SUZUKI

SF310

SUPPLEMENTARY SERVICE MANUAL

USE THIS SUPPLEMENTARY SERVICE MANUAL WITH SF310 SERVICE MANUAL (99500-60B01-01E)

SUZUKI
Caring for Customers
99501-60B00-01E
(英)

IMPORTANTE

ADVERTENCIA/PRECAUCION/NOTA
Sírvase leer este manual y seguir cuidadosamente sus instrucciones. Para enfatizar algunas informaciones especiales, se utilizan las palabras **ADVERTENCIA**, **PRECAUCION** Y **NOTA**, las cuales tienen diferentes significados. Preste atención a las indicaciones bajo estas palabras.

ADVERTENCIA:
Indica un caso peligroso que puede causar muerte o lesión.

PRECAUCION:
Indica un caso peligroso que puede causar avería del vehículo.

NOTA:
Indica una información especial para facilitar el mantenimiento o aclarar las instrucciones.

FOREWORD

This SUPPLEMENTARY SERVICE MANUAL contains those items on the structure, service procedures, etc. that were modified for the FACE-LIFT model produced in and after June 1991.

Applicable model:
SF310 of and after following body No. or vehicle identification number.

For European/ Australian markets	For other markets
(X) JSAEAA44S00140001 (X)~	AA44S-200001 ~
(X) JSAEAB44S00140001 (X)~	AB44S-200001 ~

When servicing a car with a body number after the above listed numbers, refer to this Supplementary Service Manual first. And then, for any section, item or description not found in this supplement, refer to "SF310 SERVICE MANUAL".

RELATED SERVICE MANUAL:
- **SF310 Service Manual 99500-60B01**

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.

TABLE OF CONTENTS	SECTION

SUZUKI MOTOR CORPORATION
TECHNICAL DEPARTMENT
AUTOMOBILE SERVICE DIVISION

SECTION 1A

HEATER AND VENTILATION

NOTE:

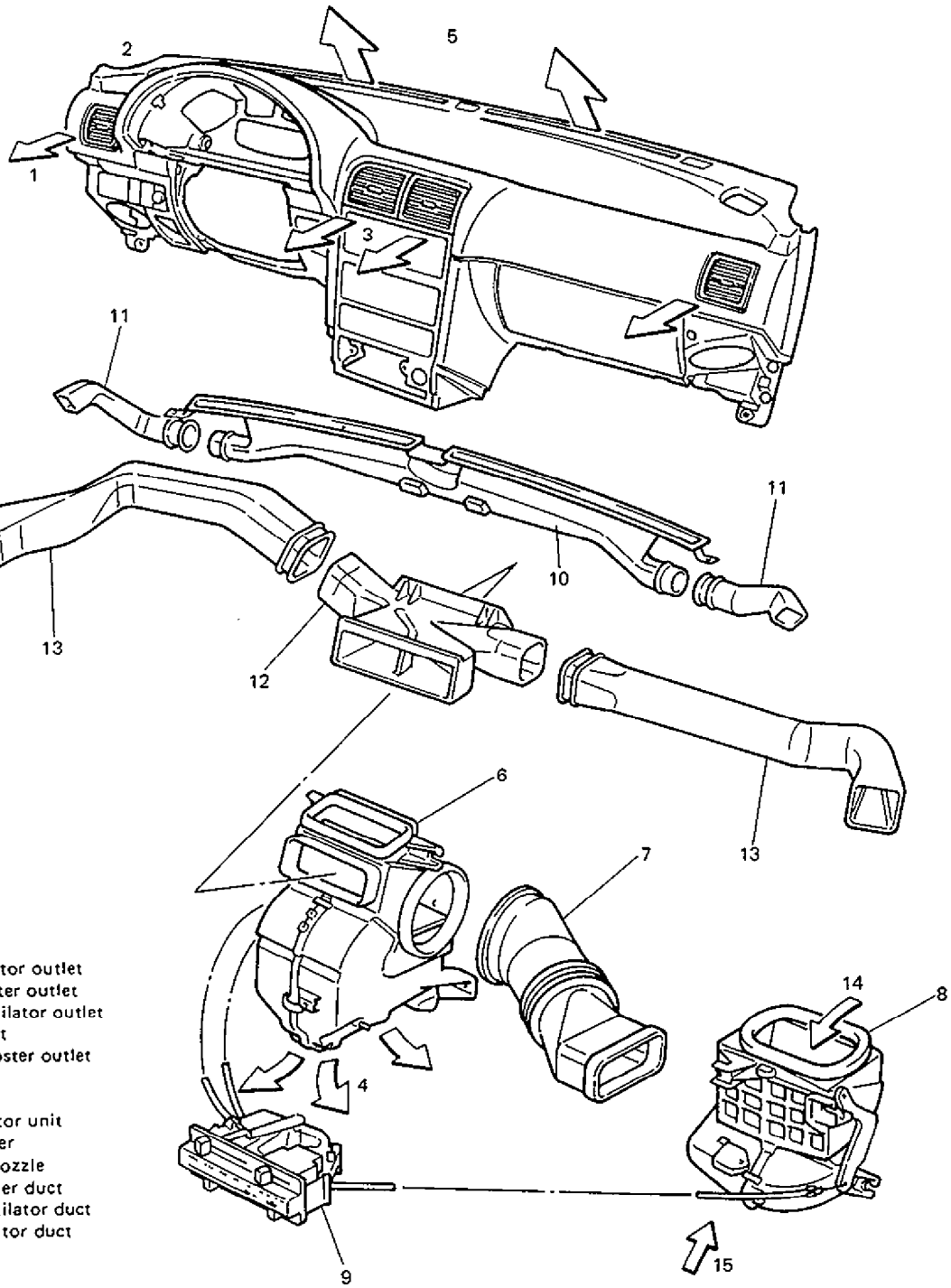
- For the descriptions (items) not found in this section, refer to the same section of the Service Manual mentioned in the FOREWORD of this manual.
- The blower motor installing position is different between the right-hand side steering car and the left-hand side steering car. In either car, the motor is installed on assistant seat side. The illustration in this manual shows the left-hand side steering car.

CONTENTS

GENERAL DESCRIPTION

HEATER

The heater and ventilation of this car 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. Air duct
8. Blower motor unit
9. Control lever
10. Defroster nozzle
11. Side demister duct
12. Center ventilator duct
13. Side ventilator duct
14. Outside air
15. Inside air

Fig. 1A-1

HEATER CONTROL OPERATION

Heater control panel is as shown below.

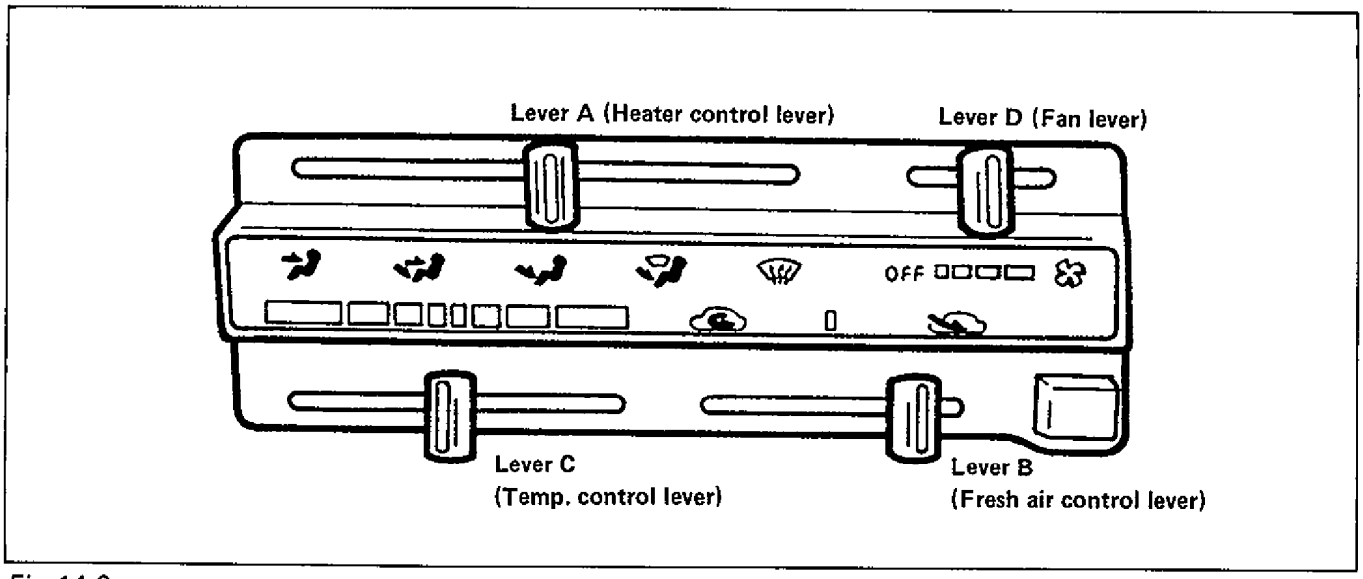


Fig. 1A-2

ON-CAR SERVICE

HEATER CONTROL CABLES

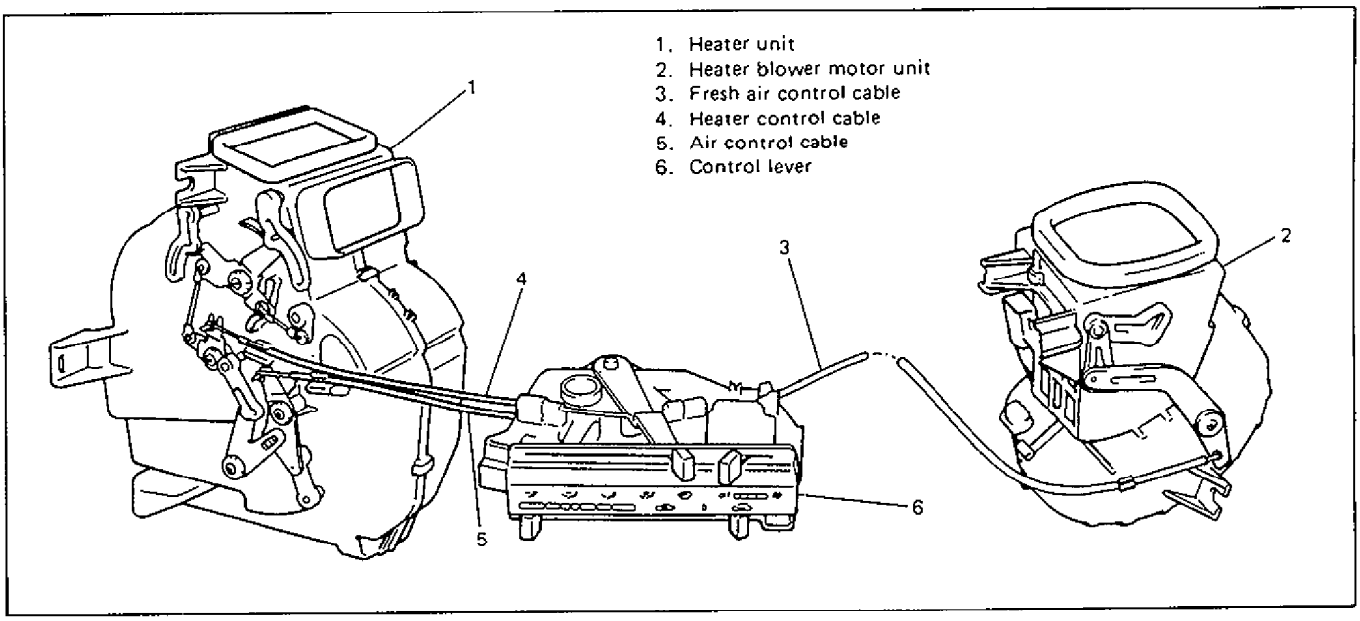


Fig. 1A-3

REMOVAL

1) Remove console box.
2) Remove asthray and ashtray upper plate.
3) Remove cigarette lighter.
4) Remove radio. (If equipped)
5) Remove control lever knobs and control panel garnish.
6) Remove control panel.
7) Disconnect lead wire from blower motor switch at coupler.
8) Disconnect control cables from blower motor unit and heater unit.
9) Remove control lever ass'y.
10) Disconnect control cables from control lever.

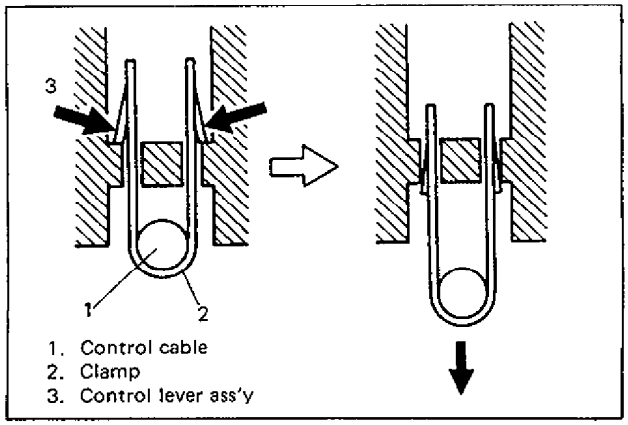


Fig. 1A-4

INSTALLATION

Install control cables by reversing removal procedure, noting the following point.

After installing control cables to control levers, move control levers to such position as to pull cables fully, then connect and clamp control cables to heater unit and blower motor unit levers as shown.

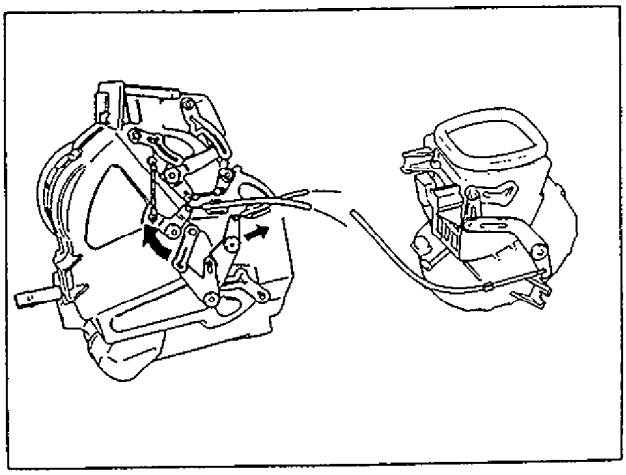


Fig. 1A-5

NOTE:

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

HEATER UNIT

REMOVAL

1. Disconnect battery (−) leadwire, drain coolant and disconnect 2 water hoses from heater unit.
2. Remove instrument panel as follows.
   1) Remove console box.
   2) Disconnect wires and cables from heater and blower unit.
   3) Remove steering wheel, steering column unit and steering joint upper bolt. (Refer to SECTION 3C.)
   4) Remove front speaker covers and front speakers (if equipped).
   5) Disconnect speedometer cable and remove speedometer ass'y.
   6) Remove engine hood opener.
   7) Remove instrument panel member mounting bolts.

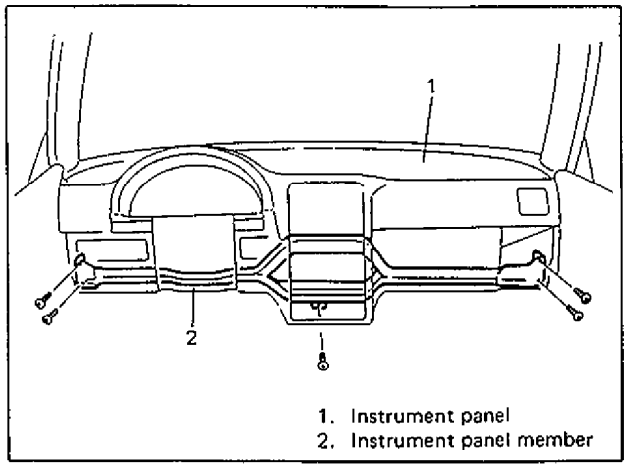


Fig. 1A-6

   8) Remove instrument panel together with instrument panel member.

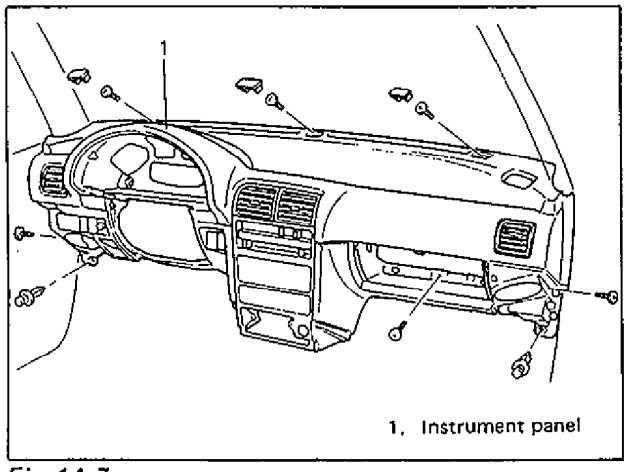


Fig. 1A-7

3. Remove heater unit.

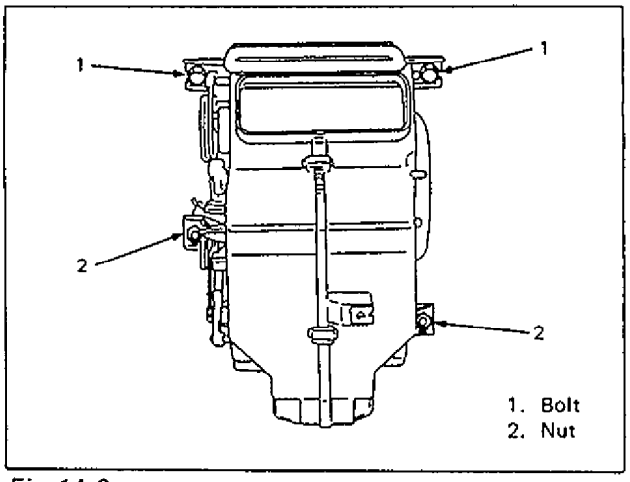


Fig. 1A-8

4. Remove heater unit clips and screws to separate heater unit.

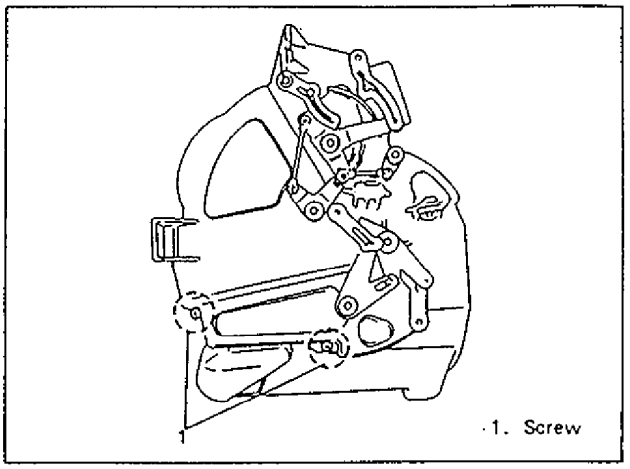


Fig. 1A-9

5. Pull out heater core from unit.

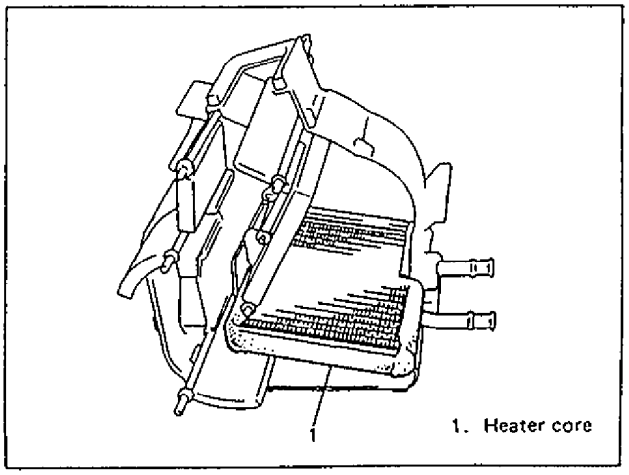


Fig. 1A-10

INSTALLATION

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

1) Adjust control cables. (Refer to p. 1A-4)
2) Fill coolant to radiator.

NOTE:

- When installing each part, be careful not to catch any cable or wiring harness.
- When installing steering shaft to steering shaft joint, set front wheels (right and left) in the straight ahead state and check to make sure that steering wheel is also in that state.
- When fastening steering column ass'y to car body, start with lower nuts on column and then upper nuts. Be sure to tighten them to specified torque. **(Refer to SECTION 3C.)**

SECTION 2

BUMPERS AND SHEET METAL

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

CONTENTS

BUMPERS

NOTE:
Fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary.
Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.

FRONT BUMPER

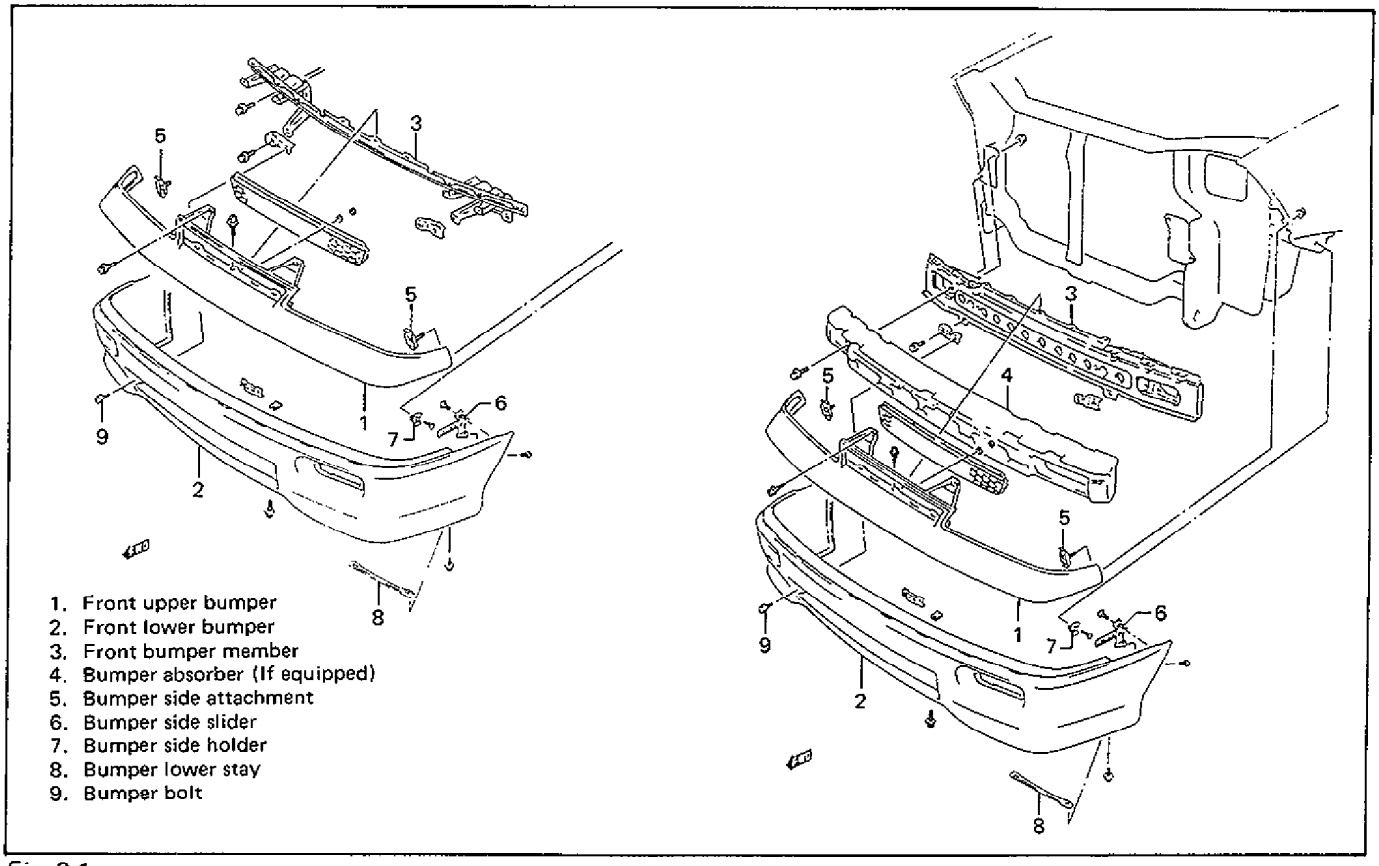


Fig. 2-1

REMOVAL

1) Remove front fender lining.
2) Remove front turn signal lamps.
3) Remove bumper fitting bolts and nuts shown in Fig. 2-2.

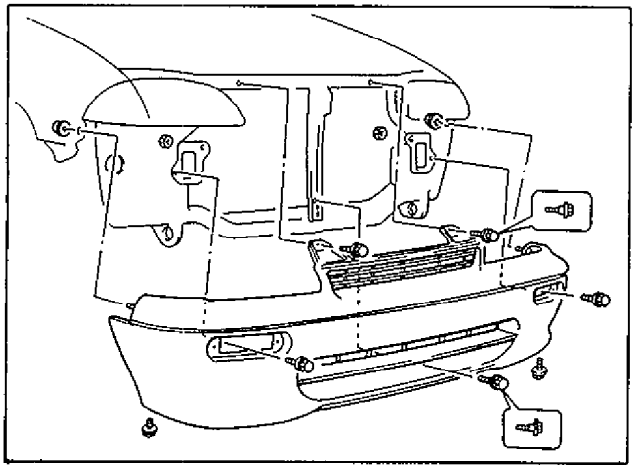


Fig. 2-2

4) Slide bumper (with bumper member) forward to remove it.

INSTALLATION

1) Slide bumper onto bumper side attachments on both fenders.
2) Use five bolts and four nuts to fix bumper in position.

REAR BUMPER

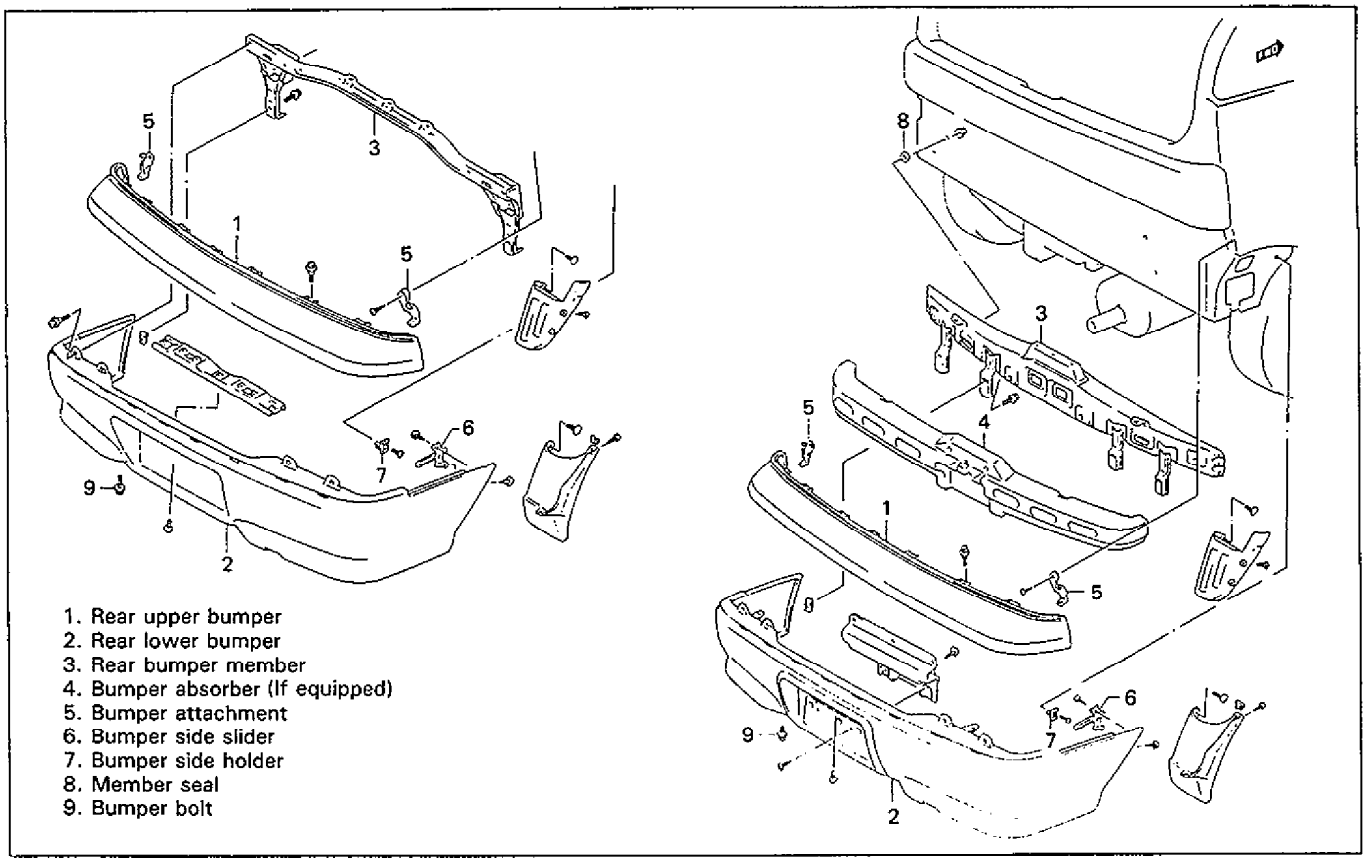


Fig. 2-3

REMOVAL

1) Remove rear garnish and then detach rear combination lights (R & L) from body without disconnecting coupler of combination rights.

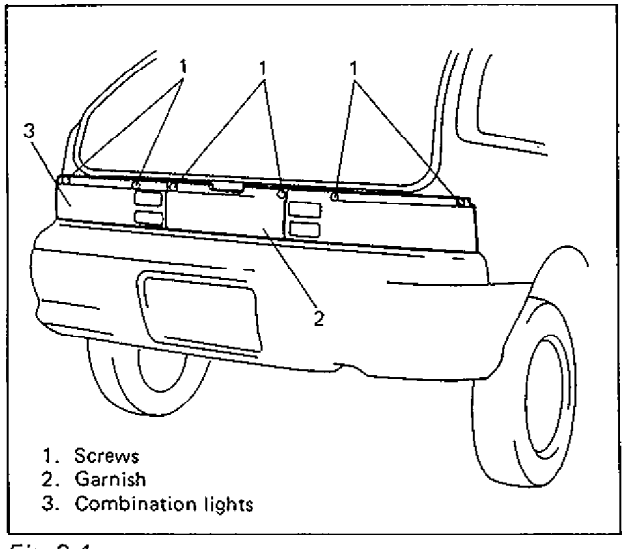


Fig. 2-4

2) Disconnect coupler of licence plate light.

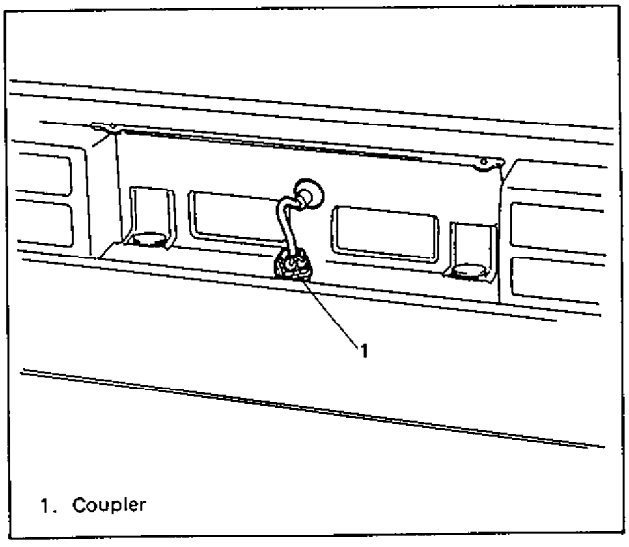


Fig. 2-5

3) Remove rear bumper bolts and nuts shown in figure below.
   To remove nut "A", removal of back panel inner trim is prerequiste.

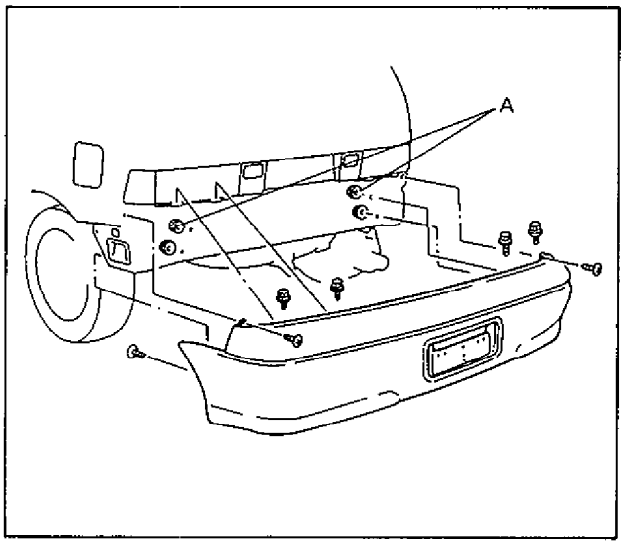


Fig. 2-6

4) Temporarily install rear combination lights in position with screws.
5) Slide bumper (with bumper member) backward to remove it.

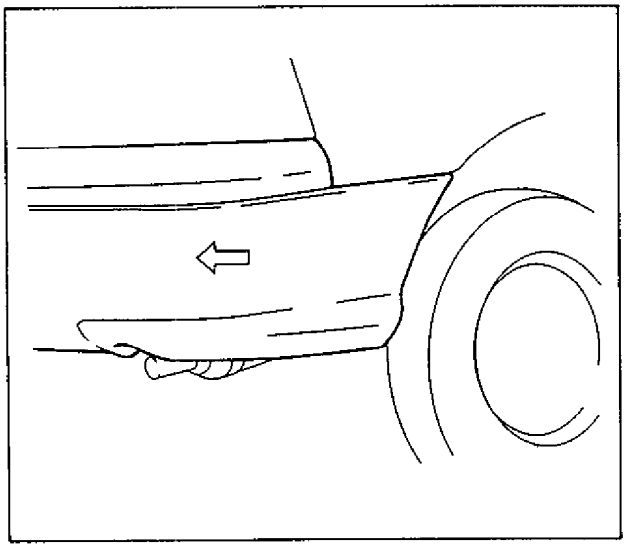


Fig. 2-7

INSTALLATION

1) Insert side sliders (R & L) of fenders and tighten bumper bolts and nuts.
2) Connect coupler of licence plate light securely.
3) Install combination lights (R & L) and then rear garnish.

SECTION 3C

STEERING WHEEL AND COLUMN

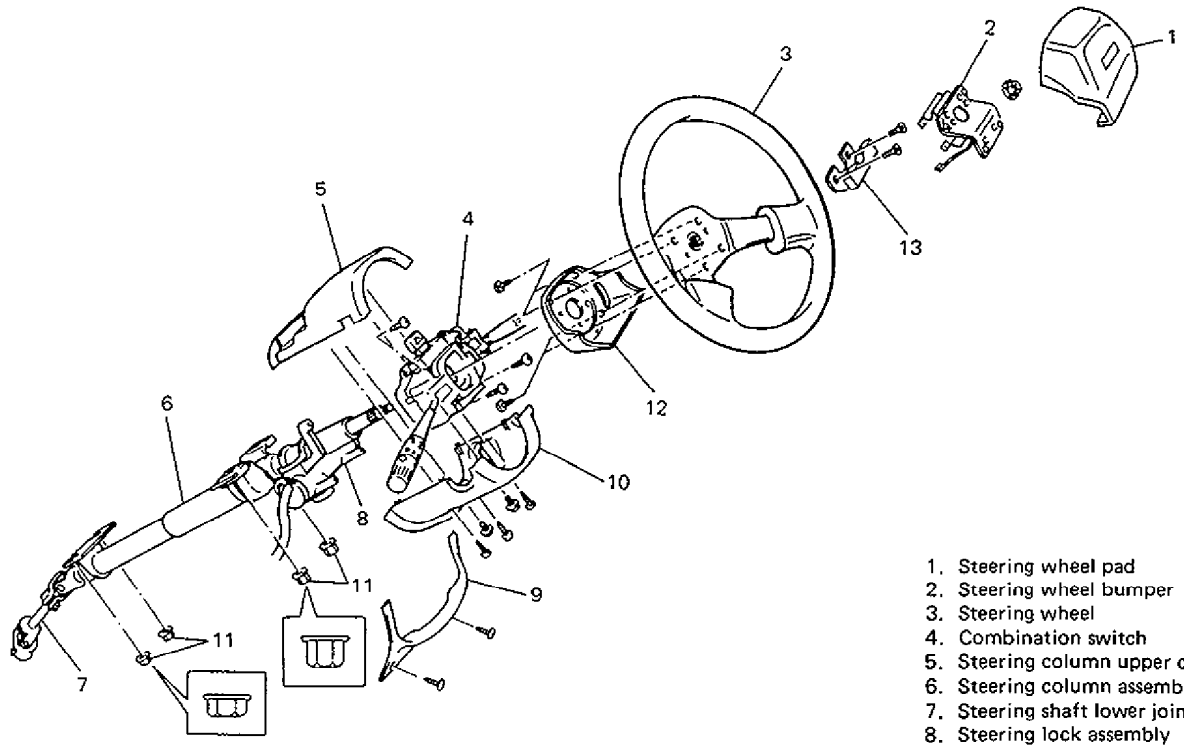
NOTE:

- All steering wheel and column fasteners are important parts in that they could affect the performance of vital parts and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.
- For the descriptions (items) not found in this section of this manual, refer to the same section of Service Manual mentioned in the FOREWORD of this manual.

CONTENTS

GENERAL DESCRIPTION

The steering wheel and column consist of following parts.



1. Steering wheel pad
2. Steering wheel bumper
3. Steering wheel
4. Combination switch
5. Steering column upper cover
6. Steering column assembly
7. Steering shaft lower joint
8. Steering lock assembly
9. Steering column under cover
10. Steering column lower cover
11. Steering column mounting nut
12. Steering wheel lower cover
13. Steering wheel mass damper

NOTE:
Use of steering column mounting nuts is different between key cylinder side and lower joint side. Refer to above figure for proper installation.

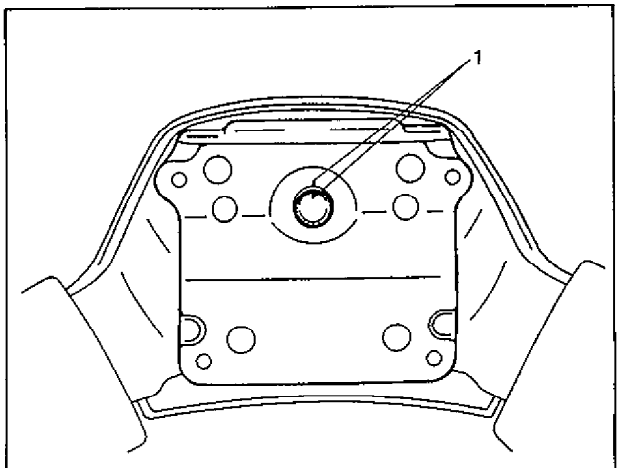
Fig. 3C-1 Steering Wheel and Column

ON CAR SERVICE

REMOVE AND INSTALL STEERING WHEEL

REMOVAL

1) Disconnect negative battery cable.
2) Remove pad by pulling it upward.
3) Remove steering shaft nut and mass damper screws.
4) Make alignment marks on steering wheel and shaft for a guide during reinstallation.



1. Make alignment marks

Fig. 3C-2

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

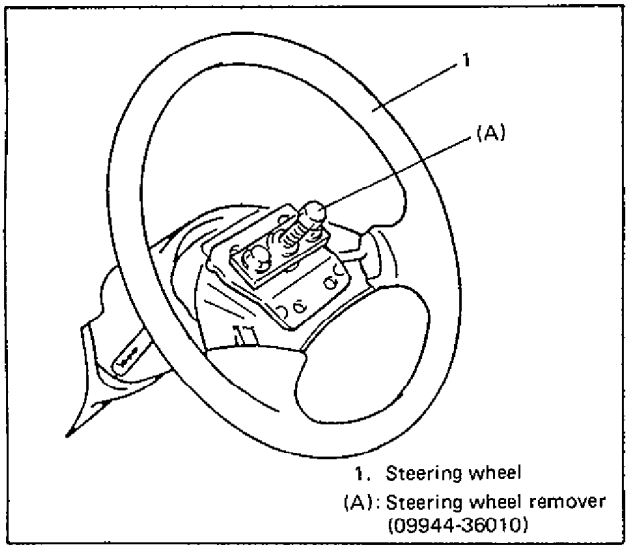


Fig. 3C-3

INSTALLATION

1) Install mass damper to steering wheel.
2) Install steering wheel onto shaft, aligning alignment marks on them.
3) Torque steering shaft nut to specification as given below.
4) Install pad.

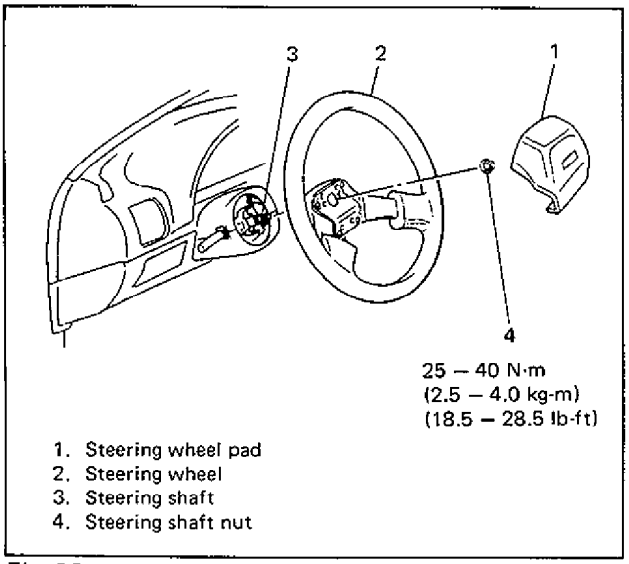


Fig. 3C-4

5) Connect negative battery cable.

CHECKING STEERING COLUMN FOR ACCIDENT DAMAGE

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

CHECKING PROCEDURE

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

NOTE:
Specified length "A" varies depending on vehicle specifications. Measure measurement "B" first and by using that data, check specified length "A" applicable to specifications and then take measurement "A".

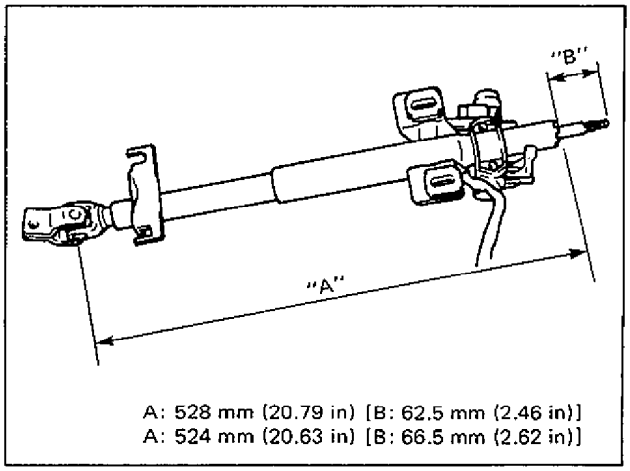
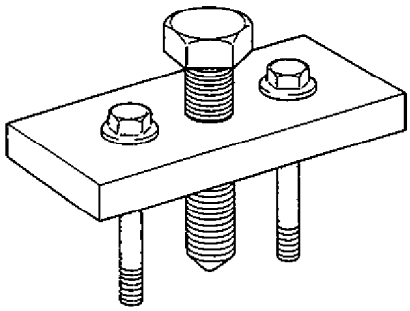


Fig. 3C-5

NOTE:
For any checking prodedure other than the above, consult the Service Manual mentioned in the FOREWORD of this manual.

SPECIAL TOOL



09944-36010
Steering wheel remover

Fig. 3C-6

SECTION 5

BRAKES

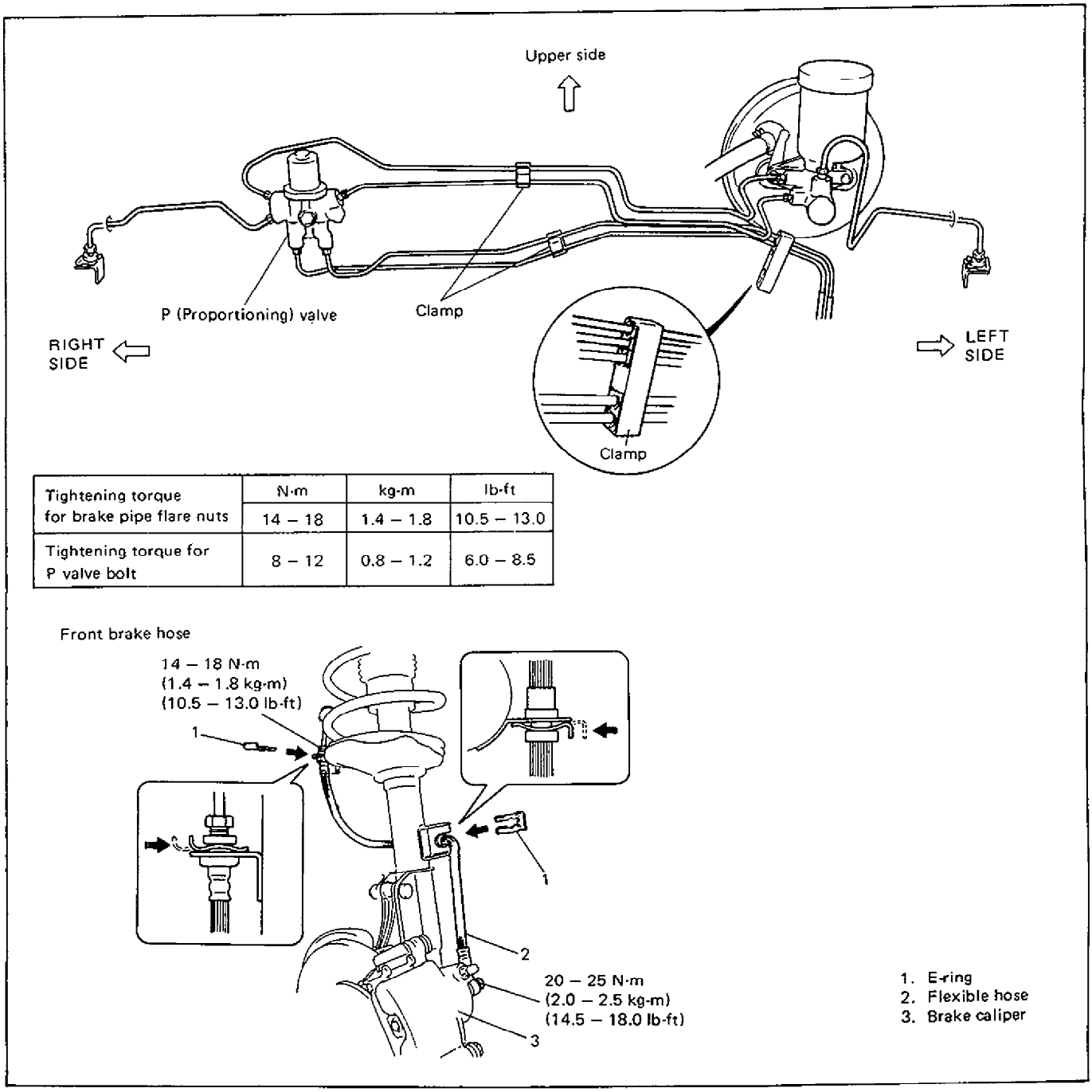
NOTE:
For the descriptions (items) not found in this section, refer to the same section of the Service Manual mentioned in the FOREWORD of this manual.

CONTENTS

BRAKE HOSE/PIPE R & I

1. REMOVE AND INSTALL FRONT BRAKE HOSE/PIPE

1) Raise and suitably support car. Remove tire and wheel.
   This operation is not necessary when removing pipes connecting master cylinder and P valve.
2) Clean dirt and foreign material from both hose end or pipe end fittings. Remove brake hose or pipe.
3) Reverse brake hose installation procedure.
   For installation, make sure that steering wheel is in straightforward position and hose has no twist or kink. Check to make sure that hose doesn't contact any part of suspension, both in extreme right and extreme left turn conditions. If it does at any point, remove and correct. Fill and maintain brake fluid level in reservoir. Bleed brake system.



Tightening torque	N·m	kg-m	lb-ft
for brake pipe flare nuts	14 – 18	1.4 – 1.8	10.5 – 13.0
Tightening torque for P valve bolt	8 – 12	0.8 – 1.2	6.0 – 8.5

Fig. 5-1 Front Brake Hose/Pipe R & I

SECTION 6A

ENGINE MECHANICAL

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

CONTENTS

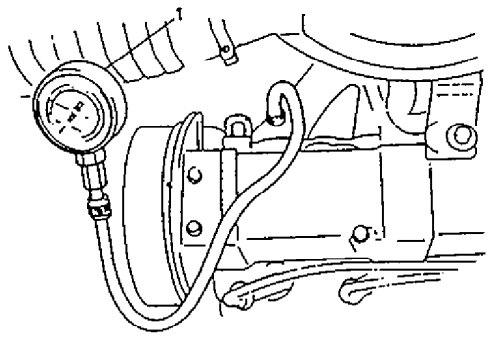
ON CAR SERVICE

ENGINE VACUUM CHECK

(For fuel injection model)

Engine vacuum that develops in intake line is a good indicator of engine condition. Check engine vacuum as follows:

1. Warm up engine to normal operating temperature.
2. With engine stopped, remove blind plug from intake manifold and install special tool (vacuum gauge) to vacated threaded hole.



1. Special tool (Vacuum gauge 09915-67310)

Fig. 6A-2 Installing Vacuum Gauge

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

Vacuum specification	40 – 50 cmHg (15.7 – 19.7 in.Hg) at specified idling speed

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

VALVE GUIDES

INSPECT

Using a micrometer and bore gauge, take diameter readings on valve stems and guides to check stem-to-guide clearance. Be sure to take reading at more than one place along the length of each stem and guide.

If clearance exceeds limit, replace valve and valve guide.

Item		Standard	Limit
Valve stem diameter	In	5.457 – 5.480 mm (0.2148 – 0.2157 in.)	———
	Ex	5.440 – 5.455 mm (0.2142 – 0.2148 in.)	———
Valve guide I.D.	In & Ex	5.500 – 5.512 mm (0.2165 – 0.2170 in.)	———
Stem-to-guide clearance	In	0.020 – 0.055 mm (0.0008 – 0.0021 in.)	0.07 mm (0.0027 in.)
	Ex	0.045 – 0.072 mm (0.0018 – 0.0028 in.)	0.09 mm (0.0035 in.)

OIL PRESSURE CHECK

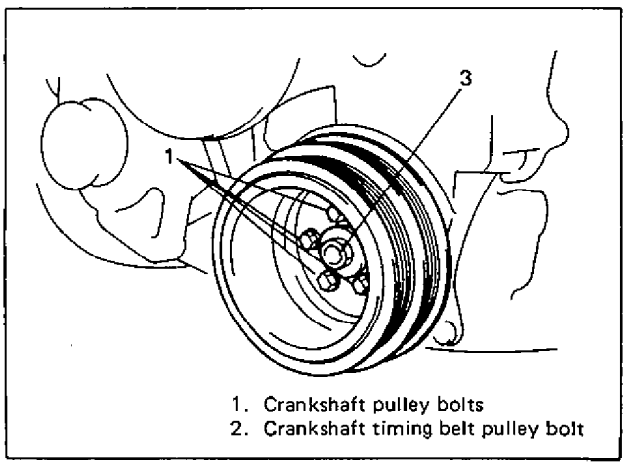
Check engine oil pressure according to the same procedure as that in service manual mentioned in the FOREWORD of this manual.

Oil pressure specification	2.7 – 3.7 kg/cm² 38.4 – 52.6 psi at 4,000 r/min.

CRANKSHAFT PULLEY

Following bolts are used for crankshaft pulley. Tighten them to specified torque below.

Tightening torque for pulley bolts	N·m	kg-m	lb-ft
	14 – 18	1.4 – 1.8	10.5 – 13.0



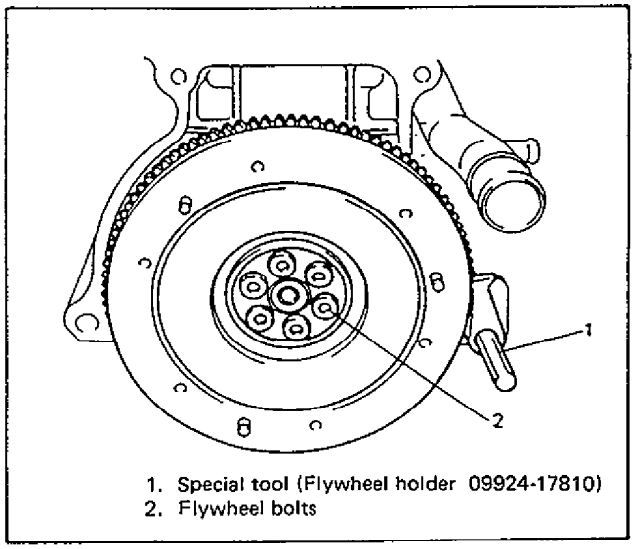
1. Crankshaft pulley bolts
2. Crankshaft timing belt pulley bolt

Fig. 6A-3 Crankshaft Pulley Bolt

FLYWHEEL

Following bolts are used for crankshaft pulley tighten them to specified torque below.

Tightening torque for flywheel or drive plate bolts	N·m	kg-m	lb-ft
	68 – 72	6.8 – 7.2	49.5 – 52.0



1. Special tool (Flywheel holder 09924-17810)
2. Flywheel bolts

Fig. 6A-4 Flywheel

ENGINE MOUNTINGS

When removing or installing engine mounting, refer to following figure.

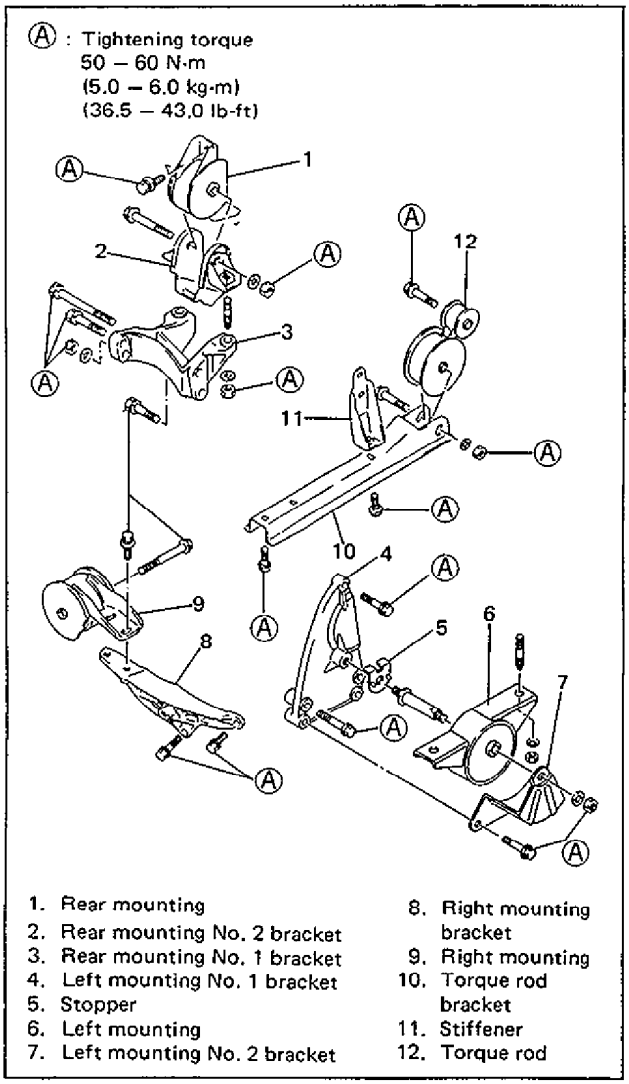


Fig. 6A-5 Engine Mounting (For A/T Model)

SECTION 6E

ELECTRONIC FUEL INJECTION SYSTEM

(Single-point Throttle Body Fuel Injection System)

NOTE:
Whether following systems (parts) are used in the particular car or not depends on specifications. Be sure to bear this in mind when performing service work.
- **Shift-up indicator light control system (Shift-up indicator light).**

CONTENTS

GENERAL DESCRIPTION

The Electronic Fuel Injection system in this car supplies the combustion chambers with air/fuel mixture of optimized ratio under widely varying driving conditions. It uses the single-point throttle body injection system which injects fuel into the throttle body through one injector.

This system has 2 major sub-systems: air/fuel delivery system and electronic control system. Air/fuel delivery system includes fuel pump, throttle body, 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 control system
- Shift-up indicator light control system (If equipped)
- Throttle valve opening signal output for A/T
- ESA (Electronic Spark Advance) system

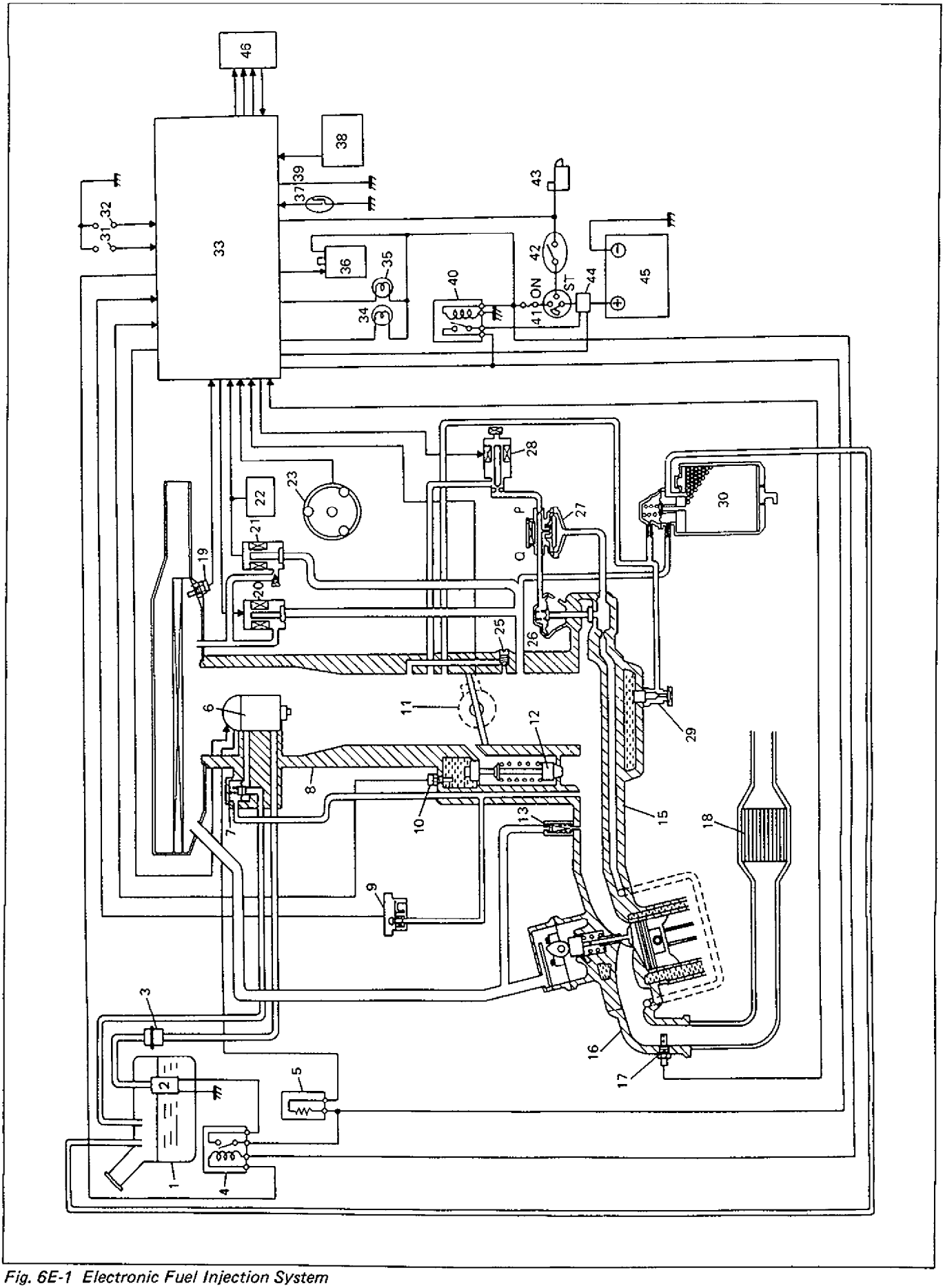


Fig. 6E-1 Electronic Fuel Injection System

1. Fuel tank
2. Fuel pump
3. Fuel filter
4. Fuel pump relay
5. Fuel injector resistor
6. Fuel injector
7. Fuel pressure regulator
8. Throttle body
9. Pressure sensor
10. WTS
11. TPS
12. Air valve
13. PCV valve
14. Blank
15. Intake manifold
16. Exhaust manifold
17. Oxygen sensor
18. Three-way catalyst
19. ATS
20. ISC solenoid valve
21. Air-conditioner VSV
    (only for car with air-conditioner)
22. Air-conditioner amplifier
    (only for car with air-conditioner)
23. Crank angle sensor in distributor
24. Blank
25. Idle speed adjusting screw
26. EGR valve
27. EGR modulator
28. EGR VSV
29. BVSV
30. Charcoal canister
31. Diagnosis switch terminal
32. Test switch terminal
33. ECM
34. "CHECK ENGINE" light
35. Shift-up indicator light
36. Ignition coil
37. Speed sensor
38. Electric load
    - Radiator fan
    - Heater blower
    - Rear window defogger
    - Stop light
    - Headlight, small (clearance) light
39. Ground
40. Main relay
41. Main switch
42. Clutch switch (M/T) or shift switch (A/T)
43. Starter magnetic switch
44. Main fuse
45. Battery
46. A/T control module (A/T)

AIR AND FUEL DELIVERY SYSTEM

The main components of this system are fuel tank, fuel pump, fuel filter, throttle body (including fuel injector, fuel pressure regulator and air valve), fuel feed line, fuel return line, air cleaner and ISC solenoid valve.

The fuel in the fuel tank is pumped up by the fuel pump, filtered by the fuel filter and fed under pressure to injector installed in throttle body. As the fuel pressure applied to the fuel injector (the fuel pressure in the fuel feed line) is always kept a certain amount higher than the pressure in the intake manifold by the fuel pressure regulator, the fuel is injected into the throttle body in conic dispersion when the injector opens according to the injection signal from ECM. The fuel relieved by the fuel pressure regulator returns through the fuel return line to the fuel tank.

The injected fuel is mixed with the air which has been filtered through the air cleaner in the throttle body. The air/fuel mixture is drawn through clearance between throttle valve and bore and idle bypass passage into intake manifold. Then the intake manifold distributes the air/fuel mixture to each combustion chamber.

When the engine is cold, the air is drawn through air valve bypassing the throttle valve into the intake manifold.
When ISC solenoid valve opens according to the signal from ECM, the air is drawn through hose bypassing the throttle valve into the intake manifold.

For the structure and operation of the fuel tank and filter, refer to SECTION 6C "ENGINE FUEL".

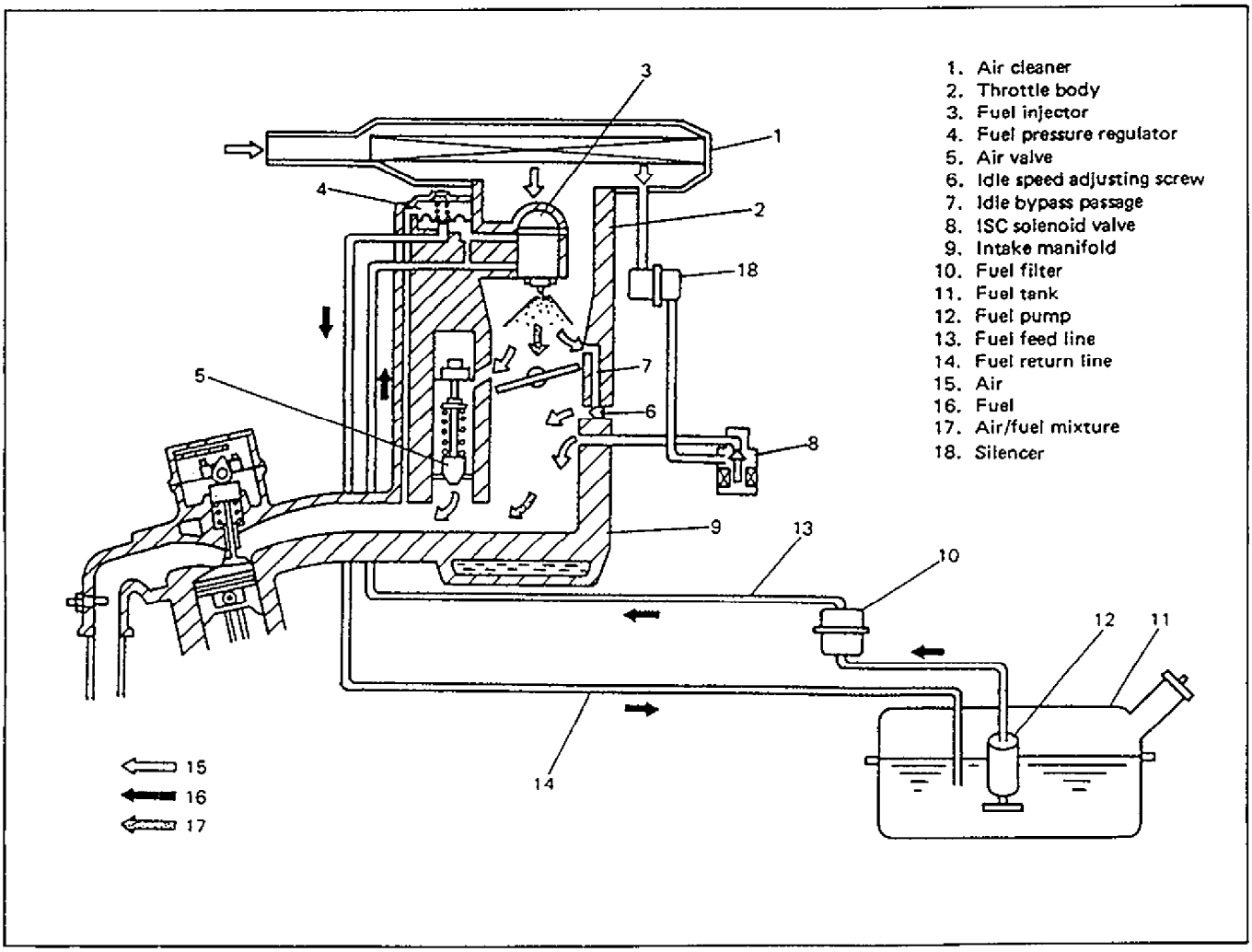


Fig. 6E-3 Air and Fuel Delivery System

FUEL PUMP

The electric fuel pump located in the fuel tank consists of armature, magnet, impeller, brush, check valve, etc.. The ECM controls its ON/OFF operation as described under "Fuel Pump Control System" included in later part of this section.

Operation

When power is supplied to the fuel pump, the motor in the pump runs and so does the impeller. This causes a pressure difference to occur between both sides of the impeller as there are many gooves around it. Then the fuel is drawn through the inlet port, and with its pressure increased it is discharged through the outlet port.
The fuel pump also has a check valve to keep some pressure in the fuel feed line even when the fuel pump is stopped.

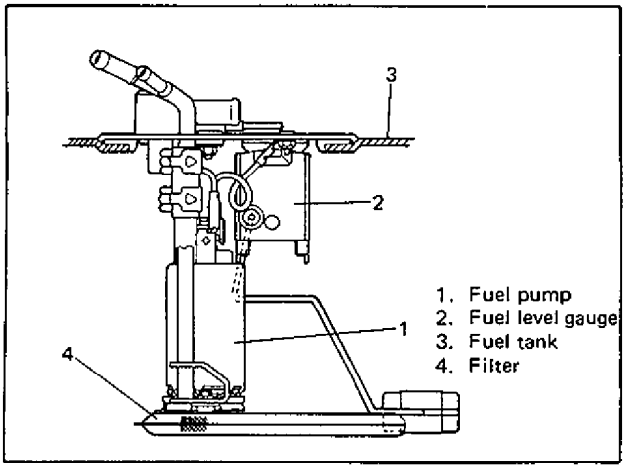


Fig. 6E-4 Fuel Pump Mounting

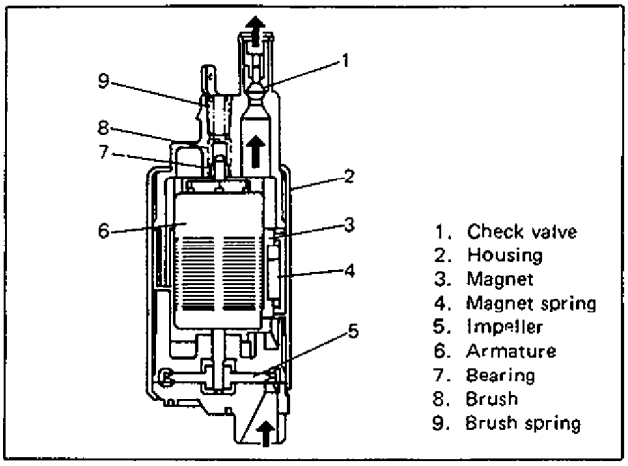


Fig. 6E-5 Fuel Pump Cross-Section

THROTTLE BODY

The throttle body consists of the main bore, air and/or fuel passage, vacuum passage (for pressure sensor, ignition timing vacuum advancer, evaporative emission control system and EGR system), air induction passage and the following parts.

- Fuel injector which injects fuel according to the signal from ECM.
- Fuel pressure regulator which maintains the fuel pressure to the injector a certain amount higher than the pressure in the intake manifold.
- Throttle valve which is interlocked with the accelerator pedal and controls the amount of the air/fuel mixture drawn into the combustion chamber.
- Air valve which supplies the bypass air when engine is cold.
- Idle speed adjusting screw which controls the amount of bypass air to adjust engine idle speed.
- TPS which detects the throttle valve opening and sends a signal to ECM.

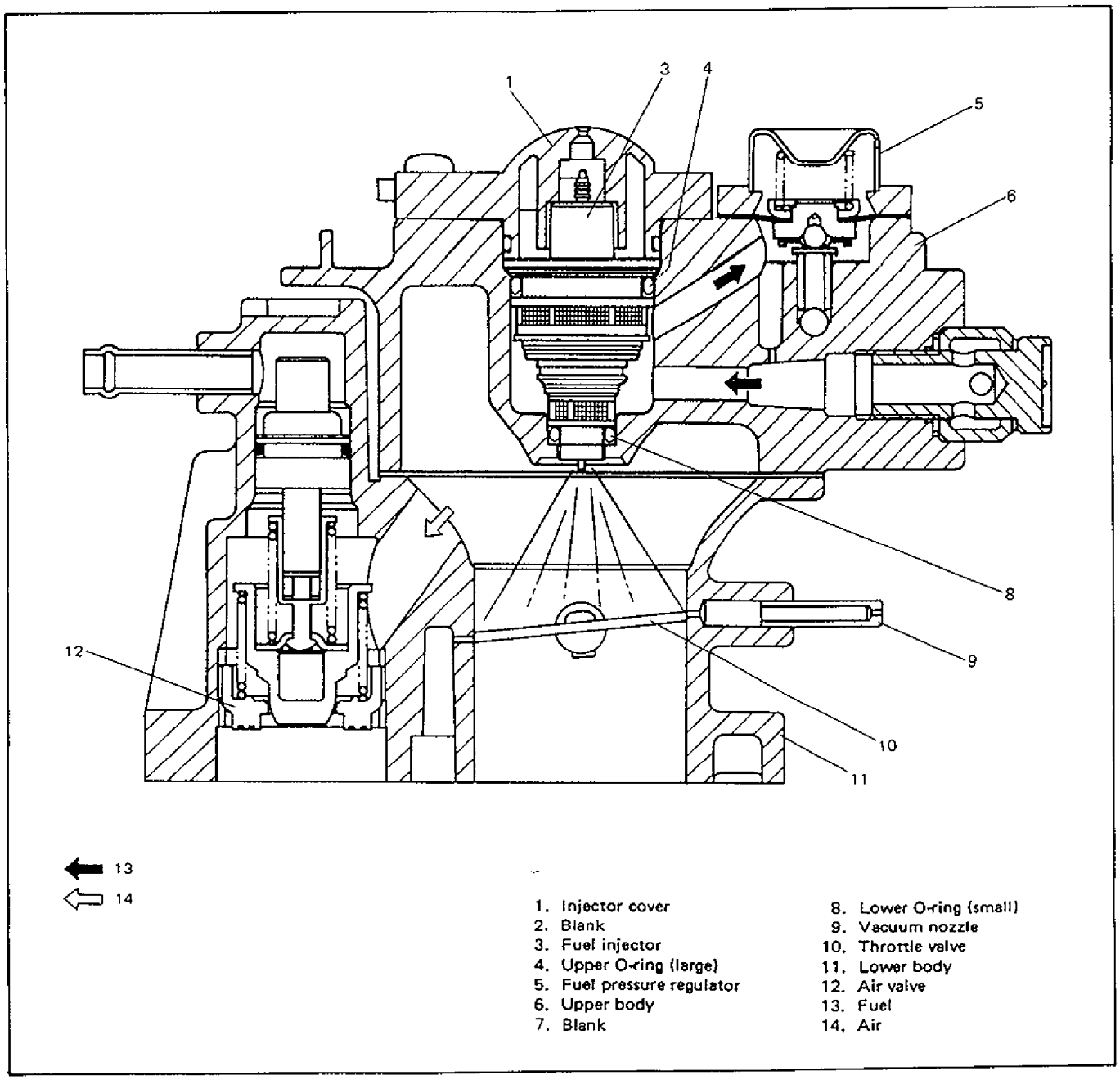


Fig. 6E-6 Throttle Body Cross-Section

FUEL INJECTOR

It is an electromagnetic type injection nozzle which injects fuel in the throttle body bore according to the signal from ECM.

Operation

When the solenoid coil of the injector is energized by ECM, it becomes an electromagnet and attracts the plunger. At the same time, the needle valve which is incorporated with the plunger opens and the injector which is under the fuel pressure injects fuel in conic dispersion. As the lift stroke of the needle valve of the injector is set constant, the amount of fuel injected at one time is determined by the length of time during which the solenoid coil is energized (injection time).

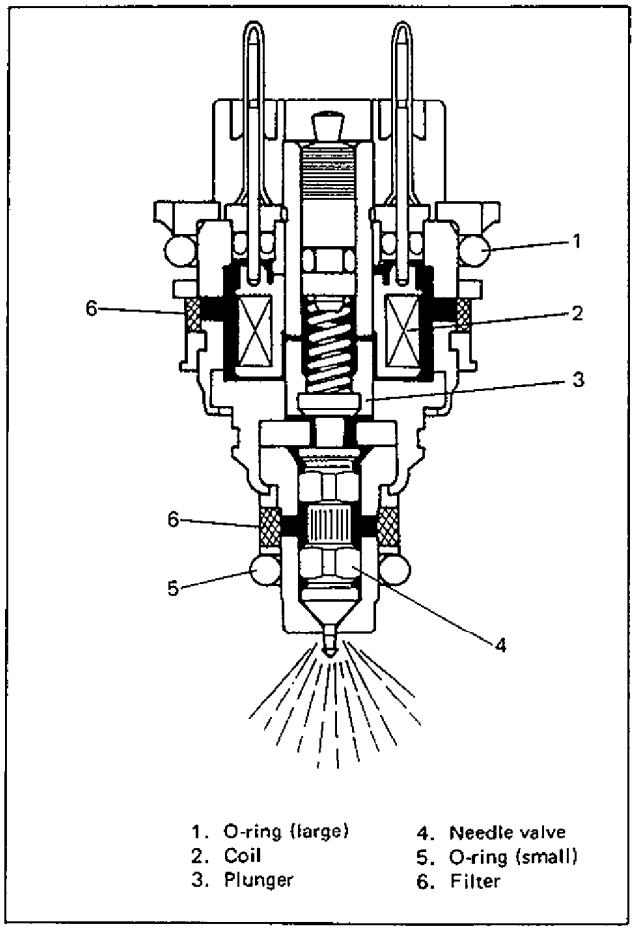


Fig. 6E-7 Fuel Injector Cross-Section

FUEL PRESSURE REGULATOR

The fuel pressure regulator is diaphragm-operated relief valve consisting of diaphragm, spring and valve. It keeps the fuel pressure applied to the injector 1.8 kg/cm² (180 kPa, 25.6 psi) higher than that in the intake manifold at all times.

The pressure applied to the chamber "A" of fuel pressure regulator is intake manifold pressure and that to the chamber "B" is fuel pressure. When the fuel pressure rises more than 1.8 kg/cm² (180 kPa, 25.6 psi) higher than the intake manifold pressure, the fuel pushes the valve in the regulator open and excess fuel returns to the fuel tank via the return line.

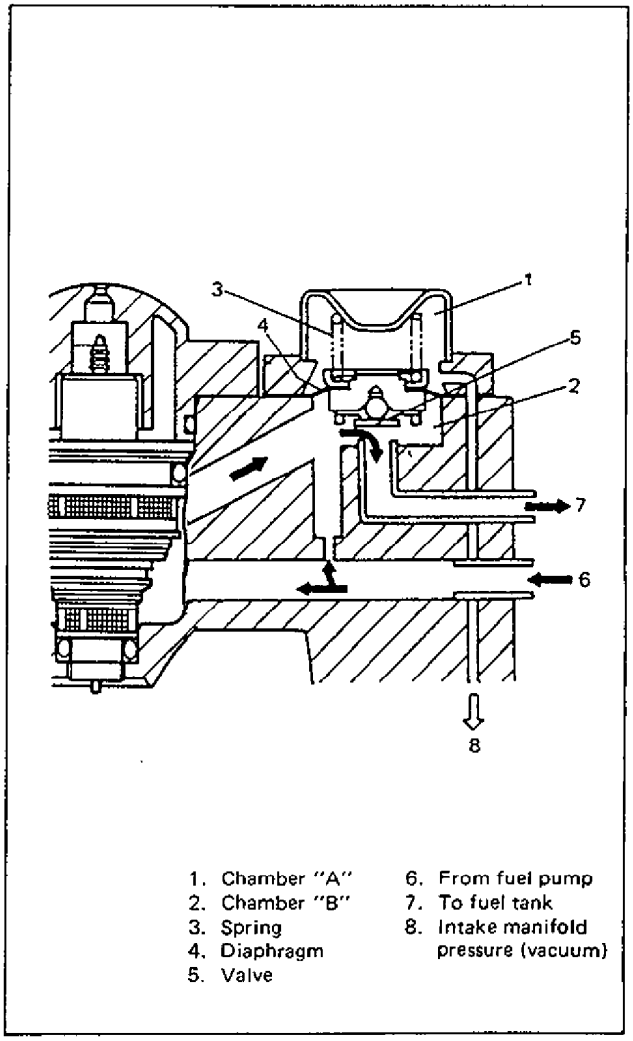


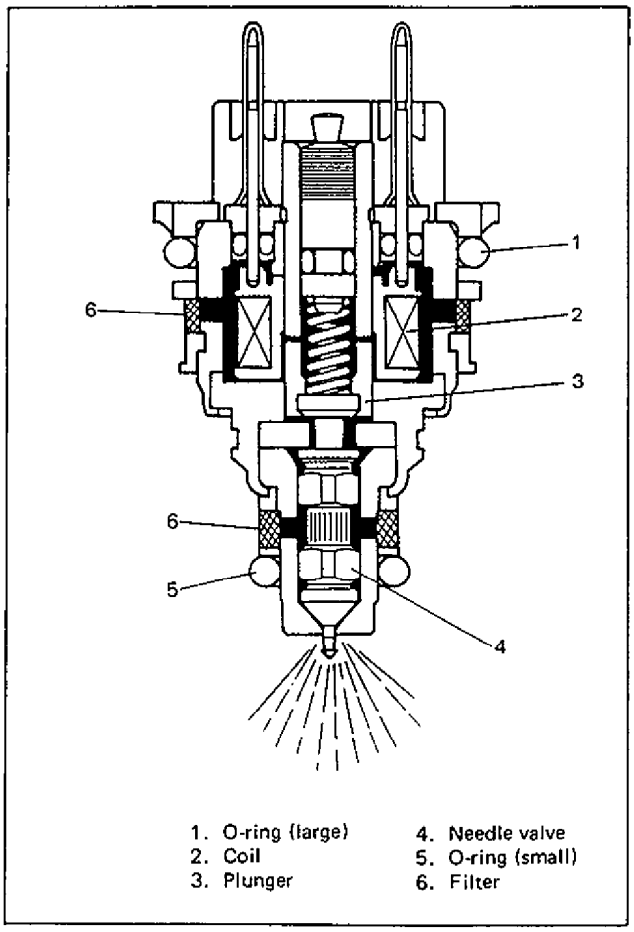
Fig. 6E-8 Pressure Regulator Cross-Section

FUEL INJECTOR

It is an electromagnetic type injection nozzle which injects fuel in the throttle body bore according to the signal from ECM.

Operation

When the solenoid coil of the injector is energized by ECM, it becomes an electromagnet and attracts the plunger. At the same time, the needle valve which is incorporated with the plunger opens and the injector which is under the fuel pressure injects fuel in conic dispersion. As the lift stroke of the needle valve of the injector is set constant, the amount of fuel injected at one time is determined by the length of time during which the solenoid coil is energized (injection time).



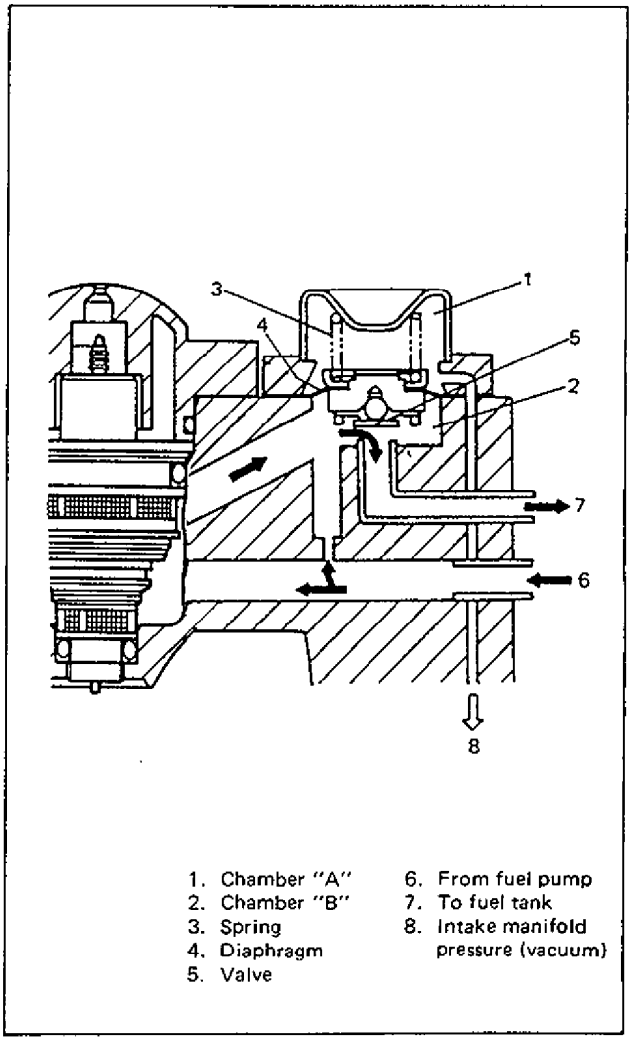
1. O-ring (large)
2. Coil
3. Plunger
4. Needle valve
5. O-ring (small)
6. Filter

Fig. 6E-7 Fuel Injector Cross-Section

FUEL PRESSURE REGULATOR

The fuel pressure regulator is diaphragm-operated relief valve consisting of diaphragm, spring and valve. It keeps the fuel pressure applied to the injector 1.8 kg/cm² (180 kPa, 25.6 psi) higher than that in the intake manifold at all times.

The pressure applied to the chamber "A" of fuel pressure regulator is intake manifold pressure and that to the chamber "B" is fuel pressure. When the fuel pressure rises more than 1.8 kg/cm² (180 kPa, 25.6 psi) higher than the intake manifold pressure, the fuel pushes the valve in the regulator open and excess fuel returns to the fuel tank via the return line.



