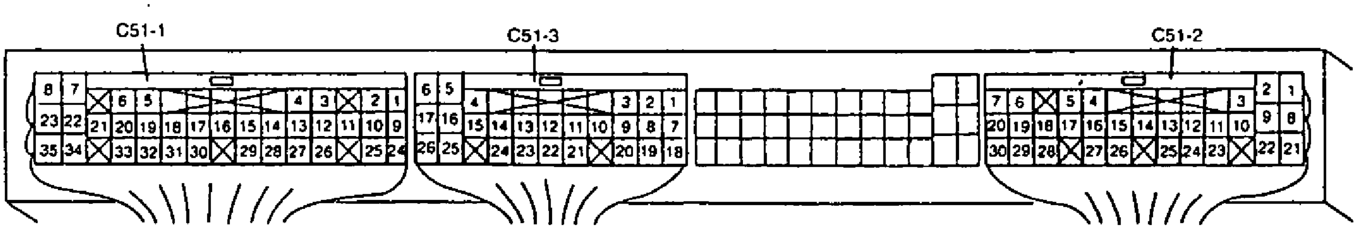
OTHERS
A : ECM
B : Main relay (left-hand steering)
C : Fuse box
D : EVAP canister
E : EGR valve
F : Data link connector
G : Combination meter
H : Main relay (right-hand steering)

NOTE:
Above figure shows left-hand steering vehicle. For right-hand steering vehicle, parts with (*) are installed at the other side.


Air
Fuel
Exhaust gas
EXHAUST PIPE
HEATED OXYGEN SENSOR-2
WARM UP THREE WAY CATALYTIC CONVERTER
EXHAUST MANIFOLD
HEATED OXYGEN SENSOR-1
ENGINE BODY
ECT SENSOR
EGR VALVE
INTAKE MANIFOLD
FUEL INJECTOR
IDLE AIR CONTROL VALVE
THROTTLE BODY
TP SENSOR
MAF SEN-SOR
AIR CLEANER
IAT SENSOR
Exhaust oxygen concentration
Engine coolant temp.
Intake air temperature
Throttle valve opening
Intake air volume
FUEL PUMP
FUEL PUMP RELAY
Fuel injection control
Bypass air flow control (Idle air control)
ECM
ECM supply voltage
Ignition signal
CMP sensor signal
CKP sensor signal
Vehicle speed
Engine start signal
A/C signal (if equipped)
Power steering signal (if equipped)
Fuel level sensor signal
Manifold differential pressure sensor signal
HEATED OXYGEN SENSOR HEATERS
IGNITION POWER UNIT (IGNITOR)
EVAP CANISTER PURGE VALVE
MALFUNC-TION INDI-CATOR LAMP



TERMINAL ARRANGEMENT OF ECM CONNECTOR (VIEWED FROM HARNESS SIDE)



1. Fuel injector No.1
2. Fuel injector No.2
3. Fuel injector No.3
4. Fuel injector No.4
5. EGR valve
6. Idle air control (IAC) valve
7. EVAP canister purge valve
8. Ignition coil/igniter (in distributor)
9. Noise suppressor
10. Fuel pump relay
11. Fuel pump
12. Malfunction indicator lamp
13. Immobilizer indicator lamp
14. Main relay
15. Starter magnetic switch
16. Vehicle speed sensor (in combination meter)
17. Fuel level sensor
18. Data link connector
19. Power steering pressure switch
20. A/C control module (amplifier) (if equipped)
21. Heated oxygen sensor-1
22. Heated oxygen sensor-2
23. Intake air temp. sensor
24. Engine coolant temp. sensor
25. Throttle position sensor
26. Manifold differential pressure sensor
27. Mass air flow sensor
28. Camshaft position sensor (in distributor)
29. Crankshaft position sensor
30. Engine control module
31. Ignition switch
32. Battery

	TERMINAL	CIRCUIT
C51-1	1	—
	2	Power source for back up
	3	Heater of HO2S-2
	4	—
	5	Immobilizer indicator lamp
	6	—
	7	MIL
	8	—
	9	Main relay
	10-11	—
	12	Data link connector (5 V)
	13	Data link connector (12 V)
	14-16	—
	17	A/C signal (if equipped)
	18-22	—
	23	Fuel pump relay
	24-25	—
	26	Heated oxygen sensor-2
	27	—
	28	Fuel level sensor
	29	—
C51-3	1	Intake air temp. sensor
	2	Engine coolant temp. sensor
	3	—
	4	Power source
	5	—
	6	Ground
	7	Power steering pressure switch
	8	Manifold differential pressure sensor
	9	Throttle position (TP) sensor
	10	Mass air flow (MAF) sensor
	11 -	Heated oxygen sensor-1
	12-13	—
	14	Power source for manifold differential pressure sensor
	15	Power source
	16	—
	17	Ground
	18	Engine start signal
	19	—
	20	Ignition switch
	21-23	—
	24	Closed throttle position switch
	25	Ground for IAT, ECT, TP and MAP sensors
	26	—

	TERMINAL	CIRCUIT
C51-2	1	Fuel injector No.2
	2	Fuel injector No.1
	3	—
	4	Heater of HO2S-1
	5-7	—
	8	Fuel injector No.4
	9	Fuel injector No.3
	10	IAC valve
	11-12	—
	13	EGR valve (stepper motor coil 4)
	14	EGR valve (stepper motor coil 3)
	15	EGR valve (stepper motor coil 2)
	16	EGR valve (stepper motor coil 1)
	17	EVAP canister purge valve
	18	—
	19	CKP sensor (+)
	20	CKP sensor (–)
	21-23	—
	24	Ignition coil
	25	Vehicle speed sensor
	26	CMP sensor
	27	—
	28	Ground
	29-30	—

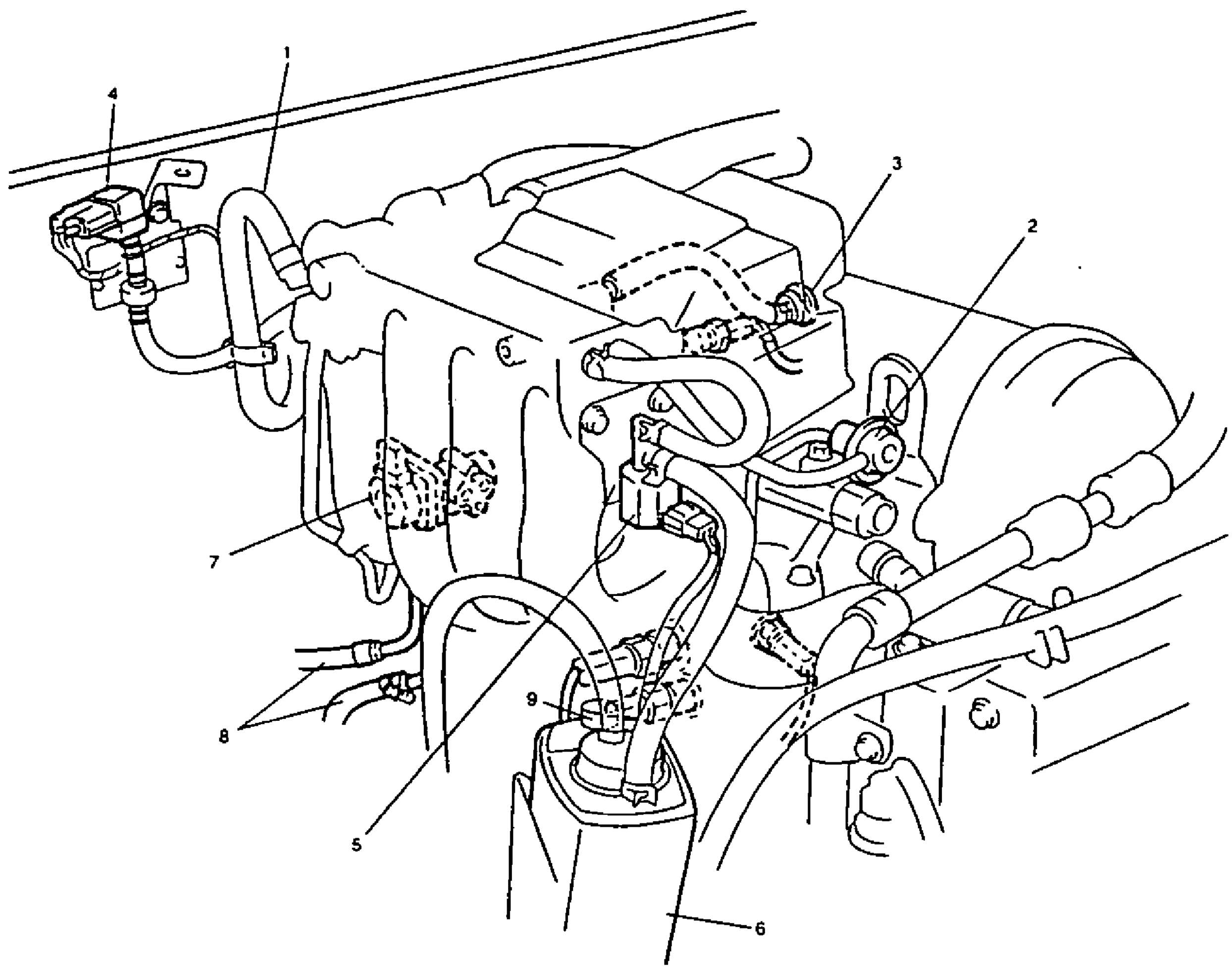
ENGINE & EMISSION CONTROL INPUT/OUTPUT TABLE

Function	Output \ Input	CMP sensor	MAF sensor	TP sensor	ECT sensor	IAT sensor	HO2S-1	VSS	PSP switch	DLC	Ignition switch	Starter switch	A/C amplifier (if equipped)
Main relay control	Main relay										○		
Fuel Pump control	Fuel pump relay	○									○	○	
Injection control	Injectors	○	○	○	○	○	○	○				○	○
Idle air control	IAC valve	○	○	○	○	○		○	○	○	○	○	○
Ignition control	Ignition coil with igniter	○	○	○	○	○		○	○	○		○	○
MIL control	MIL	○								○			
EVAP purge control	EVAP canister purge valve	○	○	○	○			○					
EGR control	EGR valve	○	○	○	○	○		○		○	○	○	
HO2S-1 and HO2S-2 heater control	HO2S	○	○		○			○			○	○	
A/C control	A/C amplifier (if equipped)	○		○	○			○				○	○

DIAGNOSIS

Refer to "ENGINE GENERAL INFORMATION AND DIAGNOSIS" section.

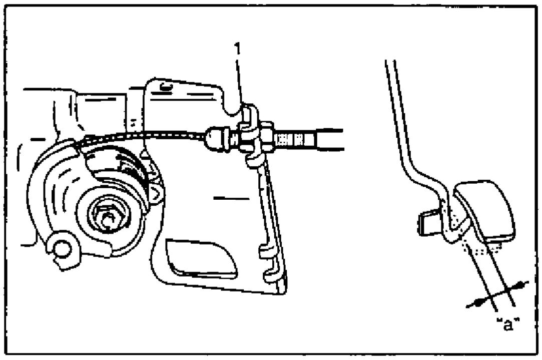
ON-VEHICLE SERVICE



1. Brake booster hose
2. Pressure regulator
3. PCV valve
4. MDP sensor
5. EVAP canister purge valve
6. EVAP canister
7. EGR valve
8. Fuel feed and return hoses
9. Canister air cap

GENERAL

When hoses are disconnected and system components are removed for service, reinstall components properly, and route and connect hoses correctly after service. Refer to Emission Control Information Label or Figure on previous page for proper routing of hoses.

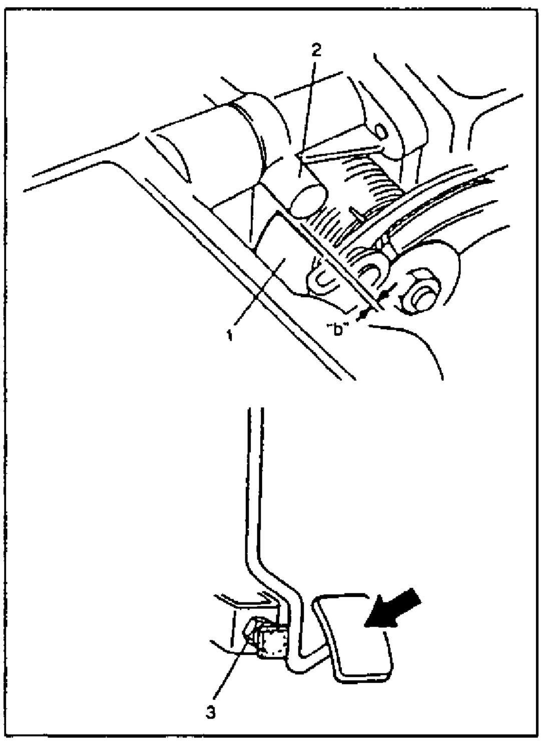


ACCELERATOR CABLE ADJUSTMENT

1) With throttle valve closed, check accelerator pedal play which should be within following specification.

   Pedal play "a": 2 – 7 mm (0.08 – 0.27 in.)

   If measured value is out of specification, adjust it to specification with cable adjusting nut (1).



2) With accelerator pedal depressed fully, check clearance between throttle lever (1) and lever stopper (throttle body) (2) which should be within following specification.

   Clearance "b": 0.5 – 2.0 mm (0.02 – 0.07 in.)
   (With pedal depressed fully)

   If measured value is out of specification, adjust it to specification by changing height of pedal stopper bolt (3).

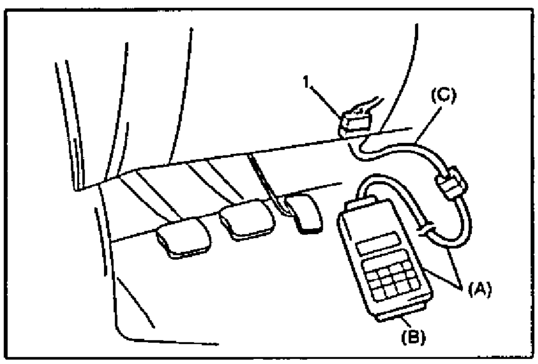
IDLE SPEED/IDLE AIR CONTROL (IAC) DUTY INSPECTION

Before idle speed and IAC duty check, make sure of the following.

- Lead wires and hoses of engine/emission control systems are connected securely.
- Accelerator cable has some play, that is, it is not tight.
- Valve lash is checked and adjusted according to maintenance schedule.
- Ignition timing is within specification.
- All accessories (wipers, heater, lights, A/C, etc.) are out of service.
- Air cleaner has been properly installed and is in good condition.
- ECM does not detect any malfunction DTC.

After above items are all confirmed, check idle speed and IAC duty as follows.

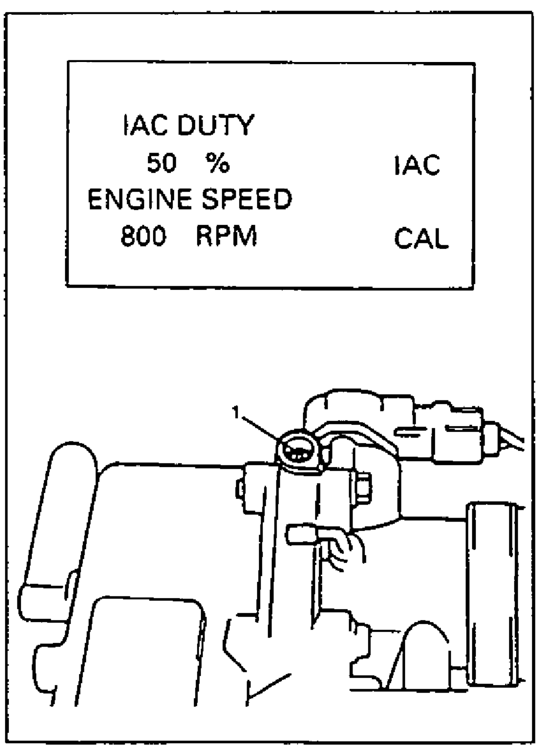
NOTE:
Before starting engine, place transmission gear shift lever in "Neutral" and set parking brake and block drive wheels.



1) Connect SUZUKI scan tool to DLC (1) with ignition switch OFF.

   Special Tool
   (A): 09931-76011 (SUZUKI scan tool)
   (B): Mass storage cartridge
   (C): 16/14 pin DLC cable

2) Warm up engine to normal operating temperature.



3) Check idle speed and IAC duty by using "Data List" mode of SUZUKI scan tool.

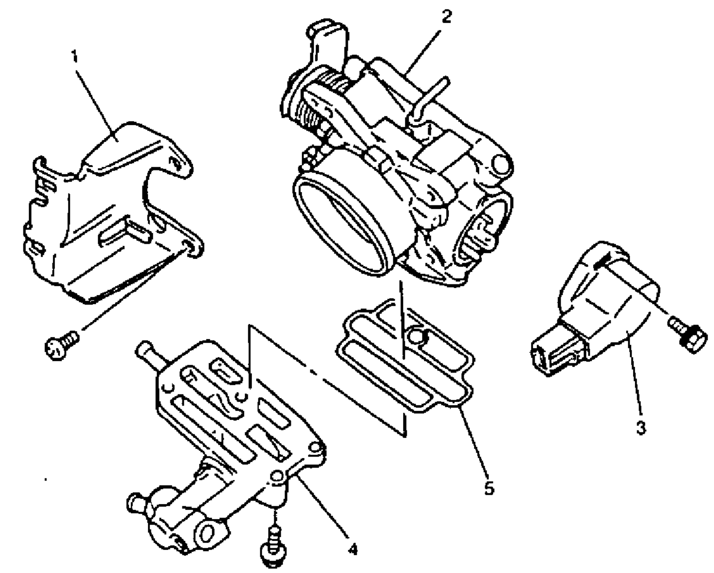
	A/C OFF	A/C ON
Engine idle speed	800 ± 50 r/min.	1000 ± 50 r/min.
IAC duty at specified idle speed	25 – 31%	

   If idle speed and /or IAC duty is out of specifications, adjust it by turning idle speed adjusting screw (1) and check idle air control system referring to DTC P0505 Diag. Flow Table in "Engine diagnosis" section.

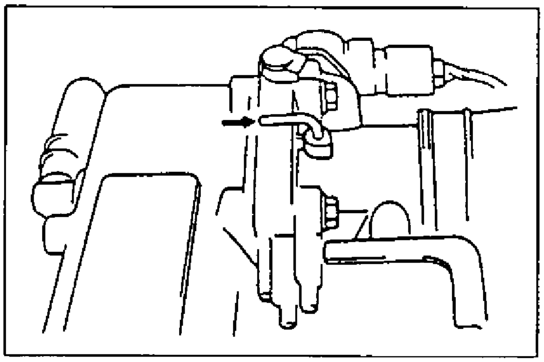
4) Check that specified engine idle speed is obtained with A/C ON if vehicle is equipped with A/C.
   If not, check A/C signal circuit and idle air control system.

AIR INTAKE SYSTEM

THROTTLE BODY

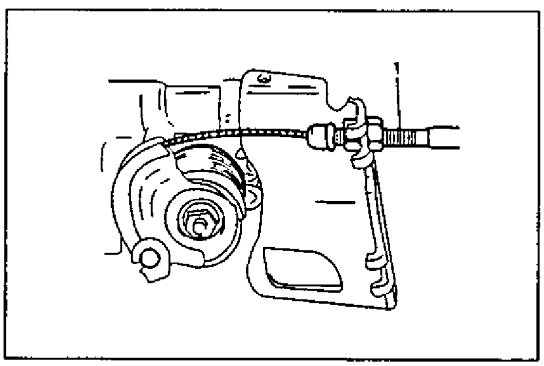


1. Cable bracket
2. Throttle body
3 TP sensor
4. Fast idle air valve
5. O-ring



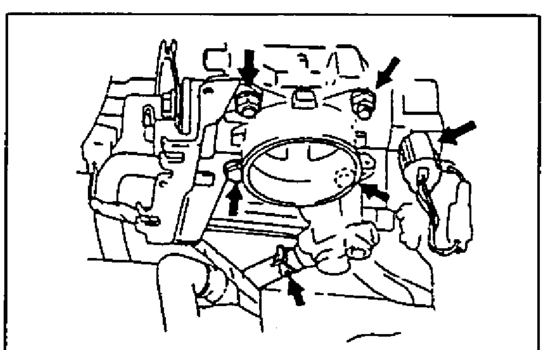
On-Vehicle Inspection

- Check that throttle valve lever moves smoothly.
- Vacuum passage inspection.
  With finger placed against vacuum nozzle, increase engine speed a little and check that vacuum is applied.

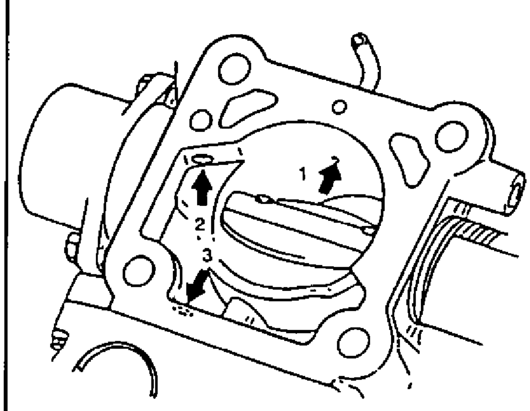


Removal

1) Disconnect negative cable at battery.
2) Drain cooling system.
3) Remove throttle cover and disconnect accelerator cable (1) from throttle body.
4) Remove air intake pipe with hose.



5) Disconnect electric coupler from TP sensor.
6) Disconnect coolant hoses from throttle body.
7) Remove throttle body from intake manifold.

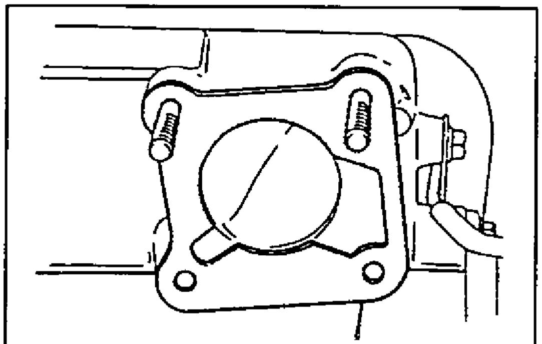


1. Vacuum passage
2. Idle bypass passage
3. Fast idle air valve passage

Cleaning

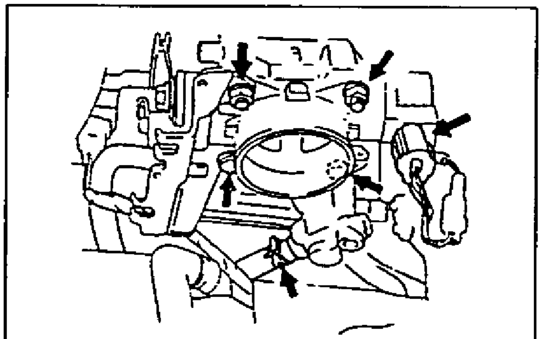
Clean throttle body bore and bypass air passages by blowing compressed air.

CAUTION:
- **Do not blow compressed air through bypass air passage with valve installed to throttle body. This will cause fast idle air valve to malfunction.**
- **TP sensor, fast idle air valve or other components containing rubber must not be places in a solvent or cleaner bath. A chemical reaction will cause these parts to swell, harden or get distorted.**

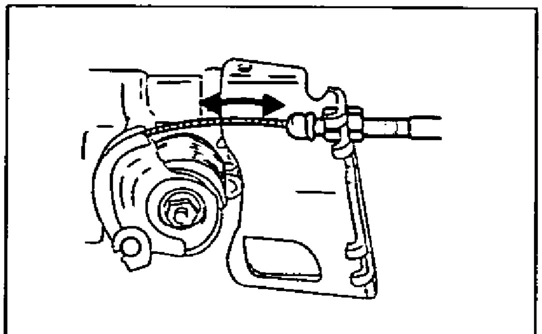


Installation

1) Clean mating surfaces and install throttle body gasket to intake manifold.
   Use new gasket.



2) Install throttle body to intake manifold and tighten bolts and nuts to specified torque.
3) Connect coolant hoses to throttle body.
4) Connect couplers to TP sensor securely.
5) Install air intake pipe with hose.

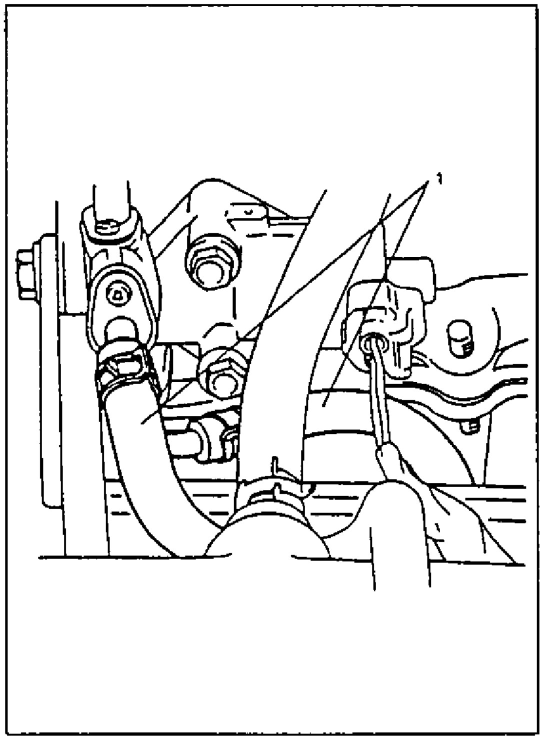


6) Connect accelerator cable and adjust cable play to specification.
7) Install throttle cover to throttle body.
8) Refill cooling system.
9) Connect negative cable at battery.

IDLE AIR CONTROL VALVE (IAC VALVE)

Inspection

Refer to DTC P0505 Diag. Flow Table in "ENGINE GENERAL INFORMATION AND DIAGNOSIS" section for check.



Removal

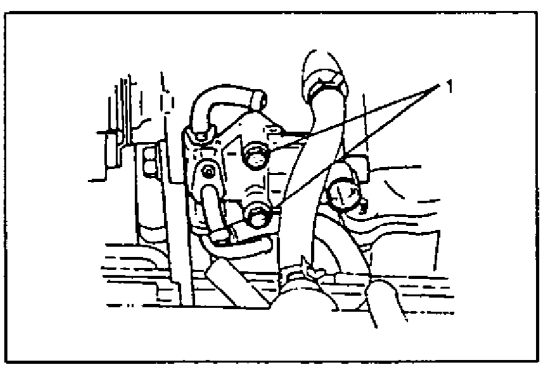
1) Disconnect battery negative cable at battery.
2) Remove throttle cover.
3) Disconnect air hose from IAC valve.
4) Disconnect IAC valve coupler.
5) Remove radiator cap to relieve engine coolant pressure and reinstall it.

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.

6) Disconnect cooling water hoses (1) from IAC valve.

   NOTE:
   Coolant, although small amount, may be released then. Cover hose-to-pipe joint with shop cloth so that released coolant is absorbed in it.

7) Remove IAC valve from intake manifold.