1. Chamber "A"
2. Chamber "B"
3. Spring
4. Diaphragm
5. Valve
6. From fuel pump
7. To fuel tank
8. Intake manifold pressure (vacuum)

Fig. 6E-8 Pressure Regulator Cross-Section

AIR VALVE

The air valve consists of thermo-wax, springs and valve.

When the engine is cold, it sends the air into the intake manifold without letting it pass through the throttle valve to increase the engine speed, and thus the engine is warmed up.

Operation

When the engine is cold (or engine cooling water is lower than about 80°C (176°F)), the thermo-wax contracts.

In this state, the valve opens by the spring force, allowing the air to be drawn into the intake manifold. Thus the amount of intake air increases even when the throttle valve is at the idle position and the engine speed rises to the fast idle state which is higher than the idle speed.

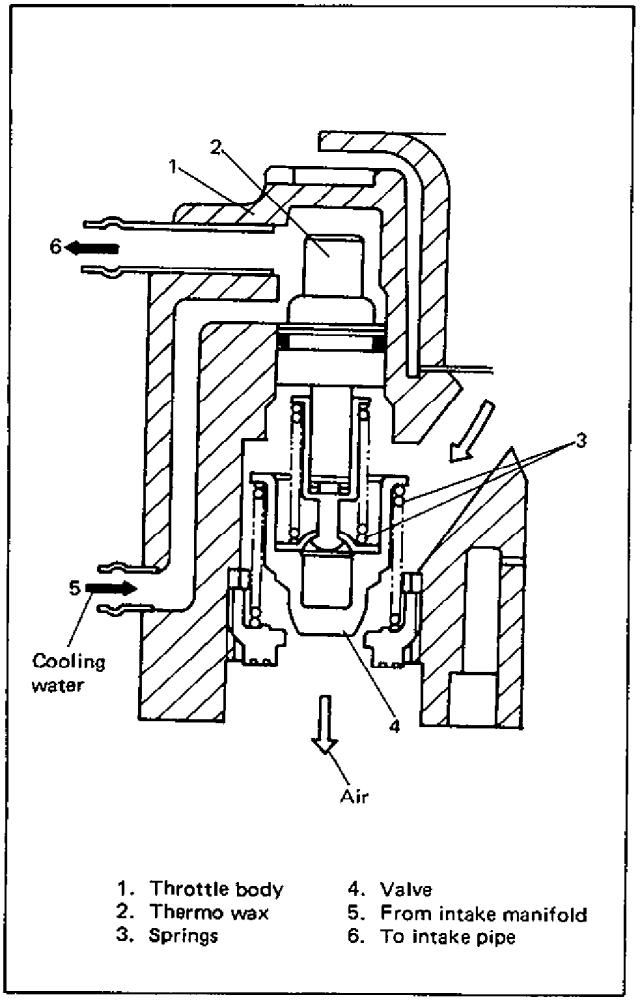


Fig. 6E-9 Opening Air Valve

As the engine is warmed up, the thermo-wax expands gradually, then the piston pushes down the valve gradually, and the amount of air passing through the air valve decreases and so does the engine speed. When the engine cooling water temperature reaches about 80°C (176°F), the valve is fully closed and the engine speed is back to the normal idle speed.

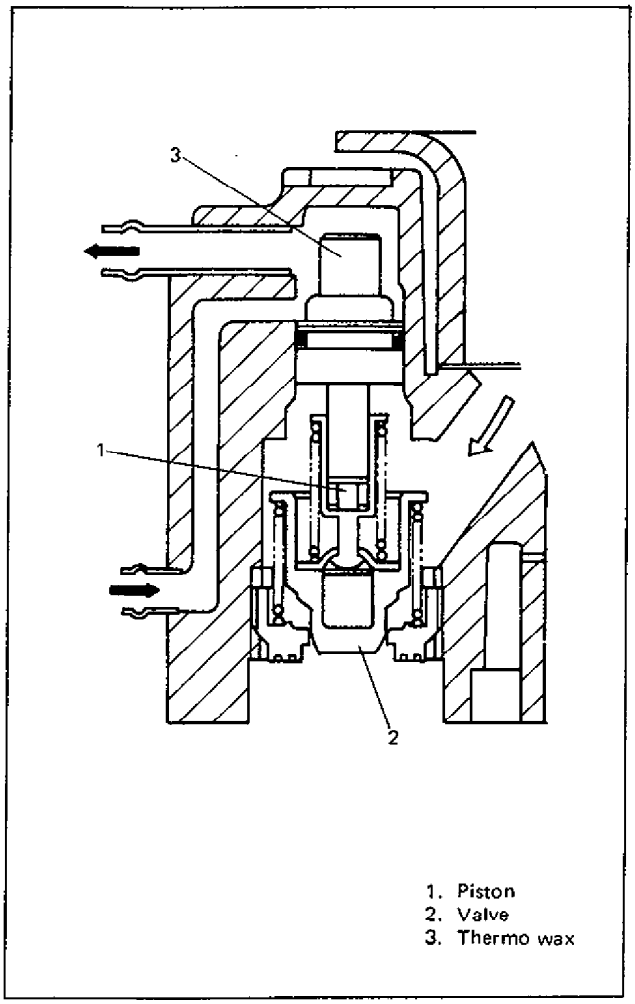


Fig. 6E-10 Closing Air Valve

ISC (Idle Speed Control) SOLENOID VALVE

The ISC solenoid valve opens and closes air by-pass passage according to the signal from ECM. When it opens, the air is supplied to the intake manifold.

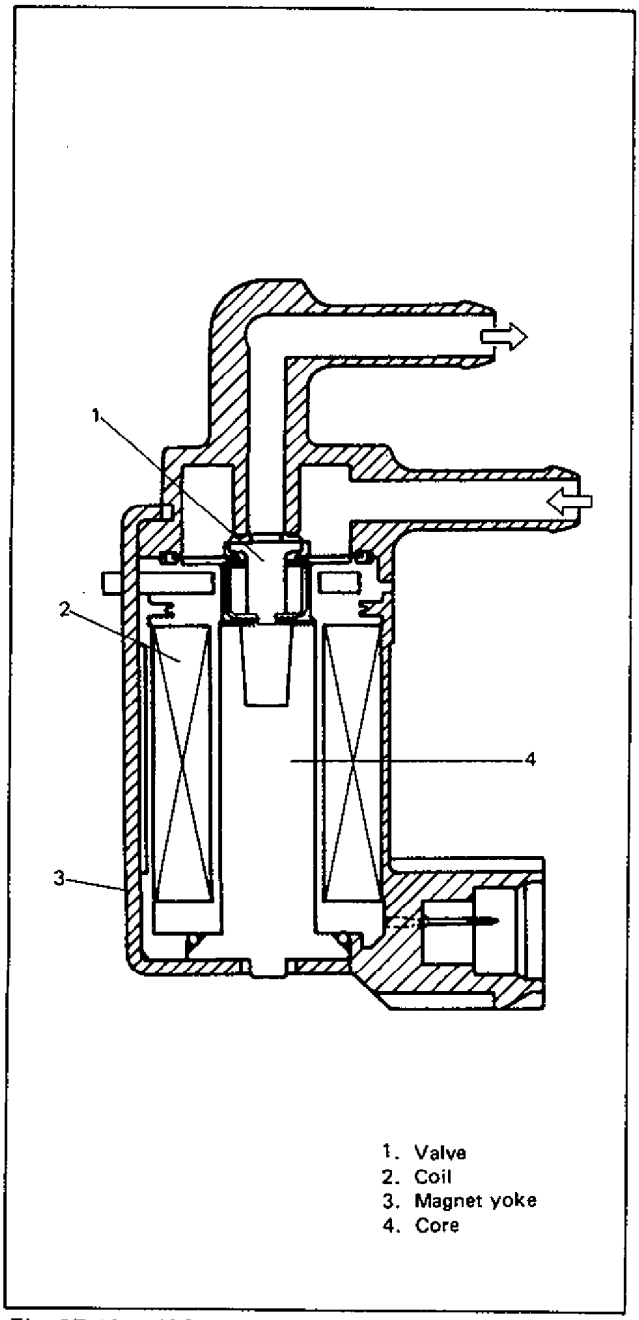


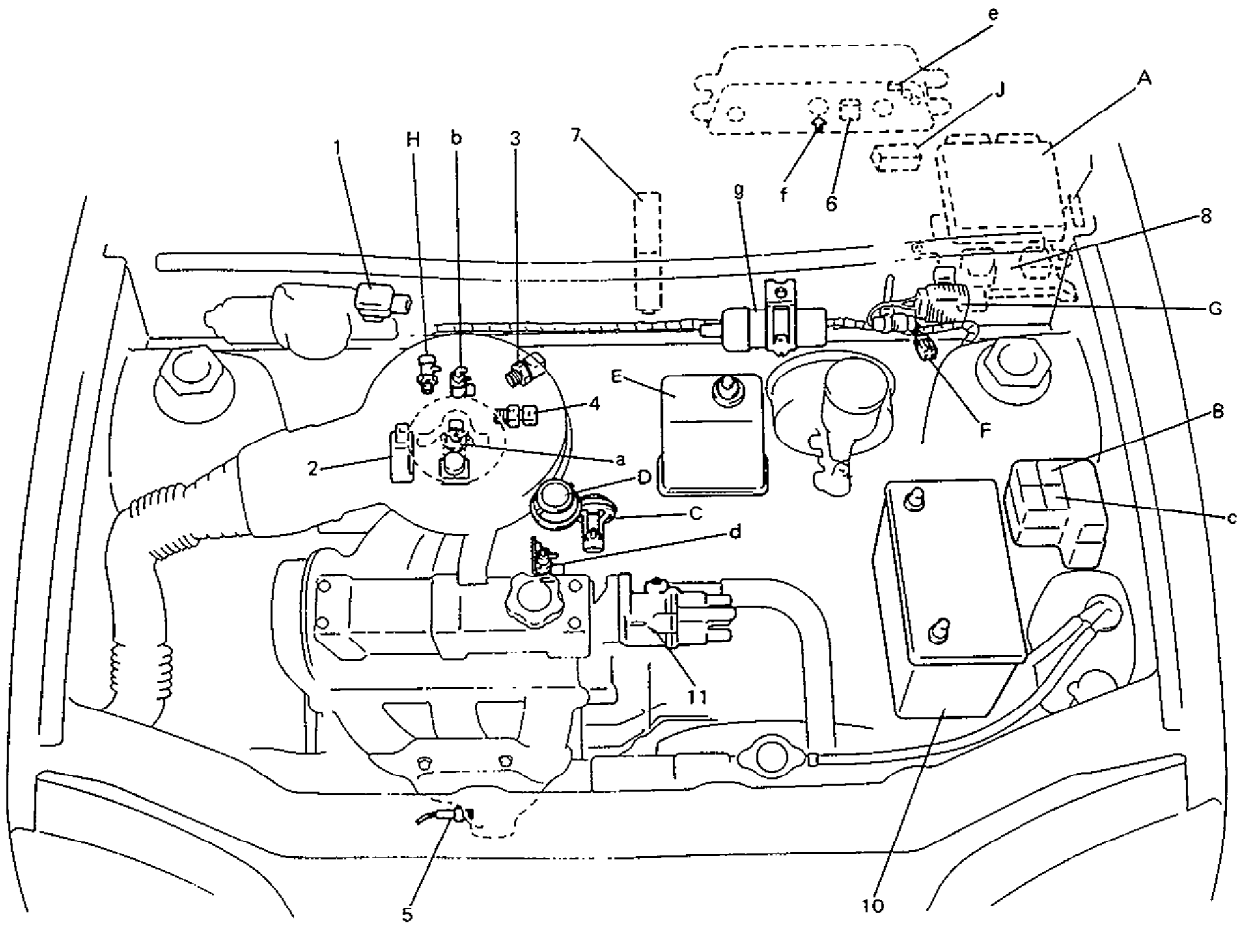
Fig. 6E-10-1 ISC Solenoid Valve Cross-Section

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.
Fanctionally, it is divided into six sub systems:

- Fuel injection control system
- ISC solenoid valve control system
- Fuel pump control system
- EGR control system
- Shift-up indicator light control system (For M/T model only)
- Electronic spark advance system

Also, with A/T model ECM sends throttle valve opening signal to A/T control module to control A/T.



INFORMATION SENSORS
1. Pressure sensor
2. TPS
3. ATS
4. WTS
5. Oxygen sensor
6. Speed sensor
7. A/T control module (For A/T model)
8. Junction/fuse block (Diagnosis switch terminal)
9. Blank
10. Battery
11. Distributor (Crank angle sensor)

CONTROLLED DEVICES
a : Fuel injector
b : ISC solenoid valve
c : Fuel pump relay
d : EGR VSV
e : "CHECK ENGINE" light
f : Shift-up indicator light
g : Ignition coil

OTHERS
A : ECM
B : Main relay
C : EGR valve
D : EGR modulator
E : Canister
F : Monitor coupler
G : Injector resistor
H : BVSV
I : Electric load diode
J : Serial data coupler (Assembly line diag. link)

Fig. 6E-11 Parts Location

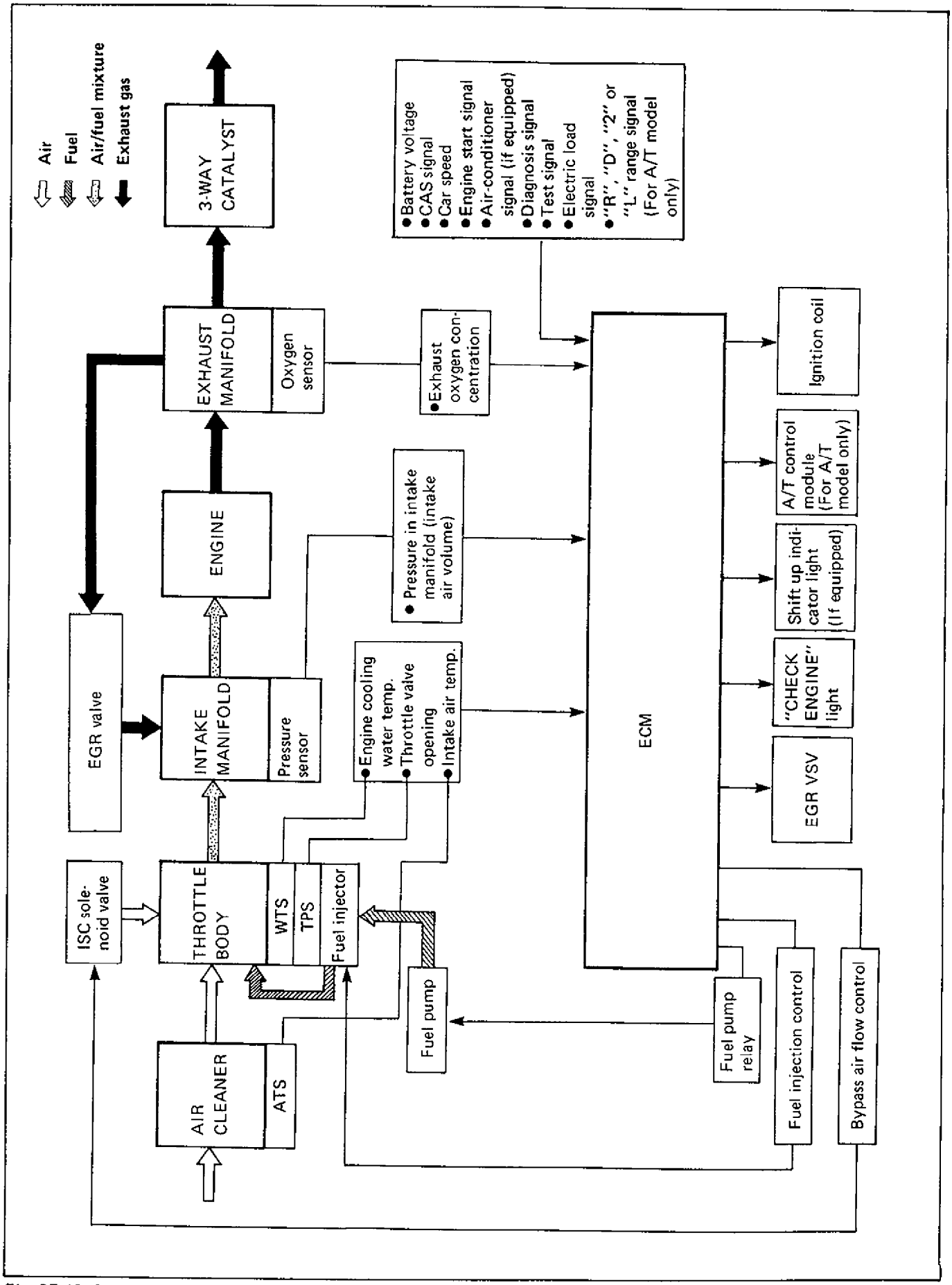


Fig. 6E-12 System Schematic

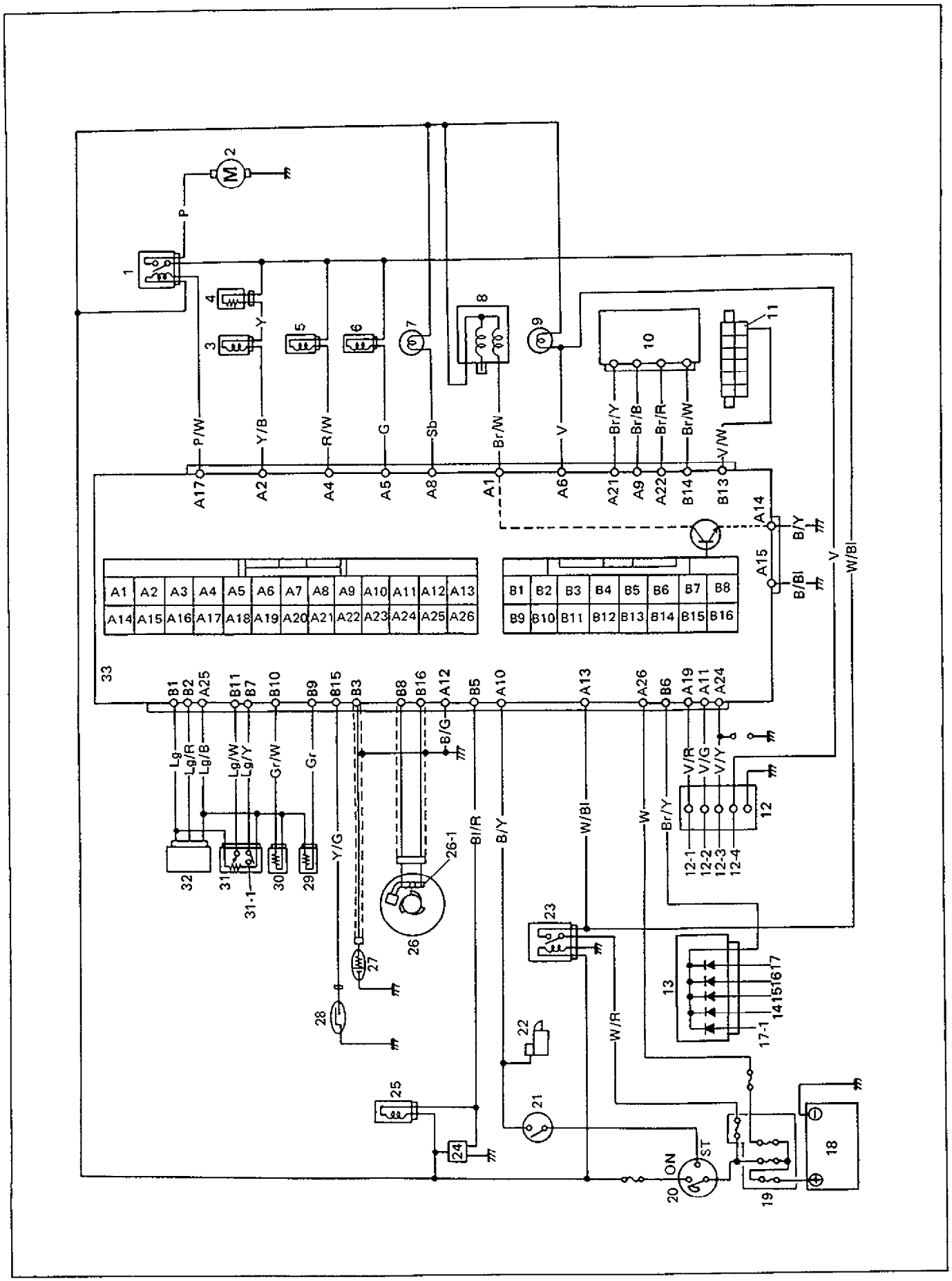


Fig. 6E-13 System Wiring Diagram

1. Fuel pump relay
2. Fuel pump
3. Fuel injector
4. Resistor
5. ISC solenoid valve
6. EGR VSV
7. Shift-up indicator light
8. Ignition coil
9. "CHECK ENGINE" light
10. A/T control module
11. Serial data terminal
12. Monitor coupler
12-1. Duty output terminal
12-2. Test switch terminal
12-3. Diag. switch terminal
12-4. Diag. output terminal
13. Diode
14. To radiator fan switch
15. To heater blower switch
16. To stop light switch
17. To lighting switch
17-1. To rear window defogger switch
18. Battery
19. Main fuse box
20. Main switch
21. Clutch switch (M/T) or shift switch (A/T)
22. Starter magnetic switch
23. Main relay
24. Air-conditioner amplifier ┐
25. Air-conditioner VSV ┘ If equipped
26. Distributor
26-1. Crank angle sensor
27. Oxygen sensor
28. Vehicle speed sensor
29. Air temp. sensor
30. Water temp sensor
31. Throttle position sensor
31-1. Idle switch
32. Pressure sensor
33. ECM

Wire color

B : Black
B/Bl : Black/Blue
B/G : Black/Green
B/R : Black/Red
B/W : Black/White
B/Y : Black/Yellow
Bl/R : Blue/Red
Br : Brown
Br/B : Brown/Black
Br/R : Brown/Red
Br/W : Brown/White
Br/Y : Brown/Yellow
G : Green
Gr : Gray
Gr/W : Gray/White
Lg : Lightgreen
Lg/B : Lightgreen/Black
Lg/R : Lightgreen/Red
Lg/W : Lightgreen/White
Lg/Y : Lightgreen/Yellow
P : Pink
P/W : Pink/White
Sb : Skyblue
V : Violet
V/G : Violet/Green
V/Y : Violet/Yellow
W : White
W/Bl : White/Blue
R/W : Red/White
Y : Yellow
Y/B : Yellow/Black

Electronic 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, ISC solenoid valve, fuel pump relay, etc. but also self-diagnosis function and fail-safe function as described in the following section.

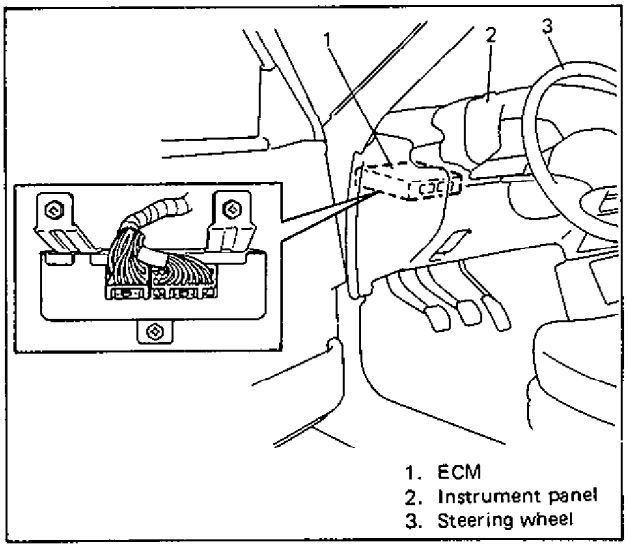


Fig. 6E-15 ECM Location

Self-diagnosis function

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

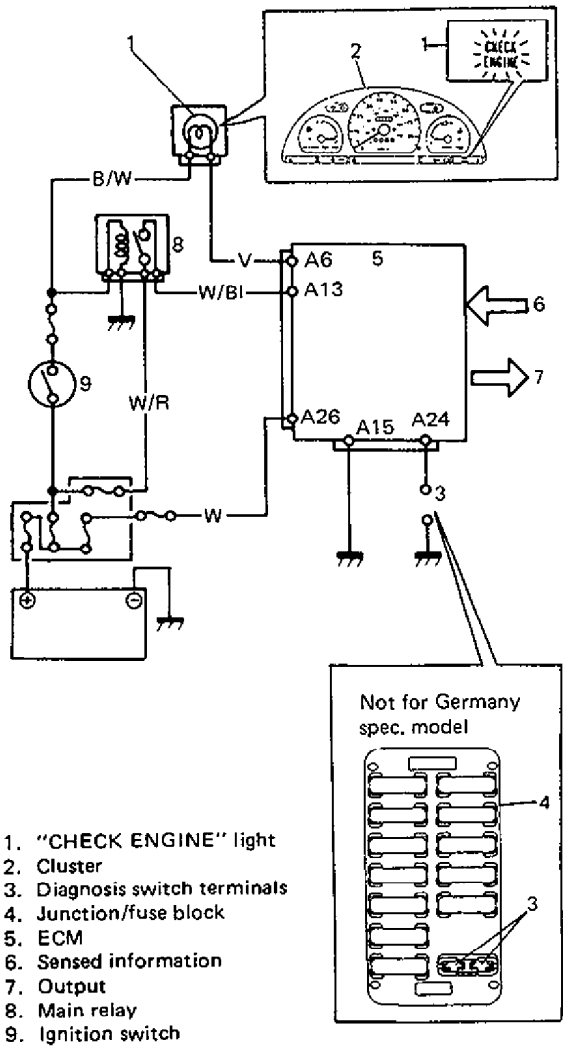
- Oxygen sensor
- Water temp. sensor
- Throttle position sensor
- Air temp. sensor
- Pressure sensor
- Ignition signal
- Vehicle speed sensor
- EGR system (California spec. vehicle only)
- CPU (Central Processing Unit) of ECM

ECM and "CHECK ENGINE" light operate as follows.

- "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 "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), "CHECK ENGINE" light turns OFF.
- When ECM detects a trouble which has occurred in the above areas, it makes "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 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 60 seconds or longer.)
  ECM also indicates trouble area in memory by means of flashing of "CHECK ENGINE" light at the time of inspection (i.e. when diagnosis switch terminal is grounded and ignition switch is turned ON).

NOTE:

- **When a trouble occurs in the above areas except EGR system and disappears soon while the diagnosis switch terminal is ungrounded and the engine is running, "CHECK ENGINE" light lights and remains ON as long as the trouble exists but it turns OFF when the normal condition is restored.**
  When it is EGR system where a trouble occurs, even if it is only a temporary one and disappears soon, "CHECK ENGINE" light remains ON till the ignition switch is turned OFF.
- Only ignition circuit trouble (code No. 41) is not stored in back-up memory of ECM. (in other words, even if ECM has detected a trouble in ignition circuit, once ignition switch is turned OFF, code No. 41 will not be indicated even when diagnosis switch terminal is grounded and ignition switch is turned ON.). Therefore, to check diagnostic code when engine fails to start, crank engine and then ground diagnostic switch terminal with ignition switch ON.



NOTE:
Germany spec. model is not provided with a diagnosis switch terminal in the fuse box but instead a diagrosis switch is installed to the underside of the instrument panel as shown below.

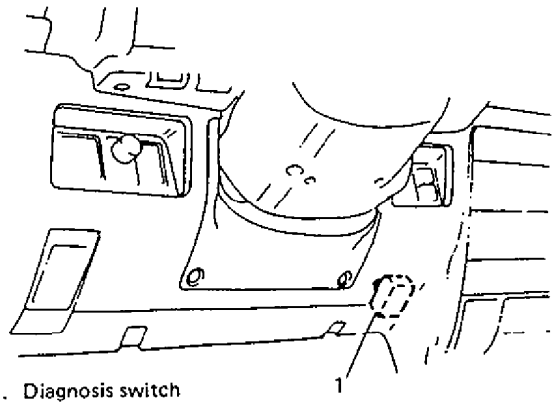


Fig. 6E-16 "CHECK ENGINE" Light Circuit

Fail-safe function

Even when a trouble has occurred in such area of Electronic Fuel Injection system that includes the following parts and a failure signal is sent to ECM, control over the injector, ISC solenoid valve and others 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 area and disability in running is avoided.

- Water temp. sensor
- Throttle position sensor
- Vehicle speed sensor
- Air temp. sensor
- Pressure sensor
- CPU in ECM

Pressure (intake manifold absolute pressure) Sensor (PS)

This sensor senses pressure change in the intake manifold and converts it into voltage change. It consists of a semi-conductor type pressure converting element which converts a pressure change into an electrical change and an electronic circuit which amplifies and corrects the electric change. The ECM sends a 5-volt reference voltage to the pressure sensor. As the manifold pressure changes, the electrical resistance of the sensor also changes. By monitoring the sensor output voltage, ECM knows the manifold pressure (intake air volume).

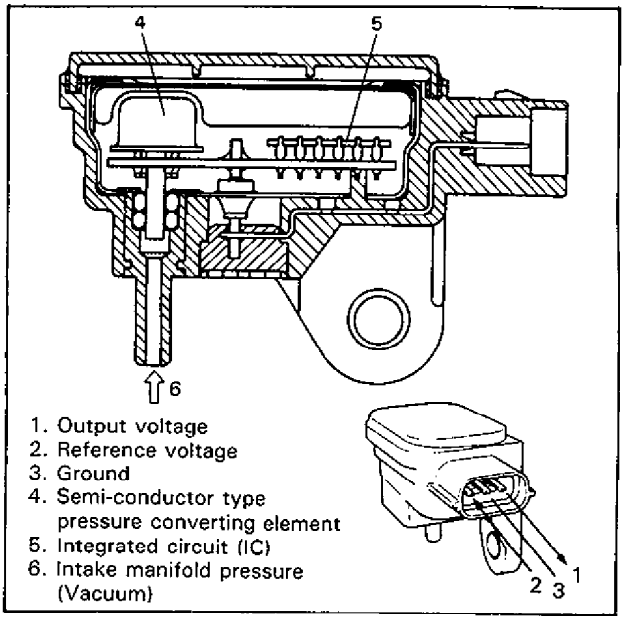


Fig. 6E-17 Pressure Sensor

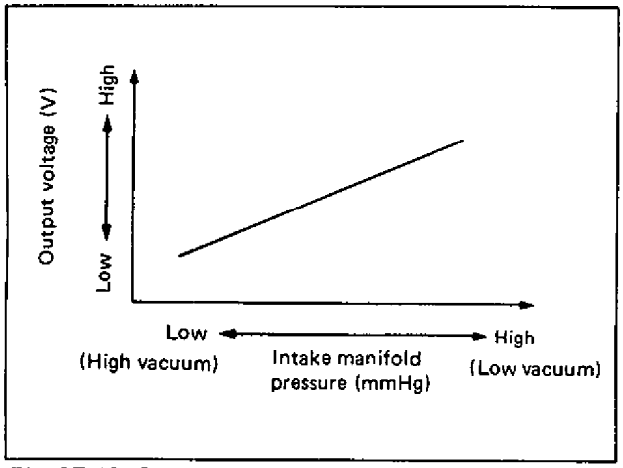


Fig. 6E-18 Output Characteristic

ECM uses the voltage signal from the pressure sensor as one of the signals to control fuel injector, ISC solenoid valve, shift-up indicator light and EGR VSV.

Throttle Position Sensor (TPS)

The throttle position sensor consisting of a contact point (idle switch) and a potentiometer is connected to the throttle valve shaft 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.

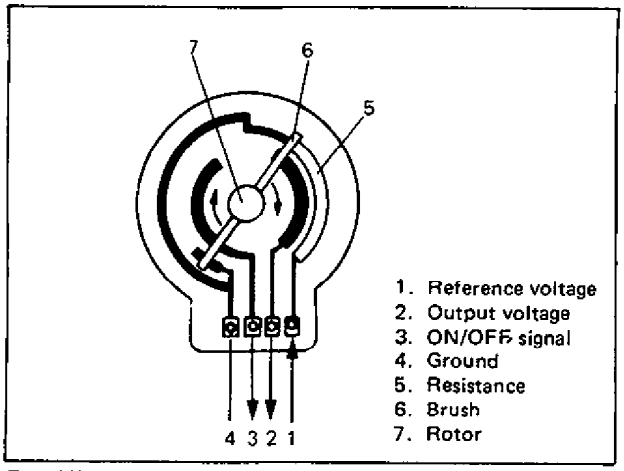


Fig. 6E-20 Throttle Position Sensor

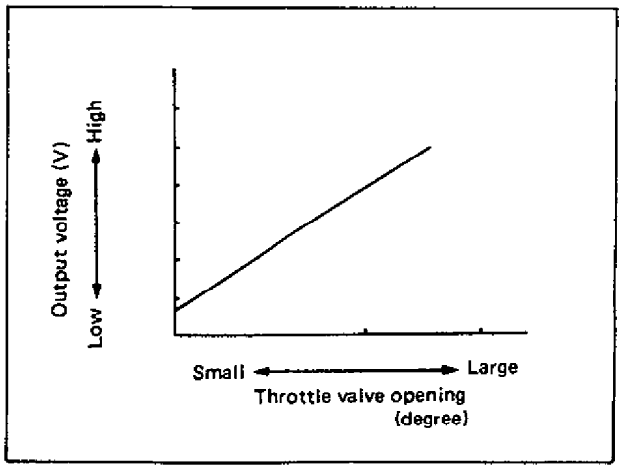


Fig. 6E-21 Output Characteristic

ECM uses the signal from TPS as one of the signals to control fuel injector, ISC solenoid valve and EGR VSV.
Also, ECM converts the voltage signal from TPS into ON/OFF signal and sends it to A/T control module, where it is used as one of the signals to control the automatic transmission.

Air Temperature Sensor (ATS)

Located at the side of air cleaner case, this sensor constantly measures the temperature of the air entering there and converts a change in the air temperature into that in resistance through its thermister. That is, as air temperature lowers, resistance increases and as it rises, resistance decreases. As air density of the intake air varies with variation in temperature, ECM, by monitoring the resistance, adjusts the amount of fuel injection according to the air temperature.

Water Temperature Sensor (WTS)

Located at the side of throttle body, this sensor measures the temperature of the engine cooling water and converts its change into that in resistance through the thermister like the air temperature sensor.
That is, as cooling water temperature lowers, resistance increases and as it rises, resistance decreases.
By monitoring the resistance of the water temperature sensor, ECM detects the engine cooling water temperature and that affects most systems under the control of ECM.

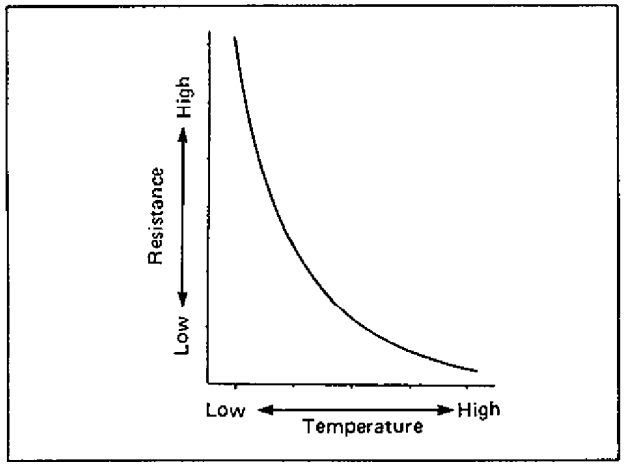


Fig. 6E-22 Air/Water Temperature Sensor Characteristic

Oxygen Sensor

The oxygen sensor is located on the exhaust manifold to detect the concentration of oxygen in the exhaust gases. It consists of the zirconia element (with thin platinum surface coating) which generates electromotive force, lead wire which draws out the electromotive force and cover and housing which protect the zirconia element from damage.
The zirconia element, by its property, generates the electromotive force when a difference in oxygen concentration exists between its faces. As its temperature rises, the change of the electromotive force is amplified by catalytic reaction of the platinum. The oxygen sensor makes use of this property. As atmosphere is introduced into the oxygen sensor, the inside of the zirconia element is exposed to the atmosphere and outside to exhaust gases. Thus the difference in concentration between the inside and the outside of the zirconia element varies with the oxygen concentration in the exhaust gases.
The large concentration difference results in about 1V of the electromotive force and small difference results in about 0V. To put in other words, if the amount of oxygen in the exhaust gases is less (air-fuel mixture is richer than the stoichiometric mixture), about 1V of electromotive force is generated and if more (air-fuel mixture is leaner than the stoichiometric mixture), almost none is generated.
In this way, the oxygen sonsor detects whether the oxygen concentration is high or low (or the mixture is leancer or richer than the stoichiometric mixture).

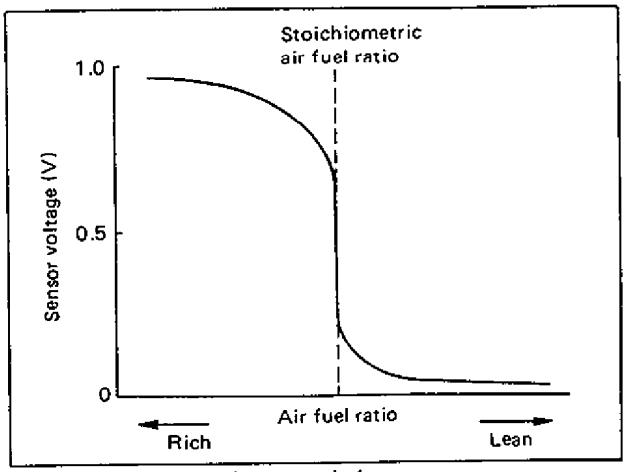


Fig. 6E-23 Output Characteristic

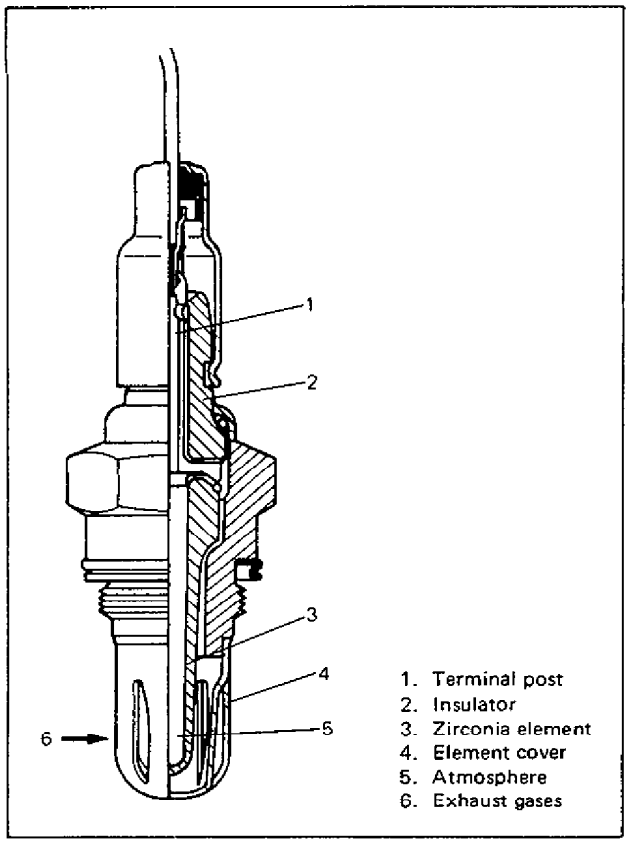


Fig. 6E-24 Oxygen Sensor

Vehicle Speed Sensor

The speed sensor consisting of the read switch and magnet is built in the speedometer. As the magnet turns with the speedometer cable, its magnetic force causes the lead switch to turn ON and OFF. Such ON/OFF frequency increases or decreases in proportion with the car speed and is sent to ECM as pulse signals.

ECM uses it as one of the signals to control the ISC solenoid valve and shift-up indicator light.

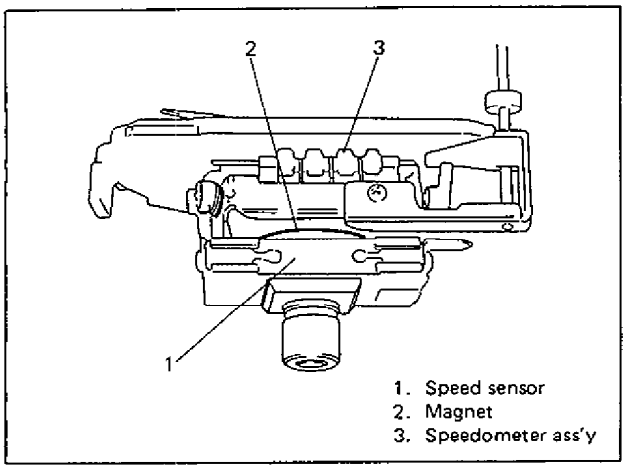


Fig. 6E-25 Vehicle Speed Sensor

Crank Angle Sensor (CAS)

The crank angle sensor located in the distributor consists of the signal generator (pick-up coil and magnet) and signal rotor.

As the signal rotor turns, AC voltage is generated in the pick-up coil which varies in pulsatory way as shown below. This pulse signal (3 pluses/ revolution) is sent to ECM where it is used to calculate the engine speed and also as one of the signals to control various devices.

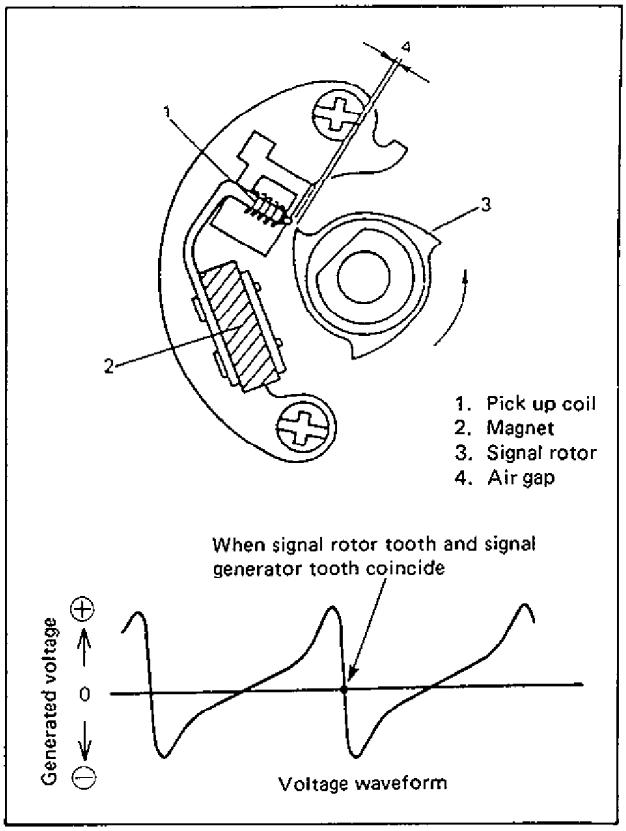


Fig. 6E-25-1 CAS

Ignition Signal

This signal is sent from the ignition coil primary circuit.

ECM uses it as one of the factors for controlling fuel injector.

Engine Start Signal

This signal is sent from the engine starter circuit. Receiving it, ECM judges whether the engine is cranking or not and uses it as one of the signals to control the fuel injector and fuel pump relay.

"R", "D", "2" or "L" Range Signal (A/T model only)

This signal is sent from A/T control module as a battery voltage signal only when A/T is in "R", "D", "2" or "L" range. Thus, ECM judges whether A/T is in one of the above ranges or otherwise (i.e. in "P" or "N" range) and uses it as one of the signals to control the fuel injector and ISC solenoid valve.

Electric Load Signal

This signal is sent from each circuit of head & small (or clearance) lights, heater fan, radiator fan, stop light and rear window difogger.
ECM uses it as one of the factors for controlling ISC solenoid valve operation.

Air-Conditioner Signal (Car with air-conditioner only)

This signal is sent from the air-conditioner circuit. ECM detects whether the air-conditioner is operating or not through the signal and uses it as one of the signals for controlling ISC solenoid valve operation.

Battery Voltage

The fuel injector is driven by its solenoid coil based upon the ECM output signal.
There is some delay called as "Ineffective injection time", which doesn't provide fuel, between ECM signal and valve action.
As the ineffective injection time depends on the battery voltage, ECM takes voltage information to compensate it in fuel injection time.

Diagnosis Switch Terminal

There are two diagnosis switch terminals; one included in the junction/fuse block and the other in the monitor coupler in the engine room. When either diagnosis switch terminal is grounded, a diagnosis signal is fed to ECM which then outputs self-diagnosis code and at the same time output ISC duty through duty output terminal.

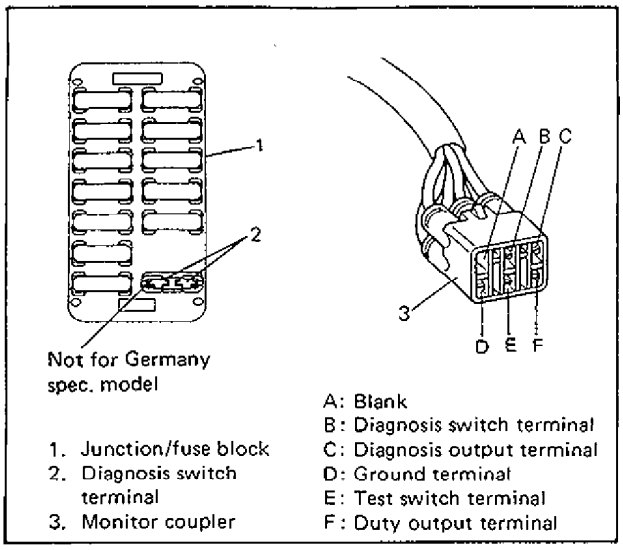


Fig. 6E-26 Diagnosis and Test Switch Terminals

NOTE:
Germany spec. model is not provided with a diagnosis switch terminal in the fuse box but instead a diagnosis switch is installed to the underside of the instrument panel as shown below.

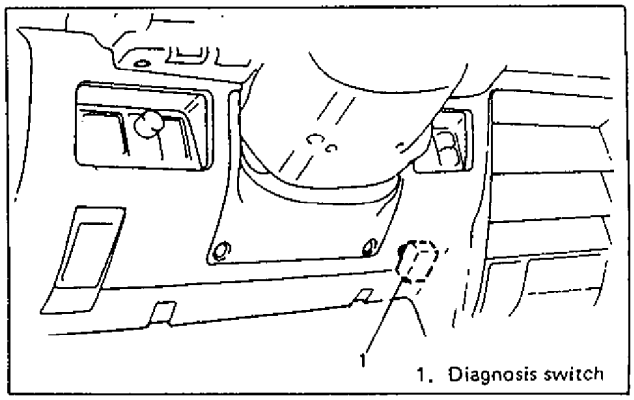


Fig. 6E-26-1 Diagnosis Switch (Germany Spec. Model Only)

Test Switch Terminal

The test switch terminal is included in the monitor coupler.
When this terminal is grounded, ECM fix the ignition timing to initial one.
When both test switch terminal and diagnosis switch terminal are grounded, ECM outputs A/F duty through the A/F duty output terminal.

FUEL INJECTION CONTROL SYSTEM

In this system, ECM controls the time (amount) and timing of the fuel injection from the fuel injector into the throttle body according to the signals from the various sensors so that suitable air/fuel mixture is supplied to the engine in each driving condition.

Injection Timing

Thre are two types of injection timing. One is "synchronous injection" in which injection is synchronous with the CAS signal and the other is "asynchronous injection" in which injection takes place independently of the CAS signal.

- **Synchronous injection**

  Normally, the injector injects fuel at every CAS signal. But when the engine cooling water temperature is low immediately after its start, the injection time for one ignition cycle is divided into some and injection takes place accordingly.

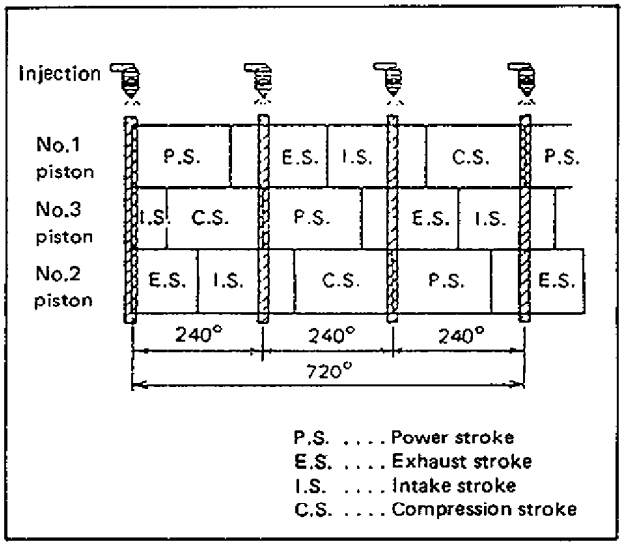


Fig. 6E-27 Synchronous Injection

- **Asynchronous injection**

  When the throttle valve is opened from its idle position, the injector injects fuel in addition to synchronous injection independently of the CAS signal.

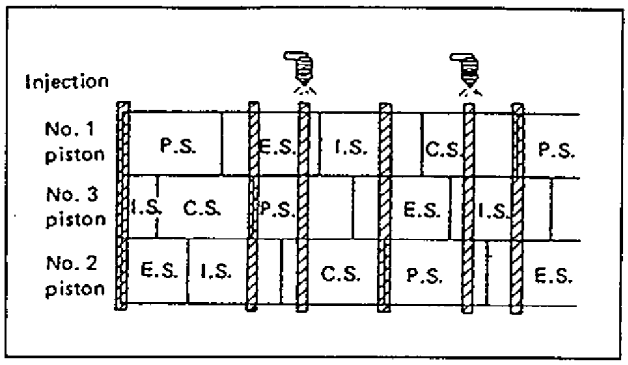


Fig. 6E-28 Asynchronous Injection

Injection Time (amount of injection)

The factors to determine the injection time are the basic injection time which is calculated on the basis of the engine speed and the intake manifold pressure (amount of the intake air) and various compensations which are determined according to the signals from various sensors that detect the state of the engine and driving conditions.

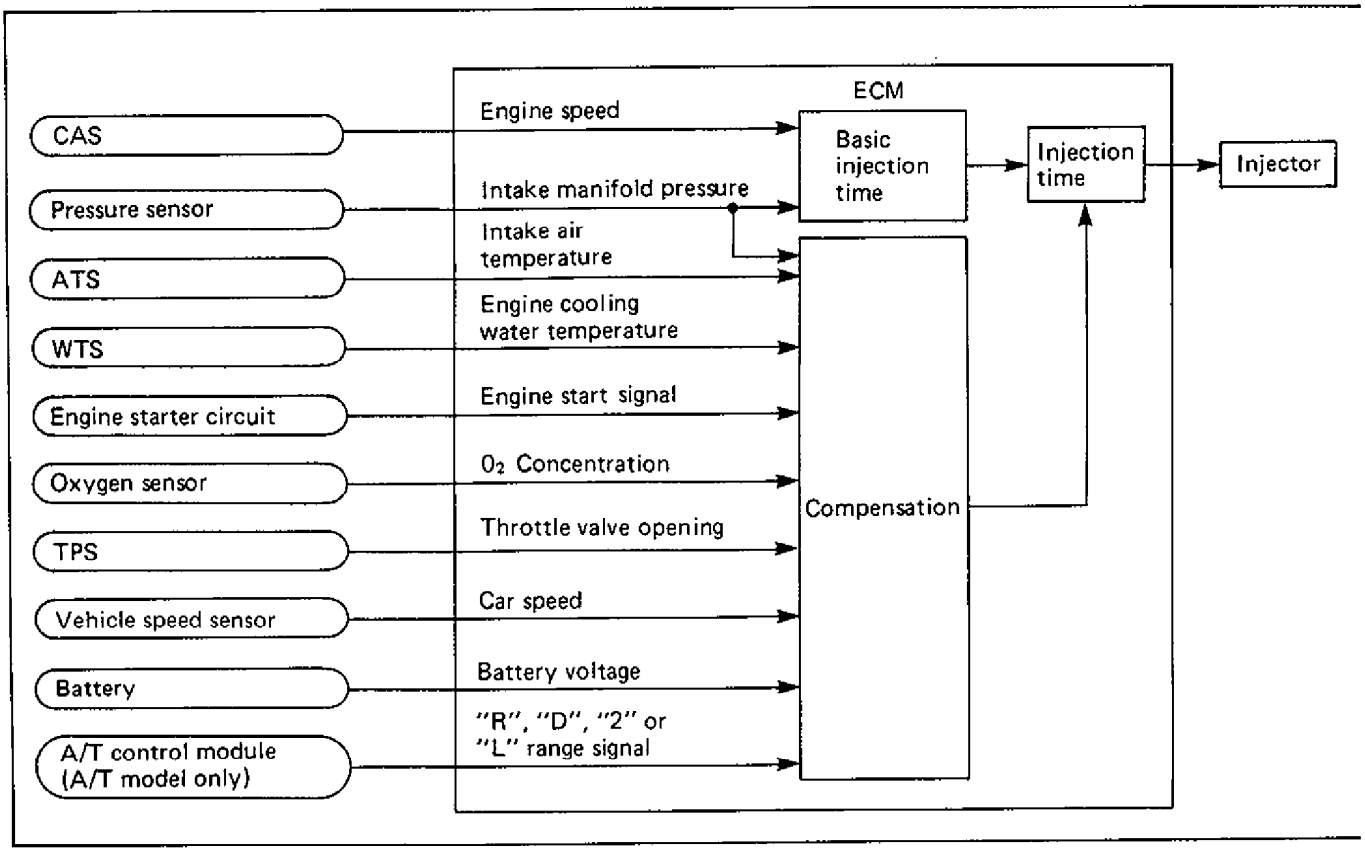


Fig. 6E-29 Parameter Diagram for Fuel Injection Control System

Intake air temperature compensation

As the intake air volume varies with the temperature, it is compensated for its temperature.

Enriching compensation while engine starting

In order to improve starting performance, enriching compensation at start is carried out.

Enriching compensation after engine start

For a certain time after the engine is started, air/fuel mixture enriching compensation is made so as to stabilize the engine speed. The amount of compensation varies depending on the engine cooling water temperature and it is the largest immediately after the engine start and after that, it reduces gradually.

Enriching compensation while warming up

When the engine is cold, enriching compensation is made to ensure good driveability till the engine cooling water temperature reaches the specified level. The amount to enrich the air/fuel mixture is decreased as the temperature rises.

Power enriching compensation

To ensure smooth acceleration and good driveability under the high load driving condition, enriching compensation is carried out when the throttle valve opening is larger than specification.

Enriching compensation when accelerating
To ensure smooth acceleration, enriching compensation is carried out when the intake manifold pressure varies by more than a specified amount druring acceleration. The amount of compensation is determined according to the engine cooling water temperature and how much the intake manifold pressure varies.

Leaning compensation when decelerating
To obtain a proper air/fuel mixture ratio during deceleration, leaning compensation is carried out when the intake manifold pressure varies by more than a specified amount during deceleration.

Battery voltage compensation
A power voltage drop delays the mechanical operation of the injector. Then the actual injection time becomes shorter for the time that electricity is supplied to the injector. To compensate this, the electricity supply time is made longer when the voltage is lower.

Base air/fuel ratio compensation
The air/fuel ratio may vary due to such factors as variation in each engine itself and aging. To compensate such variation, feed back compensation is used and base air/fuel mixture ratio is adjusted to a proper level for feed back compensation.

Fuel cut
Fuel injection stops (with operation of the injector prevented) when decelerating (i.e. when the throttle valve is at idle position and the engine speed is high), so that unburned gas will not be exhausted and it starts again when above conditions are not met.
The fuel injection also stops when the engine speed exceeds about 7,000 r/min to prevent over-run which affects the engine adversely and it starts again when the engine speed reduces to less than about 6,800 r/min.

Leaning compensation when EGR valve is operating
To ensure proper air/fuel mixture ratio even while EGR valve is open, leaning compensation is carried out when EGR VSV is ON.

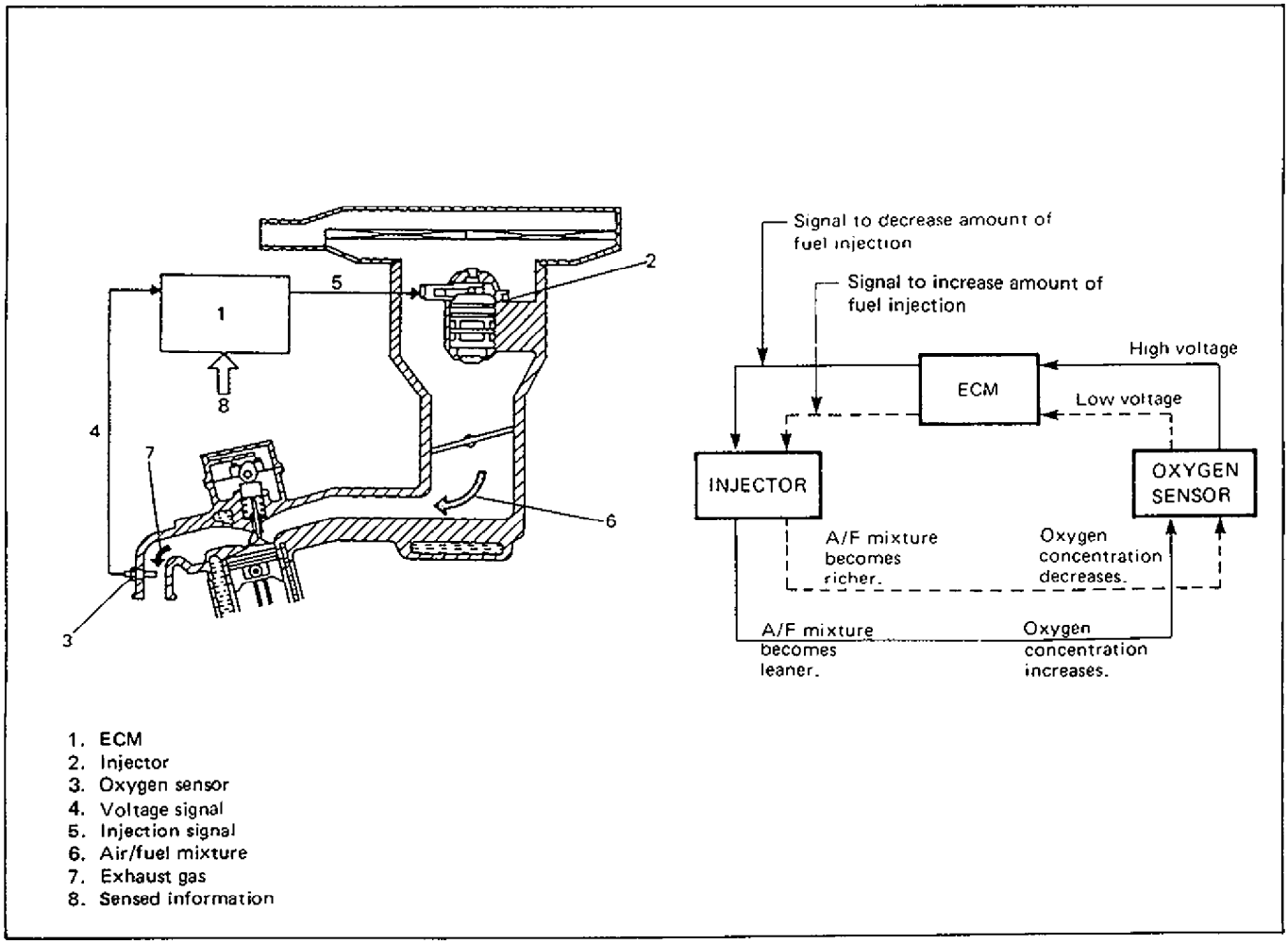
Air/fuel ratio feed back compensation

It is necessary to keep the air/fuel mixture close to the theoretical air/fuel ratio (14.7) to obtain efficient performance of the 3-way catalyst and high clarification rate of CO, HC and NOx in the exhaust gas. For that purpose, ECM operates as follows. It first compares the signal from the oxygen sensor with a specified reference voltage and if the signal is higher, it detects that the air/fuel ratio is richer than the theoretical air/fuel ratio and reduces fuel. On the other hand, if the signal is lower, it detects that the air/fuel ratio is leaner and increases fuel. By repeating these operations, it adjusts the air/fuel ratio closer to the theoretical air/fuel ratio.

1) When oxygen concentration in the exhaust gas is low, that is, when the air/fuel ratio is smaller than the theoretical air/fuel ratio (fuel is richer), electromotive force of the oxygen sensor increases and a rich signal is sent to ECM.
2) Upon receipt of the rich signal, ECM decreases the amount of fuel injection, which causes oxygen concentration in the exhaust gas to increase and electromotive force of the oxygen sensor to decrease. Then a lean signal is sent to ECM.
3) As ECM increases the amount of fuel injection according to the lean signal, oxygen concentration in the exhaust gas decreases and the situation is back to above 1).

This control process, however, will not take place under any of the following conditions.

- At engine start and when fuel injection is increased after engine start
- When engine cooling water temperature is low
- When highly loaded and fuel injection is increased
- At fuel cut
- When oxygen sensor is cold
- When engine is running at high speed (higher than about 4000 r/min).



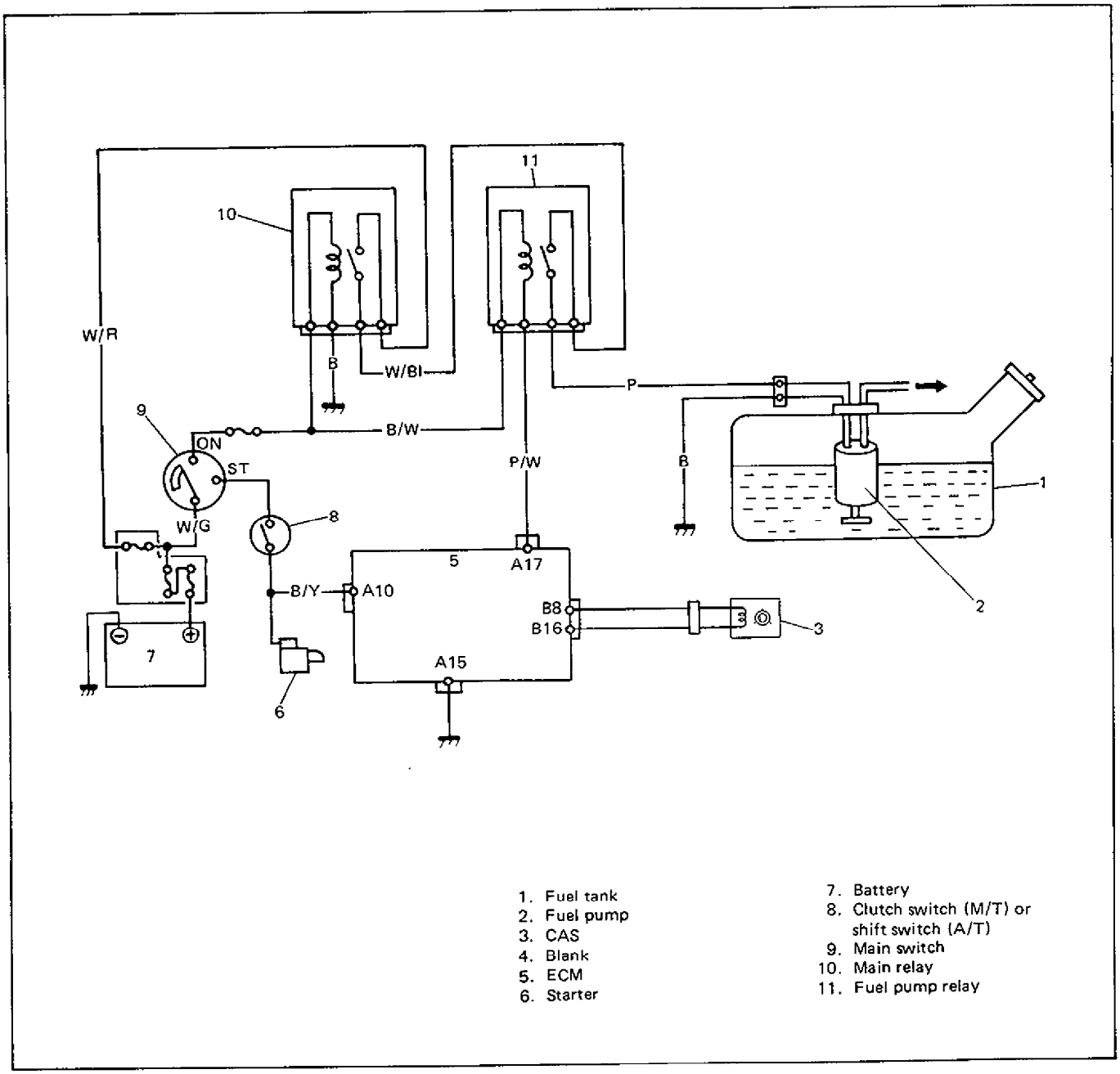
1. ECM
2. Injector
3. Oxygen sensor
4. Voltage signal
5. Injection signal
6. Air/fuel mixture
7. Exhaust gas
8. Sensed information

Fig. 6E-30 A/F Ratio Feed Back Compensation

FUEL PUMP CONTROL SYSTEM

ECM controls ON/OFF operation of the fuel pump by turning it ON via the fuel pump relay under any of the following conditions.

- For 2 seconds after ignition switch ON.
- While cranking engine (while engine start signal is inputted to ECM).
- While CAS signal is inputted to ECM



1. Fuel tank
2. Fuel pump
3. CAS
4. Blank
5. ECM
6. Starter
7. Battery
8. Clutch switch (M/T) or shift switch (A/T)
9. Main switch
10. Main relay
11. Fuel pump relay

Fig. 6E-31 Fuel Pump Circuit

ISC SOLENOID VALVE CONTROL SYSTEM

This system controls the bypass air flow by means of ECM and ISC solenoid valve for the following three purposes.

- To keep the engine idle speed as specified at all times
  The engine idle speed can vary due to following reasons.
  * Load applied to engine (when electric load is applied, automatic transmission is shifted to "R", "D" "2" or "L" range, air-conditioner is turned ON, etc.)
  * Variation in atmospheric pressure
  * Change in engine itself with passage of time
  * Other factors causing idle speed to change
- To improve starting performance of engine
- To compensate air/fuel mixture ratio when decelerating (Dash-pot effect)

Operation

ISC solenoid valve opens the bypass air passage when it is turned ON by ECM and closes it when turned OFF.

ECM detects the engine condition by using signals from various sensors and switches and while repeating ON and OFF cycle of ISC solenoid valve at a certain rate (12 times a second), it controls bypass air flow by increasing and decreasing its ON time within a cycle.

While the engine is cranking, ECM keeps ISC solenoid valve ON so as to obtain better start of the engine. After the engine has started, it reduces ON time gradually to maintain the idle speed as specified.

When the accelerator pedal is depressed (throttle valve is at other than idle position), ECM keeps ISC solenoid valve ON. When decelerating, on the other hand, it reduces its ON time gradually (thereby reducing the bypass air flow gradually) to adjust air/fuel mixture to an optimum ratio for combustion.

When the car is at a stop, the throttle valve is at the idle position and the engine is running, ECM controls the bypass air flow by increasing or decreasing ON time of ISC solenoid valve so that the engine speed is kept at a specified idle speed.

With an air-conditioner equipped car, when the air-conditioner is ON, a certain amount of the bypass air is supplied by the air-conditioner VSV independently of this system. The bypass air supplied by this system is used for fine control to keep the idle speed as specified.

Engine idle speed specifications at engine normal operating temperature are as follows.

(Unit: r/min)

		Air-conditioner OFF	Air-conditioner ON
M/T model		800 ± 50	900 ± 50
A/T model	At "P" or "N" range	850 ± 50	900 ± 50

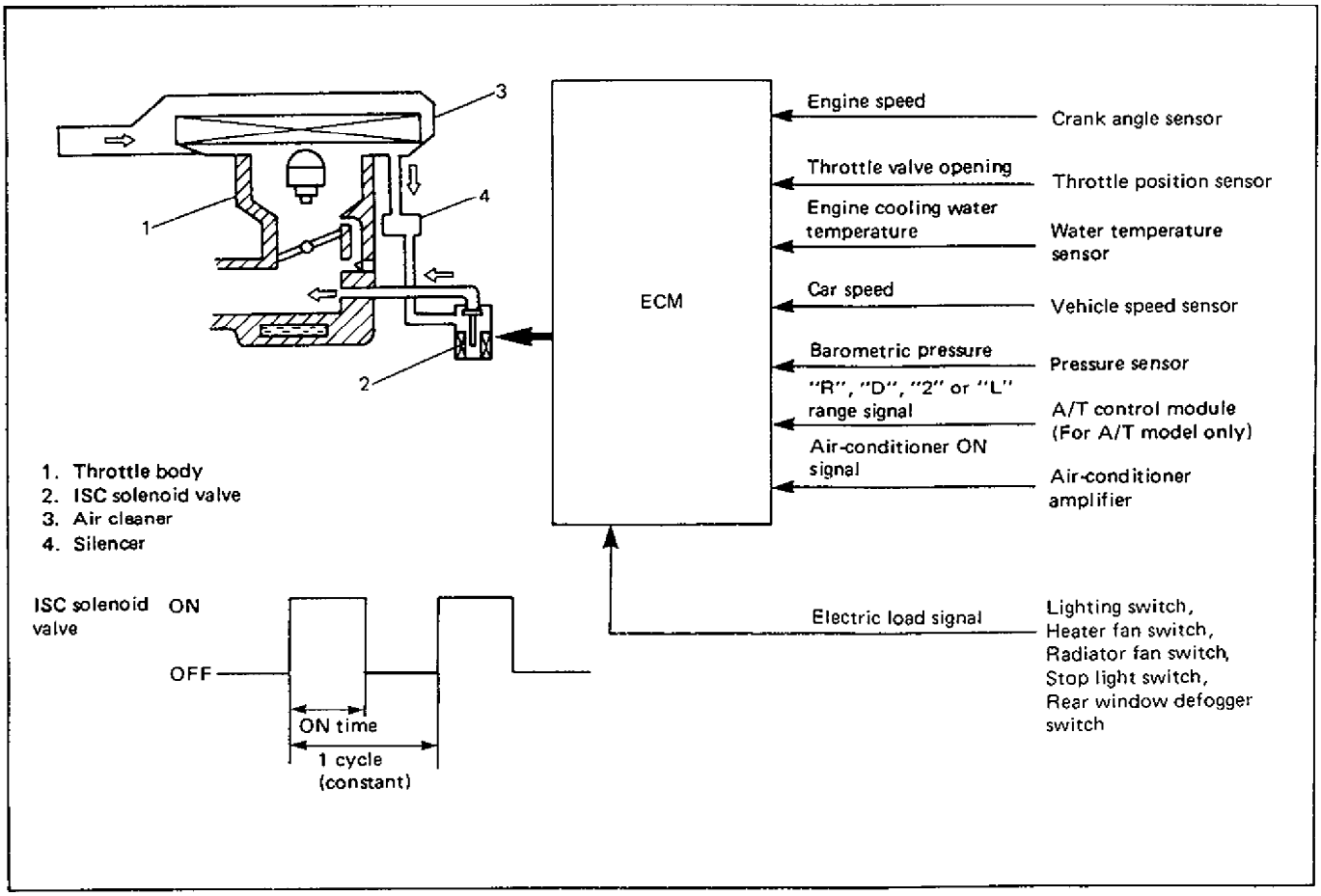


Fig. 6E-32 ISC Solenoid Valve Control System

EXHAUST GAS RECIRCULATION (EGR) CONTROL SYSTEM

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 modulator and VSV controlled by ECM according to signals from various sensors.

The diaphragm mounted in the EGR modulator 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 modulator 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 modulator is pushed down by the spring force and the modulator 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 following conditions, ECM closes the vacuum passage of VSV. In this state, as the vacuum is not transmitted to the EGR valve, it remains closed.

- When engine cooling water temperature is low.
- When throttle valve is at idle position.
- When engine is running under high load.
- When intake manifold pressure is low.

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

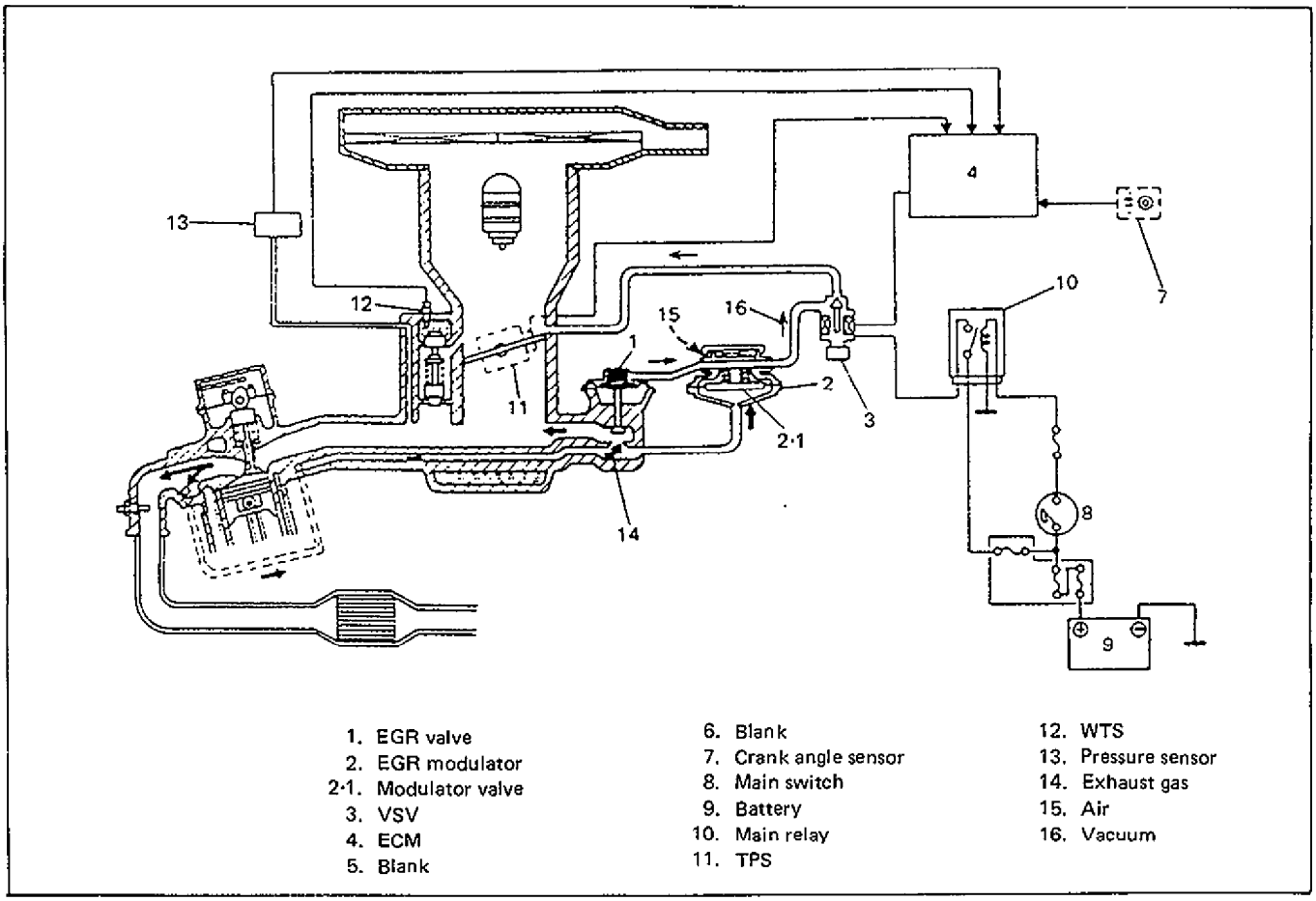


Fig. 6E-33 EGR System

SHIFT-UP INDICATOR LIGHT CONTROL SYSTEM (If equipped)

This system is intended for economical driving by using proper gear positions. When the following conditions are all met, it turns ON the shift-up indicator light included in the meter cluster, but for 5 seconds at the longest, so as to urge the driver to shift up the gear.

- Car speed is higher than 5 km/h (3.1 mile/h)
- Both idle switch and wide open switch are OFF
- Engine speed is higher than a specified speed (The specified engine speed varies with the intake manifold pressure and engine cooling water temperature.)

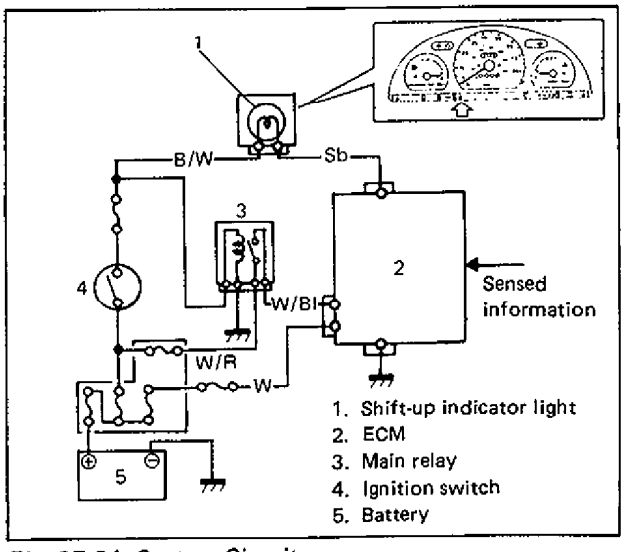


Fig. 6E-34 System Circuit

THROTTLE VALVE OPENING SIGNAL OUTPUT FOR A/T

Receiving the throttle valve opening signal from the throttle position sensor, ECM converts it into the three ON/OFF signals and sends their signals to A/T control module through A21, A9, and A22 terminals. Then A/T control module uses them as the signals to control the automatic transmission.

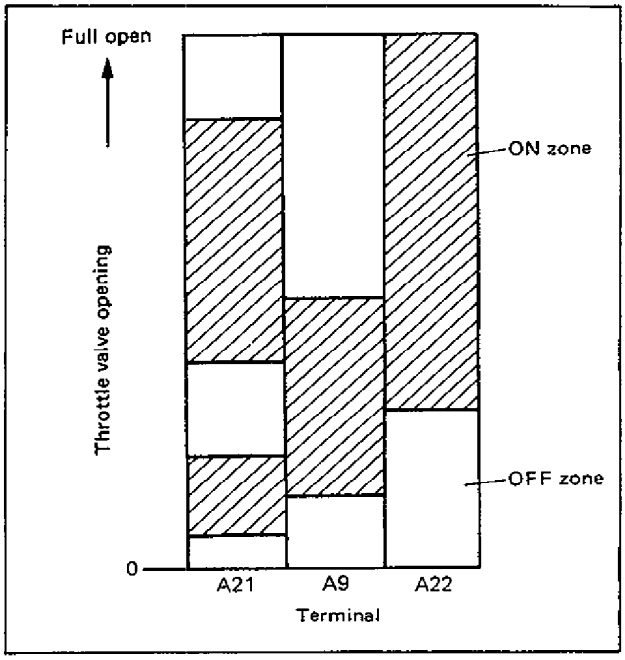


Fig. 6E-35 ON/OFF Signal Diagram

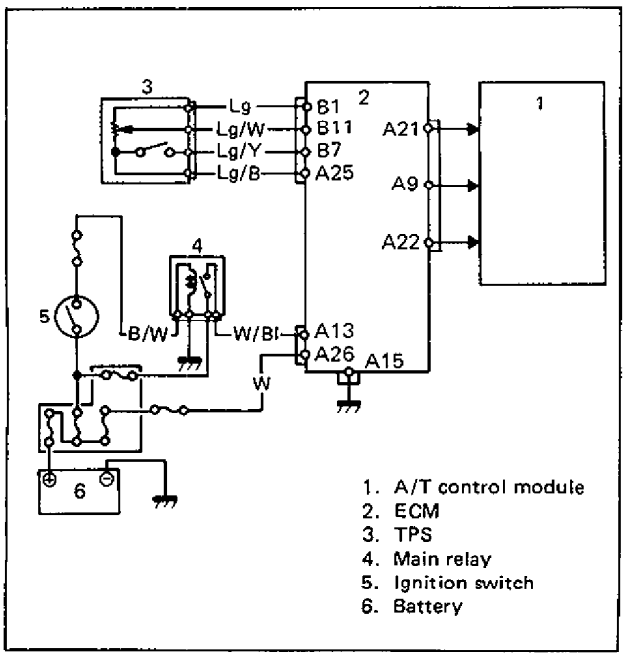


Fig. 6E-36 Signal Output Circuit

ESA (ELECTRONIC SPARK ADVANCE) CONTROL SYSTEM

This system controls electronically the time of electric current flow to ignition primary coil as well as ignition timing.

ECM judges the engine condition by using signals from various sensors, selects the most suitable electric current flow time and ignition timing for that engine condition from among those pre-stored in its memory and sends an ignition signal to the igniter (power unit).

Control of this system includes three different types as follows.

- Ignition timing control at engine start
- Ignition timing control after engine start
- Electric current flow time control

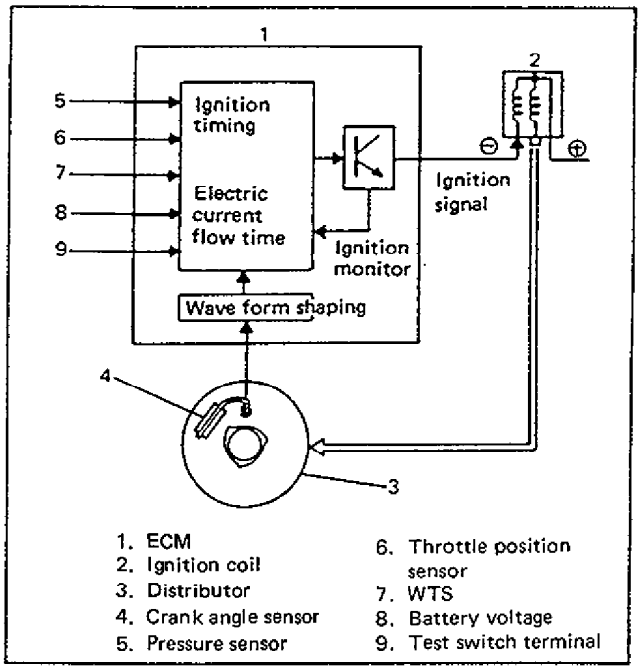


Fig. 6E-40 System Diagram

Ignition Timing Control at Engine Start
To obtain better starting performance of the engine at the engine start (when the engine speed is lower than 500 r/min.) ESA system sets the ignition timing to the initial ignition timing (5° BTDC).

Ignition Timing Control After Engine Start
The ignition timing after the engine start is determined as follows so that the spark occurs at the most suitable timing for each engine condition.

Ignition timing	=	Initial ignition timing	+	Basic ignition advance	+	Various compensating advance

When the idle swith is ON, the ignition timing is determined by adding basic ignition advance which varies according to the engine speed, water temperature compensating advance and compensating advance for idle speed stability to the initial ignition timing.

When the idle switch is OFF, the ignition timing is determined by adding basic ignition advance which varies according to the engine speed and intake manifold pressure and water temperature compensating advance to the initial ignition timing.

- **Water temperature compensating advance**
  This compensation is added according to the signal from the water temperature sensor which detects the engine cooling water temperature. The amount of compensation is larger when the engine cooling water temperature is lower and smaller when higher.
- **Compensating advance for idle speed stability**
  This compensation is carried out to stabilize the engine idle speed.

Electric Current Flow Time Control
To stabilize the secondary voltage generated in the ignition coil to a proper level, ESA system controls the time of primary current flow to the ignition coil.

NOTE:
The ignition timing is controlled by ECM as described above. Therefore, when checking or adjusting the ignition timing, the ignition timing must be fixed to the initial one by grounding the test switch terminal.

DIAGNOSIS

ECM has a system self-diagnosis function as described previously (p. 6E-17).
Investigate where the trouble is by referring to "Diagnostic Flow Chart" and "Diagnostic Code" in this section.