Installation

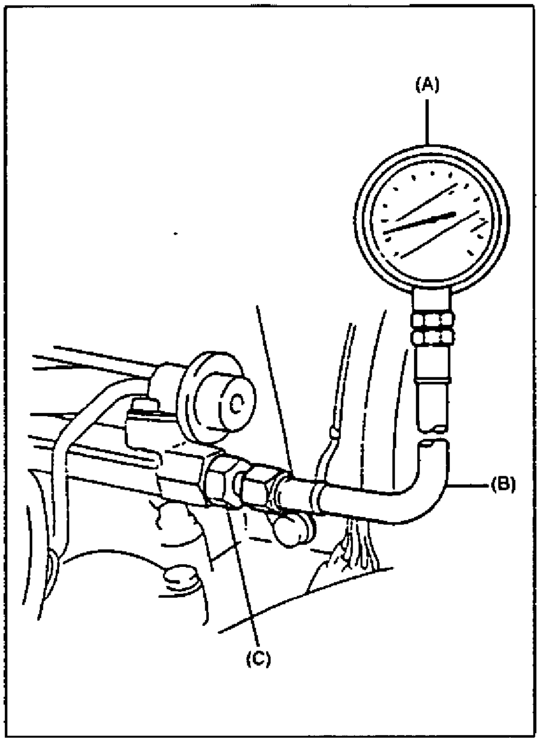
For installation, reverse removal procedure and note following precautions.

- Use new gasket.
- Tighten IAC valve bolts (1) to specified torque.

FUEL DELIVERY SYSTEM

FUEL PRESSURE INSPECTION

1) Relieve fuel pressure in fuel feed line referring to "ENGINE GENERAL INFORMATION AND DIAGNOSIS" section.



2) Using backup wrench, loosen plug bolt on fuel delivery pipe and remove it. Connect special tools (fuel pressure gauge) to delivery pipe.

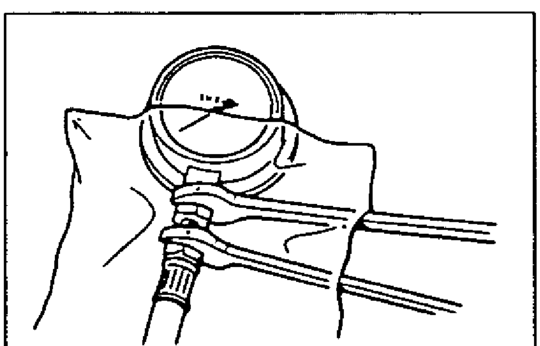
> **CAUTION:**
> **A small amount of fuel may be released when plug bolt is loosened. Place container under the bolt or cover bolt hole with a shop cloth so that released fuel is caught in container or absorbed in cloth. Place that cloth in an approved container.**

Special Tool
(A): 09912-58441
(B): 09912-58431
(C): 09919-46010

3) Check that battery voltage is above 11 V.

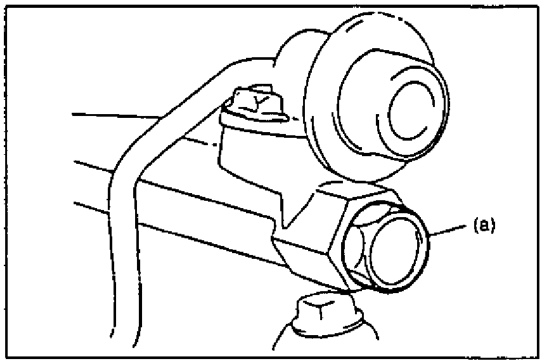
CONDITION	FUEL PRESSURE
With fuel pump operating and engine stopped	250 – 300 kPa 2.5 – 3.0 kg/cm^2 35.6 – 42.7 psi
At specified idle speed	210 – 260 kPa 2.1 – 2.6 kg/cm^2 29.8 – 37.0 psi
With 1 min. after engine (fuel pump) stop (Pressure reduces as time passes)	Over 180 kPa 1.8 kg/cm^2 25.6 psi

4) Turn ignition switch ON to operate fuel pump and after 3 seconds turn it OFF. Repeat this 3 or 4 times and then check fuel pressure.
5) Start engine.
6) Measure fuel pressure at idling.
   If measured pressure doesn't satisfy specification, refer to "Diagnostic Flow Table B-3" in "ENGINE GENERAL INFORMATION AND DIAGNOSIS" section and check each possibly defective part. Replace if found defective.



7) After checking fuel pressure, remove fuel pressure gauge.

> **CAUTION:**
> **As fuel feed line is still under high fuel pressure, make sure to release fuel pressure according to following procedures.**
> - **Place fuel container under joint.**
> - **Cover joint with rag and loosen joint nut slowly to release fuel pressure gradually.**



8) Install plug bolt to fuel delivery pipe.
   Use new gasket.
   Tighten it to specified torque, using backup wrench.

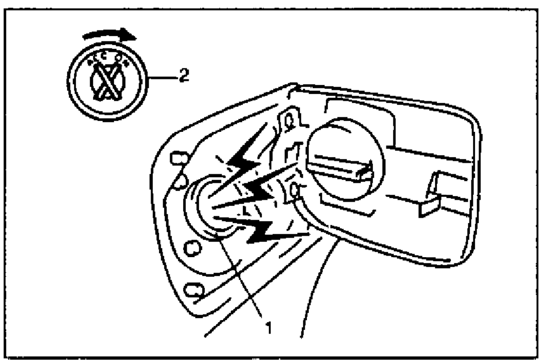
   Tightening Torque
   (a): 30 N·m (3.0 kg-m, 22.0 lb-ft)

9) With engine "OFF" and ignition switch "ON", check for fuel leaks.

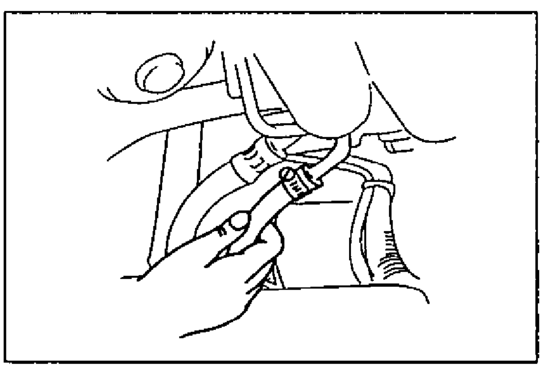
FUEL PUMP

On-Vehicle Inspection

CAUTION:
When fuel filler cap is removed in any procedure, work must be done in a well-ventilated area, keep away from any open flames and without smoking.



1) Remove filler cap and turn "ON" ignition switch (2). Then fuel pump operating sound be heard from fuel filler (1) for about 3 seconds and stop. Be sure to reinstall fuel filler cap after checking.
   If above check result is not satisfactory, advance to "Diagnostic Flow Table B-1" in "ENGINE GENERAL INFORMATION AND DIAGNOSIS" section.



2) Fuel pressure should be felt at fuel return hose for 3 seconds after ignition switch "ON".
   If fuel pressure is not felt, advance to "Diagnostic Flow Table B-3" in "ENGINE GENERAL INFORMATION AND DIAGNOSIS" section.

Removal

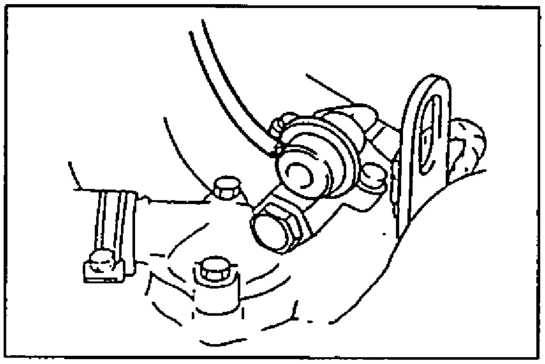
1) Remove fuel tank from body according to procedure described in "ENGINE FUEL" section and remove fuel pump from fuel tank.

Inspection

Check fuel pump filter for evidence of dirt and contamination. If present, clean and check for presence of dirt in fuel tank.

Installation

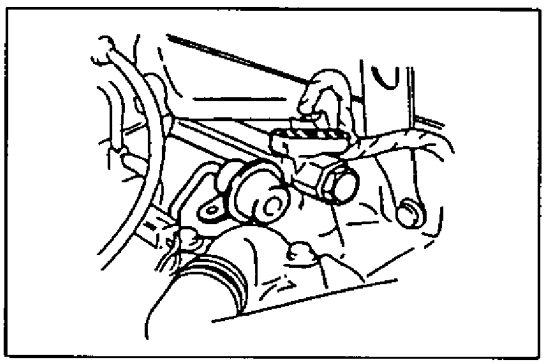
1) Install fuel pump to its bracket.
2) Install fuel pump to fuel tank and then install fuel tank to body according to procedure described in "ENGINE FUEL" section.



FUEL PRESSURE REGULATOR

Removal

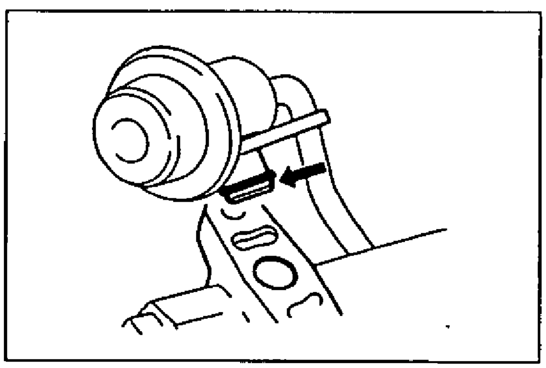
1) Relieve fuel pressure according to procedure described on "ENGINE GENERAL INFORMATION AND DIAGNOSIS" section.
2) Disconnect battery negative cable from battery.
3) Disconnect vacuum hose from fuel pressure regulator.



4) Remove fuel pressure regulator from fuel delivery pipe.

> **CAUTION:**
> **A small amount of fuel may be released when it is from delivery pipe.**
> **Place a shop cloth under delivery pipe so that released fuel is absorbed in it.**

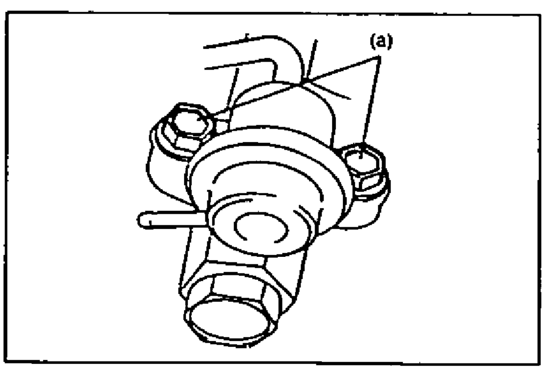
5) Disconnect fuel return hose from fuel pressure regulator.



Installation

For installation, reverse removal procedure and note following precautions.

- Use new O-ring.
- Apply thin coat of gasoline to O-ring to facilitate installation.



- Tighten fuel pressure regulator bolts to specified torque.

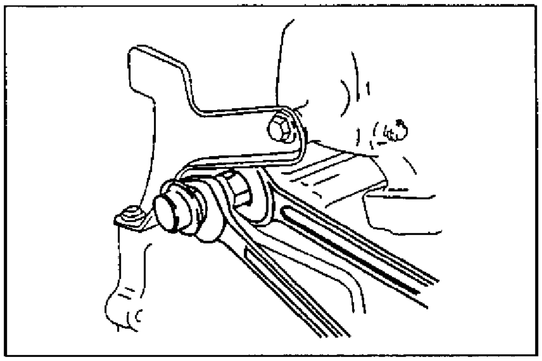
Tightening Torque
(a): 10 N·m (1.0 kg-m, 7.5 lb-ft)

- With engine "OFF" and ignition switch "ON", check for fuel leaks around fuel line connection.

FUEL PULSATION DAMPER

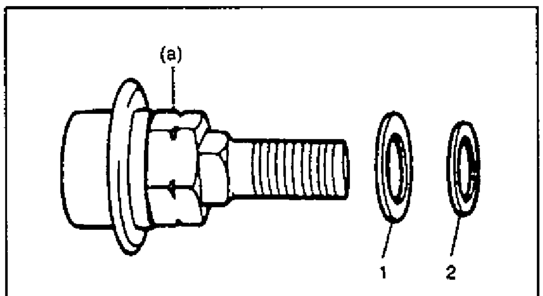
Removal

1) Relieve fuel pressure according to procedure described on "ENGINE GENERAL INFORMATION AND DIAGNOSIS" section.
2) Disconnect negative cable at battery.
3) Remove fuel feed-pipe clamp bolt.



4) Remove damper from delivery pipe.
   Use backup wrench when loosening.

> **CAUTION:**
> **A small amount of fuel may be released after it is removed. Cover feed pipe with a shop cloth.**



1. Large
2. Small

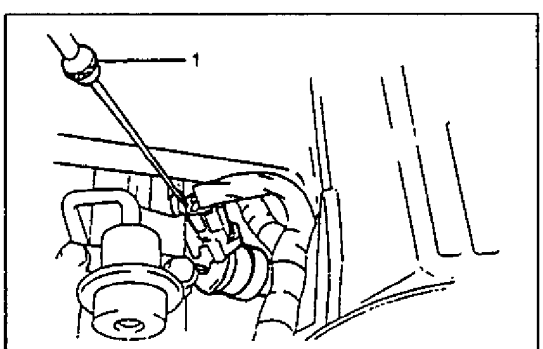
Installation

For installation, reverse removal procedure and note following precautions.

- Make sure to use new gaskets and apply thin coat of engine oil to them.
- Using backup wrench, tighten damper to specified torque.

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

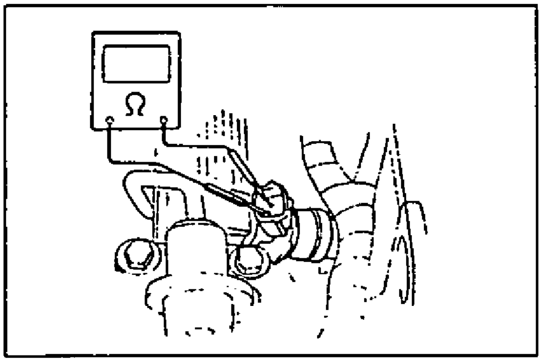
- With engine "OFF" and ignition switch "ON", check for fuel leaks around fuel line connection.



FUEL INJECTOR

On-Vehicle Inspection

1) Using sound scope (1) or such, check operating sound of injector when engine is running or cranking.
   Cycle of operating sound should vary according to engine speed.
   If no sound or an unusual sound is heard, check injector circuit (wire or coupler) or injector.

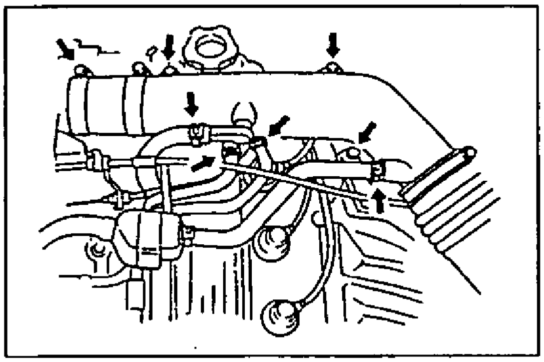


2) Disconnect coupler from injector, connect ohmmeter between terminals of injector and check resistance.

Resistance of injector: 12 – 17 Ω at 20°C, 68°F

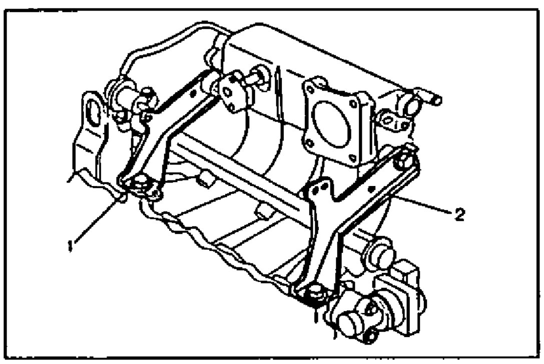
If resistance is out of specification, replace.

3) Connect coupler to injector securely.

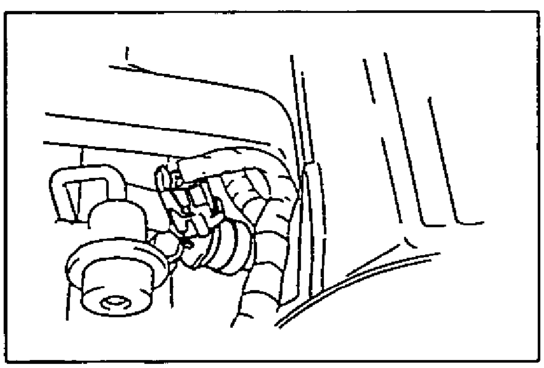


Removal

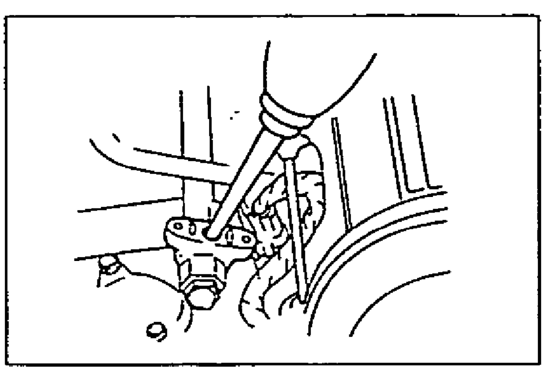
1) Relieve fuel pressure according to procedure described on "ENGINE GENERAL INFORMATION AND DIAGNOSIS" section.
2) Disconnect battery negative cable at battery.
3) Remove throttle cover.
4) Remove air intake pipe with hose.
5) Remove throttle body from intake manifold, refer to "THROTTLE BODY" in this section for removal.
6) Remove IAC valve from intake manifold, refer to "IAC VALVE" in this section for removal.



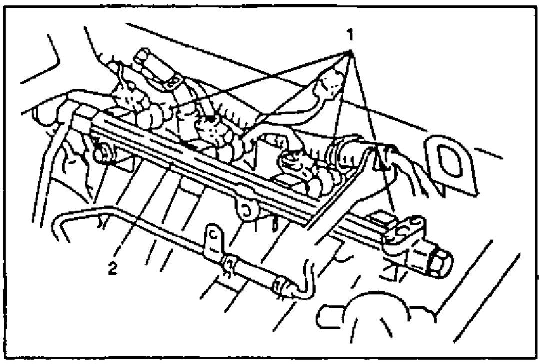
7) Detach intake manifold No.1 stiffener (1) and No.2 stiffener (2) from intake manifold.



8) Disconnect coupler from each injector.



9) Remove fuel pressure regulator from delivery pipe and drain fuel delivery pipe.
10) Remove clamp bolts for fuel feed pipe and return pipe.

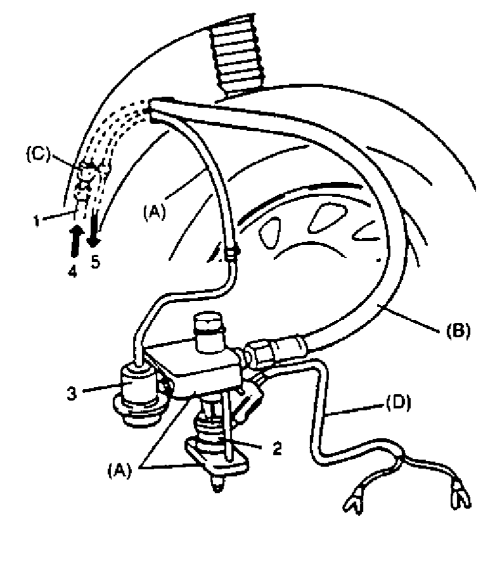


11) Remove fuel delivery pipe bolts.
12) Remove fuel injector(s) (1) from delivery pipe (2) and intake manifold.

> **WARNING:**
> **A small amount of fuel may be released when fuel injector is removed. In order to reduce the chance of personal injury, cover than with a shop cloth.**

Inspection

> **WARNING:**
> **As fuel is injected in this inspection, perform in a well ventilated area and away from open flames.**
> **Use special care to prevent sparking when connecting and disconnecting test lead to and from battery.**



1. Fuel feed pipe
4. From fuel filter
5. To fuel tank

1) Install injector (2) and fuel pressure regulator (3) to special tool (injector checking tool).

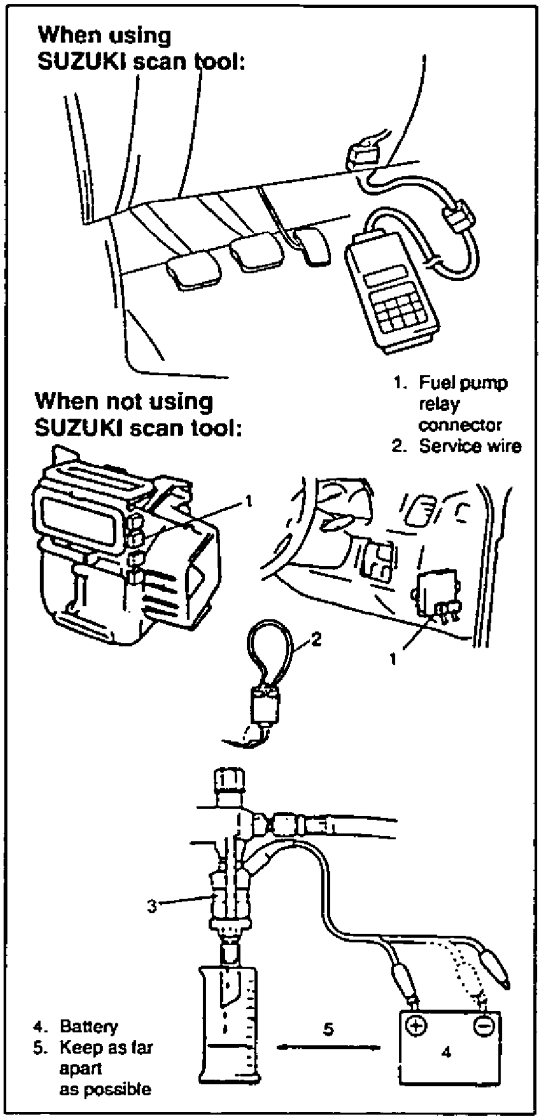
   Special Tool
   (A): 09912-58421

2) Connect special tools (hoses and attachment) to hose and pipe of vehicle.

   Special Tool
   (B): 09912-58431
   (C): 09919-46010

3) Connect special tool (test lead) to injector.

   Special Tool
   (D): 09930-88530

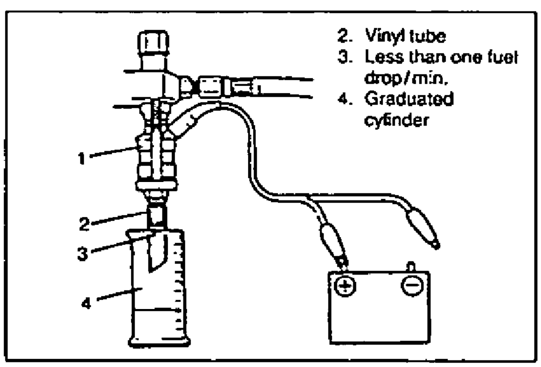


4) Install suitable vinyl tube onto injector nozzle to prevent fuel from splashing out when injecting.
5) Put graduated cylinder under injector (3) as shown.
6) Operate fuel pump and apply fuel pressure to injector as follows:
When using SUZUKI scan tool:
(1) Connect SUZUKI scan tool to DLC with ignition switch "OFF".
(2) Turn ignition switch "ON", clear DTC and select "MISC TEST" mode on SUZUKI scan tool.
(3) Turn fuel pump "ON" by using SUZUKI scan tool.
When not using SUZUKI scan tool:
(1) Disconnect fuel pump relay connector.
(2) Connect "Bl/B" and "P/B" wire harness terminals of relay connector using service wire.

> **CAUTION:**
> **Check to make sure that connection is made between correct terminals. Wrong connection can cause damage to ECM, wire harness, etc.**

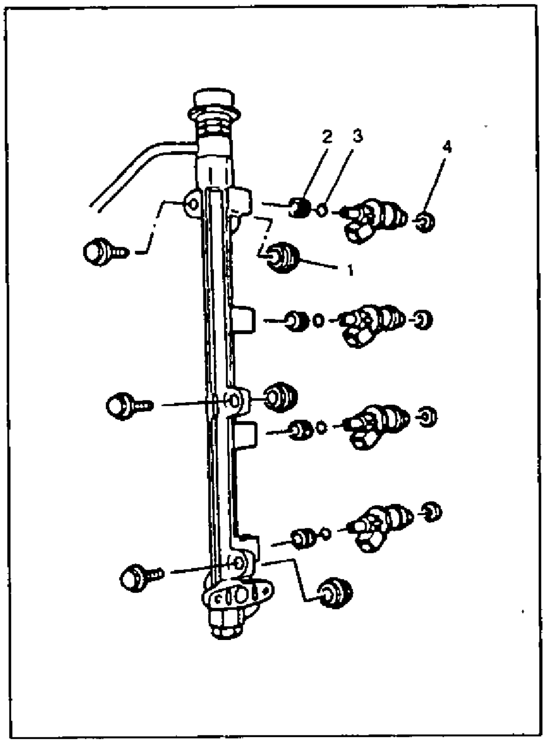
(3) Turn ignition switch "ON".
7) Apply battery voltage to injector for 15 seconds and measure injected fuel volume with graduated cylinder.
Test each injector two or three times.
If not within specification, replace injector.

Injected fuel volume:
39 – 49 cc/15 sec. (1.32/1.37 – 1.66/1.72 US/Imp. oz/15 sec.)



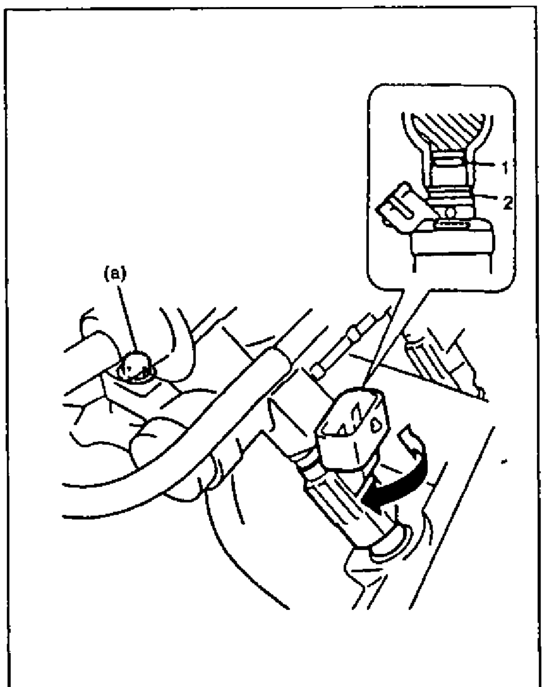
8) Check fuel leakage from injector nozzle. Do not operate injector (1) for this check (but fuel pump should be at work).
If fuel leaks more than following specifications, replace.

Fuel leakage: Less than 1 drop/min.