PRECAUTIONS IN DIAGNOSING TROUBLES IN ELECTRONIC FUEL INJECTION SYSTEM

[PRECAUTIONS IN IDENTIFYING DIAGNOSTIC CODE]

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

[INTERMITTENT TROUBLES]

- There are cases where "CHECK ENGINE" light indicates a diagnostic 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 an accident, be sure to follow instructions given below when checking by using "Diagnostic Flow Chart".
  * When trouble can be identified, that is, it is not an intermittent one:
    Check sensor (actuator), wires and each connection and if they are all in good condition, substitute a known-good ECM and recheck.
  * When trouble can not be identified but "CHECK ENGINE" light indicates a trouble code:
    Diagnose trouble by using that code No. and if sensor (actuator), wires and each connection are all in good condition, erase diagnostic code in ECM memory. Then conduct a test run and check what "CHECK ENGINE" light indicates. Only when it indicates trouble code again, substitute a known-good ECM and check again.
    If it indicates not trouble code but normal code No. 12, 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]

- Intermittent trobles
  Most intermittent problems are caused by faulty electrical connections or wiring.
  Perform careful check of suspect circuits for:
  — Poor mating of coupler halves, or terminals not fully seated in coupler body (backed out).
  — Improperly formed or damaged terminals. All coupler terminals in problem circuit should be carefully reformed to increase contact tension.
  — Poor terminal to wire connection.
- Never connect any tester (voltmeter, ohmmeter, or whatever) to ECM when its coupler is disconnected. Attempt to do it may cause damage to ECM.
- Never connect an ohmmeter to ECM with its coupler connected to it. Attempt to do it may cause damage to ECM and sensors.
- Be sure to use a voltmeter with high impedance (MΩ/V minimum) or a digital type voltmeter. Any other voltmeter should not be used because accurate measurements are not obtained.

- When disconnecting and connecting coupler, make sure to turn ignition switch OFF.
- 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.
- When connecting a probe of ohmmeter, voltmeter, etc. to coupler terminal, be sure to connect it from wire harness side of coupler.

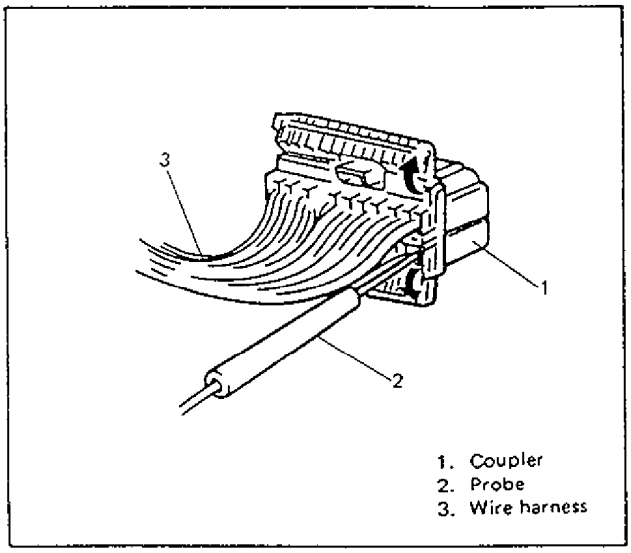


Fig. 6E-38 Connecting Meter Probe

- 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 or force its female terminal open for connection.
  In case of such coupler as shown below, connect probe as shown below to avoid opening female terminal.
  Never connect probe where male terminal is supposed to fit.

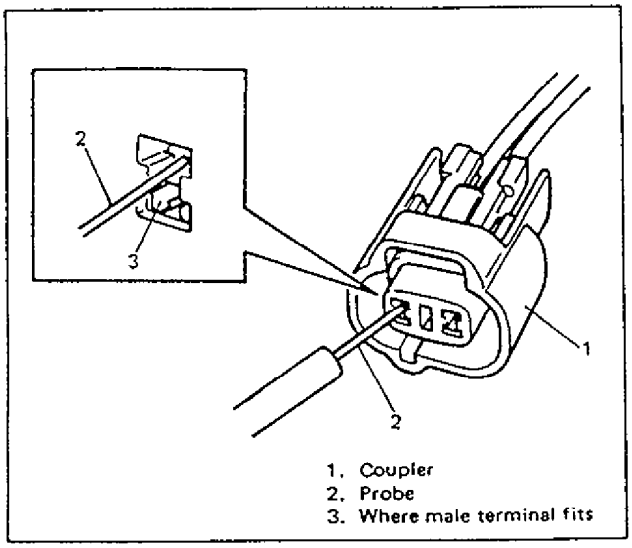


Fig. 6E-39 Connecting Meter Probe

- 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.

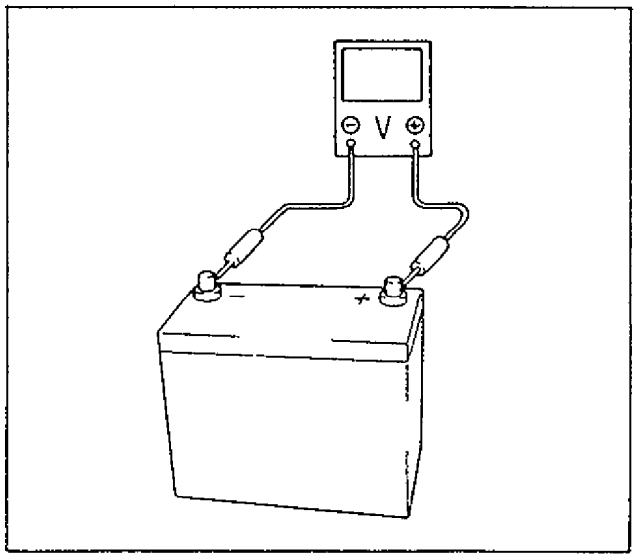


Fig. 6E-40 Checking Battery Voltage

- When checking voltage at each terminal of the coupler which is connected to ECM, be sure to connect negative probe to body ground and using service wire, connect ECM case to body ground as shown in Fig. 6E-41. Any other way is prohibited even by accident.
  Applying probes of voltmeter improperly may cause the sensor or ECM to be shorted and damaged.

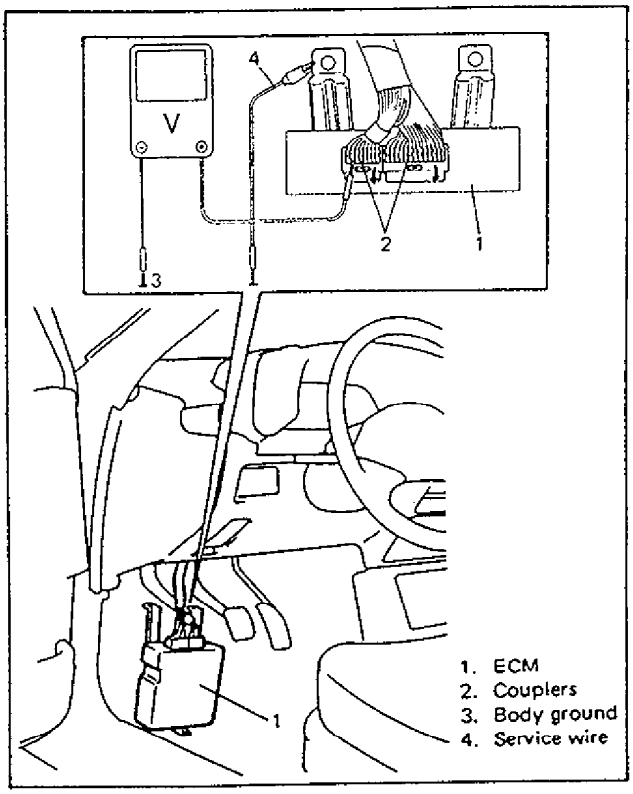


Fig. 6E-41 Checking Voltage

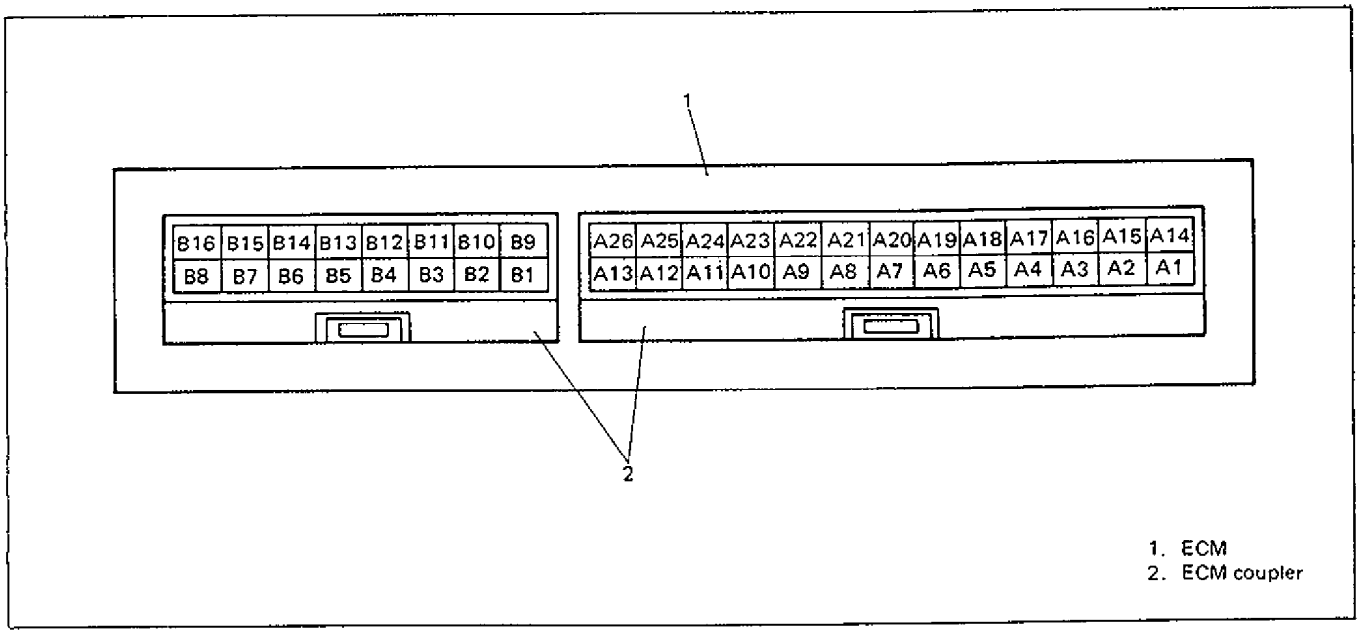


Fig. 6E-41-1 ECM Coupler Terminals

DIAGNOSTIC FLOW CHART

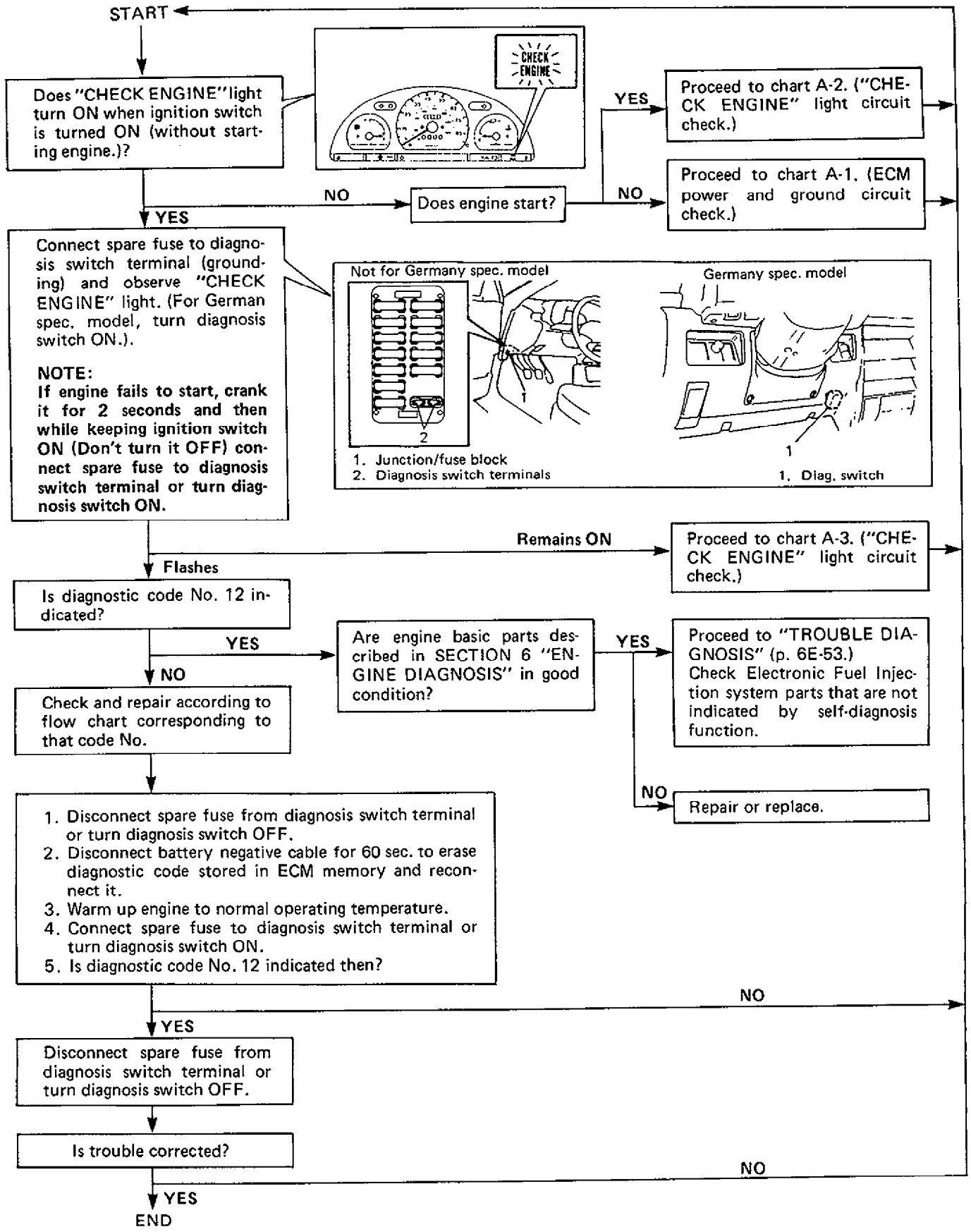
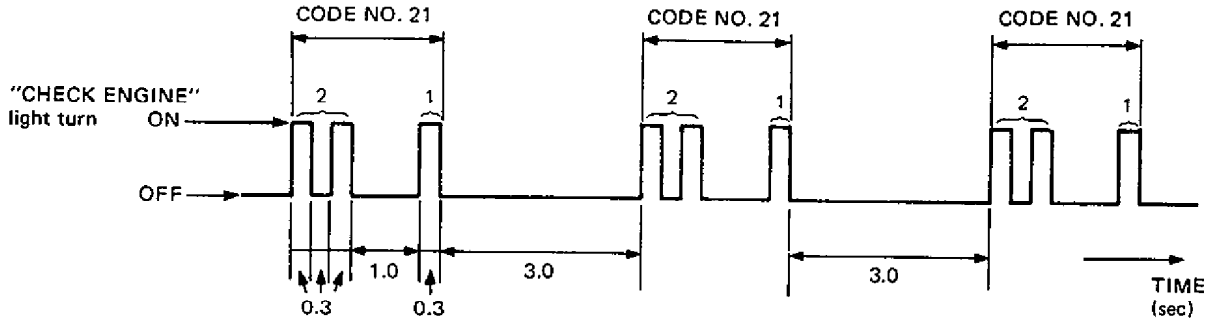


Fig. 6E-42 Diagnostic Flow Chart for Electronic Fuel Injection System

DIAGNOSTIC CODE TABLE

EXAMPLE: THROTTLE POSITION SENSOR FAILURE (CODE NO. 21)



DIAGNOSTIC CODE NO.	DIAGNOSTIC CODE MODE	DIAGNOSTIC AREA	DIAGNOSIS
12	1 2	Normal	This code appears when none of the other codes (Below codes) are identified.
13	1 3	Oxygen sensor	Diagnose trouble according to "DIAGNOSTIC FLOW CHART" corresponding to each code No.
14	1 4	Water temperature sensor	
15	1 5		
21	2 1	Throttle position sensor	
22	2 2		
23	2 3	Air temperature sensor	
25	2 5		
24	2 4	Vehicle speed sensor	
31	3 1	Pressure sensor	
32	3 2		
41	4 1	Ignition signal	
42	4 2	Crank angle sensor	
51	5 1	EGR system (California spec. model only)	
ON		ECM	ECM failure

Fig. 6E-43 Diagnostic Code Table

A-1 ECM POWER AND GROUND CIRCUIT CHECK

("CHECK ENGINE" LIGHT DOESN'T LIGHT AT IGNITION SWITCH ON AND ENGINE DOESN'T START THOUGH IT IS CRANKED UP.)

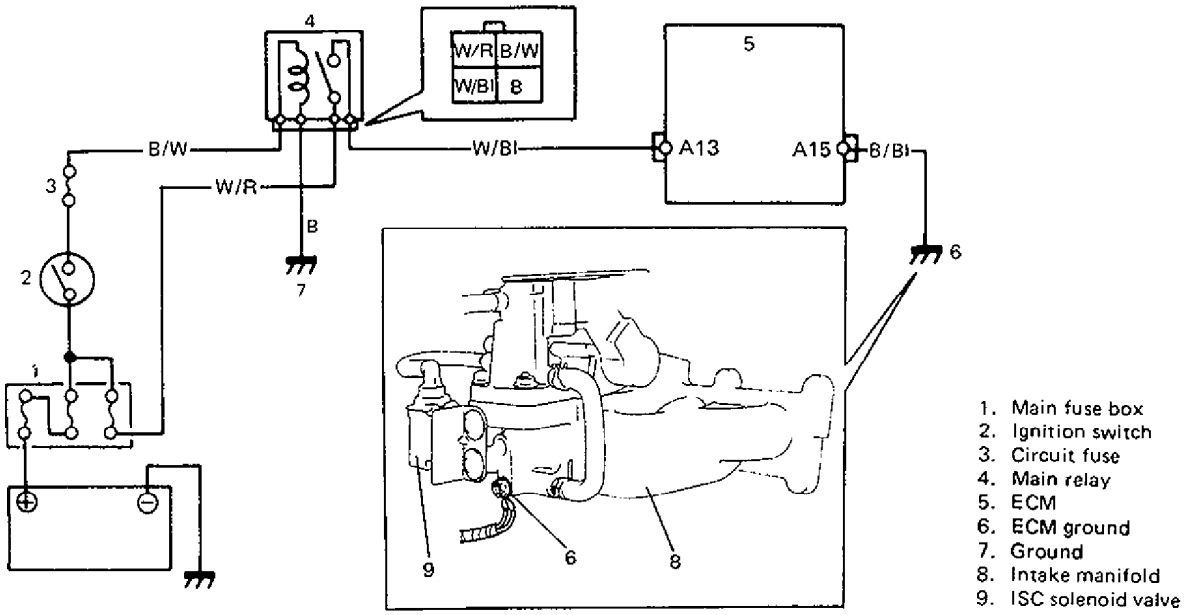
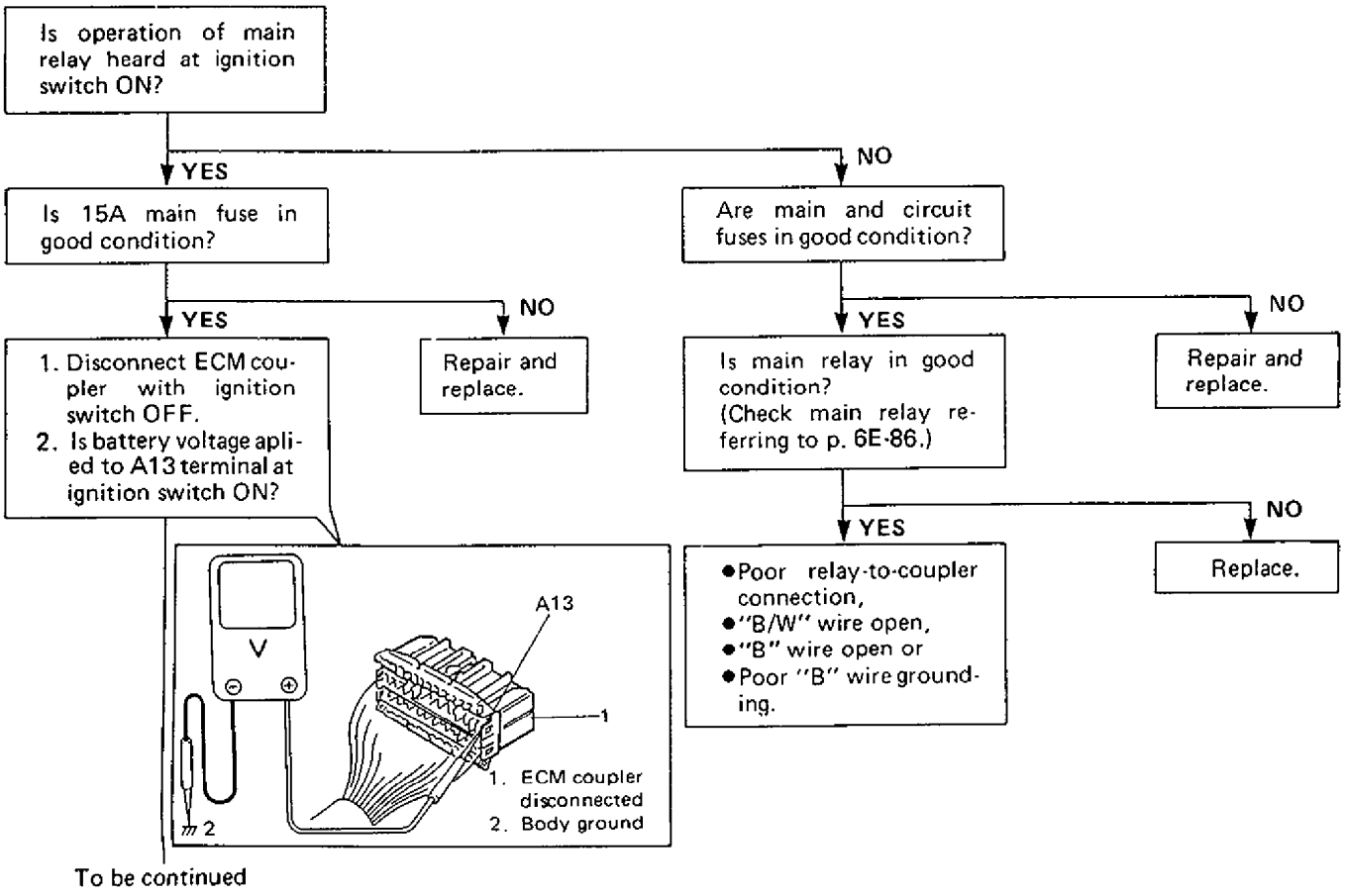


Fig. 6E-44 ECM Power and Ground Circuit



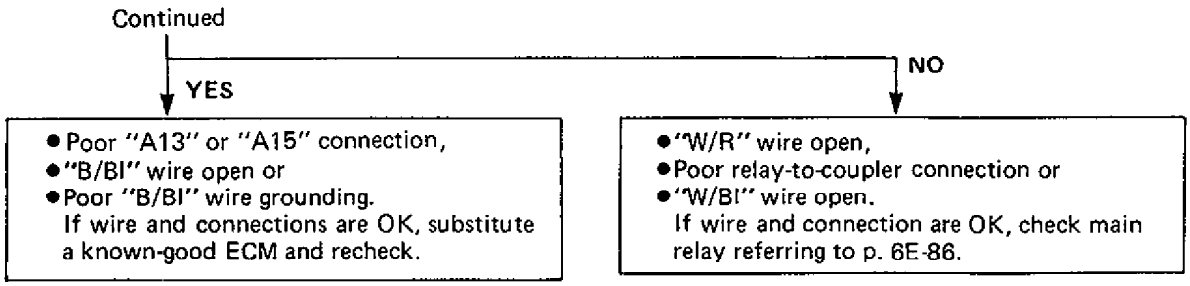
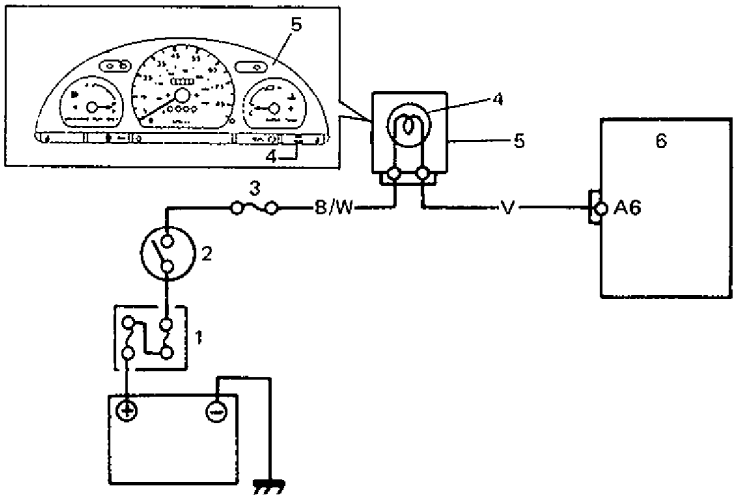


Fig. 6E-45 Diagnostic Flow Chart A-1 for ECM Power and Ground Circuit

A-2 "CHECK ENGINE" LIGHT CIRCUIT CHECK

("CHECK ENGINE" LIGHT DOES NOT LIGHT BUT ENGINE STARTS.)



1. Main fuse
2. Ignition switch
3. Circuit fuse
4. "CHECK ENGINE" light
5. Combination meter
6. ECM

Fig. 6E-46 "CHECK ENGINE" Light Circuit

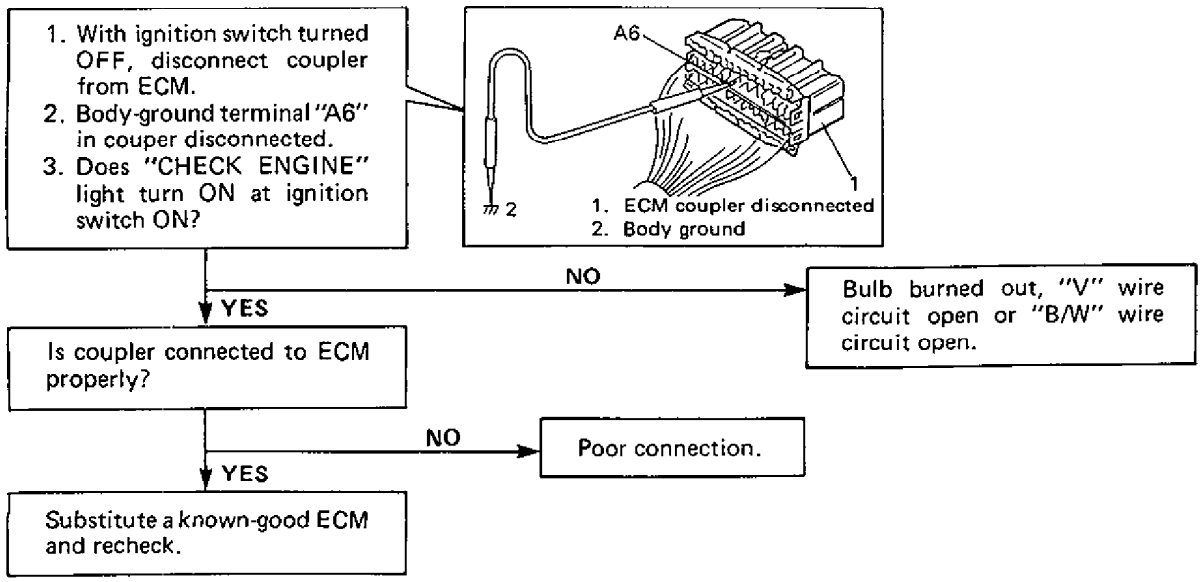
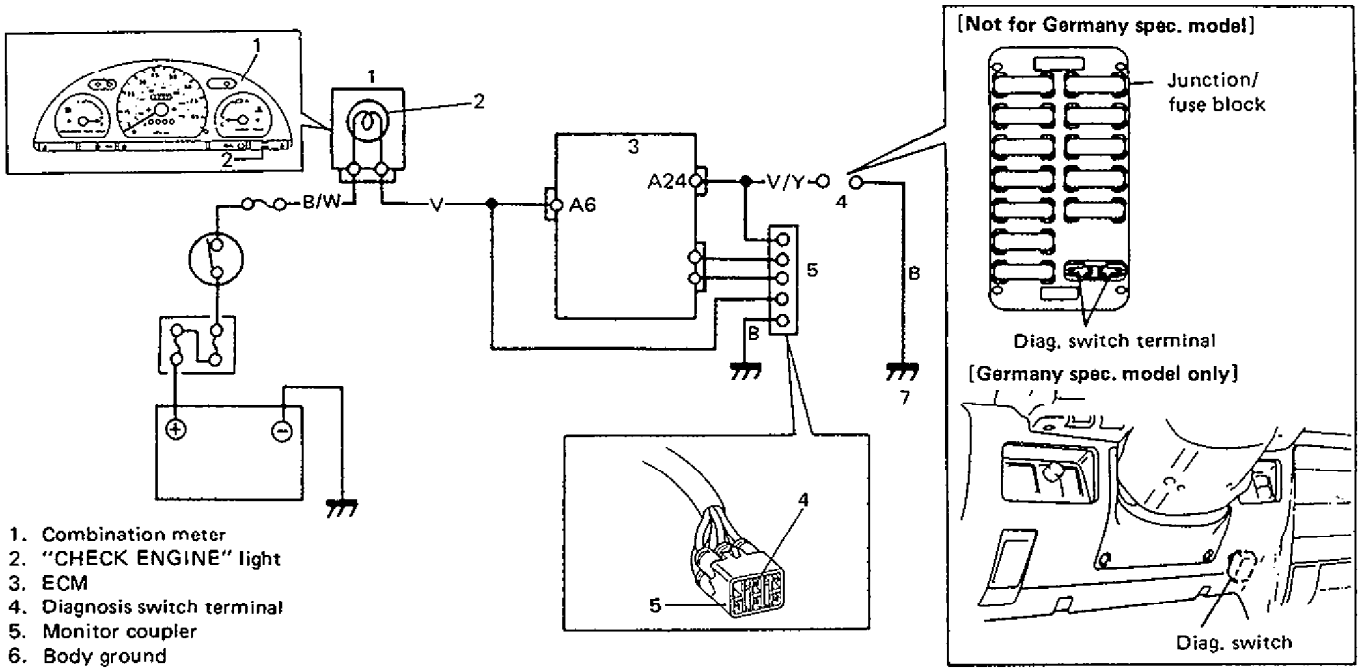


Fig. 6E-47 Diagnostic Flow Chart A-2 for "CHECK ENGINE" Light Circuit

A-3 "CHECK ENGINE" LIGHT CIRCUIT CHECK

("CHECK ENGINE" LIGHT DOESN'T FLASH OR JUST REMAINS ON EVEN WITH SPARE FUSE CONNECTED TO DIAGNOSIS SWITCH TERMINAL.)



1. Combination meter
2. "CHECK ENGINE" light
3. ECM
4. Diagnosis switch terminal
5. Monitor coupler
6. Body ground

Fig. 6E-48 "CHECK ENGINE" Light Circuit

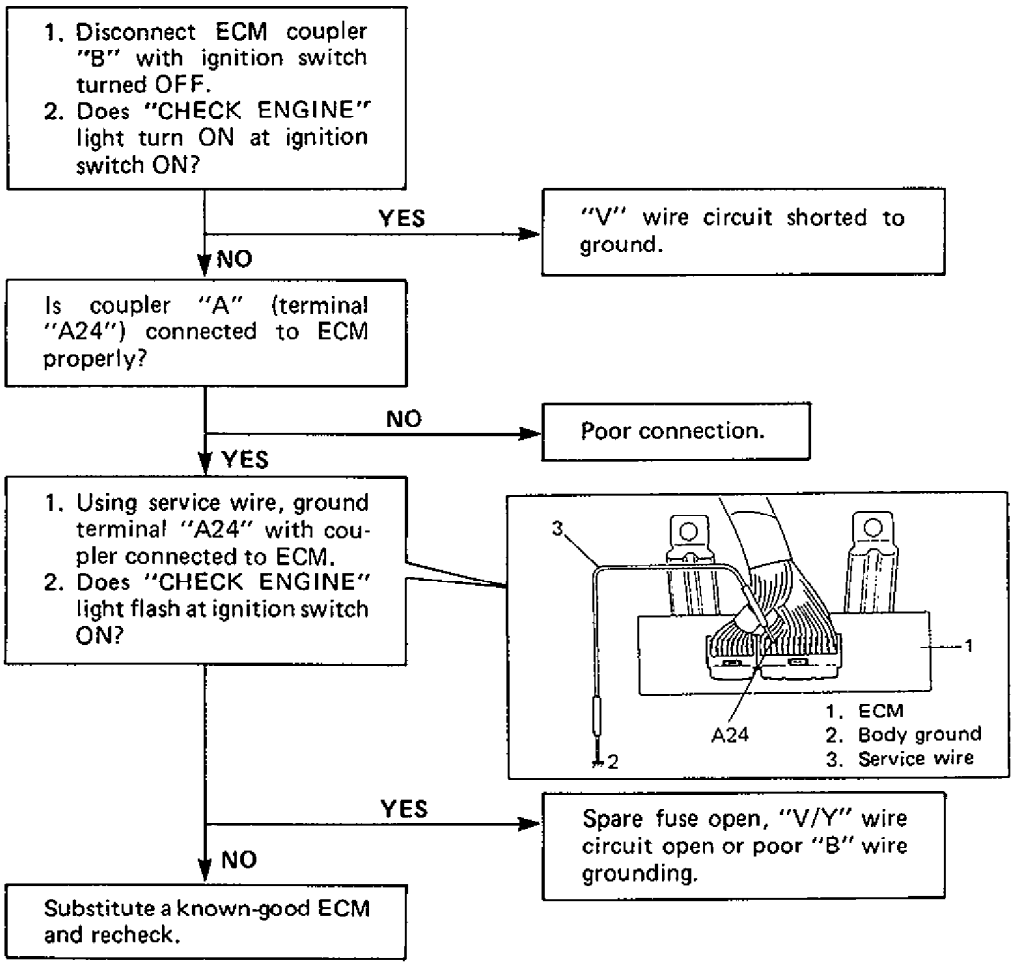


Fig. 6E-49 Diagnositc Flow Chart A-3 for "CHECK ENGINE" Light Circuit

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

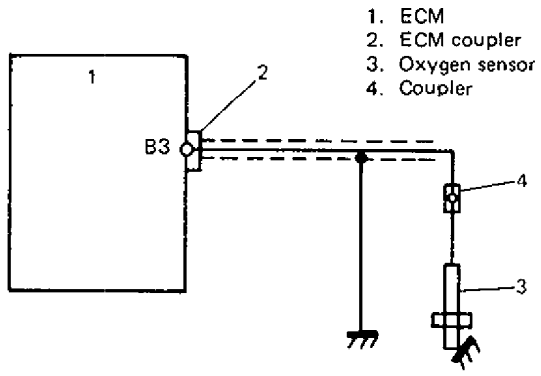
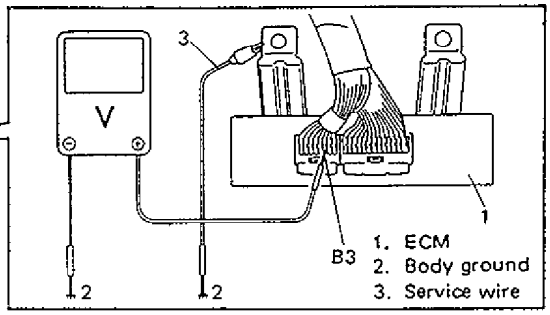


Fig. 6E-50 Oxygen Sensor Circuit

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 "B3" 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 or
- Poor connection.

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

Remains unchanged at below 0.45V.

Maintain engine speed at 2000 r/min. After 60 sec., disconnect vacuum hose from pressure sensor and check voltmeter. Is voltage 0.45V or more?

NO

Faulty oxygen sensor.

YES

Poor B3 connection or lean A/F mixture.

- Check pressure sensor, WTS, ATS, fuel pressure and injector.

If all above are OK, check ECM and its circuit referring to p. 6E-65.

Remains unchanged at above 0.45V.

Poor B3 connection or rich A/F mixture.

- Check TPS, clogged pressure sensor hose, pressure sensor, ATS, WTS, fuel pressure and injector.

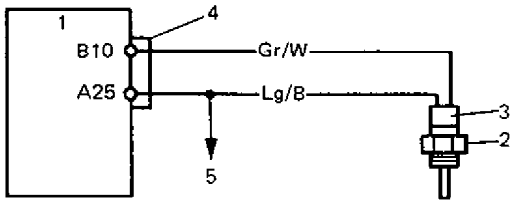
If all above are OK, check ECM and its circuit referring to P. 6E-65.

Deflects between above and below 0.45V repeatedly.

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" on p. 6E-32.

Fig. 6E-51 Diagnostic Flow Chart for Code No. 13

CODE NO. 14 WTS (WATER TEMPERATURE SENSOR) CIRCUIT (LOW TEMPERATURE INDICATED, SIGNAL VOLTAGE HIGH)

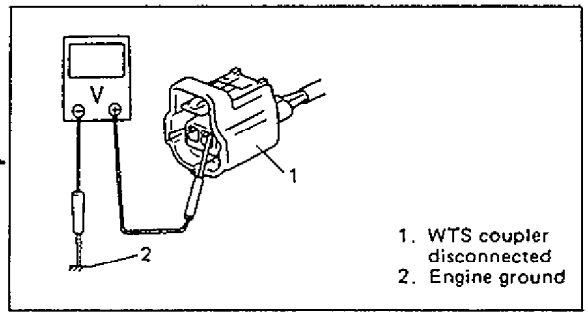


1. ECM
2. WTS
3. WTS coupler
4. ECM coupler
5. To other sensors

Fig. 6E-52 WTS Circuit

NOTE:
When Code Nos. 14, 23 and 32 are indicated together, it is possible that "Lg/B" wire is open or A25 terminal connection is poor.

1. Disconnect WTS coupler with ignition switch OFF.
2. With ignition switch ON, check voltage at "Gr/W" wire terminal of WTS coupler.
   Is it about 4 — 5V?



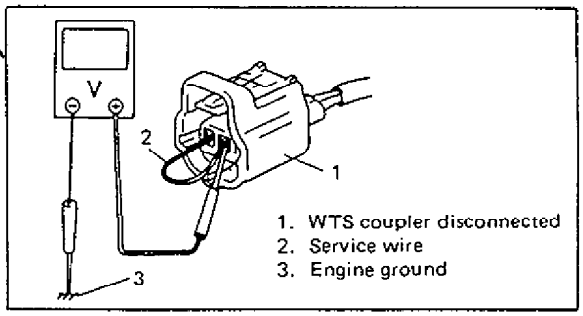
1. WTS coupler disconnected
2. Engine ground

YES

NO

"Gr/W" wire open, poor B10 connection or "Gr/W" wire shorted to power circuit.
If wire and connection are OK, substitute a known-good ECM and recheck.

1. Using service wire, connect WTS coupler terminals.
2. Check voltage at "Gr/W" wire terminal of WTS coupler with ignition switch ON.
   Is it below 0.15V?



1. WTS coupler disconnected
2. Service wire
3. Engine ground

NO

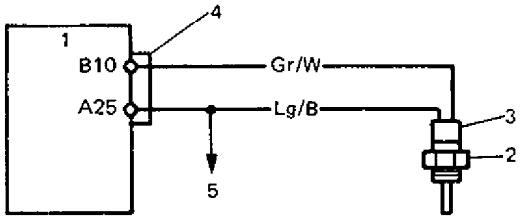
"Lg/B" wire open or poor A25 connection.
If wire and connection are OK, substitute a known-good ECM and recheck.

YES

Poor WTS-to-WTS coupler connection or faulty WTS.
If connection and WTS are OK, intermittent trouble or faulty ECM. Recheck referring to "Intermittent trouble" on Fig. 6E-32.

Fig. 6E-53 Diagnostic Flow Chart for Chart for Code No. 14

CODE NO. 15 WTS (WATER TEMPERATURE SENSOR) CIRCUIT (HIGH TEMPERATURE INDICATED, SIGNAL VOLTAGE LOW)



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

Fig. 6E-54 WTS Circuit

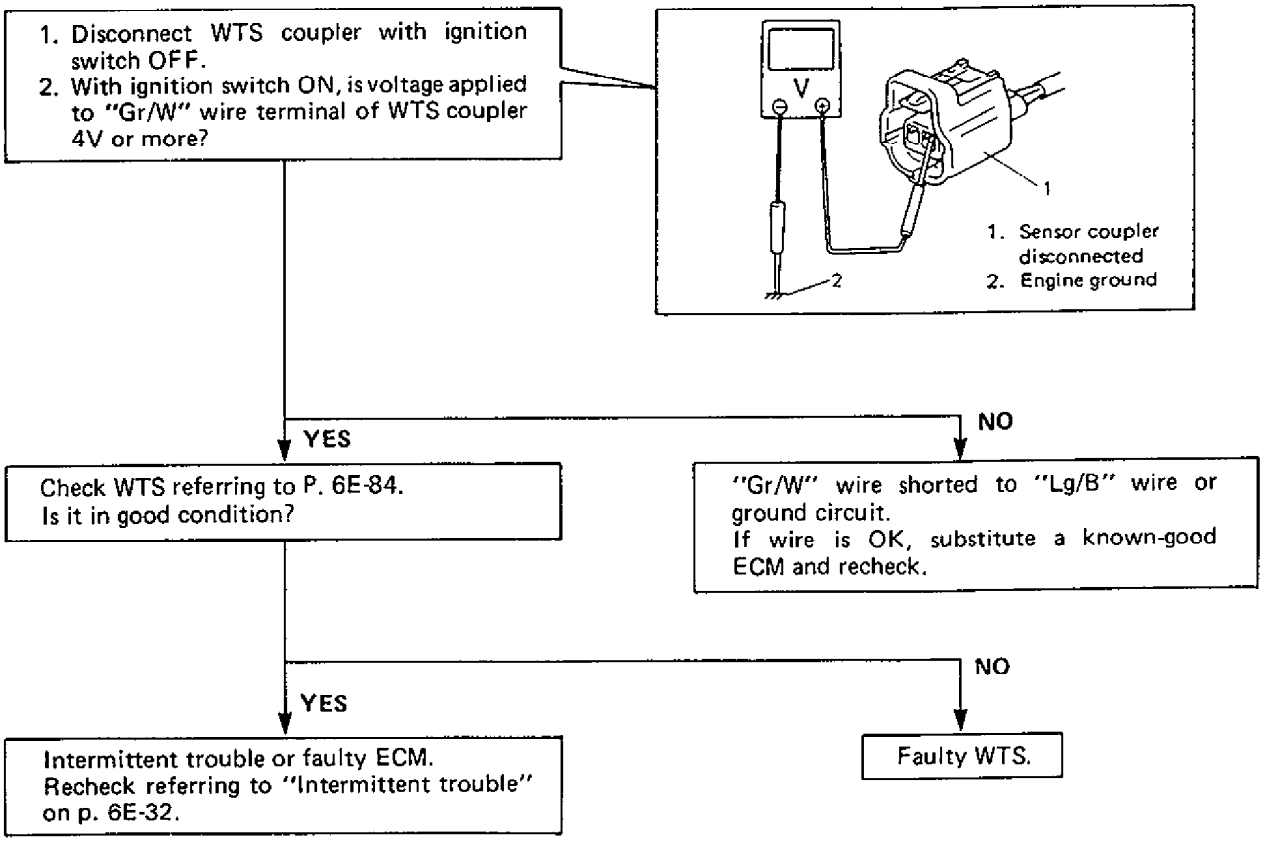
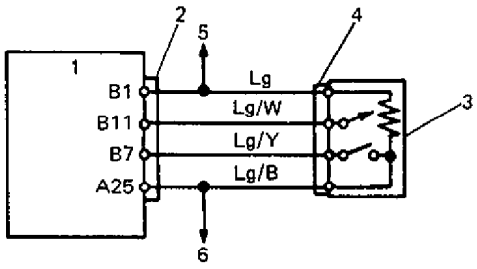


Fig. 6E-55 Diagnostic Flow Chart for Code No. 15

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



1. ECM
2. ECM coupler
3. TPS
4. TPS coupler
5. To PS
6. To other sensors

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

Fig. 6E-58 TPS Circuit

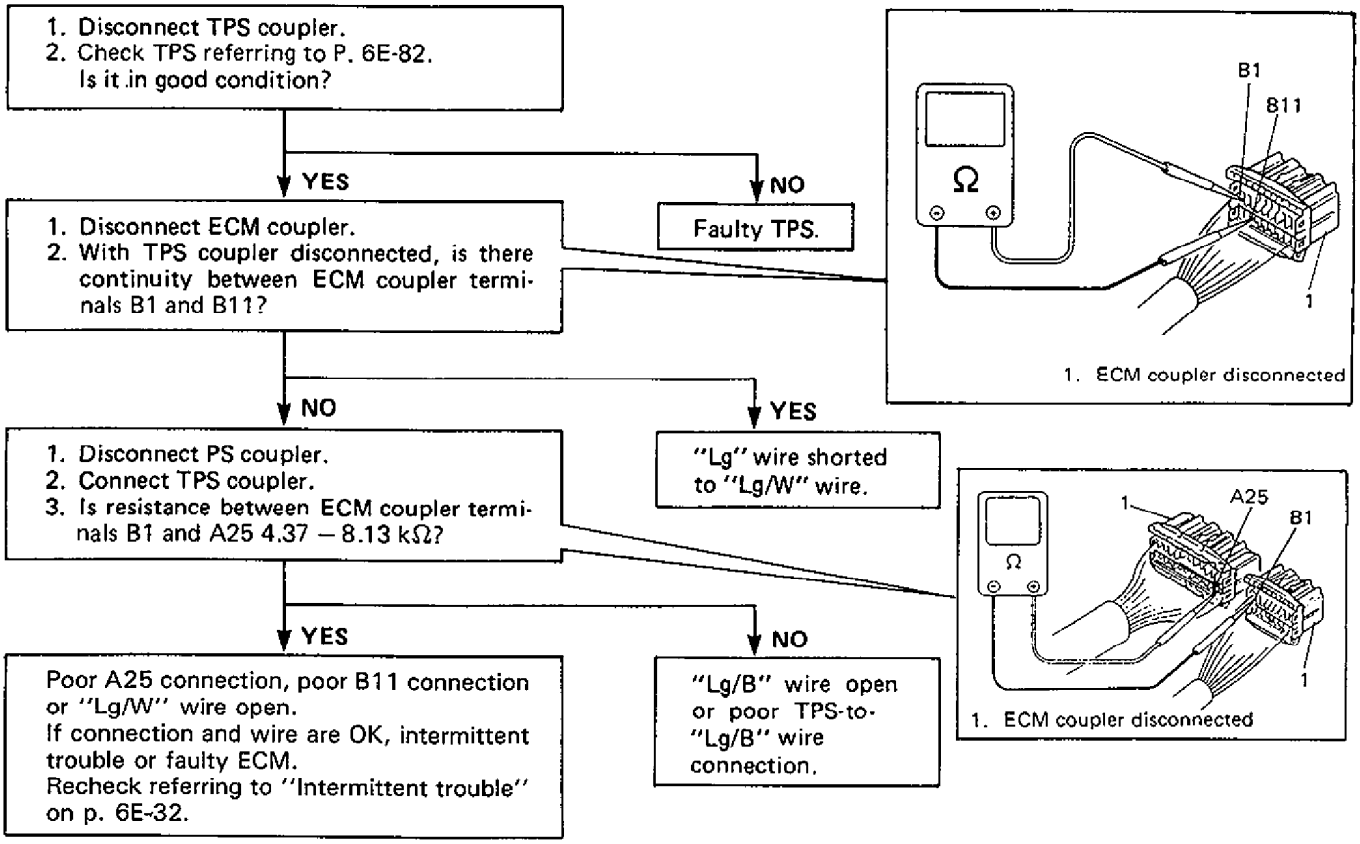
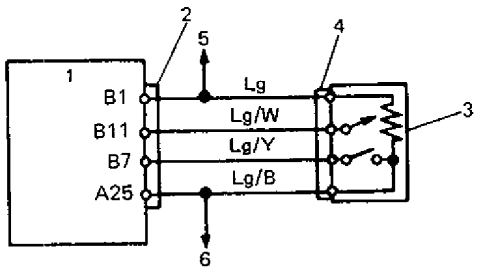


Fig. 6E-59 Diagnostic Flow Chart for Code No. 21

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



1. ECM
2. ECM coupler
3. TPS
4. TPS coupler
5. To PS
6. To other sensors

Fig. 6E-60 TPS Circuit

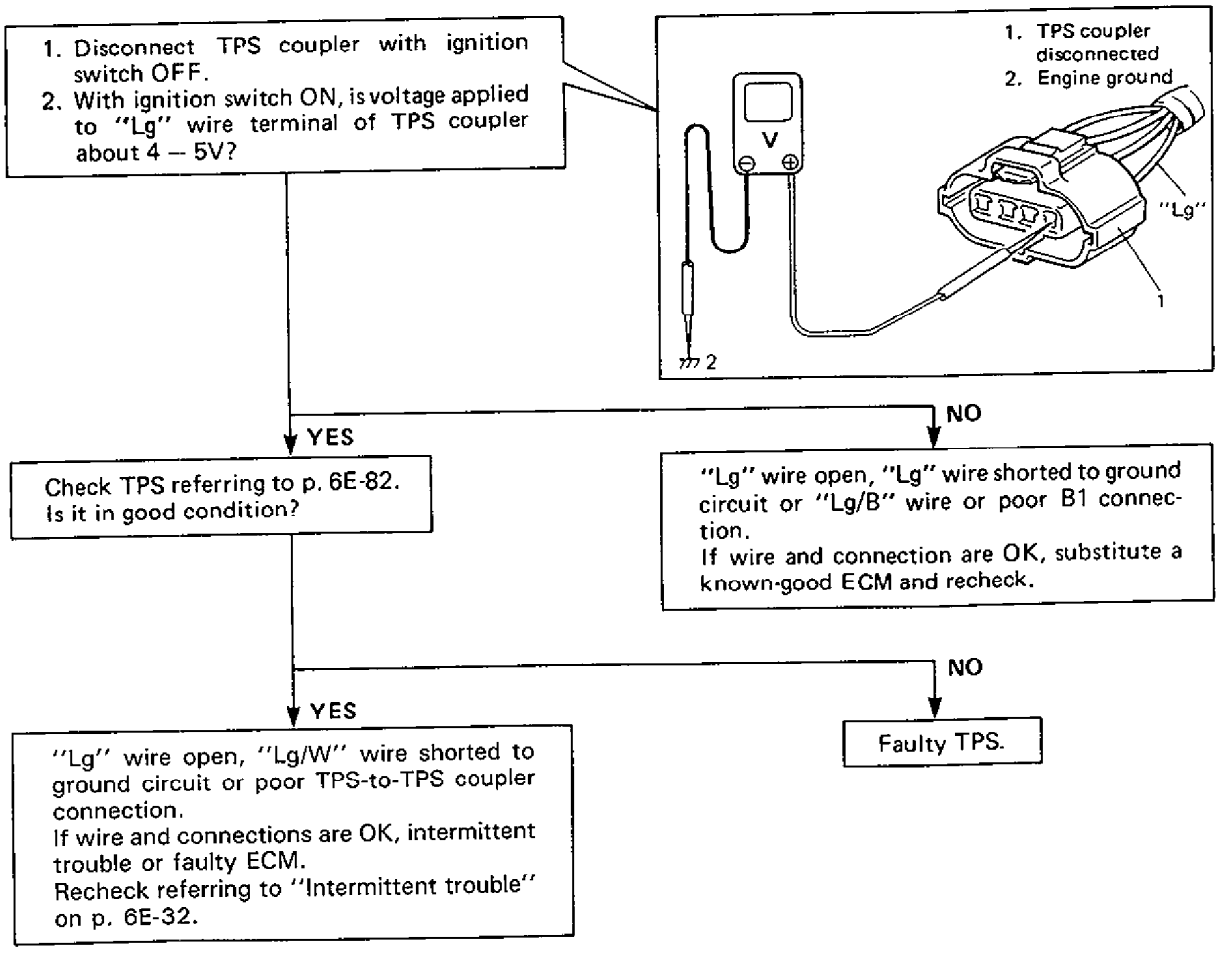


Fig. 6E-61 Diagnostic Flow Chart for Code No. 22

CODE NO. 23 ATS (AIR TEMPERATURE SENSOR) CIRCUIT (LOW TEMPERATURE INDICATED, SIGNAL VOLTAGE HIGH)

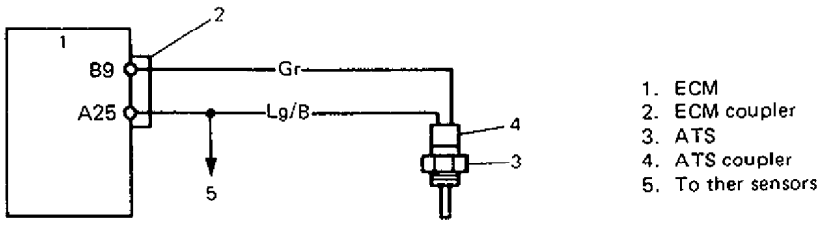


Fig. 6E-62 ATS Circuit

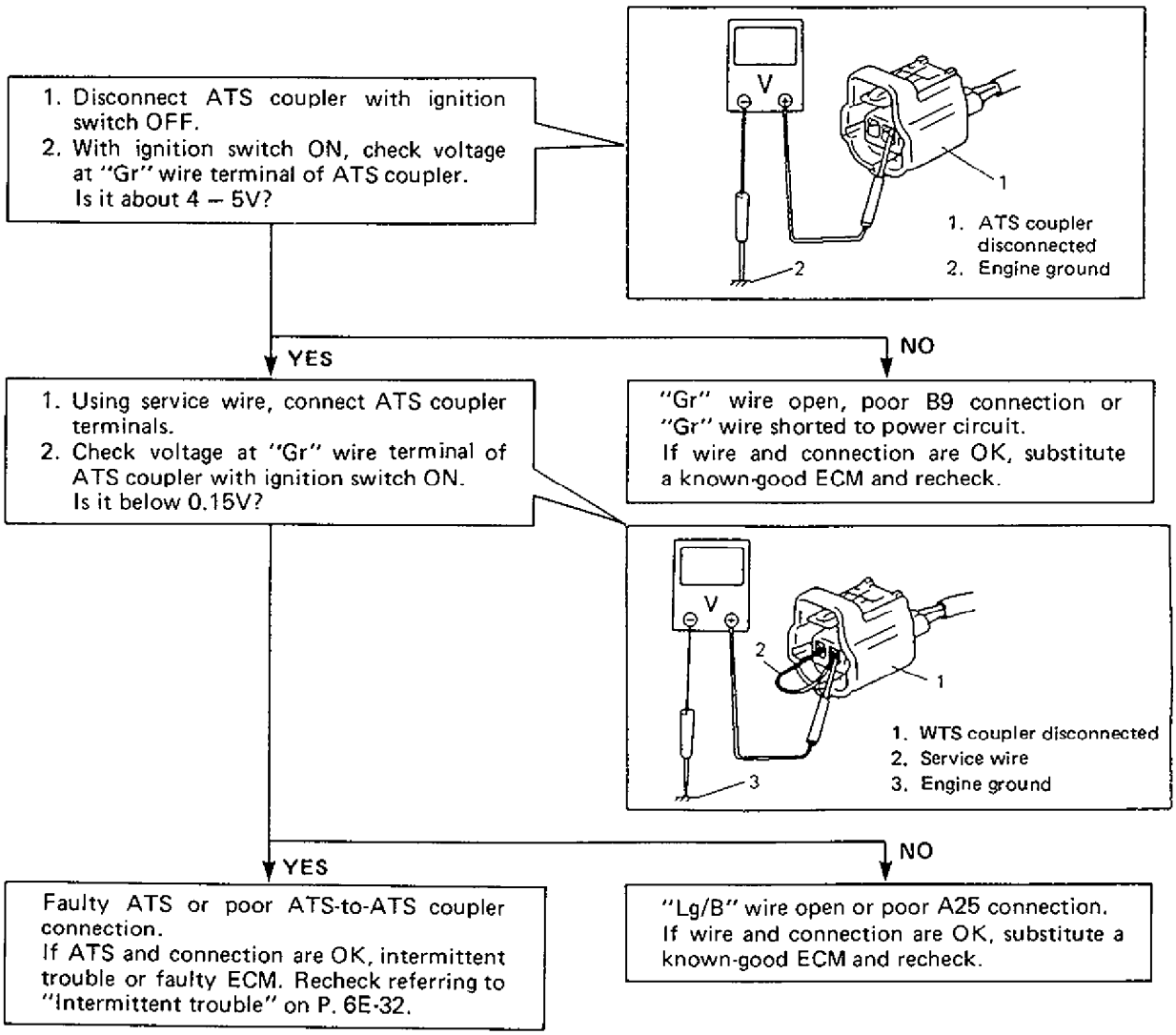
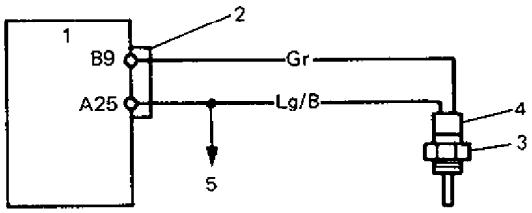


Fig. 6E-63 Diagnostic Flow Chart for Code No. 23

CODE NO. 25 ATS (AIR TEMPERATURE SENSOR) CIRCUIT (HIGH TEMPERATURE INDICATED, SIGNAL VOLTAGE LOW)



1. ECM
2. ECM coupler
3. ATS
4. ATS coupler
5. To other sensors

Fig. 6E-64 ATS Circuit

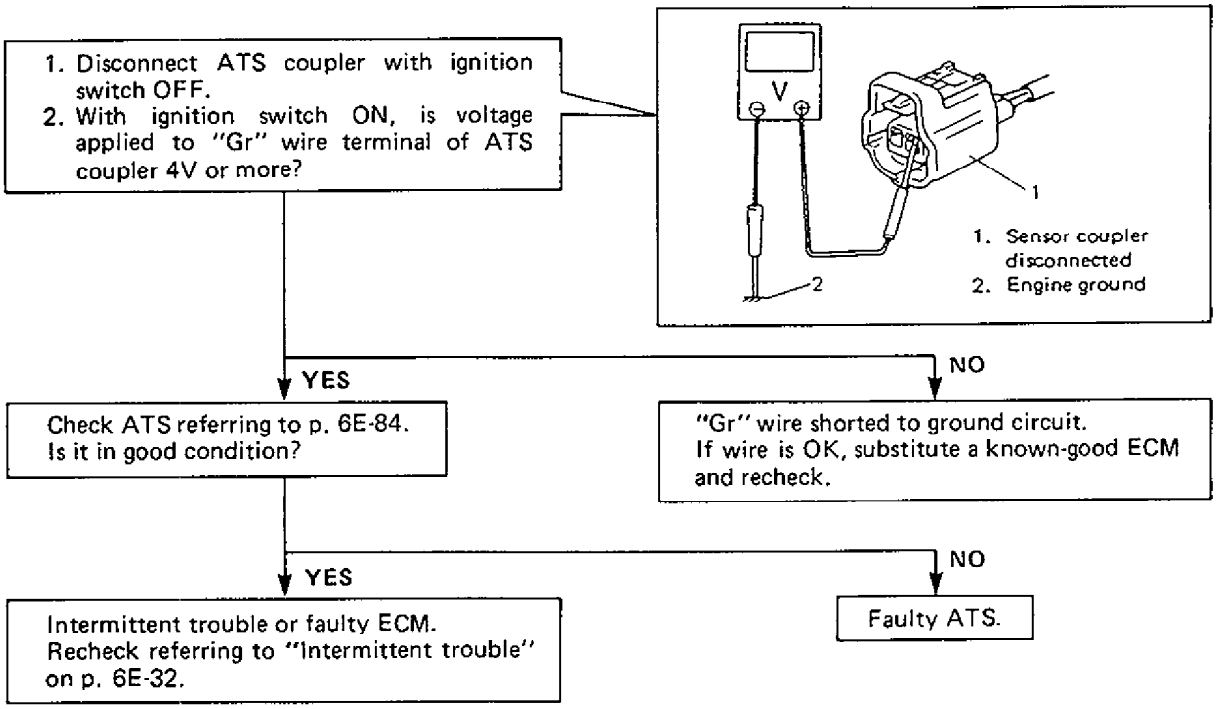
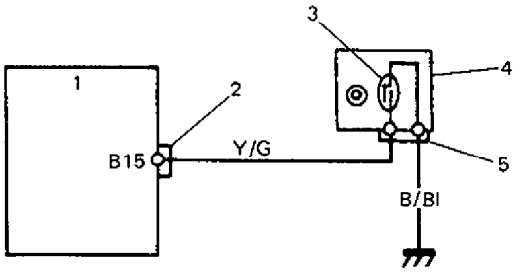


Fig. 6E-65 Diagnostic Flow Chart for Code No. 25

CODE NO. 24 VEHICLE SPEED SENSOR CIRCUIT (SPEED SENSOR SIGNAL NOT INPUTTED ALTHOUGH FUEL IS KEPT CUT AT LOWER THAN 4000 r/min FOR LONGER THAN 4 SECONDS)



1. ECM
2. ECM coupler
3. Speed sensor
4. Speedometer
5. Coupler

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

Fig. 6E-66 Speed Sensor Circuit

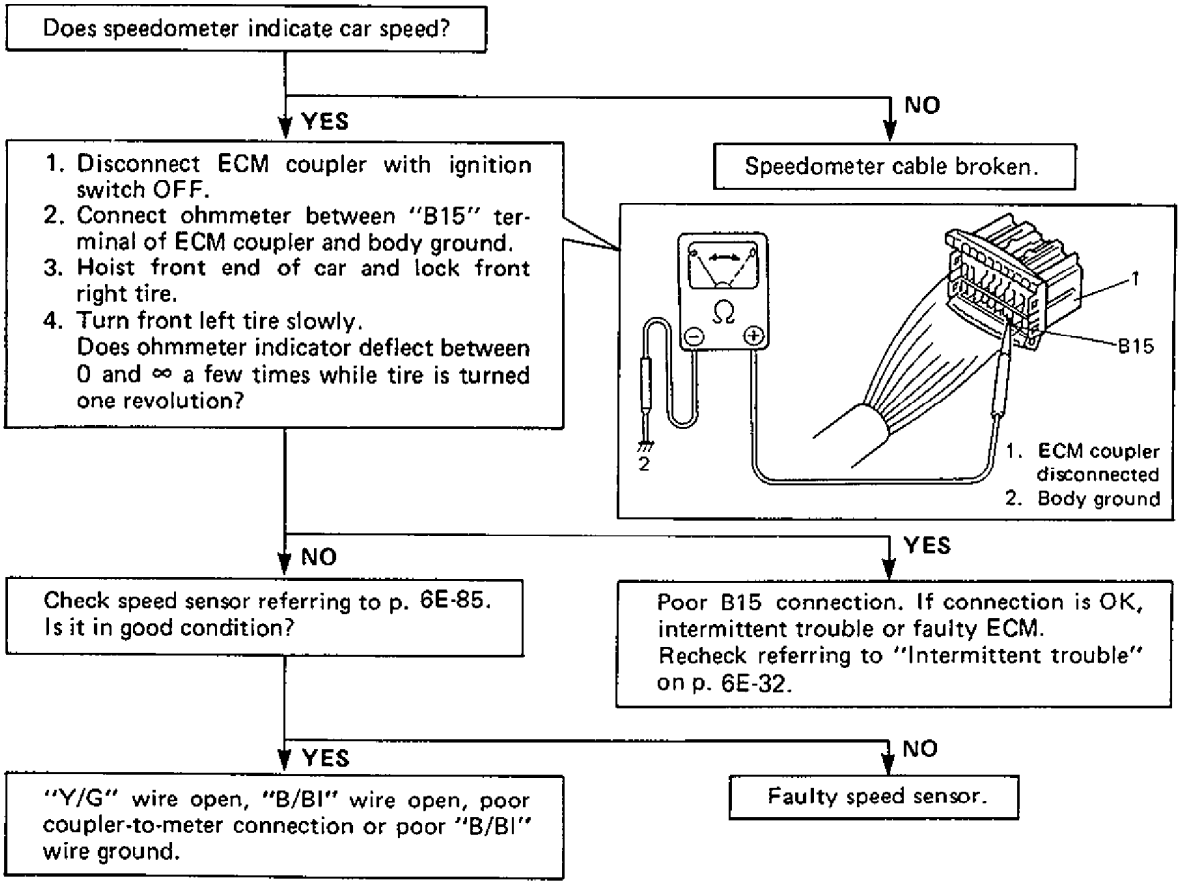
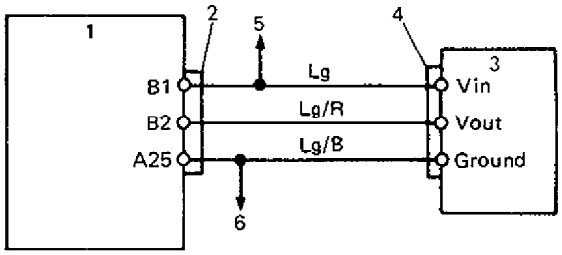


Fig. 6E-67 Diagnostic Flow Chart for Code No. 24

CODE NO. 31 PS (PRESSURE SENSOR) CIRCUIT (SIGNAL VOLTAGE LOW – LOW PRESSURE – HIGH VACUUM)



1. ECM
2. ECM coupler
3. PS
4. PS coupler
5. To TPS
6. To other sensors

Fig. 6E-68 PS Circuit

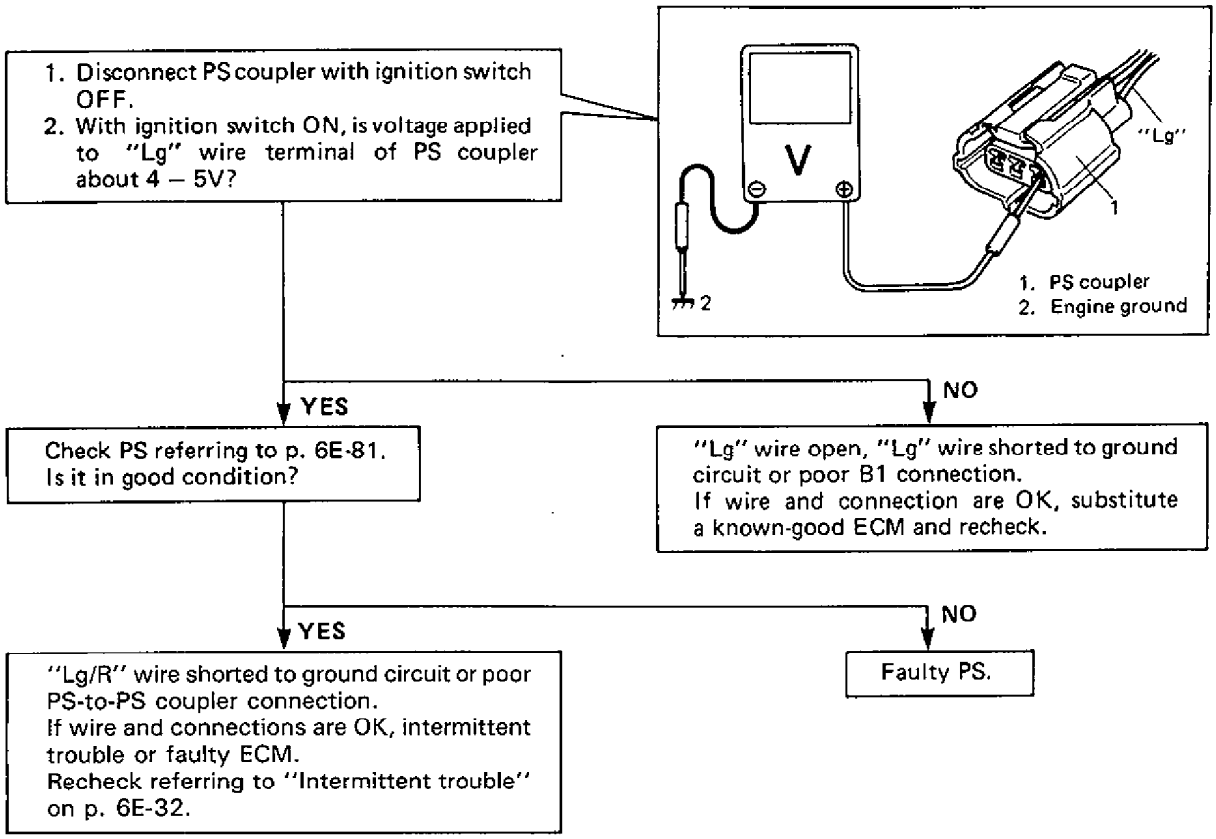
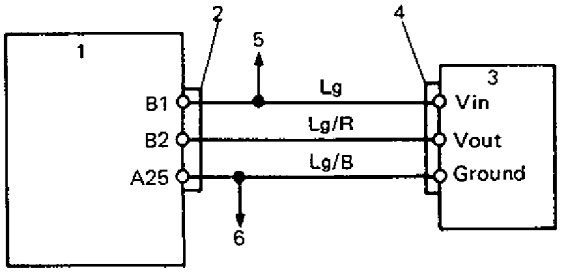


Fig. 6E-69 Diagnostic Flow Chart for Code No. 31

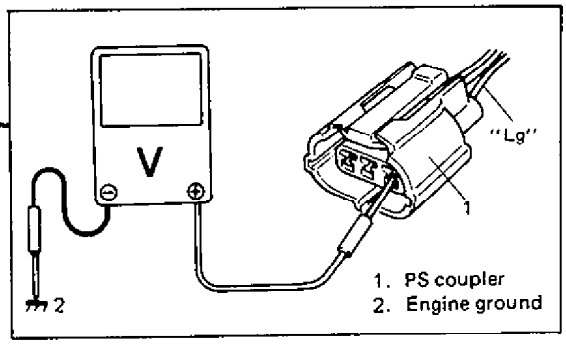
CODE NO. 32 PS (PRESSURE SENSOR) CIRCUIT (SIGNAL VOLTAGE HIGH – HIGH PRESSURE – LOW VACUUM)



1. ECM
2. ECM coupler
3. PS
4. PS coupler
5. To TPS
6. To other sensors

Fig. 6E-70 PS Circuit

1. Disconnect PS coupler with ignition switch OFF.
2. With ignition switch ON, is voltage applied to "Lg" wire terminal of PS coupler about 4 – 5V?



YES

Check PS referring to p. 6E-81.
Is it in good condition?

NO

"Lg" wire shorted to power circuit.
If wire is OK, substitute a known-good ECM and re-check.

NOTE:
When battery voltage is applied to "Lg" wire, it is possible that PS is also faulty.

YES

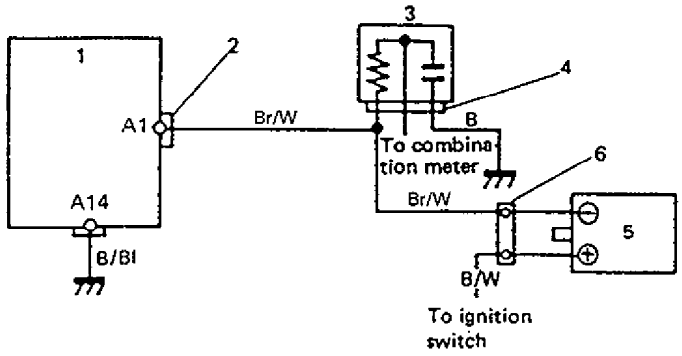
"Lg" wire shorted to "Lg/R" wire, "Lg/B" wire open, poor A25 connection, poor B2 connection, "Lg/R" wire open or poor PS-to-"Lg/B" wire connection.
If wires and connections are OK, intermittent trouble or faulty ECM.
Recheck referring to "Intermittent trouble" on p. 6E-32.

NO

Faulty PS.

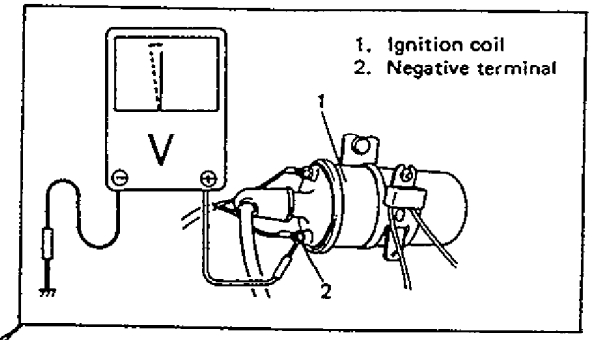
Fig. 6E-71 Diagnostic Flow Chart for Code No. 32

CODE NO.41 IGNITION SIGNAL CIRCUIT (IGNITION SIGNAL NOT INPUTTED FOR 2 SECONDS AT ENGINE CRANKING)



1. ECM
2. ECM coupler
3. Noise suppressor
4. Coupler
5. Ignition coil
6. Coupler

Fig. 6E-72 Ignition Signal Circuit



With ignition switch ON, is battery voltage applied to ignition coil negative terminal?

YES

1. Turn ignition switch OFF.
2. Disconnect center high-tension cord from distributor and ground it securely.
3. Remove distributor cap and rotor.
4. Check if signal rotor teeth are off sensor tooth.
   If not, make it off by turning crankshaft.
5. With ignition switch ON, move a screwdriver close to and away from tooth of crank angle sensor. Does voltmeter indicator deflect from battery voltage toward lower side?

NO

Poor ignition coil positive terminal connection, "Br/W" wire shorted to ground, faulty noise suppressor or faulty ignition coil.
If they are OK, substitute a known-good ECM and recheck.

NO

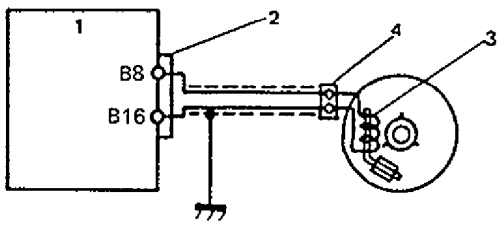
Faulty ignition coil, "Br/W" wire open, "Br/W" wire shorted to power circuit, poor A1 connection, poor A14 connection, open "B/Bl" wire or poor "B/Bl" wire grounding.
If all above are OK, substitute a known-good ECM and recheck.

YES

Substitute a known-good ECM and recheck.

Fig. 6E-72-1 Diagnostic Flow Chart for Code No. 41

CODE NO. 42 CRANK ANGLE SENSOR CIRCUIT (SENSOR SIGNAL NOT INPUTTED FOR 2 SECONDS AT ENGINE CRANKING)



1. ECM
2. ECM coupler
3. Crank angle sensor
4. Coupler

Fig. 6E-73 Crank Angle Sensor Circuit

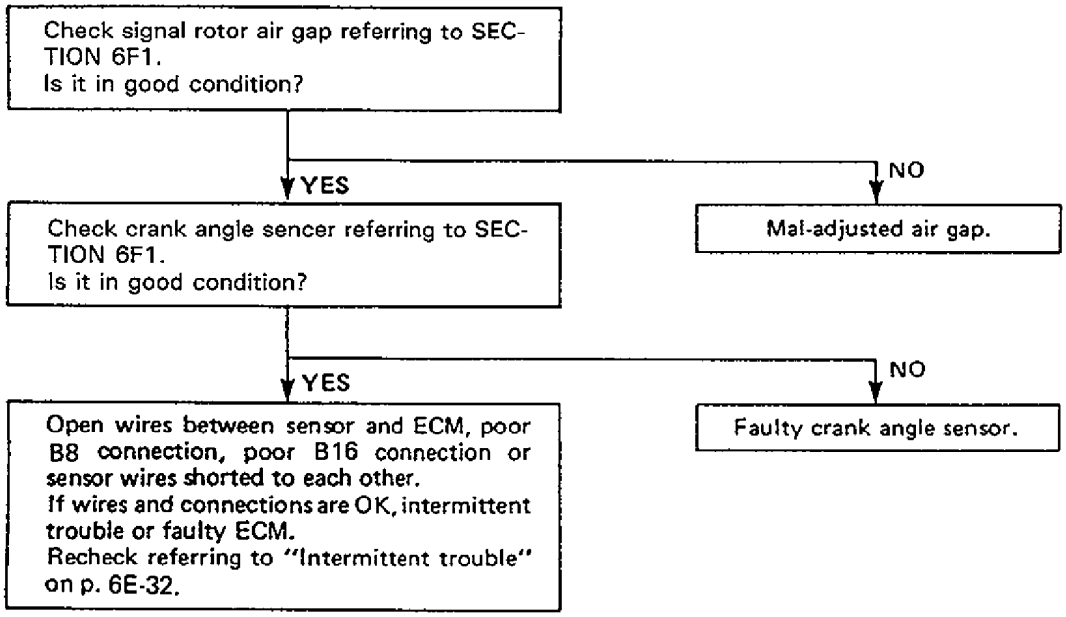


Fig. 6E-73-1 Diagnostic Flow Chart for Code No. 42

CODE NO. 51 EGR SYSTEM (FAULTY EGR SYSTEM)

For California spec. model only

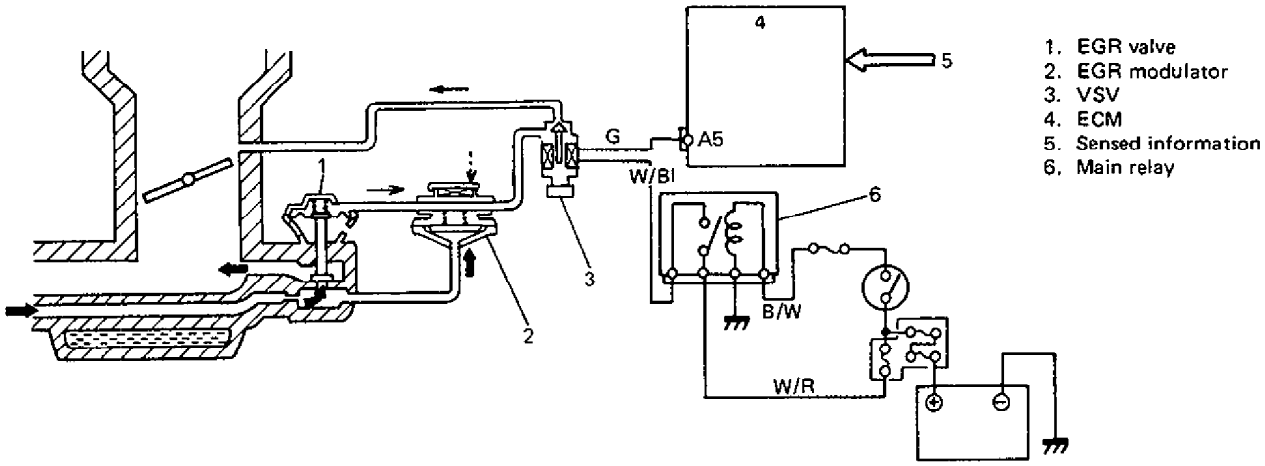


Fig. 6E-74 EGR System

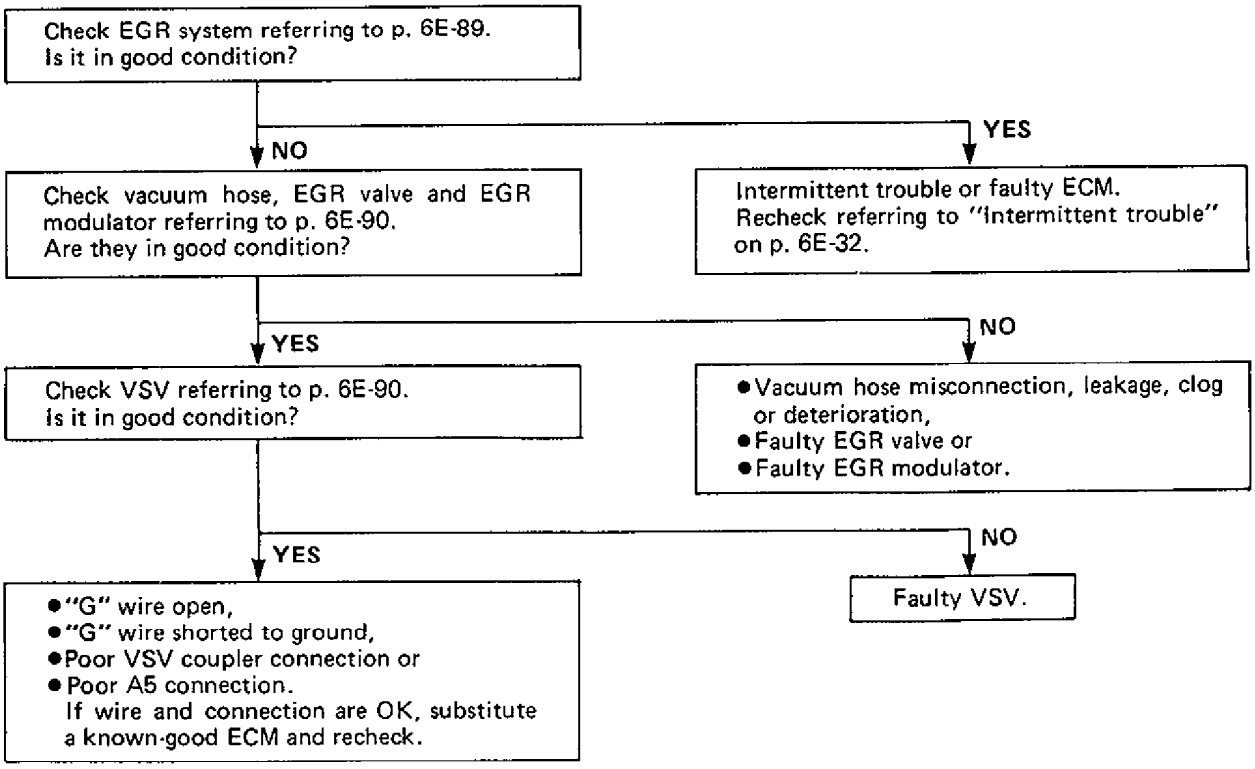


Fig. 6E-75 Diagnostic Flow Chart for Code No. 51 (California Spec. Model Only)

TROUBLE DIAGNOSIS

This section describes trouble diagnosis of Electronic Fuel Injection system parts whose trouble is not indicated by the self-diagnosis function.

When diagnostic code No. 12 is indicated by the self-diagnosis function and assuredly those engine basic parts as described in "ENGINE DIAGNOSIS" are all in good condition, check below Electronic Fuel Injection system parts which may be a possible cause for each symptom of the engine.

SYMPTOM	POSSIBLE CAUSE	INSPECTION
Hard or no starting (Engine cranks OK)	• Shortage of fuel in fuel tank	
	• Injector or its circuit faulty	Diagnostic flow chart B-1
	• Faulty fuel pump or its circuit open	Diagnostic flow chart B-2
	• Fuel pressure out of specification	Diagnostic flow chart B-3
	• Faulty air valve	See p. 6E-77
	• Engine start signal not to fed	Diagnostic flow chart B-5
	• Poor performance of ATS, WTS or pressure sensor	See p. 6E-84 or 6E-81
	• Faulty ECM	See p. 6E-65
NOTE: • **If engine doesn't start at all, perform fuel injector and its circuit check first. (Advance to "Diagnostic Flow Chart B-1".)** • **If engine is hard to start only when it is cold, check air valve first.**		
Engine fails to idle	• Shortage of fuel in fuel tank	
	• Faulty ISC solenoid valve control system	Diagnostic flow chart B-4
	• Maladjusted idle speed adjusting screw	See p. 6E-69
	• Faulty air valve	See p. 6E-77
	• Faulty EGR system	See p. 6E-89
	• Fuel pressure out of specification	Diagnostic flow chart B-3
	• Faulty injector	Check injector for resistance and injection condition (Refer to p. 6E-78)
	• Poor performance of ATS, WTS or pressure sensor	See p. 6E-84 or 6E-81
	• Faulty ECM	See p. 6E-65
NOTE: **If engine fails to idle only when it is cold, check air valve.**		

SYMPTOM	POSSIBLE CAUSE	INSPECTION
Improper engine idle speed	• Maladjusted accelerator cable play	See p. 6E-69
	• Clogged pressure sensor vacuum passage	Check vacuum hose and filter
	• Faulty ISC solenoid valve control system	Diagnostic flow chart B-4
	• Faulty air-conditioner VSV control system (if equipped)	See section 1B
	• Faulty power steering VSV (if equipped)	See p. 6E-93
	• Faulty idle switch (in TPS)	See p. 6E-82
	• Maladjusted idle speed adjusting screw	See p. 6E-69
	• Faulty air valve	See p. 6E-77
	• Fuel pressure out of specification	Diagnostic flow chart B-3
	• Poor performance of ATS, WTS or pressure sensor	See p. 6E-84 or 6E-81
	• Faulty ECM	See p. 6E-65
NOTE: **If engine idle speed lowers below specification only when electric load is applied (e.g. headlight ON), check ISC solenoid valve control system first.**		
Engine has no or poor	• Maladjusted accelerator cable play	See p. 6E-69
	• Faulty EGR system	See p. 6E-89
	• Fuel pressure out of specification (Low fuel pressure)	Diagnostic flow chart B-3
	• Poor performance of TPS, ATS, WTS or pressure sensor	See p. 6E-82, 6E-84 or 6E-81
	• Faulty ECM	See p. 6E-65
Engine hesitates when accelerating	• Clogged pressure sensor vacuum passage	Check vacuum hose and filter
	• Faulty EGR system	See p. 6E-89
	• Fuel pressure out of specification (Low fuel pressure)	Diagnostic flow chart B-3
	• Poor performance of TPS, ATS or WTS pressure sensor	See p. 6E-82, 6E-84 or 6E-81
	• Faulty ECM	See p. 6E-65
Surges (Variation in car speed is felt although accelerator pedal is not operated)	• Variable fuel pressure (Clogged fuel filter, faulty fuel pressure regulator, etc.)	Diagnostic flow chart B-3
	• Poor performance of pressure sensor	See p. 6E-81
	• Faulty ECM	See p. 6E-65

SYMPTOM	POSSIBLE CAUSE	INSPECTION
Poor gasoline mileage	• High idle speed	Refer to item "Improper engine idle speed" previously outlined
	• Fuel pressure out of specification or fuel leakage	Diagnostic flow chart B-3
	• Poor performance of TPS, ATS or WTS	See p. 6E-82 or 6E-84
	• Faulty ECM	See p. 6E-65
Excessive hydrocarbon (HC) emission	• Engine not at normal operating temperature	
	• Clogged air cleaner	
	• Faulty ignition system	See section 6F1
	• Vacuum leaks	
	• Low compression	See section 6
	• Lead contamination of catalytic converter	Check for absence of filler neck restrictor
	• Fuel pressure out of specification	Diagnostic flow chart B-3
	• A/F feed back compensation fails	
	— Faulty TPS	See p. 6E-82
	— Poor performance of WTS or pressure sensor	See p. 6E-84 or 6E-81
	• Poor performance of ATS	See p. 6E-84
	• Faulty injector	See p. 6E-78
	• Faulty ECM	See p. 6E-65
Excessive carbon monoxide (CO)	• Engine not at normal operating temperature	
	• Clogged air cleaner	
	• Faulty ignition system	See section 6F1
	• Low compression	See section 6
	• Lead contamination of catalytic conveter	Check for absence of filler neck restrictor
	• Fuel pressure out of specification	Diagnostic flow chart B-3
	• A/F feed back compensation fails	
	— Faulty TPS	See p. 6E-82
	— Poor performance of WTS or pressure sensor	See p. 6E-84 or 6E-81
	• Poor performance of ATS	See p. 6E-84
	• Faulty injector	See p. 6E-78
	• Faulty ECM	See p. 6E-65

SYMPTOM	POSSIBLE CAUSE	INSPECTION
Excessive nitrogen oxides (NOx) emission	• Improper ignition timing	See section 6F1
	• Lead contamination of catalytic converter	Check for adsence of filler neck restrictor
	• Faulty EGR system	See p. 6E-89
	• Fuel pressure out of specification	Diagnostic flow chart B-3
	• A/F feed back compensation fails	
	– Faulty TPS	See p. 6E-82
	– Poor performance of WTS or pressure sensor	See p. 6E-84 or 6E-81
	• Poor performance of ATS	See p. 6E-84
	• Faulty injector	See p. 6E-78
	• Faulty ECM	See p. 6E-65

B-1 FUEL INJECTOR AND ITS CIRCUIT CHECK (ENGINE NOT STARTING)

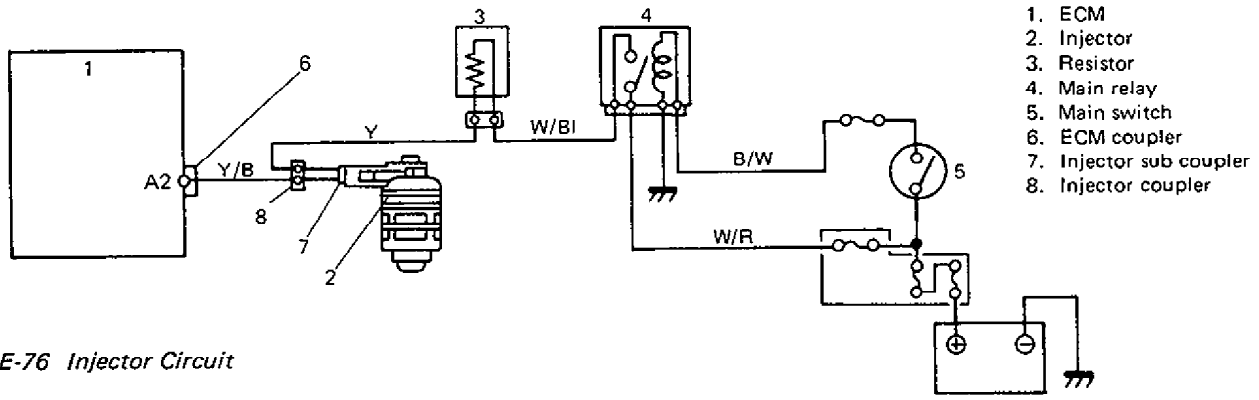


Fig. 6E-76 Injector Circuit

Is fuel injected from injector at ignition switch ON (not cranking)?

YES → "Y/B" wire shorted to ground or faulty injector. If wire and injector are OK, check to make sure that resistance of resistor and injector is as specified respectively and then substitute a known-good ECM and recheck.

NO → Is fuel injected from injector at engine cranking? (Refer to p. 6E-78 for checking).

YES → Check injector for leaks. (Refer to p. 6E-78 for checking). Is it in good condition?

NO → Faulty fuel injector.

YES → Injector and its circuit in good condition.

NO → Using sound scope, check injector for operating sound at engine cranking. Is it detected?

YES → Check fuel pump and fuel pressure. (Proceed to DIAGNOSTIC FLOW CHART B-2 and B-3.).

NO →
1. Desconnect injector coupler with ignition switch OFF.
2. Is resistance of injector 0.5 — 1.5 Ω (at 20°C, 68°F)?

To be continued

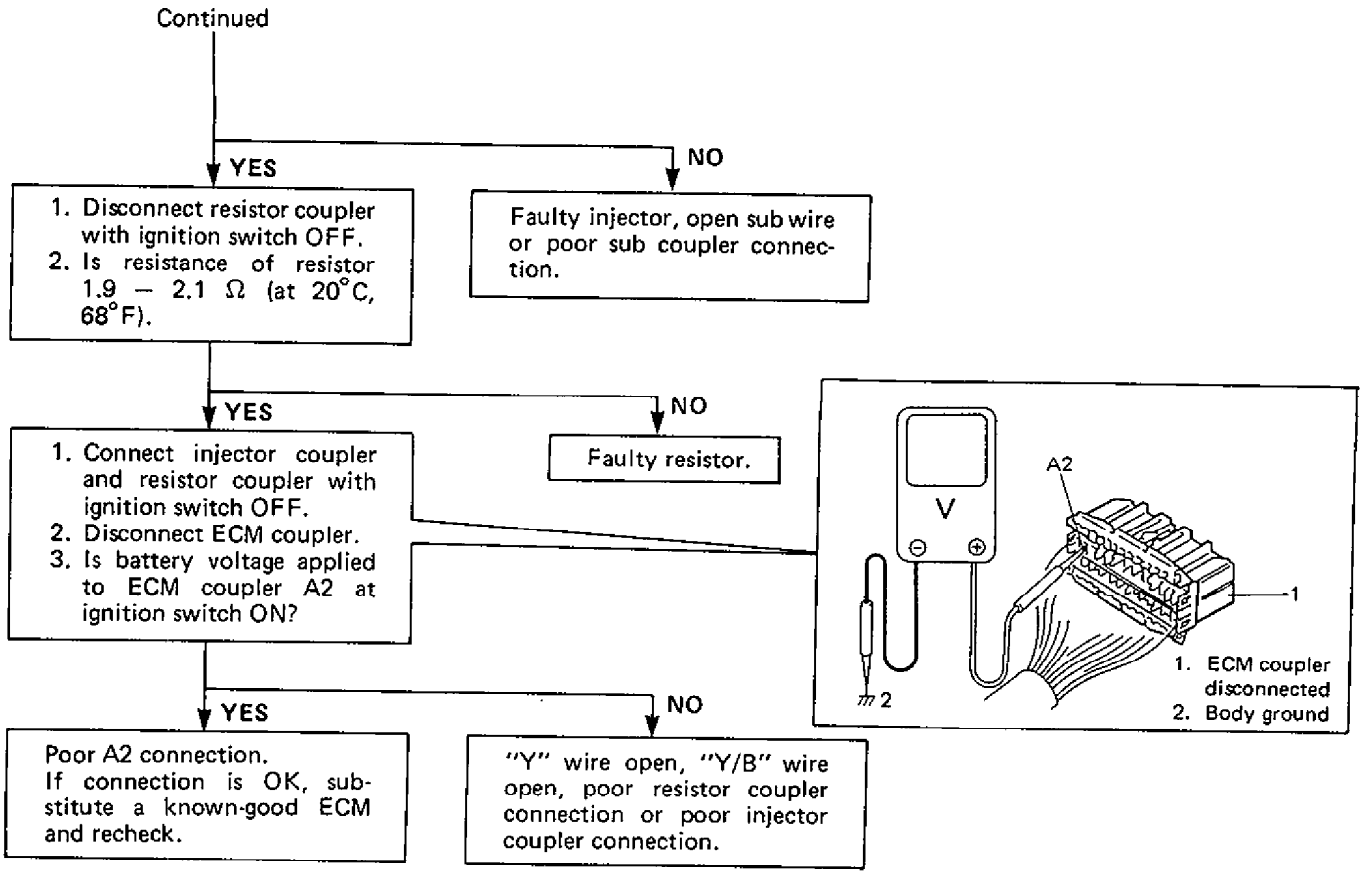


Fig. 6E-77 Diagnostic Flow Chart B-1 for Injector and Its Circuit

B-2 FUEL PUMP AND ITS CIRCUIT CHECK

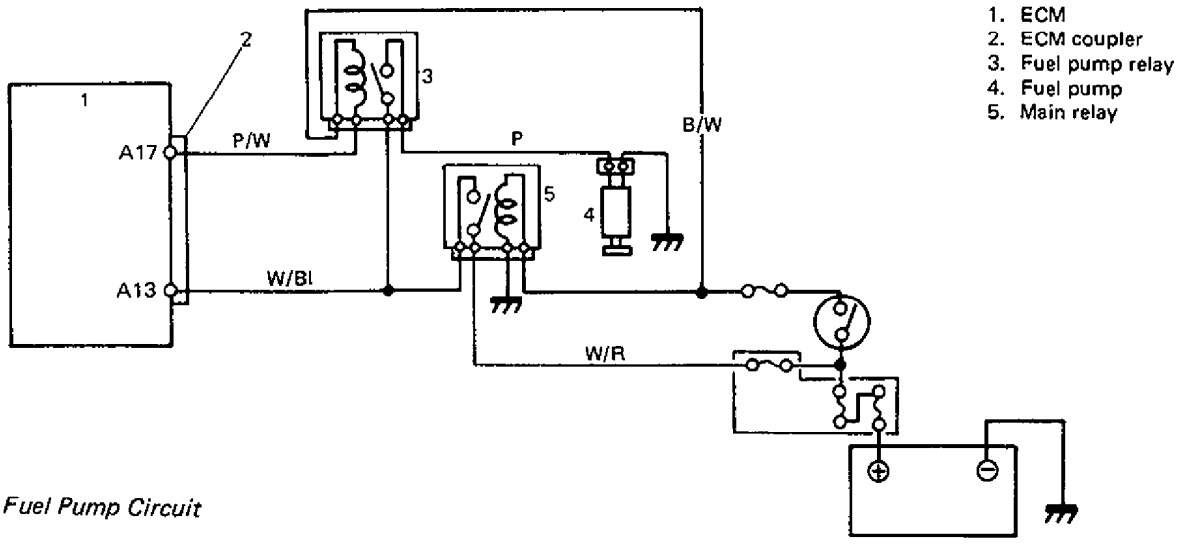


Fig. 6E-78 Fuel Pump Circuit

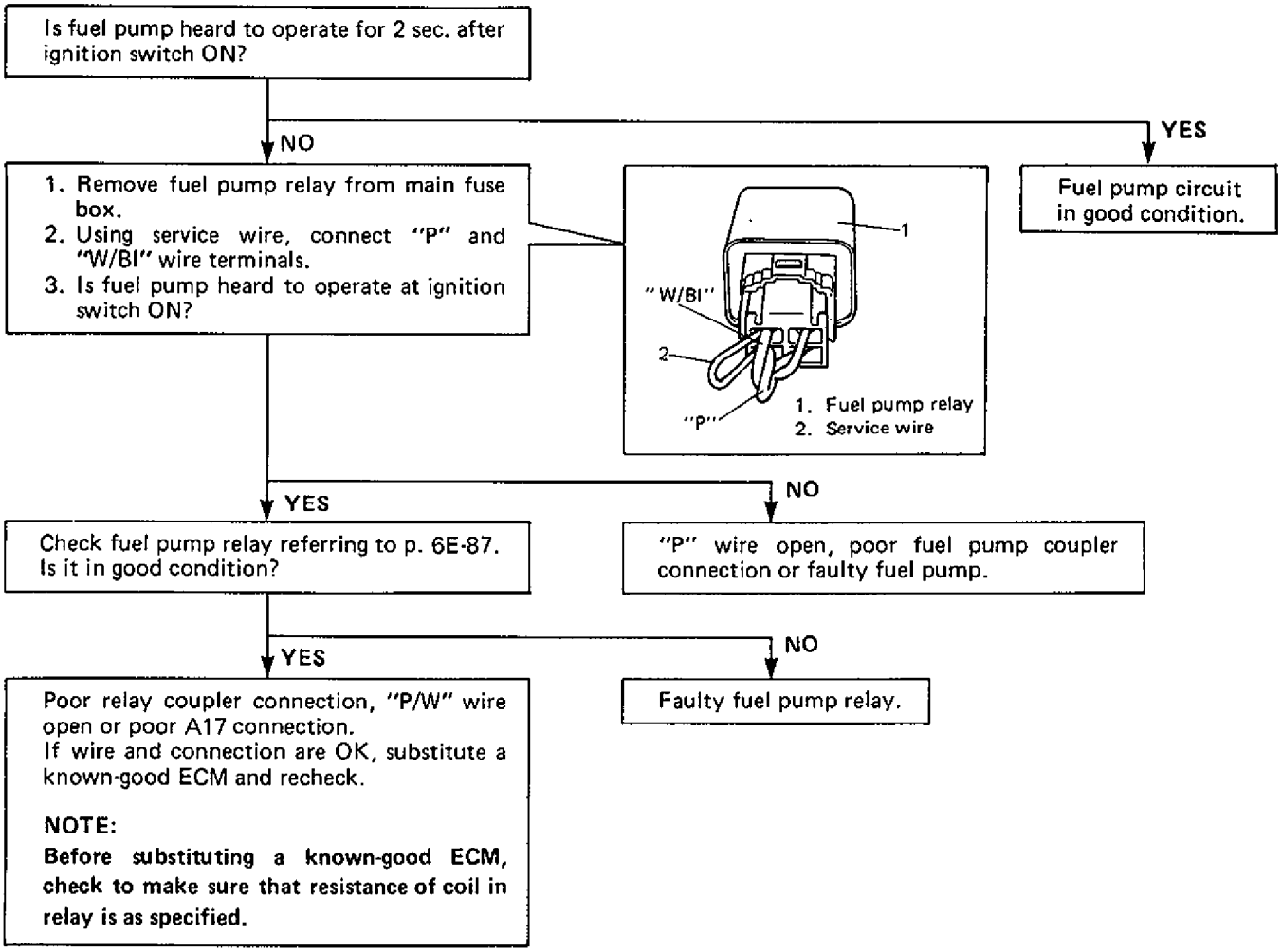


Fig. 6E-79 Diagnostic Flow Chart B-2 for Fuel Pump and Its Circuit Check

B-3 FUEL PRESSURE CHECK

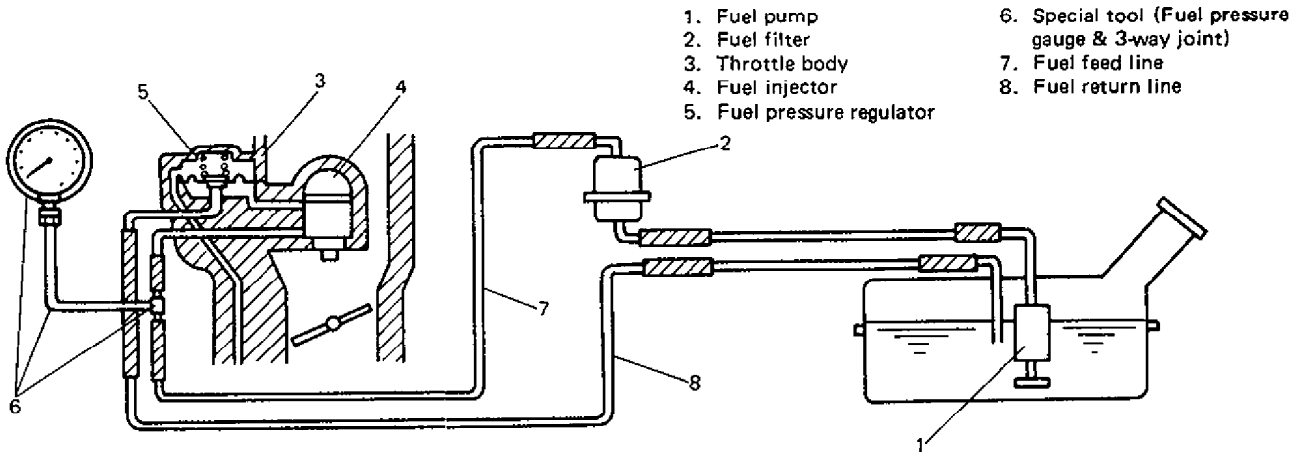


Fig. 6E-80 Fuel Pressure Check

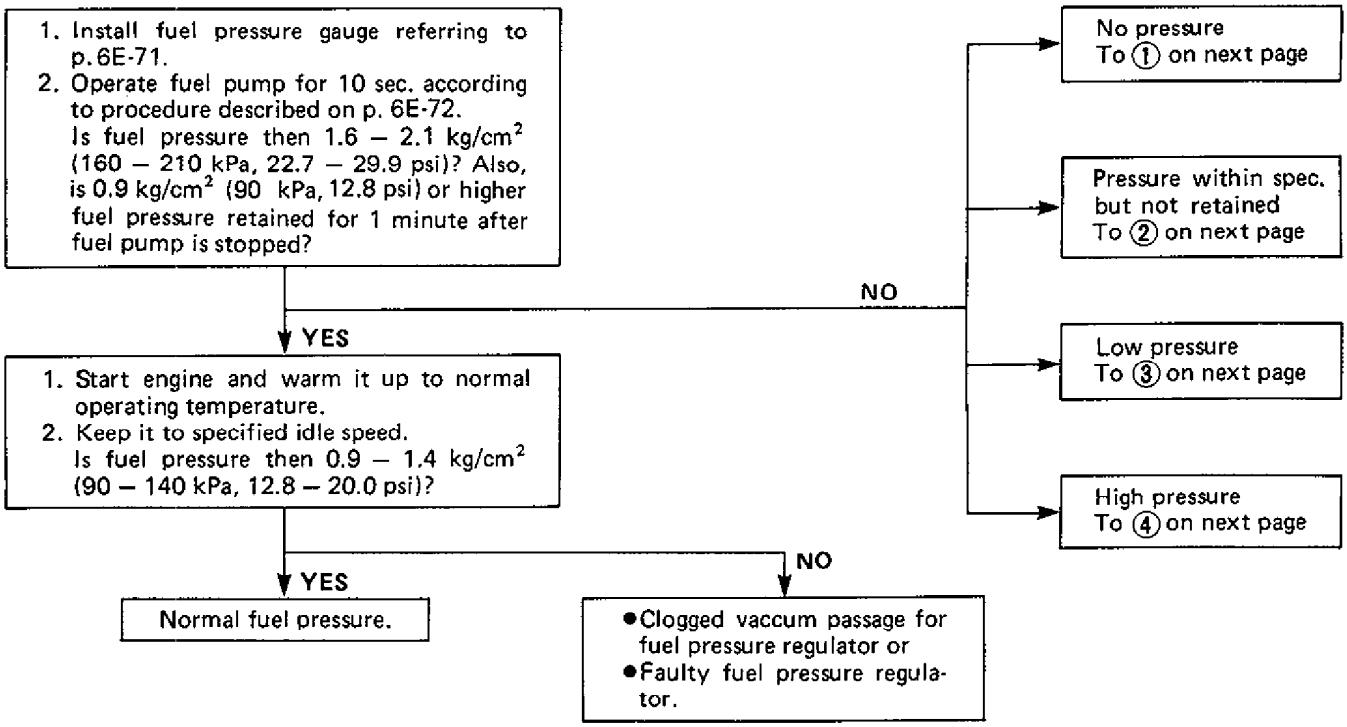


Fig. 6E-81 Diagnostic Flow Chart B-3 for Fuel Pressure (1)

B-3 FUEL PRESSURE CHECK (continued)

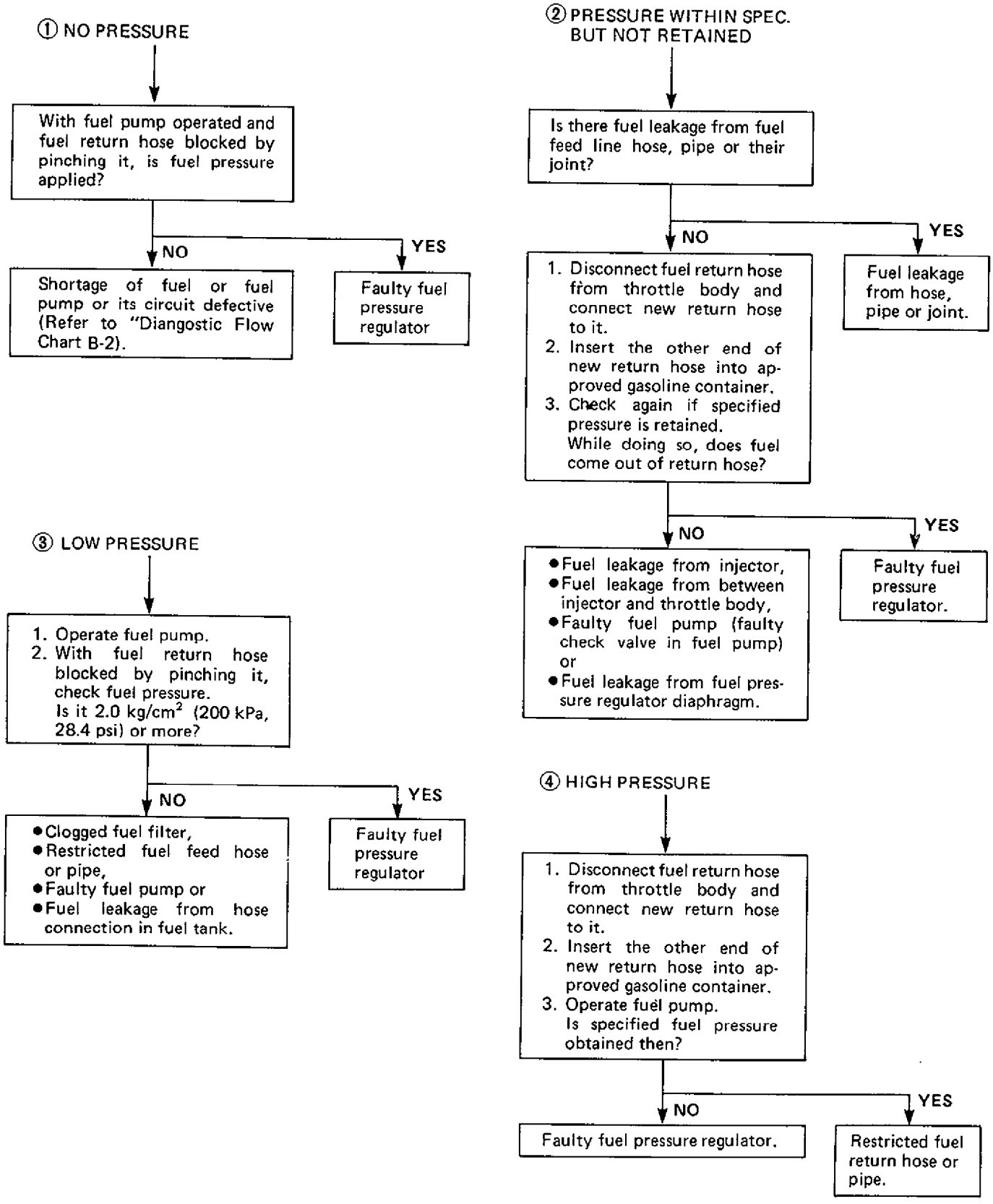
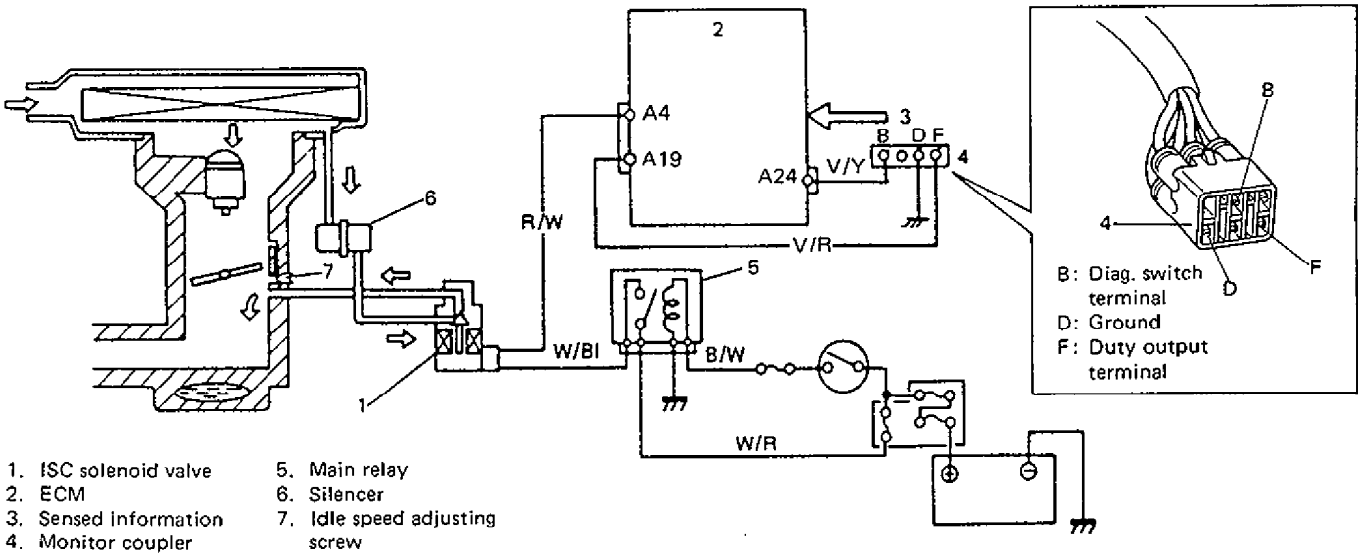


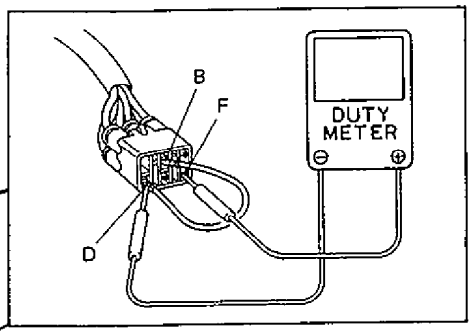
Fig. 6E-81-1 Diagnostic Flow Chart B-3 for Fuel Pressure (2)

B-4 ISC SOLENOID VALVE CONTROL SYSTEM CHECK



1. ISC solenoid valve
2. ECM
3. Sensed Information
4. Monitor coupler
5. Main relay
6. Silencer
7. Idle speed adjusting screw

Fig. 6E-82 ISC Solenoid Valve Circuit



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

YES

Check idle speed and ISC duty referring to p. 6E-69.
Are they within specification?

NO

Go back to "Diagnostic Flow Chart" on p. 6E-35.

NO

High idle speed
To ① on next page.

NO

Low idle speed
To ② on next page.

YES

Idle speed is within specification but duty is not.
1. Adjust ISC duty to specification.

NOTE:
- When ON duty of ISC is close to 0% (but close to 100% with such duty meter that indicates OFF duty, in other words, when ISC is almost fully closed), check that air intake system is free from vacuum leakage and adjust it.
- If duty remains unchanged even when adjusting screw is turned, check duty output terminal circuit.

2. Proceed to next step.

Is engine idle speed kept at specified speed even with headlights turned ON?

NO

Proceed to system circuit check ③ on next page.

YES

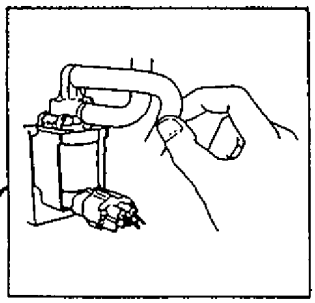
System is in good condition.

Fig. 6E-82-1 Diagnostic Flow Chart B-4 for ISC Solenoid Valve Control System (1)

B-4 ISC SOLENOID VALVE CONTROL SYSTEM CHECK (Continued)

① HIGH IDLE SPEED

1. Block ISC solenoid valve hose by pinching it.
2. Does engine speed reduce then?



YES

Check ISC solenoid valve for its resistance and operation. (Refer to p. 6E-88.)
Is it in good condition?

YES

Check idle switch and its circuit.
Are they in good condition?

YES

"R/W" wire shorted to ground.
If wire is OK, substitute a known-good ECM and recheck.

NO

- Faulty idle switch,
- Maladjusted TPS installation angle,
- Wire open or
- Poor connection.

NO

Faulty ISC solenoid valve.

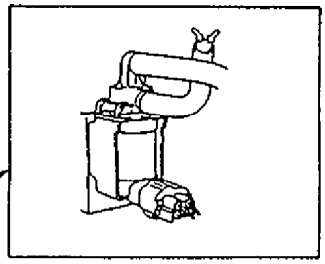
NO

1. Check that air intake system (including A/C VSV and P/S VSV) is free from vacuum leakage.
2. Adjust duty and idle speed referring to p. 6E-69.

NOTE:
If not adjustable with idle speed adjusting screw, check air valve.

② LOW IDLE SPEED

1. Disconnect ISC hose from air cleaner case.
2. Then, is air drawn into it?



NO

Check ISC solenoid valve for its resistance and operation. (Refer to p. 6E-88.)
Is it in good condition?

YES

- Clogged ISC hose,
- "R/W" wire open or
- Poor coupler connections.

If all above are OK, substitute a known-good ECM and recheck.

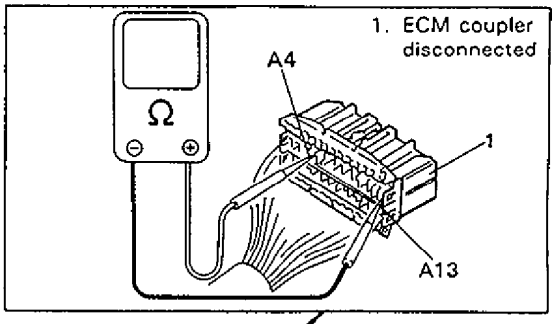
YES

Adjust duty and idle speed referring to p. 6E-69.

NO

Faulty ISC solenoid valve.

③ SYSTEM CIRCUIT CHECK



1. Disconnect ECM couplers with ignition switch OFF.
2. Is resistance between A4 and A13 30 – 33 Ω?

YES

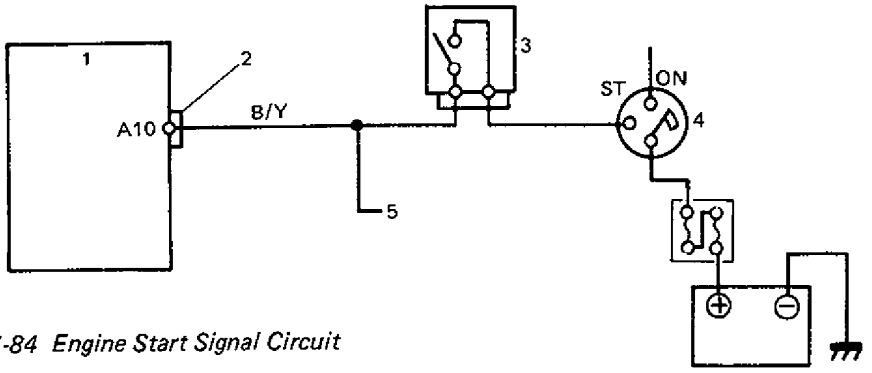
Poor coupler connection.
If connection is OK, substitute a known-good ECM and recheck.

NO

- Faulty ISC solenoid
- Poor coupler connection or
- Open wire harness

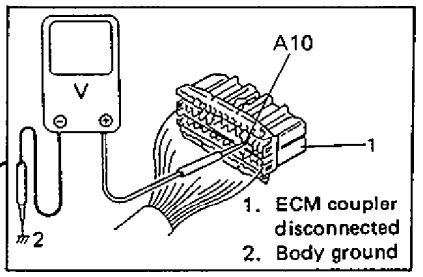
Fig. 6E-82-2 Diagnostic Flow Chart B-4 for ISC Solenoid Valve Control System (2)

B-5 ENGINE START SIGNAL CHECK



1. ECM
2. ECM coupler
3. Clutch switch (M/T) or shift switch (A/T)
4. Main switch
5. To starter motor

Fig. 6E-84 Engine Start Signal Circuit



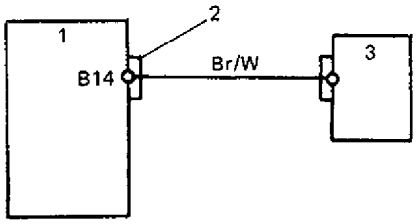
1. With ignition switch OFF, disconnect "A" coupler (right side coupler) from ECM.
2. Is 6 – 12V voltage applied to A10 terminal of coupler only when cranking engine ?

YES → Engine start signal circuit is in good condition.

NO →
- Wire open,
- Poor connection or
- Faulty clutch switch (M/T) or shift switch (A/T).

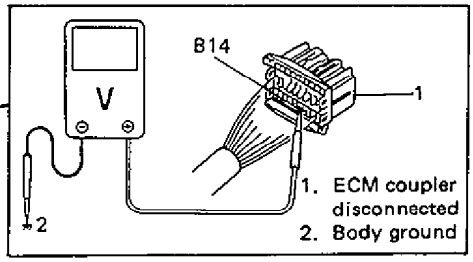
Fig. 6E-85 Engine Start Signal Check

B-6 "R", "D", "2" OR "L" RANGE SIGNAL CHECK (A/T MODEL ONLY)



1. ECM
2. ECM coupler
3. A/T control module

Fig. 6E-86 "R", "D", "2" or "L" Range Signal Circuit



1. With ignition switch OFF, disconnect "B" coupler (left side coupler) from ECM.
2. Turn ignition switch ON and check voltage at B14 terminal of coupler under each condition given in below table.

Selector lever in "P" or "N" range position	0V
Selector lever in "R", "D", "2" or "L" range position	10 – 14V

Is check result satisfactory?

YES → Signal circuit is in good condition.

NO →
- Wire open or
- Poor connection

If wire and connection are OK, check A/T control system referring to section 7B.

Fig. 6E-87 "R", "D", "2" or "L" Range Signal Check (A/T Model Only)

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 p. 6E-80.
2. Connect ECM couplers to ECM.
3. Using service wire, ground ECM case.
4. 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.

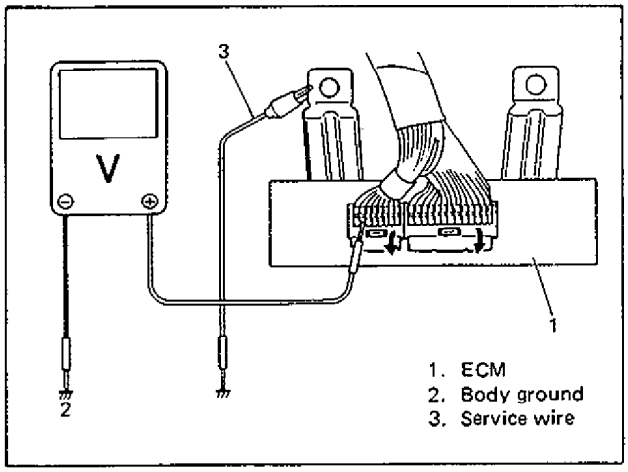


Fig. 6E-88 Checking Voltage

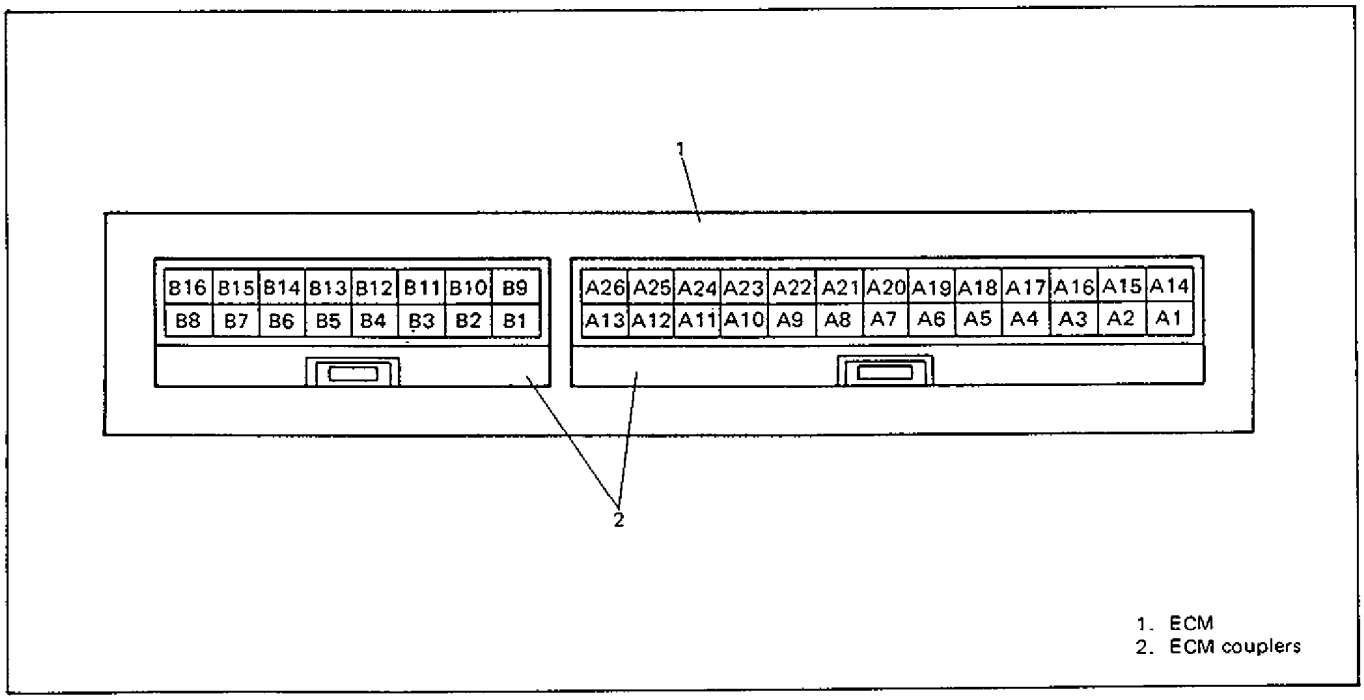


Fig. 6E-89 ECM Coupler Terminals

TER-MINAL	CIRCUIT	NORMAL VOLTAGE	CONDITION
A1	Ignition coil	10 – 14V	Ignition switch ON
A2	Injector	10 – 14V	Ignition switch ON
A3	Blank	———	———
A4	ISC solenoid valve	0.9 – 1.5V	Ignition switch ON
A5	EGR VSV	10 – 14V	Ignition switch ON
A6	"CHECK ENGINE" light	1.1 – 2.0V	Ignition switch ON
		10 – 14V	When engine running
A7	Blank	———	———
A8	Shift-up indicator light	1 – 2V	Ignition switch ON
		10 – 14V	When engine running
A9 (A/T model only)	A/T control module (Throttle valve opening signal)	10 – 14V ↕ 0.2 – 0.4V	Ignition switch ON Voltage varies as specified at the left while throttle valve is opened gradually. (Refer to Fig. 6E-157 for relations between opening and voltage)
A10	Engine start switch (Engine start signal)	6 – 12V	While engine cranking
		0V	Other than above
A11	Test switch terminal	10 – 14V	Ignition switch ON
A12	Ground	0V	Ignition switch ON
A13	Power source	10 – 14V	Ignition switch ON
A14	Ground	0V	Ignition switch ON
A15	Ground	0V	Ignition switch ON
A16	Blank	———	———
A17	Fuel pump relay	0.5 – 1.8V	For 2 seconds after ignition switch ON
		10 – 14V	After the above time
A18	Blank	———	———
A19	Duty output terminal	0V	Ignition switch ON
A20	Blank	———	———
A21, A22 (A/T model only)	A/T control module (Throttle valve opening signal)	10 – 14V ↕ 0.2 – 0.4V	Ignition switch ON Voltage varies as specified at the left while throttle valve is opened gradually. (Refer to Fig. 6E-157 for relations between opening and voltage)
A23	Blank	———	———
A24	Diagnosis switch terminal	10 – 14V	Ignition switch ON
A25	Ground for sensors	0V	Ignition switch ON
A26	Power source for back-up circuit	10 – 14V	Ignition switch ON and OFF

TER-MINAL	CIRCUIT	NORMAL VOLTAGE	CONDITION
B1	Power source of sensor (PS and TPS)	4.75–4.25V	Ignition switch ON
B2	Pressure sensor	3.5 – 4.1V	Ignition switch ON Barometric pressure: 760 mmHg
B3	Oxygen sensor	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
B4	Blank	———	———
B5	A/C circuit (if equipped)	10 – 14V	Ignition switch ON
		0 – 0.6V	While engine running at idle speed and A/C ON
B6	Electric load signal	0V	Ignition switch ON Headlight, small light, heater fan, radiator fan, stop light and rear window defogger all turned OFF
		10 – 14V	Ignition switch ON Headlight, small light, heater fan, radiator fan, stop light or rear window defogger turned ON
B7	Idle switch (in TPS)	0V	Ignition switch ON Throttle valve at idle position
		10 – 14V	Ignition switch ON Throttle valve opens larger than idle position
B8	Crank angle sensor (positive)	0.4 – 0.8V	Ignition switch ON
B9	Air temp. sensor	2.0 – 2.7V	Ignition switch ON Sensor ambient temp. (Intake air temp.): 20°C (68°F)
B10	Water temp. sensor	0.45–0.85V	Ignition switch ON Engine cooling water temp.: 80°C (176°F)
B11	Throttle position sensor	0.18–1.03V	Ignition switch ON Throttle valve at idle position
		3.27–4.58V	Ignition switch ON Throttle valve at full open position
B12	Blank	———	———
B13	Serial data terminal	4 – 5V	Ignition switch ON
B14 (A/T model only)	A/T control module ("R", "D", "2" or "L" range signal)	0V	Ignition switch ON, Selector lever in "P" or "N" range position
		10 – 14V	Ignition switch ON, Selector lever in "R", "D", "2" or "L" range position
B15	Vehicle speed sensor	Indicator deflection repeated 0V and 10 – 14V	Ignition switch ON Front left tire turned slowly with front right tire locked
B16	Crank angle sensor (negative)	0.4 – 0.8V	Ignition switch ON

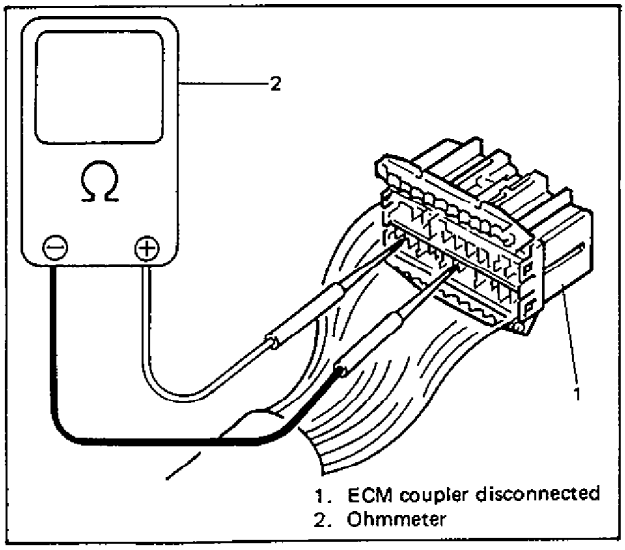
Resistance Check

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

CUATION:
Never touch terminals of ECM itself or connect voltmeter or ohmmeter.

2. Check resistance between each terminal of couplers disconnected.

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



1. ECM coupler disconnected
2. Ohmmeter

Fig. 6E-90 Checking Resistance

TERMINALS	CIRCUIT	NORMAL RESISTANCE	CONDITION	
A2 – A13	Injector and resistor	2.4 – 3.6 Ω	——	
A4 – A13	ISC solenoid valve	30 – 33 Ω	——	
A5 – A13	EGR VSV	33 – 39 Ω	——	
A11 – Body ground	Test switch terminal	Continuity	Test switch terminal grounded	
		∞ (Infinity)	Test switch terminal ungrounded	
A14 – Body ground	Ignitor ground	Continuity	——	
A15 – Body ground	ECM ground	Continuity	——	
A24 – Body ground	Dia. switch terminal	Continuity	Diag. switch terminal grounded	
		∞ (Infinity)	Diag. switch terminal ungrounded	
B7 – A25	Idle switch in TPS	Continuity	Throttle valve at idle position	
		∞ (Infinity)	Throttle valve opens larger than idle position	
B8 – B16	Crank angle sensor	140 – 180 Ω	——	
B9 – A25	ATS	2.21 – 2.69 kΩ	Intake air temp. 20°C (68°F)	
B10 – A25	WTS	290 – 354 Ω	Engine cooling water temp. 80°C (176°F)	
B11 – A25	TPS	0.20–11.42 kΩ	Throttle valve at idle position	With pressure sensor coupler disconnected
		3.03–17.08 kΩ	Throttle valve at full open position	
B15 – Body ground	Vehicle speed sensor	Ohmmeter indicator deflects between 0 and ∞	Front left tire turned slowly with front right tire locked	

ON CAR SERVICE

GENERAL

When hoses have been disconnected and system's component removed for service, be sure to reinstall component properly, and route and connect hose correctly after service. Refer to Emission Control Information Label for proper connection of hoses.

ACCELERATOR CABLE ADJUSTMENT

Check accelerator cable for play and adjust if necessary.

Cable play should be within specification. If out of specification, loosen accelerator cable lock nut and adjust by turning adjusting nut. Be sure to tighten lock nut securely after adjustment.

Accelerator cable play	3 – 5 mm (0.12 – 0.20 in.)

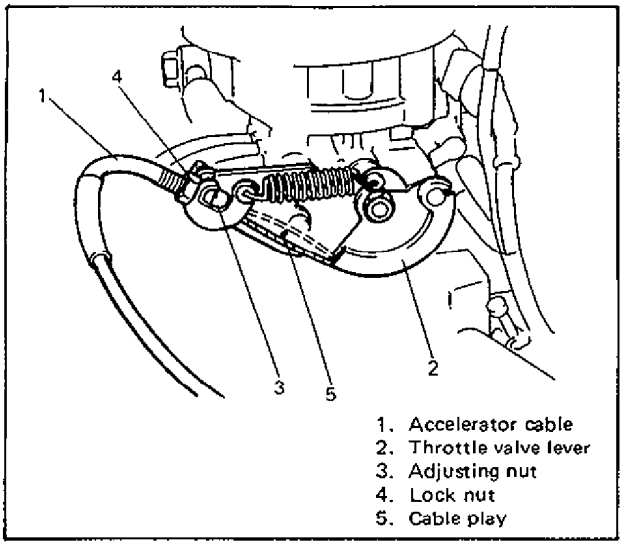


Fig. 6E-91 Accelerator Cable Play

IDLE SPEED/ISC DUTY ADJUSTMENT (INCLUDING AIR-CONDITIONER VSV ADJUSTMENT)

Before idle speed/ISC duty and adjustment, make sure to the following.

- Lead wires and hoses of Electronic Fuel Injection and engine emission control systems are connected securely.
- Accelerator cable has some play, that is, it is not tight.
- Ignition timing is within specification.
- All of electrical loads except ignition are switched off.
- Air-conditioner is OFF, if equipped.
- All of electrical loads except ignition are switched off.

After above items are all confirmed, check idle speed and ISC duty as follows.

NOTE:

Before starting engine, place transmission gear shift lever in "Neutral" (shift selector lever to "P" range for A/T model), and set parking brake and block drive wheels.

1. Warm up engine to normal operating temperature.
2. Set tachometer
3. Using service wire, ground "Diagnosis switch terminal" in monitor coupler so that ECM outputs ISC duty through "Duty output terminal" and make sure that "CHECK ENGINE" light indicate diagnostic code No. 12.

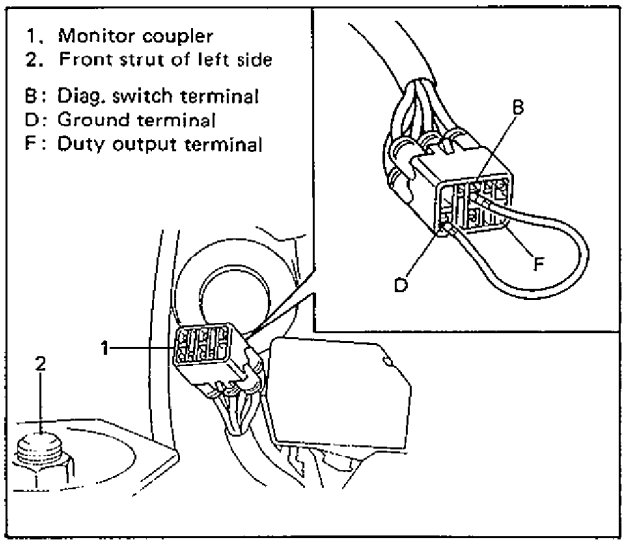


Fig. 6E-92 Grounding Diag. Switch Terminal

4. Connect duty meter between "Duty output terminal" and "Ground terminal" of monitor coupler.

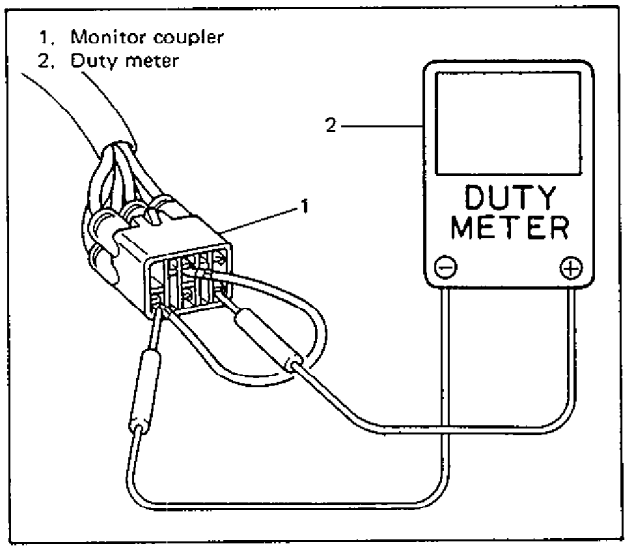


Fig. 6E-92-1 Connecting Duty Meter

5. Check to ensure that idle speed and ISC duty conform to specifications respectively. If ISC duty and/or idle speed is not within specified range, adjust it by turning idle speed adjusting screw.

	ENGINE IDLE SPEED	ISC DUTY AT SPECIFIED IDLE SPEED
M/T MODEL	800 ± 50 r/min	30 ± 5% (ON duty meter indication) or 4.2 ± 0.7V when battery voltage is 14V
A/T MODEL	850 ± 50 r/min	

NOTE:
ISC duty can be checked by using analog type voltmeter. ISC duty to voltage relation is as follows.

ON DUTY METER INDICATION (%)	OFF DUTY METER INDICATION (%)	VOLTMETER INDICATION (V)
0	100	0
25	75	0.25 x V_B
35	65	0.35 x 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.**

NOTE:
When using duty meter which indicates OFF duty, adjust so that it indicates 70%. Then ISC duty (ON duty) is adjusted to above specified value (30%).

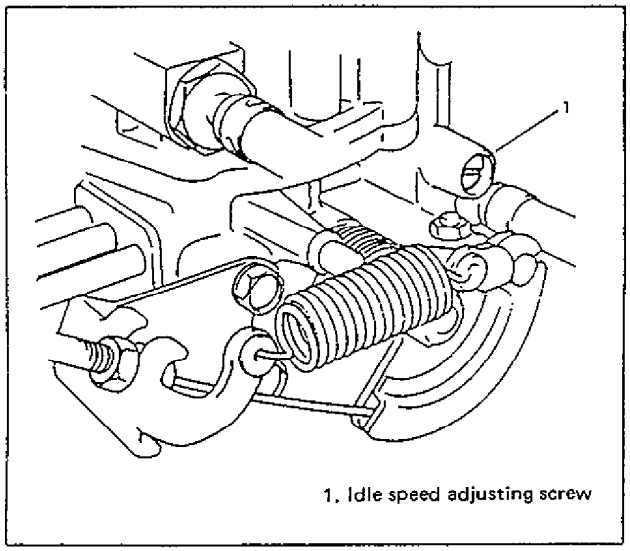


Fig. 6E-93 Idle Speed Adjusting Screw

6. Upon completion of adjustment, install adjusting screw cap to throttle body.
7. This step is for checking and/or adjusting engine idle speed and ISC duty when air-conditioner is working.
   With cars without air conditioner, advance to steps 8. With air-conditioner equipped ones, follow procedure described below.
   1) Turn air-conditioner switch ON and set heater blower switch to high (max.) speed position. Then check that air-conditioner is working.
   2) Check to ensure that idle speed and ISC duty conform to specifications respectively.

NOTE:
Specified values used for this inspection and adjustment vary depending on types of ECM as listed in tables below. Types of ECM can be identified by the last number of ECM part No.

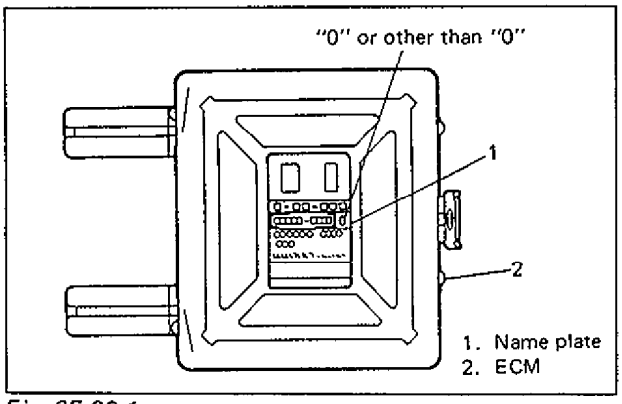


Fig. 6E-93-1

When ECM Part No. ends with "0"

	IDLE SPEED WITH A/C ON AND DIAG. SWITCH TERMINAL GROUNDED	ISC DUTY
M/T MODEL	800 ± 50 r/min	10 – 20%
A/T MODEL	850 ± 50 r/min	

When ECM Part No. ends with No. other than "0"

	IDLE SPEED WITH A/C ON AND DIAG. SWITCH TERMINAL GROUNDED	ISC DUTY
ALL MODELS	900 ± 50 r/min	20% (ON duty meter indication) or 2.8V when battery voltage is 14V

3) If idle speed and/or ISC duty is not within specified range, adjust it by turning adjusting screw of air-conditioner VSV.

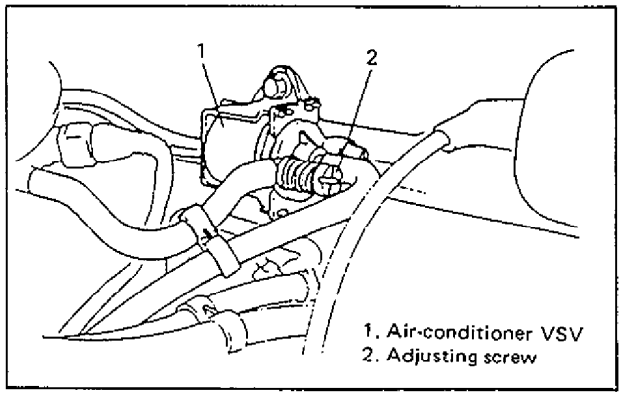


Fig. 6E-94 Adjusting Screw for Air-Con. VSV

8. Upon completion of adjustment, disconnect service wire from monitor coupler and install cap to monitor coupler.
9. Check that specified idle speed is obtained with A/C ON and "Diag. switch terminal" ungrounded. (Vehicle with A/C only)

	IDLE SPEED WITH A/C ON AND DIAG. SWITCH TERMINAL UNGROUNDED
ALL MODELS	900 ± 50 r/min

AIR AND FUEL DELIVERY SYSTEM

FUEL PRESSURE INSPECTION

1. Relieve fuel pressure according to procedure described in Section 6.
2. Separate air cleaner assembly from throttle body and shift its position.
3. Disconnect fuel feed hose from throttle body.

CAUTION:
A small amount of fuel may be released after fuel line is disconnected.
In order to reduce chance of personal injury, cover fitting to be disconnected with a shop cloth. Place that cloth in an approved container when disconnection is completed.

4. Connect special tool (fuel pressure gauge, hose & 3-way joint) between throttle body and fuel feed hose, and clamp hoses securely to ensure no leaks occur during checking.

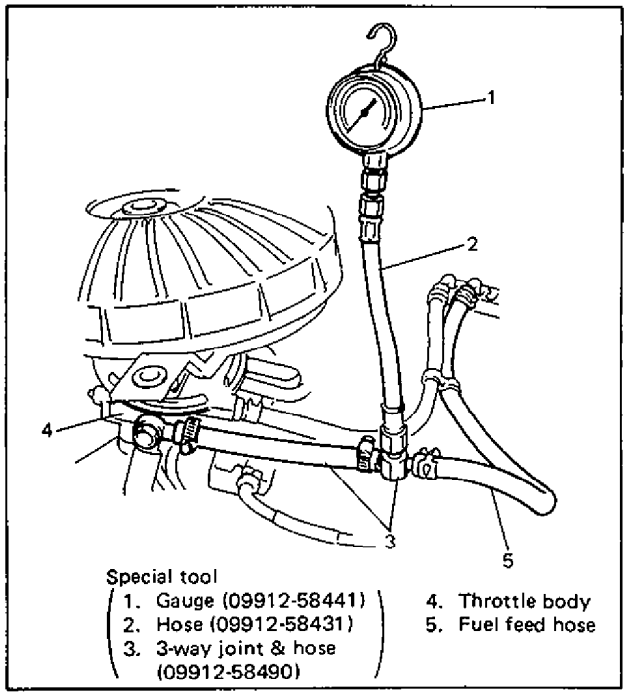


Fig. 6E-95 Connecting Fuel Pressure Gauge

5. Install air cleaner assembly to throttle body and cylinder head cover.
6. Start engine and warm it up to normal operating temperature.

   If engine doesn't start, operate fuel pump according to following procedure.

   1) Remove fuel pump relay from main fuse box after disconnecting its coupler and then reconnect coupler to fuel pump relay.

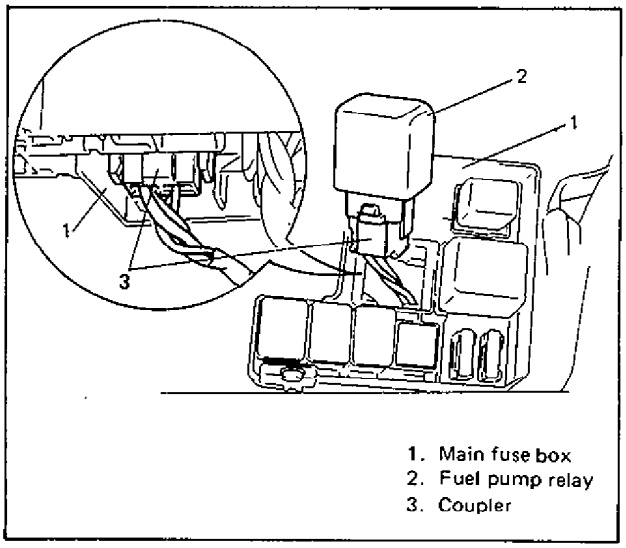


Fig. 6E-96 Removing Fuel Pump Relay

   2) To operate fuel pump, connect Pink and White/Blue wire terminals by using service wire and then turn ON ignition switch.

NOTE:
Check that battery voltage is 11V or more before operating fuel pump.

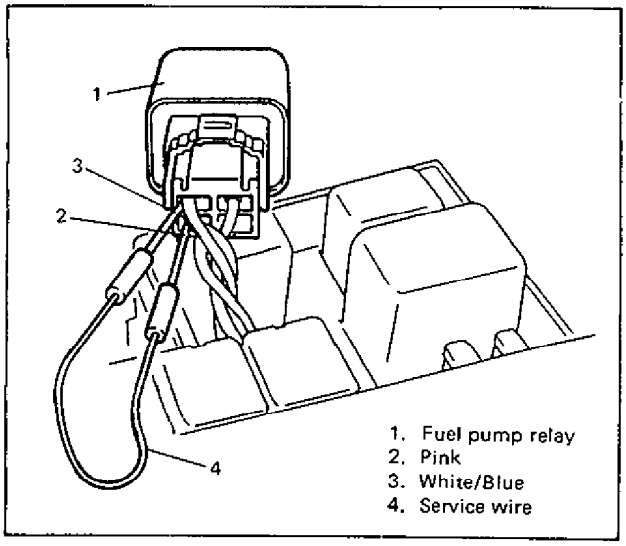


Fig. 6E-97 Operating Fuel Pump

7. Measure fuel pressure under each of the following conditions.

CONDITION	FUEL PRESSURE
At specified idle speed	0.9 – 1.4 kg/cm^2 90 – 140 kPa 12.8 – 20.0 psi
With fuel pump operating and engine at stop	1.6 – 2.1 kg/cm^2 160 – 210 kPa 22.7 – 29.9 psi
Within 1 min. after engine (fuel pump) stop (Pressure reduces as time passes)	Over 0.9 kg/cm^2 90 kPa 12.8 psi

If measured pressure doesn't satisfy specification, refer to "Diagnostic Flow Chart B-3" and check each possibly defective part. Replace if found defective.

8. Relieve fuel pressure according to procedure described in Section 6.
9. Remove fuel pressure gauge, hose & 3-way joint after removing air cleaner assembly.
10. Connect fuel feed hose to throttle body and clamp it securely.
11. Install air cleaner assembly.
12. With engine "OFF" and ignition switch "ON", check for fuel leaks.

FUEL PUMP

Fuel Pump On-Car Inspection

WARNING:
When fuel filler cap is removed in any procedure, work must be done with no smoking, in a well-ventilated area and away from any open flames.

1. Remove filler cap and turn ON ignition switch. Then fuel pump operating sound should be heard from fuel filler for about 2 seconds and stop. Be sure to reinstall fuel filler cap after checking.

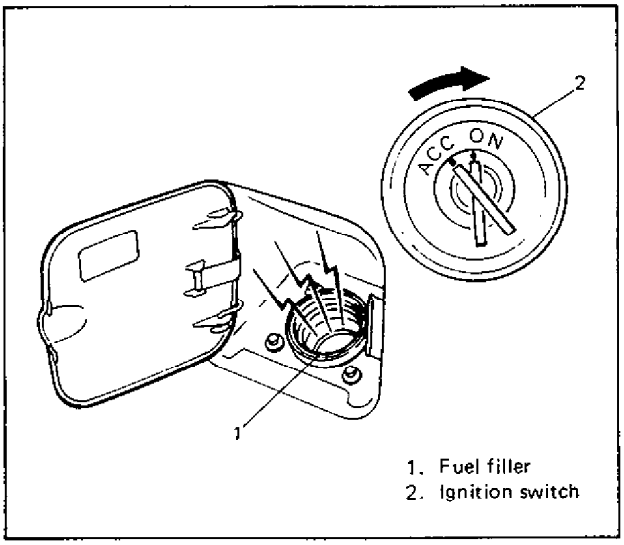


Fig. 6E-98 Checking Fuel Pump

If above check result is not satisfactory, advance to "Diagnostic Flow Chart B-2".

Removal

1. Remove fuel tank from body according to procedure described in section 6C and remove fuel pump & level gauge from fuel tank.

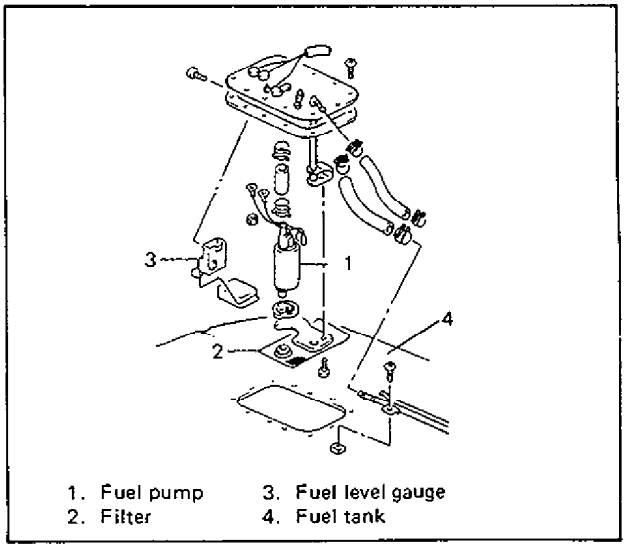


Fig. 6E-99 Removing Fuel Pump & Level Gauge

2. Remove fuel pump from its bracket.

Inspection

Check fuel pump filter for evidence of dirt and contamination. If present, clean and check for presence of dirt in fuel tank.

Installation

1. Install fuel pump to its bracket.
2. Install fuel pump & level gauge to fuel tank and then install fuel tank to body according to procedure described in section 6C.

THROTTLE BODY

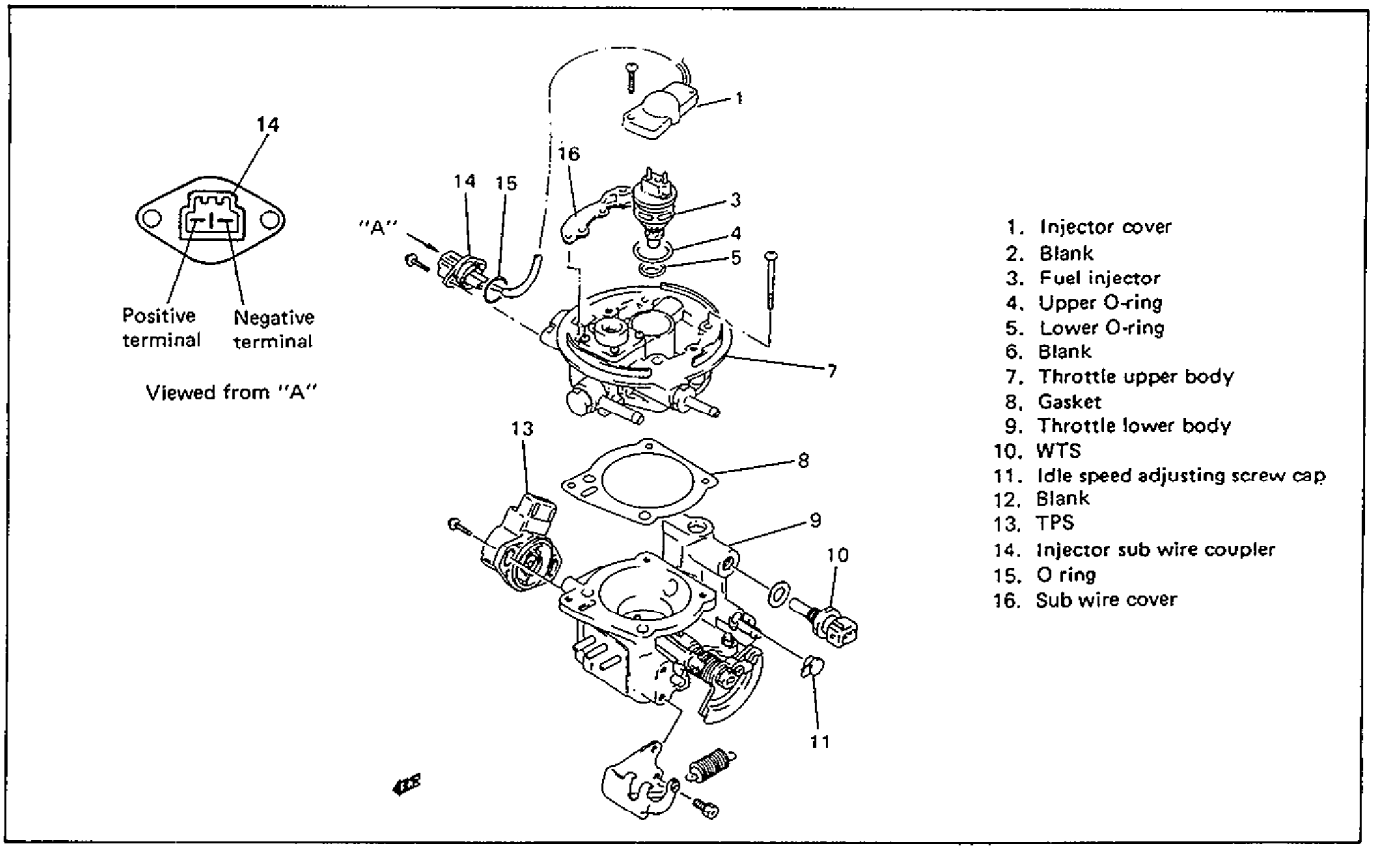


Fig. 6E-100 Throttle Body Parts Identification

On-Car Inspection

- Check that throttle valve lever moves smoothly.
- Vacuum passage inspection.
  With fingers placed against vacuum nozzles (2 pcs), increase engine speed a little and check that vacuum is applied.

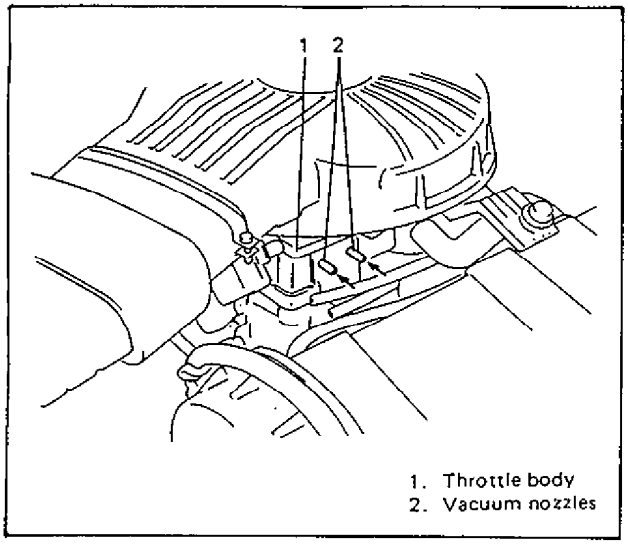


Fig. 6E-101 Checking Vacuum Passage

Removal

1. Relieve fuel pressure according to procedure described in Section 6.
2. Disconnect battery negative cable at battery.
3. Remove air cleaner assembly referring to section 6A.
4. Drain cooling system.
5. Disconnect following wire harness couplers:
   - TPS
   - Fuel injector
   - WTS
6. Disconnect following hoses from throttle body.
   - Fuel feed and return hoses
   - Engine cooling water hoses
   - Vacuum hoses
7. Disconnect accelerator cable from throttle valve lever and cable bracket.

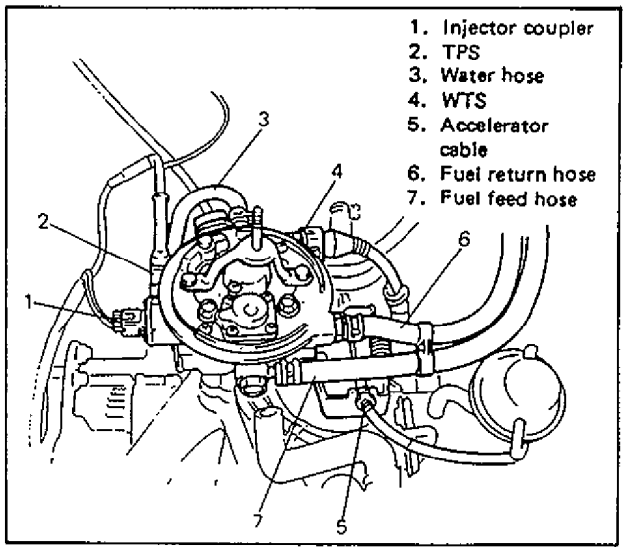


Fig. 6E-102 Disconnecting Couplers and Hoses

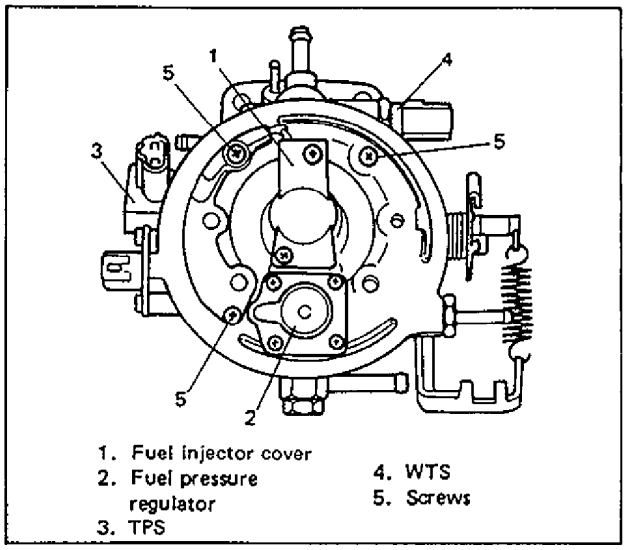


Fig. 6E-103 Disassembling Throttle Body

8. Remove throttle body from intake manifold.

Disassembly

NOTE:

- **Be sure not to remove either fuel pressure regulator or air valve from throttle body. They are factory adjusted precisely.**
- **Be sure to replace gaskets and O rings as well as worn or damaged parts.**
- **While disassembling and assembling throttle body, use special care not to deform levers on throttle valve shaft or cause damage to any other parts.**

1. Remove fuel injector from throttle body according to procedure described on p. 6E-79.
2. Remove TPS.
3. Remove WTS.
4. After removing screws, separate upper and lower bodies.

Cleaning

Clean below passages and fuel injector chamber by blowing compressed air.

NOTE:

- **TPS, fuel pressure regulator, fuel injector, air valve, WTS, other components containing rubber (resin) or throttle valve shaft seal must not be placed in a solvent or cleaner bath. Chemical reaction will cause these parts to swell, harden or get distorted.**
- **Don't put drills or wires into passages for cleaning. It causes damage in passages.**

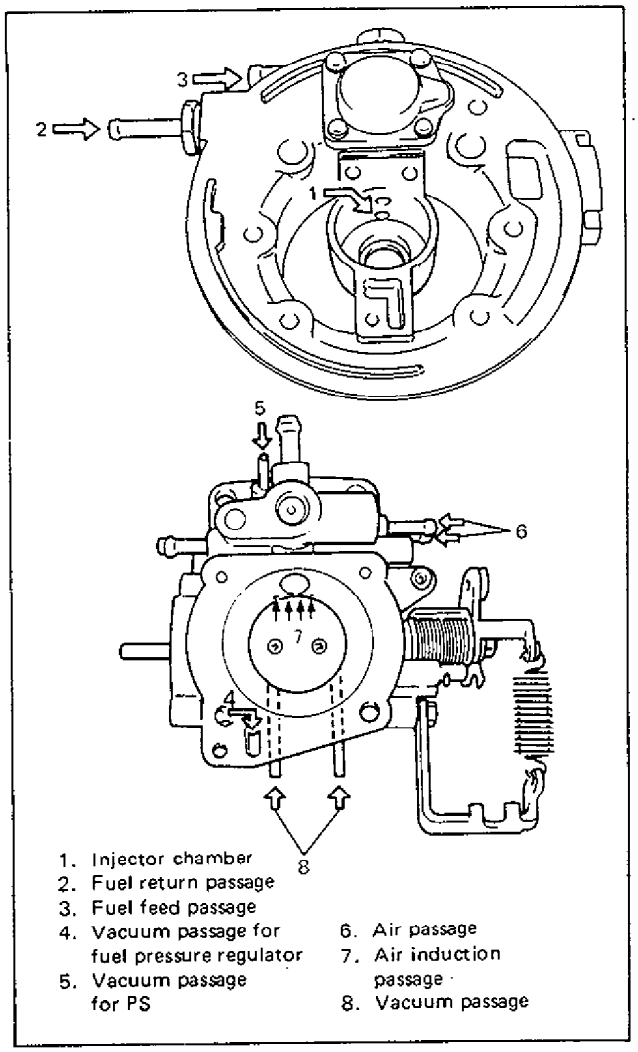


Fig. 6E-104 Cleaning Passage

Assembly

1. Install new gasket to lower body.

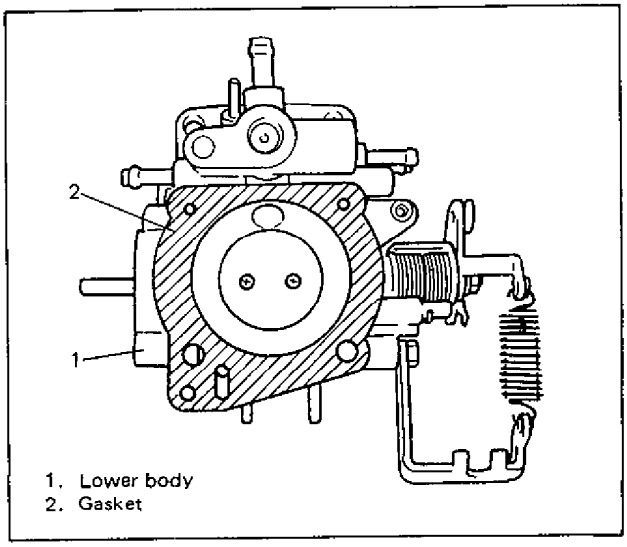


Fig. 6E-105 Installing Gasket

2. Install upper body on gasket, using care not to cause gasket to slip out of place.
3. Make sure to fit sub wire harness to grooves of throttle body and sub wire coupler and install sub wire cover to throttle body. Tighten screws to specified torque.

Tightening torque of screw	N·m	kg-m	lb-ft
	2.9–4.1	0.29–0.41	2.1 – 2.9

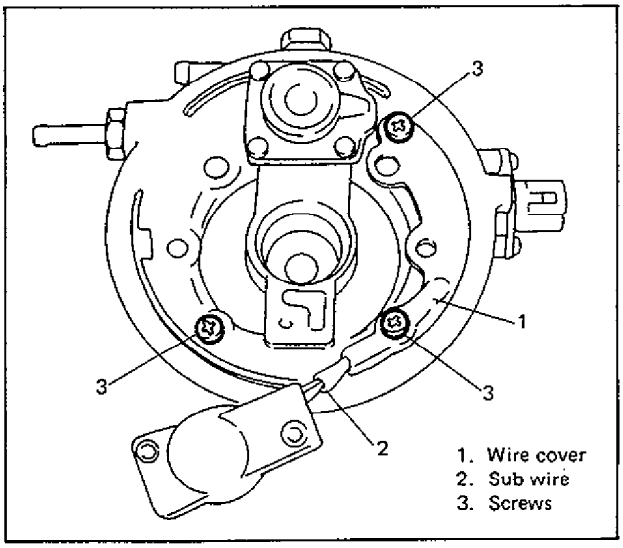


Fig. 6E-106 Clamping Sub Wire

4. Install WTS according to procedure described on p. 6E-84.
5. Install TPS according to procedure described on p. 6E-82.
6. Install fuel injector according to procedure described on p. 6E-79.

Installation

1. Clean mating surfaces and install throttle body gasket to intake manifold. Use new gasket.

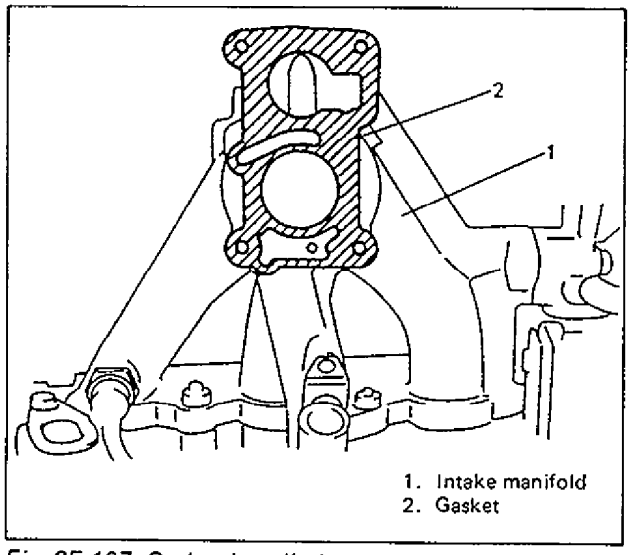


Fig. 6E-107 Gasket Installation

2. Install throttle body to intake manifold and tighten bolts and nuts to specified torque.

Tightening torque for throttle body bolts & nuts	N·m	kg-m	lb-ft
	18 – 28	1.8 – 2.8	13.0 – 20.0

3. Install accelerator cable to throttle valve lever and cable bracket.
   Adjust cable play to specification according to procedure described on p. 6E-69.
4. Connect fuel, cooling water and vacuum hoses to throttle body, and clamp securely.
5. Connect TPS injector and WTS coupler securely.
6. Refill cooling system referring to section 6B.
7. Connect negative cable at battery.
8. With engine "OFF" and ignition switch "ON", check for fuel leaks around fuel line connection.
9. Install air cleaner assembly referring to section 6A.
10. Upon completion of installation, start engine and check for fuel leaks and engine cooling water leaks.

AIR VALVE

Inspection

1. Remove throttle body assembly from intake manifold as previously outlined.
2. Separate upper and lower bodies.
3. Remove WTS from lower body.
4. Immerse air valve of throttle body in water as shown below. Check visually that air valve closes gradually as water temperature rises and closes fully at higher than about 80°C, 176°F.

NOTE:

- **Be very careful to prevent water from entering throttle body bore.**
- **Be very careful never to put throttle body parts except air valve thermo wax in water or expose them to water splash.**

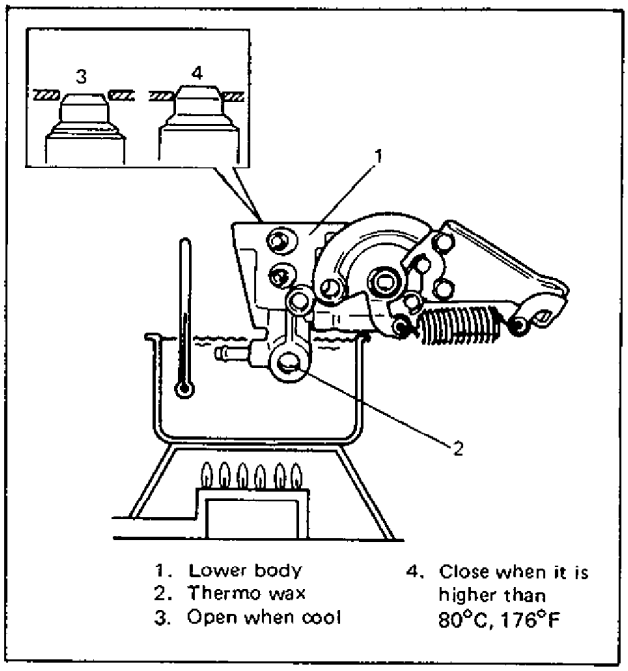


Fig. 6E-108 Inspection Air Valve

If check result is not satisfactory, replace.