Installation

1) Replace injector O-ring (3) with new one using care not to damage it. Install grommet (2) to injector.
2) Check if insulator (1) is scored or damaged. If it is, replace with new one.
   Install insulators and cushions (4) to intake manifold.



2. Grommet

3) Apply thin coat of fuel to O-rings (1) and then install injectors into delivery pipe and intake manifold.
   Make sure that injectors rotate smoothly. If not, probable cause is incorrect installation of O-ring. Replace O-ring with new one.
4) Tighten delivery pipe bolts and make sure that injectors rotate smoothly.

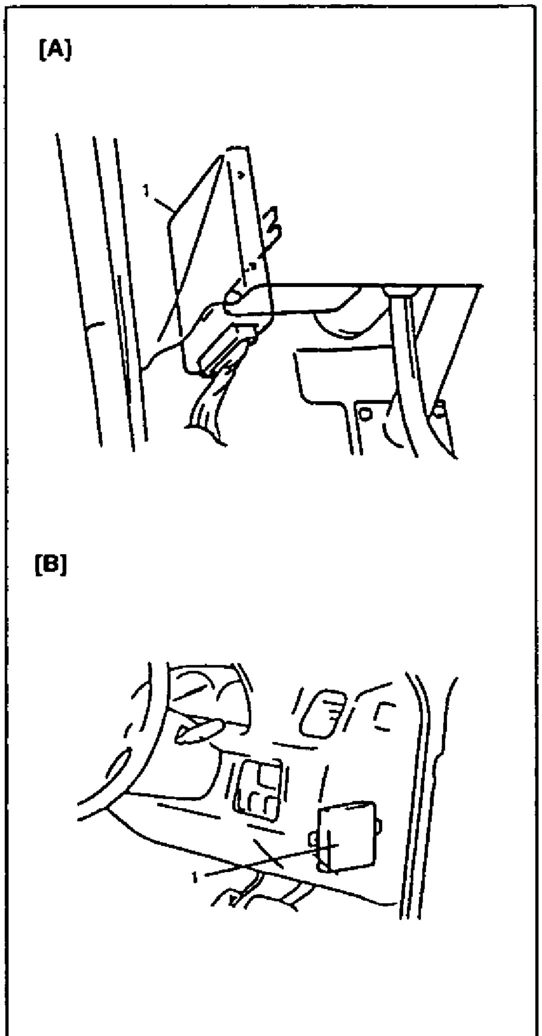
   Tightening Torque
   (a): 23 N·m (2.3 kg-m, 17.0 lb-ft)

5) Connect couplers to injectors securely.
6) Install intake manifold stiffeners (No.1 and No.2) to intake manifold.
7) Install fuel pressure regulator.
8) Install clamp bolts for fuel feed pipe and return pipe.
9) Install IAC valve to intake manifold, refer to "IAC VALVE" in this section for installation.
10) Install throttle body to intake manifold, refer to "THROTTLE BODY" in this section for installation.
11) Connect battery negative cable.
12) With engine "OFF" and ignition switch "ON", check for fuel leaks around fuel line connection.

ELECTRONIC CONTROL SYSTEM

ENGINE CONTROL MODULE (ECM)

> **CAUTION:**
> **As ECM consists of precision parts, be careful not to expose it to excessive shock.**



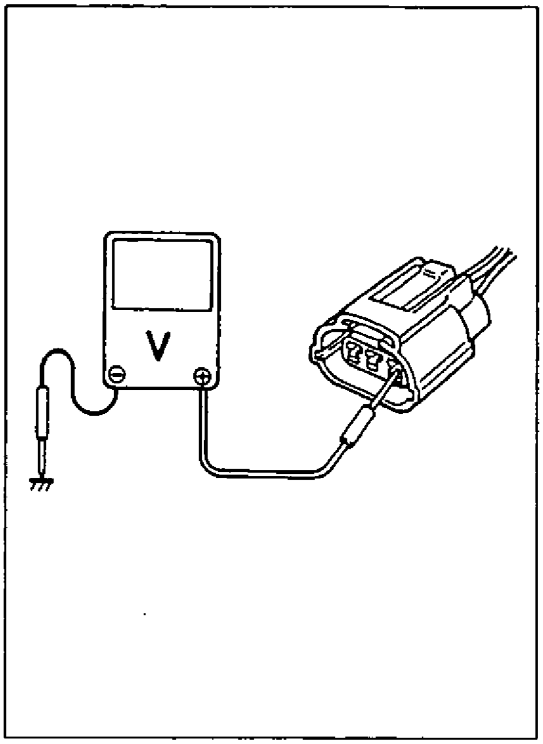
[A]: For LH steering vehicle
[B]: For RH steering vehicle

Removal

1) Disconnect battery negative cable from battery.
2) Disable air bag system (if equipped) referring to "DISABLING THE AIR BAG SYSTEM" in Air Bag System section.
3) Disconnect connectors from ECM (1).
4) Remove ECM.

Installation

1) Install ECM to vehicle.
2) Connect connectors to ECM securely.
3) Enable air bag system (if equipped) referring to "ENABLING AIR BAG SYSTEM" in Air Bag system section.
4) Connect negative cable to battery.



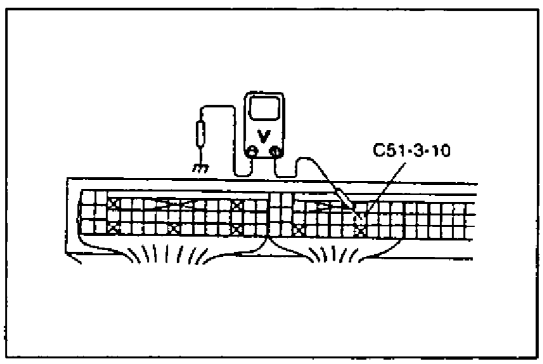
MASS AIR FLOW SENSOR (MAF SENSOR)

Inspection

NOTE:

Use voltmeter with high-impedance (10 kΩ/V minimum) or digital type voltmeter.

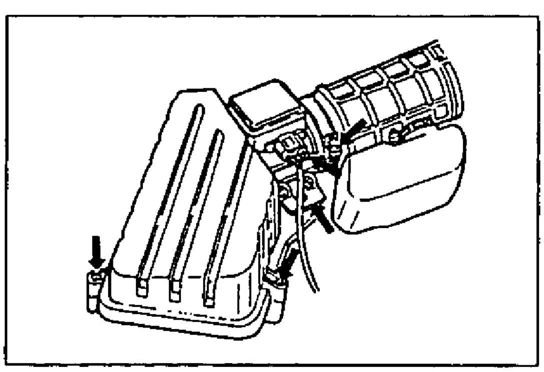
1) Connect voltmeter to "B +" terminal of MAF sensor coupler disconnected and ground.
2) Turn ignition switch "ON" and check that voltage is battery voltage.
   If not, check if wire harness is open or connection is poor.



3) Connect MAF sensor coupler to MAF sensor.
4) Turn ignition switch "ON" and check voltage at MAF sensor output terminal.

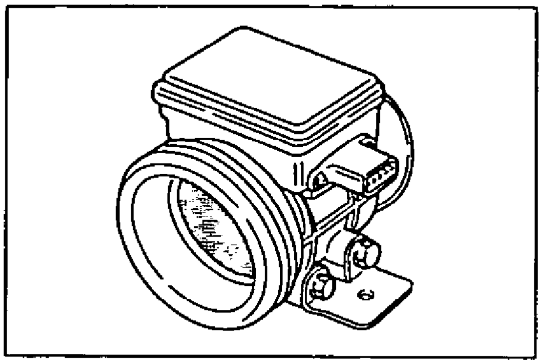
   Voltage: 1.0 – 1.6 V

5) Start engine and check that voltage is lower than 5 V and it rises as engine speed increases.
   (Reference data: 1.7 – 2.0 V at specified idle speed)
   If check result is not as specified above, cause may lie in wire harness, coupler connection, MAF sensor or ECM.



Removal

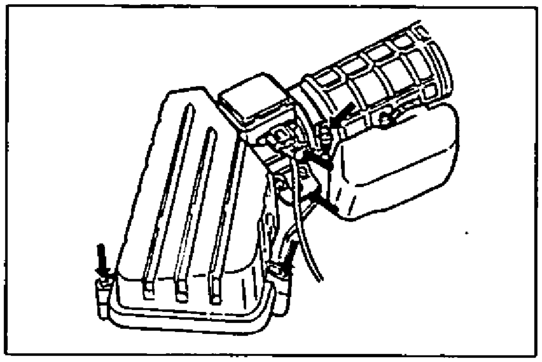
1) Disconnect negative cable at battery and coupler from MAF sensor.
2) Remove MAF sensor with air cleaner upper ease.



3) Remove MAF sensor from air cleaner upper case.

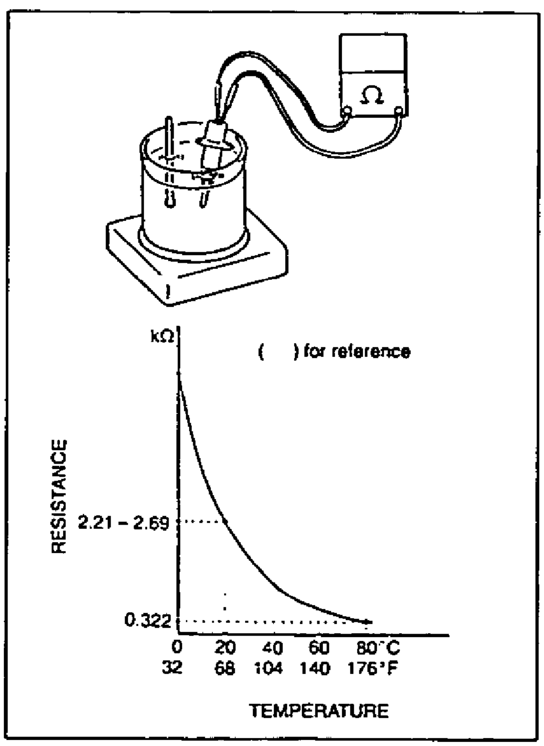
NOTE:
Don't disassemble MAF sensor.

> **CAUTION:**
> - **Do not expose MAF sensor to any shock.**
> - **Do not blow compressed air by using air gun or the like.**
> - **Do not put finger or any other object into MAF sensor. Malfunction may occur.**

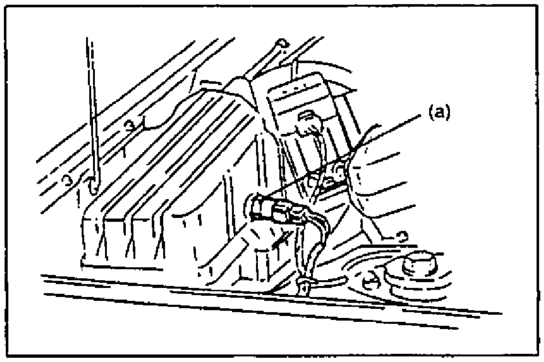


Installation
1) Check MAF sensor seal for deterioration and damage.
2) Install MAF sensor to air cleaner upper case and then confirm that seal is attached securely.
3) Install upper case with MAF sensor to vehicle and tighten case bolts securely.
4) Connect MAF sensor coupler securely.
5) Connect battery negative cable to battery.

INTAKE AIR TEMPERATURE (IAT) SENSOR
Removal
1) Disconnect negative cable from battery.
2) Disconnect IAT sensor coupler.
3) Remove IAT sensor from air cleaner case.



Inspection
Immerse temperature sensing part of IAT sensor in water (or ice) and measure resistance between sensor terminals while heating water gradually.
If measured resistance doesn't show such characteristic as shown in figure, replace IAT sensor.



Installation

Reverse removal procedure noting the following.

- Clean mating surface of sensor and air cleaner.
- Use new gasket.
- Tighten IAT sensor to specified torque.

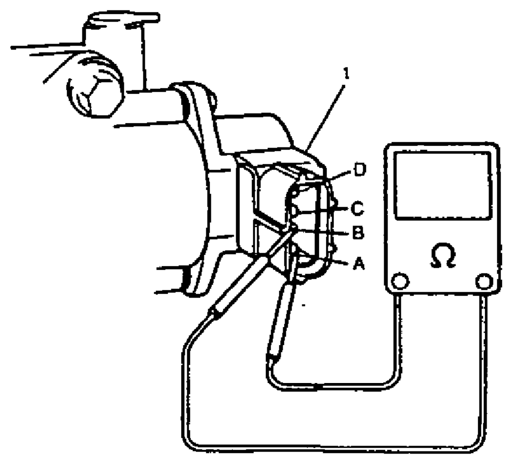
Tightening Torque
(a): 15 N·m (1.5 kg-m, 11.0 lb-ft)

- Connect sensor coupler securely.

THROTTLE POSITION SENSOR (TP SENSOR)

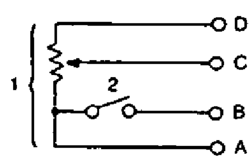
Inspection

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	CONDITION	RESISTANCE
Between A and B terminals (Idle switch)	When throttle lever-to-stop screw clearance is 0.5 mm (0.020 in.)	0 – 500 Ω
	When throttle lever-to-stop screw clearance is 0.8 mm (0.031 in.)	∞ (Infinity)
Between A and D terminals	———	3.5 – 6.5 kΩ
Between A and C terminals	Throttle valve is at idle position	0.3 – 2.0 kΩ
	Throttle valve is fully opened	2.0 – 6.5 kΩ

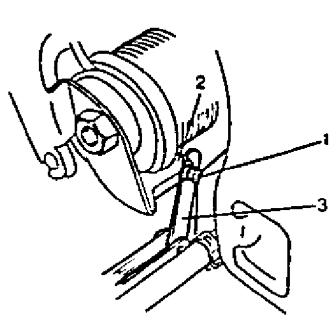
NOTE:
There should be more than 2 kΩ resistance difference between when throttle valve is at idle position and when it is fully open.



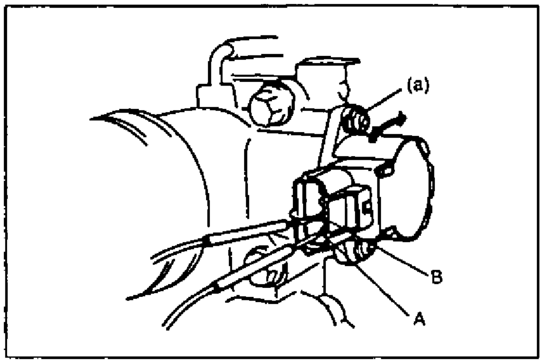
If idle switch check result is not satisfactory, adjust installation angle of TP sensor (1) and if found defective in the other check, replace TP sensor.

3) Connect TP sensor coupler securely.
4) Connect negative cable to battery.

Adjustment

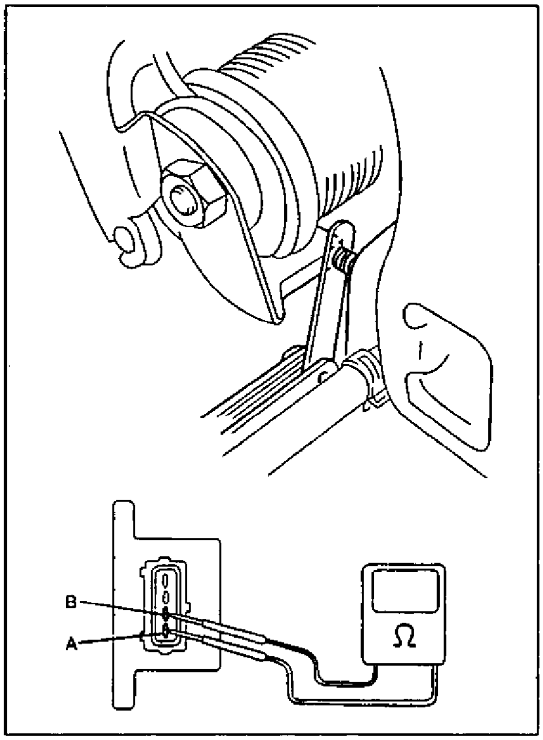


1) Disconnect negative cable at battery and disconnect TP sensor coupler.
2) Insert 0.65 mm (0.026 in.) thickness gauge (3) between throttle stop screw (1) and throttle lever (2).



3) Loosen TP sensor screws.
4) Connect ohmmeter between A and B terminals.
5) First, turn TP sensor counterclockwise fully and then clockwise gradually to find position where ohmmeter reading changes from continuity to ∞ (no continuity).
   Then fix TP sensor at that position by tightening screw to specified torque.

   Tightening Torque
   (a): 3.5 N·m (0.35 kg-m, 2.5 lb-ft)

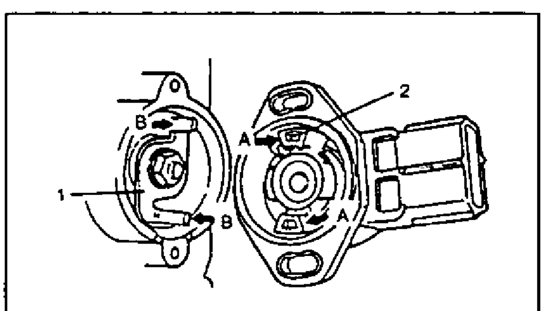


6) Check that there is no continuity between terminals A and B when 0.8 mm (0.037 in.) thickness gauge is inserted.
7) Check that there is continuity between terminals A and B when 0.5 mm (0.020 in.) thickness gauge is inserted.
   If check result is unsatisfactory in steps 6) and 7), it means that installation angle of TP sensor is not adjusted properly.
   Therefore, start all over again from step 1).

CAUTION:
As throttle stop screw is factory adjusted precisely, don't remove or adjust it.

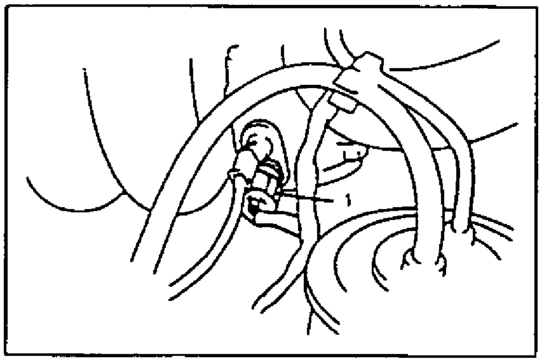
8) Connect coupler to TP sensor securely, and connect battery negative cable.

Removal
1) Disconnect battery negative cable at battery.
2) Disconnect coupler from TP sensor.
3) Remove TP sensor from throttle body.



A: Should engage with B

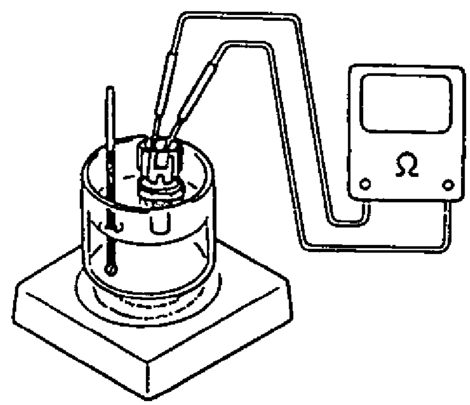
Installation
1) To install sensor, place it onto throttle body so that sensor pickup lever (2) can engage with throttle body lever (1).
2) Hand-tighten TP sensor screws.
3) Adjust installation angle of TP sensor according to procedure described in item "Adjustment".
4) Connect coupler to TP sensor securely.
5) Connect battery negative cable to battery.

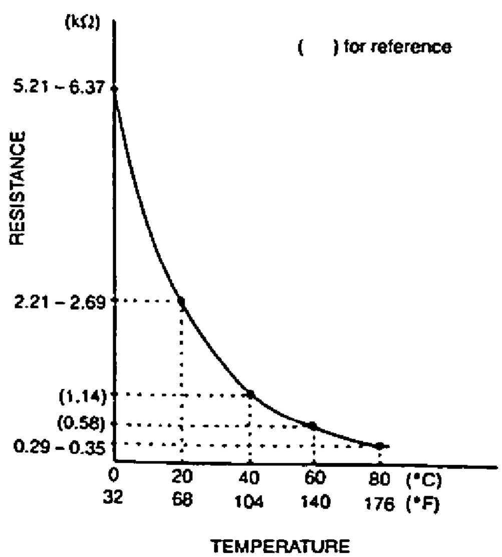


ENGINE COOLANT TEMPERATURE SENSOR (ECT SENSOR)

Removal

1) Disconnect negative cable from battery.
2) Drain cooling system.
3) Disconnect coupler from ECT sensor (1).
4) Remove ECT sensor from intake manifold .



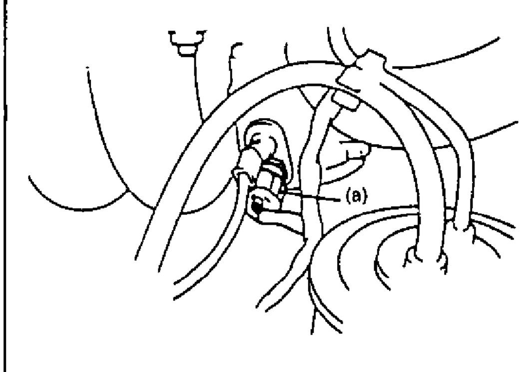


ECT SENSOR CHARACTERISTIC

Inspection

Immerse temperature sensing part of ECT sensor in water and measure resistance between sensor terminals while heating water gradually.

If measured resistance doesn't show such characteristic as shown, replace ECT sensor.



Installation

Reverse removal procedure noting the following.

- Clean mating surfaces of sensor and intake manifold.
- Use new gasket
- Tighten ECT sensor to specified torque.

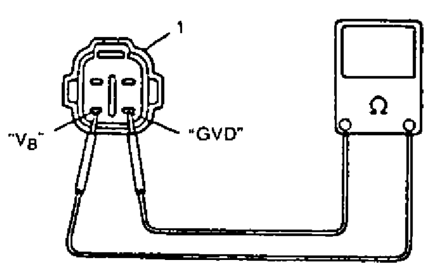
Tightening Torque
(a): 15 N·m (1.5 kg-m, 11.0 lb-ft)

- Connect coupler to sensor securely.
- Refill cooling system.

HEATED OXYGEN SENSOR-1 and -2 (HO2S-1 and HO2S-2)

Oxygen Sensor-1 Inspection

Inspect oxygen sensor and its circuit referring to DTC P0130 Diag. Flow Table in "ENGINE GENERAL INFORMATION AND DIAGNOSIS" section. If malfunction is found, replace.



1. Sensor coupler
(Viewed from terminal side)

Oxygen Sensor Heater Inspection (Sensor-1 and -2)

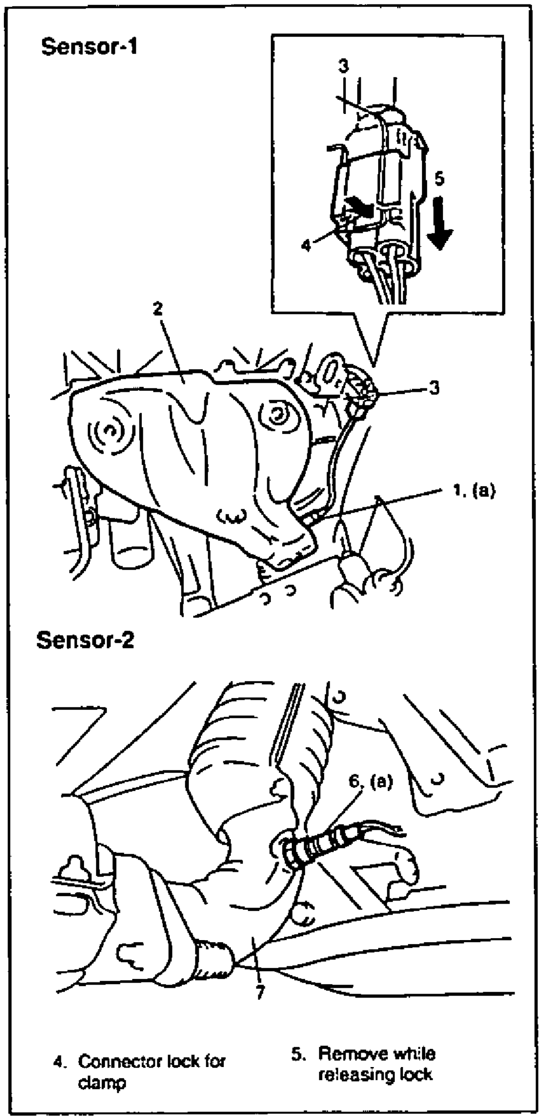
1) Disconnect oxygen sensor coupler.
2) Using ohmmeter, measure resistance between terminals "V_B" and "GND" of sensor coupler.

NOTE:
Temperature of sensor affects resistance value largely. Make sure that sensor heater is at correct temperature.

Resistance of oxygen sensor heater:
5.4 – 6.4 Ω (at 20°C, 68°F) for HO2S-1
11.7 – 14.3 Ω (at 20°C, 68°F) for HO2S-2

If found faulty, replace oxygen sensor.

3) Connect oxygen 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 from battery.
2) Remove connector from bracket (3) and disconnect coupler of oxygen sensor (1).
3) Remove exhaust manifold upper cover (2) if necessary.
4) Hoist vehicle when removing sensor-2 (6).
5) Remove oxygen sensor from exhaust manifold or exhaust pipe (7).

> **CAUTION:**
> **Be careful not to expose it to excessive shock.**
> **It may cause damage to sensor inside.**

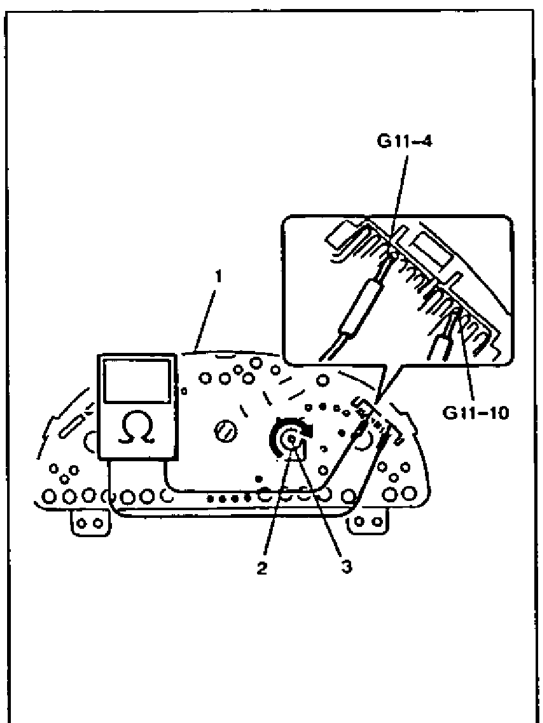
Installation

Reverse removal procedure noting the following.

- Tighten oxygen sensor to specified torque.

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

- Connect coupler of oxygen sensor and fit connector to bracket.
- After installing oxygen sensor, start engine and check that no exhaust gas leakage exists.



VEHICLE SPEED SENSOR (VSS)

On-Vehicle Inspection

1) Disconnect negative cable at battery.
2) Remove combination meter (1) from instrument panel.
3) Connect ohmmeter between G11-4 and G11-10 terminal of combination meter and turn cable joint (2) of speedometer with a screwdriver (3).
   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 to battery.