5. Install WTS according to procedure described on p. 6E-84.
6. Put upper and lower bodies together and tighten its screws to specified torque.
   Use new gasket between lower and upper bodies.
7. Install throttle body assembly to intake manifold as previously outlined.

FUEL INJECTOR

On-Car Inspection

1. With battery negative cable disconnected, disconnect injector coupler.
2. Connect ohmmeter to each injector terminal and measure resistance.

Resistance of injector	0.5 – 1.5 Ω at 20°C (68°F)

If resistance is out of specification, replace fuel injector.

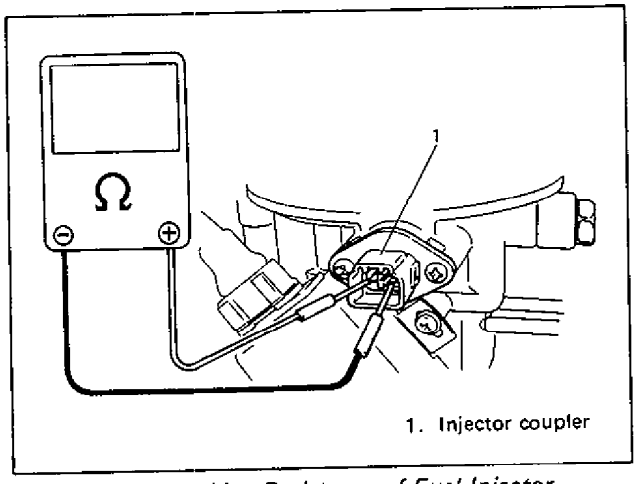


Fig. 6E-109 Checking Resistance of Fuel Injector

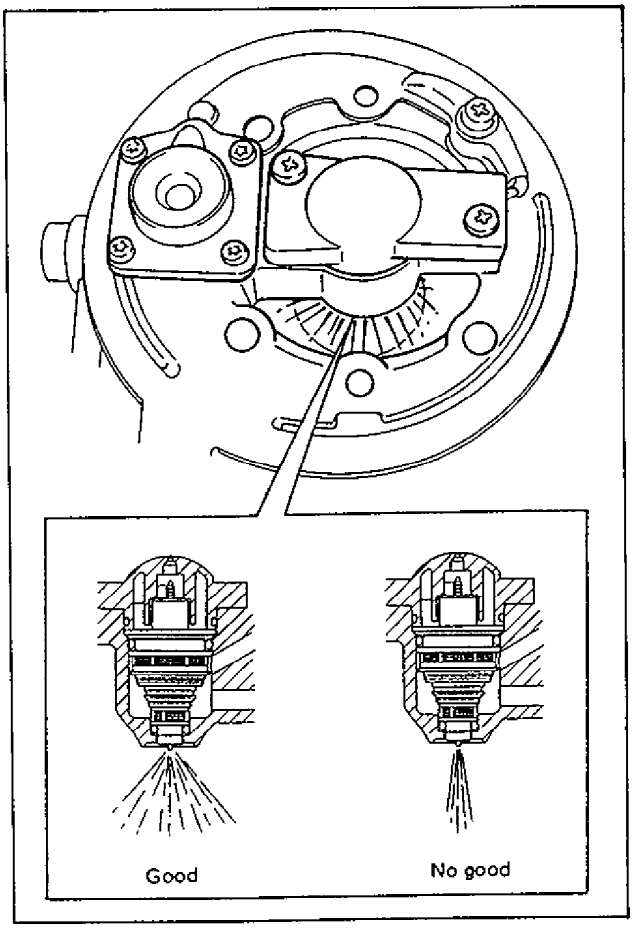


Fig. 6E-110 Checking Fuel Injection

3. Connect injector coupler.
4. Remove air cleaner assembly without disconnecting ATS coupler.
5. Check that fuel is injected out in conical shape from fuel injector when cranking or running engine.

   If no fuel is injected, check wiring harness for continuity and couplers for proper connection referring to "Diagnostic Flow Chart B-1".

   If fuel is not injected out in conical shape, replace injector.
6. Check injector for fuel leakage after injection is stopped (i.e., after cranking or engine stop). Replace if leakage exists.

Fuel leakage	Less than 1 drop/min.

7. Install air cleaner assembly.

Removal

NOTE:
Use care when handling fuel injector especially not to damage filter and its needle.
Also, because injector is an electrical component, it should not be immersed in any type of liquid solvent or cleaner, or it may get damaged.

1. Relieve fuel pressure according to procedure described in Section 6.
2. Disconnect battery negative cable at battery.
3. Remove air cleaner assembly referring to section 6A.
4. Remove air cleaner mounting stay for throttle body.
5. Remove injector cover and then remove fuel injector from throttle body.

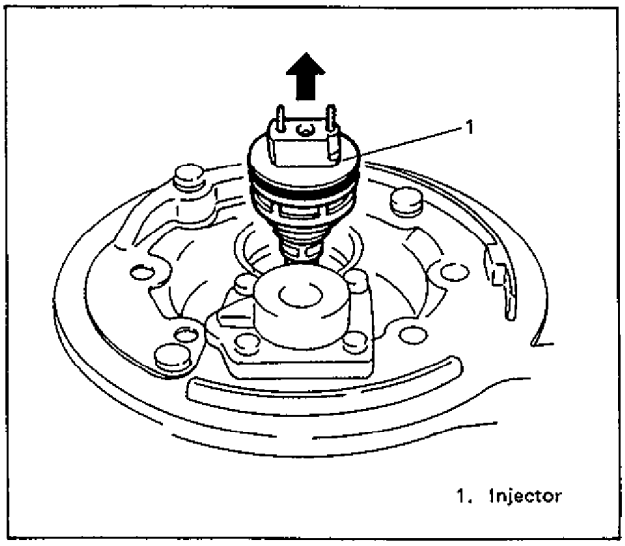


Fig. 6E-111 Checking Fuel Injection

Inspection

Check fuel injector filter for evidence of dirt and contamination. If present, clean and check for presence of dirt in fuel lines and fuel tank.

Installation

1. Apply thin coat of spindle oil or gasoline to new upper and lower O-rings, install lower O-ring to injector cavity and upper O-ring to injector.

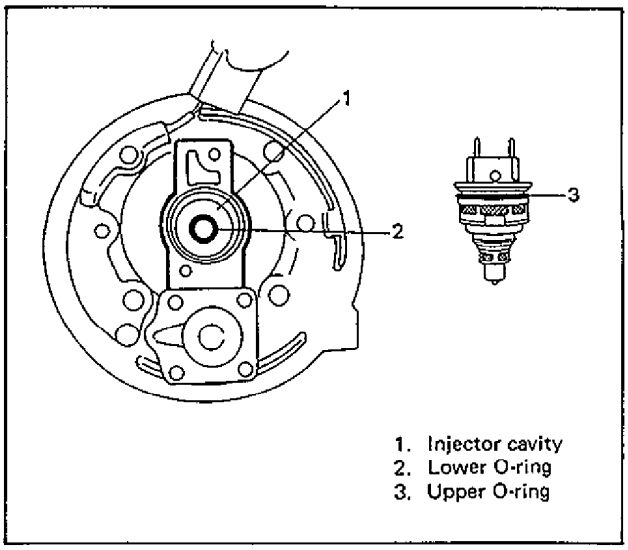


Fig. 6E-112 Installing O-rings and Insulator

2. Install injector by pushing it straight into fuel injector cavity.
   Never turn injector while pushing it.

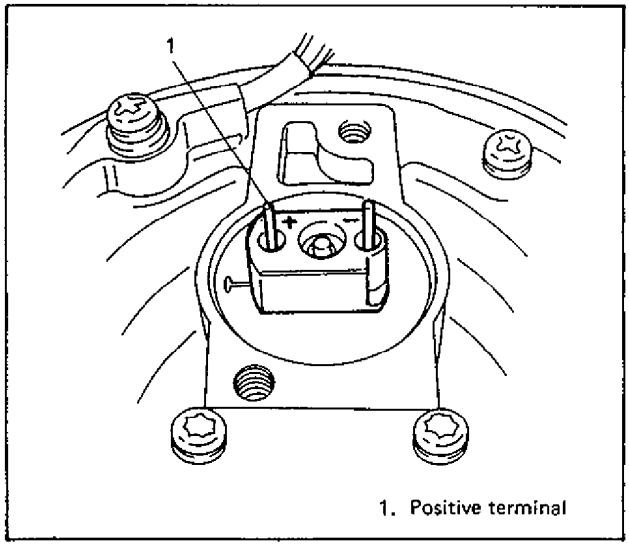


Fig. 6E-113 Installing Fuel Injector

3. Make sure that injector cover O-ring is free from any damage and deterioration, and apply thin coat of spindle oil or gasoline to O-ring. Install injector cover and tighten cover screw to specified torque.

Tightening torque for injector cover screw	N·m	kg-m	lb-ft
	2.9 – 4.1	0.29–0.41	2.1 – 2.9

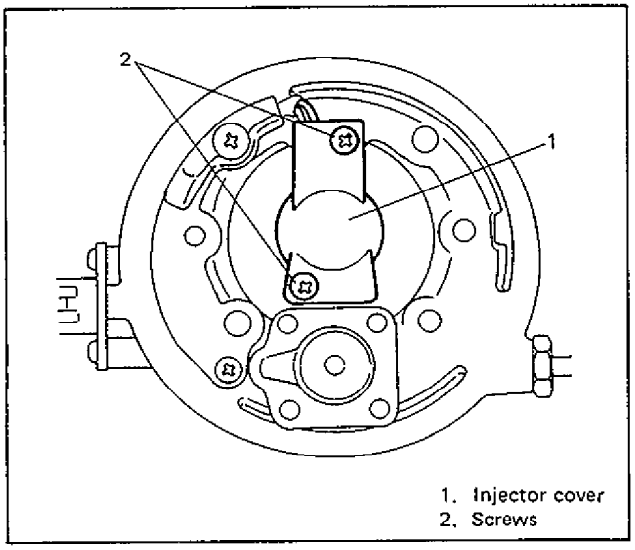


Fig. 6E-114 Installing Cover

4. Connect battery negative cable at battery.
5. With engine "OFF" and ignition switch "ON", check for fuel leaks.
6. Install air cleaner mounting stay as shown below.

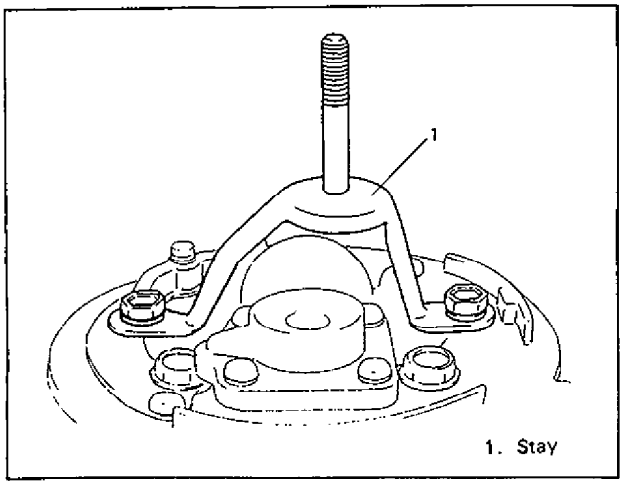


Fig. 6E-115 Installing Stay

7. Install air cleaner assembly referring to section 6A.

ELECTRONIC CONTROL SYSTEM

ELECTRONIC CONTROL MODULE (ECM)

CAUTION:
As ECM consists of precision parts, be careful not to expose it to excessive shock.

Removal

1. Disconnect battery negative cable at battery.
2. Lower junction/fuse block after removing its bolts.
3. Disconnect couplers from ECM while releasing coupler lock.
4. Remove ECM from body.

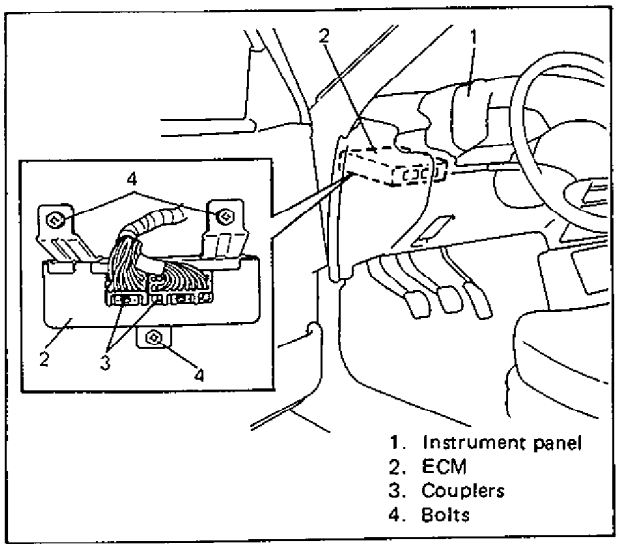


Fig. 6E-116 Removing ECM

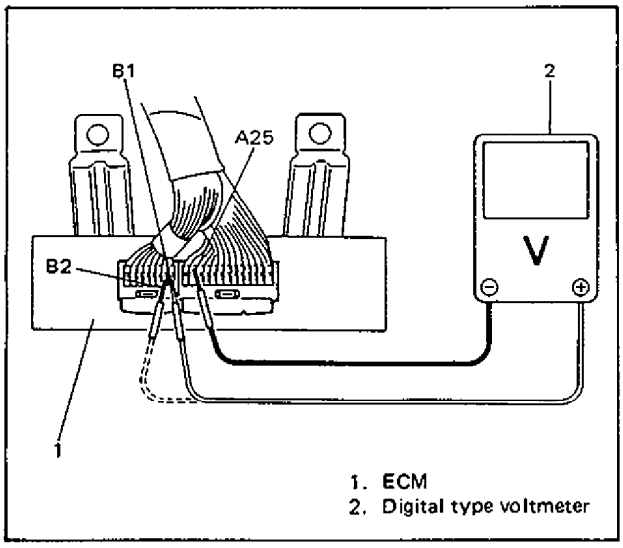
Installation

1. Install ECM to body.
2. Connect couplers to ECM securely.
3. Fix junction/fuse block with bolts.
4. Connect battery negative cable at battery.

PRESSURE SENSOR (PS)

Output Voltage Check

1. Remove ECM according to previously outlined.
2. Connect couplers to ECM securely.
3. With coupler connected to ECM, connect digital type voltmeter as shown below and check that ECM supply voltage 4.75 – 5.25V is applied to coupler terminal B1.
4. Check output voltage at coupler terminal B2. Note that it varies with atmospheric pressure and altitude.
   Also, start engine, if it can, and check if output voltage varies.



1. ECM
2. Digital type voltmeter

Fig. 6E-117 Checking PS and Its Circuit

Output voltage (ECM supply voltage 4.75 – 5.25V, ambient temp. 10 – 40°C, 50 – 104°F)

ALTITUDE (Referance)		BAROMETRIC PRESSURE	OUTPUT VOLTAGE
(ft)	(m)	(mmHg)	(V)
0	0	760	3.5 – 4.1
1 000	305	733	3.4 – 4.0
2 000	610	707	3.2 – 3.8
3 000	914	682	3.1 – 3.7
4 000	1 219	658	3.0 – 3.6
5 000	1 524	634	2.9 – 3.5
6 000	1 829	611	2.8 – 3.3
7 000	2 133	589	2.7 – 3.2
8 000	2 438	567	2.6 – 3.1
9 000	2 743	546	2.5 – 3.0
10 000	3 048	526	2.4 – 2.9

NOTE:

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

If check result is not satisfactory in previous step 3 or 4, check PS and its circuit according to Diagnostic Flow Chart for Code No. 31.

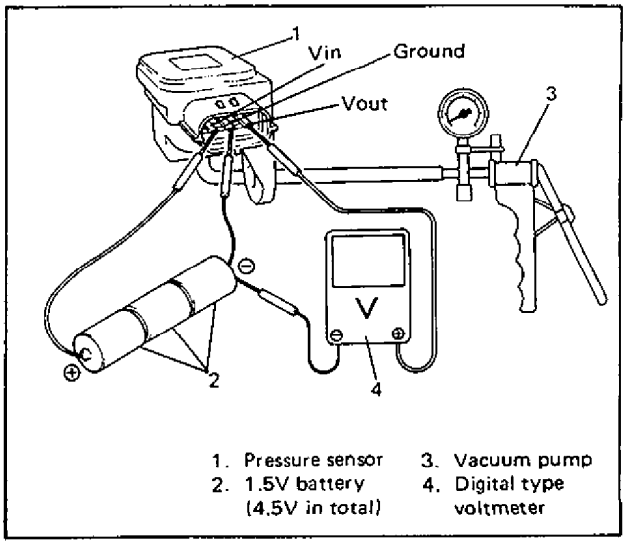
NOTE:

If output voltage does not vary when engine is started, it is possible that vacuum hose and/or filter are clogged. Clean them.
Another possibility is that filter in PS is clogged from freezing. If it is suspected, leave it at room temperature (20°C, 68°F) for a while and recheck.

5. Upon completion of checking, install ECM and connect ECM coupler securely.

PS Individual Check

1. Disconnect PS vacuum hose from filter.
2. Disconnect coupler from PS.
3. Remove PS.
4. Arrange 3 new 1.5V batteries in series (check that total voltage is 4.5 – 5.0V) and connect its positive terminal to "Vin" terminal of sensor and negative terminal to "Ground" terminal. Then check voltage between "Vout" and "Ground".
   Also, check if voltage reduces when vacuum is applied up to 40 cmHg by using vacuum pump.



1. Pressure sensor
2. 1.5V battery (4.5V in total)
3. Vacuum pump
4. Digital type voltmeter

Fig. 6E-118 Checking PS

Output voltage (Vin voltage 4.5 – 5.0V, abmient temp. 20 – 30°C, 68 – 86° F)

ALTITUDE (Reference)		BAROMETRIC PRESSURE	OUTPUT VOLTAGE
(ft)	(m)	(mmHg)	(V)
0 – 2 000	0 – 610	760 – 707	2.9 – 4.2
2 001 – 5 000	611 – 1 524	Under 707 over 634	2.7 – 4.0
5 001 – 8 000	1 525 – 2 438	Under 634 over 567	2.5 – 3.8
8 001 – 10 000	2 439 – 3 048	Under 567 over 526	2.0 – 3.3

If check result is not satisfactory, replace PS.

5. Install PS and connect vacuum hose securely.
6. Connect PS coupler securely.

THROTTLE POSITION SENSOR (TPS)

Inspection

1. Disconnect negative cable at battery.
2. Remove air cleaner assembly referring to section 6A.
3. Disconnect coupler from TPS.
4. Using ohmmeter, check resistance between terminals under each condition given in below table.

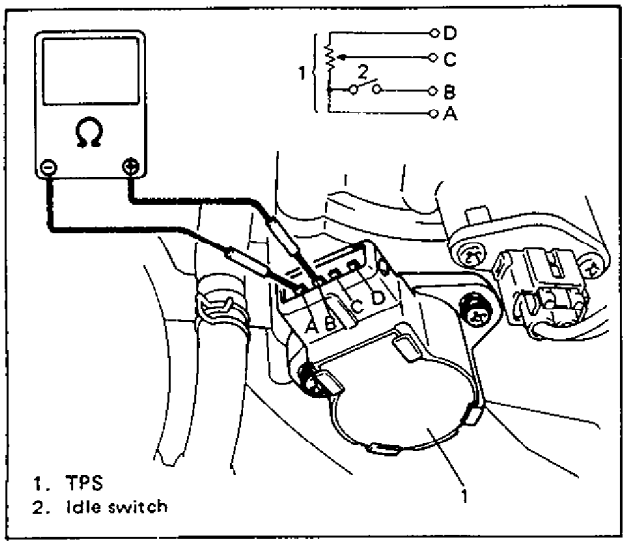


Fig. 6E-126 Checking TPS

TERMINALS	CONDITION	RESISTANCE
Between A and B terminals (Idle switch)	When throttle lever-to-stop screw clearance is 0.3 mm (0.012 in.)	0 – 5 kΩ
	When throttle lever-to-stop screw clearance is 0.9 mm (0.035 in.)	∞
Between A and D terminals	——	4.37 – 8.13 kΩ
Between A and C terminals	Throttle valve is at idle position	0.20 – 11.42 kΩ
	Throttle valve is fully opened	3.03 – 17.08 kΩ
The resistance between A and C should increase as throttle valve opens larger.		

If idle switch check result is not satisfactory, adjust installation angle of TPS and if found defective in the other check, replace TPS.

5. Connect TPS coupler securely.
6. Install air cleaner assembly referring to section 6A.
7. Connect battery negative cable to battery.

Adjustment

1. Disconnect battery negative cable, remove air cleaner assembly and disconnect TPS coupler.
2. Insert 0.6 mm (0.024 in) thickness gauge between throttle stop screw and throttle lever.

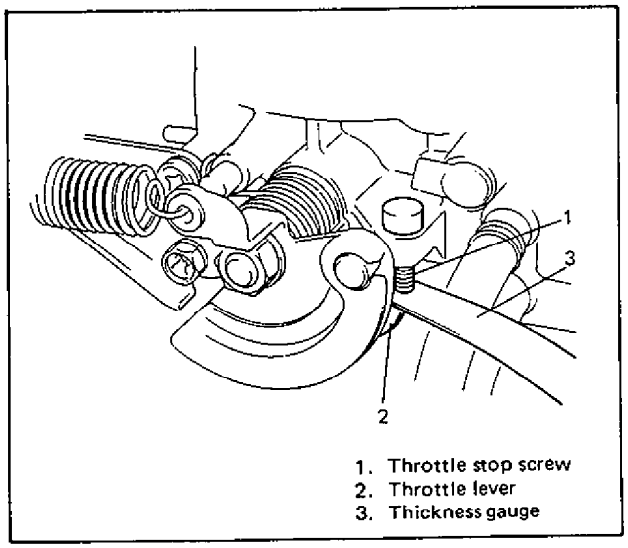


Fig. 6E-127 Inserting Thickness Gauge

3. Loosen TPS screws.
4. Connect ohmmeter between A and B terminals.
5. First, turn TPS counterclockwise fully and then clockwise gradually to find position where ohmmeter reading changes from 0 (zero, continuity) to ∞ (no continuity).
   Then fix TPS at that position by tightening screws to specified torque.

Tightening torque of TPS screw	N·m	kg-m	lb-ft
	1.6 – 2.4	0.16–0.24	1.2 – 1.7

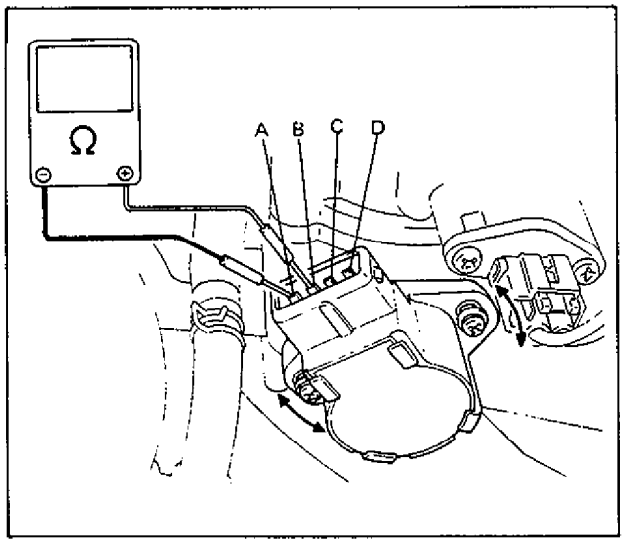


Fig. 6E-128 Adjusting Installation Angle

6. Check that there is no continuity between terminals A and B when 0.9 mm (0.035 in) thickness gauge is inserted.
7. Check that there is continuity between terminals A and B when 0.3 mm (0.012 in) thickness gauge is inserted.

   If check result is unsatisfactory in steps 6 and 7, it means that installation angle of TPS 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.

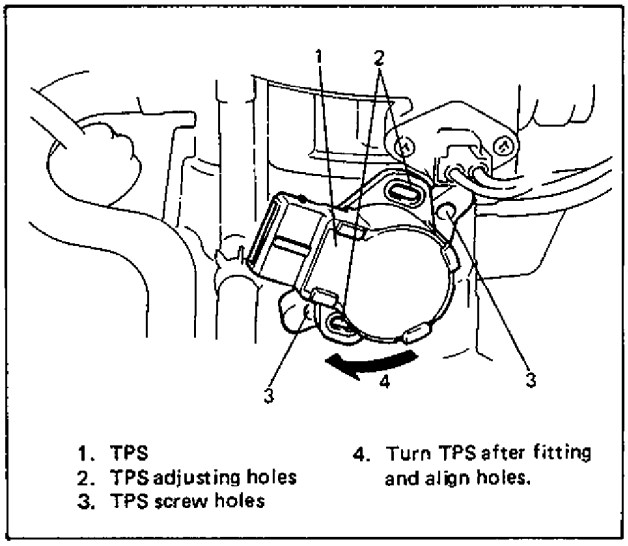
8. Connect coupler to TPS securely, install air cleaner assembly and connect battery negative cable.

Removal

1. Disconnect battery negative cable at battery.
2. Remove air cleaner assembly referring to section 6A.
3. Disconnect coupler from TPS.
4. Remove TPS from throttle body.

Installation

1. Install TPS to throttle body.
   Fit TPS to throttle body in such way that its adjusting holes are a little away from TPS screw holes as shown in Fig. 6E-129 and turn TPS clockwise so that those holes align.
   Then hand-tighten TPS screws.



1. TPS
2. TPS adjusting holes
3. TPS screw holes
4. Turn TPS after fitting and align holes.

Fig. 6E-129 Installing TPS

2. Adjust installation angle of TPS according to procedure described in item "Adjustment".
3. Connect coupler to TPS securely.
4. Install air cleaner assembly referring to section 6A.
5. Connect battery negative cable to battery.

AIR TEMPERATURE SENSOR (ATS)

Removal

1. Disconnect battery negative cable at battery.
2. Disconnect coupler from ATS.
3. Remove ATS and gasket from air cleaner case.

Inspection

Immerse temperature sensing part of ATS 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 Fig. 6E-131, replace ATS.

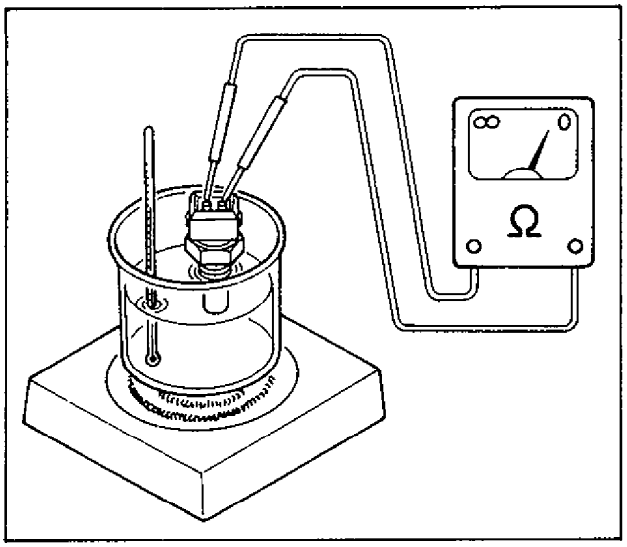


Fig. 6E-130 Checking ATS

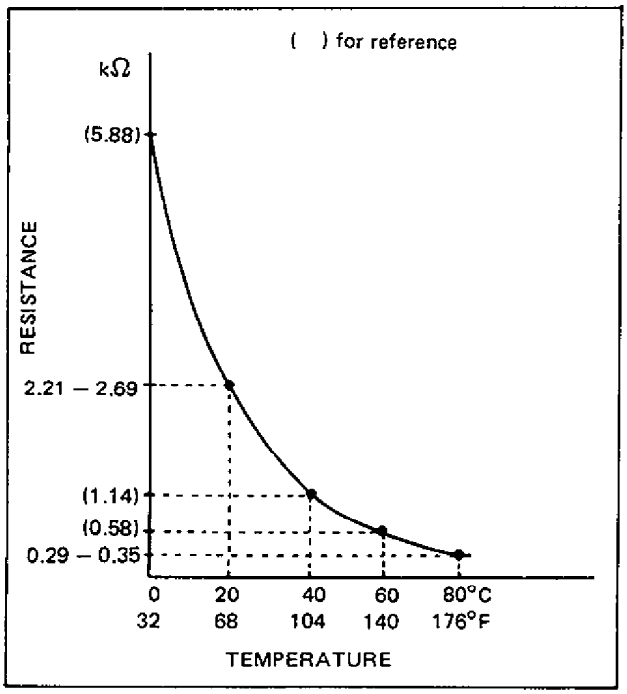


Fig. 6E-131 ATS and WTS Characteristic

Installation

Reverse removal procedure noting the following.

- Clean mating surfaces of ATS and air cleaner case.
- Tighten ATS to specified torque.

Tightening torque for ATS	N·m	kg-m	lb-ft
	13 – 17	1.3 – 1.7	9.5 – 12.0

- Connect ATS coupler securely.

WATER TEMPERATURE SENSOR (WTS)

Removal

1. Disconnect battery negative cable at battery.
2. Remove air cleaner assembly referring to section 6A.
3. Remove radiator cap to relieve engine cooling water pressure and install 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.

4. Disconnect coupler from WTS.
5. Remove WTS and gasket from throttle body.

NOTE:
Cooling water, although small amount, may be released then. Cover WTS with shop cloth so that released water is absorbed on it.

Inspection

Check resistance of WTS variable with temperature by using the same checking method as ATS.
For WTS characteristic, refer to Fig. 6E-131.
If found defective, replace.

Installation

Reverse removal procedure noting the following.

- Clean mating surfaces of WTS and throttle body.
- Check gasket for damage and replace if necessary.

- Tighten WTS to specified torque.

Tightening torque for WTS	N-m	kg-m	lb-ft
	20 – 30	2.0 – 3.0	14.5 – 21.5

- Connect coupler to WTS securely.

OXYGEN SENSOR

Removal

WARNING:
To avoid danger of being burned, do not touch exhaust system when system is hot. Oxygen sensor removal should be performed when system is cool.

1. Disconnect negative cable from battery.
2. Disconnect coupler of oxygen sensor and release its wire harness from clamps.
3. Remove oxygen sensor from exhaust manifold.

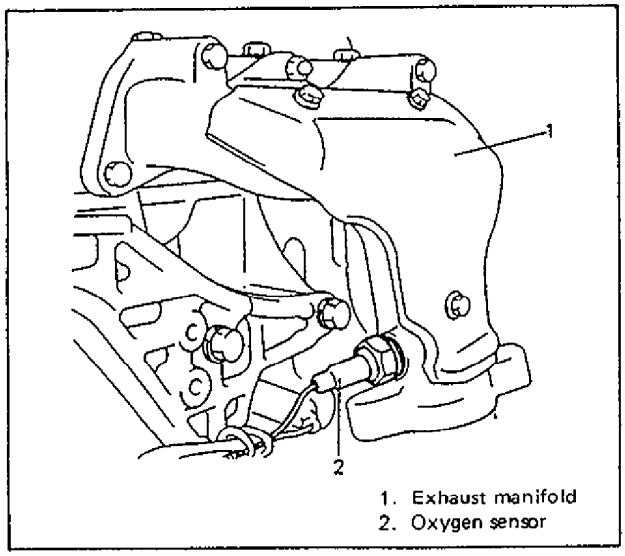


Fig. 6E-132 Removing Oxygen Sensor

Installtion

Reverse removal procedure noting the following.

- Tighten oxygen sensor to specified torque.

Tightening torque for oxygen sonsor	N-m	kg-m	lb-ft
	45 – 55	4.5 – 5.5	33.0 – 39.5

- Connect coupler of oxygen sensor and clamp wire harness securely.
- After installing oxygen sensor, start engine and check that no exhaust gas leakage exists.

VEHICLE SPEED SENSOR

Inspection

1. Disconnect negative cable at battery.
2. Remove combination meter from instrument panel.
3. Connect ohmmeter between "VSS" terminal and "GND" terminal of combination meter and turn cable joint of speedometer with a screwdriver. Ohmmeter indicator should move back and forth between 0 (zero) and ∞ (infinity) 4 times while cable joint is turned one full revolution.

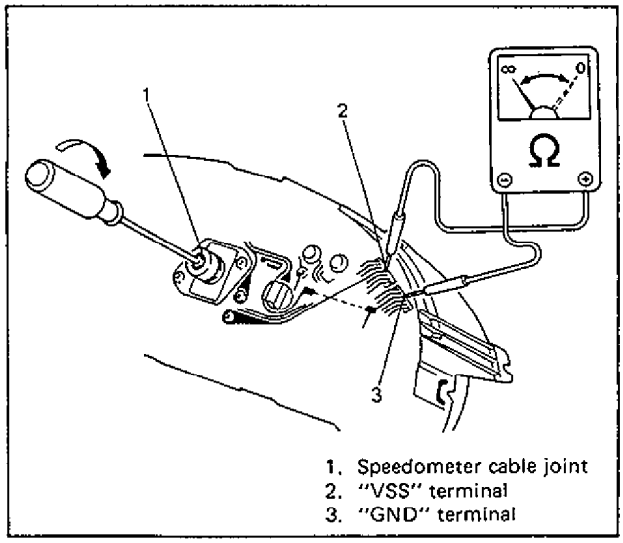


Fig. 6E-133 Checking Speed Sensor

Replace speedometer if check result is not satisfactory.

4. Install combination meter to instrument panel.
5. Connect negative cable to battery.

MAIN RELAY

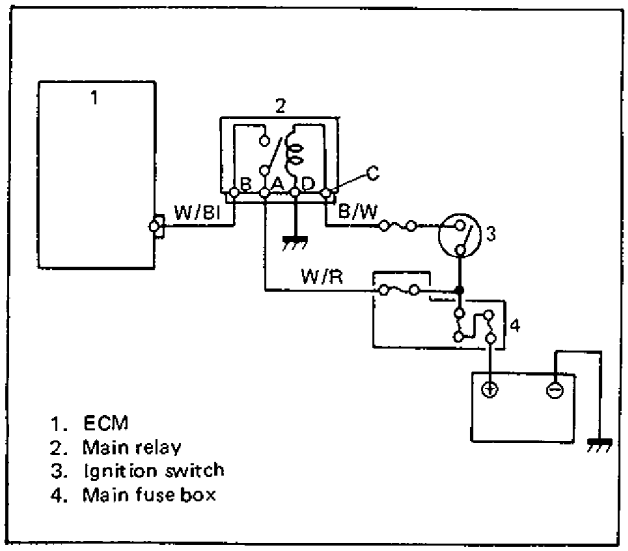


Fig. 6E-134 Main Relay Circuit

Inspection

1. Disconnect negative cable at battery.
2. Remove main relay from main fuse box after disconnecting its coupler.

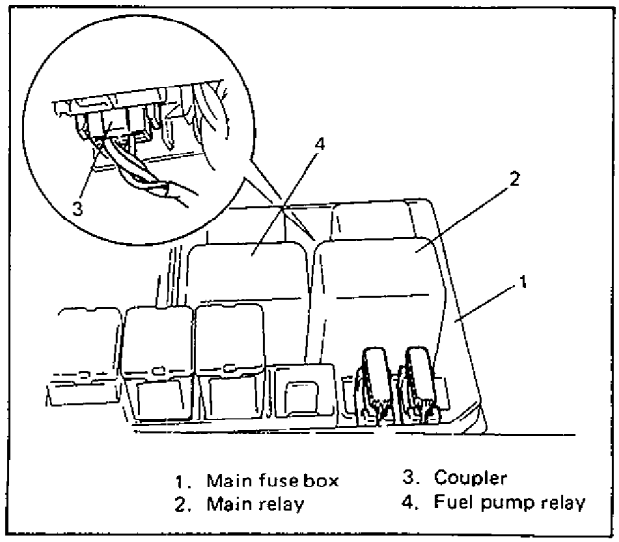


Fig. 6E-135 Removing Main Relay

3. Check resistance between each two terminals as in table below.

   If check results are as specified, proceed to next operation check. If not, replace.

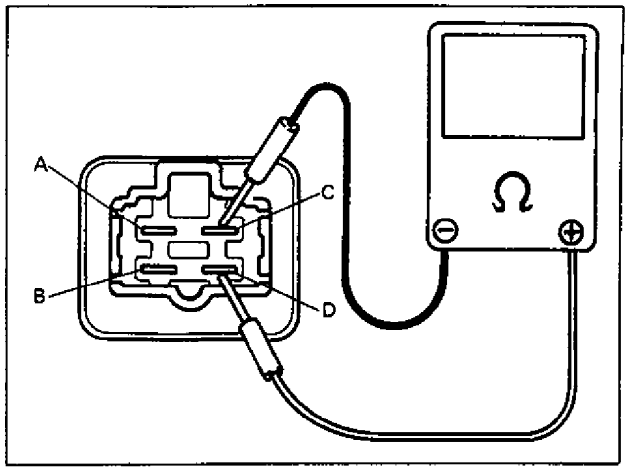


Fig. 6E-136 Checking Main Relay Resistance

TERMINALS	RESISTANCE
Between A and B	∞ (infinity)
Between C and D	56 – 84 Ω

4. Check that there is continuity between terminals "A" and "B" when battery is connected to terminals "C" and "D".

   If found defective, replace.

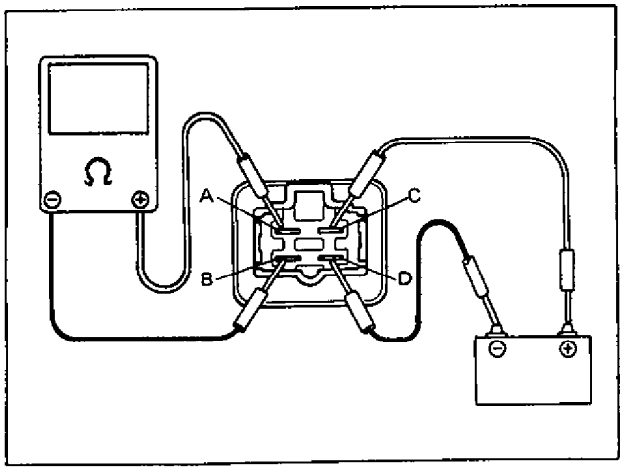


Fig. 6E-137 Checking Main Relay Operation

FUEL PUMP RELAY

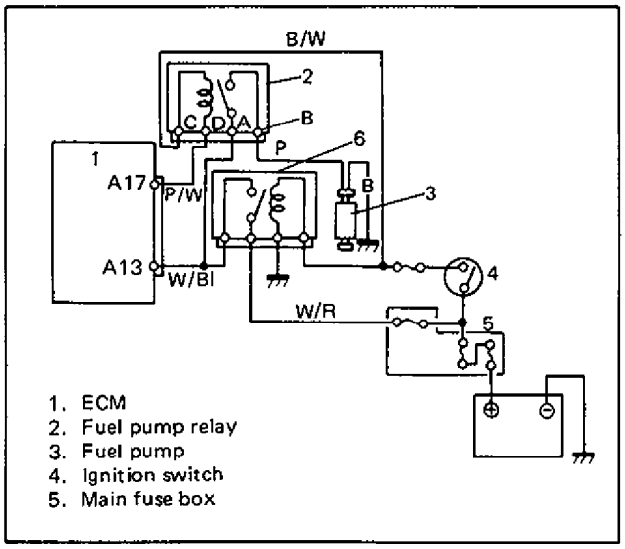


Fig. 6E-138 Fuel Pump Circuit

Inspection

1. Remove fuel pump relay in the same way as main relay.
2. Structure of fuel pump relay is the same as that of main relay. Check its resistance and operation using the same procedure as that for main relay.
   If found defective, replace.

FUEL INJECTOR RESISTOR

Inspection

1. With ignition switch OFF, disconnect resistor coupler.
2. Check resistor for resistance.

Resistance of fuel injector resistor	1.9 — 2.1 Ω

If check result is not satisfied, replace.

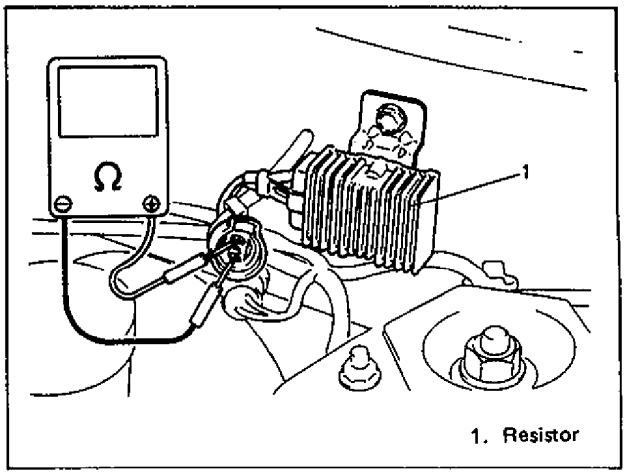


Fig. 6E-139 Checking Resistor

FUEL CUT OPERATION

Inspection

NOTE:
Before inspection, check to make sure that gear shift lever is in neutral position (with A/T model, selector lever in "P" range), A/C is OFF and that parking brake lever is pulled all the way up.

1. Warm up engine to normal operating temperature.
2. While listening to sound of injector by using sound scope 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.

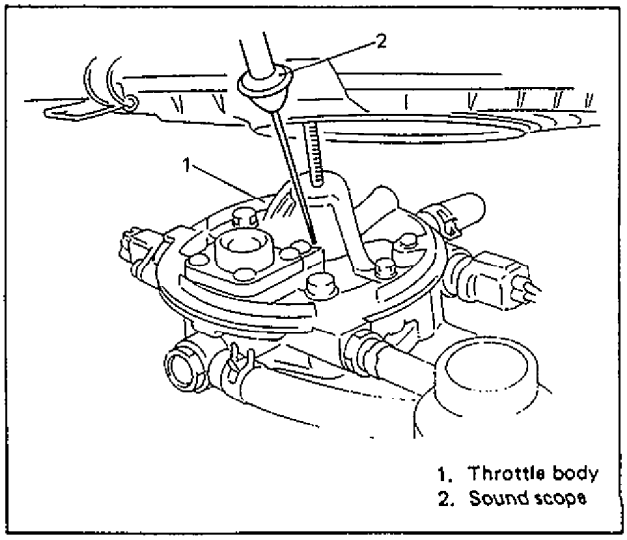


Fig. 6E-140 Checking Fuel Cut

ISC SOLENOID VALVE

Inspection

1. With ignition switch "OFF", disconnect ISC solenoid valve coupler.
2. Check resistance between each two terminals of ISC solenoid valve.

Resistance of ISC solenoid valve	30 – 33 Ω

If it is within specification, proceed to next operation check. If not, replace.

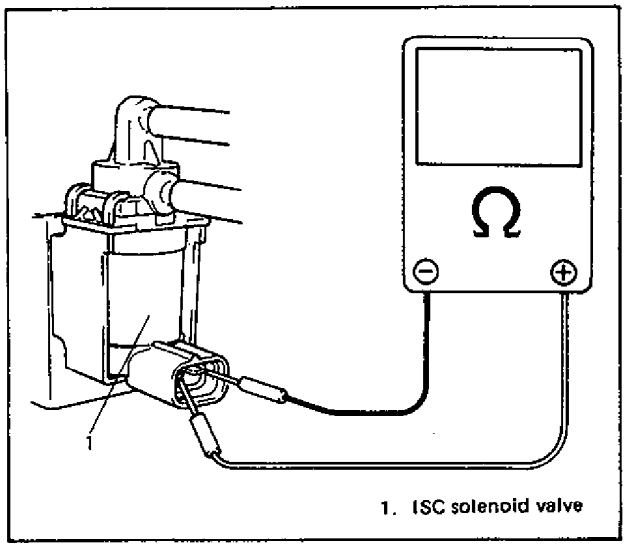


Fig. 6E-141 Checking Resistance

3. Warm up engine to normal operating temperature.
4. With engine running and ISC solenoid valve coupler disconnected, disconnect ISC solenoid valve hose of underside as shown below. In this state, check that air is not drawn into the ISC solenoid valve.

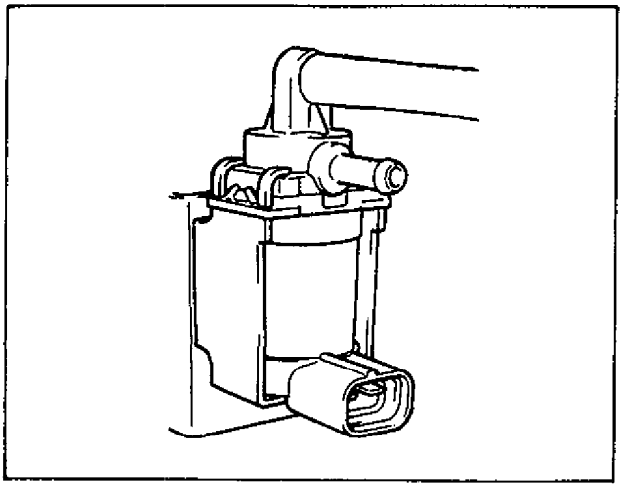


Fig. 6E-142 Checking ISC Solenoid Valve (1)

5. Under above condition, connect 12V-battery to ISC solenoid valve terminals and check that air is drawn into the ISC solenoid valve.

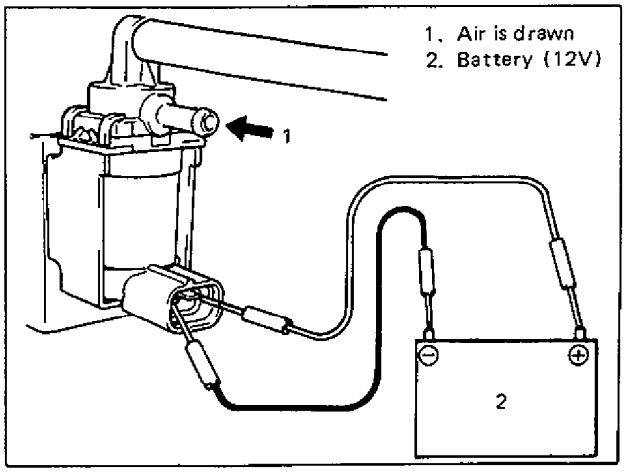


Fig. 6E-143 Checking ISC Solenoid Valve (2)

If check result is not satisfactory, replace ISC solenoid valve.

6. Connect hose and coupler securely.

EGR CONTROL SYSTEM

System Inspection

NOTE:

Before inspection, check to make sure that gear shift lever is in neutral position (with A/T model, selector lever in "P" range) and that parking brake lever is pulled all the way up.

1. When engine is cool (cooling water temperature is below 40°C, 104°F), start engine and race it, and check that EGR valve diaphragm is not operating in this state.

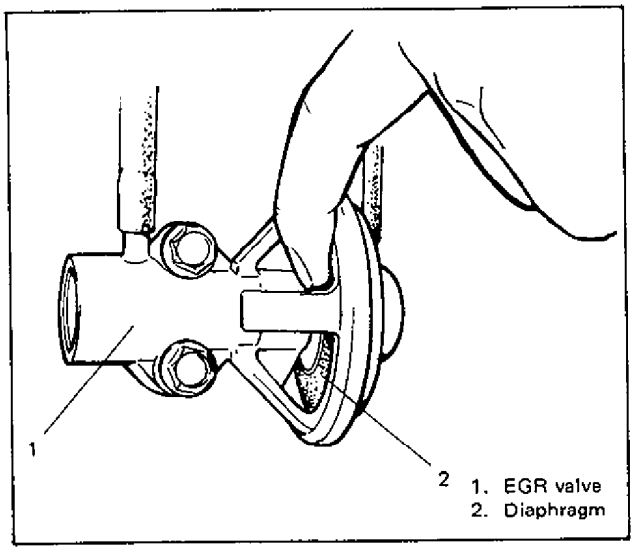


Fig. 6E-144 Checking EGR Valve Diaphragm

2. Warm up engine to normal operating temperature and race it after warming up. Then check to be sure that diaphragm moves toward 1 in Fig. 6E-145 during acceleration and toward 2 during deceleration.

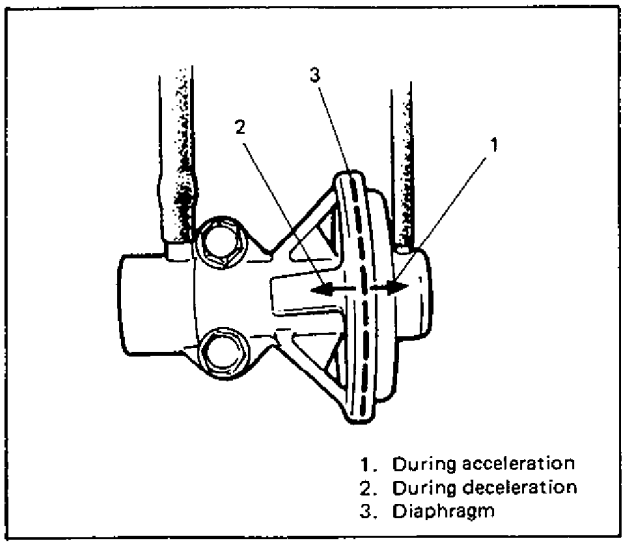


Fig. 6E-145 Movement of EGR Valve Diaphragm

If EGR valve fails to operate properly, check vacuum hoses, EGR valve, EGR modulator and VSV.

3. Keep engine running at idle speed and open EGR valve by hand, and engine should either stop or reduce its speed. If neither occurs, EGR passage is clogged. Clean it.

Vacuum Hose Inspection

Check hoses for connection, leakage, clog and deterioration. Replace as necessary.

EGR Valve Inspection

1. Disconnect vacuum hose from EGR modulator.
2. Connect vacuum pump gauge to its hose.
3. Check that EGR valve diaphragm moves smoothly and that it is held at the same position when 20 cmHg vacuum is applied to EGR valve.

   If diaphragm doesn't move smoothly, or it isn't held at the same position, replace EGR valve.

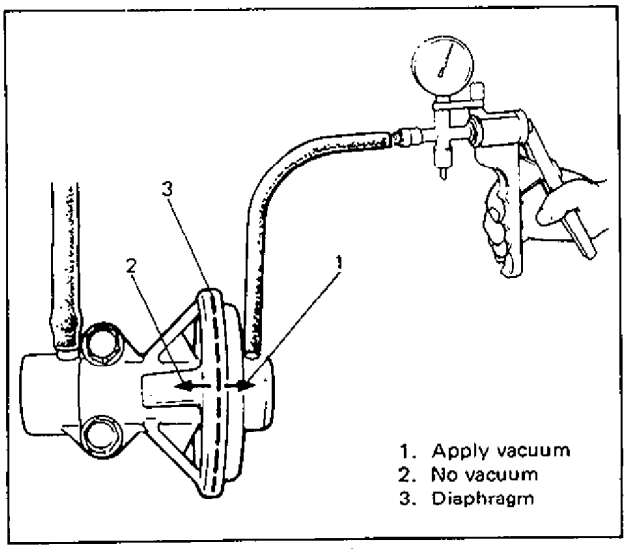


Fig. 6E-146 Checking EGR Valve

4. After checking, be sure to connect vacuum hose.

EGR CONTROL SYSTEM

System Inspection

NOTE:
Before inspection, check to make sure that gear shift lever is in neutral position (with A/T model, selector lever in "P" range) and that parking brake lever is pulled all the way up.

1. When engine is cool (cooling water temperature is below 40°C, 104°F), start engine and race it, and check that EGR valve diaphragm is not operating in this state.

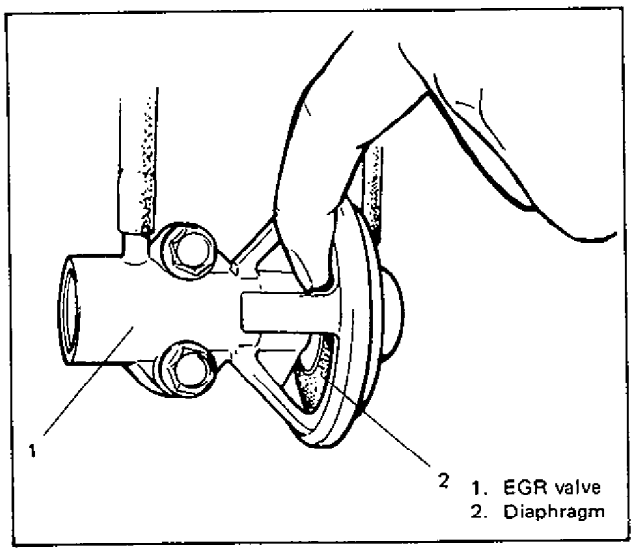


Fig. 6E-144 Checking EGR Valve Diaphragm

2. Warm up engine to normal operating temperature and race it after warming up. Then check to be sure that diaphragm moves toward 1 in Fig. 6E-145 during acceleration and toward 2 during deceleration.

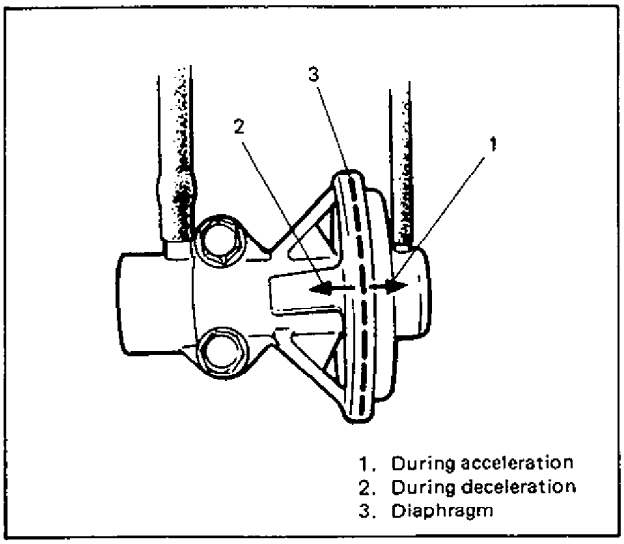


Fig. 6E-145 Movement of EGR Valve Diaphragm

If EGR valve fails to operate properly, check vacuum hoses, EGR valve, EGR modulator and VSV.

3. Keep engine running at idle speed and open EGR valve by hand, and engine should either stop or reduce its speed. If neither occurs, EGR passage is clogged. Clean it.

Vacuum Hose Inspection

Check hoses for connection, leakage, clog and deterioration. Replace as necessary.

EGR Valve Inspection

1. Disconnect vacuum hose from EGR modulator.
2. Connect vacuum pump gauge to its hose.
3. Check that EGR valve diaphragm moves smoothly and that it is held at the same position when 20 cmHg vacuum is applied to EGR valve.
   If diaphragm doesn't move smoothly, or it isn't held at the same position, replace EGR valve.

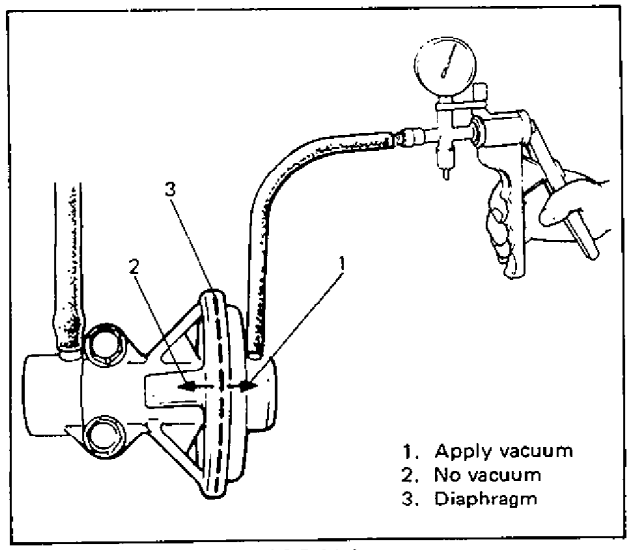


Fig. 6E-146 Checking EGR Valve

4. After checking, be sure to connect vacuum hose.

EGR Modulator Inspection

1. Check filter for contamination and damage.
   Using compressed air, clean filter.

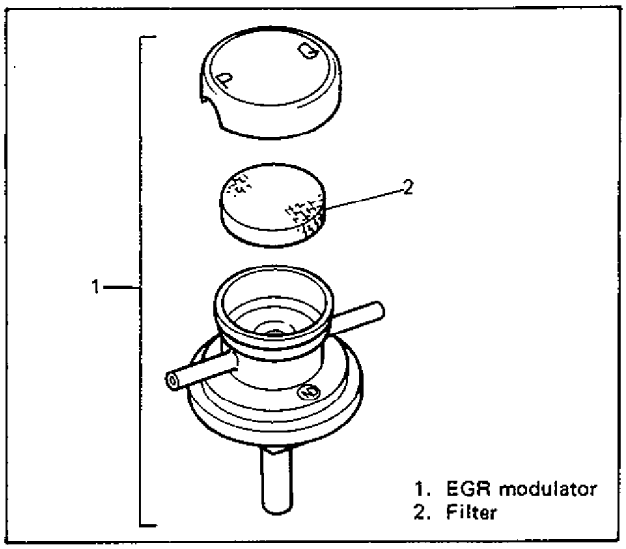


Fig. 6E-147 Filter of EGR Modulator

2. Remove EGR modulator and plug nozzle with finger. Blow air into another nozzle and check that air passes through to air filter side freely.

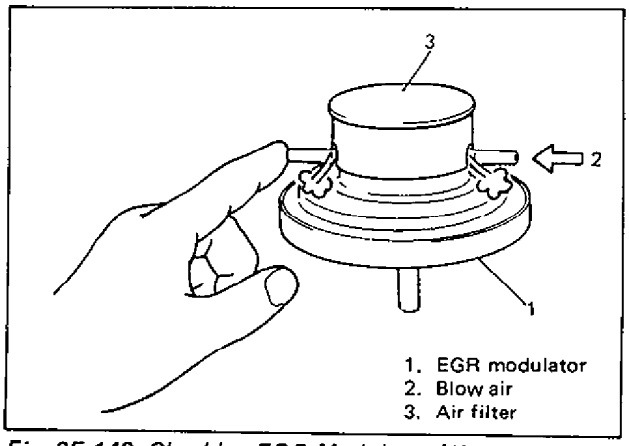


Fig. 6E-148 Checking EGR Modulator (1)

3. Connect vacuum pump gauge to nozzle "P" and plug nozzle "Q" with finger.
   While blowing air into nozzle "A", operate vacuum pump gauge and check that vacuum is applied to modulator.
   Then stop blowing nozzle "A" and check that vacuum pump gauge indicates "0" (zero).
   If check result is not satisfactory, replace EGR modulator.

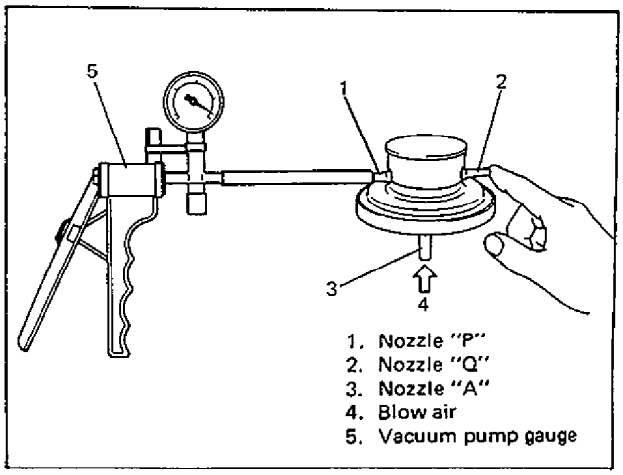


Fig. 6E-149 Checking EGR Modulator (2)

4. After checking, install modulator and connect hoses securely. Refer to emission control information label for connection.

VSV (Vacuum Switching Valve) Inspection

1. With ignition switch OFF, disconnect coupler from VSV.
2. Check resistance between two terminals of VSV.

Resistance of EGR VSV	33 – 39 Ω

If resistance is as specified, proceed to next operation check. If not, replace.

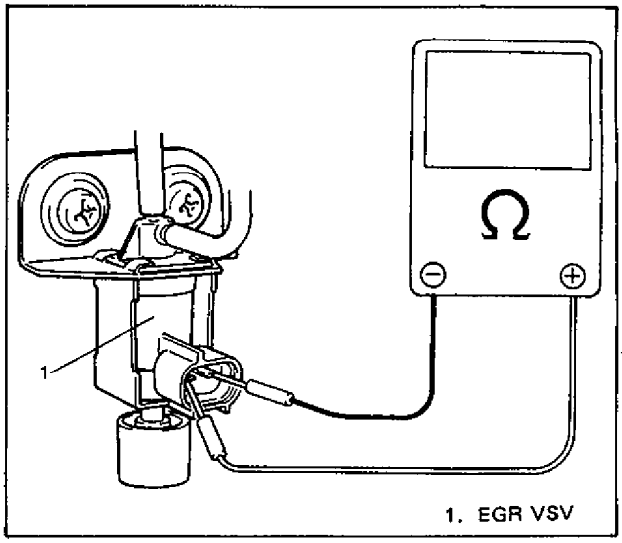


Fig. 6E-150 Checking Resistance

3. Disconnect vacuum hoses from EGR modulator and throttle body.
4. Blow into nozzle "A". Air should come out of filter and not out of nozzle "B".

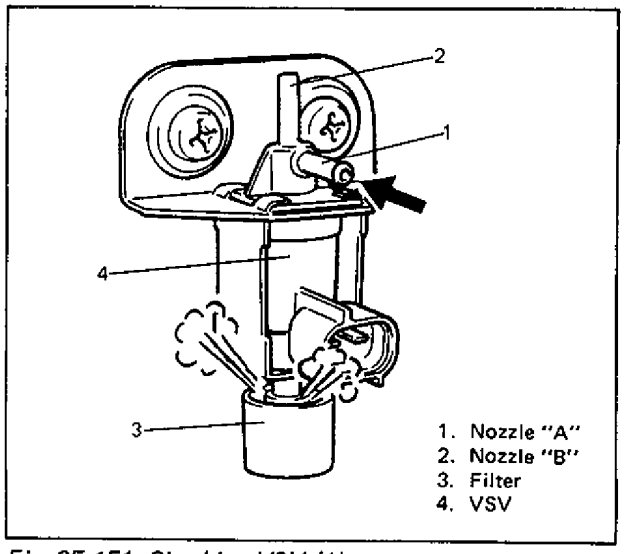


Fig. 6E-151 Checking VSV (1)

5. Connect 12V-battery to VSV terminals. In this state, blow nozzle "A".
   Air should come out of nozzle "B" and not out of filter.

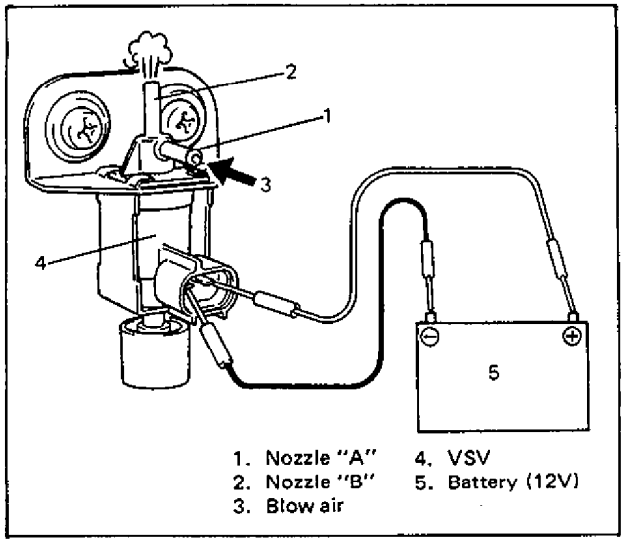


Fig. 6E-152 Checking VSV (2)

If check result is not as described above, replace VSV.

6. Connect VSV coupler securely.
7. Connect vacuum hose securely.

SHIFT-UP INDICATOR LIGHT CONTROL SYSTEM (If equipped)

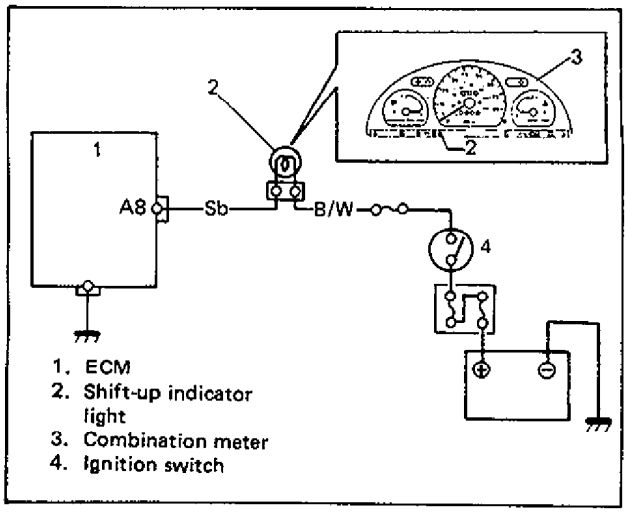


Fig. 6E-153 System Circuit

System Inspection

CAUTION:
This check requires test drive. Use special care for safety when driving.

1. Turn ignition switch ON, and shift-up indicator light should light.
   If not, cause may be burned bulb, open wire, poor connection or faulty ECM. Proceed to "Shift up indicator light and its circuit inspection".
2. Start engine, and shift-up indicator light should go off.
   If not, cause may be shorted wire to ground or faulty ECM.
3. Warm up engine to normal operating temperature.
4. With gear shift lever in low gear position, increase engine speed. When it exceeds 1,600 r/min. shift-up indicator light should light for 5 seconds at the longest.
   If it doesn't light, check speed sensor, WTS and pressure sensor. If they are all in good conditon, substitute a known good ECM for existing one.

Shift up Indicator Light and Its Circuit

Inspection

1. With ignition switch OFF, disconnect ECM coupler from ECM.
2. Turn ignition switch ON, and shift-up indicator light should not light.
   If it light, wire is shorted to ground.
3. Ground A8 terminal of disconnected ECM coupler by using service wire.

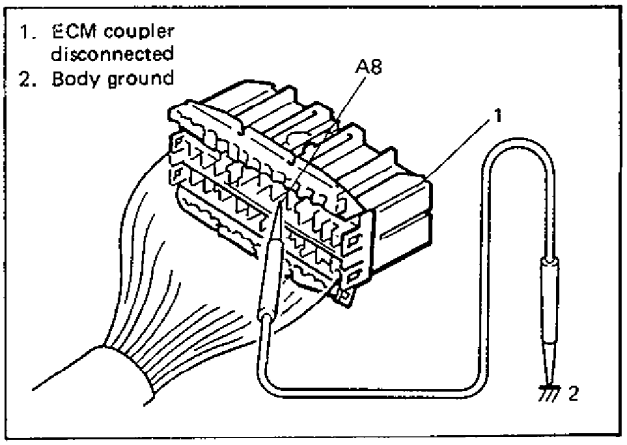


Fig. 6E-154 Checking Indicator Light

And then shift up indicator light should light. If not, cause may be burned bulb, open wire or poor connection. Repair or replace as necessary.

4. Connect coupler to ECM securely.

OUTPUT SIGNAL OF THROTTLE VALVE OPENING (A/T model only)

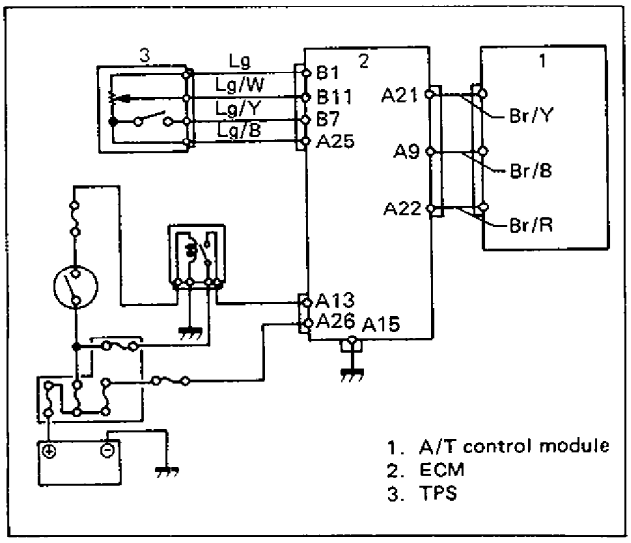


Fig. 6E-155 Signal Output Circuit

Inspection

1. Check voltage at each terminal for "Br/Y", "Br/B" and "Br/R" wires of A/T control module.

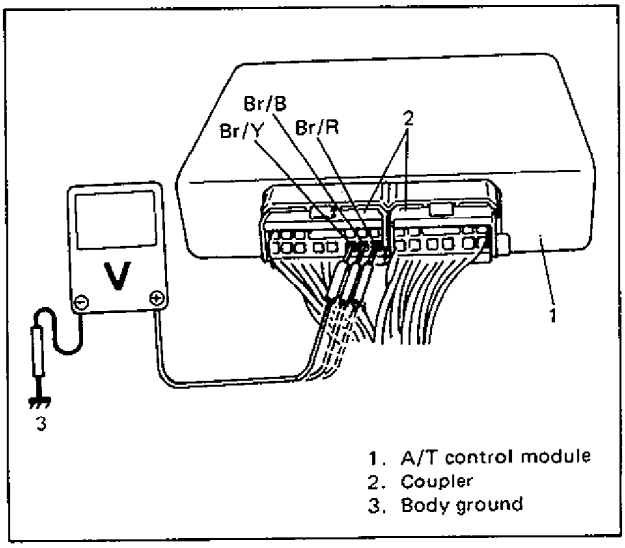


Fig. 6E-156 Checking Output Signal

Voltage at each terminal should vary as shown in following ON/OFF signal diagram.

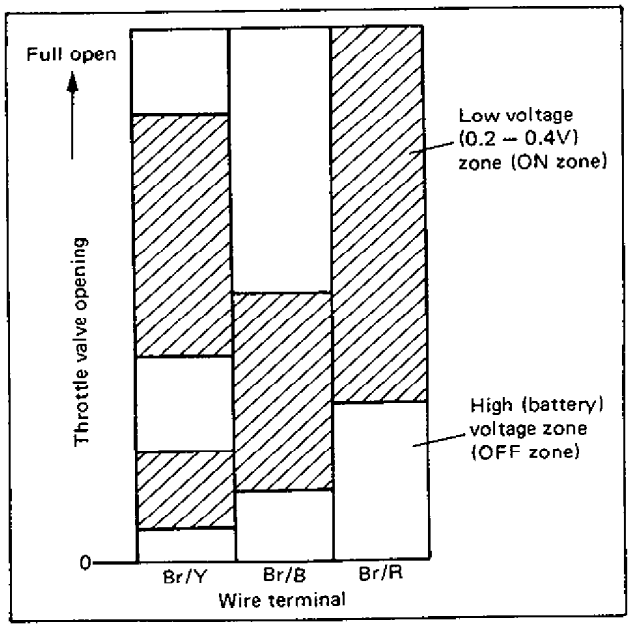
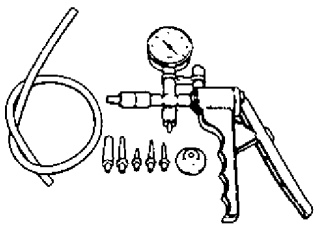


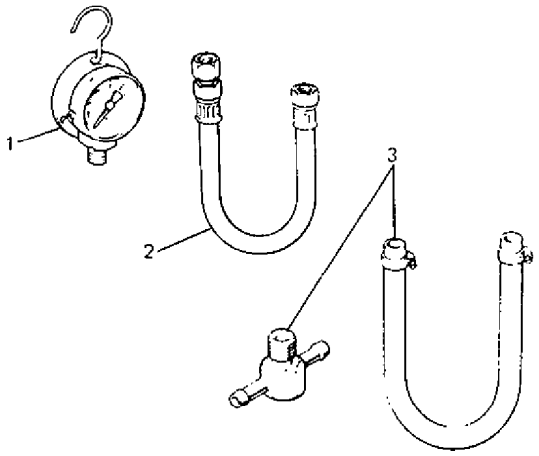
Fig. 6E-157 ON/OFF Signal Diagram

If check result is not satisfactory, check each wire harness, circuit connections and TPS.

SPECIAL TOOLS



09917-47910
Vacuum pump gauge



1. Fuel pressure guage
   09912-58441
2. Pressure hose
   09912-58431
3. 3-way joint & hose
   09912-58490

RECOMMENDED TORQUE SPECIFICATIONS

Fastening parts	Tightening torque		
	N·m	kg-m	lb-ft
Throttle body mounting bolt and nut	18 – 28	1.8 – 2.8	13.5 – 20.0
Throttle upper and lower body screw	2.9 – 4.1	0.29 – 0.41	2.1 – 2.9
Fuel injector sub wire coupler screw	1.6 – 2.4	0.16 – 0.24	1.2 – 1.7
Fuel injector cover screw	2.9 – 4.1	0.29 – 0.41	2.1 – 2.9
TPS mounting screw	1.6 – 2.4	0.16 – 0.24	1.2 – 1.7
ATS	13 – 17	1.3 – 1.7	9.5 – 12.0
WTS	20 – 30	2.0 – 3.0	14.5 – 21.5
Oxygen sensor	45 – 55	4.5 – 5.5	33.0 – 39.5

SECTION 6F

IGNITION SYSTEM

(For Carburetor Car)

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

CONTENTS

ON-CAR SERVICE

POWER SUPPLY CHECK

For ignition coil

1. With coupler disconnected from noise suppressor and ignition switch turned ON, check that battery voltage is obtained at "Br/W" wire terminal of disconnected coupler.
2. If no voltage or low voltage is found, check fuse, couplers and wiring harness.

For distributor

Refer to the same section of the Service Manual mentioned in the FOREWORD of this manual.

IGNITION COIL

1. Pull out high tension cord by gripping its cap.
2. Disconnect ignition coil coupler.
3. Measure primary and secondary coil resistance.

Ignition coil resistance (at 20°C, 68°F)	Primary	1.08 – 1.32 Ω
	Secondary	22.1 – 29.9 kΩ

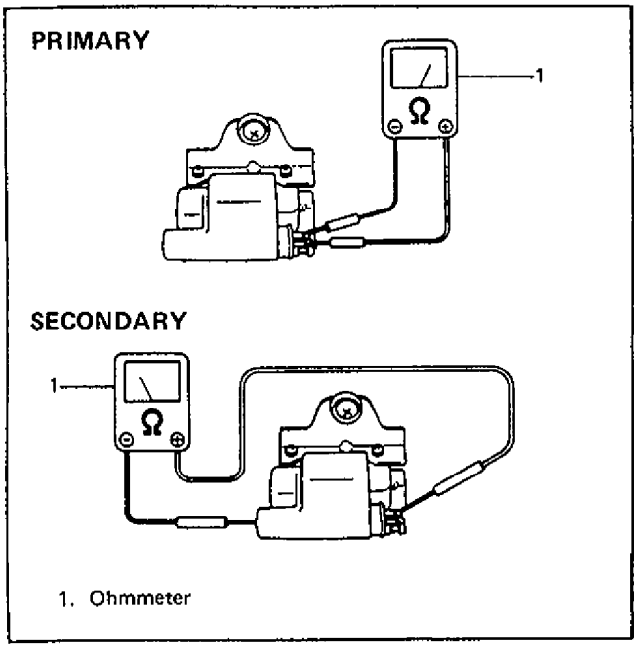


Fig. 6F-2 Measuring Ignition Coil Resistance

4. If resistance is out of specification, replace coil with new one.

SECTION 6F1

IGNITION SYSTEM

(For Car with Fuel Injection System)

CONTENTS

GENERAL DESCRIPTION

The ignition system used for this car has an ESA (Electronic Spark Advance) 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 turns ON and OFF the primary current of the ignition coil.
- Ignition coil
  When the ignition coil primary current is turned OFF, a high voltage is induced in the secondary winding.
- Distributor
  It distributes a high voltage current to each plug.
- High-tension cords and spark plugs
- CAS (Crank Angle 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.
- TPS, WTS and pressure sensor
  For their details, refer to Section 6E.

In ESA system, the ECM is programmed for the best ignition timing under every engine condition. Receiving signals which indicate the engine condition from the sensors, e.g., engine revolution, intake air pressure, coolant temperature, etc., it selects the most suitable ignition timing from its memory and operates the ignitor in the ECM.
Thus ignition timing is controlled to yield the best engine performance.
For more information, refer to Section 6E and following description.

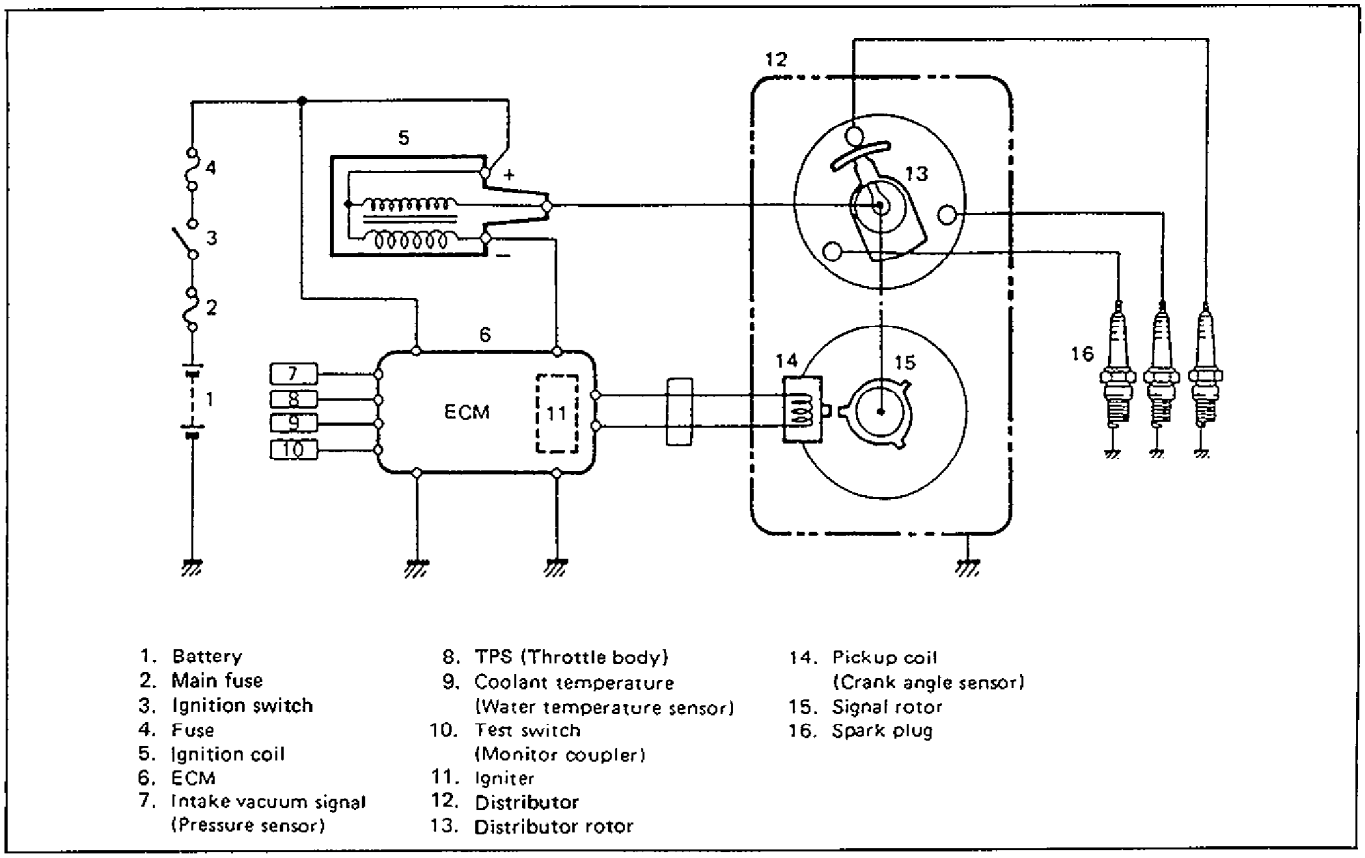


Fig. 6F1-1 Ignition Circuit Diagram

ESA SYSTEM

This system has two functions as follows.

- Ignition timing control
- Electric current flow to ignition primary coil control

These controls are performed by the Electronic (Engine) Control Module (ECM). ECM judges the engine condition by using signals from various sensors, selects the most suitable electric current flow time and ignition timing for that engine condition from among those prestored in its momory and turns ON and OFF the primary current of the ignition coil.

Ignition Timing Control

To obtain better starting performance of the engine at the engine start (when the engine speed is lower than 500 r/min.) ESA system sets the ignition timing to the initial ignition timing (5° BTDC).

The ignition timing after the engine start is determined as follows so that the spark occurs at the most suitable timing for each engine condition.

Ignition timing	=	Initial ignition timing	+	Basic ignition advance	+	Various compensating advance

Electric Current Flow Time Control

To stabilize the secondary voltage generated in the ignition coil to a proper level, ESA system controls the time of primary current flow to the ignition coil.

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
	• Maladjusted signal rotor air gap	Adjust
	• Faulty ignition coil	Replace
	• Faulty noise suppressor	Replace
	• Faulty CAS	Replace
	• Faulty ECM	Replace
	Maladjusted ignition timing	Adjust
Poor fuel economy or engine performance	• Incorrect ignition timing	Adjust
	• Faulty spark plug(s)	Adjust, clean or replace
	• Faulty ECM	Replace

SELF-DIAGNOSIS

1. To insure correct diagnosis, check to confirm that battery voltage is within standard value when engine is standstill.
2. Turn ON ignition switch and make sure that "CHECK ENGINE" light lights.
3. If engine will not start but cranking is possible, crank it for more than 3 seconds.
4. While ignition switch is ON, ground diagnosis switch terminal (or turn diagnosis switch ON) and then read diagnostic code (observe "CHECK ENGINE light).

DIAGNOSTIC CODE NO. 41

ECM indicates that no ignition signal is generated for more than 6 spark times while engine is running or being cranked.
Diagnose trouble according to "Diagnostic Flow Chart for Code No. 41" in Section 6E.

DIAGNOSTIC CODE NO. 42

ECM indicates that no CAS signal is inputted for more than 2 seconds while engine is being cranked.
Diagnose trouble according to "Diagnostic Flow Chart for Code No. 42" in Section 6E.

ON CAR SERVICE

IGNITION SPARK TEST

1. Disconnect injector coupler at throttle body side.

WARNING:
Without disconnection of injector coupler, combustible gas may come out from spark plug holes during this test and may get ignited in engine room.

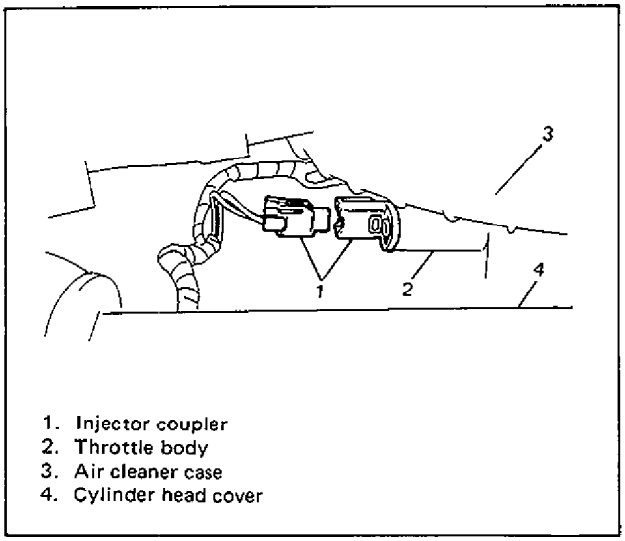


Fig. 6F1-2 Disconnecting Injector Coupler

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.

POWER SUPPLY CHECK

For Ignition Coil

1. Remove ignition coil cap.
2. Check to make sure that coil terminals have battery voltage with ignition switch ON.
3. If no voltage or low voltage is found, check fuse, couplers and wiring harness.

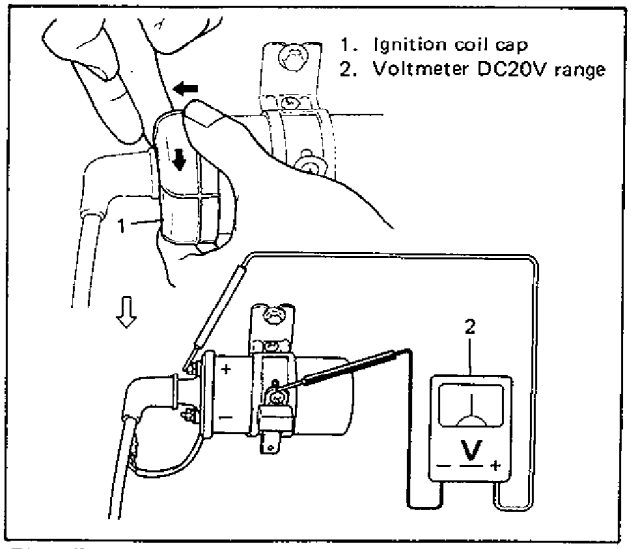


Fig. 6F1-3 Checking Power Supply to Ignition Coil

HIGH TENSION CORDS

1. Remove high tension cord at ignition coil while gripping its cap.
2. Remove distributor cap installed with high tension cords.
3. Remove high tension cord clamp from cylinder head cover.
4. Pull out high tension cords from spark plugs while gripping each cap.

CAUTION:
- **Removal of high tension cords together with clamps will be recommended so as not to damage their inside wire (resistive conductor).**
- **For the same reason, pull out each connection by gripping cap portion.**

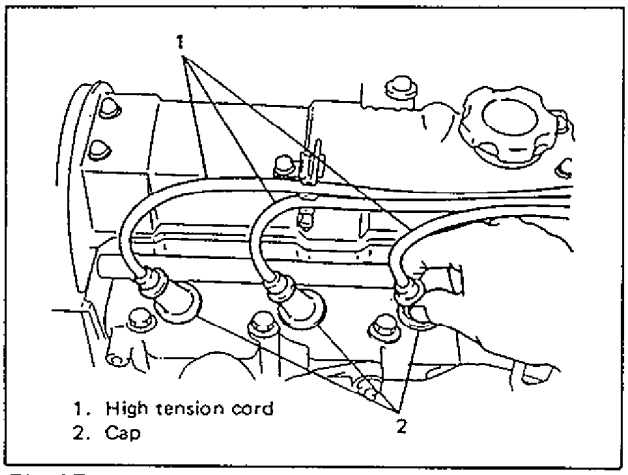


Fig. 6F1-5 Removing High Tension Cord

5. Measure resistance of high tension cord by using ohmmeter.

High tension cord resistance	10 – 22 kΩ/m 3.0 – 6.7 kΩ/ft

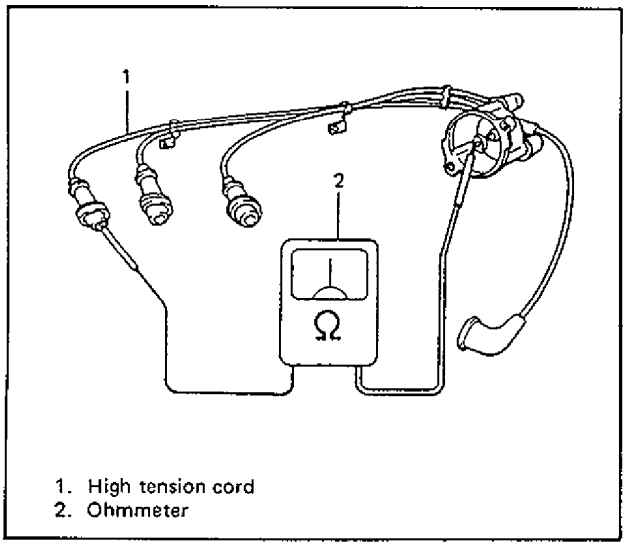


Fig. 6F1-6 Measuring High Tension Cord Resistance

6. If resistance exceeds specification, inspect distributor terminal and replace high tension cord(s) and/or distributor cap as required.

CAUTION:
- **Never attempt to use metal conductor high tension cords as replacing parts.**
- **Insert each cap portion fully when installing high tension cords.**

SPARK PLUGS

1. Pull out high tension cords by gripping their caps and then remove spark plugs.
2. Inspect them for:
   - Electrode wear
   - Carbon deposits
   - Insulator damage
3. If any abnormality is found, adjust air gap, clean with spark plug cleaner or replace them with specified new plugs.

NGK	BPR6ES
NIPPONDENSO	W20EPR-U
Air gap A	0.7 – 0.8 mm (0.028 – 0.031 in.)

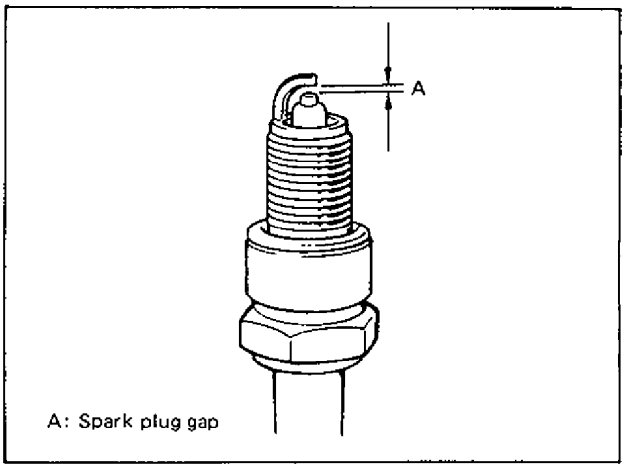


Fig. 6F1-7 Checking Spark Plug Gap

4. Install spark plugs and torque them to specification.

	N-m	kg-m	lb-ft
Spark plug tightening torque	25 – 30	2.5 – 3.0	18.0 – 21.5

5. Install high tension cords securely by gripping their caps.

NOISE SUPPRESSOR

1. Disconnect coupler of each noise filter (suppressor).
2. Using ohmmeter, check to be sure that condenser is not conductive ant resister has resistance of about 2.2 kΩ.
3. If tester reading indicates conductive, replace noise filter(s).

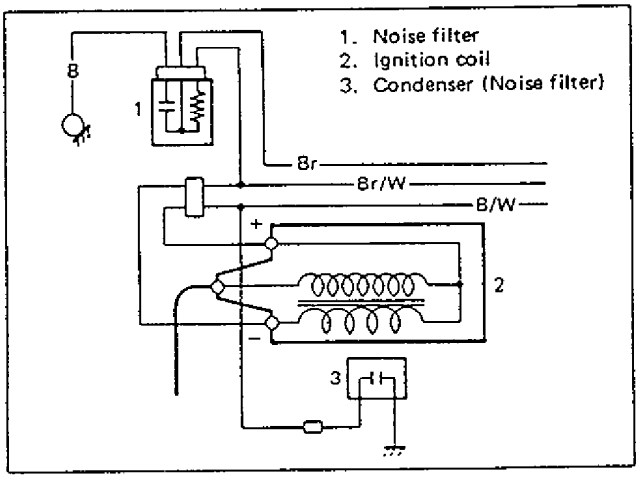


Fig. 6F1-8 Checking Noise Suppressor

IGNITION COIL

1. Pull out high tension cord by gripping its cap.
2. Disconnect ignition coil coupler.
3. Measure primary and secondary coil resistances.

Ignition coil resistance (at 20°C, 68°F)	
Primary	1.33 – 1.63 Ω
Secondary	11.4 – 13.8 kΩ

4. If resistance is out of specification, replace coil with new one.

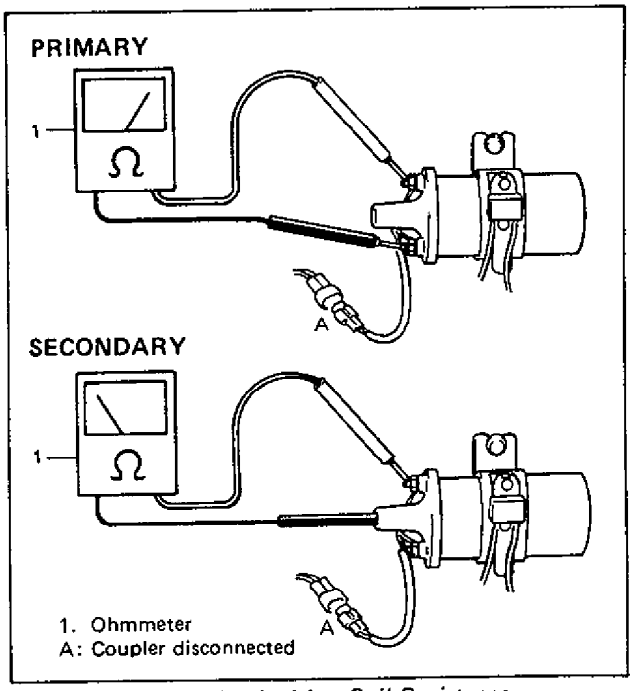


Fig. 6F1-9 Measuring Ignition Coil Resistance

DISTRIBUTOR

Distributor Cap and Rotor

Check cap and rotor for crack and their terminals for corrosion and wear. Replace as necessary.

Signal Rotor Air Gap

1. Remove distributor cap and rotor.
2. Using thickness gauge, measure air gap, between signal rotor tooth and generator.

Signal rotor air gap A	0.2 – 0.4 mm (0.008 – 0.016 in.)

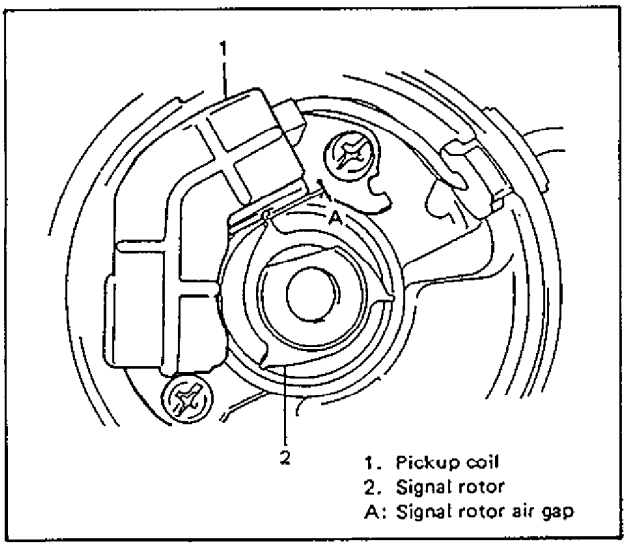


Fig. 6F1-10 Checking Air Gap

3. If gap is out of specification, loose signal generator securing screws.
   Using blade (–) screw driver, move generator and adjust gap to specification.
   After adjustment, tighten securing screws and recheck gap.

NOTE:
Check to make sure that signal generator tooth is free from any metal particles.

4. Install distributor cap.

Pickup Coil Resistance

1. Disconnect distributor lead coupler.
2. Measure resistance of pickup coil by using ohmmeter.
3. If resistance is out of specification, replace signal generator as follows.

Pickup coil resistance (at 20°C/68°F)	160 ± 20 Ω

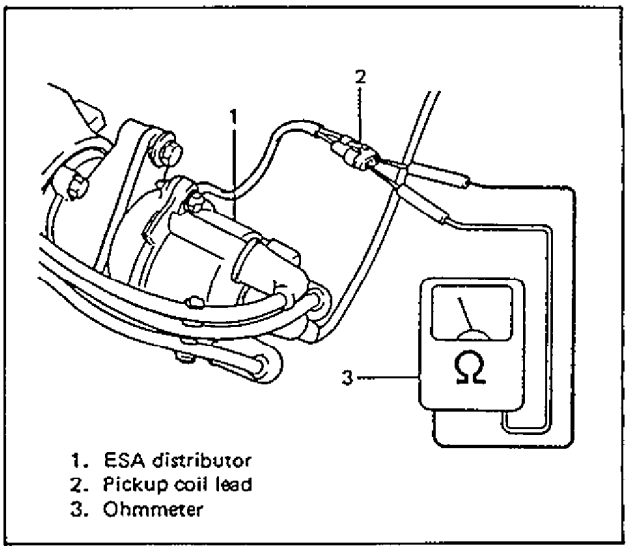


Fig. 6F1-11 Measuring Pickup Coil Resistance

4. Remove distributor cap and rotor.
5. Remove signal generator securing screws and lead wire clamp screws.
6. Replace signal generator.
7. Adjust signal rotor air gap to specification as previously outlined.
8. Install rotor, distributor cap seal and cap.

IGNITION TIMING

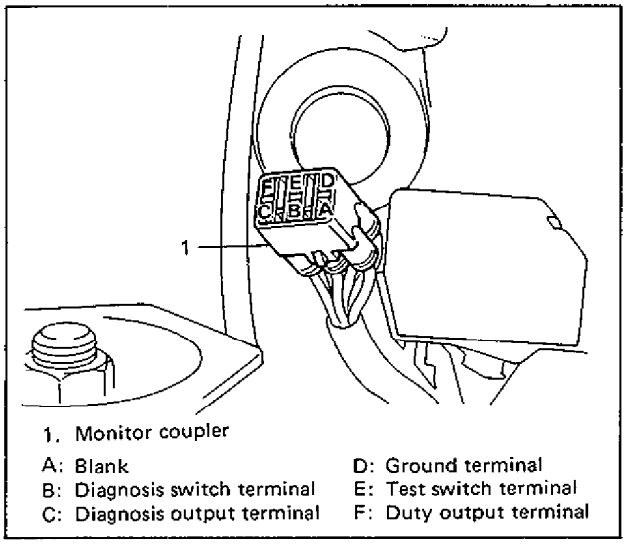
NOTE:
Before starting engine, place transmission gear shift lever in "Neutral" (shift selector lever to "P" range for A/T model), and set parking brake.

INSPECTION AND ADJUSTMENT

1. Start engine and warm it up to normal operating temperature.
2. Make sure that all of electrical loads expect ignition are switched off.
3. Check to be sure that idle speed is within specification.

M/T model	800 rpm (r/min)
A/T model	850 rpm (r/min)

4. Set timing light to No. 1 high tension code.
5. Remove monitor coupler cap beside ignition coil.
6. Connect D and E terminals of monitor coupler or E to body by using service wire so that ignition timing is fixed on initial one.



1. Monitor coupler

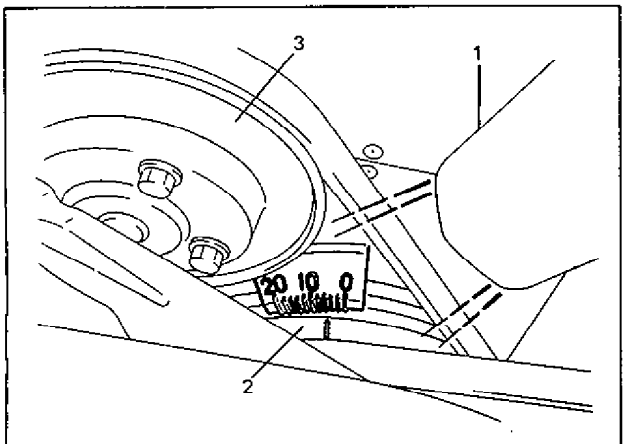
A: Blank	D: Ground terminal
B: Diagnosis switch terminal	E: Test switch terminal
C: Diagnosis output terminal	F: Duty output terminal

Fig. 6F1-12 Fixing Ignition Timing

7. Using timing light, check that timing is within specification.

Initial Ignition Timing (Test switch terminal grounded)	5 ± 1° BTDC (at idle speed)

Ignition order	1 – 3 – 2

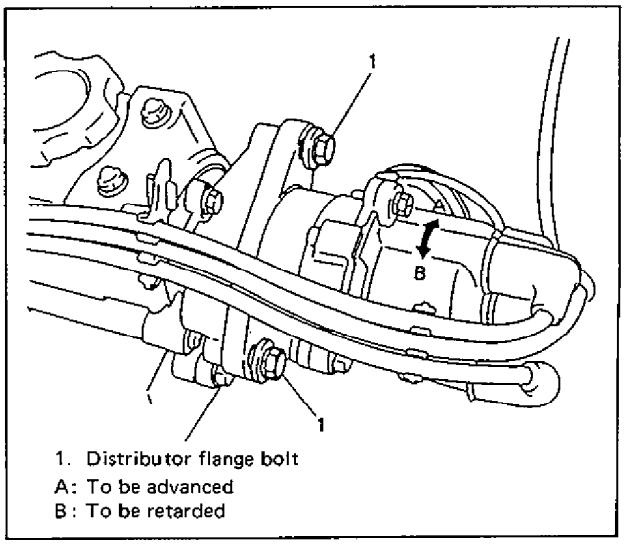


1. Special tool (Timing light 09900-27301 or 09930-76420)
2. Crankshaft pulley
3. Water pump pulley

Fig. 6F1-13 Checking Ignition Timing

8. If ignition timing is out of specification, loosen flange bolts, adjust timing by turning distributor assembly while engine is running, and then tighten bolts.

Tightening torque for distributor flange bolts	N·m	kg-m	lb-ft
	12 – 18	1.2 – 1.8	8.6 – 12.9



1. Distributor flange bolt

A: To be advanced
B: To be retarded

Fig. 6F1-14 Adjusting Ignition Timing

9. After tightening distributor flange bolts, recheck that ignition timing is within specification.
10. After checking and/or adjusting Initial Ignition Timing, disconnect service wire from monitor coupler.
11. With engine idling (test switch terminal ungrounded, idle switch ON and car stopped), check that ignition timing is about 12° BTDC. (Constant variation within a few degrees from 12° indicates no abnormality but proves operation of electronic timing control system.) Also, check that increasing engine speed advances ignition timing.
    If above check results are not satisfactory, check TPS (Idle switch), test switch terminal circuit and ECM.

DISTRIBUTOR UNIT

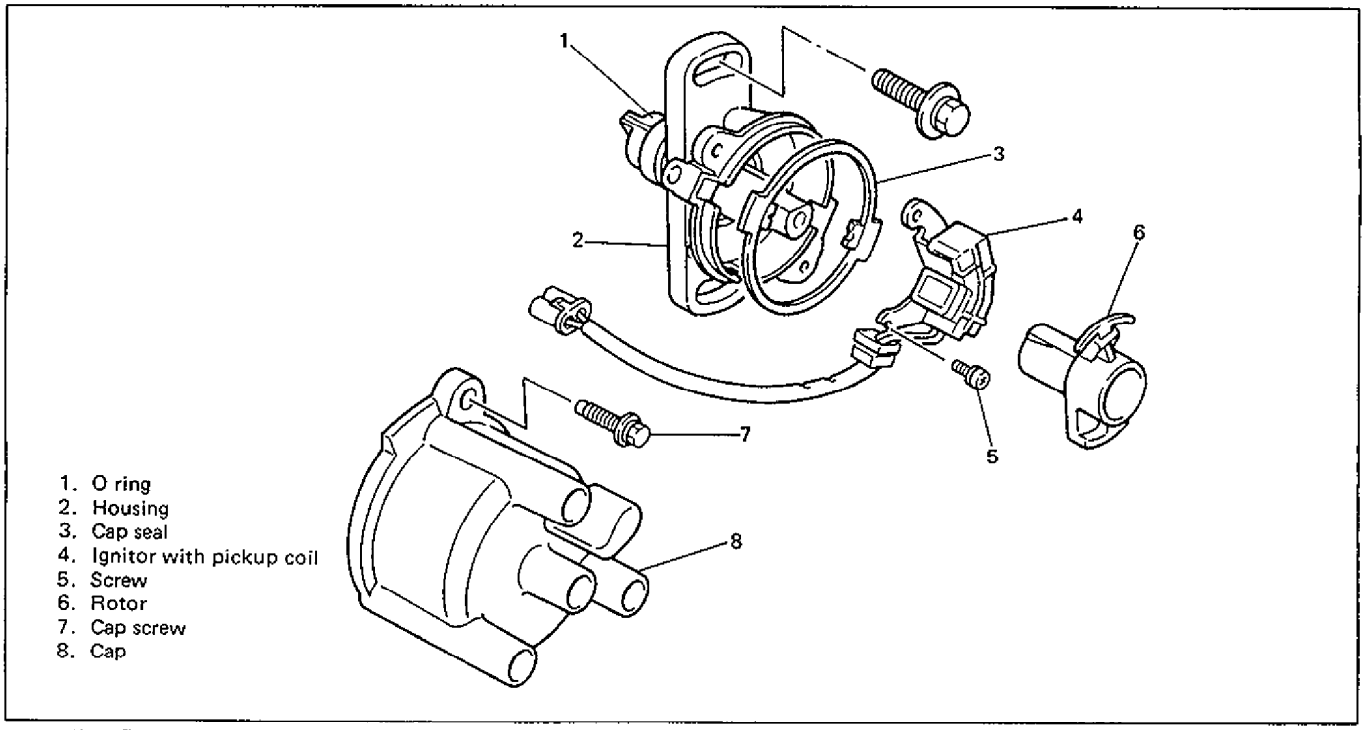


Fig. 6F1-15 Distributor Components

DISMOUNTING

1. Disconnect distributor lead coupler.
2. Remove distributor cap screws and cap.
3. Remove distributor flange bolts.
4. Pull out distributor housing assembly.

REMOUNTING

NOTE:

- **Before installing distributor, check to make sure that its O ring is in good condition.**
- **If new O ring is installed, apply oil.**

1. Install distributor without cap to camshaft. Fit the dogs of distributor coupling into the slots of camshaft, when installing. The dogs of distributor coupling are offset. Therefore, if the dogs can not be fitted into the slots, turn the distributor shaft by 180 degree and try again.
2. Lightly install flange bolts and prepare for ignition timing adjustment.
3. Check to make sure that rotor is in good condition.
4. Inspect distributor cap and clean or replace as required.
5. Make sure that distributor cap seal is placed properly and install cap, and then fasten it with screws.
6. Connect distributor lead coupler.

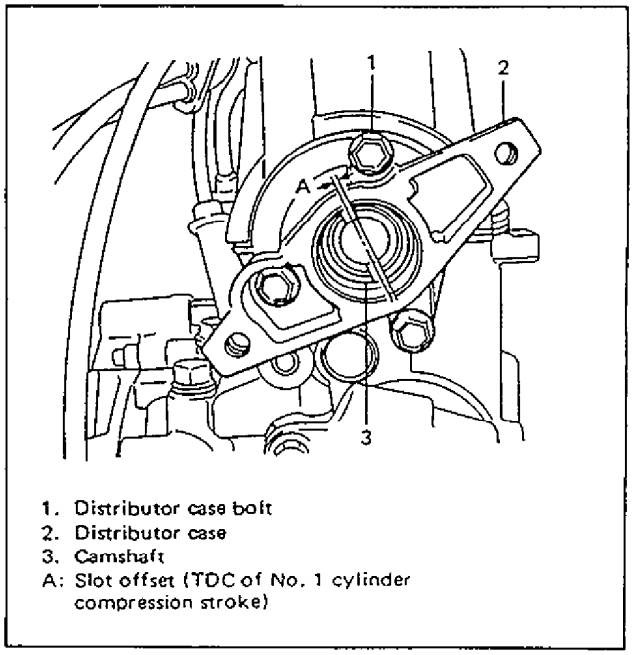
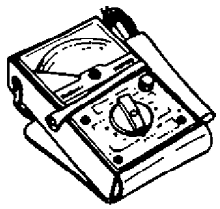
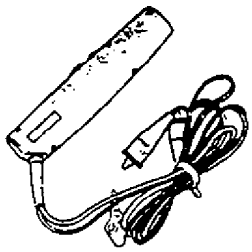
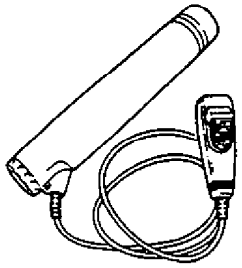


Fig. 6F1-16 Installing Distributor

SPECIAL TOOLS

			
09900-25002 Pocket tester	09900-27301 Timing light (DC 12V)	09930-76420 Timing light (Dry cell type)	

SECTION 6G1
CRANKING SYSTEM
(1.2 kW type)

CONTENTS

GENERAL DESCRIPTION

CRANKING CIRCUIT

The cranking circuit consists of the battery, starting motor, ignition switch, and related electrical wiring. These components are connected electrically as shown in Fig. 6G1-1. Only the starting motor will be covered in this portion.

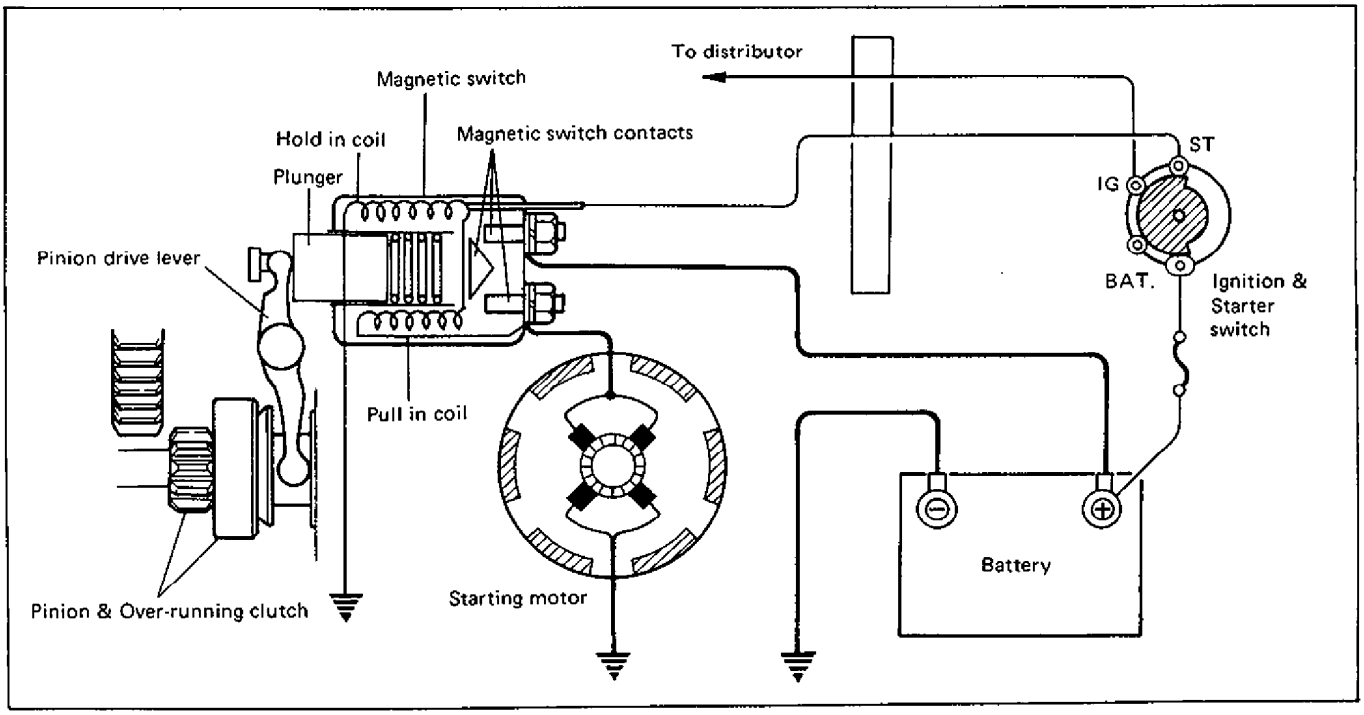


Fig. 6G1-1 Cranking Circuit

STARTING MOTOR

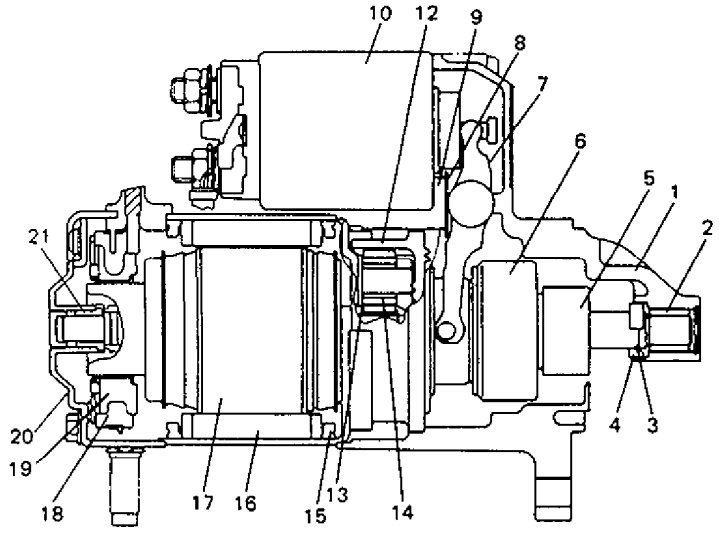
The starting motor consists of parts shown in Fig. 6G1-2 and has permanent magnets mounted in starting motor yoke (frame).

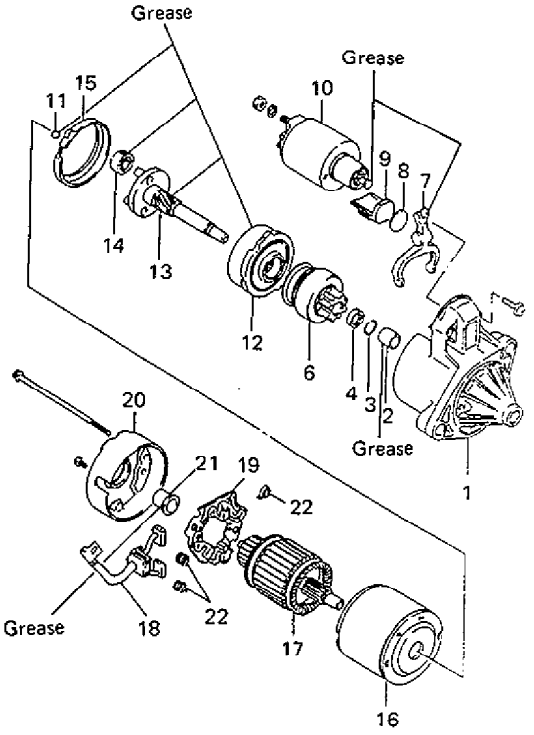
The magnetic switch assembly and parts in the starting motor are enclosed in the housings so that they will be protected against possible dirt and water splash.

In the circuit shown in Fig. 6G1-1, the magnetic (motor) switch coils are magnetized when the ignition switch is closed. The resulting plunger and pinion drive lever movement causes the pinion to engage the engine flywheel gear and the magnetic switch main contacts to close, and cranking takes place. When the engine starts, the pinion over-running clutch protects the armature from excessive speed until the switch is opened, at which time the return spring causes the pinion to disengage.

NOTE:

- **Make sure to apply grease before assembly where so indicated in the figure below.**
- **The two types of starting motors are different only in length, weight of the armature/yoke and their output but the same description of structure, procedures of disassembly, assembly and inspection is applicable. For specifications, refer to the last page of this section.**





NOTE:
Use SUZUKI SUPER GREASE A (99000-25010) where greasing is indicated.

1. Front housing
2. Bush
3. Ring
4. Stop ring
5. Pinion gear
6. Over-running clutch
7. Lever
8. Plate
9. Seal rubber
10. Magnetic switch
11. Ball
12. Internal gear
13. Gear shaft ass'y
14. Idle gear
15. Packing
16. Yoke
17. Armature
18. Brush
19. Brush holder
20. Rear bracket
21. Rear bush
22. Brush spring

Fig. 6G1-2

DIAGNOSIS

Possible symptoms due to starting system trouble are:

- Starting motor does not run (or runs slowly),
- Starting motor runs but fails to crank engine, or
- Abnormal noise is heard.

Proper diagnosis must be made to determine exactly where the cause of each trouble lies . . . . in battery, wiring harness, (including starting motor switch), starting motor or engine.

Don't remove motor just because starting motor does not run. Check following items and narrow down scope of possible causes.

1) Condition of trouble
2) Tightness of battery terminals (including ground cable connection on engine side) and starting motor terminals.
3) Discharge of battery
4) Mounting of starting motor

Condition	Possible Cause	Correction
Motor not running.	**No operating sound of magnetic switch**	
	1. Battery run down.	Recharge battery.
	2. Battery voltage too low due to battery deterioration.	Replace battery.
	3. Poor contact in battery terminal connection.	Retighten or replace.
	4. Loose grounding cable connection.	Retighten.
	5. Fuse set loose or blown off.	Tighten or replace.
	6. Poor contacting action of ignition switch.	Replace.
	7. Lead wire socket loose in place.	Retighten.
	8. Open-circuit between ignition switch and magnetic switch.	Repair.
	9. Open-circuit in pull-in coil.	Replace magnetic switch.
	10. Poor sliding of plunger and/or pinion.	Repair.
	Operating sound of magnetic switch heard.	
	1. Battery run down.	Recharge battery.
	2. Battery voltage too low due to battery deterioration.	Replace battery.
	3. Loose battery cable connections.	Retighten.
	4. Burnt main contact point, or poor contacting action of magnetic switch.	Replace magnetic switch.
	5. Brushes are seating poorly or worn down.	Repair or replace.
	6. Weakened brush spring.	Replace.
	7. Burnt commutator.	Replace.
	8. Layer short-circuit of armature.	Replace.

Condition	Possible Cause	Correction
Starting motor running but too slow (small torque).	**If battery and wiring are satisfactory, inspect starting motor.**	
	1. Insufficient contact of magnetic switch main contacts.	Replace.
	2. Layer short-circuit of armature.	Replace.
	3. Disconnected, burnt or worn commutator.	Repair or replace.
	4. Worn brushes.	Replace brush.
	5. Weakened brush springs.	Replace spring.
	6. Burnt or abnormally worn end bushings.	Replace bushing.
Starting motor running, but not cranking engine.	1. Worn pinion tip.	Replace over-running clutch.
	2. Poor sliding of over-running clutch.	Repair.
	3. Clutch slipping (idling).	Replace over-running clutch.
	4. Worn teeth of ring gear.	Replace flywheel.
Noise	1. Abnormally worn bush.	Replace bush.
	2. Worn pinion or worn teeth of ring gear.	Replace pinion or flywheel.
	3. Poor sliding of pinion (failure in return movement).	Repair or replace.
	4. Worn internal or idle gear teeth.	Replace.
	5. Lock of oil in each part.	Lubricate.
Starting motor does not stop running.	1. Fused contact points of magnetic switch.	Repair or replace.
	2. Short-circuit between turns of magnetic switch coil (layer short-circuit).	Replace.
	3. Failure of returning action in ignition switch.	Replace.

ON VEHICLE SERVICE

Starting motors do not require lubrication except during overhaul. When the motor is disassembled for any reason, lubricate as shown in Fig. 6G1-2.

REMOVAL AND INSTALLATION

STARTING MOTOR

Use following procedure to remove starter:

1) Disconnect negative battery lead at battery.
2) Disconnect magnetic switch lead wire and battery cable from starting motor terminals.
3) Remove two starting motor mount bolts.
4) Remove starting motor.
5) To install, reverse the above procedure.

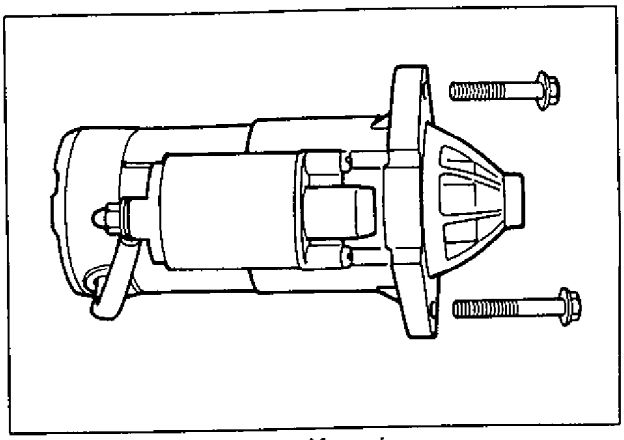


Fig. 6G1-3 Starting Motor Mounting

STARTING MOTOR REPAIR

MAGNETIC SWITCH

REMOVAL

NOTE:

Before disassembling starting motor, be sure to put match mark as shown in the figure below so that any possible mistake can be avoided.

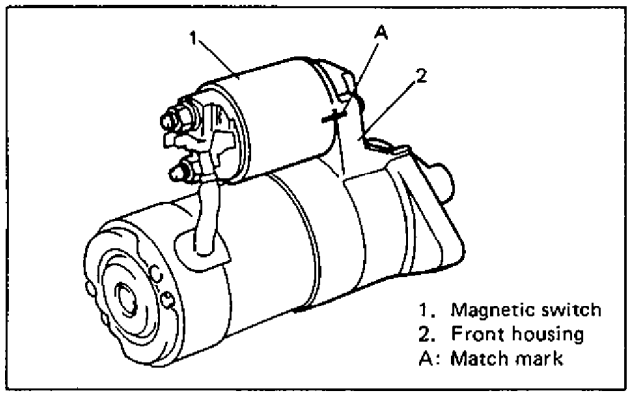


Fig. 6G1-4

1) Disconnect wire (switch to motor) from magnetic switch terminal.

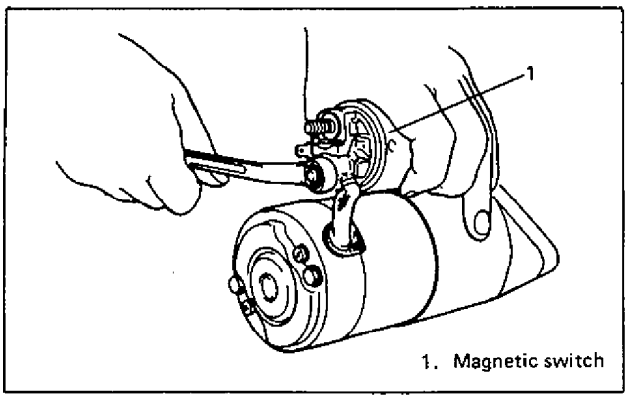


Fig. 6G1-5

2) Remove magnetic switch assembly.

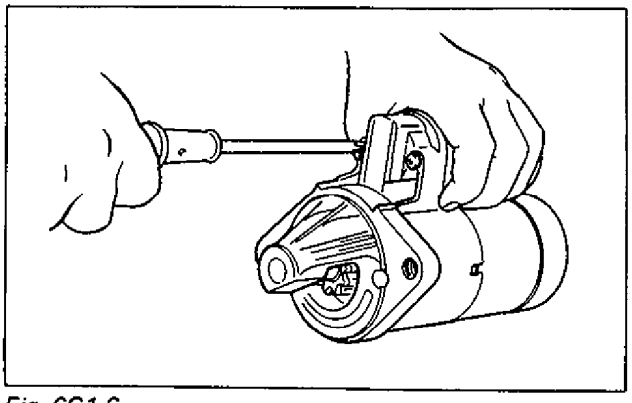


Fig. 6G1-6

NOTE:

Don't disassemble this switch. If defective, replace as a complete assembly.

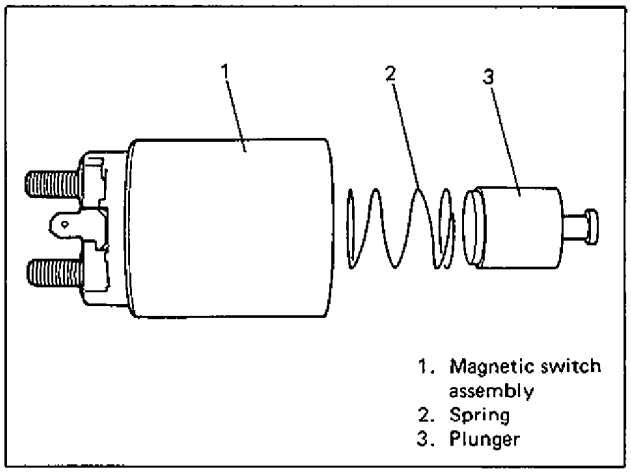


Fig. 6G1-7

INSTALLATION

Before installation, inspect plunger joint for wear and replace defective parts.

1) Apply grease. (Refer to Fig. 6G1-2)
2) Install switch assembly into front housing, referring to below figure especially for its vertical direction. And then tighten screws.

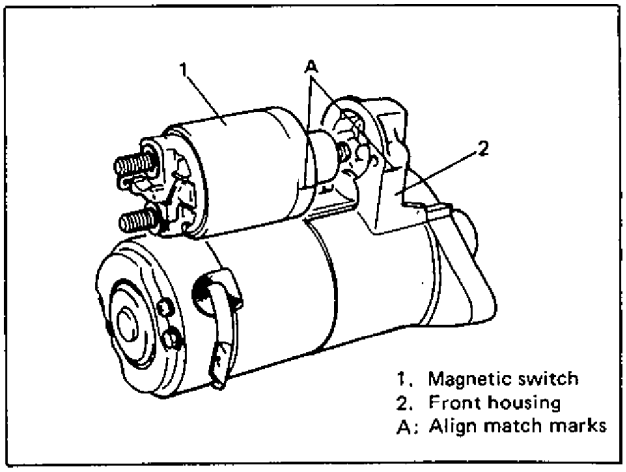


Fig. 6G1-8

3) Connect wire from motor to magnetic switch terminal.
4) Check switch for operation. (See page 6G1-15)

MOTOR BRUSH

REMOVAL

1) Remove rear bracket.

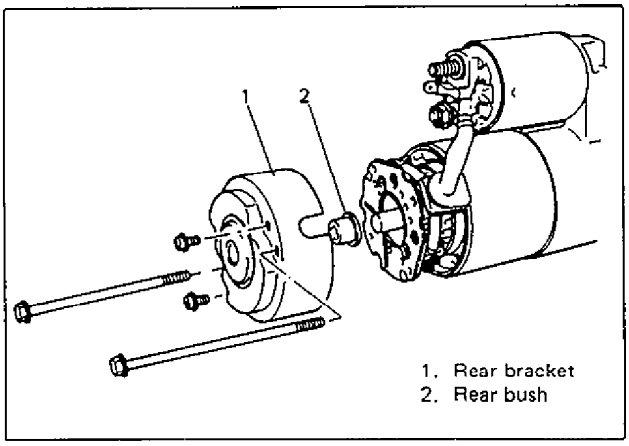


Fig. 6G1-9

2) Remove brush holder and brushes.

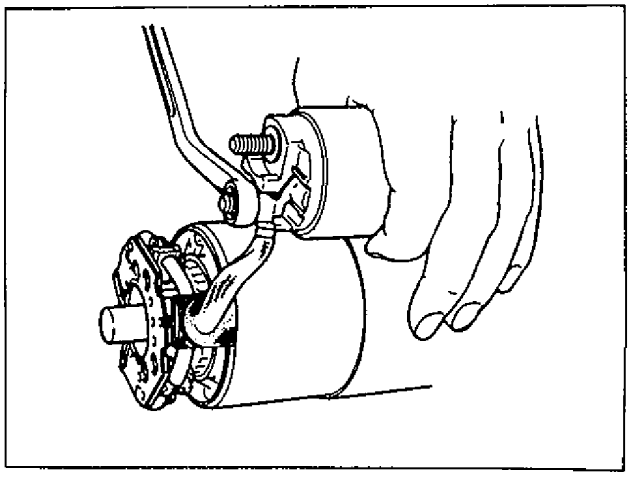


Fig. 6G1-10

INSTALLATION

Install in reverse order of REMOVAL, noting the following.

1) Apply grease. (Refer to Fig. 6G1-2.)
2) Install brush holder to armature while pushing 4 brushes outward.

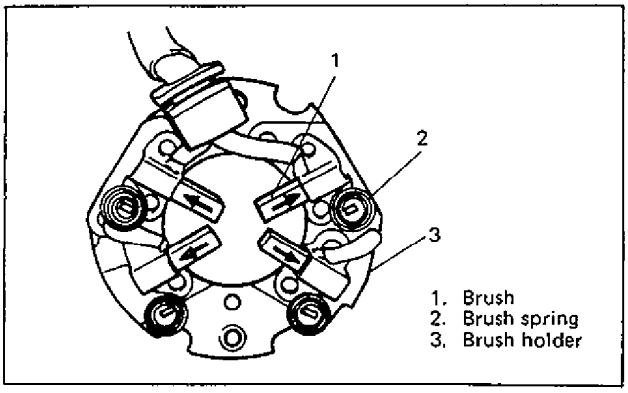


Fig. 6G1-11

3) Install rear bracket.
4) Check motor for operation. (See page 6G1-15.)

REAR BUSH (BEARING)

REMOVAL

1) Remove rear bracket.
2) Remove rear bracket cap, and then remove rear bush.

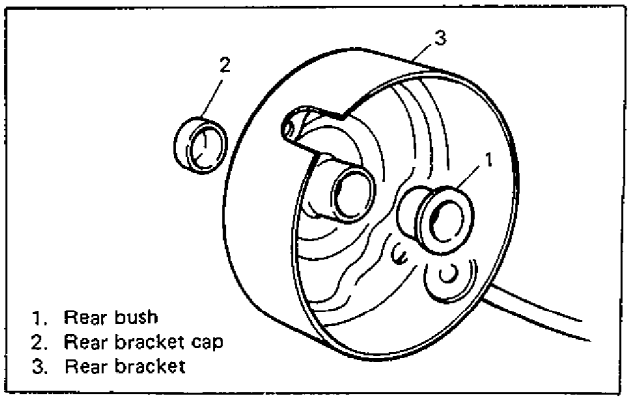


Fig. 6G1-12

INSTALLATION

1) Install rear bush as shown below.

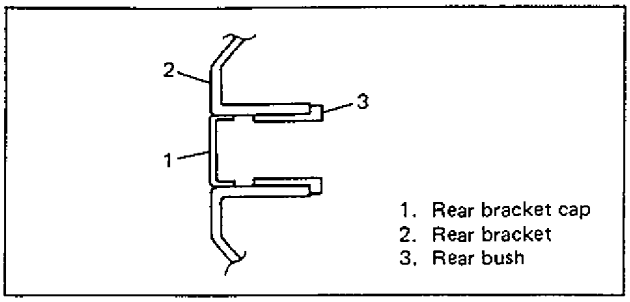


Fig. 6G1-13

2) Install rear bracket cap as shown above.
3) Apply grease. (Refer to Fig. 6G1-2.)
4) Install rear bracket.

ARMATURE/YOKE

REMOVAL

NOTE:
Before disassembling starting motor, be sure to put match marks at two locations (A & B) as shown in figure below so that any possible mistake can be avoided.

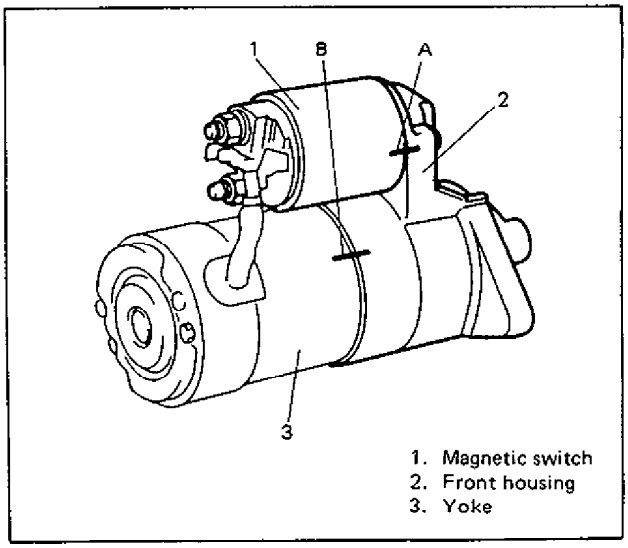


Fig. 6G1-14

1) Remove magnetic switch. (Refer to page 6G1-5.)
2) Remove brush holder. (Refer to page 6G1-6.)
3) Remove armature and yoke.

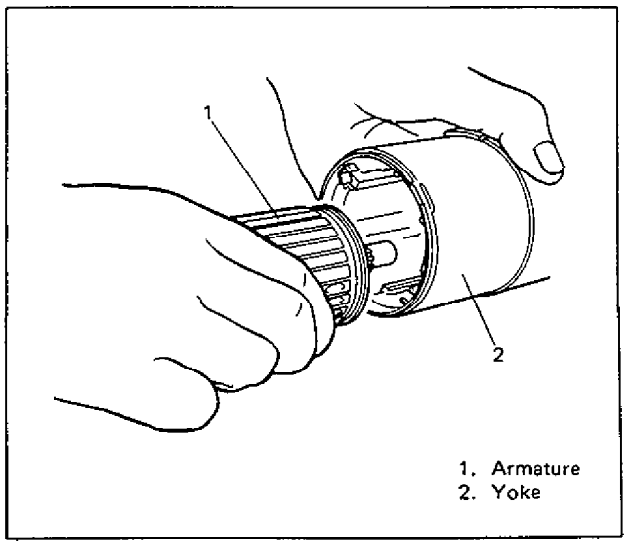


Fig. 6G1-15

INSTALLATION

Install in reverse order of REMOVAL, noting the following.
1) Apply grease. (Refer to Fig. 6G1-2.)

NOTE:
If ball of armature shaft came out when removed, be sure to apply grease to ball and put it back in.

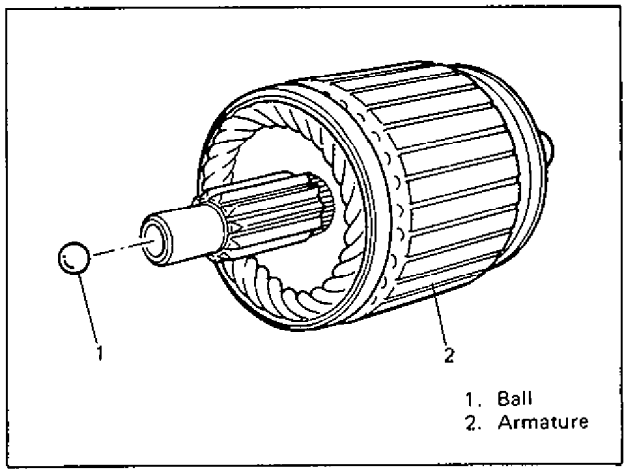


Fig. 6G1-16

2) Install armature into yoke.

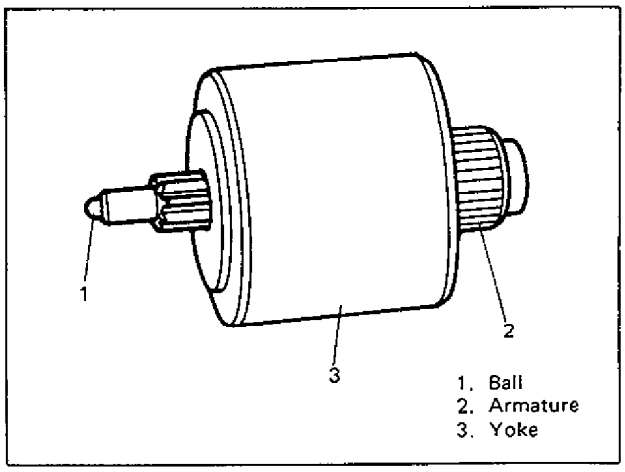


Fig. 6G1-17

3) Install yoke and armature into front housing while aligning match mark "B" provided before disassembly.
4) Install brush holder. (Refer to page 6G1-6.)
5) Install magnetic switch. (Refer to page 6G1-5.)
6) Carry out PERFORMANCE TEST referring to page 6G1-15 in this section.

OVER-RUNNING CLUTCH

REMOVAL

NOTE:

Before disassembling starting motor, be sure to put match marks at two locations (A & B) as shown in figure below so that any possible mistake can be avoided.

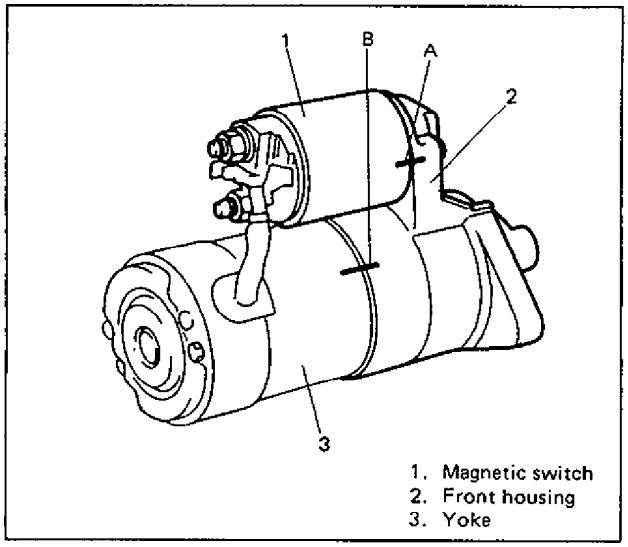


Fig. 6G1-18

1) Remove magnetic switch assembly. (For details, refer to steps 1) and 2) of MAGNETIC SWITCH REMOVAL described on page 6G1-5.)
2) Remove rear bracket.
3) Remove brush holder and brushes.

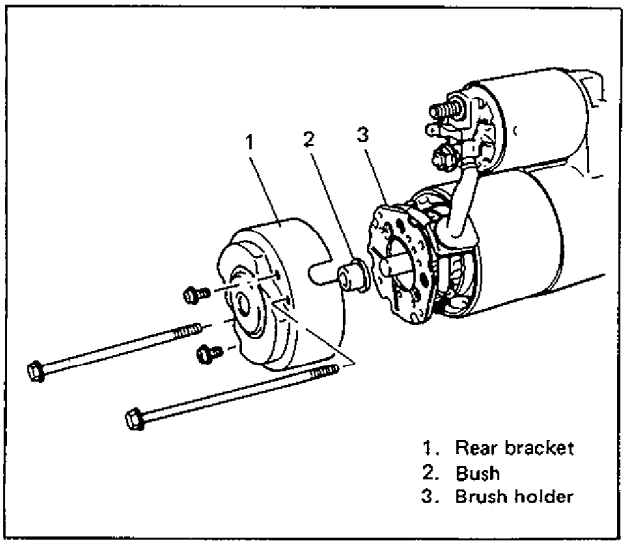


Fig. 6G1-19

4) Remove yoke and armature.

5) Remove packing and idle gears.

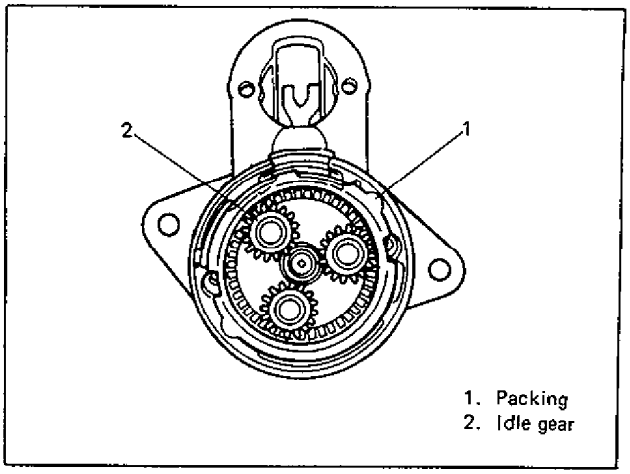


Fig. 6G1-20

6) Remove seal rubber and plate.

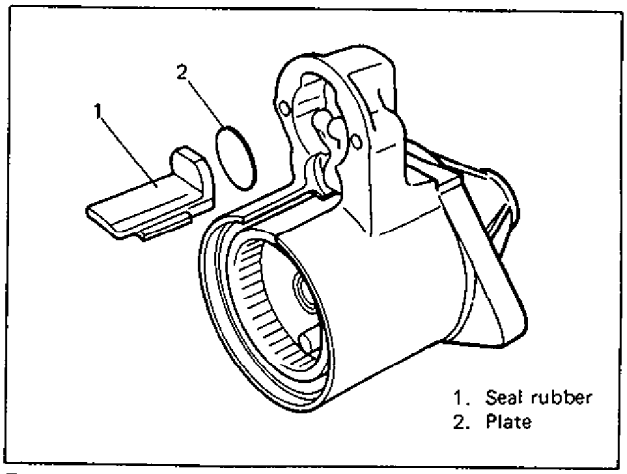


Fig. 6G1-21

7) Remove shaft assembly with lever.

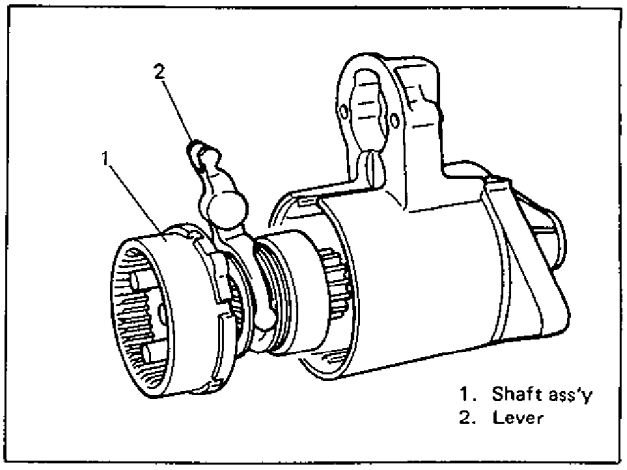


Fig. 6G1-22

8) Remove over-running clutch by removing rings.

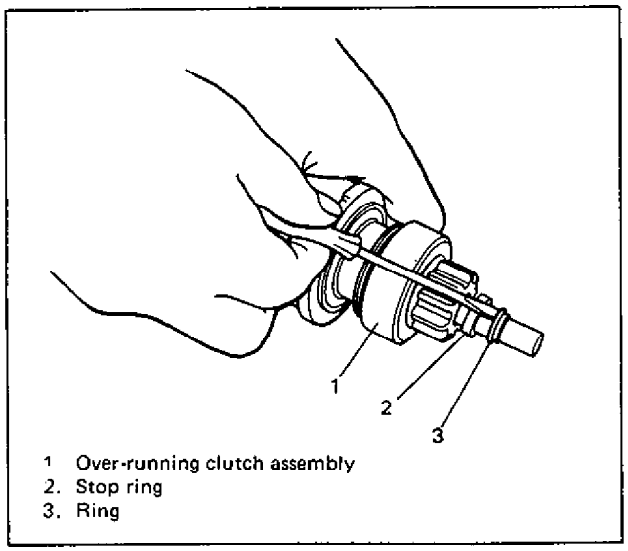


Fig. 6G1-23

INSTALLATION

Install in reverse order of REMOVAL, noting the following.

1) Apply grease. (Refer to Fig. 6G1-2.)
2) Install over-running clutch assembly to gear shaft, using care for installing direction of gear shaft stop ring.

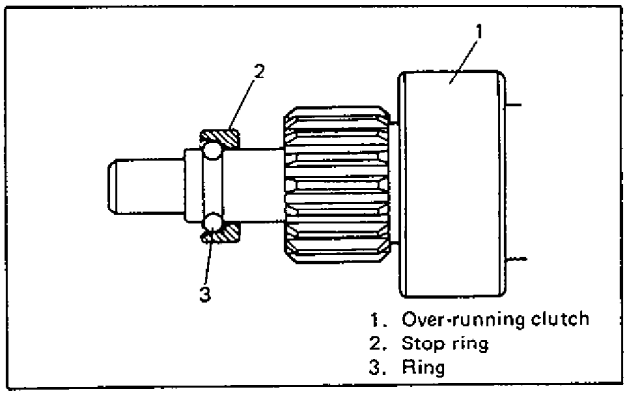


Fig. 6G1-24

3) Insert shaft ass'y into front housing with lever positioned as shown below.

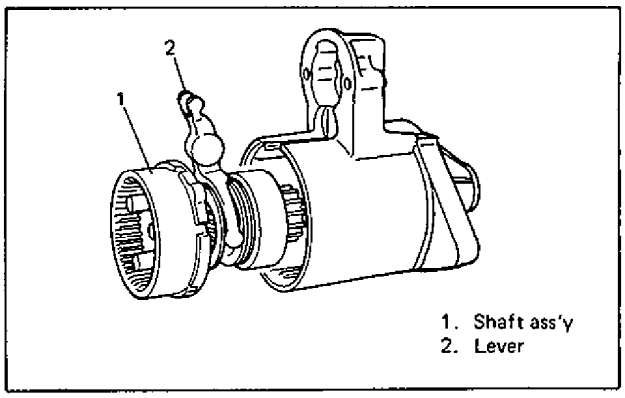


Fig. 6G1-25

4) Install packing so that cuts in packing align with holes for through bolt in front housing.

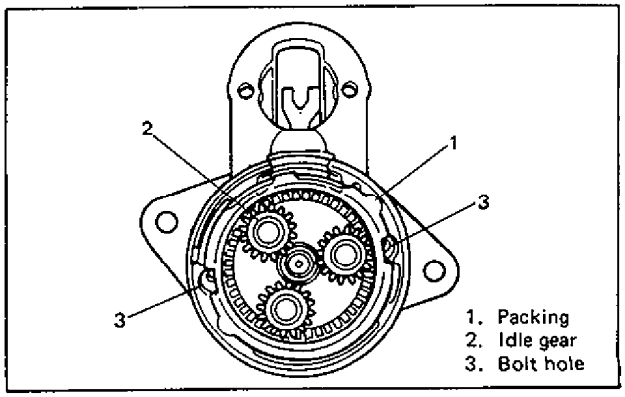


Fig. 6G1-26

5) Install plate and seal rubber to front housing.

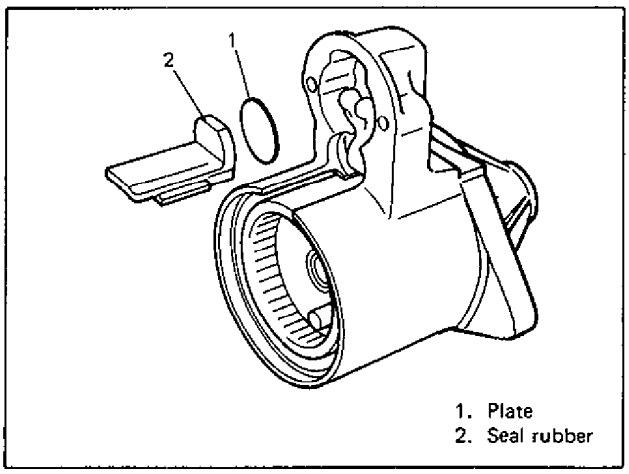


Fig. 6G1-27

6) Apply grease to ball and install ball into shaft hole.

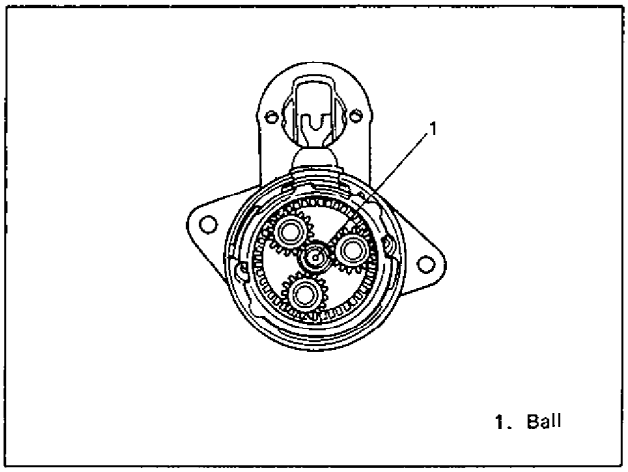


Fig. 6G1-28

7) Install yoke and armature to front housing by aligning match marks provided before removal.

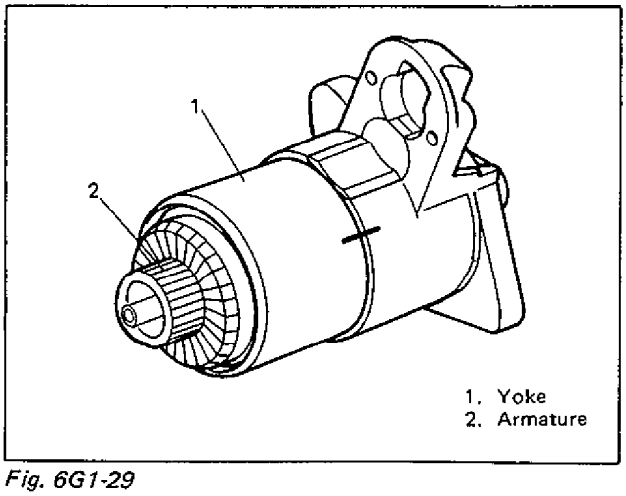


Fig. 6G1-29

8) Install brushes and brush holder. (For details, refer to steps 1) to 4) of BRUSH INSTALLATION on page 6G1-6.)
9) Tighten rear bracket bolts and brush holder screws.
10) Install magnetic switch assembly and connect wire (switch to motor) to switch terminal. (For details, refer to steps 1) to 3) of MAGNETIC SWITCH INSTALLATION on page 6G1-5.)

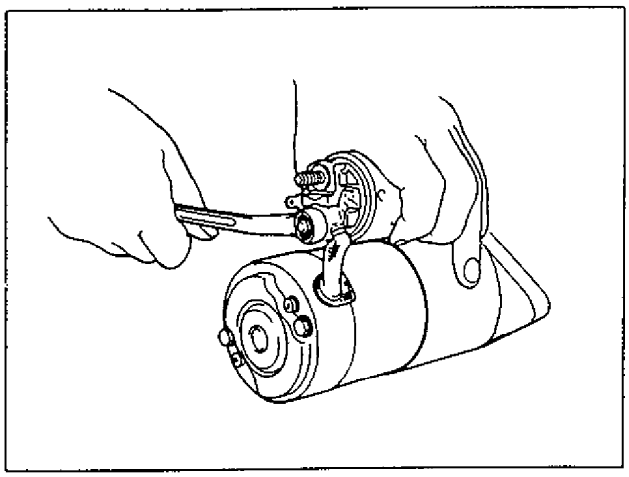


Fig. 6G1-30

11) Upon completion of assembly, carry out PERFORMANCE TEST referring to page 6G1-15 in this section.

STARTING MOTOR INSPECTION

1. INSPECT ARMATURE

Inspect commutator for dirt or burn. Correct with sandpaper or lathe, if necessary.

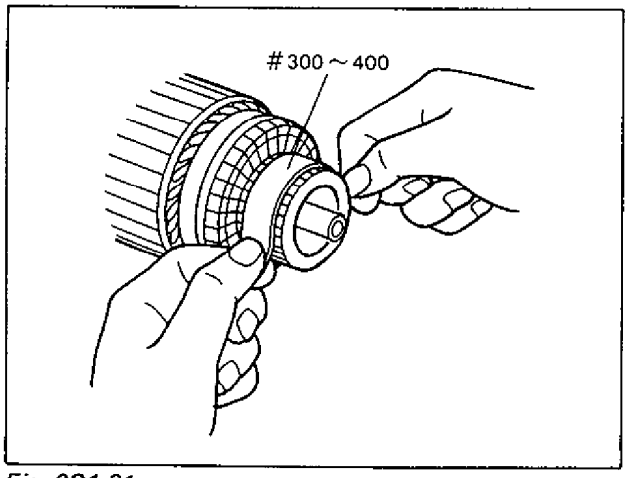


Fig. 6G1-31

Check commutator for uneven wear. If deflection of dial gauge pointer exceeds limit, repair or replace.

NOTE:
Below specification presupposes that armature is free from bend. Bent shaft must be replaced.

	Standard	Limit
Commutator out of round	0.05 mm (0.0019 in.) or less	0.4 mm (0.015 in.)

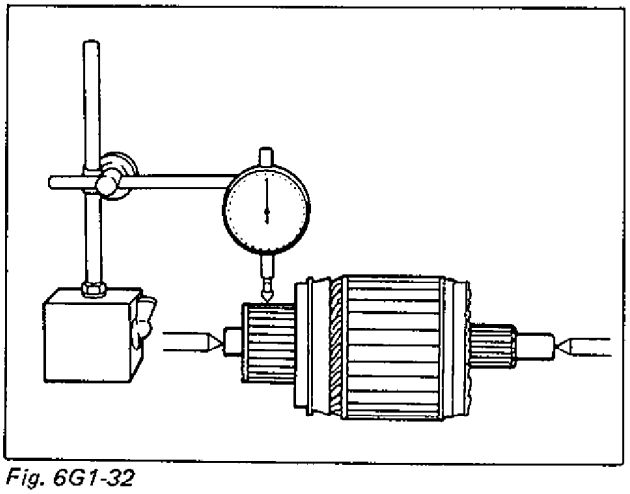


Fig. 6G1-32

Inspect commutator for wear. If below limit, replace armature.

	Standard	Limit
Commutator outside diameter	29.4 mm (1.16 in.)	28.8 mm (1.13 in.)

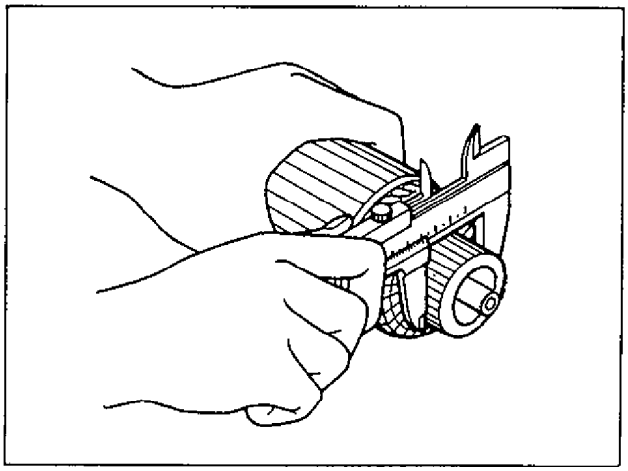


Fig. 6G1-33

Inspect commutator for insulator depth. Correct or replace if below limit.

	Standard	Limit
Commutator insulator depth	0.5 – 0.8 mm (0.0196 – 0.0314 in.)	0.2 mm (0.0078 in.)

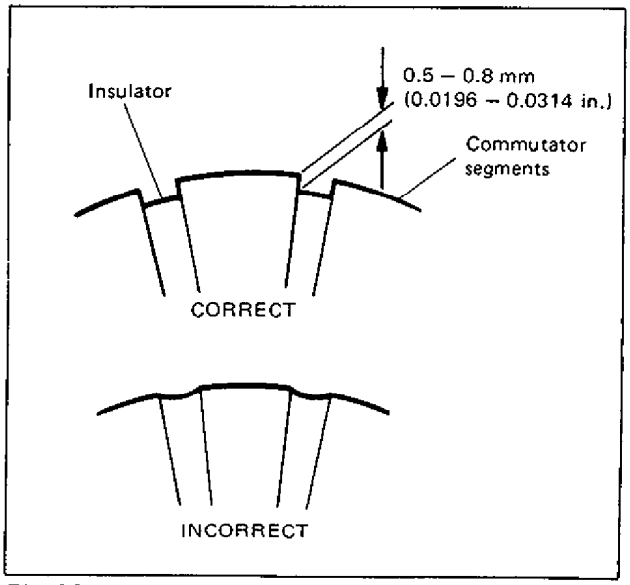


Fig. 6G1-34

Ground Test

Check commutator and armature core. If there is continuity, armature is grounded and must be replaced.

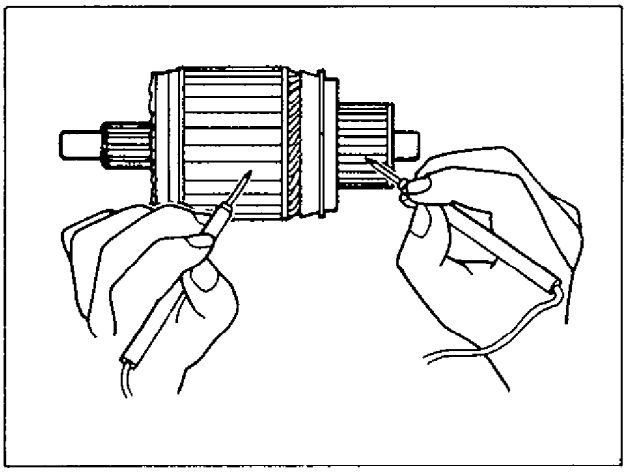


Fig. 6G1-35

Open Circuit Test

Check for continuity between segments. If there is no continuity at any test point, there is an open circuit and armature must be replaced.

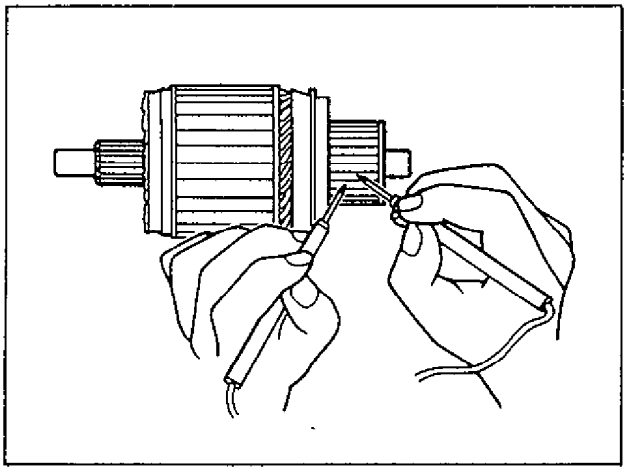


Fig. 6G1-36

2. INSPECT PLUNGER

Inspect plunger for wear. Replace if necessary.

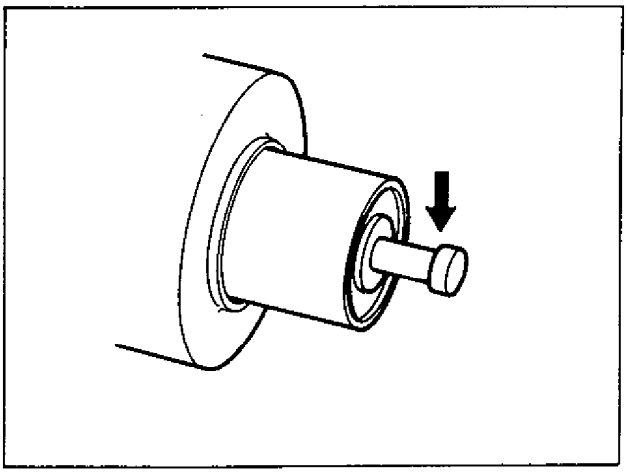


Fig. 6G1-37

3. INSPECT BRUSH

- Check brushes for wear. If below limit, replace brush.

	Standard	Limit
Brush length	17.5 mm (0.69 in.)	12 mm (0.47 in.)

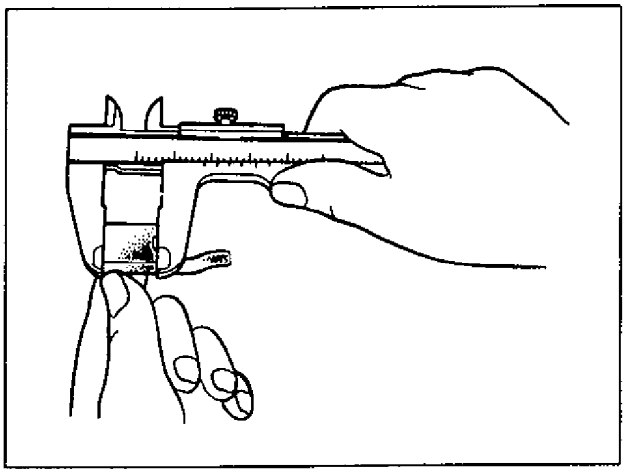


Fig. 6G1-38

- Install brushes to each brush holder and check for smooth movement.

4. INSPECT BRUSH HOLDER AND SPRING

Check movement of brush in brush holder. If brush movement within brush holder is sluggish, check brush holder for distortion and sliding faces for contamination.

Clean or correct as necessary.

Check for continuity across insulated brush holder (positive side) and grounded brush holder (negative side).

If continuity exists, brush holder is grounded due to defective insulation and should be replaced.

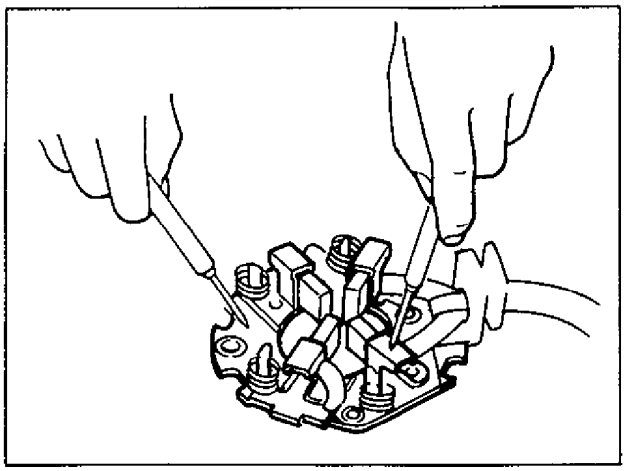


Fig. 6G1-39

Inspect brush springs for wear, damage or other abnormal conditions. Replace if necessary.

Brush spring tension (with brush holder removed from commutator.)	Standard	Limit
	2.1 kg (4.63 lb)	0.7 kg (1.54 lb)

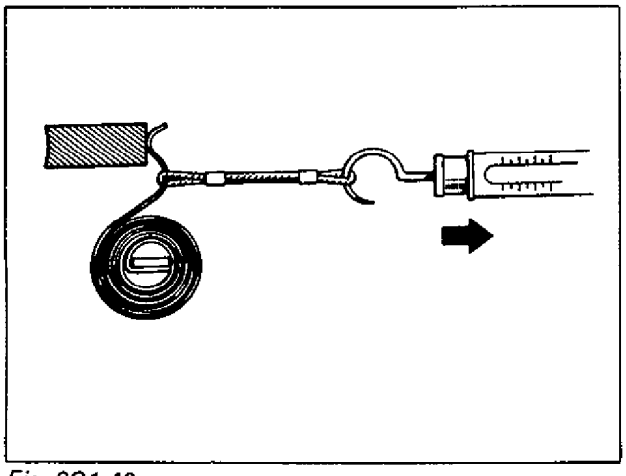


Fig. 6G1-40

5. INSPECT PINION AND OVER-RUNNING CLUTCH

Inspect pinion for wear, damage or other abnormal conditions. Check that clutch locks up when turned in direction of drive and rotates smoothly in reverse direction. Replace if necessary.

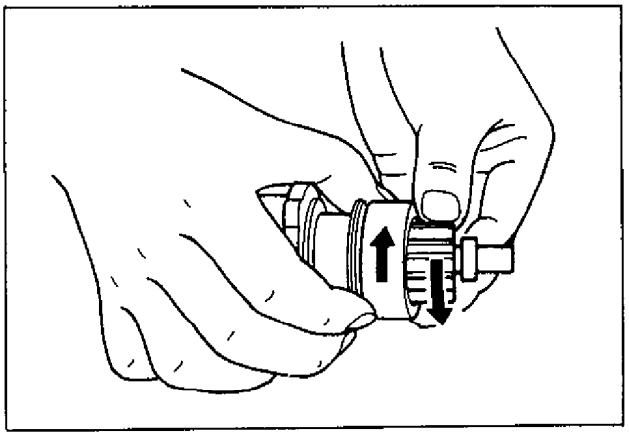


Fig. 6G1-41

Inspect spline teeth for wear or damage. Replace if necessary. Inspect pinion for smooth movement.

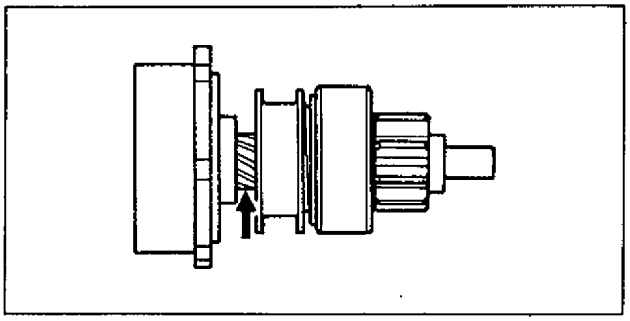


Fig. 6G1-42

6. INSPECT ARMATURE SHAFT BUSHES

Inspect bushes for wear or damage. Replace if necessary.

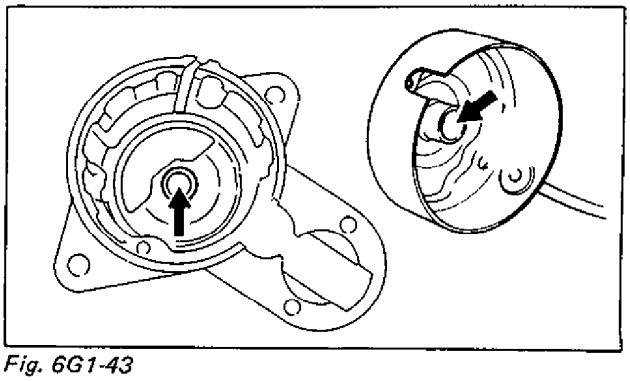


Fig. 6G1-43

7. INSPECT MAGNETIC SWITCH

Push in plunger and release it. The plunger should return quickly to its original position. Replace if necessary.

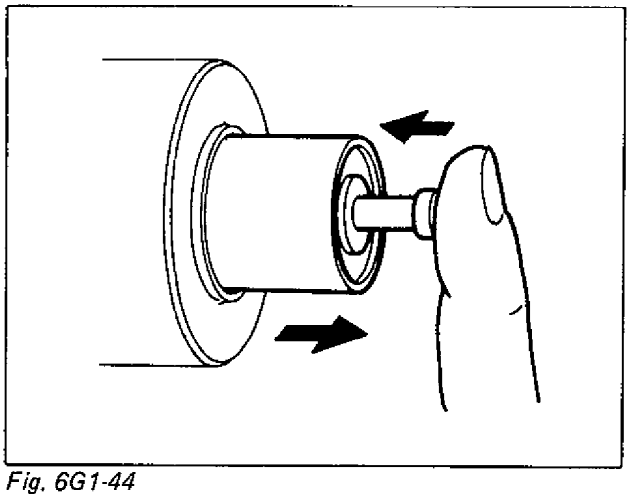


Fig. 6G1-44

Pull-In Coil Open Circuit Test

Check for continuity across magnetic switch 'S' terminal and 'M' terminal. If no continuity exists, coil is open and should be replaced.

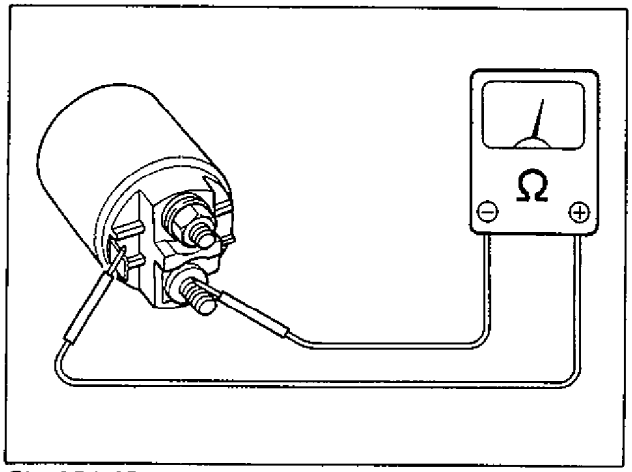


Fig. 6G1-45

Hold In Coil Open Circuit Test

Check for continuity across magnetic switch 'S' terminal and coil case. If no continuity exists, coil is open and should be replaced.

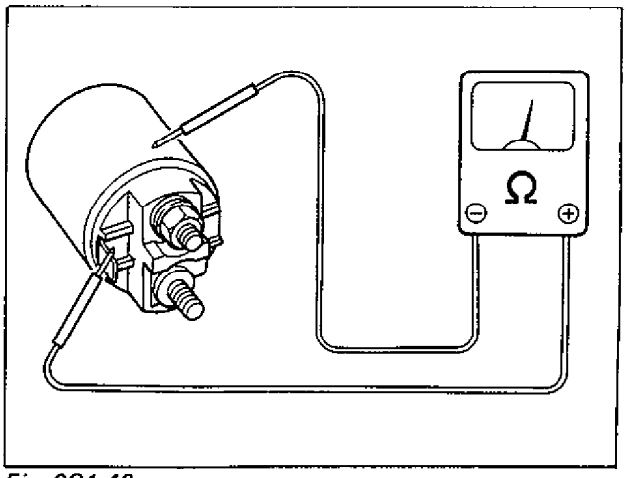


Fig. 6G1-46

8. INSPECT GEARS

Inspect internal gear and idle gears for wear, damage or other abnormal conditions. Replace if necessary.

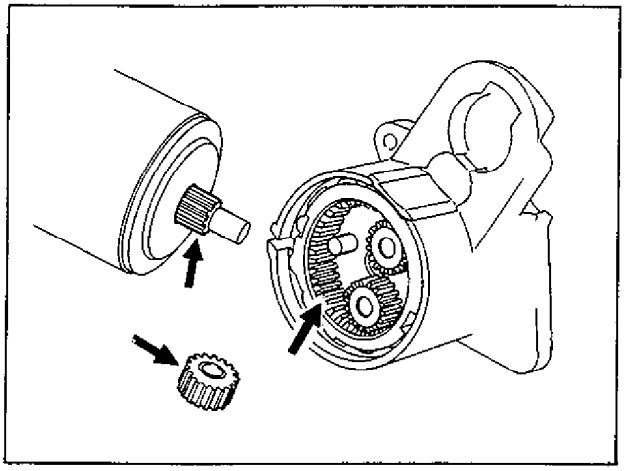


Fig. 6G1-47

9. PERFORMANCE TEST

CAUTION:
These test must be performed within 3 – 5 seconds to avoid burned coil.