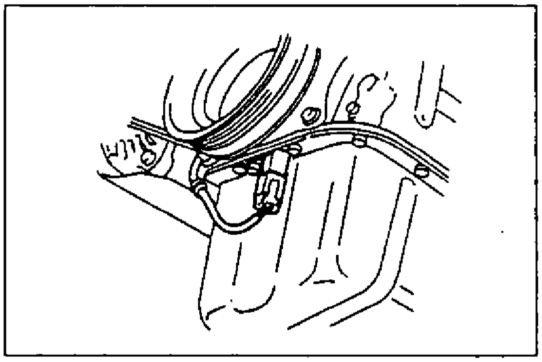
CAMSHAFT POSITION SENSOR (CMP SENSOR)

On-Vehicle Inspection

Check CMP sensor and its circuits referring to flow table of diagnostic trouble code P0340 in "ENGINE GENERAL INFORMATION AND DIAGNOSIS" section.
If malfunction is found, replace.

Removal and Installation

Refer to "CMP SENSOR REMOVAL/INSTALLATION" in Section 6F1.



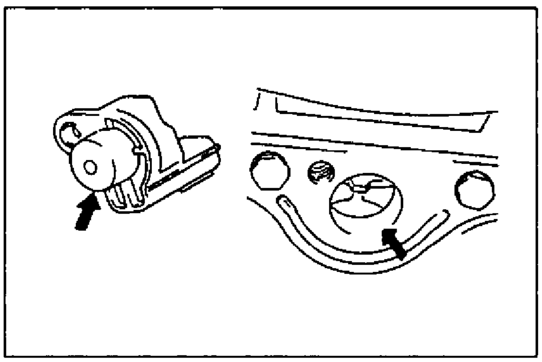
CRANKSHAFT POSITION SENSOR

Inspection

Check crankshaft position sensor referring to Steps 2 and 3 of DTC P0335 Diag. Flow Table in "ENGINE GENERAL INFORMATION AND DIAGNOSIS" section. If malfunction is found, replace.

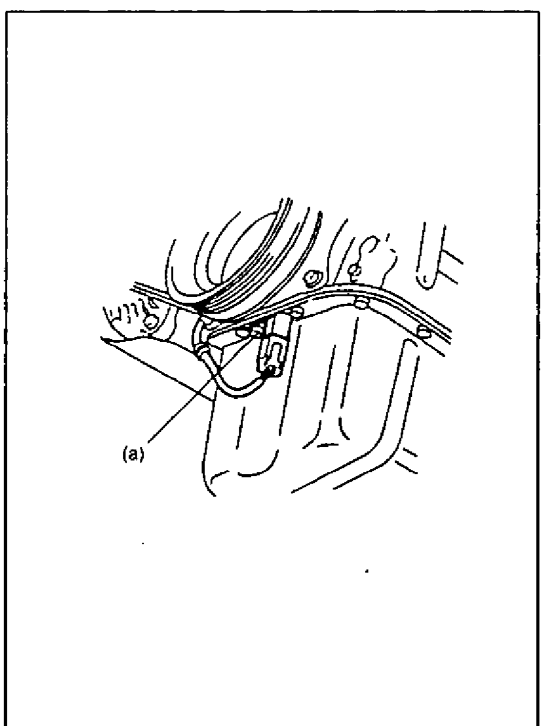
Removal

1) Hoist vehicle.
2) Disconnect connector from crankshaft position sensor.
3) Remove crankshaft position sensor from oil pan.



Installation

1) Check to make sure that crankshaft position sensor and pulley tooth is free from any metal particles and damage.

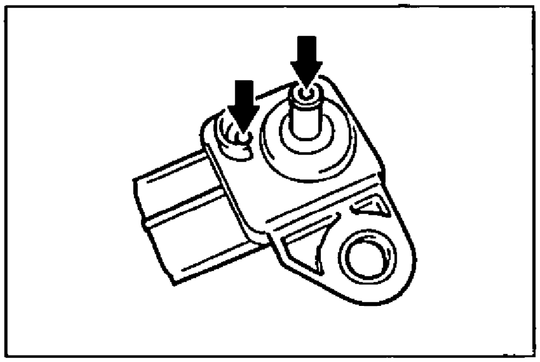


2) Install crankshaft position sensor to oil pan.

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

> **CAUTION:**
> **Be sure to tighten to specified torque. CKP sensor will be deformed if overtightened and correct CKP sensor signal will not be fed if loosened.**

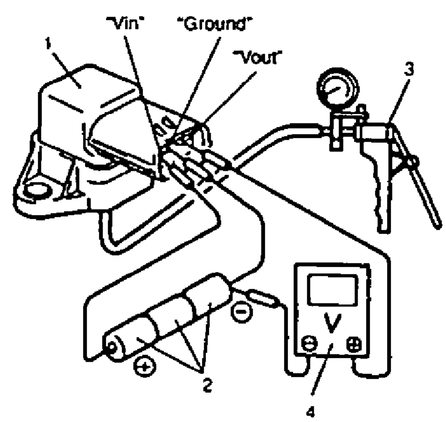
3) Connect connector to it securely.



MANIFOLD DIFFERENTIAL PRESSURE SENSOR CHECK

1) Disconnect manifold differential pressure sensor coupler.
2) Remove manifold differential pressure sensor.
3) Check pressure passage and air vent hole for clog. Clean if clogged.

> **CAUTION:**
> **Do not put drills or wires into passage and hole for cleaning. It causes damage in it.**



1. MDP sensor
2. 1.5 V battery (4.5 – 5.0 V in total)
3. Vacuum pump
4. Digital type voltmeter

4) Arrange 3 new 1.5 V batteries in series and connect its positive terminal to "Vin" terminal of coupler and negative terminal to "Ground" terminal. Then check voltage between "Vout" and "Ground".
Also, check if voltage reduces when vacuum is slowly applied up to 400 mmHg by using vacuum pump.

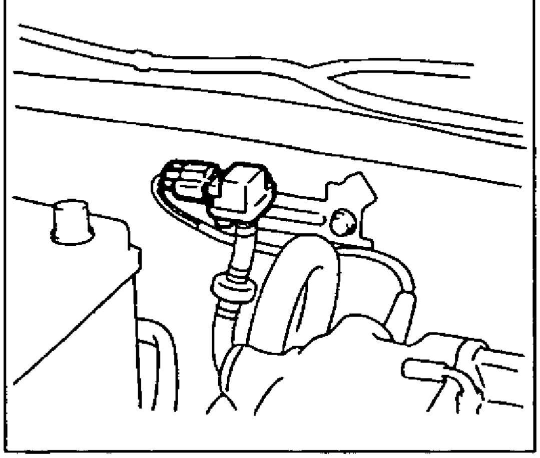
> **CAUTION:**
> **As connection to wrong terminal will cause damage to manifold differential pressure sensor, make absolutely sure to connect properly as shown in left figure.**

Output voltage at "Vout" (When voltage at "Vin" is 4.5 V)

Applied vacuum value (mmHg)	Manifold differential pressure sensor output voltage (V)
200	2.40 – 4.40
250	2.13 – 4.13
300	1.86 – 3.86
350	1.59 – 3.59
400	1.32 – 3.32

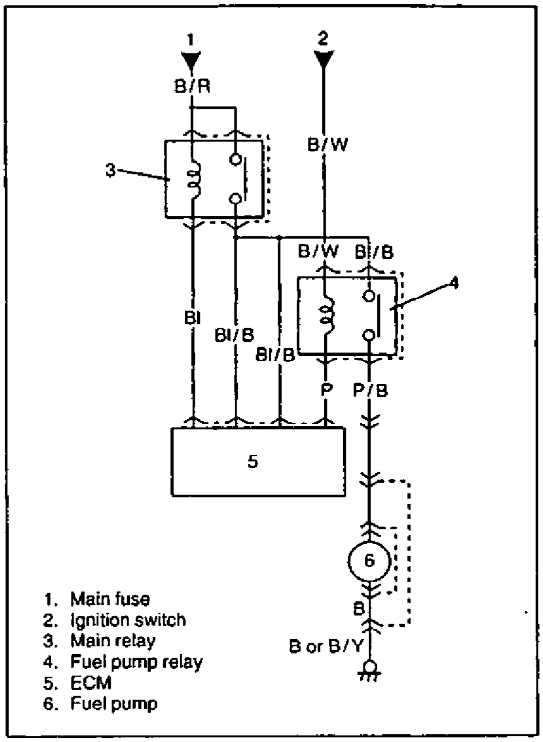
If check result is not satisfactory, replace manifold differential pressure sensor.

5) Install manifold differential pressure sensor.
Connect manifold differential pressure sensor coupler securely.



FUEL LEVEL SENSOR (SENDER GAUGE)

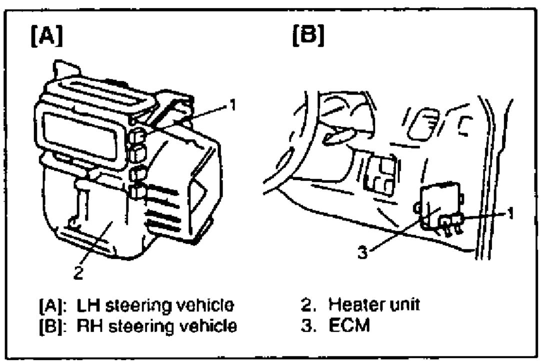
Refer to Section 8.



MAIN RELAY

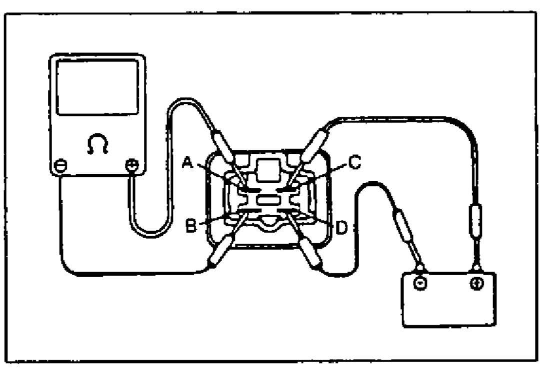
NOTE:

Distinguish between main relay and fuel pump relay by wire colors.

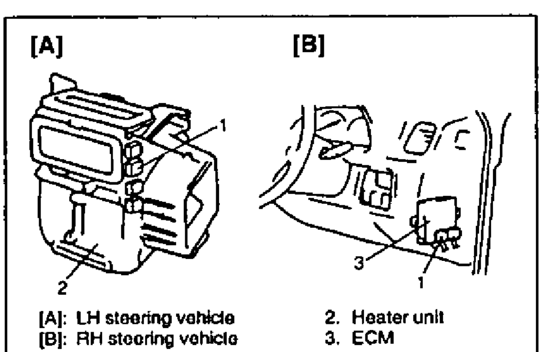


Inspection

1) Disconnect negative cable at battery.
2) Remove main relay (1) from its bracket after disconnecting its coupler.



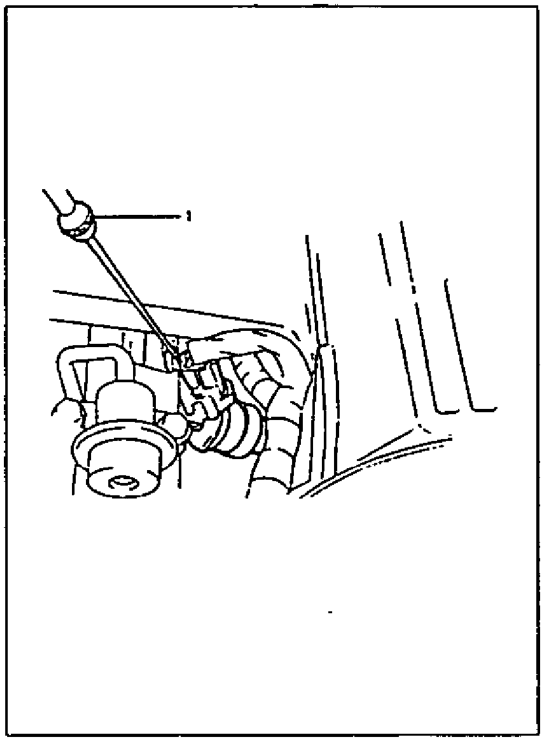
3) Check that there is continuity between terminals "A" and "B" when battery is connected to terminals "C" and "D".
   If malfunction is found, replace.
4) Install relay and connect its coupler securely.



FUEL PUMP RELAY

Inspection

1) Disconnect negative cable at battery.
2) Remove fuel pump relay (1) from its bracket after disconnecting its coupler.
3) Structure of fuel pump relay is the same as that of main relay. Check its resistance and operation using the same procedure as that for main relay.
   If malfunction is found, replace.



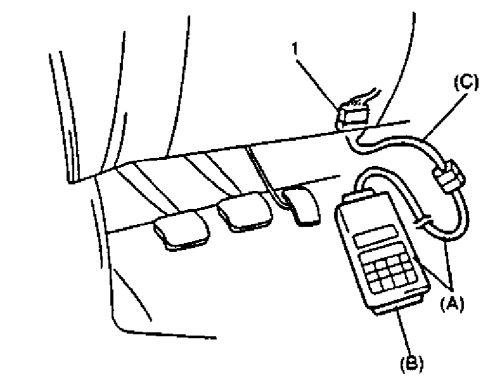
FUEL CUT OPERATION

Inspection

NOTE:

Before inspection, check to make sure that gear shift lever is in Neutral position and that parking brake lever is pulled all the way up.

1) Warm up engine to normal operating temperature.
2) While listening to sound of injector by using sound scope (1) or such, increase engine speed to higher than 3,000 r/min.
3) Check to make sure that sound to indicate operation of injector stops when throttle valve is closed instantly and it is heard again when engine speed is reduced to less than about 2,000 r/min.



EMISSION CONTROL SYSTEM

EGR SYSTEM

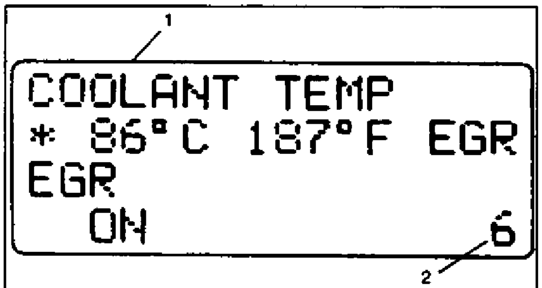
System Inspection [Using SUZUKI scan tool]

1) Connect SUZUKI scan tool to data link connector (DLC) (1) with ignition switch OFF.

   Special tool
   (A):09931-76011 (SUZUKI scan tool)
   (B):Mass storage cartridge
   (C):16/14 pin DLC cable (OBD-II adapter cable)

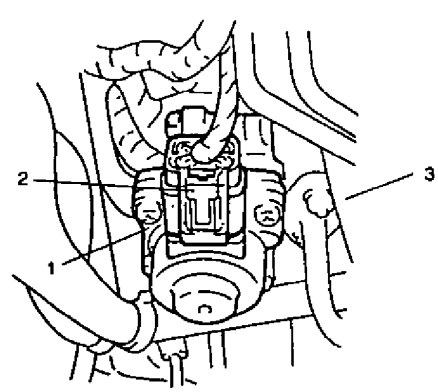
   NOTE:
   For operation procedure of cartridge, refer to its cartridge operator's manual.

2) Start engine and warm up it to normal operating temperature.



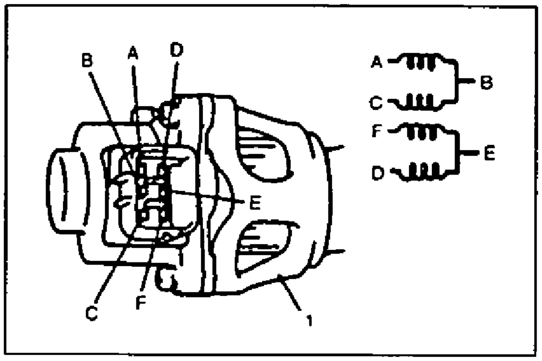
1. SUZUKI scan tool display
2. EGR valve opening (0: Close, 100: Full Open)

3) With engine idling (without depressing accelerator pedal), open EGR valve by using "MISC. TEST" mode.
   In this state, according as EGR valve opening increases engine idle speed drops. If not, possible cause is clogged EGR gas passage, stuck or faulty EGR valve.



Removal

1) Disconnect negative cable at battery.
2) Disconnect EGR valve coupler (2).
3) Remove EGR valve (1) and gasket from intake manifold (3).

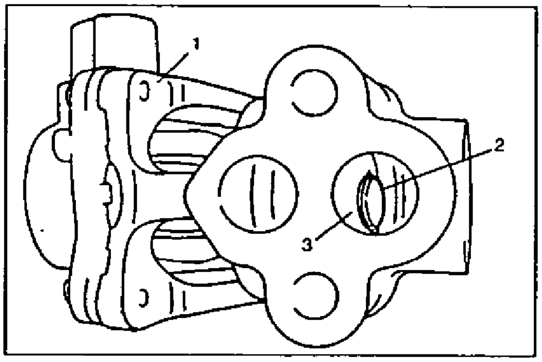


Inspection

1) Check resistance between following terminals of EGR valve (1) in each pair.

Terminals	Standard resistance
A – B C – B F – E D – E	20 – 24 Ω at 20°C, 68°F
B – valve body E – valve body	Infinity (∞)

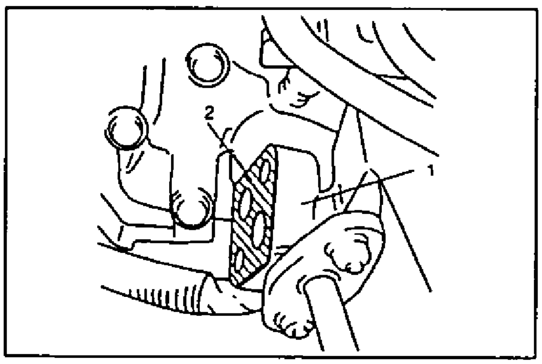
If found faulty, replace EGR valve assembly



2) Remove carbon from EGR valve gas passage.

NOTE:
Do not use any sharp-edged tool to remove carbon.
Be careful not to damage or bend EGR valve, valve seat and rod.

3) Inspect valve (2), valve seat (3) and rod for fault, cracks, bend or other damage.
If found faulty, replace EGR valve assembly (1).



Installation

Reverse removal procedure noting following.
- Clean mating surface of valve and intake manifold (1).
- Use new gasket (2).

EVAPORATIVE EMISSION CONTROL SYSTEM

EVAP Canister Purge System Check

Vacuum Hose Inspection

EVAP Canister Purge Valve Inspection

EVAP Canister Inspection

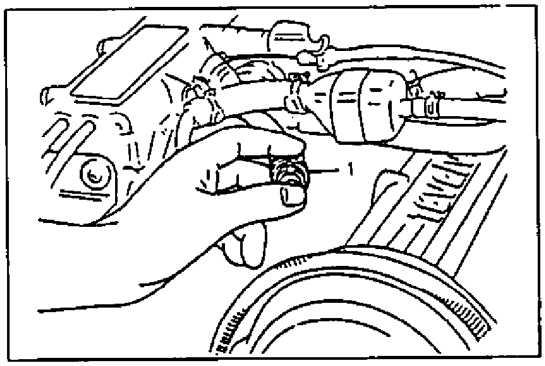
Refer to DTC P0443 Diag. Flow Table in "ENGINE GENERAL INFORMATION AND DIAGNOSIS" section for these checks.

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.

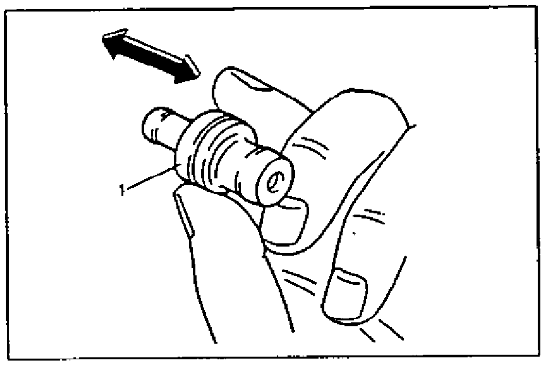
PCV HOSE

Check hoses for connection, leakage, clog, and deterioration. Replace as necessary.



PCV VALVE

1) Remove throttle cover.
2) Disconnect PCV valve (1) with PCV hose.
3) Run engine at idle.
4) Place your finger over end of PCV valve to check for vacuum. If there is no vacuum, check for clogged valve. Replace as necessary.

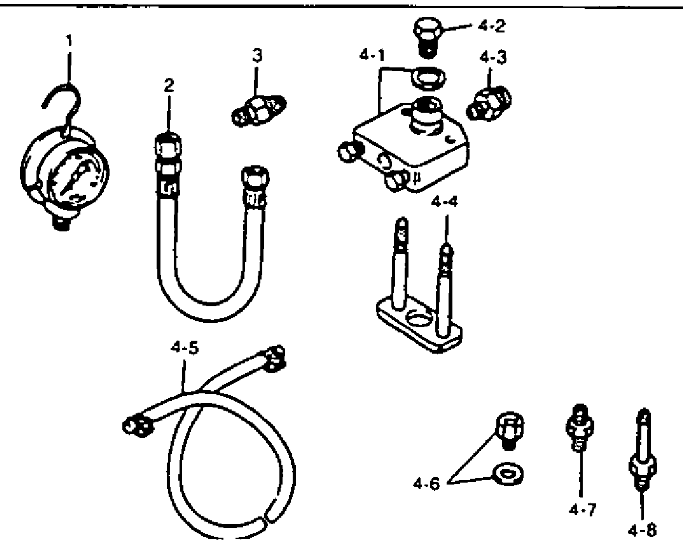


5) After checking vacuum, stop engine and remove PCV valve (1). Shake valve and listen for the rattle of check needle inside the valve. If valve does not rattle, replace valve.
6) After checking, connect PCV valve, PCV hose and clamp securely.
7) Install throttle cover.

TIGHTENING TORQUE SPECIFICATIONS

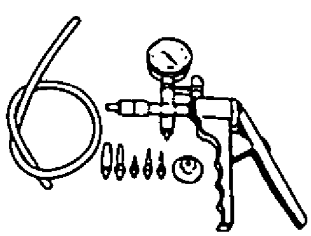
Fastening parts	Tightening torque		
	N·m	kg-m	lb-ft
Delivery pipe plug bolt	30	3.0	22.0
Delivery pipe bolts	23	2.3	17.0
Heated oxygen sensor-1 and sensor-2	45	4.5	32.5
Fuel pressure regulator bolts	10	1.0	7.5
Engine coolant temp. (ECT) sensor	15	1.5	11.0
Crankshaft position sensor bolt	10	1.0	7.5

SPECIAL TOOLS

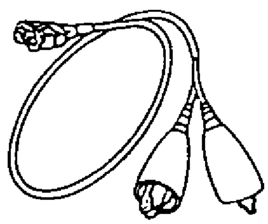


1. Pressure gauge
   09912-58441
2. Pressure hose
   09912-58431
3. Attachment
   09919-46010
4. Checking tool set
   09912-58421

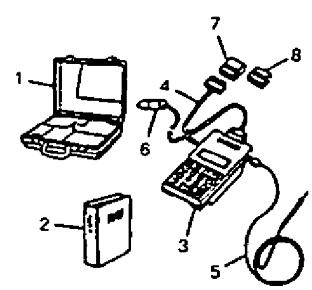
4-1. Tool body & washer
4-2. Body plug
4-3. Body attachment
4-4. Holder
4-5. Return hose & clamp
4-6. Body attachment-2 & washer
4-7. Hose attachment-1
4-8. Hose attachment-2



09917-47010
Vacuum pump gauge

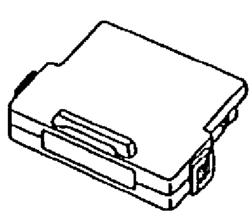


09930-88530
Injector test lead

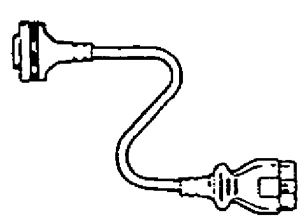


1. Storage case
2. Operator's manual
3. Tech 1A
4. DLC cable
5. Test lead/probe
6. Power source cable
7. DLC cable adaptor
8. Self–test adaptor

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



Mass storage cartridge



09931-76030
16/14 pin DLC (OBD-II adapter) cable

SECTION 6F

IGNITION SYSTEM

WARNING:
For vehicles equipped with Supplement Restraint (Air Bag) System:
- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to AIR BAG SYSTEM COMPONENTS and WIRING LOCATION VIEW under DIAGNOSIS 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 PRECAUTIONS 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).**

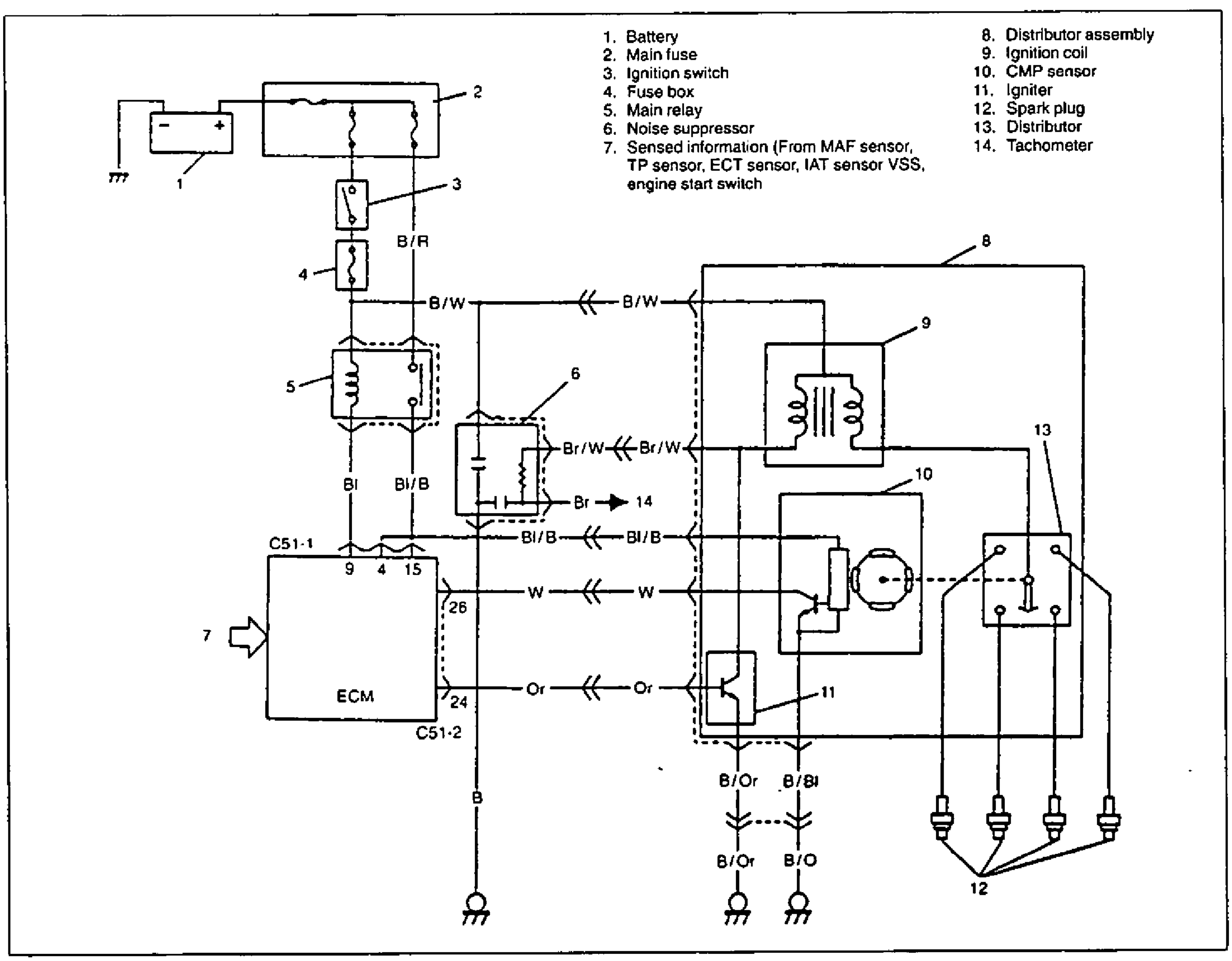
CONTENTS

GENERAL DESCRIPTION

The ignition system used for this vehicle has an IC (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 igniter.
- Igniter (Power unit)
  Located in the distributor, it turns ON and OFF the primary current of the ignition coil according to the signal from ECM.
- Ignition coil
  It is located in the distributor.
  When its primary current is turned OFF, a high voltage is induced in the secondary winding.
- Distributor
  It distributes a high voltage current induced by ignition coil 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 6E.
- MAF sensor, TP sensor, ECT sensor, IAT sensor, VSS, engine start switch and test switch terminal.
  For their details, refer to Section 6E.

In IC 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 volume, coolant temperature, etc., it selects the most suitable ignition timing from its memory and operates the igniter.
Thus ignition timing is controlled to yield the best engine performance.
For more information, refer to Section 6E.

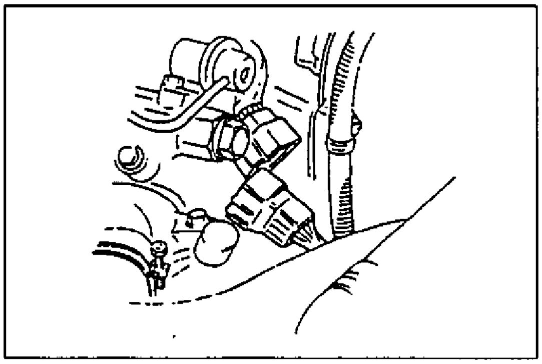


DIAGNOSIS

Condition	Possible Cause	Correction
Engine cranks, but will not start or hard to start	**No spark**	
	• Blown fuse for ignition coil	Replace
	• Loose connection or disconnection of lead wire or high-tension cord(s)	Connect securely
	• Faulty high-tension cord(s)	Replace
	• Faulty spark plug(s)	Adjust, clean or replace
	• Cracked rotor or cap	Replace
	• Faulty ignition coil	Replace
	• Faulty noise suppressor	Replace
	• Faulty CMP sensor	Replace
	• Faulty igniter	Replace
	• Faulty ECM	Replace
	Maladjusted ignition timing	Adjust
Poor fuel economy or engine performance	• Incorrect ignition timing	Adjust
	• Faulty spark plug(s) or high-tension cord(s)	Adjust, clean or replace
	• Faulty ECM	Replace

DIAGNOSTIC FLOW TABLE (When engine cranks but does not start)

STEP	ACTION	YES	NO
1	Check ignition spark. Is it OK?	Go to Section 6 DIAGNOSIS.	Go to Step 2.
2	Check following system parts. • Fuses • High-tension cords • Spark plugs • Noise suppressor • Distributor (distributor cap) • Ignition coil • Signal rotor air gap • CMP sensor Are they OK?	Go to Step 3.	Adjust, repair or replace the malfunction part(s).
3	Check electric wire and connections. Are they OK?	Go to Step 4.	Repair or replace.
4	Substitute a known-good igniter and recheck ignition spark. Is it OK?	Faulty igniter. Replace faulty igniter.	Substitute a known-good ECM and restart the flow table.



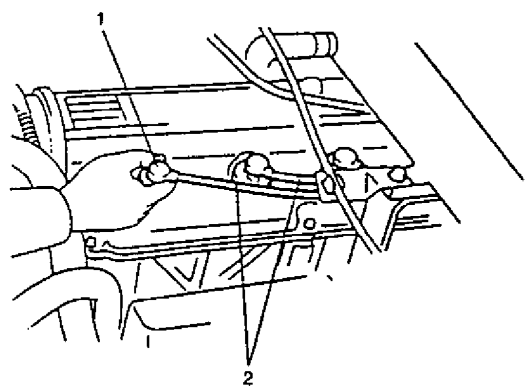
ON-VEHICLE SERVICE

IGNITION SPARK TEST

1) Disconnect injectors, TP sensor and IAC valve wire harness at the couplers.

> **WARNING:**
> **Without disconnection of the 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.

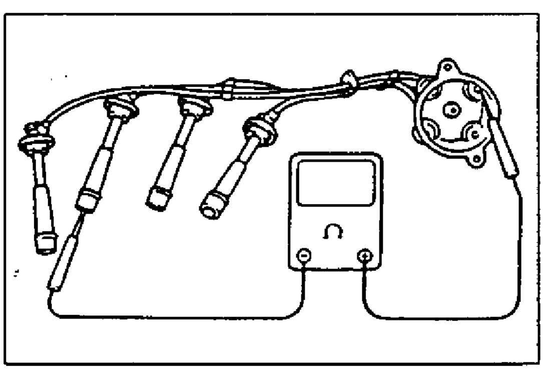


1. Cap
2. High-tension cord

HIGH-TENSION CORDS

1) Disconnect high-tension cord at ignition coil while gripping its cap.
2) Remove distributor cap installed with high tension cords.
3) Pull out high-tension cords from spark plugs while gripping each cap.

> **CAUTION:**
> - **It is recommended to check high-tension cords without unclamping their clamps so as to avoid damage to their inside wire (resistive conductor).**
> - **For the same reason, pull out each connection by gripping cap.**

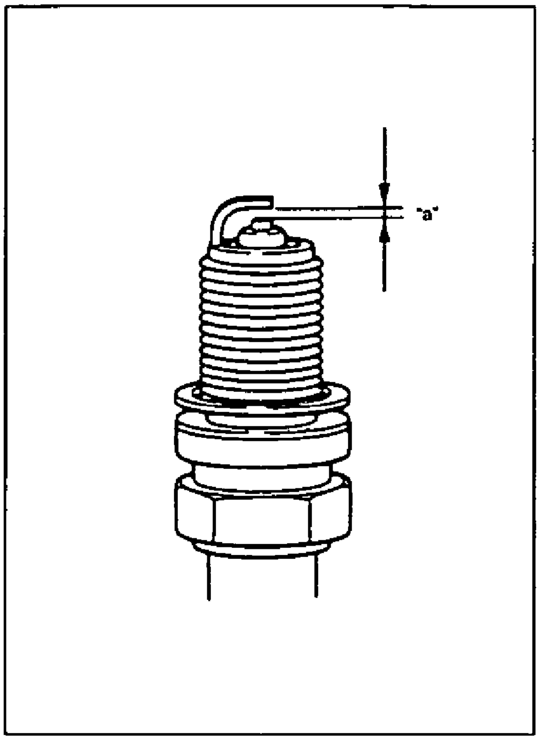


4) Measure resistance of high-tension cord by using ohmmeter.

High-tension cord resistance: 10 – 22 kΩ/m, 3.0 – 6.7 kΩ/ft

5) 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.**

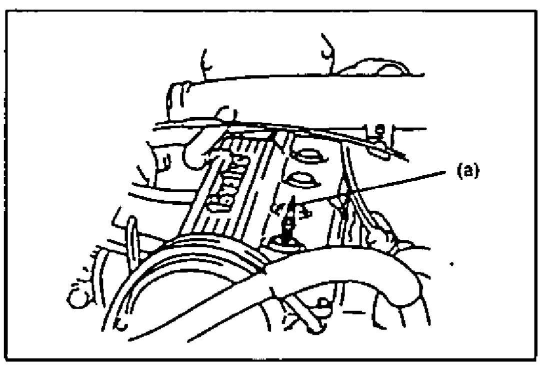


SPARK PLUGS

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 type: NGK BKR6E
DENSO K20PR-U

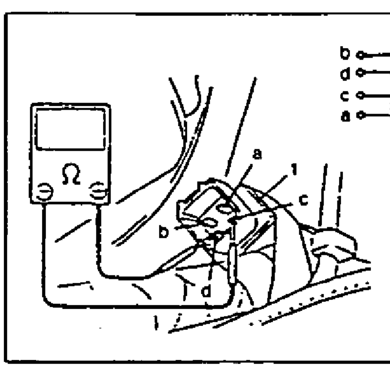
Spark plug gap "a": 0.7 – 0.8 mm (0.028 – 0.031 in.)



4) Install spark plugs and torque them to specification.

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

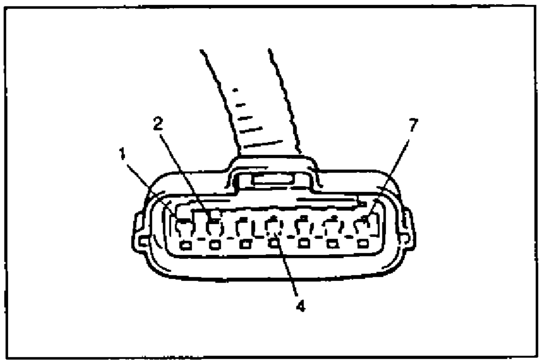
5) Install high-tension cords securely by gripping their caps.



1. Noise suppressor
2. Resistor
3. Capacitor (Condenser)

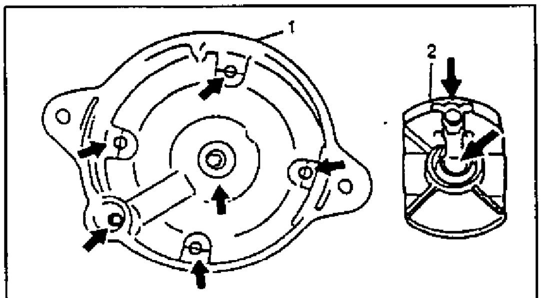
NOISE SUPPRESSOR

1) Disconnect coupler of noise suppressor.
2) Using ohmmeter, check to be sure that condenser is not conductive and resistor has resistance of about 2.2 kΩ.
3) If check result is not satisfactory, replace noise suppressor.



DISTRIBUTOR POWER SUPPLY

1) Disconnect distributor lead wire from distributor.
2) Check voltage between "+" terminal (7) and "–" terminal (4) of disconnected distributor lead wire, and "+" terminal (2) and "–" terminal (1) of the same coupler with ignition switch ON.
   Are both measured voltages 10 – 14 V?
   If not, check wire harness.

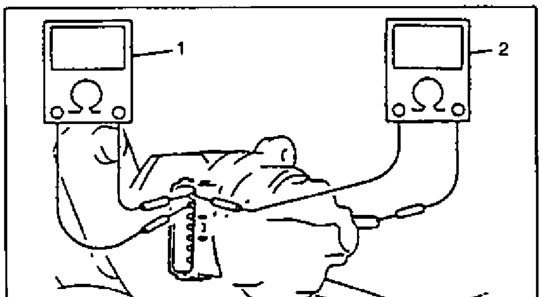


1. Distributor cap
2. Rotor

DISTRIBUTOR

Distributor Cap and Rotor

Check cap and rotor for crack and their terminals for corrosion and wear, Replace as necessary.



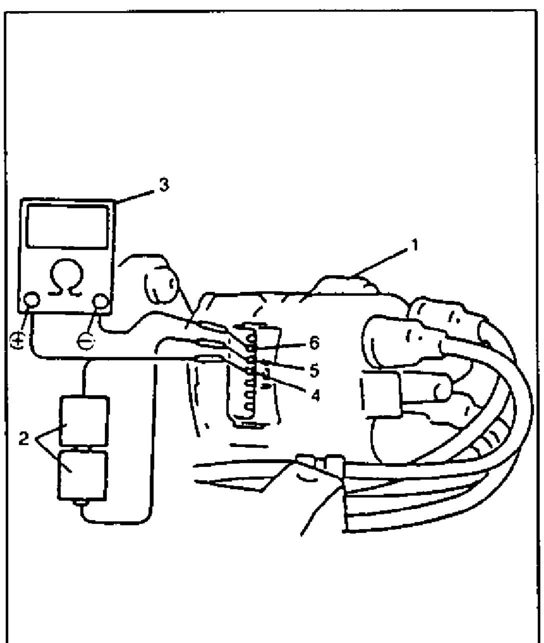
1. Primary resistance
2. Secondary resistance

Ignition Coil Circuit

1) Remove distributor cap and disconnect distributor coupler.
2) Measure primary and secondary coil circuit resistances.

Ignition coil resistance at 20°C (68°F)
Primary circuit : 0.7 – 0.9 Ω
Secondary circuit: 13 – 18 kΩ

If check result is not satisfactory, replace distributor.



1. Distributor
2. 1.5 V battery (3.0 V in total)
3. Analog type ohmmeter

Igniter Circuit

Before this check, prepare 2 new 1.5 V batteries and an analog type ohmmeter.

1) Disconnect distributor coupler from distributor.
2) Arrange 2 new 1.5 V batteries in series (check that total voltage is about 3.0 V).

   Connect positive terminal of ohmmeter to "4" terminal of distributor and negative terminal to "6" terminal.

   Check continuity between "6" and "4" terminals with about 3 V applied to its "5" terminal and also none applied.

No voltage applied to "5" terminal	No continuity (infinity)
Voltage applied to "5" terminal	Continuity

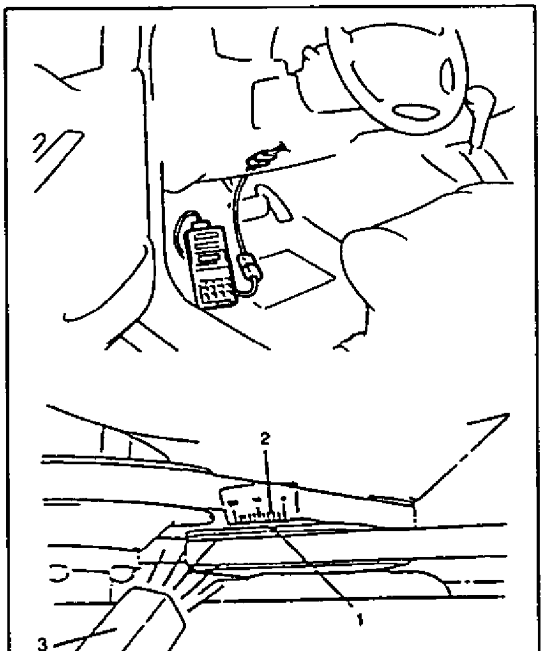
If check result is not satisfactory, replace distributor.

IGNITION TIMING

INSPECTION AND ADJUSTMENT

1) Start engine and warm it up to normal operating temperature.
2) Make sure that:
   - All of electrical loads except ignition are switched off.
   - A/C is OFF, if equipped.
   - M/T is set in neutral.
   - Parking brake lever is pulled fully.
3) Check to be sure that idle speed is within specification.
4) Set timing light to No.1 high tension cord.
5) Connect SUZUKI scan tool to DLC with ignition switch OFF, restart engine and fix ignition timing by using "FIXED SPARK" mode of SUZUKI scan tool.

   NOTE:
   In this state, observe ignition timing with timing light. If it is varying (if it is not fixed), that indicates ungrounded "E" terminal which prevents accurate inspection and adjustment. Therefore, be sure to ground it securely.

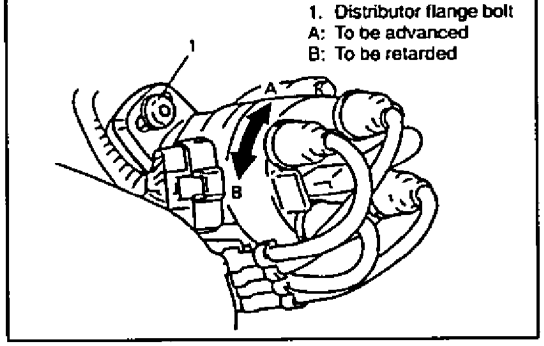


1. "V" mark on crankshaft pulley
2. 5° BTDC
3. Timing light

6) Using timing light, check that timing is within specification.

   Initial ignition timing (Ignition timing fixed):
   5 ± 1° BTDC at 800 r/min.

   Ignition order: 1 – 3 – 4 – 2



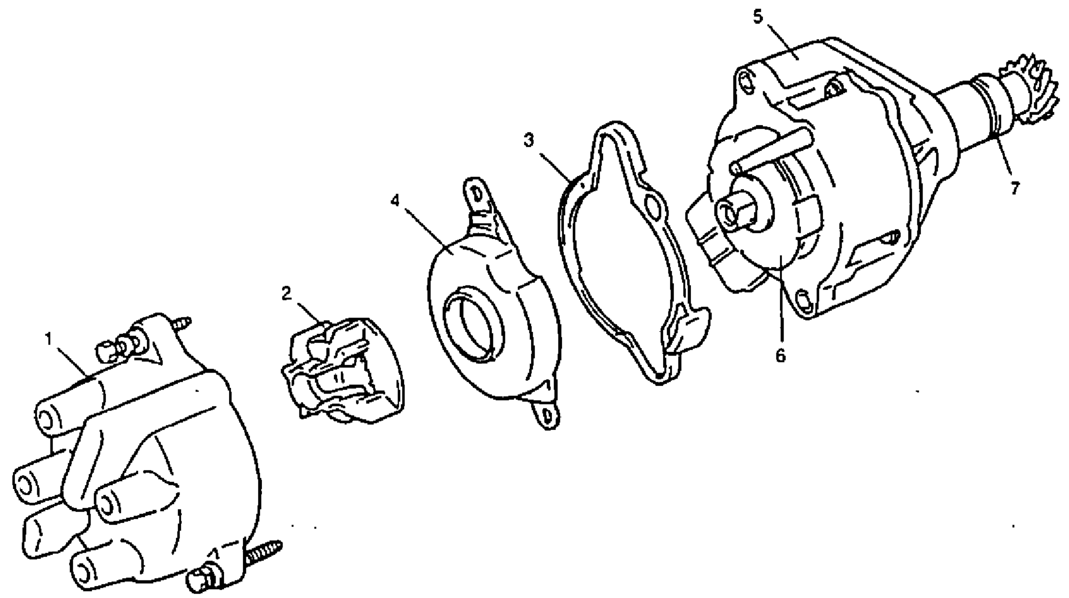
1. Distributor flange bolt
A: To be advanced
B: To be retarded

7) If ignition timing is out of specification, loosen flange bolts, adjust timing by turning distributor assembly while engine is running, and then tighten bolts.
8) After tightening distributor flange bolts, recheck that ignition timing is within specification.
9) After checking and/or adjusting, release ignition timing fixation by using SUZUKI scan tool.

   NOTE:
   In this state, ignition timing may vary more or less of 8° BTDC but it is nothing abnormal.

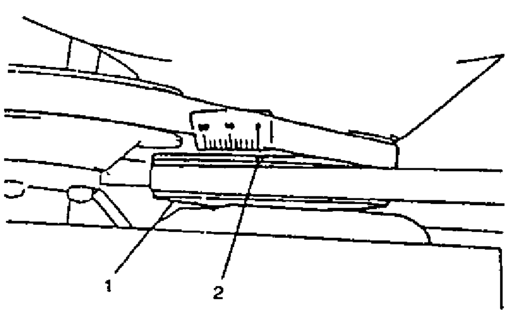
10) Verify that increasing engine speed advances ignition timing.

DISTRIBUTOR UNIT

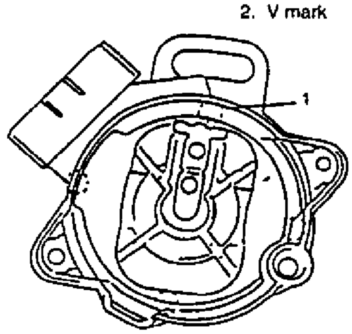


1. Cap
2. Rotor
3. Cap seal
4. Cover
5. Housing assembly
6. Signal rotor
7. O-ring

CAUTION:
Don't remove the signal rotor.



1. Crankshaft pulley
2. V mark

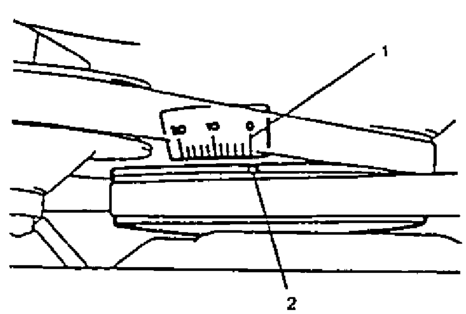


1. No.1 terminal position

REMOVAL

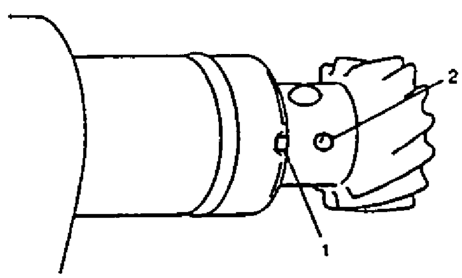
1) Disconnect negative cable at battery.
2) Disconnect distributor coupler.
3) Remove distributor cap. Then to facilitate re-installation, turn crankshaft in normal direction (clockwise as viewed from crankshaft pulley side) so that distributor rotor is positioned at No.1 terminal of distributor cap.
4) Remove distributor flange bolt.
5) Pull out distributor housing assembly.

INSTALLATION



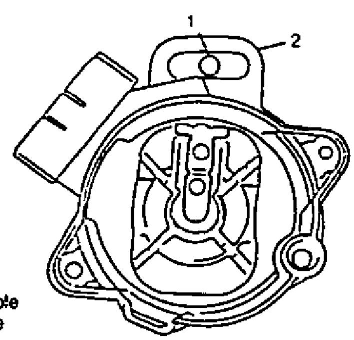
1. "0" mark
2. "V" mark (Timing notch) on crankshaft pulley

1) If distributor rotor has not been positioned at No.1 terminal of distributor cap in distributor removal, perform following step.
   i) Turn over crankshaft in normal direction (clockwise as viewed from crankshaft pulley side) until "V" mark on pulley aligns with timing mark "0" (zero) on timing tab.
   ii) After aligning two marks, remove cylinder head cover to visually confirm that the rocker arms are not riding on the camshaft cams at No.1 cylinder. If the arms are found to be riding on the cams, turn over crankshaft 360° to align the two marks anew.



1. Dent mark
2. Punch mark

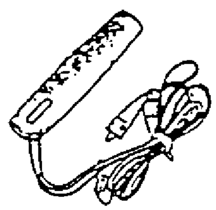
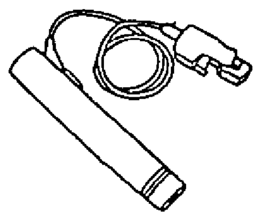
2) Check O-ring for damage and deterioration.
   Replace if necessary.
   Apply engine oil to it.
3) Align punch mark on gear with "V" mark on housing.



1. Bolt hole
2. Flange

4) Insert distributor into gear case in such a way that the center of distributor flange will coincide with distributor flange bolt hole provided in distributor gear case. When inserting the distributor completely, position of distributor rotor becomes as shown in figure. Secure distributor in place tentatively by making flange bolt finger-tight.
5) Check to make sure that rotor is in good condition.
6) Inspect distributor cap and clean or replace as required.
7) Make sure that distributor cap seal is placed properly and install cap, and then fasten it with screws.
8) Connect distributor coupler.
9) Connect negative cable at battery.
10) Check and adjust ignition timing as previously outlined.

SPECIAL TOOLS

 09900-27301 Timing light (DC 12 V)	 09930-76420 Timing light (Dry cell type)

SECTION 6K

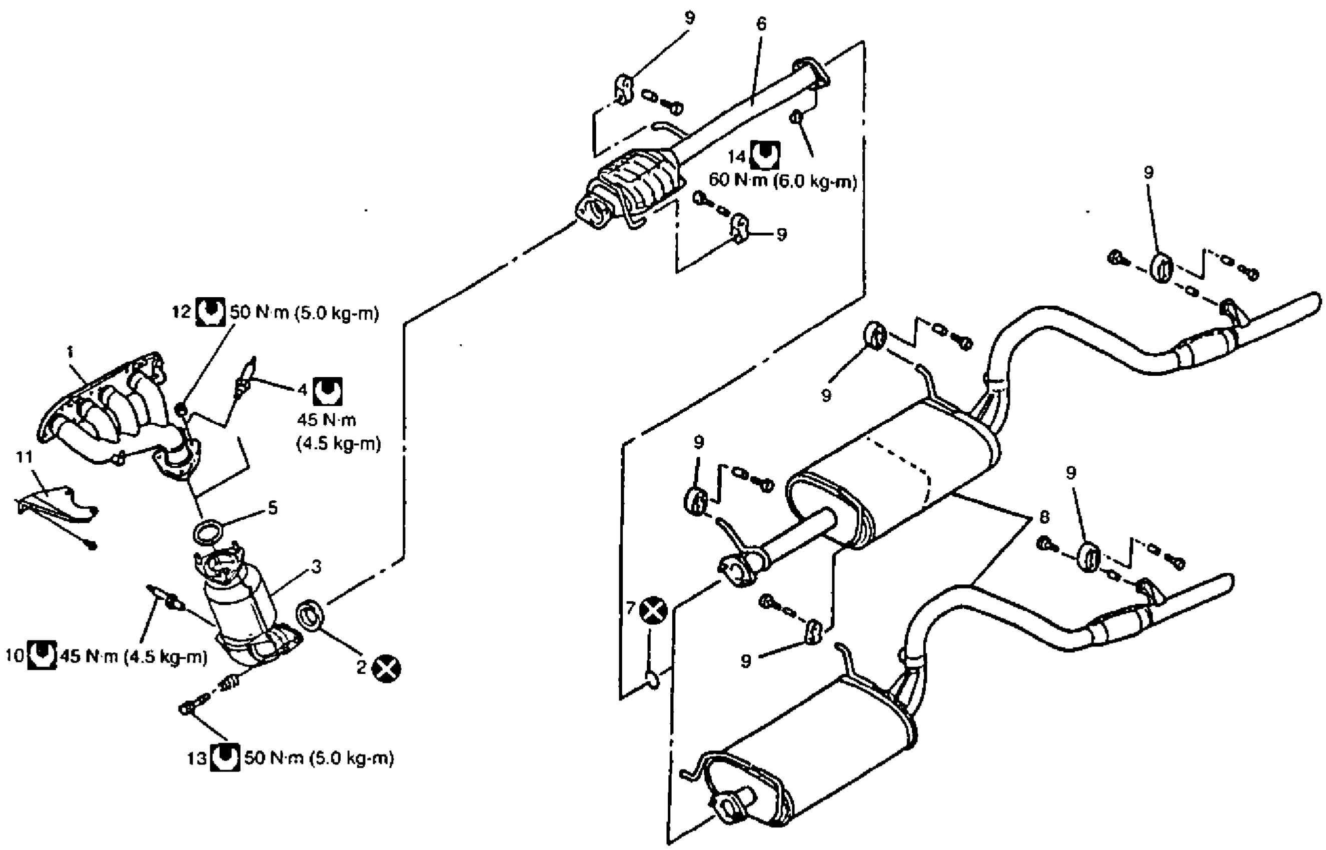
EXHAUST SYSTEM

CAUTION:
Be sure to use UNLEADED FUEL for the catalytic converter equipped vehicle. Use of LEADED FUEL will affect performance of the catalytic converter adversely to a great extent.