1) Pull-In Test

Connect battery to magnetic switch as shown.
Check that plunger and pinion move outward.
If plunger and pinion don't move, replace magnetic switch.

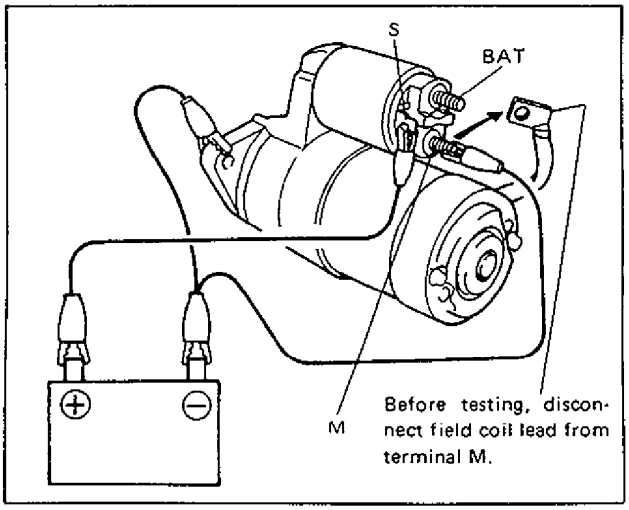


Fig. 6G1-48

2) Hold-In Test

While connected as above with plunger out, disconnect negative lead from terminal 'M'.
Check that plunger and pinion remain out.
If plunger and pinion return inward, replace magnetic switch.

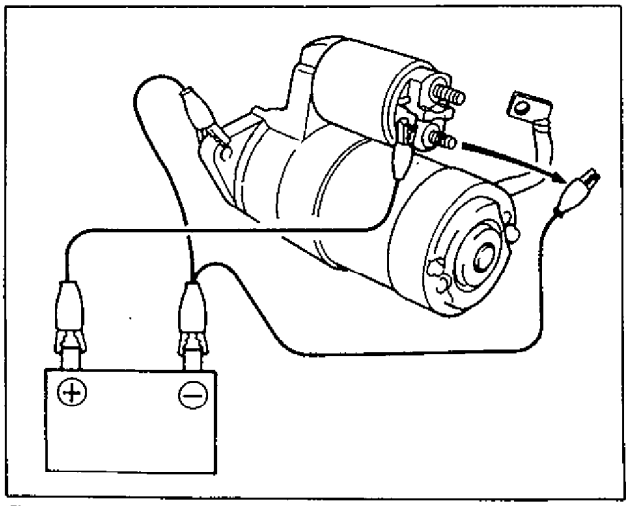


Fig. 6G1-49

3) Check Plunger and Pinion Return

Disconnect negative lead from switch body.
Check that plunger and pinion return inward.
If plunger and pinion don't return, replace magnetic switch.

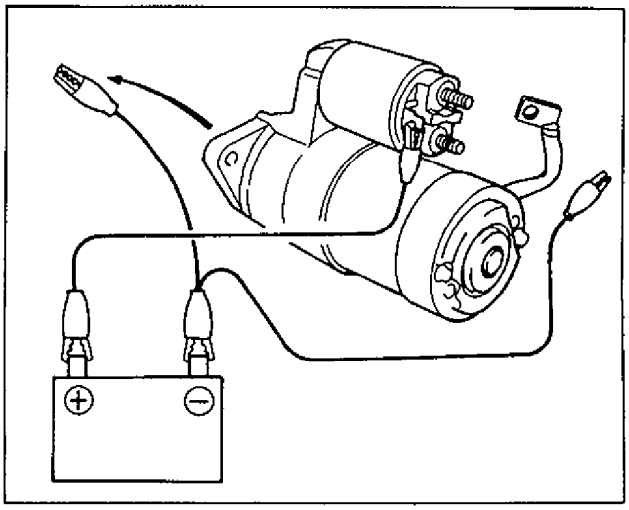


Fig. 6G1-50

4) No-Load Performance Test

a) Connect battery and ammeter to starter as shown.
b) Check that starter rotates smoothly and steadily with pinion moving out. Check that ammeter indicates specified current.

Specified current
50 – 75A at 11V

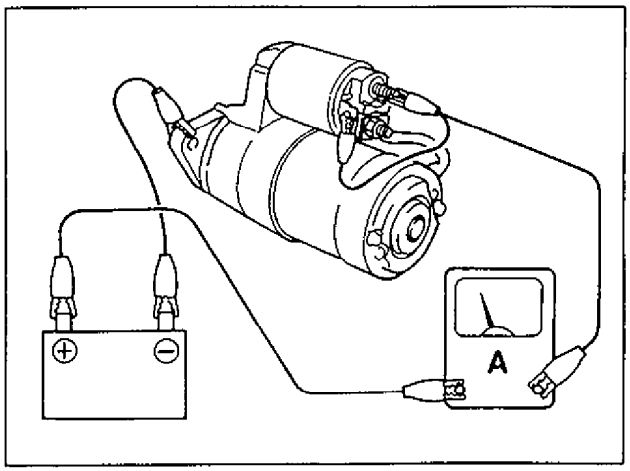


Fig. 6G1-51

SPECIFICATIONS

Voltage	12 volts
Output	1.2 kW
Rating	30 seconds
Direction of rotation	Clockwise as viewed from pinion side
Brush length	17.5 mm (0.69 in.)
Number of pinion teeth	8
No-load characteristic	50 – 75A maximum at 11.0 volts, 3,000 r/min (rpm) minimum
Load characteristic	300A maximum at 7.7 volts, 0.93 kg-m torque, 850 r/min (rpm) minimum
Locked rotor current	780A maximum at 4.0 volts, 1.9 kg-m minimum
Magnetic switch operating voltage	8 volts maximum

SECTION 6K

EXHAUST SYSTEM

NOTE:

- **There are two types of exhaust No. 2 pipe, one with catalytic converter and the other without it. Their use depends on regulations of each country.**
- **For the descriptions (items) not found in this section of this manual, refer to the same section of Service Manual mentioned in the FOREWORD of this manual.**

GENERAL DESCRIPTION

The exhaust system consists of an exhaust manifold, an exhaust No. 1 pipe, pipe, and seals and gaskets etc.

The catalytic converter is an emission control device added to the exhaust system to lower the levels of Hydrocarbon (HC), Carbon Monoside (CO) and Oxides of Nitrogen (NOx) pollutants in the exhaust gas.

THE CATALYTIC CONVERTER REQUIRES USE OF UNLEADED FUEL ONLY.

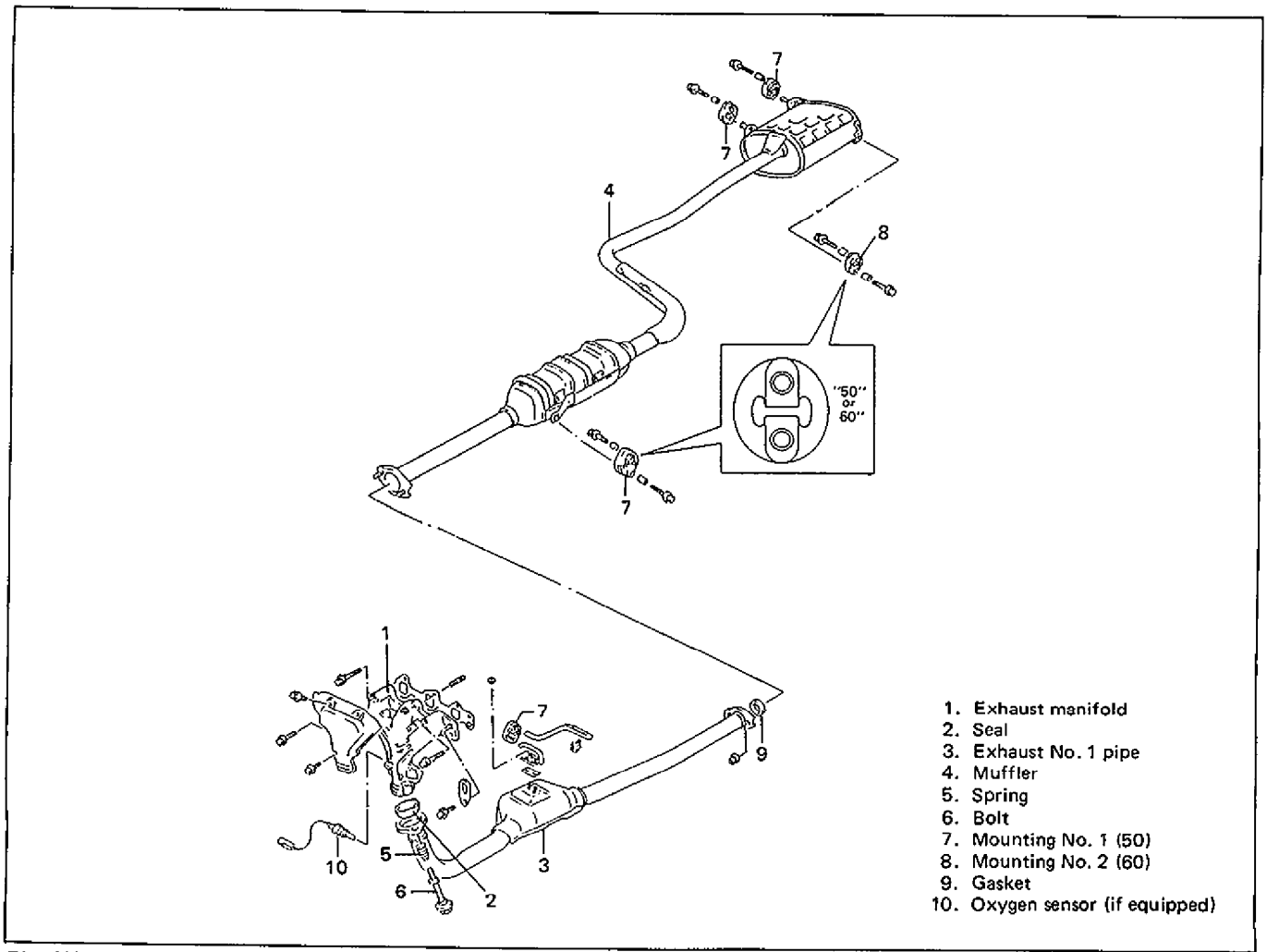


Fig. 6K-1 Exhaust System

SECTION 7A

MANUAL TRANSMISSION

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

ON-CAR SERVICE

GEAR SHIFT CONTROL

REMOVAL AND INSTALLATION

For removal and installation of gear shift control other than its lever adjustment after installation, use the same procedures as those described in Service Manual mentioned in the FOREWORD of this manual. Shift control lever adjustment is as follows.

For positioning control lever, loosely install 4 guide plate bolts and 4 control lever housing nuts first, adjust position and then tighten those nuts and bolts.

Control lever position distance "A"	215 mm (8.5 in.)

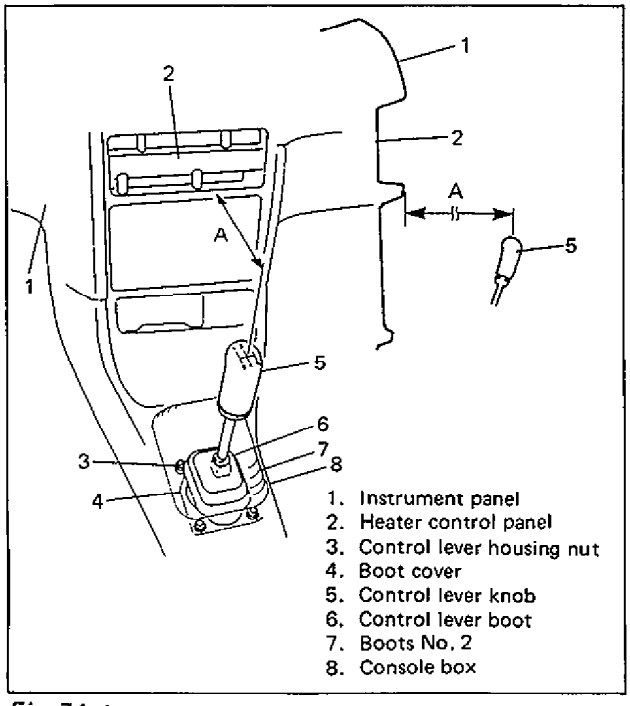


Fig. 7A-1

SECTION 7B

AUTOMATIC TRANSMISSION

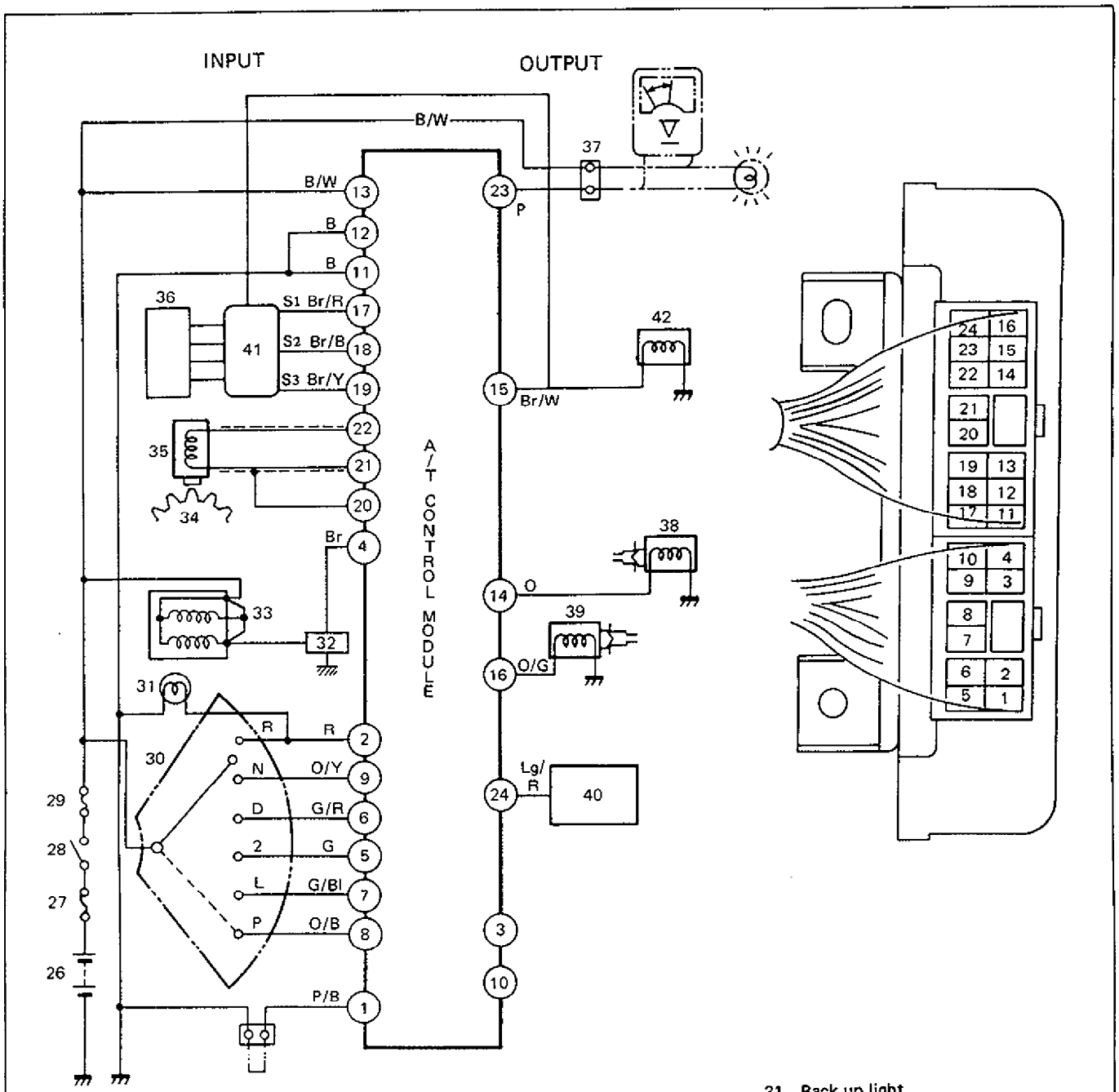
NOTE:
For the descriptions (items) not found in this section, refer to the same section of the Service Manual mentioned in the FOREWORD of this manual.

CONTENTS

DIAGNOSIS

ELECTRIC SHIFT CONTROL SYSTEM

Process trouble shooting for electric control system by using SELF-DIAGNOSIS and SYSTEMATIC TROUBLE SHOOTING and find a defective area reasonably.



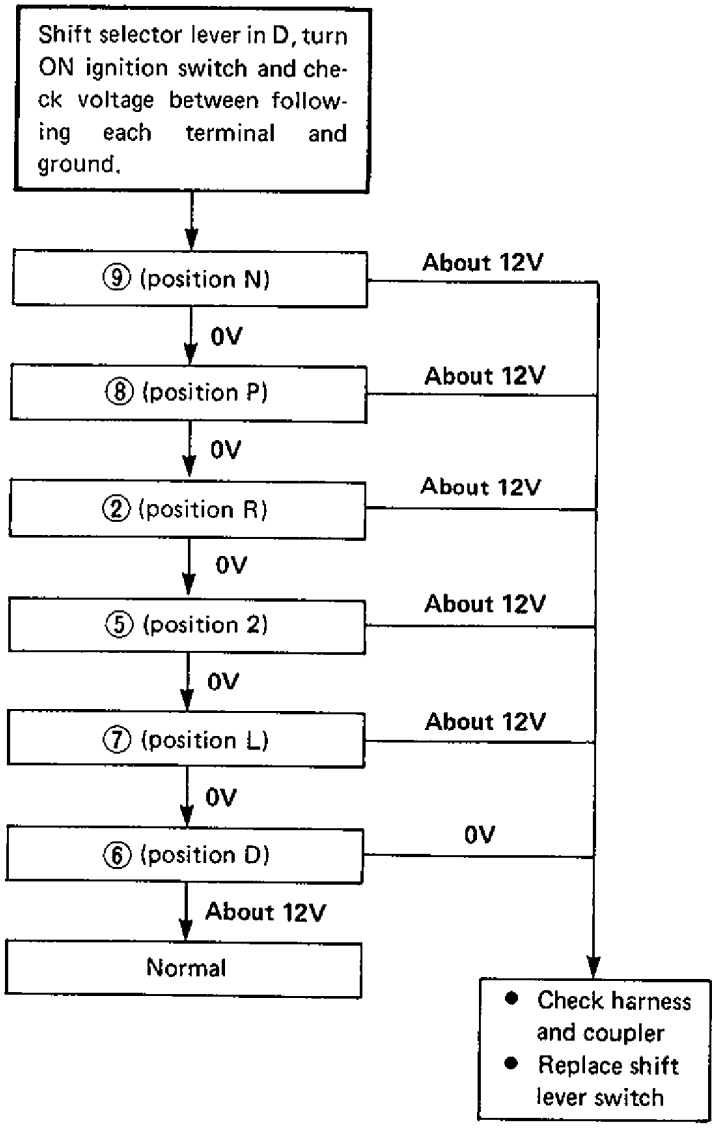
1. Diagnosis switch
2. R position
3. No connection
4. Ignition signal
5. 2nd position
6. D position
7. L position
8. P position
9. N position
10. No connection
11. Ground
12. Ground
13. Power supply
14. Direct clutch solenoid
15. R, D, 2 and L signal
16. 2nd brake solenoid
17. Throttle opening signal
18. Throttle opening signal
19. Throttle opening signal
20. Speed sensor ground
21. Speed sensor
22. Speed sensor
23. Diagnosis monitor
24. Air-con control
25. Diagnosis switch
26. Battery
27. Main fuse
28. Ignition switch
29. Fuse
30. Shift lever switch
31. Back up light
32. Noise filter
33. Ignition coil
34. Countershaft
35. Speed sensor
36. TPS
37. Diagnosis monitor
38. Direct clutch solenoid
39. 2nd brake solenoid
40. Air-con controller
41. ECM (Fuel Injection model)
42. Idle up VSV (Carburetor model)

Fig. 7B-1 Gear Shift Control System Wiring Diagram

SHIFT LEVER SWITCH CHECKING PROCEDURE

1. Turn OFF ignition switch.
2. Disconnect couplers from A/T control module.
3. For each check, bring tester probes in touch with coupler terminals from harness side.

A–1 Check Procedure



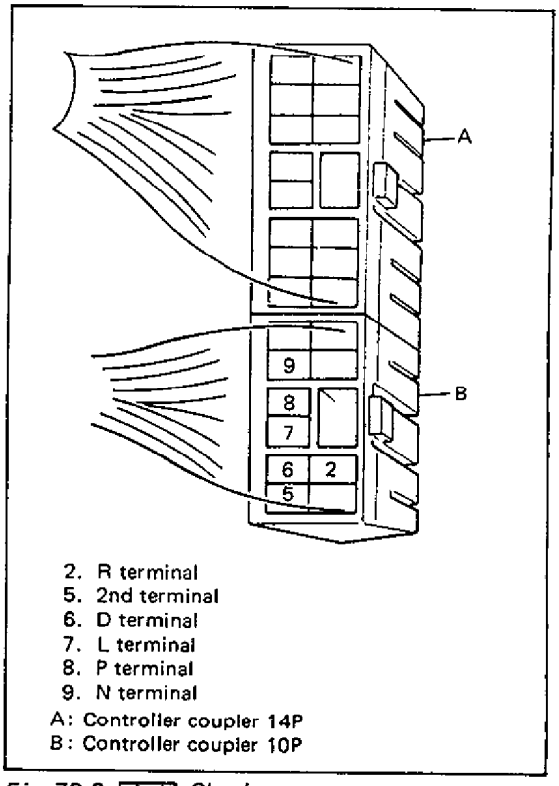


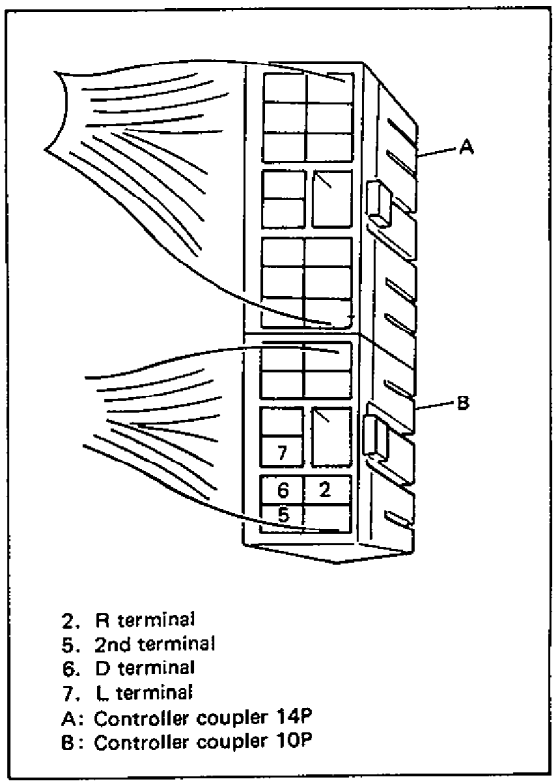
Fig. 7B-2 A-1 Check

A–2 Check Procedure

Shift selector lever in 2, turn ON ignition switch and check voltage between following each terminal and ground.

⑦ (position L) — About 12V
↓ 0V
⑥ (position D) — About 12V
↓ 0V
② (position R) — About 12V
↓ 0V
⑤ (position 2) — 0V
↓ About 12V
Normal

- Check harness and coupler
- Replace shift lever switch



2. R terminal
5. 2nd terminal
6. D terminal
7. L terminal
A: Controller coupler 14P
B: Controller coupler 10P

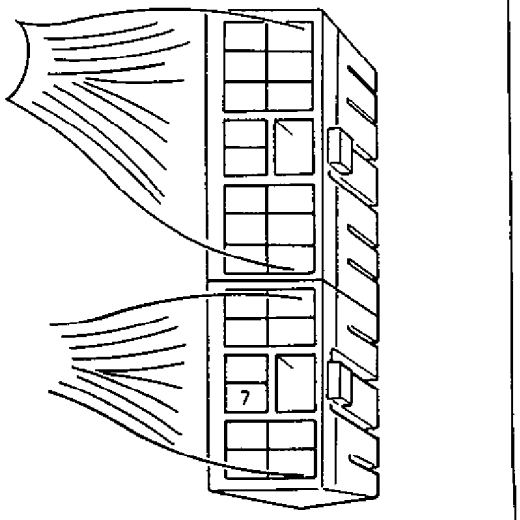
Fig. 7B-3 A-2 Check

A–3 Check Procedure

Shift selector lever in L, turn ON ignition switch and check voltage between following each terminal and ground.

⑦ (position L) — 0V
↓ About 12V
Normal

- Check harness and coupler
- Replace shift lever switch



7. L terminal

Fig. 7B-4 A-3 Check

A–4 Check Procedure

Shift selector lever in R, turn ON ignition switch and check voltage between following each terminal and ground.

⑦ (position L)
- 12V
- 0V

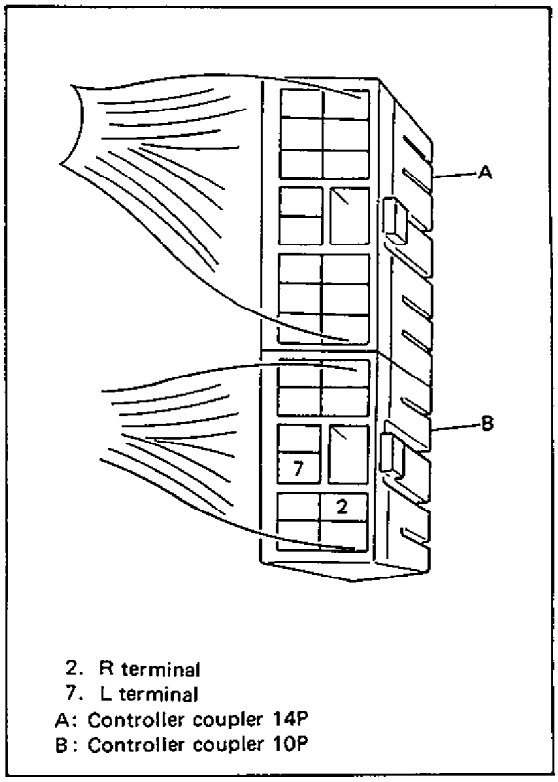
↓

② (position R)
- 0V
- About 12 V

↓

Normal

- Check harness and coupler
- Replace shift lever switch



2. R terminal
7. L terminal
A: Controller coupler 14P
B: Controller coupler 10P

Fig. 7B-5 A-4 Check

N P Check Procedure

Shift selector lever in N, turn ON ignition switch and check voltage between following each terminal and ground.

⑨ (position N)
- 0V
- About 12V

↓

Normal

- Check harness and coupler
- Replace shift lever switch

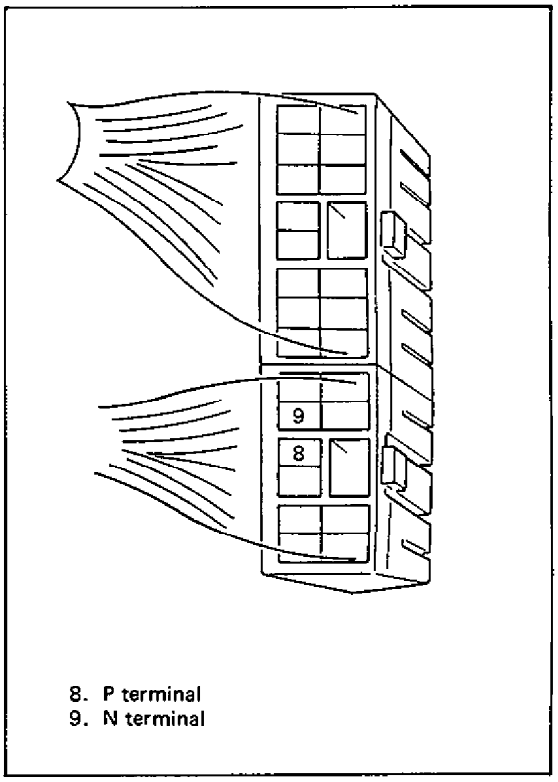
Shift selector lever in P, turn ON ignition switch and check voltage between following each terminal and ground.

⑧ (position P)
- 0V
- About 12V

↓

Normal

- Check harness and coupler
- Replace shift lever switch



8. P terminal
9. N terminal

Fig. 7B-6 N P Check

Separately from the above inspection, shift lever switch itself can be checked on continuity in each shift position. Refer to following table for connection and lead wire color.

Position	Shift lever switch lead wire color									
	Black	Blue/ White	Blue	Green	Green/ Red	Green/ Blue	Red	Yellow	Black/ Red	Black/ Yellow
P	○	○							○	○
R							○	○		
N	○		○						○	○
D	○			○						
2	○				○					
L	○					○				

ON CAR SERVICE

MAINTENANCE SERVICE

MANUAL SELECTOR

REMOVAL

1. Selector knob screws and then selector knob.
2. Console box, if equipped.
3. Select indicator assembly.
4. Illumination lamp coupler.
5. Select cable from selector lever.
6. Raise car.
7. 4 housing nuts.
8. Lever housing with selector lever from floor.

NOTE:

- **Knob and push button must not be disassembled.**
- **Do not drive out detent pin.**

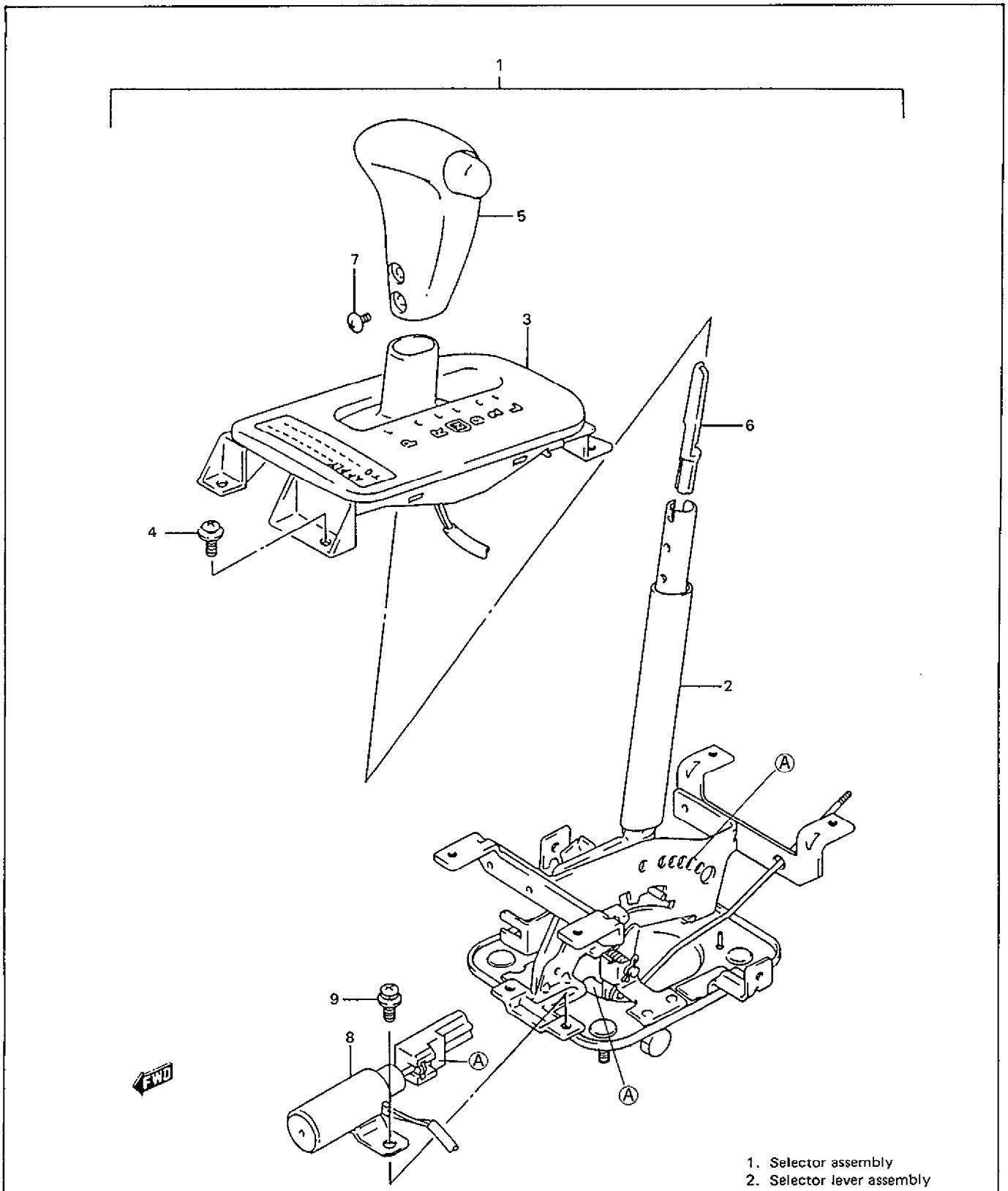
INSTALLATION

Assemble selector by reversing removal procedure, replacing parts with new ones as necessary. Apply grease to portions indicated as A in figure.

NOTE:

- **When installing knob, make sure that there is a slight clearance between detent pin and cam bottom when knob botton is pushed in all the way.**
- **Check selector for proper operation as follows.**
  1. **With knob botton pushed half way, N to R and D to 2 shifts are available (but not any other shift).**
  2. **With knob button pushed all the way in, 2 to L and R to P shifts are available.**
- **For adjustment of interlock cable, refer to Service Manual mentioned in the FOREWORD of this manual.**
- **Check that illumination lamp lights when light switch is turned ON.**

Tightening torque	N·m	kg-m	lb-ft
Selector lever shaft nut	18 – 22	1.8 – 2.2	13.0 – 15.5
Housing nuts	10 – 16	1.0 – 1.6	7.5 – 11.5



1. Selector assembly
2. Selector lever assembly
3. Indicator assembly
4. Screw
5. Knob assembly
6. Guide, dent release rod
7. Screw
8. Solenoid (If equipped)
9. Screw

Fig. 7B-7 Manual Selector Components

SECTION 8

BODY ELECTRICAL SYSTEM

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

CONTENTS

BODY ELECTRICAL SYSTEM

FUSES

The main fuse block is located on the fender apron panel in the engine room and junction/fuse block is installed to underside of instrument cover panel.

The designation and location of each fuse, refer to Service Manual mentioned in the FOREWORD of this manual.

CAUTION:

- **When replacing a fuse, be sure to use one having a correct rated amperage.**
- **Before replacing a fuse, turn OFF every switch of electric equipments including main switch.**

MAIN FUSE BLOCK CIRCUIT

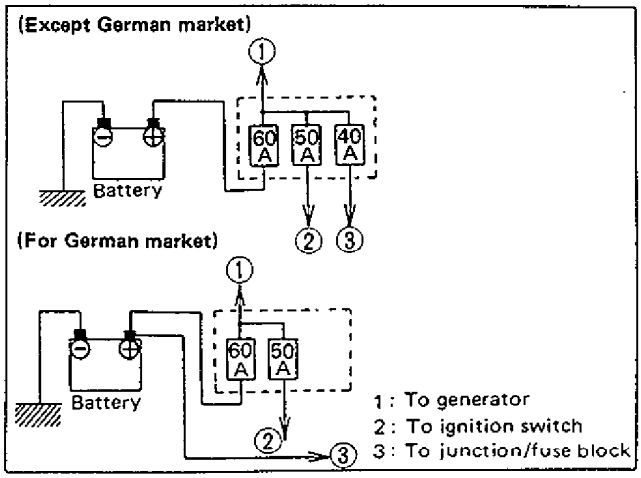
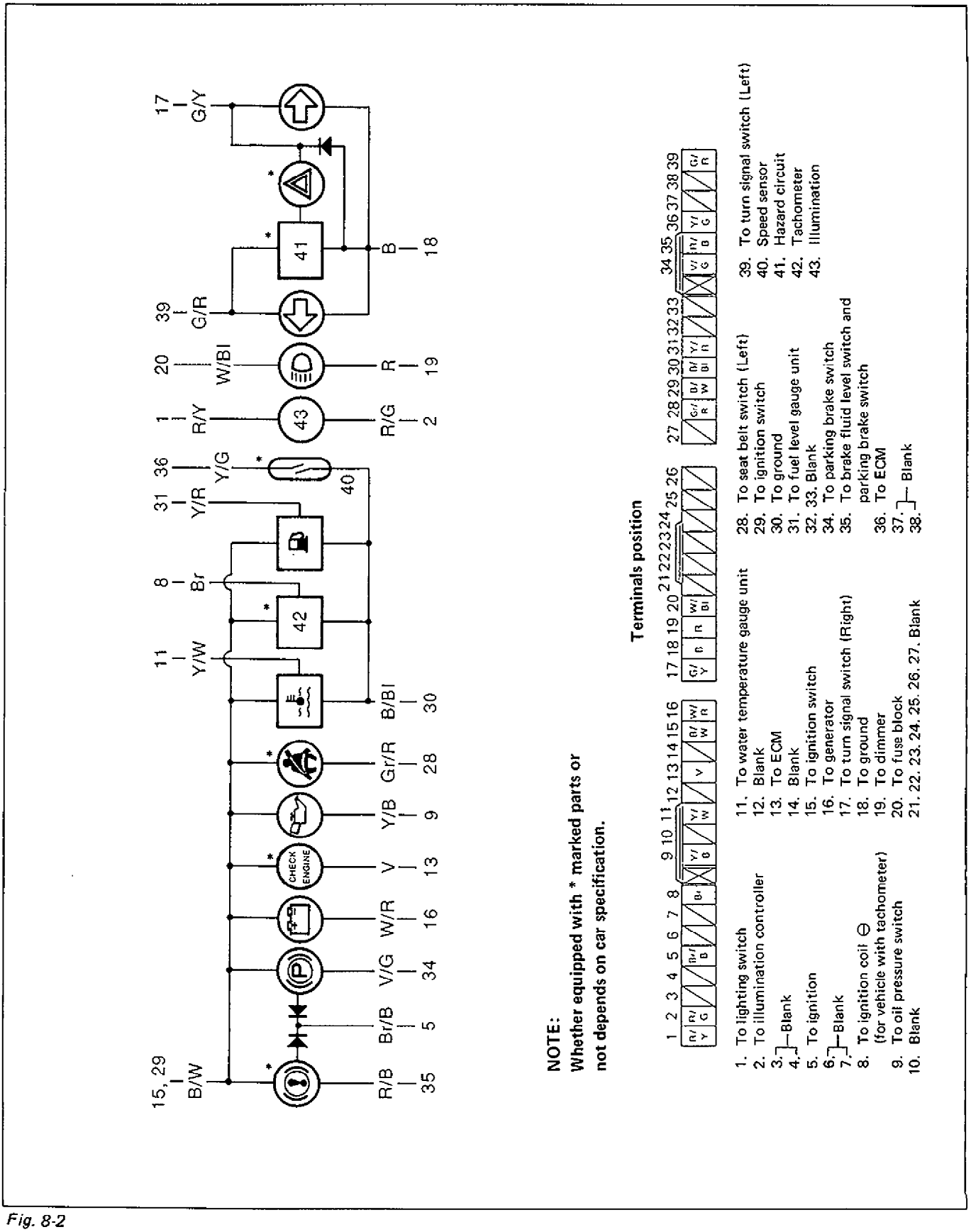


Fig. 8-1 Main Fuse Block Circuit

INSTRUMENTS AND GAUGES

COMBINATION METER WIRING



NOTE:
Whether equipped with * marked parts or not depends on car specification.

1. To lighting switch
2. To illumination controller
3.]—Blank
4.]
5. To ignition
6.]—Blank
7.]
8. To ignition coil ⊖ (for vehicle with tachometer)
9. To oil pressure switch
10. Blank
11. To water temperature gauge unit
12. Blank
13. To ECM
14. Blank
15. To ignition switch
16. To generator
17. To turn signal switch (Right)
18. To ground
19. To dimmer
20. To fuse block
21. 22. 23. 24. 25. 26. 27. Blank
28. To seat belt switch (Left)
29. To ignition switch
30. To ground
31. To fuel level gauge unit
32. 33. Blank
34. To parking brake switch
35. To brake fluid level switch and parking brake switch
36. To ECM
37.]—Blank
38.]
39. To turn signal switch (Left)
40. Speed sensor
41. Hazard circuit
42. Tachometer
43. Illumination

Fig. 8-2

INSTRUMENTS AND GAUGES

COMBINATION METER WIRING

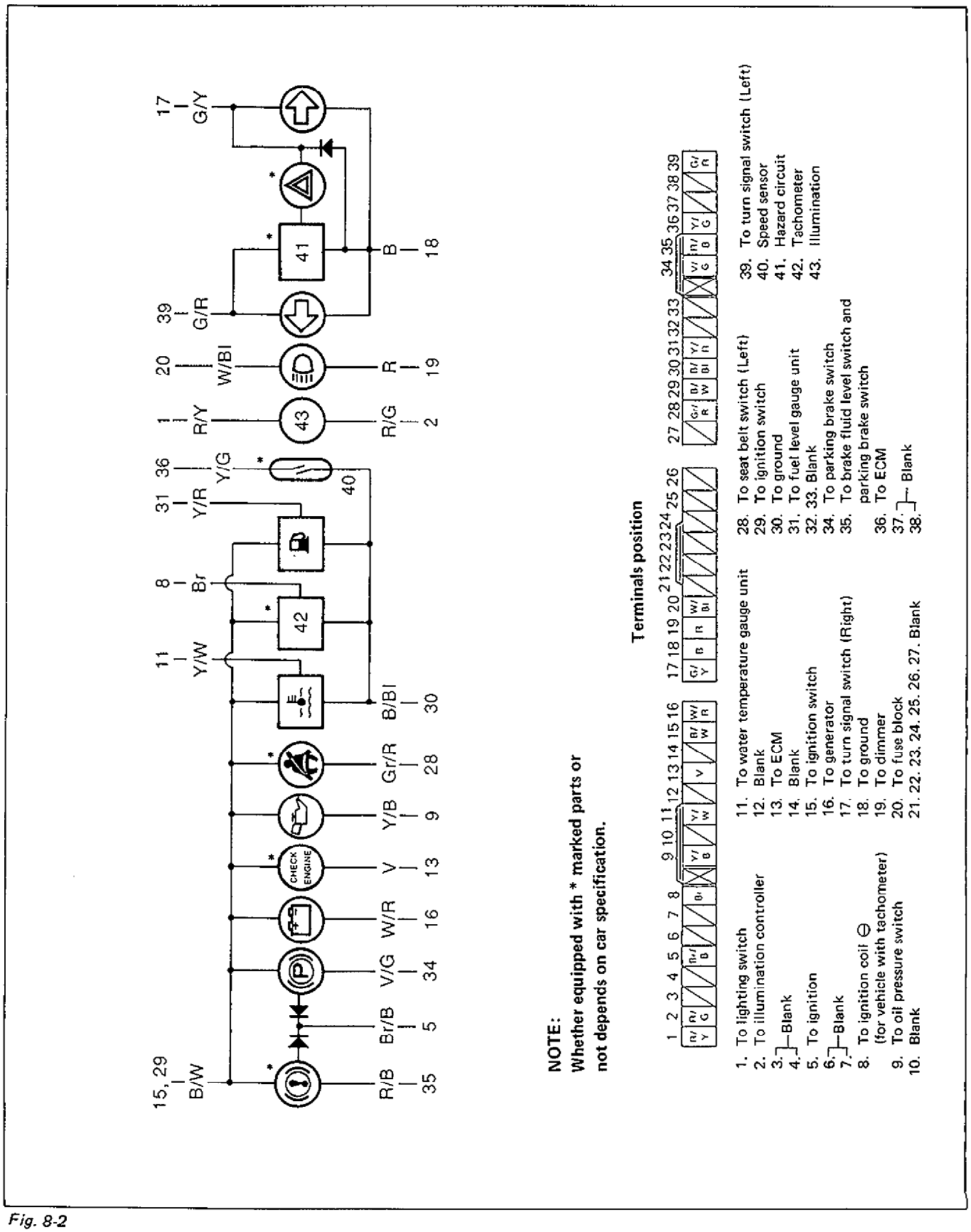


Fig. 8-2

LIGHT WARNING BUZZER

DESCRIPTION OF CIRCUIT

The light warning buzzer circuit is a system to sound the buzzer when ignition switch turns OFF and door switch (driver's side) turns ON (i.e. driver's side door opens) while lighting switch turns still ON, warning driver to turn off the lights.

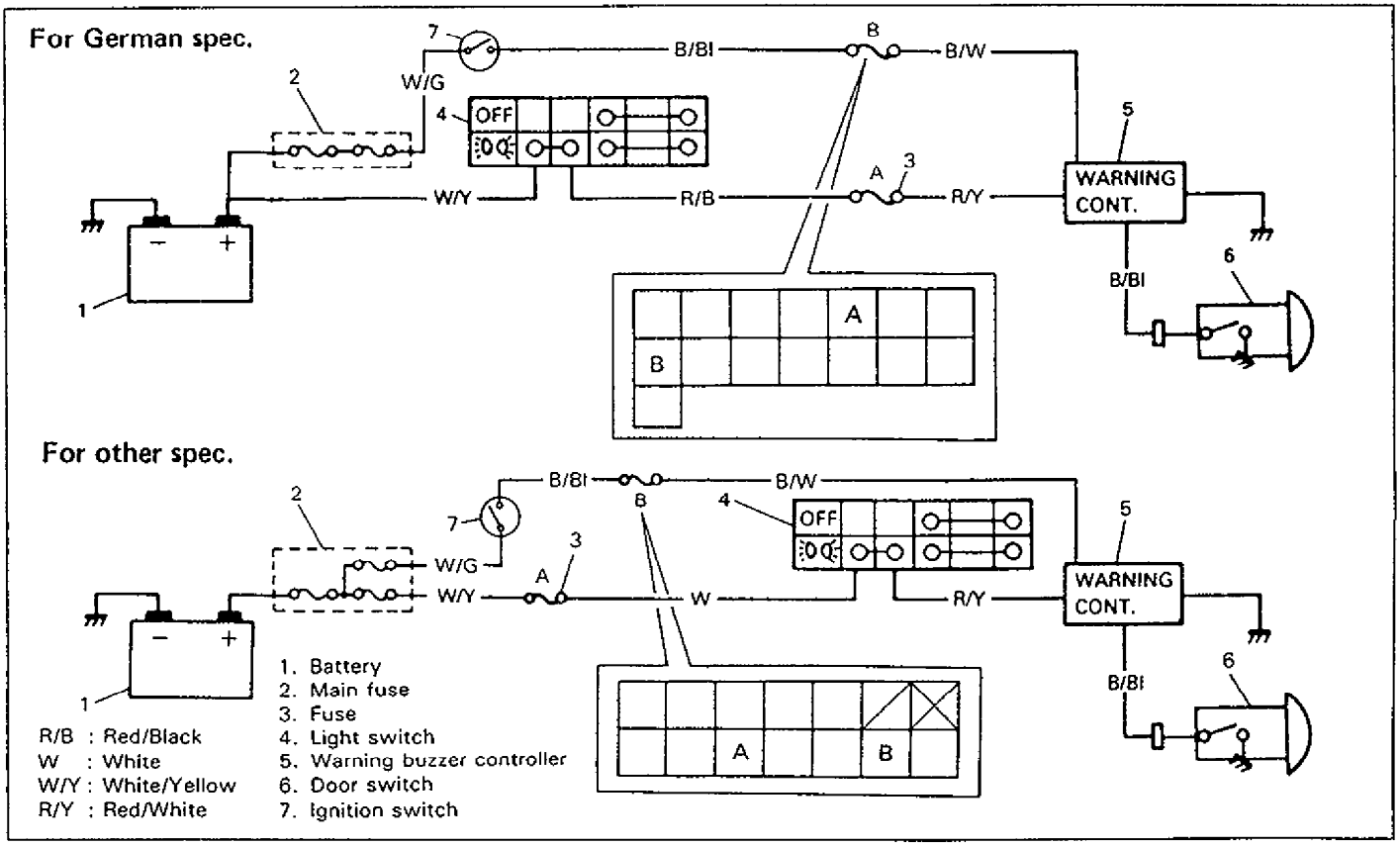


Fig. 8-3

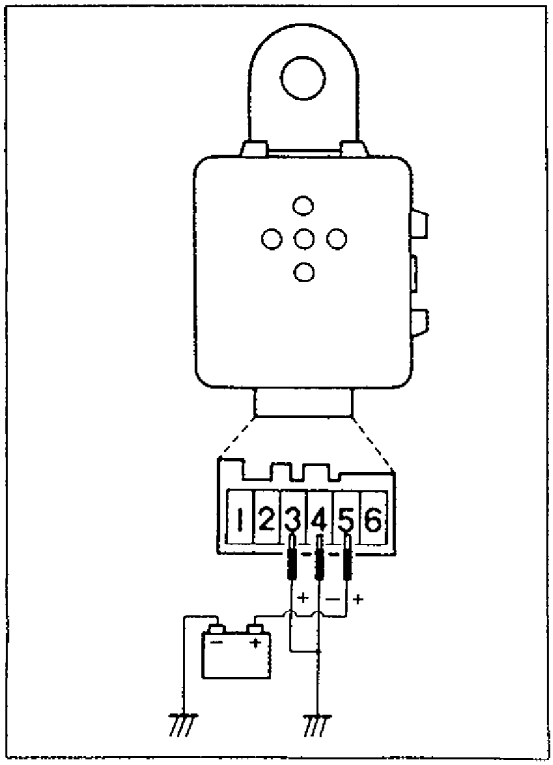


Fig. 8-4

INSPECTION

When the warning buzzer does not make sounding, use the above circuit diagram as reference to check the buzzer, wiring, etc.

INSPECTION OF WARNING CONTROLLER

First, connect positive (+) terminal of battery to terminal ⑤ of controller and negative (—) one to ③ and ④.
If buzzer emits buzzing sound then, controller is in good condition. If not, replace.

MAIN SWITCH KEY REMAINDER WARNING BUZZER

DESCRIPTION OF CIRCUIT

The main switch key remainder warning buzzer circuit is a system to sound the buzzer if the driver leaves the car with the main switch key inserted so as to urge him to take it out.

INSPECTION

If main switch key remainder warning buzzer does not sound, use its wiring diagram in figure below as reference to check buzzer, wiring, etc.

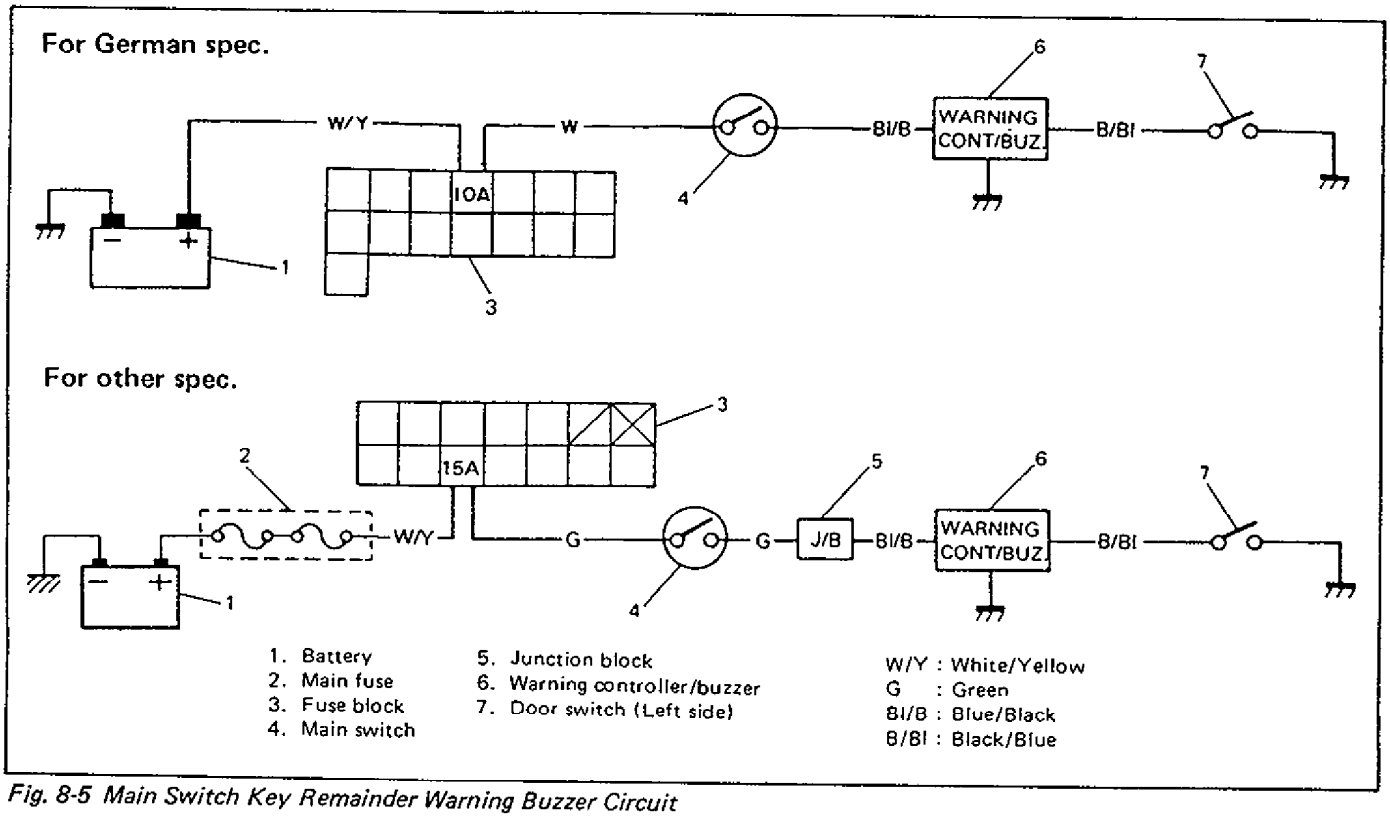


Fig. 8-5 Main Switch Key Remainder Warning Buzzer Circuit

INSPECTION OF WARNING CONTROLLER/ BUZZER

With positive (+) terminal of battery connected to terminal ⑥ of controller and negative (—) one to ④, also connect negative (—) one to ③ as shown in figure.

If buzzer emits buzzing sound then, controller is in good condition. If not, replace.

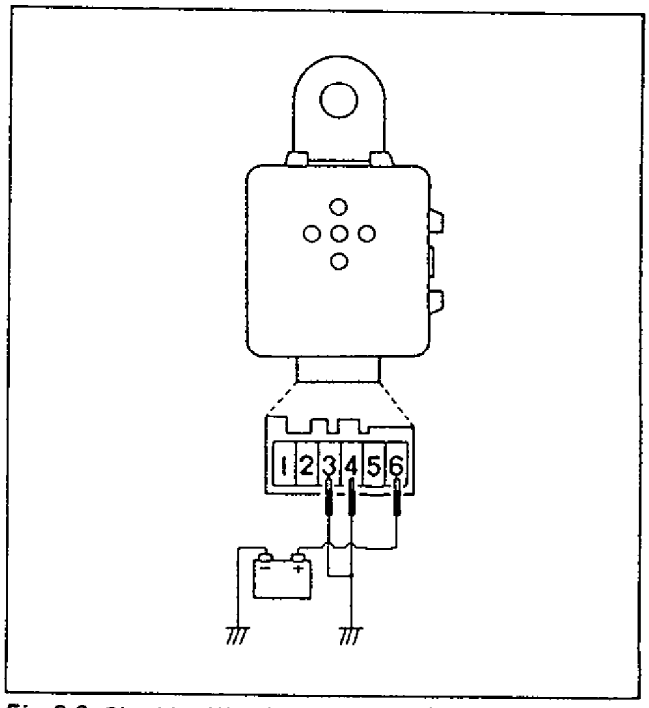


Fig. 8-6 Checking Warning Controller/Buzzer

ON CAR SERVICE

LIGHTING SYSTEMS

BACK-UP LIGHTS

WIRING CIRCUIT

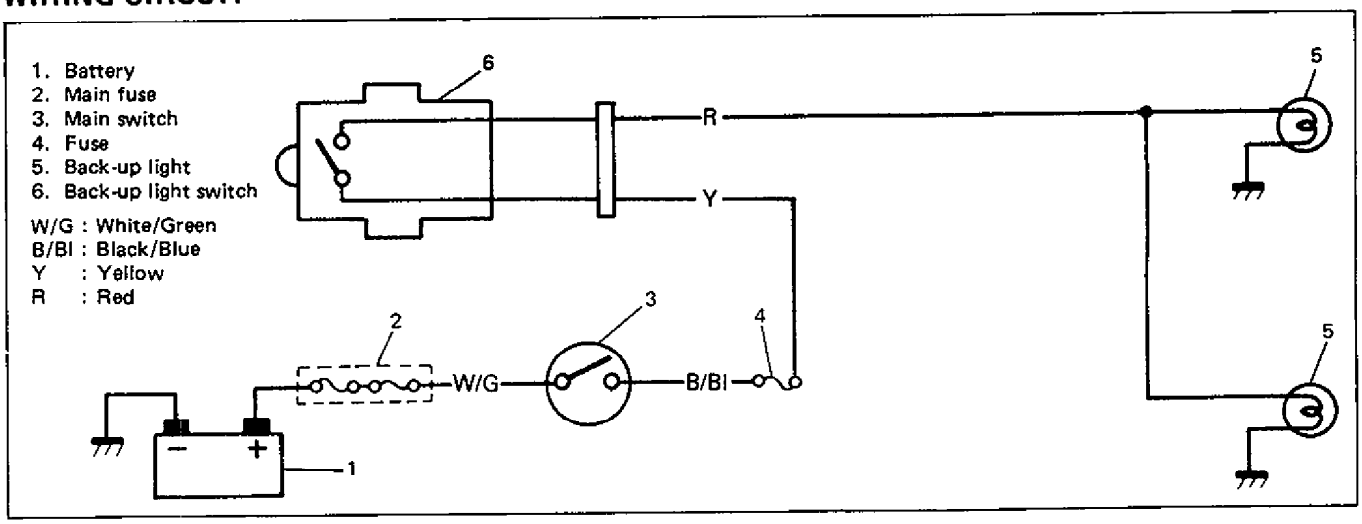


Fig. 8-7 Back-up Light Circuit (For M/T model)

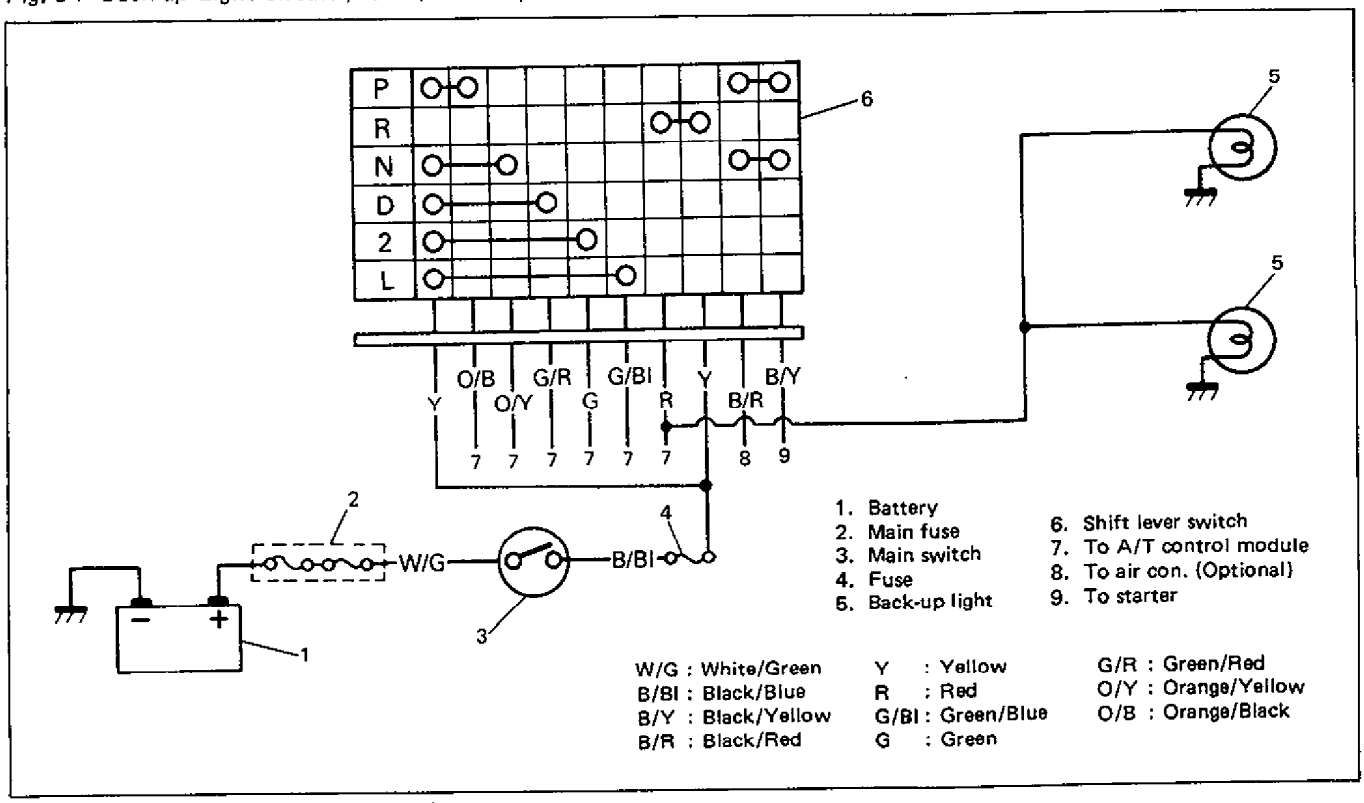


Fig. 8-8 Back-up Light Circuit (For A/T model)

TROUBLE DIAGNOSIS

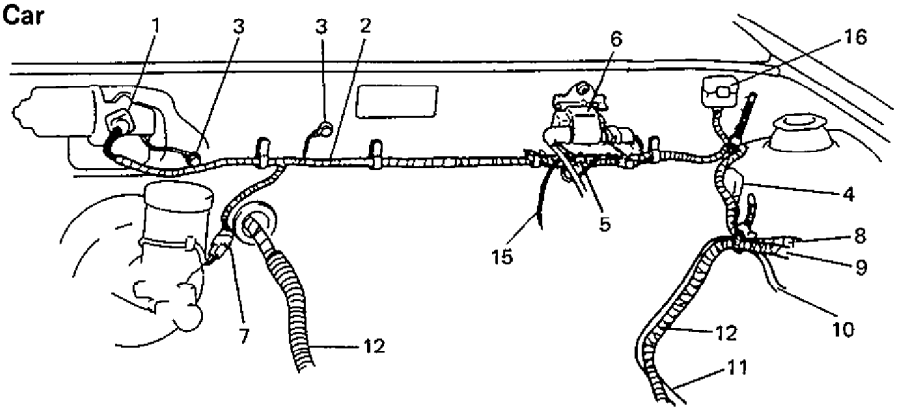
Trouble	Possible cause	Correction
Back-up lights do not light.	Fuse blown	Replace fuse to check for short.
	Back-up light switch or shift lever switch faulty	Check switch.
	Wiring or grounding faulty	Repair as necessary.

WIRING HARNESS ROUTING

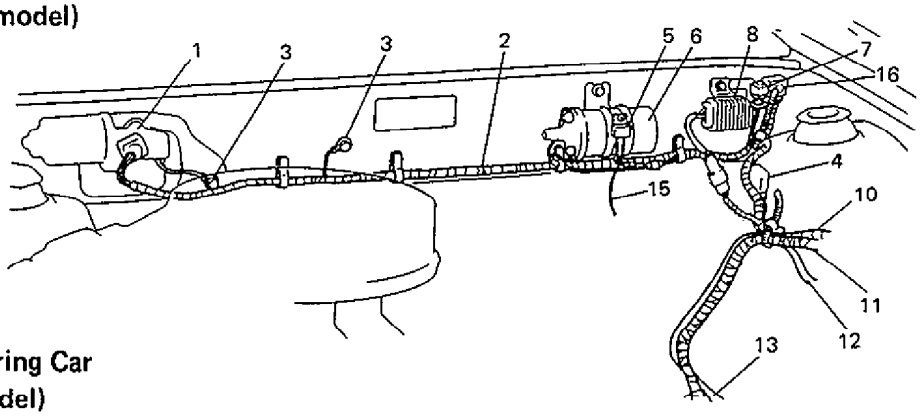
For the wirings not found in this section, refer to the Service Manual mentioned in the FOREWORD of this manual.

COWL TOP PANEL WIRING

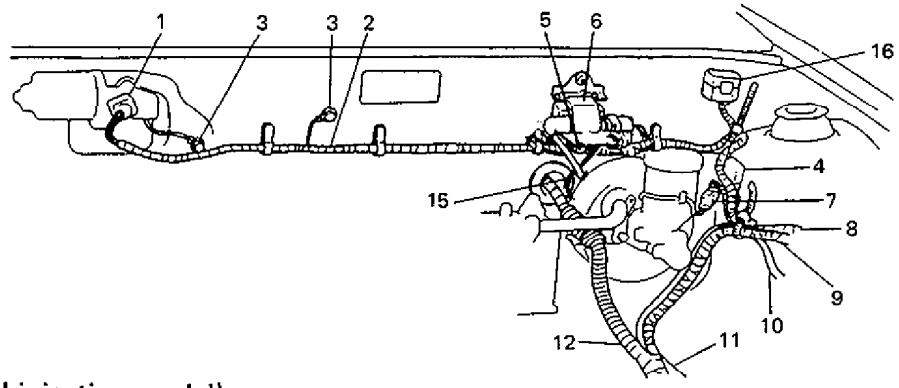
Right Hand Steering Car
(Carburetor model)



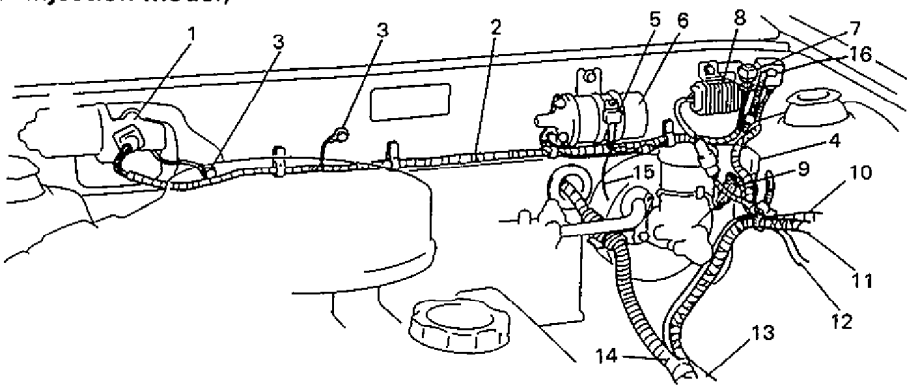
(Fuel injection model)



Left Hand Steering Car
(Carburetor model)



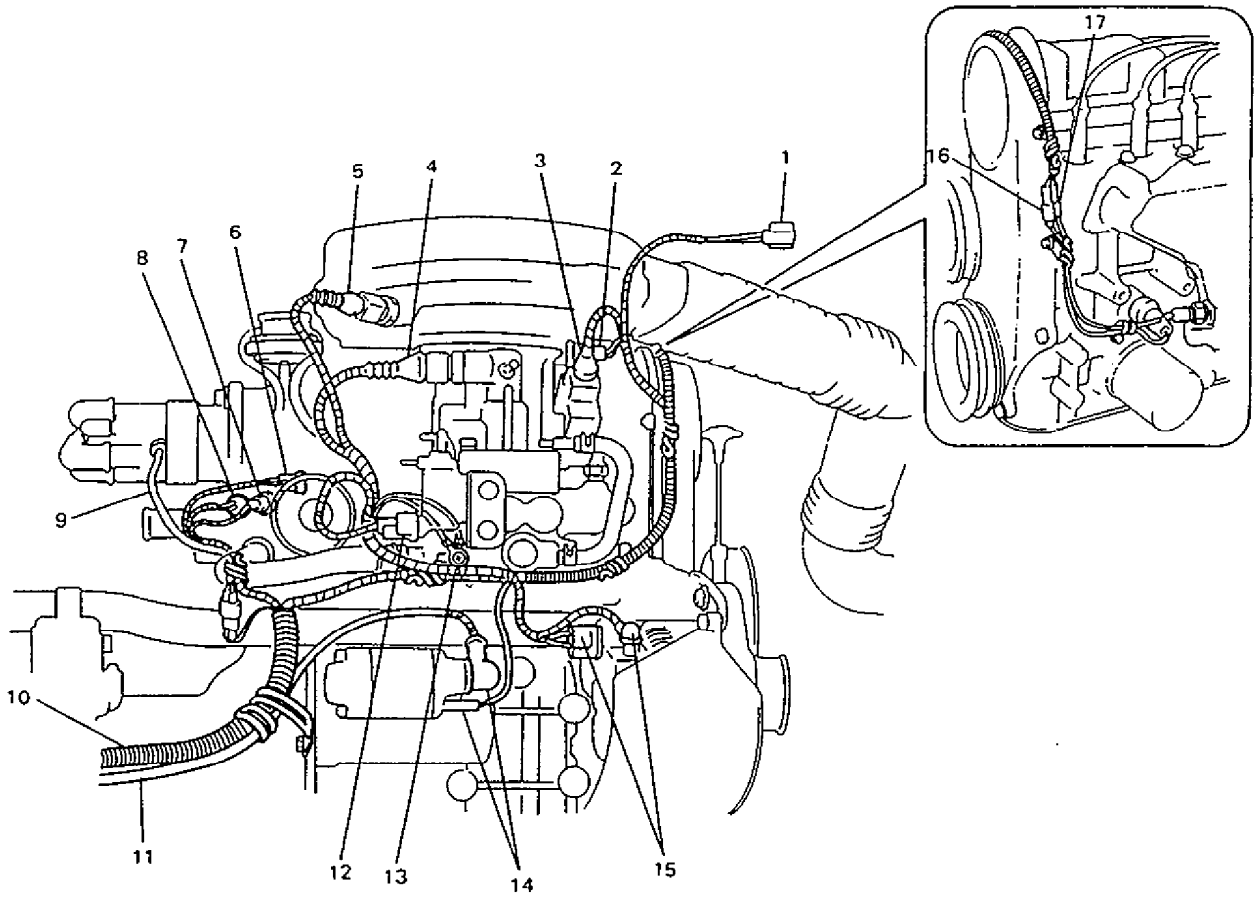
(Fuel injection model)



1. Wiper motor
2. Main wiring harness No. 1
3. Ground
4. Noise suppressor
5. Condenser
6. Ignition coil
7. Moniter coupler
8. Resister
9. To brake fluid level switch
10. To left headlight, turn signal and small light
11. To main fuse
12. To battery positive terminal
13. To starting motor
14. Engine wiring harness No. 5
15. To ground
16. Radiator fan fuse

Fig. 8-9 Cowl Top Panel Wiring

ENGINE WIRING (For Fuel Injection Model)



1. To pressure sensor
2. To injector
3. To throttle position sensor
4. To water temp. sensor
5. To air temp. sensor
6. To E.G.R. VSV
7. To water temp. gauge unit
8. To radiator fan motor switch
9. To distributor
10. Engine wiring harness No. 5
11. To battery positive terminal
12. To idle speed control solenoid valve
13. Ground (A/T model: 3 wires)
14. To starting motor
15. To generator
16. To oxygen sensor
17. To oil pressure switch

Fig. 8-10 Engine Wiring

AUTOMATIC TRANSMISSION WIRING

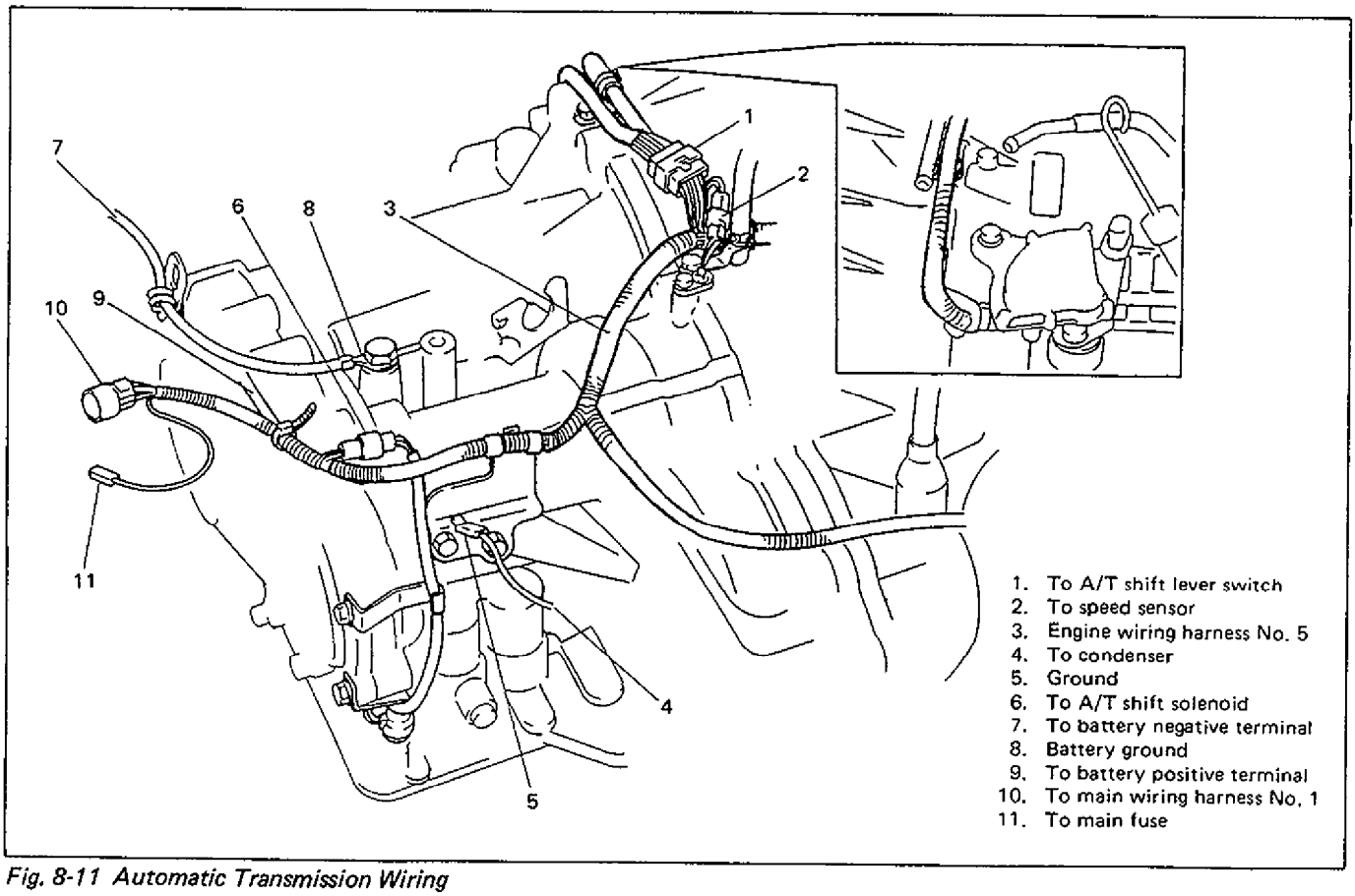
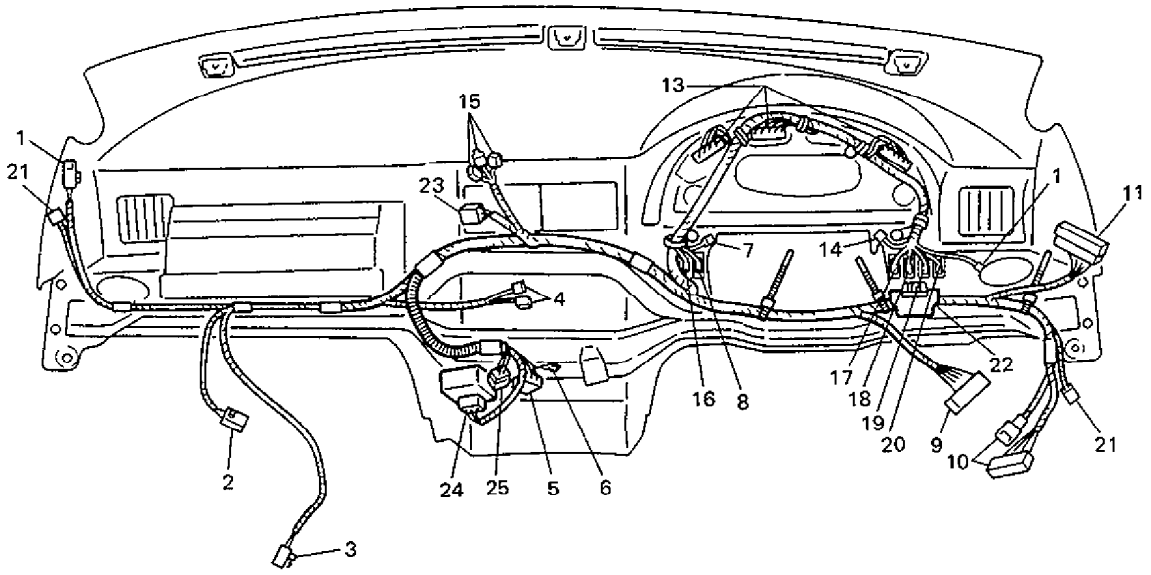


Fig. 8-11 Automatic Transmission Wiring

INSTRUMENT PANEL WIRING

(Left hand steering car)



1. To front speaker (Optional)
2. To blower resister
3. To blower motor
4. To heater fan switch
5. To cigar lighter (Optional)
6. Ground
7. To rear wiper/washer switch (If equipped)
8. To illumination controller (If equipped)
9. To floor wiring harness No. 3 (Except German market)
10. To junction block (or main wiring harness No. 1)
11. To main wiring harness No. 1
12. To front fog light switch (If equipped)
13. To combination meter
14. To rear defogger and front fog light switch (If equipped)
15. To radio (Optional)
16. To seat heater switch (R) (Optional)
17. To head light washer switch (If equipped) or to head light leveling switch (If equipped)
18. To seat heater switch (L) (Optional)
19. To rear fog light switch (If equipped)
20. To mirror switch (Optional)
21. To mirror motor (Optional)
22. ALDL connector
23. To clock
24. To warning controller/buzzer
25. To ash tray illumination

(Right hand steering car)

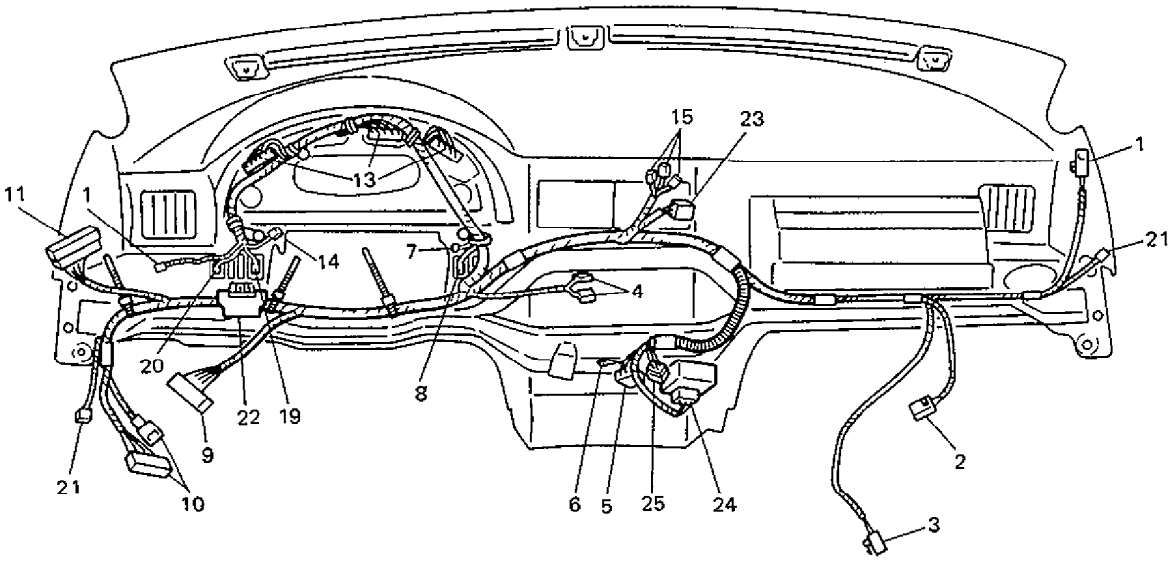


Fig. 8-12 Instrument Panel Wiring

SECTION 9

BODY SERVICE

NOTE:

- For the descriptions (items) not found in this section, refer to the same section of the Service Manual mentioned in the FOREWORD of this manual.
- Illustrations in this section may somewhat differ from actual vehicles depending on specifications or countries.

CONTENTS

ON CAR SERVICE

FRONT DOOR

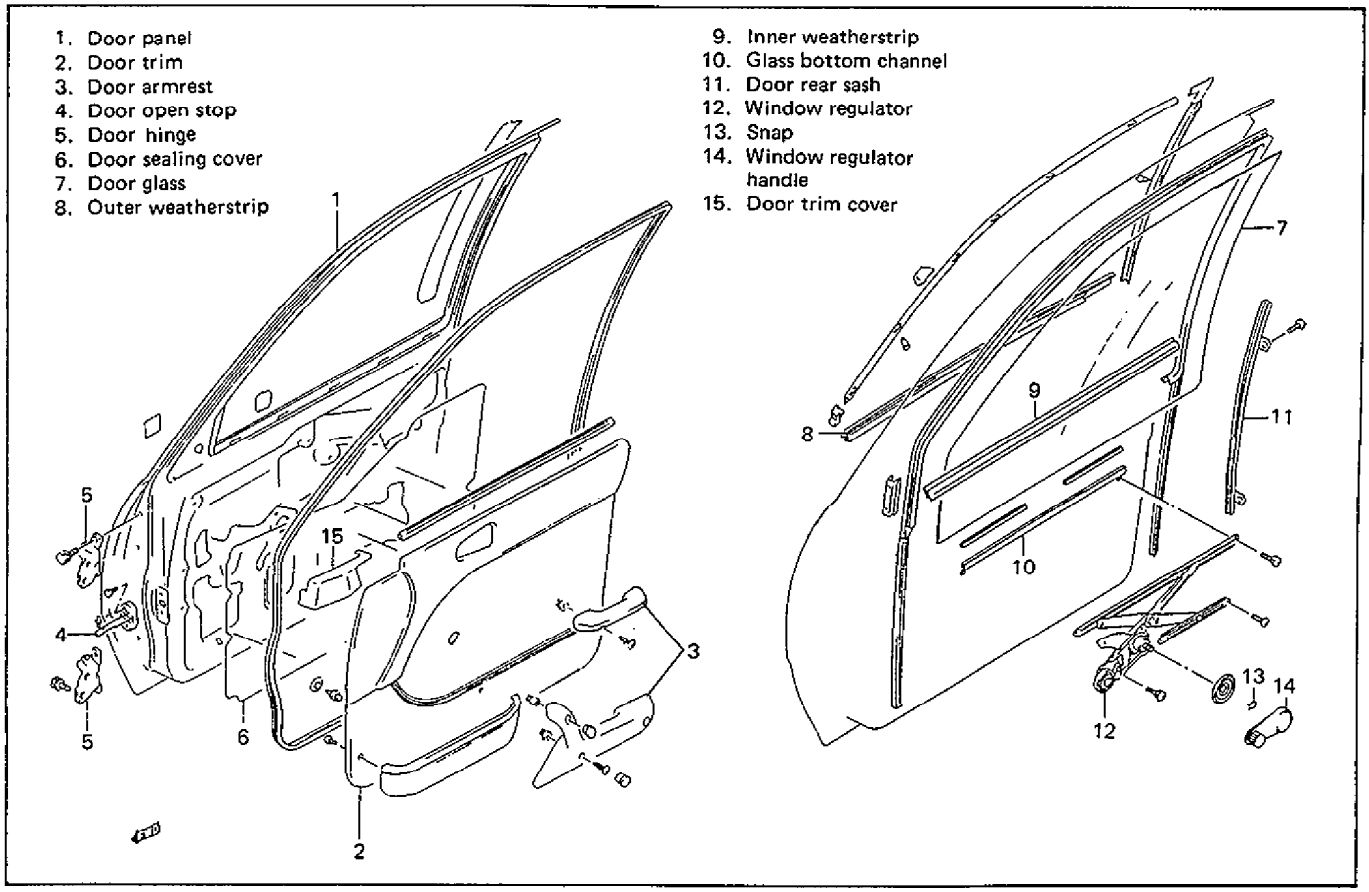


Fig. 9-1 Front Door Assembly

DOOR GLASS

REMOVAL

Remove following parts.