CONTENTS

GENERAL DESCRIPTION

The exhaust system of the vehicle consists of the exhaust manifold, exhaust No.1 pipe (with Warm Up Three-Way Catalytic Convertor, WU-TWC), exhaust No.2 pipe (with Three-Way Catalytic Converter, TWC), muffler, seals, gasket, etc. The three way catalytic converter is an emission control device added to the exhaust system to lower the level of Hydrocarbon (HC), Carbon Monoxide (CO) and Oxides of Nitrogen (NOx) pollutants in the exhaust gas.

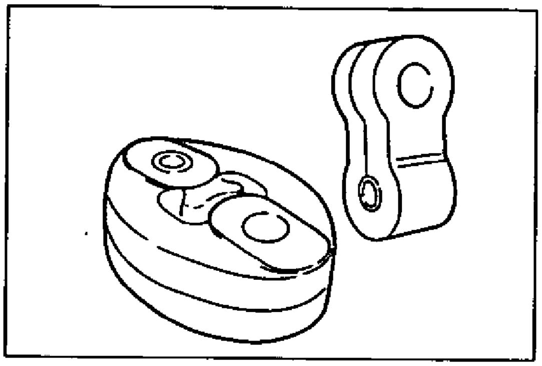


: Do not reuse
: Tightening torque

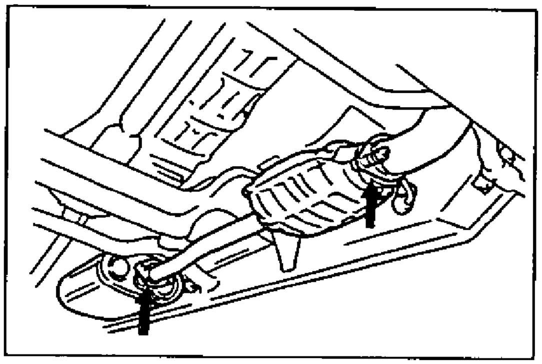
1. Exhaust manifold
2. Gasket
3. Exhaust No.1 pipe
4. Heated oxygen sensor-1
5. Gasket
6. Exhaust No.2 pipe
7. Gasket
8. Muffler
9. Rubber mounting
10. Heated oxygen sensor-2
11. Exhaust pipe bracket
12. No.1 exhaust pipe nut
13. No.2 exhaust pipe bolt
14. Muffler nut

MAINTENANCE

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



At every interval of periodic maintenance service, and when vehicle is raised for other service, check exhaust system as follows:
- Check rubber mountings for damage, deterioration, and out of position.



- Check exhaust system for leakage, loose connection, dent and damage.
  If bolts or nuts are loosened, tighten them to specified torque. Refer to "ON-VEHICLE SERVICE" for torque data.
- Check nearby body areas damaged, missing, or mispositioned part, open seam, hole connection or any other defect which could permit exhaust fumes to seep into vehicle.
- Make sure that exhaust system components have enough clearance from underbody to avoid overheating and possible damage to passenger compartment carpet.
- Any defect should be fixed at once.

ON-VEHICLE SERVICE

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

EXHAUST MANIFOLD

Refer to Section 6A1 for removal and installation procedures. Before installation, check gasket and seal for deterioration or damage. Replace them as necessary.

MUFFLER

CAUTION:
As exhaust pipe has three way catalytic converter in it, it should not be exposed to any impulse. Be careful not to drop it or hit it against something.

Refer to figure of previous page for removal and installation.

SECTION 8G

IMMOBILIZER CONTROL SYSTEM (IF EQUIPPED)

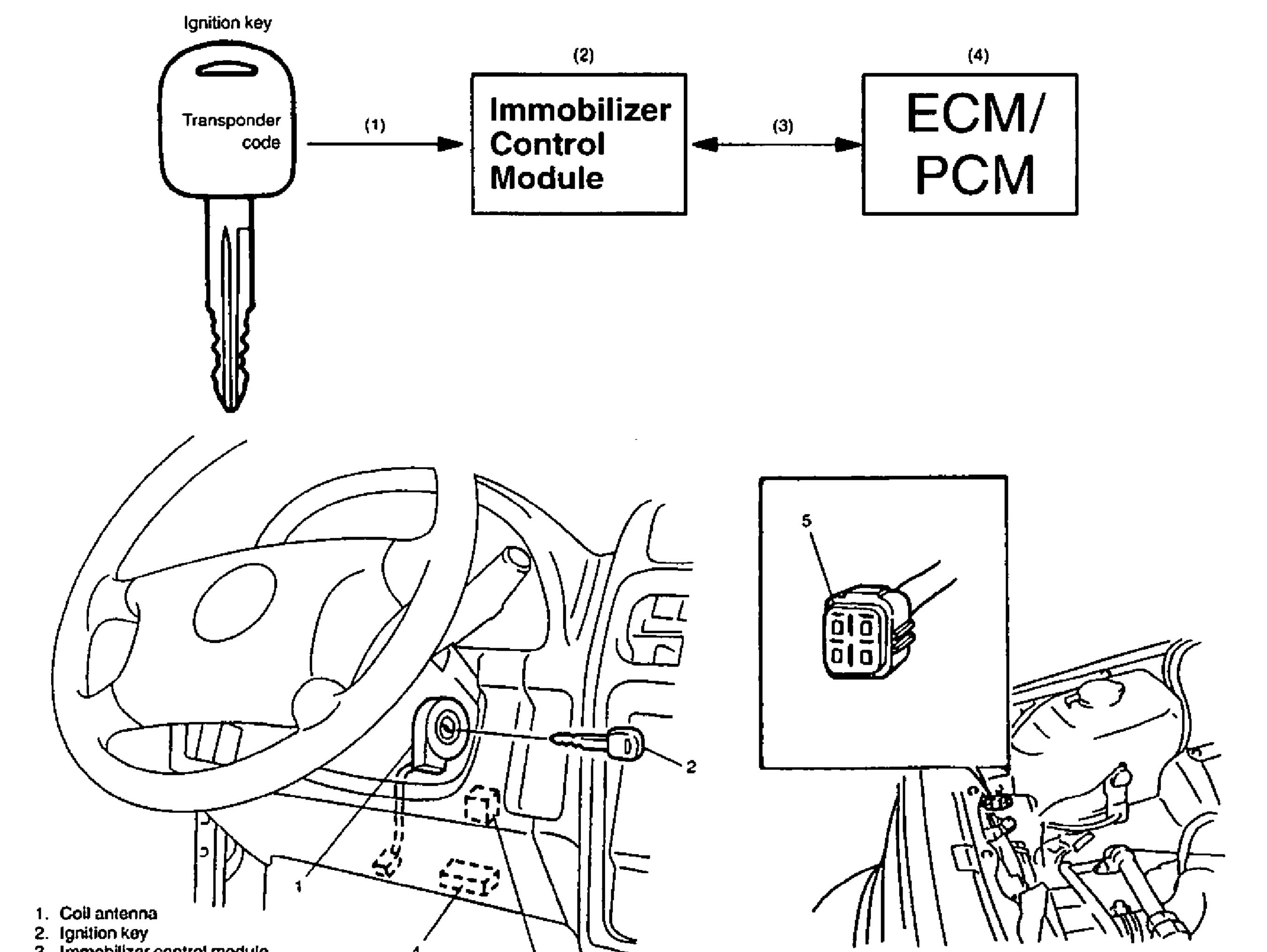
WARNING:
For vehicles equipped with Supplemental Restraint (Air Bag) System
- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "Air Bag System Components and Wiring Location View" under "General Description" in air bag system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

CONTENTS

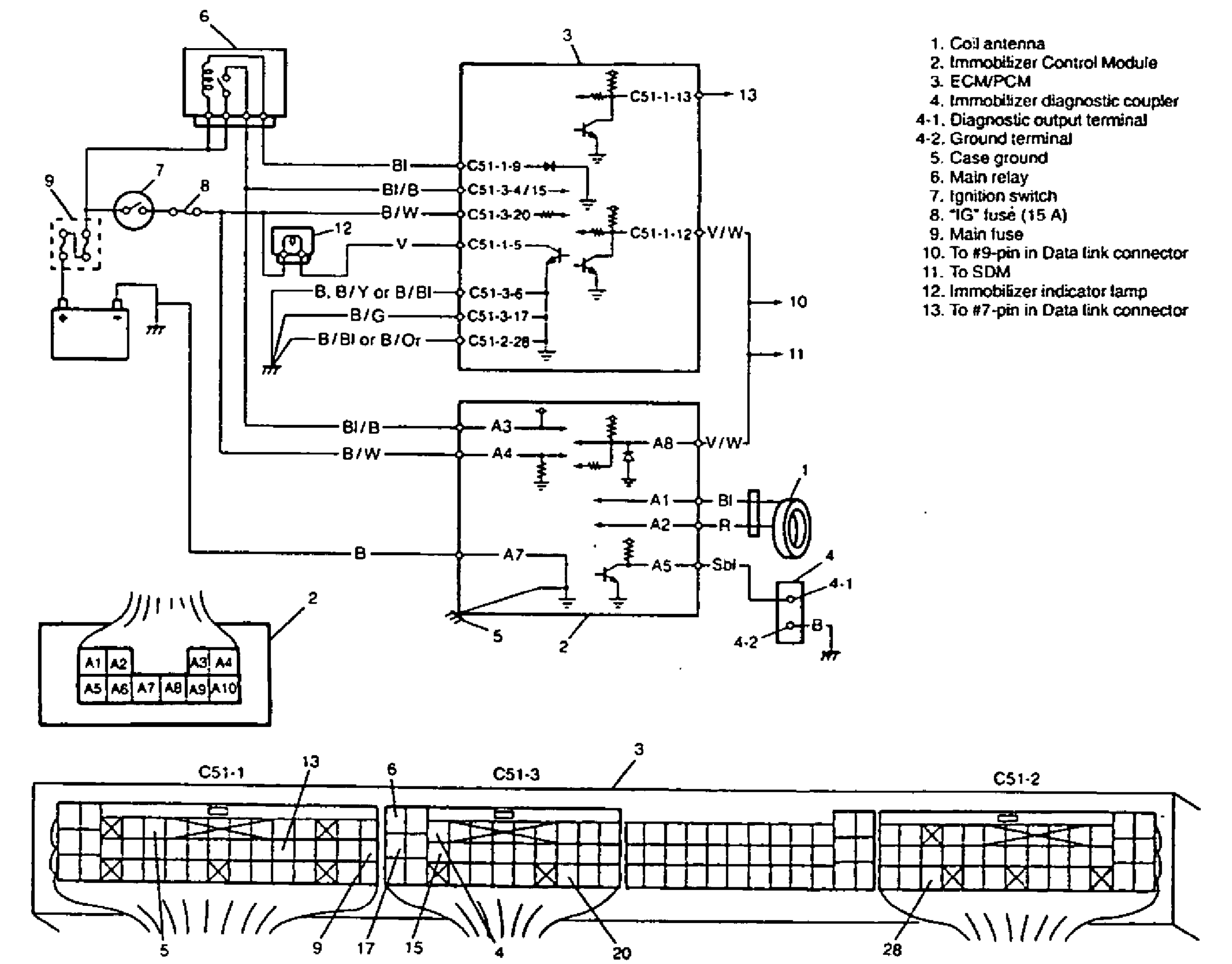
GENERAL DESCRIPTION

The immobilizer control system designed to prevent vehicle burglar consists of following components.
- Engine control module (ECM)/Powertrain control module (PCM)
- Immobilizer control module
- Ignition key (with built-in transponder)
- Coil antenna

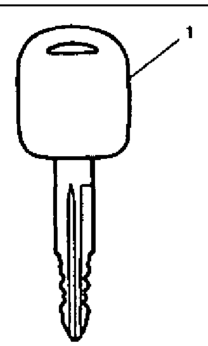
Operation of this system is as follows.
(1) Each ignition key has its own code (Transponder code) stored in memory. When the ignition switch is turned ON, Immobilizer Control Module tries to read the Transponder code through the coil antenna installed to the steering lock assembly.
(2) Immobilizer Control Module compares the Transponder code read in (1) and that registered in Immobilizer Control Module and checks if they match.
(3) When it is confirmed that two Transponder codes match each other as described above, Immobilizer Control Module and ECM/PCM check if ECM/Immobilizer Control Module codes registered in them respectively match.
(4) Only when it is confirmed that ECM/Immobilizer Control Module codes match, the engine starts running. If Transponder codes in Step (2) or ECM/Immobilizer Control Module codes in Step (3) do not match, ECM/PCM will stop operation of the injector and ignition of spark plug.



1. Coil antenna
2. Ignition key
3. Immobilizer control module
4. Data link connector (DLC)
5. Immobilizer diagnostic coupler

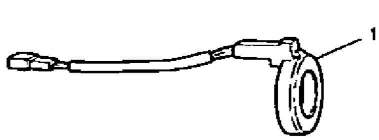


Terminal arrangement of Immobilizer Control Module and ECM/PCM couplers (Viewed from harness side)


1. Ignition key with built-in transponder

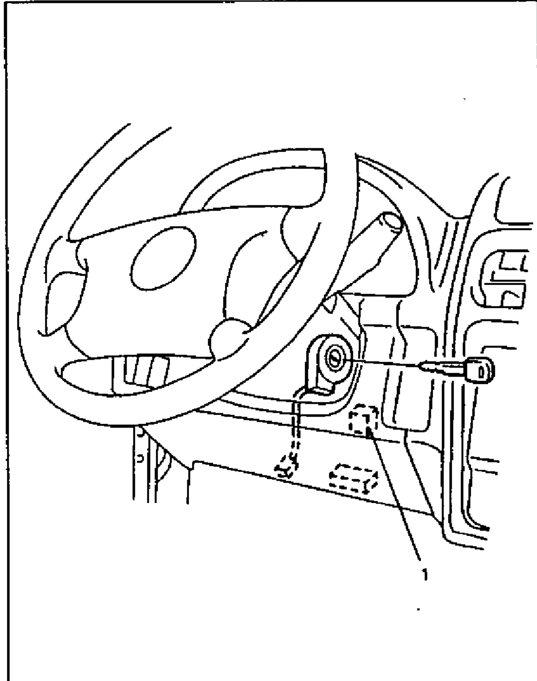
IGNITION KEY

The ignition key for the immobilizer control system has a built-in transponder. Each transponder in the key has an each transmitting code (Transponder code). The code will transmitted from the key via the coil antenna to Immobilizer Control Module when the ignition switch is turned ON.


1. Coil antenna

COIL ANTENNA

The coil antenna is installed to the steering lock assembly. As it is energized by Immobilizer Control Module, it transmits the transponder code of the ignition key to Immobilizer Control Module.



1. Immobilizer Control Module

IMMOBILIZER CONTROL MODULE

Immobilizer Control Module is installed to the underside of the instrument panel at the driver's seat side.
As main functions, Immobilizer Control Module checks matching not only between the Transponder Code transmitted from the ignition key and that registered in Immobilizer Control Module (Up to 4 different Transponder codes can be registered.) but also between the ECM/Immobilizer Control Module code transmitted from ECM/PCM and that registered in Immobilizer Control Module. In addition, it has an on-board diagnostic system (self-diagnosis function) which is described in "On-Board Diagnostic System (Self-Diagnosis Function)" in this section.

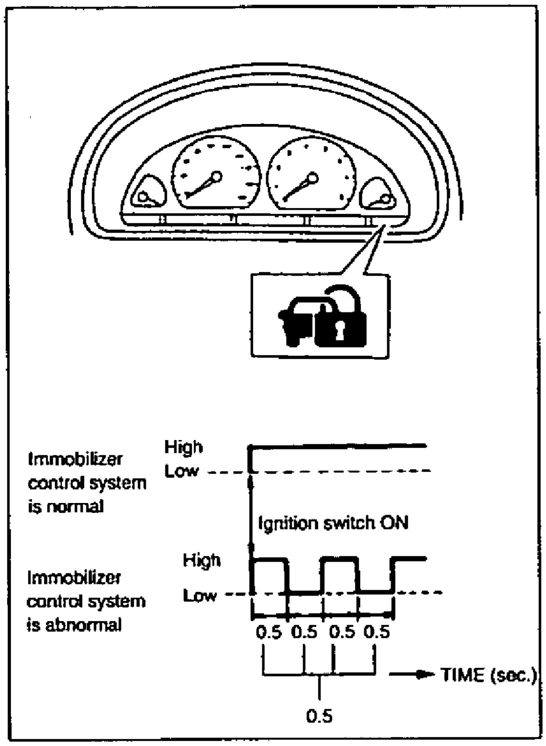
ECM/PCM

As main functions, ECM/PCM not only checks matching of ECM/Immobilizer Control Module code but also has an on-board diagnostic system (self-diagnosis function) as described in "On-Board Diagnostic System (Self-Diagnosis Function)" in this section.
For installation position of ECM/PCM, refer to Section 6E.

ON-BOARD DIAGNOSTIC SYSTEM (SELF-DIAGNOSIS FUNCTION)

Immobilizer Control Module and ECM/PCM diagnose troubles which may occur in the area including the following parts when the ignition switch is ON.

ECM/ PCM:	•ECM/Immobilizer Control Module code •Serial data link circuit •ECM/PCM	Immobilizer Control Module:	•Transponder code •Coil antenna •ECM/Immobilizer Control Module code •Serial data link circuit •Immobilizer Control Module •Ignition signal



With the ignition switch turned ON (but the engine at stop) regardless of the condition of engine and emission control system, ECM/PCM indicates whether a trouble has occurred in the immobilizer control system or not by causing the immobilizer indicator lamp to flash or turn ON.

Immobilizer indicator lamp is ON:
No trouble exists in the immobilizer control system.
Immobilizer indicator lamp is flashing:
ECM/PCM or Immobilizer Control Module has detected some trouble in the immobilizer control system.

NOTE:
As soon as the ignition switch is turned ON, ECM/PCM and Immobilizer Control Module diagnose if a trouble has occurred in the immobilizer control system. While the diagnosis is being made, the Immobilizer indicator lamp stays ON and if the diagnosis result is "abnormal", it immediately changes to flashing but if the result is "normal", it remains ON. Diagnosis takes about 3 seconds at maximum.

When ECM/PCM and Immobilizer Control Module detects a trouble which has occurred in the above areas, it stores DTC corresponding to the exact trouble area in ECM/PCM and Immobilizer Control Module memory.

DTCs stored in memory of each controller (Immobilizer Control Module and ECM/PCM) can be read by using the procedure described in "DIAGNOSTIC TROUBLE CODE CHECK (IMMOBILIZER CONTROL MODULE)" and "DIAGNOSTIC TROUBLE CODE CHECK (ECM/PCM)" in this section.

DIAGNOSIS

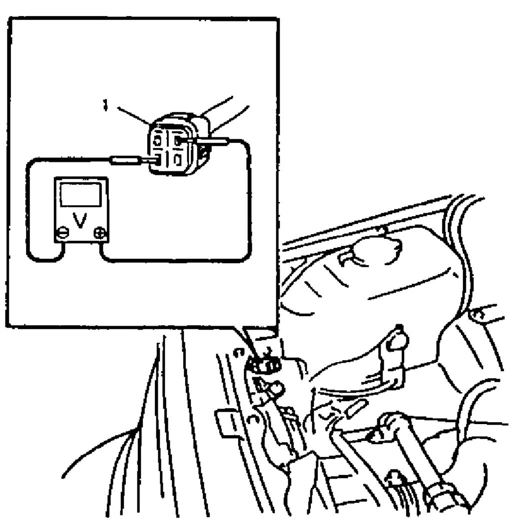
ECM/PCM and Immobilizer Control Module have on-board diagnostic system (a system self-diagnosis function) as described previously.
Investigate where the trouble is by referring to "Diagnostic Flow Table" and "Diagnostic Trouble Code Table" on later pages.

PRECAUTIONS IN DIAGNOSING TROUBLES

[PRECAUTIONS IN IDENTIFYING DIAGNOSTIC TROUBLE CODE]

ECM/PCM

- Before identifying diagnostic trouble code indicated through Suzuki scan tool, don't disconnect couplers from ECM/PCM, battery cable from battery, ECM/PCM ground wire harness from engine.
  Such disconnection will clear trouble codes for electronic fuel injection system stored in memory of ECM/PCM.
- 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 application.
- Take a note of diagnostic trouble code indicated first.



1. Immobilizer diagnostic coupler

Immobilizer Control Module

- Take a note of diagnostic trouble code indicated first.

[INTERMITTENT TROUBLES]

- There are cases where output of diagnostic output terminal and/or Suzuki scan tool indicates a diagnostic trouble code representing a trouble which occurred only temporarily and has gone. In such case, it may occur that good parts are replaced unnecessarily. To prevent such accident, be sure to follow instructions given below when checking by using "Diagnostic Flow Table".
  - When trouble can be identified, it is not an intermittent one: Check coil antenna, ignition key, wires and each connection and if they are all in good condition, substitute a known-good ECM/PCM and recheck.
  - When trouble can not be identified but output of diagnostic output terminal and/or Suzuki scan tool indicates a trouble code: Diagnose trouble by using that code No. and if ignition key, coil antenna, wires and each connection are all in good condition, turn OFF ignition switch and then ON.

Then check what Suzuki scan tool and/or output of diagnostic output terminal indicates.
Only when they indicate trouble code again, substitute a known-good ECM/PCM or Immobilizer Control Module and check again.
If they indicate not trouble code but normal code, it means that an intermittent trouble did occur and has gone. In this case, check wires and connections carefully again.

[NOTES ON SYSTEM CIRCUIT INSPECTION]
Refer to "Precautions for Electrical Circuit Service" and "Intermittents and Poor Connection" in Section 0A.

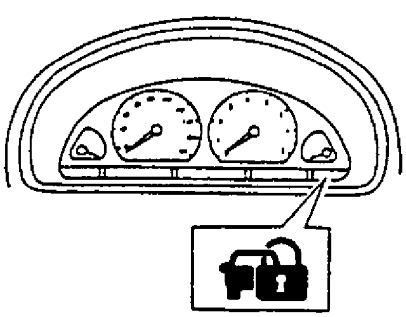
[Precaution after replacing ECM/PCM or Immobilizer Control Module]

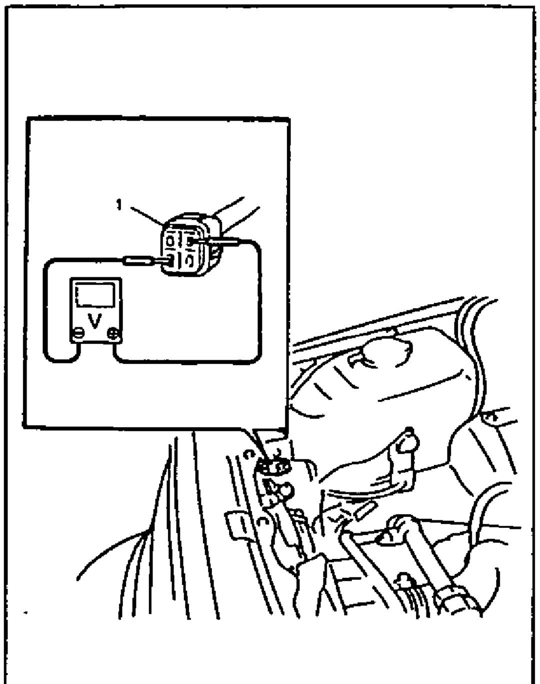
- When ECM/PCM was replaced, including when replaced because rechecking by using a known-good ECM/PCM was necessary during trouble diagnosis, the ECM/Immobilizer Control Module code must be registered in ECM/PCM and Immobilizer Control Module by performing procedure described in "Procedure after ECM/PCM Replacement" on p. 8G-28. If it is not registered, the engine would not start and accurate trouble diagnosis would not be assured.
- When Immobilizer Control Module was replaced, including when replaced because rechecking by using a known-good Immobilizer Control Module was necessary during trouble diagnosis, the Transponder code and ECM/Immobilizer Control Module code must be registered in Immobilizer Control Module and ECM/Immobilizer Control Module code in ECM/PCM by performing procedure described in "Procedure after Immobilizer Control Module Replacement" on p. 8G-27. If they are not registered, the engine would not start and accurate trouble diagnosis would not be assured.

DIAGNOSTIC FLOW TABLE

STEP	ACTION	YES	NO
1	1) Check immobilizer indicator lamp while ignition switch is ON (but without starting engine). See Fig. 1. Dose immobilizer indicator lamp flash?	Go to Step 3.	• If immobilizer indicator lamp remains ON, go to Step 2. • If immobilizer indicator lamp remains OFF, go to "IMMOBILIZER INDICATOR LAMP CHECK" in this section.
2	1) Check DTC stored in ECM/PCM referring to "DIAGNOSTIC TROUBLE CODE CHECK (ECM/PCM)" in this section. Is there any DTC(s)?	Go to "IMMOBILIZER INDICATOR LAMP CHECK" in this section.	Immobilizer control system is in good condition.
3	1) Check DTC stored in immobilizer control module referring to "DIAGNOSTIC TROUBLE CODE CHECK (IMMOBILIZER CONTROL MODULE)" in this section. Is there any DTC(s)?	Go to flow table for DTC No.	Go to Step 4.
4	1) Check DTC stored in ECM/PCM referring to "DIAGNOSTIC TROUBLE CODE CHECK (ECM/PCM)" in this section. Is there any DTC(s) for immobilizer control system?	Go to flow table for DTC No.	Substitute a known-good ECM/PCM and recheck. NOTE: After replacing with a known-good ECM/PCM, register ECM/Immobilizer Control Module code in ECM/PCM by performing procedure described in "Procedure after ECM/PCM Replacement" section.