1) Inside handle bezel.
2) Door armrest.
3) Window regulator handle.
   For its removal, pull off snap by using a cloth as shown below.

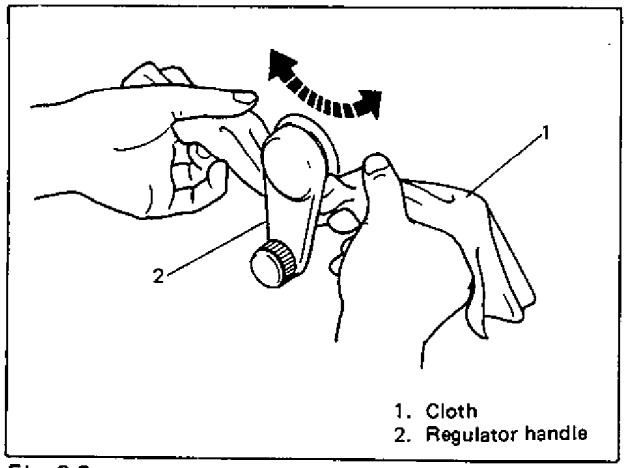


Fig. 9-2

4) Door mirror inner garnish.
5) Inner weatherstrip (5 door model).
6) Door trim.

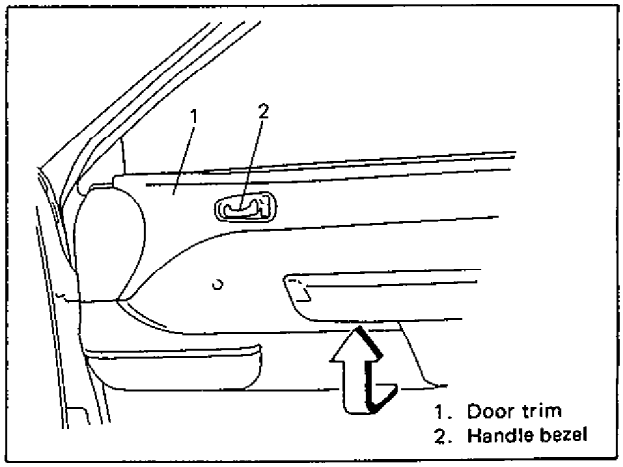


Fig. 9-3 Removing Door Trim

7) Door sealing cover.
8) Door outside weatherstrip.
9) Glass bottom channel attaching screws.

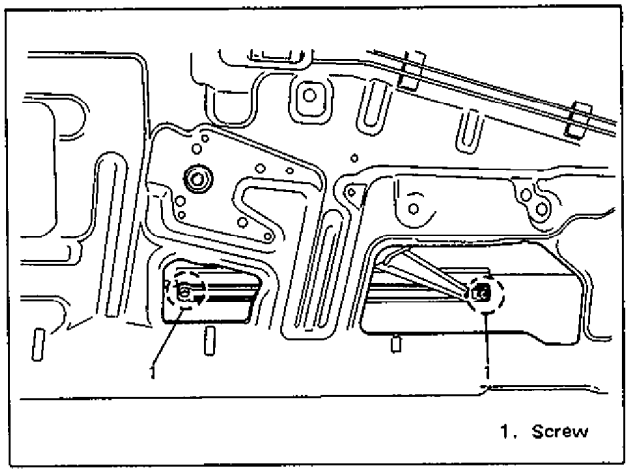


Fig. 9-4

10) Take out door glass together with bottom channel.
11) Detach glass from bottom channel.

INSTALLATION

Reverse the removal sequence to install door glass noting the following points:

1) When installing glass to bottom channel, coat channel with soap water and tap it with a plastic hammer.
   Glass-fitted position of bottom channel is as shown below.

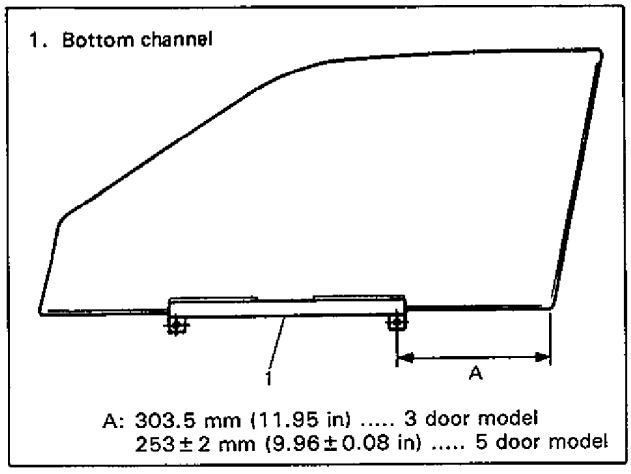


Fig. 9-5

2) Adjust equalizer of window regulator so that measurements A and B in Fig. 9-7 are equal to each other.

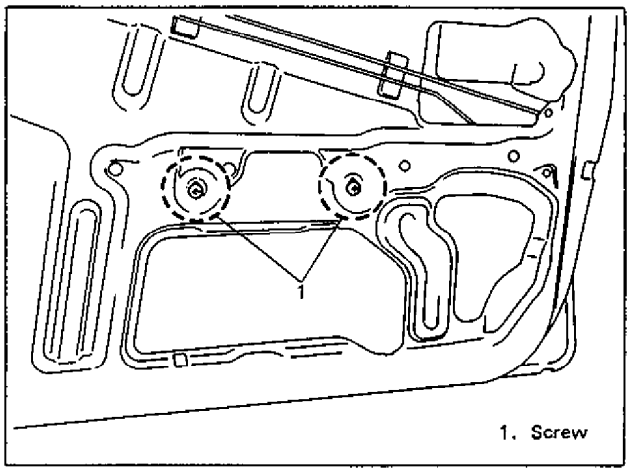


Fig. 9-6 Adjusting Equalizer

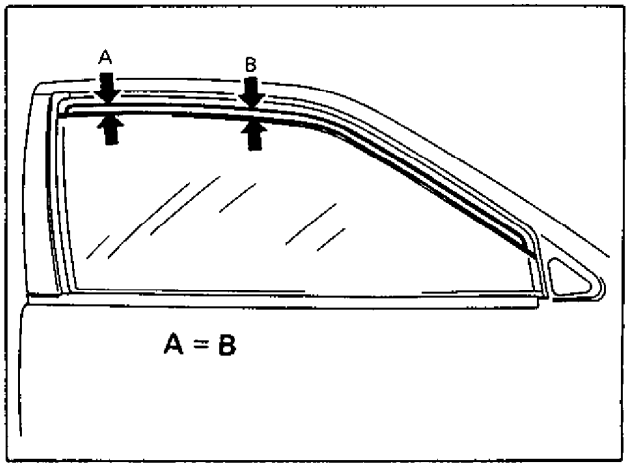


Fig. 9-7

3) Securely seal door sealing cover with adhesive.

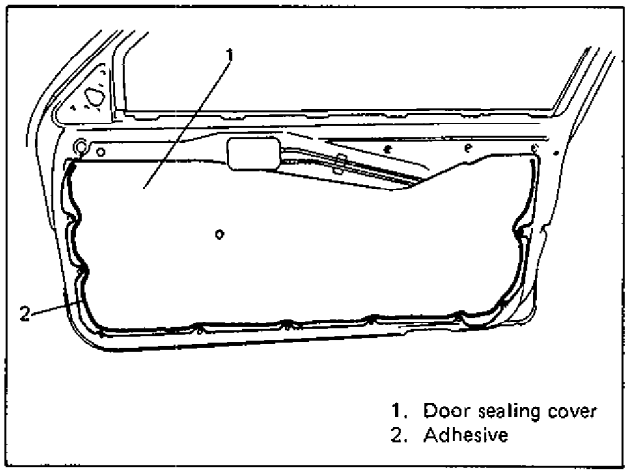


Fig. 9-8

4) Install door window regulator handle so that it has a 45° angle when glass is fully closed, as illustrated below.

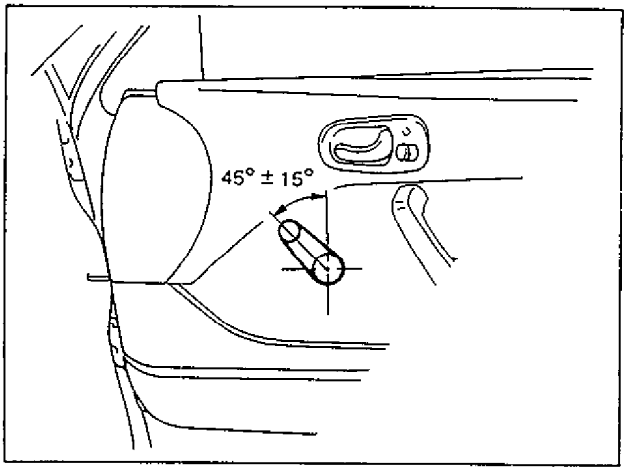


Fig. 9-9

DOOR WINDOW REGULATOR

REMOVAL

Remove following parts.

1) Door glass. (See previous section.)
2) Front door trim bracket.
3) Power window motor lead wire at coupler.
4) Door window regulator attaching screws (six pcs.). Take out regulator through hole "A".

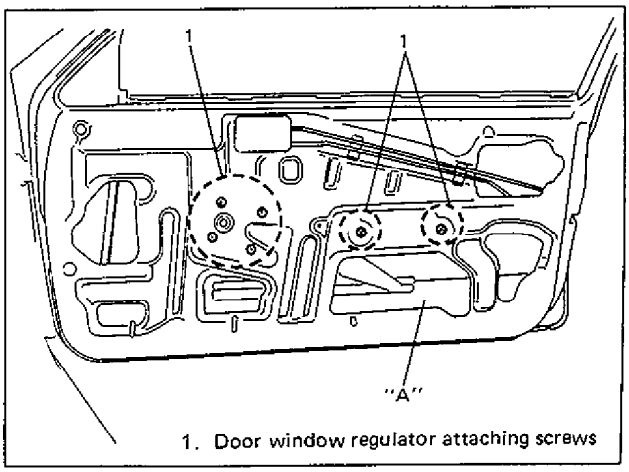


Fig. 9-10

INSPECTION

a. Check gear for wear or damage.
b. Check spring for weakened condition.

INSTALLATION

Reverse removal sequence to install door window regulator.

1) Apply multi-purpose grease to sliding parts.

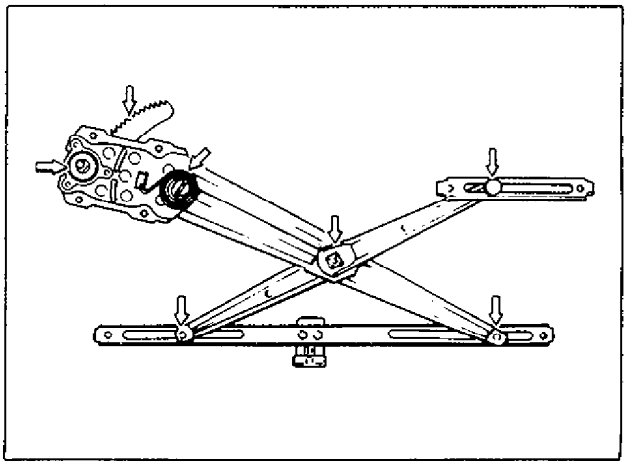


Fig. 9-11 Greasing Sliding Points

FRONT DOOR LOCK

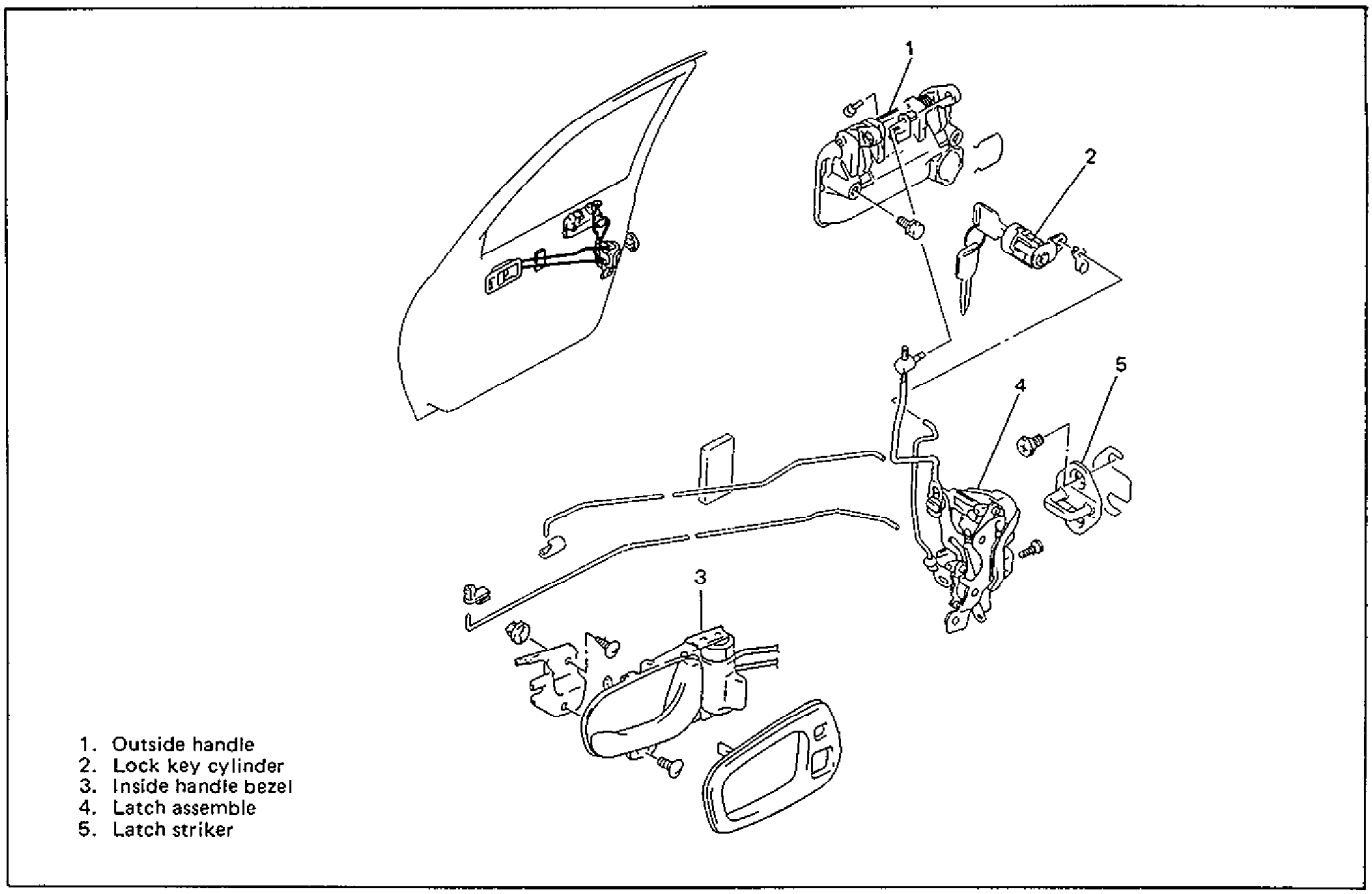


Fig. 9-12 Front Door Lock Assembly

REMOVAL

Remove following parts.

1) Inside handle bezel.
2) Door armrest. (or trim mounting screw)
3) Window regulator handle. (if equipped)
   For its removal, pull off snap by using a cloth as shown below.

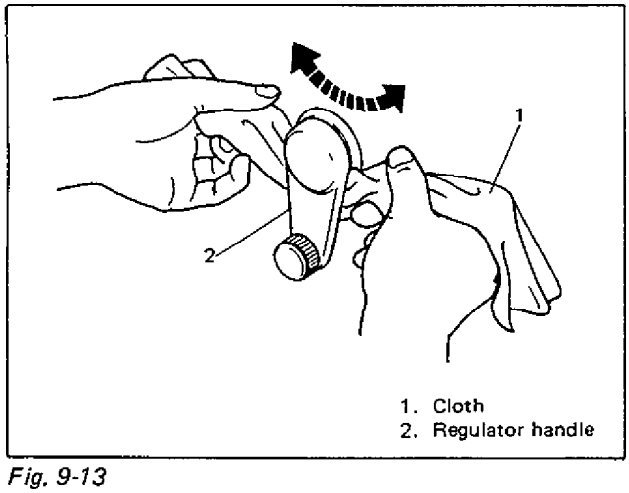


Fig. 9-13

4) Inner weatherstrip (5 door model).
5) Door trim.

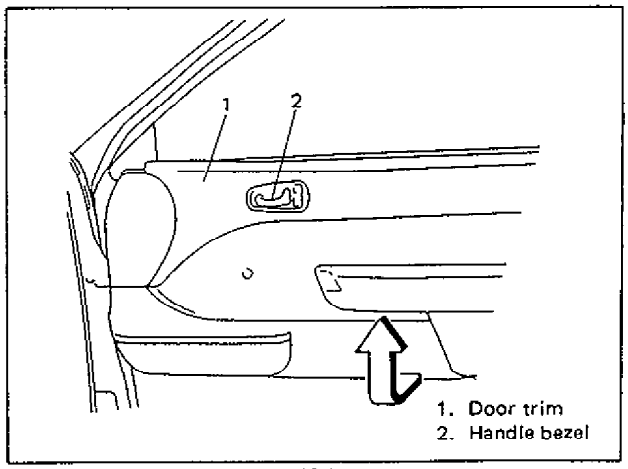


Fig. 9-14 Removing Door Trim

6) Door sealing cover.
7) Front door rear sash.
8) Door inside handle and door latch ass'y.
After disconnecting each joint of control link, remove door inside handle, door locking motor lead wire (if equipped) and door latch ass'y.

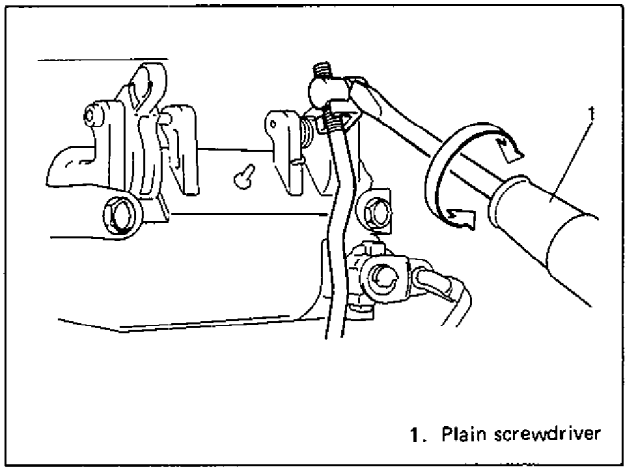


Fig. 9-15 Disconnecting Door Opening Control Link

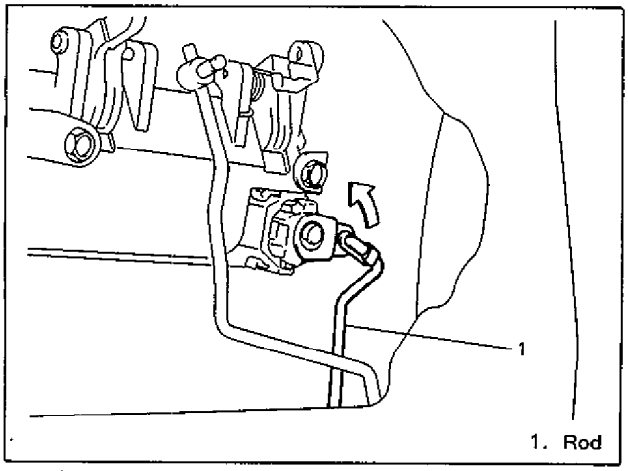


Fig. 9-16 Disconnecting Rod

INSTALLATION

Reverse removal sequence for installation while using care for following items.

1) Door outside opening rod
When installing opening rod 1 to outside handle 2, turn joint 3 to adjust distance "A" to 0 to 2 mm (0 to 0.08 in.) as shown below.

NOTE:
Do not push down opening link 6 when adjusting and installing opening rod.

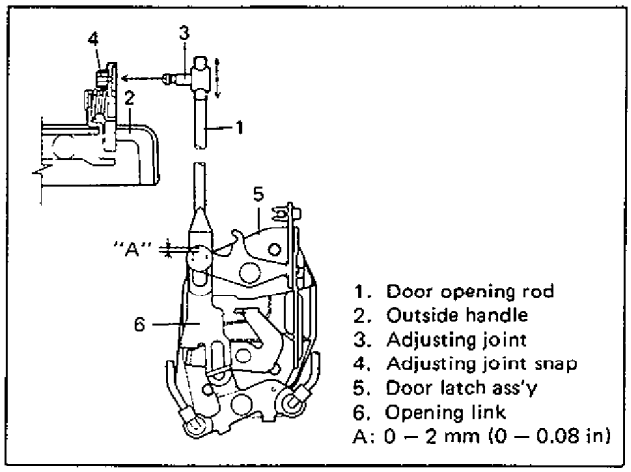


Fig. 9-17

2) Door latch striker
Move door latch striker up and down so that its shaft 3 approximately aligns with the center of groove "C" of door latch.

NOTE:
Striker should be placed level and moved vertically. Do not adjust door latch.

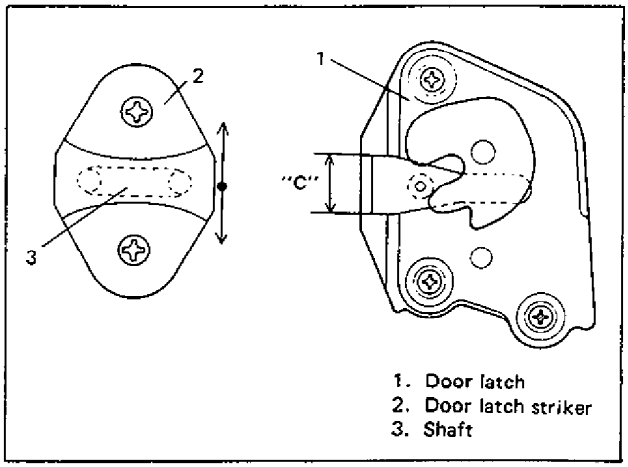


Fig. 9-18

Move door latch striker sideways to adjust to 0 mm (0 in.) the door surface-to-body surface difference with door closed.

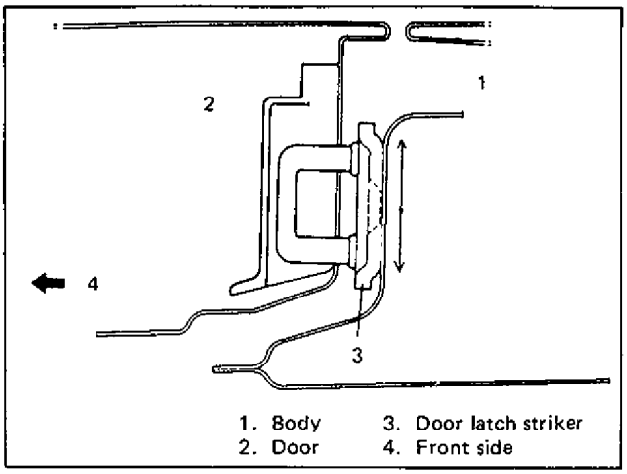


Fig. 9-19

In order to correctly obtain door striker position in fore-and-aft direction, increase or decrease number of spacers inserted between body and striker to adjust it. Dimension "D" should be adjusted to 12.6 to 14.6 mm (0.50 to 0.57 in.).

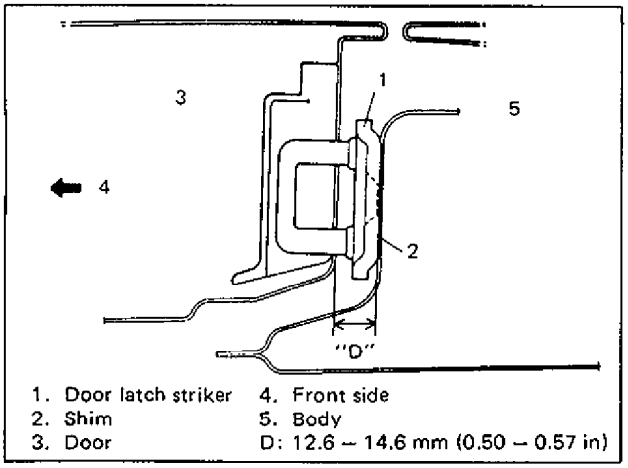


Fig. 9-20

NOTE:
Apply oil or grease to striker joints periodically.

FRONT DOOR ASSEMBLY

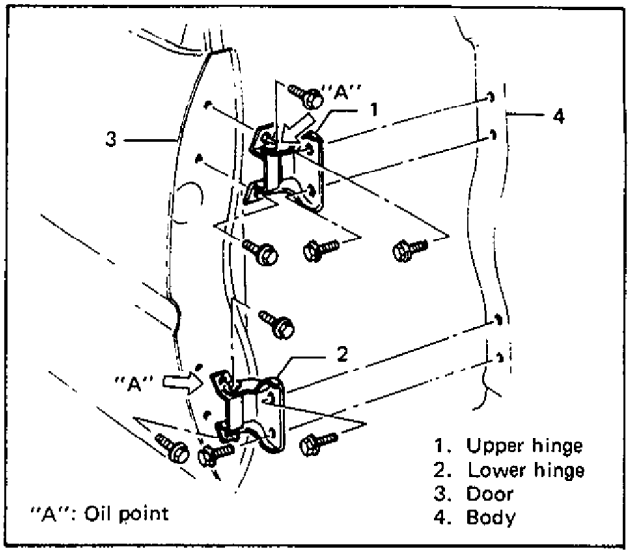


Fig. 9-21

REMOVAL

1) Remove stopper pin upward by tapping it with hammer.

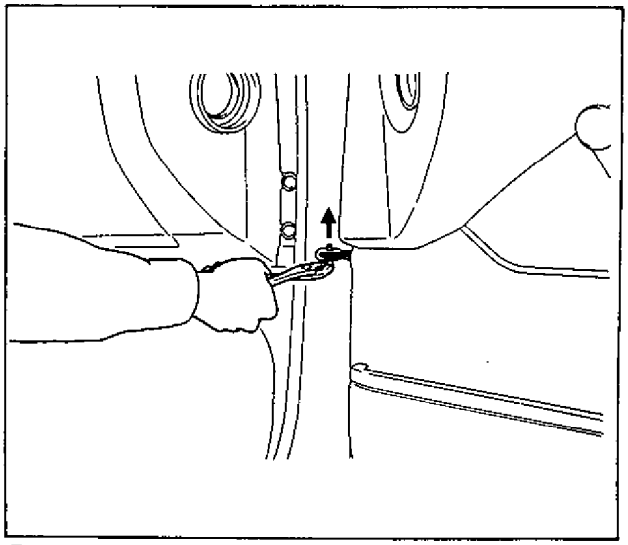


Fig. 9-22

2) Using a jack, support door panel with a piece of wood placed between jack and panel.
3) Remove door ass'y by loosening hinge mounting bolts.

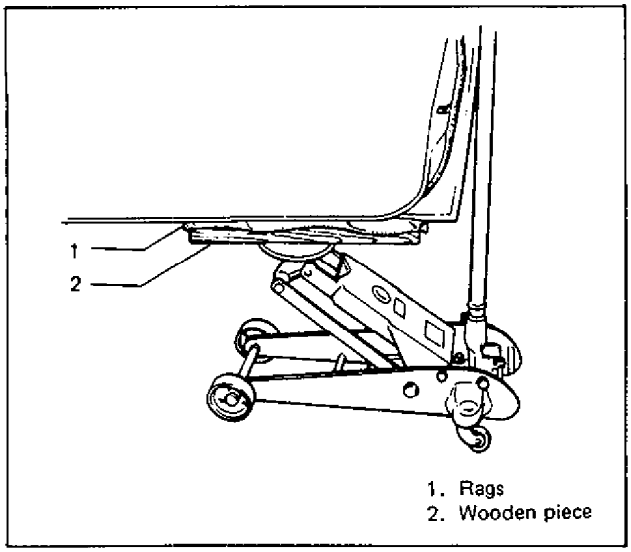


Fig. 9-23

INSTALLATION

Reverse removal sequence to install front door.

- When weatherstrip is hardened, water leak may develop. In such case, replace it with new one.
- After installing, adjust door latch striker position by referring to FRONT DOOR LOCK INSTALLATION section so that door is positioned correctly.

REAR DOOR

DOOR GLASS

REMOVAL AND INSTALLATION

For removal and installation of door glass other than its bottom channel position adjustment, use the same procedures as those described in the Service Manual mentioned in the FOREWORD of this manual. When installing glass to bottom channel, coat channel with soap water and tap it with a plastic hammer. Glass-fitted position of bottom channel is as shown below.

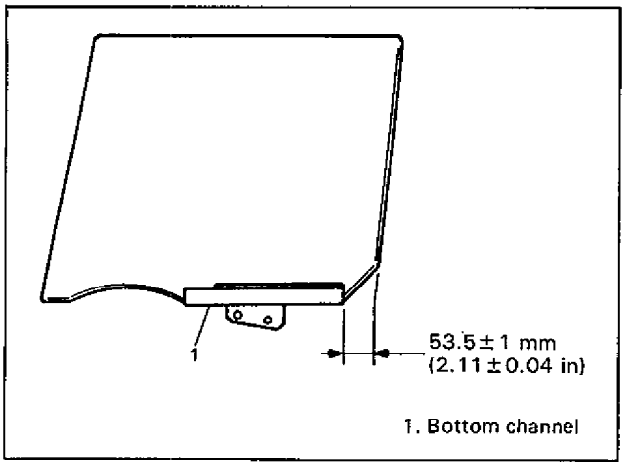


Fig. 9-24

WINDSHIELD

The windshield is installed by using a special type of adhesive (that is, one component urethane adhesive used with primer). For window glass replacement, it is important to use an adhesive which provides sufficient adhesion strength and to follow the proper procedure.

CAUTION:
Described here is the glass replacement by using one component urethane adhesive to be used with primer in combination. Each adhesive has its own drying and setting time and must be handled and used in a certain specific procedure. Negligence in following such procedure or misuse of the adhesive in any way hinders its inherent adhesive property. Therefore, before the work, make sure to read carefully the instruction and description given by the maker of the adhesive to be used and be sure to follow the procedure and observe each precaution throughout the work.

Use an adhesive of above mentioned type which has following property.

Shearing strength	40 kg/cm² or more (569 lb/in²)

Adhesive materials and tools required for removal and installation

- One component urethane adhesive and primers used in combination (For one sheet of window glass).
  Adhesive (600 g (21.2 oz.))
  Primer for glass (20 g (0.7 oz.))
  Primer for body (20 g (0.7 oz.))
  Primer for urethane (moulding) (20 g (0.7 oz.))
- Eyeleteer
- Piano string
- Brush for primer application (2 pcs)
- Knife
- Rubber sucker grip
- Sealant gun (for filling adhesive)
- Putty spatula (for correcting adhered parts)

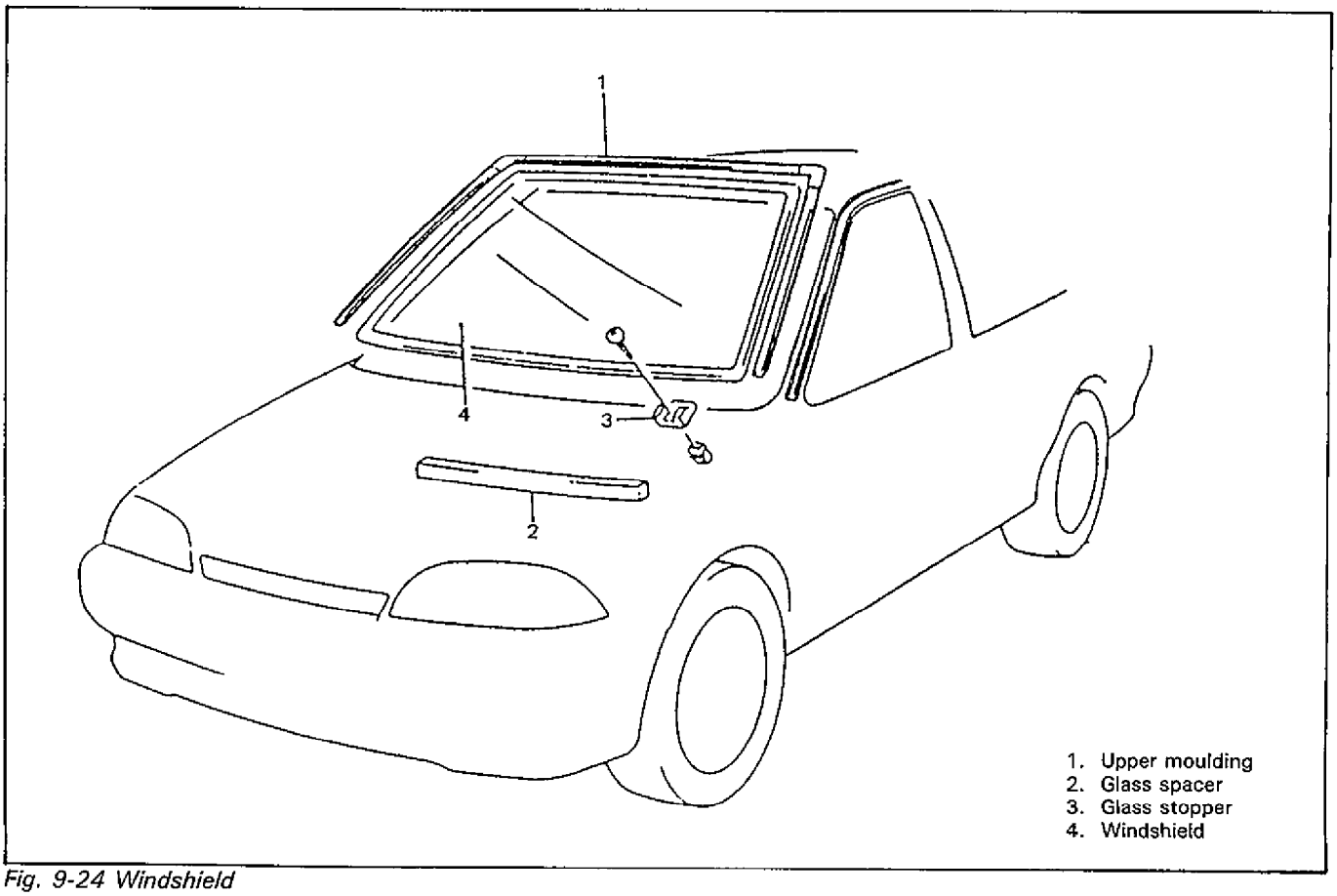


Fig. 9-24 Windshield

REMOVAL

1) Clean both inside and outside of glass and arount it.
2) Remove wiper arms, garnish and spacers.
3) Remove moulding and moulding joints by cutting with knife.
4) Using tape, cover body surface around front window glass to prevent any damage.
5) Remove room mirror, sunshades, and front pillar trims (right & left).
6) Warm up font part of roof lining. Then, remove front side rib of roof lining from between front glass and body.

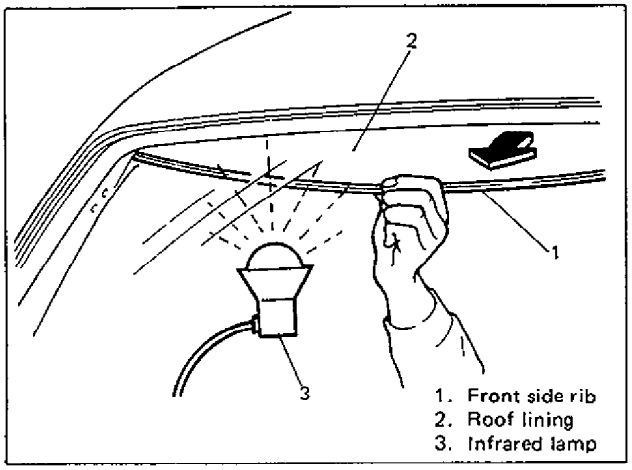


Fig. 9-25

7) Drill hole with eyeleteer through adhesive and let piano string through it.

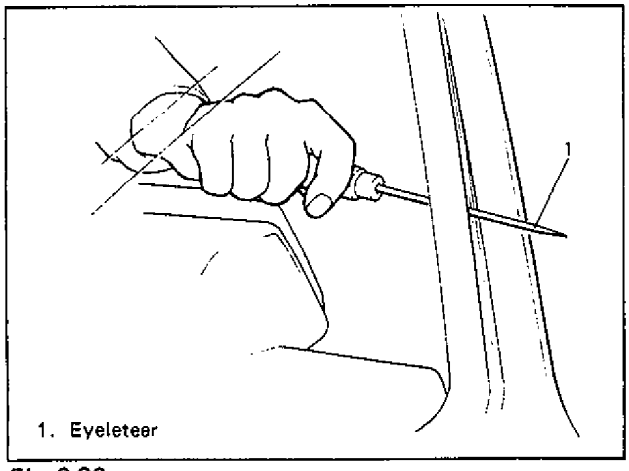


Fig. 9-26

8) Cut adhesive all around front glass with piano string.

NOTE:
Use piano string as close to glass as possible so as to prevent damage to body.

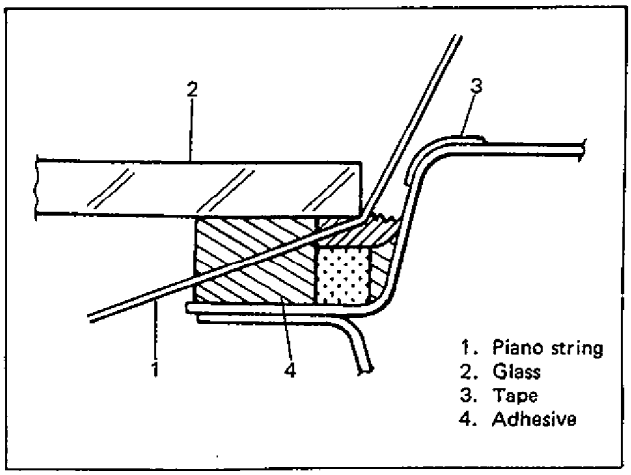


Fig. 9-27

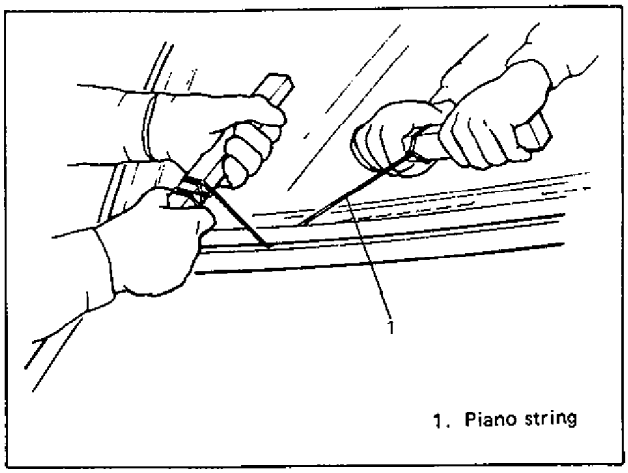


Fig. 9-28

9) Using knife, smooth adhesive remaining on body side so that it is 1 — 2 mm thick all around.

NOTE:
Before using knife, clean it with alcohol or the like to remove oil from it.

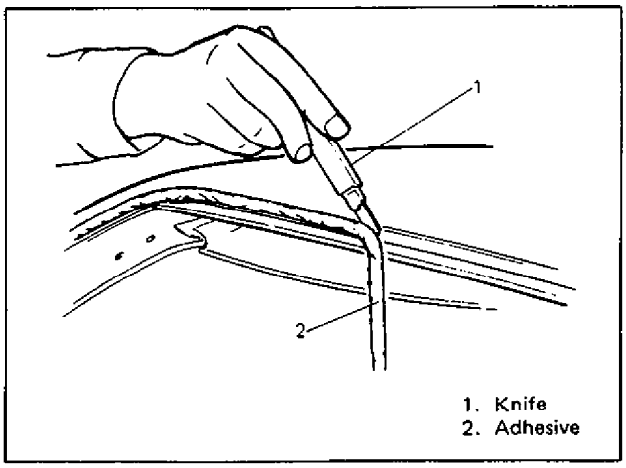


Fig. 9-29

10) When re-using glass, remove adhesive from glass, using care not to damage primer coated surface.

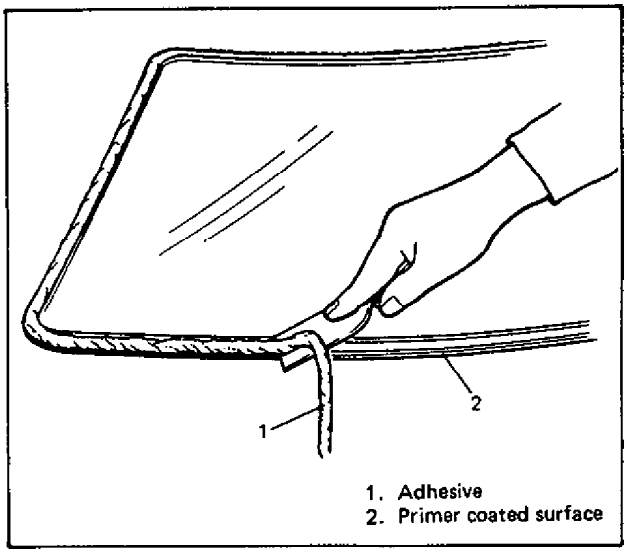


Fig. 9-30

INSTALLATION

1) Using cleaning solvent, clean window frame (body) where glass is to be adhered. (Let it dry for more than 10 minutes.)
2) Install stopper (2 pcs) to lower side of window frame (body).
3) Peel paper from one side of new glass spacer and attach that lower side to windshield glass.

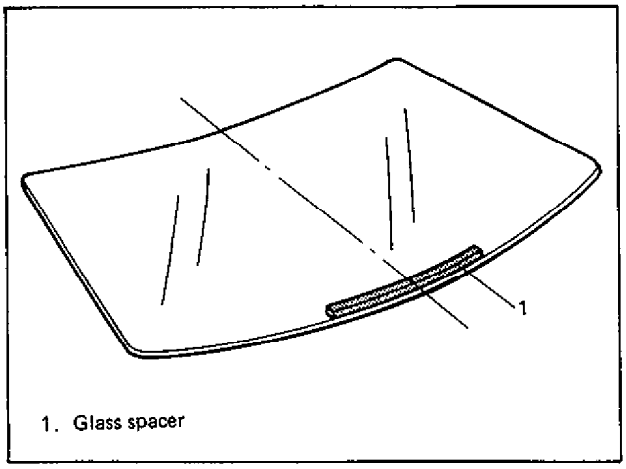


Fig. 9-31

4) Install new upper moulding to glass. Warming moulding for over half an hour at 35°C (95°F) temperature will facilitate work.

5) To determine installing position of glass to body, position glass against body so that clearance between upper end of glass and body is about 6 mm (0.236 in) and clearances between each side end (right & left) of glass and body are even. Then mark mating marks on glass and body as shown below. Upper clearance can be adjusted by moving stoppers position.

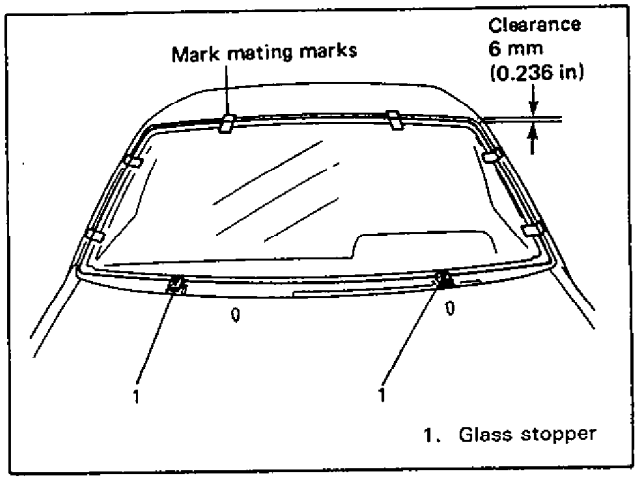


Fig. 9-32

6) Using new brush, apply sufficient amount of primer for body along body surface where window is to be adhered.

NOTE:
Be sure to refer to maker's instruction for proper handling and drying time.

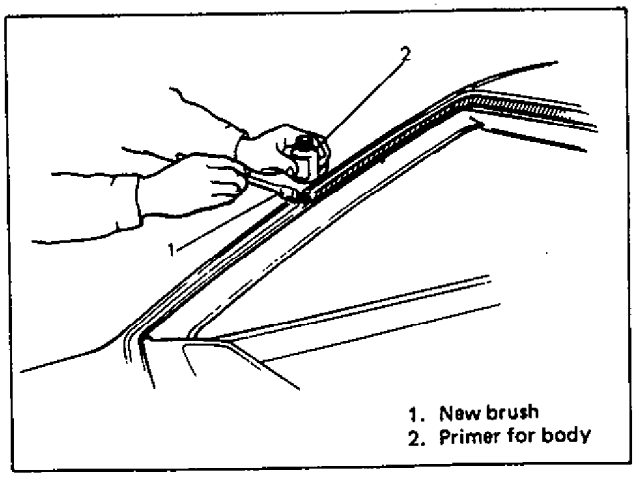


Fig. 9-33

7) Clean glass surface to be adhered to window with clean cloth. If cleaning solvent is used, let it dry for more than 10 minutes.
8) Clean moulding surface "A" with clean cloth. (Refer to below figure.)

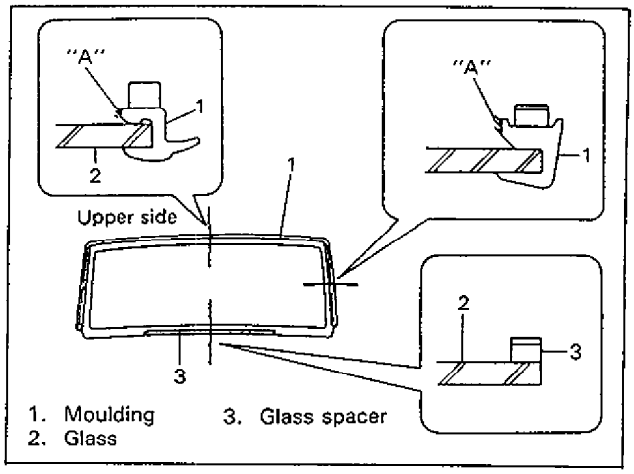


Fig. 9-34

9) Using new brush, apply sufficient amount of primer for glass along glass surface to be adhered to window.

NOTE:
- **Be sure to refer to maker's instruction for proper handling and drying time.**
- **Do not touch primer coated surface.**

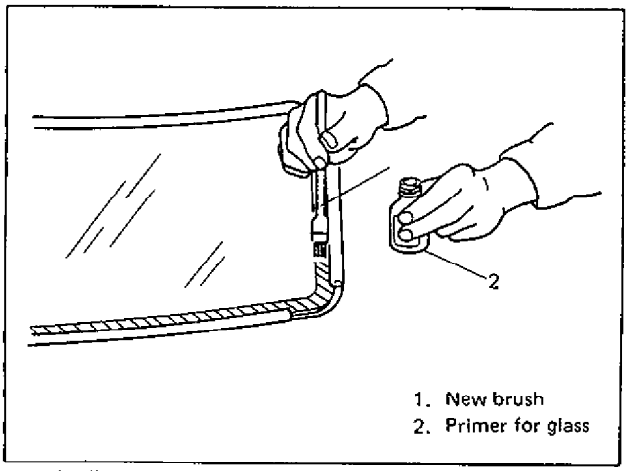


Fig. 9-35

10) Using new brush, apply sufficient amount of primer for moulding (Urethane) to surface "A" asshown in Fig. 9-34.

NOTE:
- **Be sure to refer to maker's instruciton for proper handling and drying time.**
- **Do not touch primer coated surface.**

11) Apply adhesive referring to Fig. 9-36.

NOTE:
- **Start from bottom side of glass.**
- **Be careful not to damage primer.**
- **Height of adhesive applied to lower side should be higher than that of other three sides.**
- **Press glass against body quickly after adhesive is applied.**
- **Use of rubber sucker grip is helpful to hold and carry glass after adhesive is applied.**

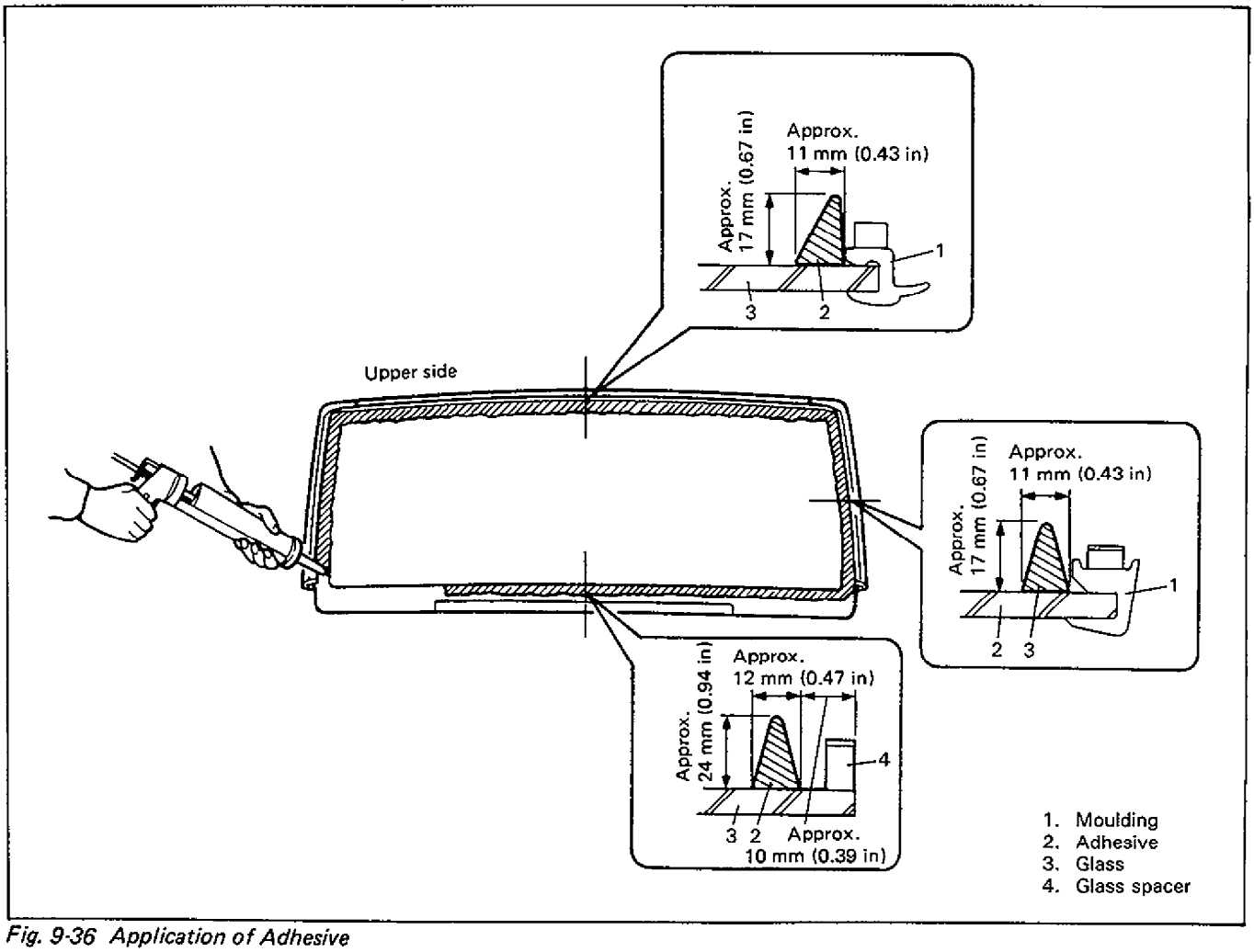


Fig. 9-36 Application of Adhesive

12) Peel remaining paper from moulding and glass spacer.
13) Holding rubber sucker grips, place glass onto body by aligning mating marks marked in step 4) and press it.

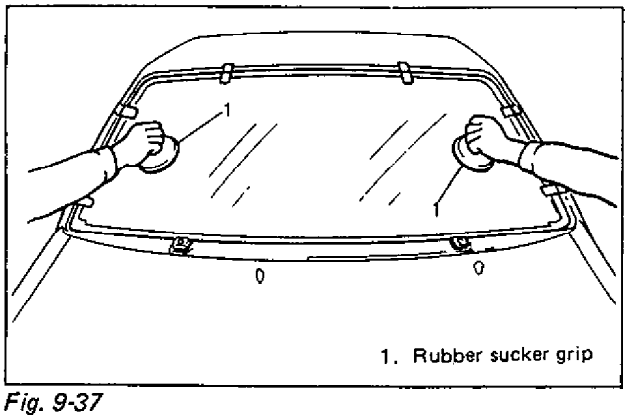


Fig. 9-37

14) Check for water leakage by pouring water over window through hose. If leakage is found, dry window and fill leaky point with adhesive. If water still leaks even after that, remove glass and start installation procedure all over again.

NOTE:

- **Do not use high pressure water.**
- **Do not blow compressed air directly at adhesive applied part when drying.**
- **Do not use infrared lamp or the like for drying.**

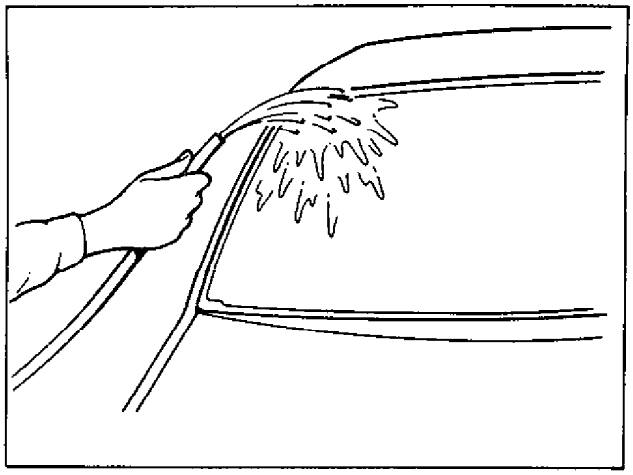


Fig. 9-38

CAUTION:
Upon completion of installation, note the following.

- Sudden closing of door before adhesive is completely set may cause glass to become loose or to come off. Therefore, if door is opened or closed before adhesive is completely set, make sure to open all door glasses and use proper care.
- If moulding is not securely in place, hold it down with a tape until adhesive is completely set.
- Each adhesive has its own setting time. Be sure to refer to maker's instruction, check setting time of adhesive to be used and observe precautions to be taken before adhesive is set.
- Refrain from driving till adhesive is completely set so as to ensure proper and sufficient adhesion.

SEAT BELTS (If equipped)

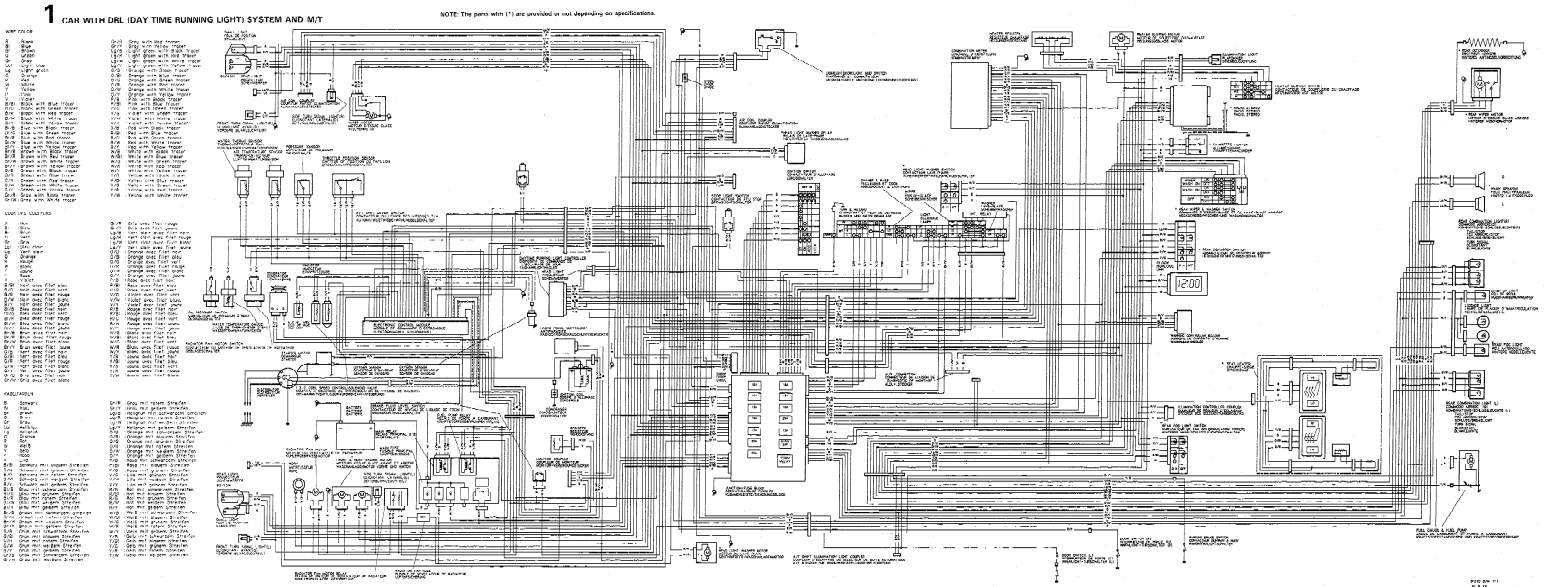
WARNING:
If replacing seat belt is necessary, replace buckle and ELR (or webbing) together as a set. This is for the reason of ensuring locking of tongue plate with buckle.
If these parts are replaced individually, such a locking condition may become unreliable. For this reason, Suzuki will supply only the spare buckle and ELR (or webbing) in a set part.

WIRING DIAGRAM

CONTENTS

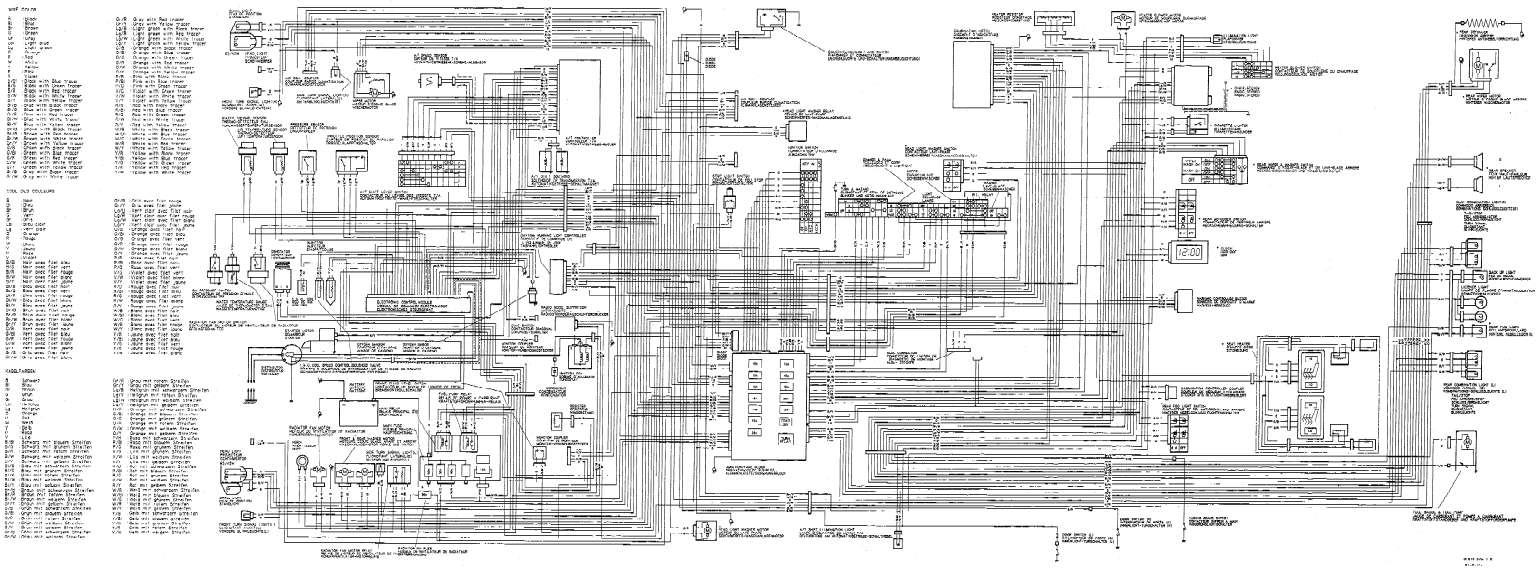
1 CAR WITH DRL (DAY TIME RUNNING LIGHT) SYSTEM AND M/T

NOTE: The parts with (*) are provided or not depending on specifications.



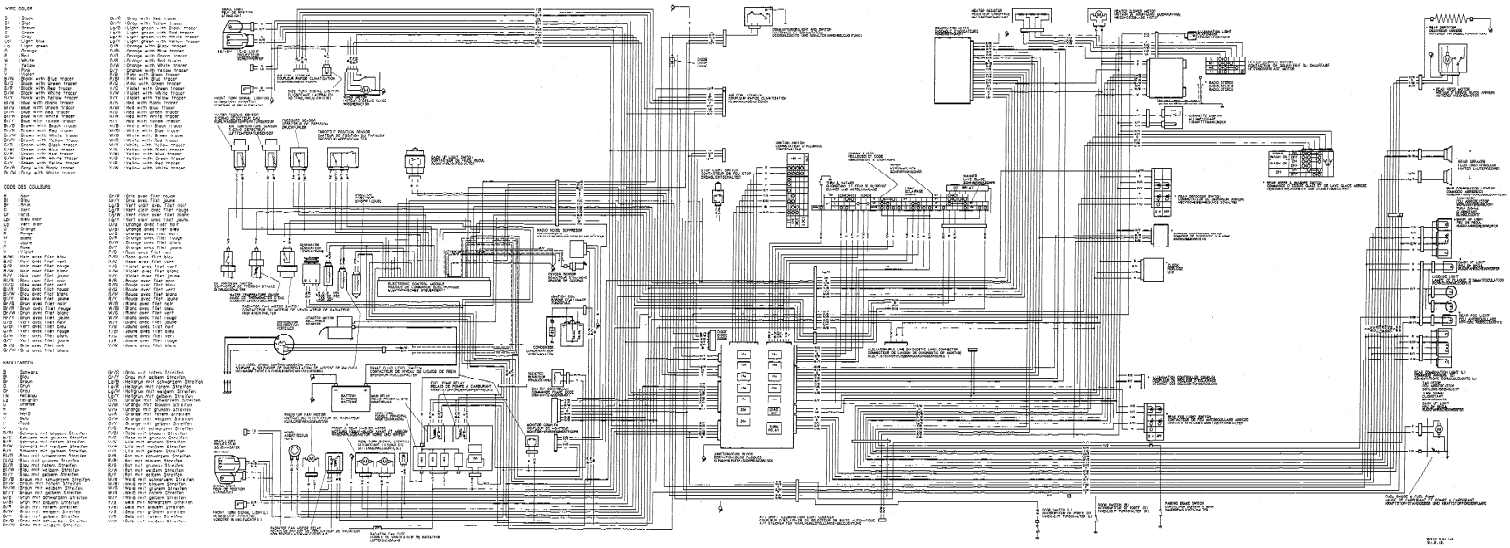
2 CAR WITH DRL (DAY TIME RUNNING LIGHT) SYSTEM AND A/T

NOTE: The parts with (*) are provided or not depending on specifications



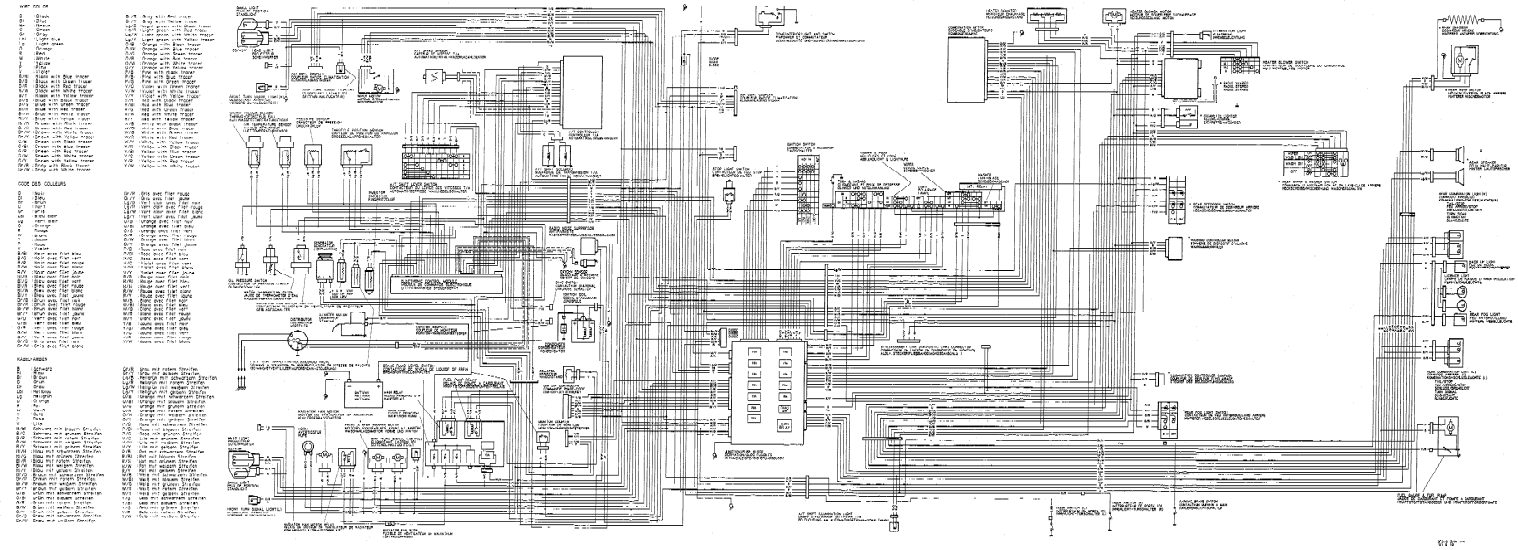
3 CAR WITH DIM-DIM SYSTEM AND M/T

NOTE: The parts with (*) are provided or not depending on specifications.



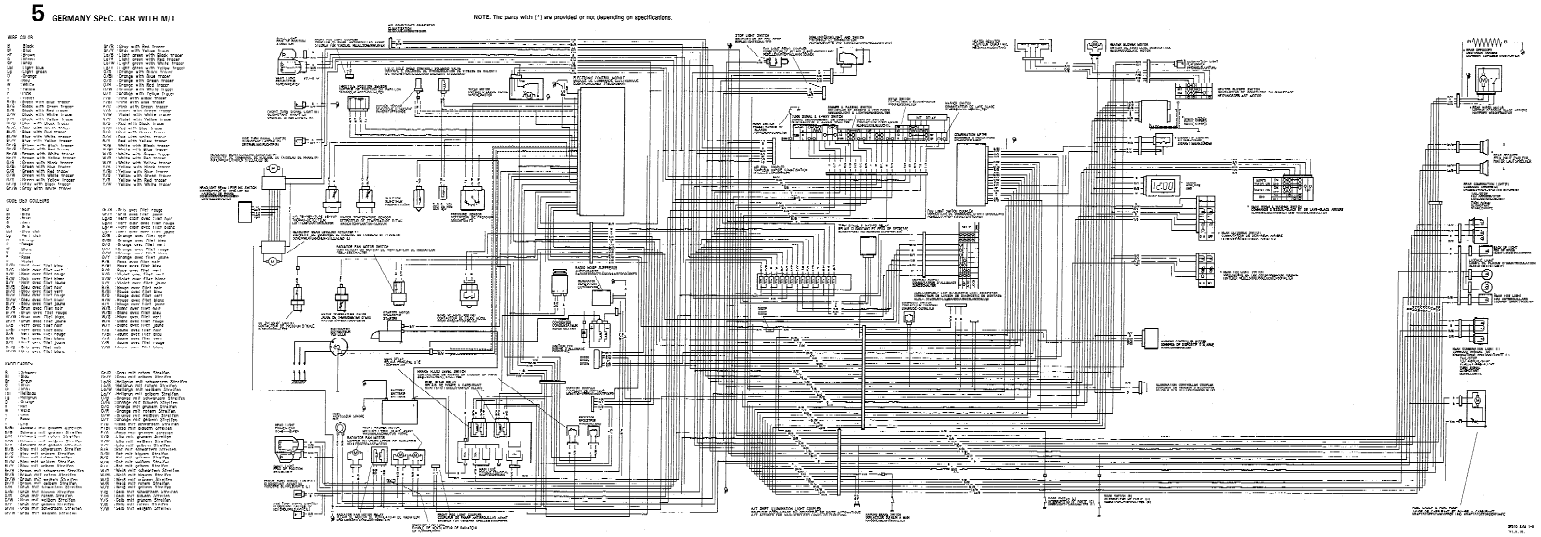
4 CAR WITH DIM-DIP SYSTEM AND A/T

NOTE: The parts with (*) are provided or not depending on specifications.



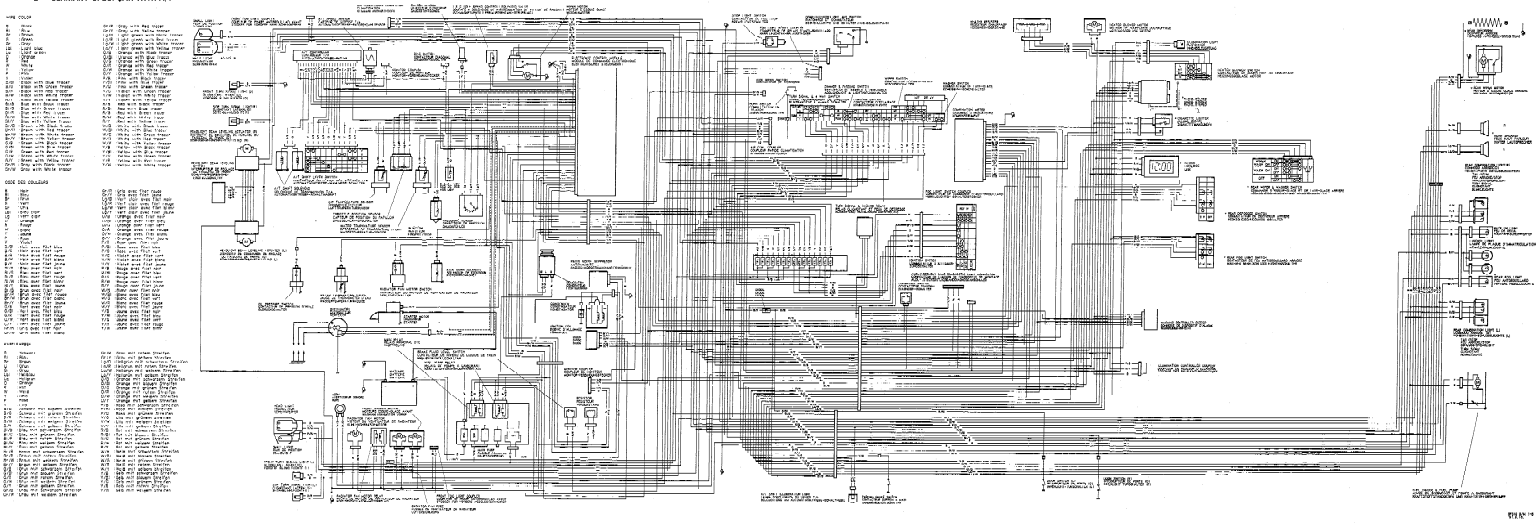
5 GERMANY SPEC. CAR WITH M/T

NOTE: The parts with (*) are provided or not, depending on specifications.



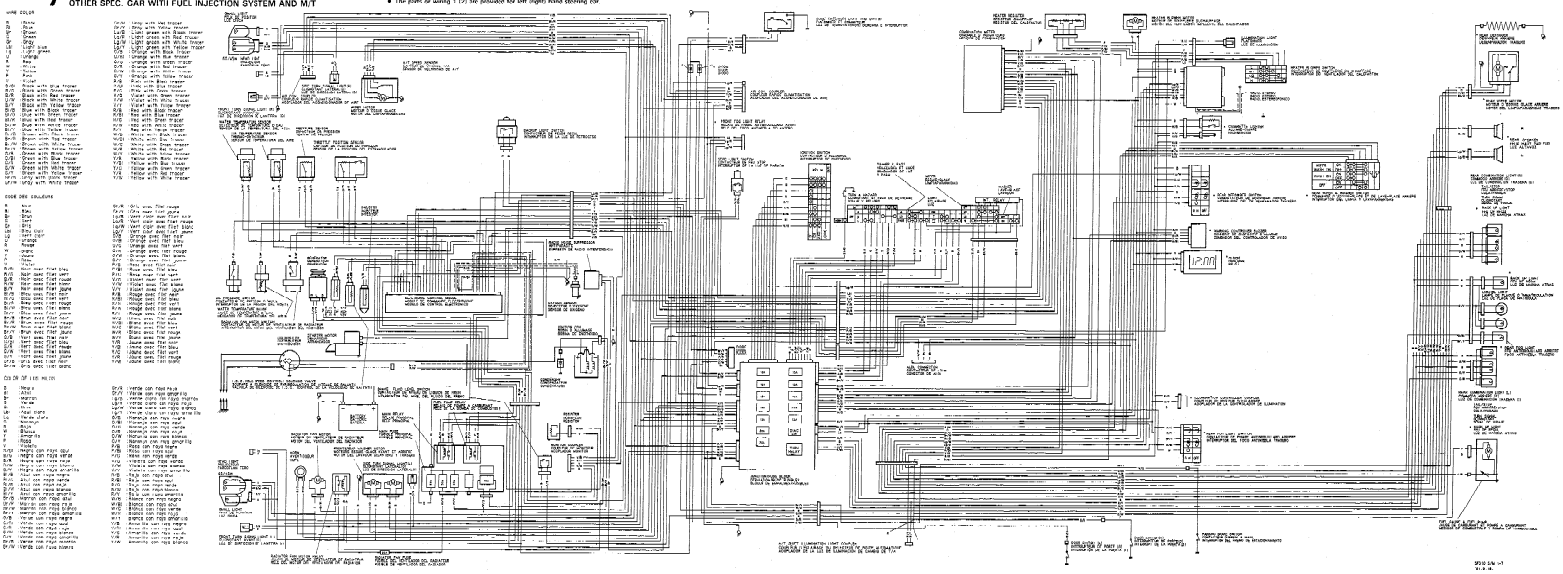
6 GERMANY SPEC. CAR WITH A/T

NOTE: The parts with (*) are provided or not depending on specifications.



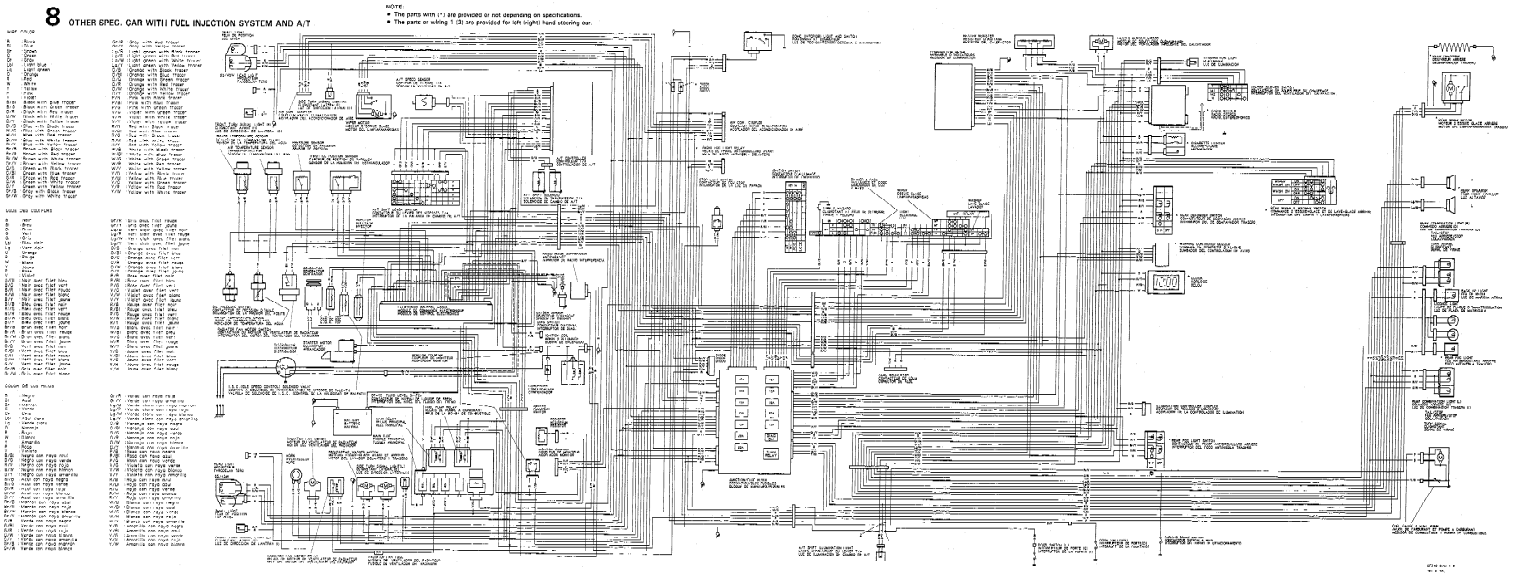
7 OTHER SPEC. CAR WITH FUEL INJECTION SYSTEM AND M/T

NOTE:
- The parts with (*) are provided or not depending on specifications.
- The parts on sliding T (?) are provided for left (right) hand steering car



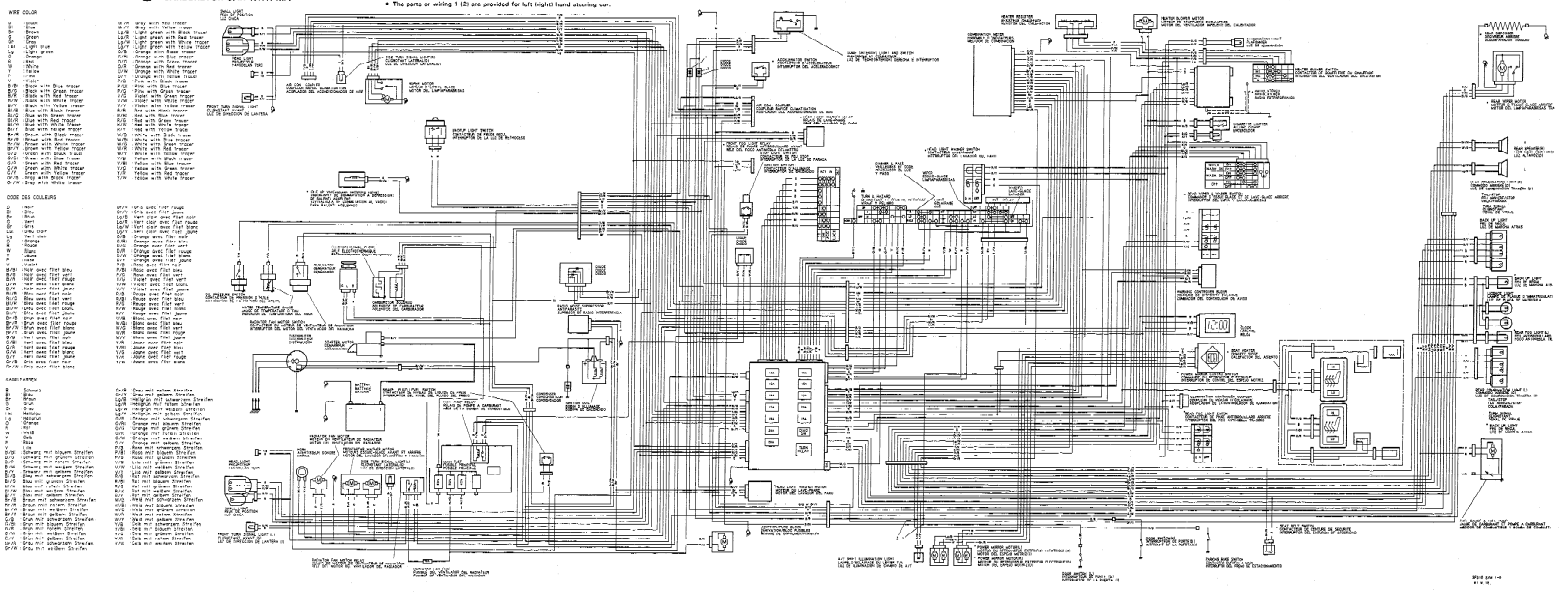
8 OTHER SPEC. CAR WITH FUEL INJECTION SYSTEM AND A/T

NOTE:
- The parts with (*) are provided or not depending on specifications.
- The parts or wiring 1 (3) are provided for left (right) hand steering car.



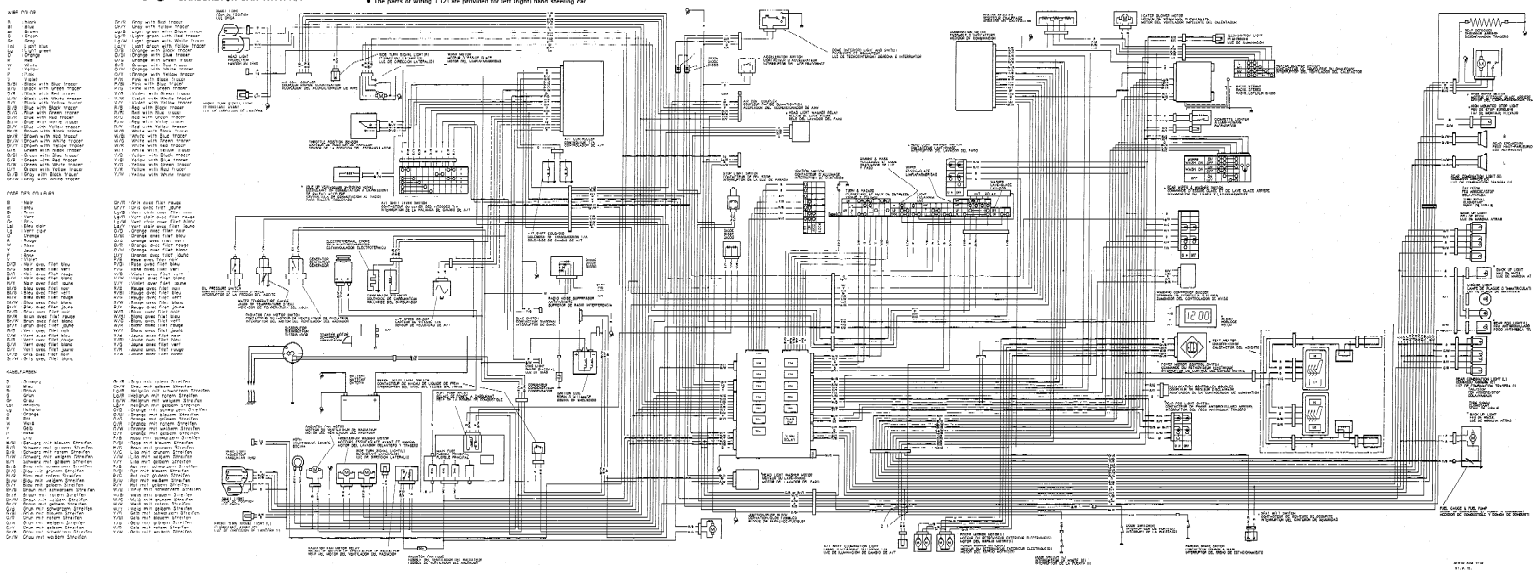
9 CARBURETOR CAR WITH M/T

NOTE:
- The parts with (*) are provided or not depending on specifications
- The parts or wiring 1 (2) are provided for left (right) hand steering car.



10 CARBURETOR CAR WITH A/T

NOTE:
- The parts with (*) are provided or not depending on specifications.
- The parts of wiring 1 (2) are provided for left (right) hand steering car



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