Fig. 1 for Step 1





1. Immobilizer diagnostic coupler

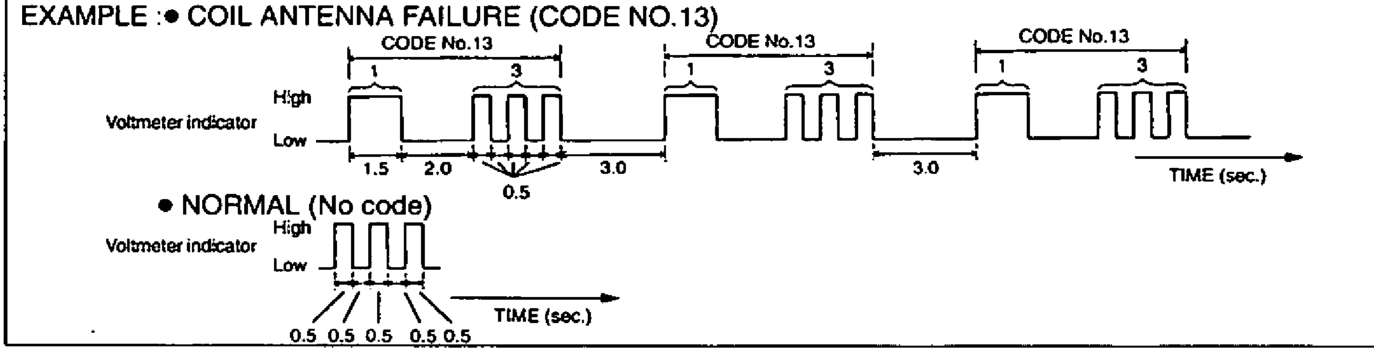
DIAGNOSTIC TROUBLE CODE (DTC) CHECK (IMMOBILIZER CONTROL MODULE)

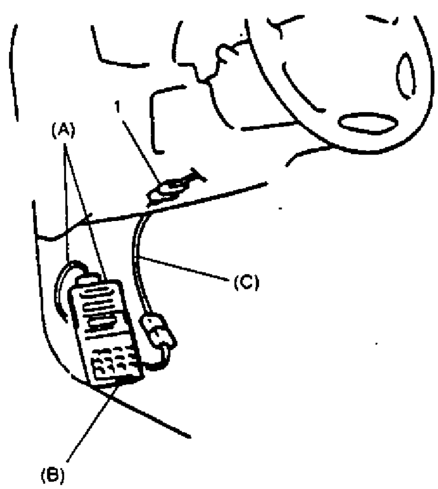
1) Using analog type voltmeter, connect positive probe to diagnostic output terminal and negative probe to ground of immobilizer diagnostic coupler with ignition switch turned ON.
2) Read deflection of voltmeter indicator which represents DTC as shown in example below and write it down. For details of DTC, refer to Immobilizer Control Module side in "Diagnostic Trouble Code Table".
   If voltmeter indicator dose not deflect, go to "Diagnostic Flow Table A".

NOTE:

If abnormality or malfunction lies in two or more areas, voltmeter indicates applicable codes three times each.

EXAMPLE :● COIL ANTENNA FAILURE (CODE NO.13)





1. Data link connector (DLC)

DIAGNOSTIC TROUBLE CODE (DTC) CHECK (ECM/PCM)

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

   Special Tool
   (A): 09931-76011 (Suzuki scan tool)
   (B): Mass storage cartridge
   (C): 09931-76030 (16/12 pin DLC adapter)

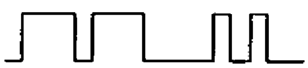
3) Turn ignition switch ON.
4) Read DTC stored in ECM/PCM according to instructions displayed on Suzuki scan tool and print it or write it down. Refer to Suzuki scan tool operator's manual for further details.

   NOTE:
   - **When reading DTC stored in ECM/PCM using Suzuki scan tool, select "ECM" from the applications menu and "SUZUKI mode" from the communication mode menu displayed on Suzuki scan tool.**
   - **If ECM/PCM detects a trouble in both engine and emission control system and immobilizer control system, Suzuki scan tool indicates trouble codes of both systems using Suzuki mode of ECM application.**

   If communication between Suzuki scan tool and ECM/PCM is not possible, check if Suzuki scan tool is communicable by connecting it to ECM/PCM in another vehicle. If communication is possible in this case, Suzuki scan tool is in good condition. Then check data link connector and serial data line (circuit) in the vehicle with which communication was not possible.
5) After completing the check, turn ignition switch OFF and disconnect Suzuki scan tool from data link connector (DLC).

DIAGNOSTIC TROUBLE CODE TABLE

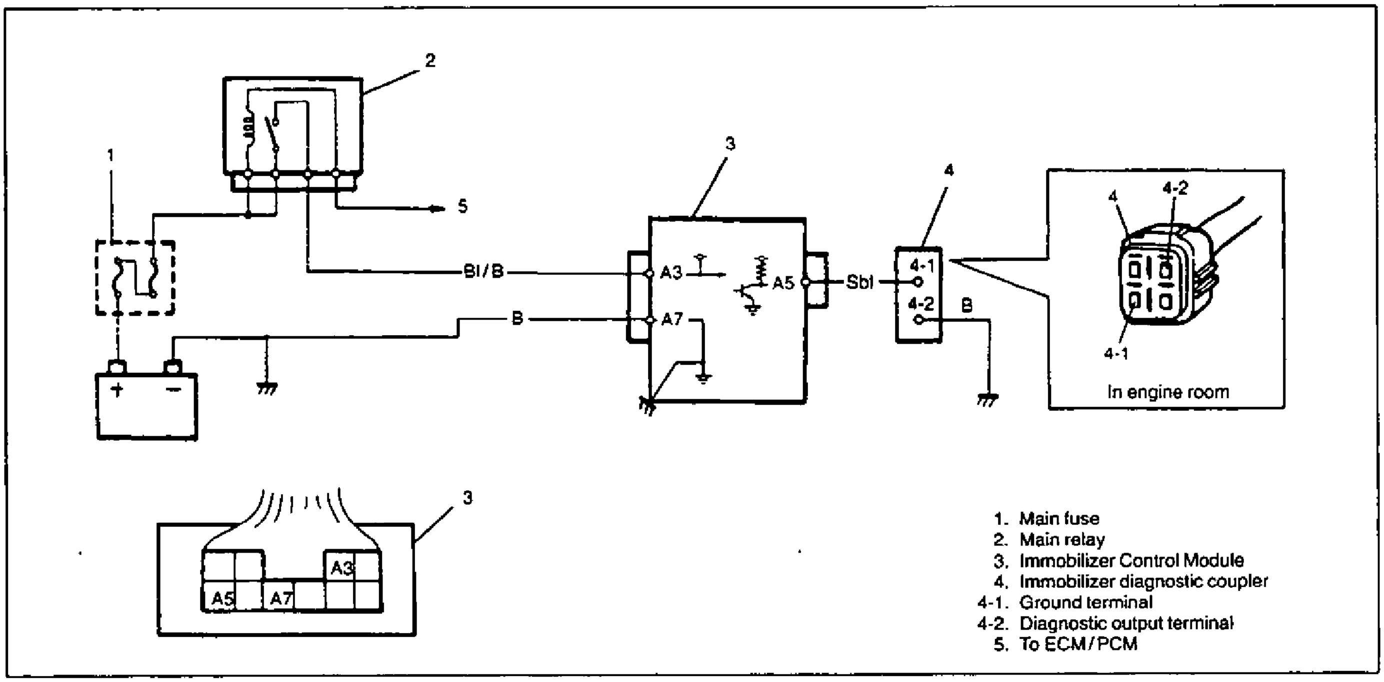
Immobilizer Control Module

DIAGNOSTIC TROUBLE CODE		DIAGNOSTIC AREA	DIAGNOSIS
NO.	VOLTMETER INDICATION		
–		Normal (No code)	This code appears when none of the other codes are identified.
11		Transponder code	Diagnose trouble according to "DIAGNOSTIC FLOW TABLE" corresponding to each code No.
31			
12		Immobilizer Control Module	
13		Coil antenna or ignition key with built-in transponder	
21		ECM/Immobilizer Control Module code	
22		Ignition switch circuit	
23		Serial data link wire	

ECM/PCM

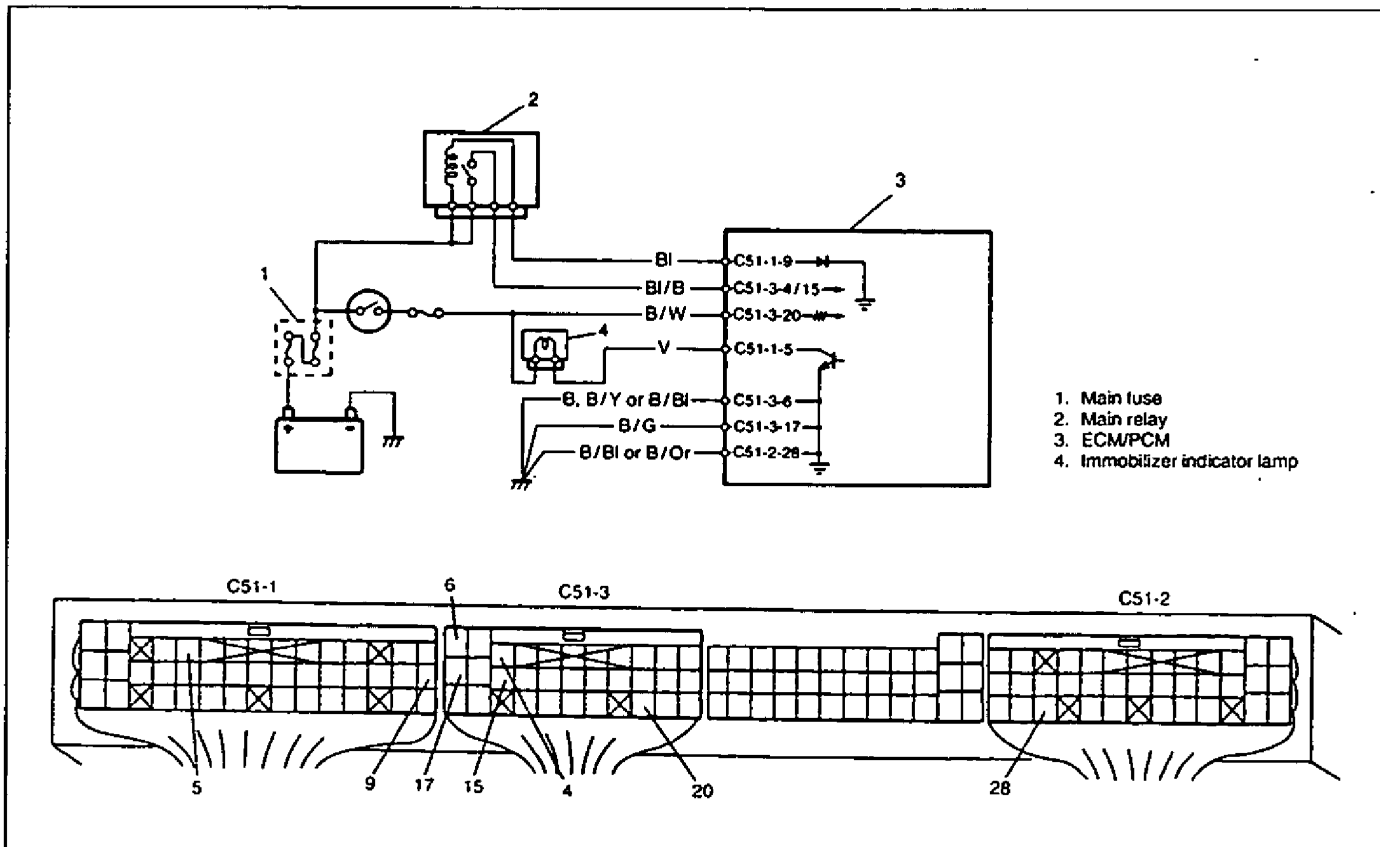
DTC (indicated on Suzuki scan tool)	DIAGNOSTIC AREA	DIAGNOSIS
NO DTC	Normal	This code appears when it is confirmed that none of other trouble codes is set for immobilizer control system or engine and emission control system.
P1623	ECM/Immobilizer Control Module code	Diagnose trouble according to "DIAGNOSTIC FLOW TABLE" corresponding to each code No.
P1620		
P1622	ECM/PCM	
P1621	Serial data link wire	

TABLE A DTC IS NOT OUTPUT FROM DIAGNOSTIC OUTPUT TERMINAL



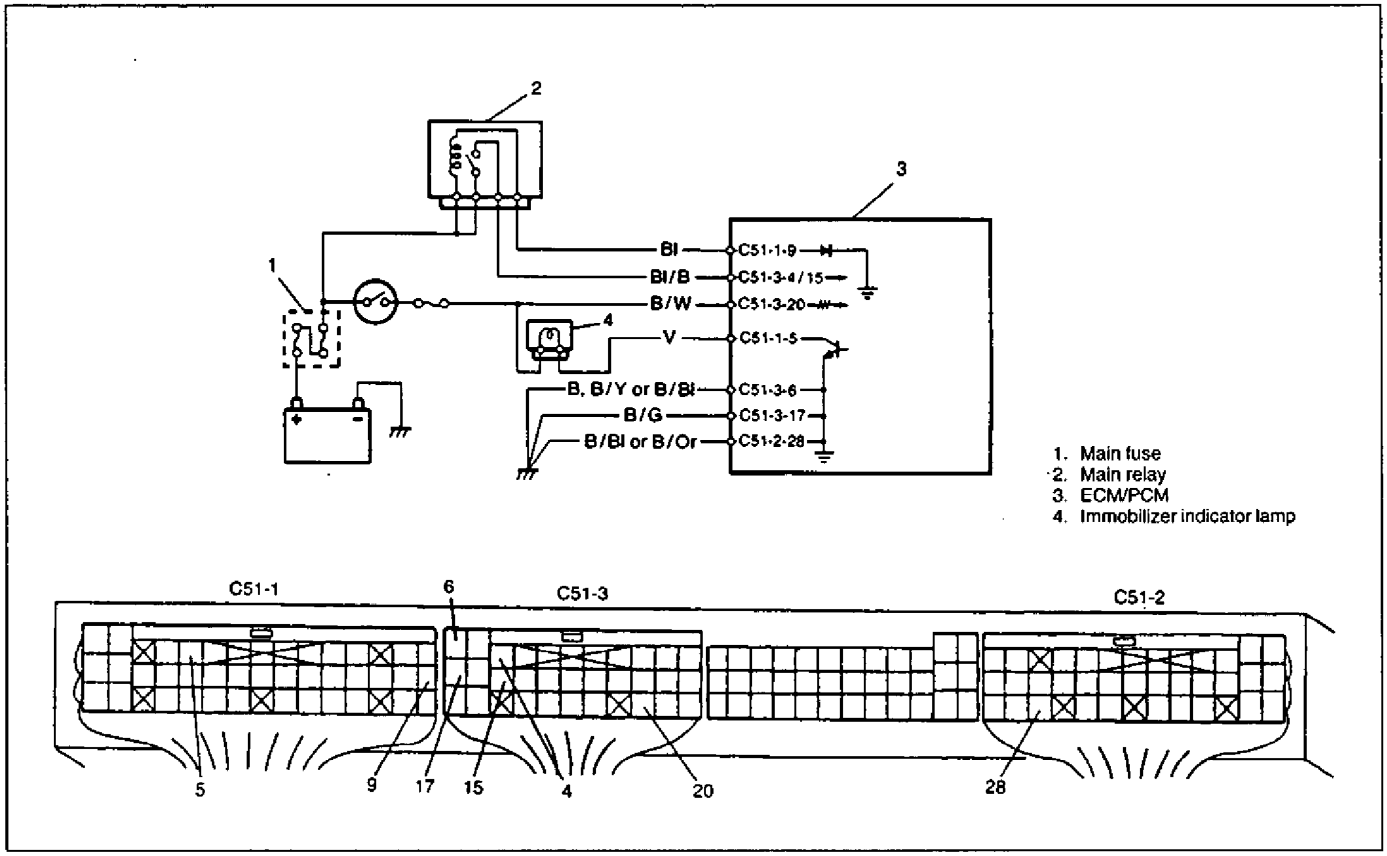
STEP	ACTION	YES	NO
1	Check voltage between A3 terminal and body ground with ignition switch turned ON. Is it 10 – 14 V?	Go to Step 2.	"Bl/B" wire open.
2	1) Connect voltmeter between A5 terminal and body ground. 2) Does voltmeter indicator deflect?	Go to Step 3.	• Poor A3, A5 or A7 connection. • "B" wire of A7 terminal open. • "Sbl" wire between A5 terminal and diagnostic output terminal of immobilizer diagnostic coupler short. If wire and connections are OK, substitute a known-good Immobilizer Control Module and recheck. **NOTE:** **After replacing with a known-good Immobilizer Control Module, register ECM/Immobilizer Control Module code in ECM/PCM and Transponder code and ECM/Immobilizer Control Module code in Immobilizer Control Module by performing procedure described in "Procedure after Immobilizer Control Module Replacement" section.**
3	1) Connect voltmeter between diagnostic output terminal of immobilizer diagnostic coupler and body ground. 2) Is it possible to read DTC by checking deflection of voltmeter indicator?	"B" wire of ground terminal for immobilizer diagnostic coupler open.	"Sbl" wire between A5 terminal and diagnostic output terminal of immobilizer diagnostic coupler open.

TABLE B IMMOBILIZER INDICATOR LAMP CHECK (IMMOBILIZER INDICATOR LAMP DOSE NOT LIGHT AT IGNITION SWITCH ON)



STEP	ACTION	YES	NO
1	1) Turn ignition switch ON. Do other indicator/warning lights in combination meter come ON?	Go to Step 2.	"IG" fuse blown, main fuse blown, ignition switch malfunction, "B/W" circuit between "IG" fuse and combination meter or poor coupler connection at combination meter.
2	1) Turn ignition switch OFF and disconnect connectors from ECM/ PCM. 2) Check for proper connection to ECM/ PCM at terminal C51-1-5. 3) If OK, then using service wire, ground terminal C51-1-5 in connector disconnected. Does immobilizer indicator lamp turn on at ignition switch ON?	Substitute a known-good ECM/PCM and recheck.	Bulb burned out or "V" wire circuit open.

TABLE C 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/PCM. Does immobilizer indicator lamp turn ON at ignition switch ON?	"V" wire shorted to ground circuit.	Substitute a known-good ECM/PCM and recheck.

DTC11 TRANSPONDER CODE NOT MATCHED

DESCRIPTION:

Immobilizer Control Module checks if Transponder code transmitted from ignition key and that registered in Immobilizer Control Module match when ignition switch is ON. If they do not, this DTC is set.

INSPECTION:

Register ignition key with built-in transponder by using Suzuki scan tool (TECH1 cartridge for immobilizer control system and TECH 1A kit) and performing following steps.

1) Register Transponder code in Immobilizer Control Module by performing procedure described in "How to register ignition key" section.
2) Turn ignition switch OFF, then turn it ON and check that DTC11 is not set.

DTC31 TRANSPONDER CODE NOT REGISTERED

DESCRIPTION:

Immobilizer Control Module checks if Transponder code transmitted from ignition key and that registered in Immobilizer Control Module match when ignition switch is ON. If there is no Transponder code registered in Immobilizer Control Module, this DTC is set.

INSPECTION:

Register ignition key with built-in transponder by using Suzuki scan tool (TECH1 cartridge for immobilizer control system and TECH 1A kit) and performing following steps.

1) Register Transponder code in Immobilizer Control Module by performing procedure described in "How to register ignition key" section.
2) Turn ignition switch OFF, then turn it ON and check that DTC31 is not set.

DTC12 FAULT IN IMMOBILIZER CONTROL MODULE

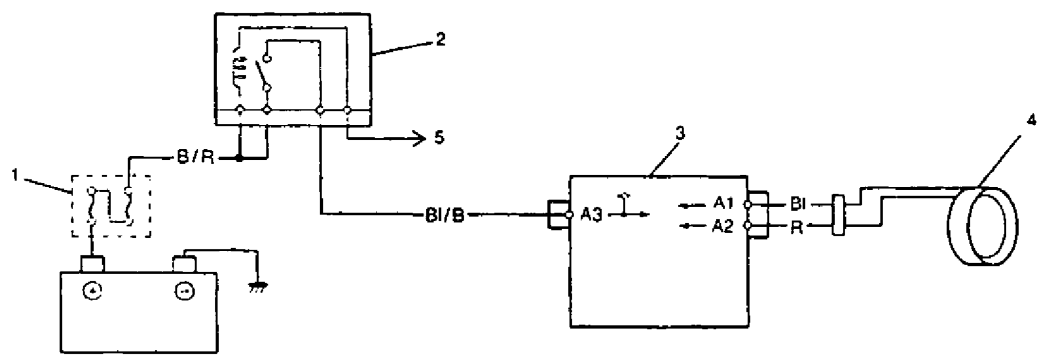
DESCRIPTION:

This DTC is set when an internal fault is detected in Immobilizer Control Module.

INSPECTION:

STEP	ACTION	YES	NO
1	1) Ignition switch OFF. 2) Disconnect connectors from Immobilizer Control Module. 3) Check for proper connection to Immobilizer Control Module at all terminals. Are they in good condition?	Substitute a known-good Immobilizer Control Module and recheck. **NOTE:** **After replacing with a known-good Immobilizer Control Module, register ECM/Immobilizer Control Module code in ECM/PCM and Transponder code and ECM/Immobilizer Control Module code in Immobilizer Control Module by performing procedure described in "Procedure after Immobilizer Control Module Replacement" section.**	Repair or replace.

DTC13 NO TRANSPONDER CODE TRANSMITTED OR COIL ANTENNA OPENED/SHORTED



1. Main fuse
2. Main relay
3. Immobilizer Control Module
4. Coil antenna
5. To ECM/PCM

DESCRIPTION:

Immobilizer Control Module energizes the coil antenna when the ignition switch is ON and reads Transponder code from the ignition key. When Immobilizer Control Module cannot read Transponder code from the ignition key even when the coil antenna is energized, this DTC is set.

INSPECTION:

STEP	ACTION	YES	NO
1	Does ignition key being used have built-in transponder? (See Fig. 1)	Go to Step 2.	Replace ignition key with built-in transponder and follow "DIAGNOSTIC FLOW TABLE" again.
2	1) Disconnect coil antenna coupler with ignition switch turned OFF. 2) Is there continuity between coil antenna coupler terminals A and B? (See Fig. 2)	Go to Step 3.	Coil antenna open.
3	Measure resistance between terminals of coil antenna coupler and body ground. (See Fig. 3) Is it ∞ (infinity) Ω ?	Go to Step 4.	Coil antenna shorted to ground.
4	1) With coil antenna coupler disconnected, disconnect Immobilizer Control Module coupler. 2) Measure resistance between coil antenna terminals of Immobilizer Control Module coupler. (See Fig. 4) Is it ∞ (infinity) Ω ?	Go to Step 5.	"Bl" wire shorted to "R"wire.
5	Measure resistance between terminal A1 of Immobilizer Control Module coupler and body ground. (See Fig. 5) Is it ∞ (infinity) Ω ?	Go to Step 6.	"Bl" wire shorted to ground.
6	Measure resistance between terminal A2 of Immobilizer Control Module coupler and body ground. (See Fig. 6) Is it ∞ (infinity) Ω ?	Go to Step 7.	"R" wire shorted to ground.
7	1) Connect coil antenna coupler. 2) Is there continuity between Immobilizer Control Module coupler terminals A1 and A2? (See Fig. 7)	Go to Step 8.	• "Bl" or "R" wire open. • Poor coil antenna-to-coupler.

DTC13 NO TRANSPONDER CODE TRANSMITTED OR COIL ANTENNA OPENED/SHORTED (CONTINUED)

STEP	ACTION	YES	NO
8	Poor A1 or A2 connection. 1) If connections are OK, connect Immobilizer Control Module coupler and substitute a known-good coil antenna. 2) Is DTC 13 also indicated with ignition switch turned ON?	Go to Step 9.	Faulty coil antenna.
9	Is DTC 13 still indicated even when another ignition key (with built-in transponder) for that vehicle used?	Substitute a known-good Immobilizer Control Module and recheck. **NOTE:** **After replacing with a known-good Immobilizer Control Module, register ECM/Immobilizer Control Module code in ECM/PCM and Transponder code and ECM/Immobilizer Control Module code in Immobilizer Control Module by performing procedure described in "Procedure after Immobilizer Control Module Replacement" section.**	Faulty ignition key.

Fig. 1 for Step 1

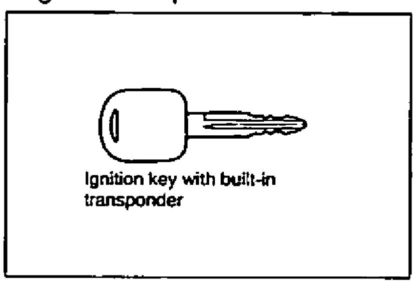


Fig. 2 for Step 2

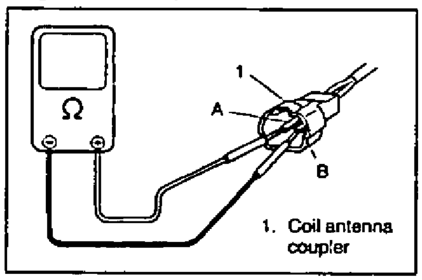


Fig. 3 for Step 3

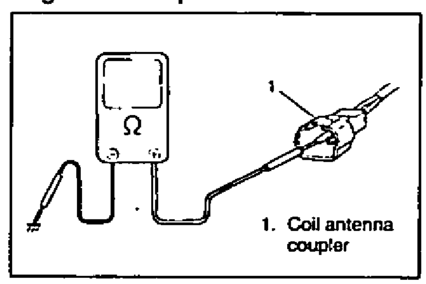


Fig. 4 for Step 4

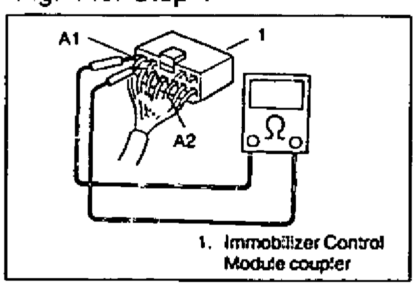


Fig. 5 for Step 5

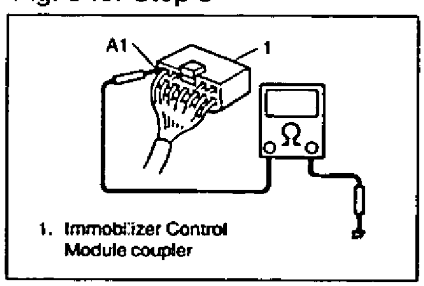


Fig. 6 for Step 6

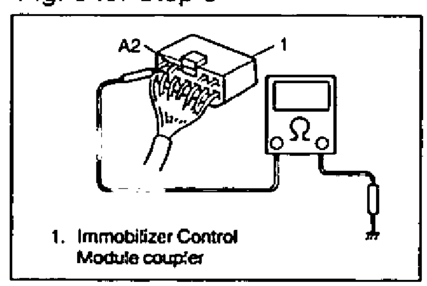
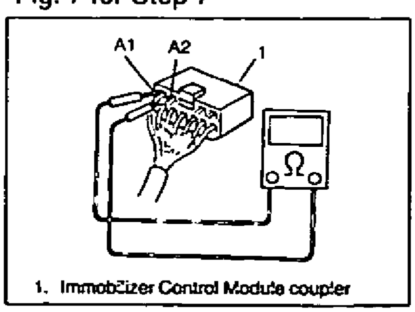


Fig. 7 for Step 7



DTC21 ECM/IMMOBILIZER CONTROL MODULE CODE NOT MATCHED (IMMOBILIZER CONTROL MODULE SIDE)
DTC81 (P1623) ECM/IMMOBILIZER CONTROL MODULE CODE NOT MATCHED (ECM/PCM SIDE)
DTC84 (P1620) ECM/IMMOBILIZER CONTROL MODULE CODE NOT REGISTERED

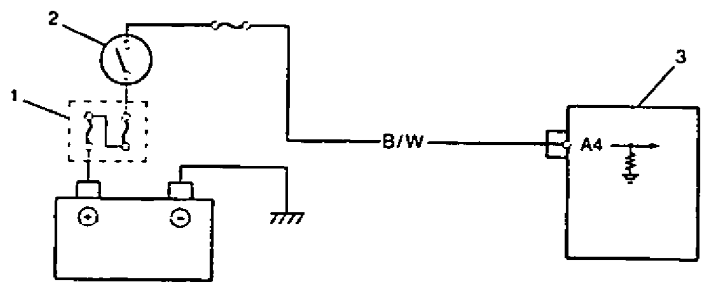
DESCRIPTION:

- DTC21
  Immobilizer Control Module checks if ECM/Immobilizer Control Module code transmitted from ECM/PCM and that registered in Immobilizer Control Module match when ignition switch is ON. If they do not, this DTC is set.
- DTC81 (P1623)
  ECM/PCM checks if ECM/Immobilizer Control Module code transmitted from Immobilizer Control Module and that registered in ECM/PCM match when ignition switch is ON. If they do not, this DTC is set.
- DTC84 (P1620)
  ECM/PCM checks if code transmitted from Immobilizer Control Module and that registered in ECM/PCM match when ignition switch is ON. If there is no ECM/Immobilizer Control Module code registered in ECM/PCM, this DTC is set.

INSPECTION:

Perform procedure described in “Procedure after ECM/PCM Replacement” section.

DTC22 IGNITION SWITCH CIRCUIT OPEN/SHORT



1. Main fuse
2. Ignition switch
3. Immobilizer Control Module

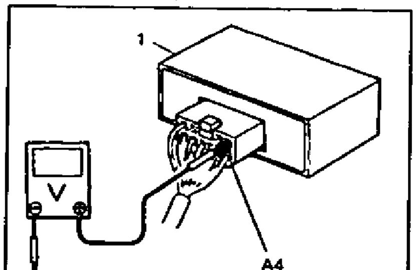
DESCRIPTION:

Immobilizer Control Module monitors ignition signal when the ignition switch is ON. This DTC is set when no ignition signal input is detected by Immobilizer Control Module.

INSPECTION:

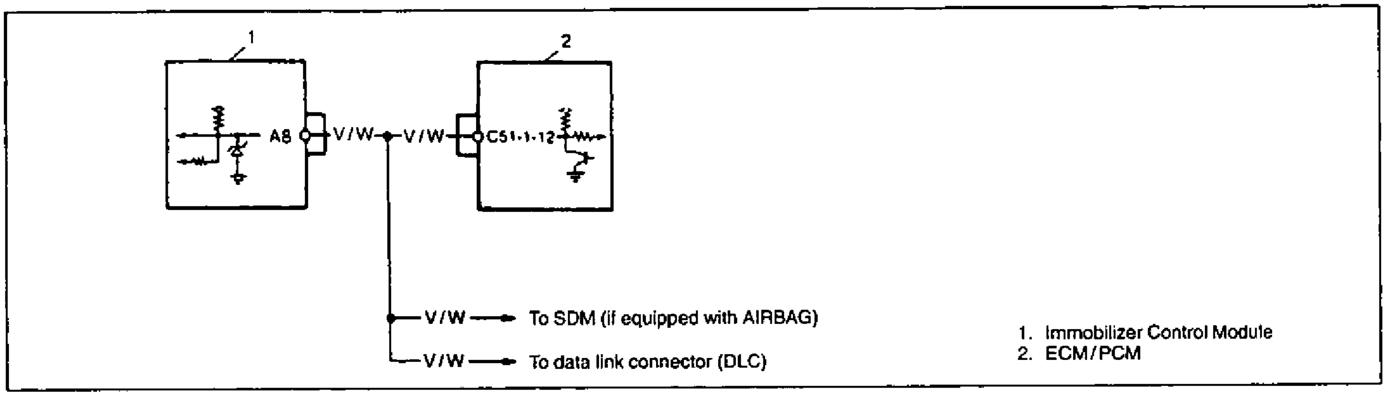
STEP	ACTION	YES	NO
1	Check voltage between Immobilizer Control Module coupler terminal A4 and body ground with ignition switch turned ON. (See Fig. 1) Is it 10 – 14 V?	Poor A4 terminal connection. If connection is OK, substitute a known-good Immobilizer Control Module and recheck. **NOTE:** **After replacing with a know-good Immobilizer Control Module, register ECM/Immobilizer Control Module code in ECM/PCM and Transponder code and ECM/Immobilizer Control Module code in Immobilizer Control Module by performing procedure described in "Procedure after Immobilizer Control Module Replacement" section.**	"B/W" wire open or short.

Fig. 1 for Step 1



1. Immobilizer Control Module

DTC23 NO ECM/IMMOBILIZER CONTROL MODULE CODE TRANSMITTED FROM ECM/PCM OR DLC CIRCUIT OPENED/SHORTED
DTC83 (P1621) NO ECM/IMMOBILIZER CONTROL MODULE CODE TRANSMITTED FROM IMMOBILIZER CONTROL MODULE OR DLC CIRCUIT OPENED/SHORTED



DESCRIPTION

When the ignition switch is ON, Immobilizer Control Module requests ECM/PCM and ECM/PCM requests Immobilizer Control Module to transmit ECM/Immobilizer Control Module code. If ECM/Immobilizer Control Module code is not transmitted from ECM/PCM or Immobilizer Control Module, Immobilizer Control Module sets DTC23 and ECM/PCM sets DTC83 (P1621).

INSPECTION:

STEP	ACTION	YES	NO
1	Check voltage between Immobilizer Control Module coupler terminal A8 and body ground with ignition switch turned ON. Is it 4 – 5 V?	Go to Step 2.	"V/W" wire short.
2	1) Disconnect ECM/PCM coupler with ignition switch turned OFF. 2) Is there continuity between Immobilizer Control Module coupler terminal A8 and Data link connector terminal of ECM/PCM coupler? (For positions of Data link connector terminal of ECM/PCM coupler, refer to Section 6E.)	Poor A8 connection (Immobilizer Control Module) or Poor Data link connector terminal connection (ECM/PCM). If connections are OK, substitute a known-good ECM/PCM or Immobilizer Control Module and recheck. **NOTE :** • **After replacing with a known-good ECM/PCM, register ECM/Immobilizer Control Module code in ECM/PCM by performing procedure described in "Procedure after ECM/PCM Replacement" section.** • **After replacing with a known-good Immobilizer Control Module, register ECM/Immobilizer Control Module code in ECM/PCM and Transponder code and ECM/Immobilizer Control Module code in Immobilizer Control Module by performing procedure described in "Procedure after Immobilizer Control Module Replacement" section.**	"V/W" wire between Immobilizer Control Module and ECM/PCM open.

Fig. 1 for Step 1

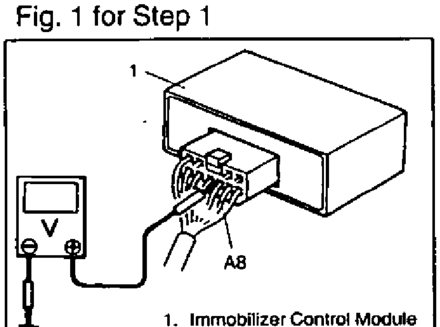
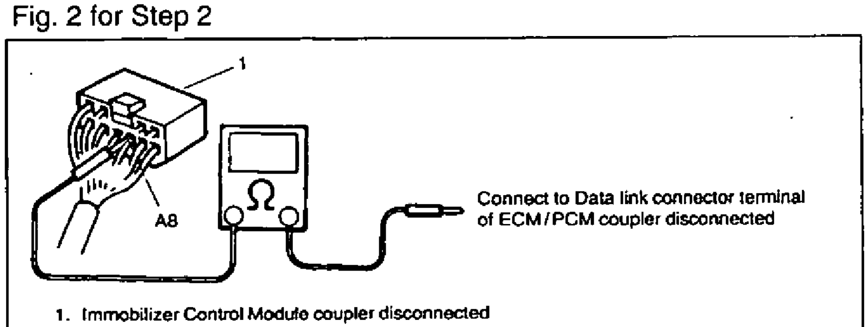


Fig. 2 for Step 2



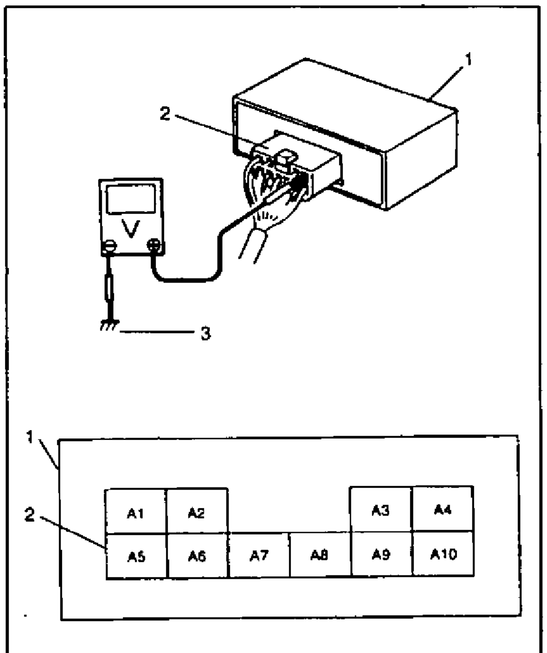
DTC82 (P1622) FAULT IN ECM/PCM

DESCRIPTION:

This DTC is set when an internal fault is detected in ECM/PCM.

INSPECTION:

STEP	ACTION	YES	NO
1	1) Ignition switch OFF. 2) Disconnect connectors from ECM/PCM. 3) Check for proper connection to ECM/PCM at all terminals. Are they in good condition?	Substitute a known-good ECM/PCM and recheck. **NOTE:** **After replacing with a known-good ECM/PCM, register ECM/Immobilizer Control Module code in ECM/PCM by performing procedure described in "Procedure after ECM/PCM Replacement" section.**	Repair or replace.



1. Immobilizer Control Module
2. Immobilizer Control Module Coupler
3. Body ground

INSPECTION OF ECM/PCM, IMMOBILIZER CONTROL MODULE AND ITS CIRCUIT

ECM/PCM, Immobilizer Control Module and its circuit can be checked at ECM/PCM wiring couplers and Immobilizer Control Module wiring coupler by measuring voltage and resistance. Described here is only inspection of Immobilizer Control Module. For inspection of ECM/PCM, refer to "SECTION 6E".

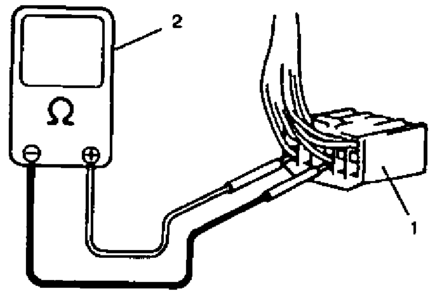
> **CAUTION:**
> **Immobilizer Control Module cannot be checked by itself. It is strictly prohibited to connect voltmeter or ohmmeter to Immobilizer Control Module with coupler disconnected from it.**

Voltage Check

1) Remove Immobilizer Control Module from body with ignition switch OFF, referring to p. 8G-25.
2) Connect Immobilizer Control Module coupler to Immobilizer Control Module.
3) Check voltage at each terminal of coupler connected.
   NOTE:
   As each terminal voltage is affected by the battery voltage, confirm that it is 11 V or more when ignition switch is ON.

TERMINAL	CIRCUIT	NORMAL VOLTAGE	CONDITION
A1	Coil antenna 1	0 V	
A2	Coil antenna 2	0 V	Ignition switch ON
A3	Power source	10 – 14 V	
A4	Ignition signal	10 – 14 V	Ignition switch ON
		0 – 0.8 V	Ignition switch OFF
A5	Diagnosis output	0 – 14 V	Ignition switch ON
		0 V	Ignition switch OFF
A6	Blank	–	–
A7	Ground	–	–
A8	Data link connector (Serial data terminal)	4 – 5 V	Ignition switch ON
A9 A10	Blank	–	–

NOTE:
When measuring voltage at A1 and A2 terminals with ignition switch turned ON, be sure to turn ignition switch ON before connecting positive probe of voltmeter to A1 or A2 terminal. If it is not turned ON first, DTC13 (Diagnostic Trouble Code 13) may be indicated.



1. Immobilizer Control Module coupler disconnected
2. Ohmmeter

Resistance Check

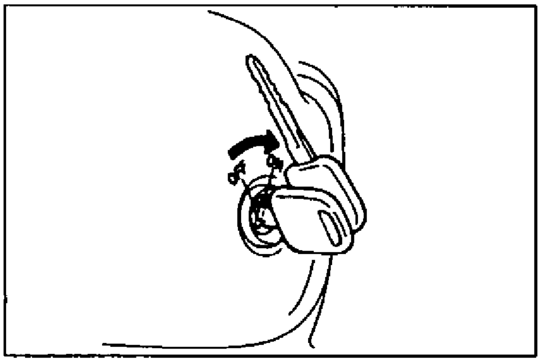
1) Disconnect Immobilizer Control Module couplers from Immobilizer Control Module with ignition switch OFF.

> **CAUTION:**
> **Never touch terminals of Immobilizer Control Module itself or connect voltmeter or ohmmeter.**

2) Check resistance between each terminal of coupler disconnected.

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

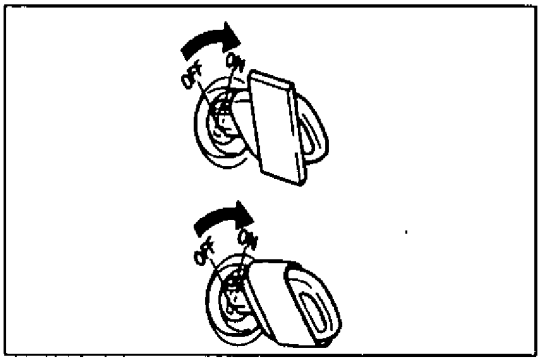
TERMINAL	CIRCUIT	NORMAL RESISTANCE	CONDITION
A1 – A2	Coil antenna	Continuity	–



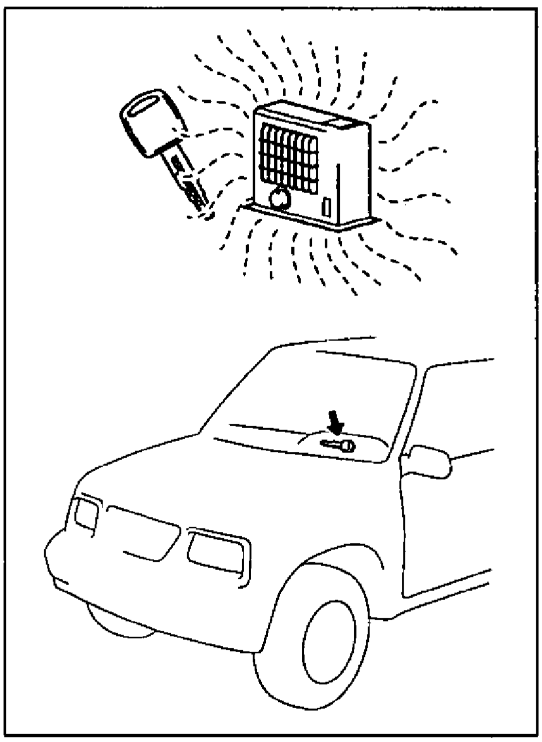
ON-VEHICLE SERVICE

PRECAUTIONS IN HANDLING IMMOBILIZER CONTROL SYSTEM

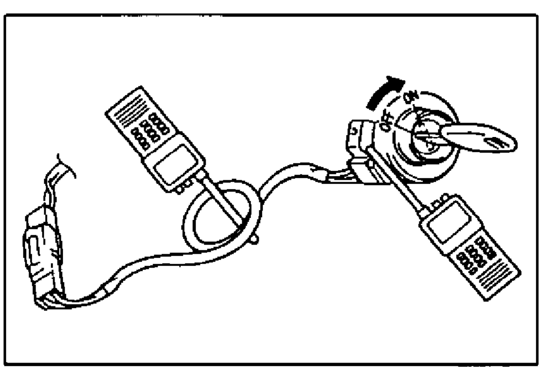
- Do not turn ON ignition switch with ignition key for immobilizer control system put together with another one or placed quite close to another one. Or the system may detect abnormal condition and prevent engine from starting.



- Do not turn ON ignition switch by using ignition key with any type of metal wound around its grip or in contact with it. Or the system may detect abnormal condition and prevent engine from starting.



- Do not leave ignition key where high temperature is anticipated. High temperature will cause transponder in ignition key to be abnormal or damaged.



- Do not turn ON ignition switch with a radio antenna placed near coil antenna or its harness to Immobilizer Control Module. Or the system may detect abnormal condition and prevent engine from starting.

IMMOBILIZER CONTROL MODULE

Removal

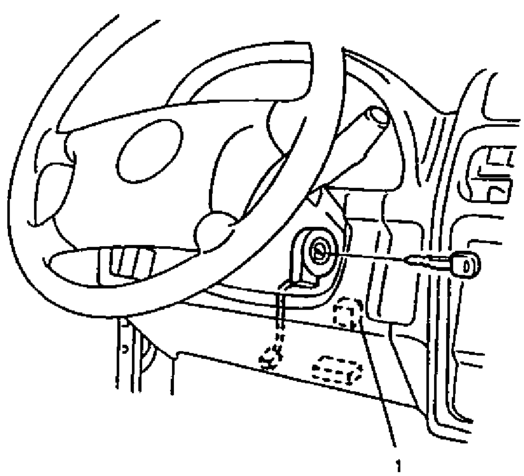
1) Disconnect negative (–) cable at battery.
2) Remove steering column hole cover.
3) Disconnect coupler at Immobilizer Control Module.
4) Remove Immobilizer Control Module.

Installation

Reverse removal procedure for installation.

NOTE:

After replacing Immobilizer Control Module, be sure to register Transponder code and ECM/Immobilizer Control Module code in Immobilizer Control Module and ECM/Immobilizer Control Module code in ECM/PCM by performing procedure described in "Procedure after Immobilizer Control Module Replacement" section.

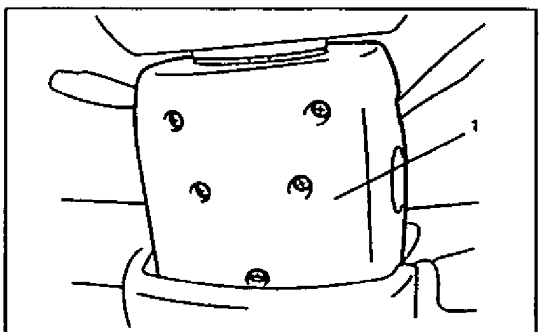


1. Immobilizer Control Module

COIL ANTENNA

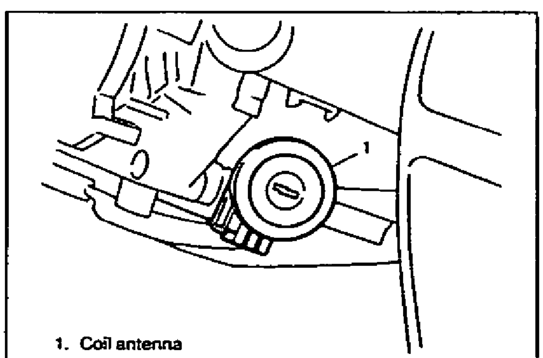
Removal

1) Disconnect negative (–) cable at battery.
2) Remove steering column hole cover.
3) Remove steering column upper and lower cover by removing screws.



1. Steering column lower cover

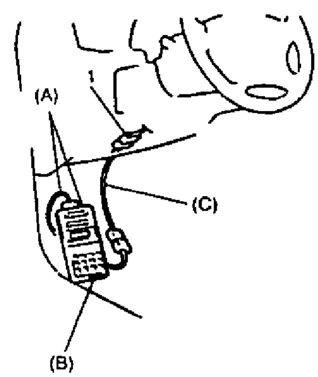
4) Remove coil antenna.



1. Coil antenna

Installation

For installation, reverse removal procedure.



1. Data link connector (DLC)

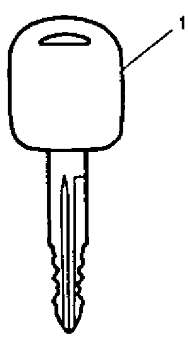
HOW TO REGISTER IGNITION KEY

Register the ignition key with a built-in transponder in Immobilizer Control Module by using the following procedure.

1) Prepare Suzuki scan tool (TECH 1A kit and cartridge for immobilizer control system).
2) With ignition switch OFF, connect Suzuki scan tool to data link connector (DLC) located on underside of instrument panel at driver's seat side.

   Special Tool
   (A): 09931-76011 (Tech 1A)
   (B): Immobilizer cartridge
   (C): 09931-76030 (16/14-pin DLC cable)

   NOTE:
   For operation procedure of Suzuki scan tool, refer to Suzuki scan tool operator's manual.



1. Ignition key with built-in transponder

3) Prepare ignition key with a built-in transponder. And then turn ignition switch ON by using it.
4) Number of Transponder codes for ignition key with a built-in transponder that can be registered in Immobilizer Control Module is limited to 4. If needed, clear all Transponder codes for ignition key with a built-in transponder that have been registered in Immobilizer Control Module by executing the "CLR. TRANS COD (CLEAR TP CODE)" command in the SELECT MODE menu by using Suzuki scan tool.

   NOTE:
   When "CLR. TRANS COD (CLEAR TP CODE)" command is executed with the immobilizer indicator lamp ON, it remains ON even after execution of that command is over. It will start flashing when the ignition switch is turned OFF once and then turned ON after some seconds.

5) Using Suzuki scan tool, register Transponder code in Immobilizer Control Module by executing "ENT. TRANS COD (ENT. TP CODE)" command in SELECT MODE menu.
6) Make sure that immobilizer indicator lamp lights when ignition switch is turned OFF once and then ON.

7) If any other Transponder code for ignition key with a built-in transponder needs to be registered, repeat above Steps 3), 5) and 6).

NOTE:
- **Up to 4 Transponder codes for ignition key with a built-in transponder can be registered.**
- **It is not possible to register the same Transponder code for ignition key with a built-in transponder as the one already registered in Immobilizer Control Module.**

PROCEDURE AFTER IMMOBILIZER CONTROL MODULE REPLACEMENT

When Immobilizer Control Module was replaced, including when replaced because rechecking by using a known-good Immobilizer Control Module was necessary during trouble diagnosis, register Transponder code and ECM/Immobilizer Control Module code in Immobilizer Control Module and ECM/Immobilizer Control Module code in ECM/PCM by performing following procedure.

1) Perform Steps 1) and 2) described in "How to register ignition key" section.
2) Prepare ignition key with a built-in transponder. And then turn ignition switch ON by using it.
3) Using Suzuki scan tool, clear all transponder codes registered in Immobilizer Control Module by executing "CLR. TRANS COD (CLEAR TP CODE)" command in SELECT MODE menu.

NOTE:
When "CLR. TRANS COD (CLEAR TP CODE)" command is executed with the immobilizer indicator lamp ON, it remains ON even after execution of that command is over. It will start flashing when the ignition switch is turned OFF once and then turned ON after some seconds.

4) Using Suzuki scan tool, register Transponder code in Immobilizer Control Module by executing "ENT. TRANS COD (ENT. TP CODE)" command in SELECT MODE menu.
5) Using Suzuki scan tool, register ECM/Immobilizer Control Module code in both Immobilizer Control Module and ECM/PCM by executing "RECORD ECU (RECORD ECM/PCM/ICM)" command in SELECT MODE menu.
6) Make sure that immobilizer indicator lamp lights when ignition switch is turned OFF once and then ON.
7) If any other Transponder code for ignition key with a built-in transponder needs to be registered, repeat above Steps 2), 4) and 6).

NOTE:
- **Up to 4 Transponder codes for ignition key with a built-in transponder can be registered.**
- **It is not possible to register the same Transponder code for ignition key with a built-in transponder as the one already registered in Immobilizer Control Module.**

PROCEDURE AFTER ECM/PCM REPLACEMENT

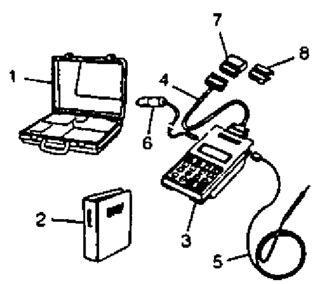
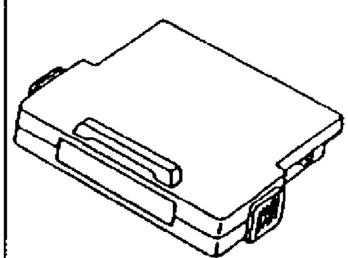
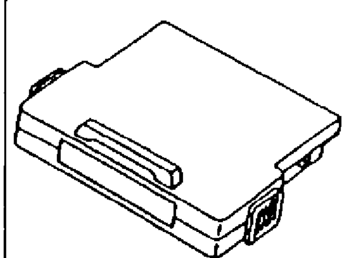
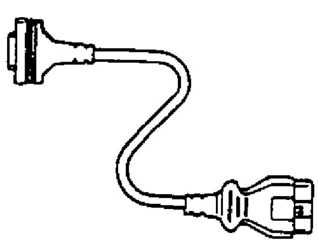
When ECM/PCM was replaced, including when replaced because rechecking by using a known-good ECM/PCM was necessary during trouble diagnosis, register ECM/Immobilizer Control Module code in ECM/PCM by performing following procedure.

1) Perform Steps 1) and 2) described in "How to register ignition key" section. And then turn ignition switch ON.
2) Using Suzuki scan tool, register ECM/Immobilizer Control Module code in ECM/PCM by executing "RECORD ECU (RECORD ECM/PCM/ICM)" command in SELECT MODE menu.

   NOTE:
   For operation procedure of Suzuki scan tool, refer to Suzuki scan tool operator's manual.

3) Make sure that immobilizer indicator lamp lights when ignition switch is turned OFF once and then ON.

SPECIAL TOOLS

 1. Storage case 2. Operator's manual 3. Tech 1A 4. DLC cable (14/26 pin, 09931-76040) 5. Test lead/probe 6. Power source cable 7. DLC cable adapter 8. Self-test adapter 09931-76011 Suzuki scan tool (Tech 1A kit)	 Immobilizer cartridge of version 1.1 or more	 Mass storage cartridge of version1.5 or more
 **NOTE:** **Use this cable only with immobilizer cartridge of version 1.1 or more.** **Use of this cable with 96 immobilizer cartridge will disable 96 immobilizer cartridge from operating properly.** 09931-76030 16/14 pin DLC cable		

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