SUBARU®

1992

SERVICE MANUAL

Precaution for Supplemental Restraint System "Airbag"
The Supplemental Restraint System "Airbag" helps to reduce the risk or severity of injury to the driver in a frontal collision.
The Supplemental Restraint System consists of an airbag module (located in the center of the steering wheel), sensors, a control unit, warning light, wiring harness and spiral cable.
Information necessary to service the safety is included in the "5-5. SUPPLEMENTAL RESTRAINT SYSTEM" of this Service Manual.
WARNING:
- To avoid rendering the Airbag system inoperative, which could lead to personal injury or death in the event of a severe frontal collision, all maintenance must be performed by an authorized SUBARU dealer.
- Improper maintenance, including incorrect removal and installation of the Airbag system, can lead to personal injury caused by unintentional activation of the Airbag system.
- All Airbag system electrical wiring harnesses and connectors are covered with yellow outer insulation. Do not use electrical test equipment on any circuit related to the Supplemental Restraint System "Airbag".

MECHANISM AND FUNCTION

neral

ne Multi Point Fuel Injection (MPFI) system is a system iat supplies the optimum air-fuel mixture to the engine r all the various operating conditions through the use f the latest electronic technology.

/ith this system fuel, which is pressurized at a constant ressure, is injected into the intake air passage of the ylinder head. The injection quantity of fuel is controlled y an intermittent injection system where the electro-iagnetic injection valve (fuel injector) opens only for a hort period of time, depending on the quantity of air equired for one cycle of operation. In actual operation, ne injection quantity is determined by the duration of n electric pulse applied to the fuel injector and this permits simple, yet highly precise metering of the fuel. Further, all the operating conditions of the engine are converted into electric signals, and this results in additional features of the system, such as large improved adaptability, easier addition of compensating element, etc. The MPFI system also has the following features:

1) Reduced emission of harmful exhaust gases.
2) Reduced in fuel consumption.
3) Increased engine output.
4) Superior acceleration and deceleration.
5) Superior startability and warm-up performance in cold weather since compensation is made for coolant and intake air temperature.
6) Good matching with turbocharger.

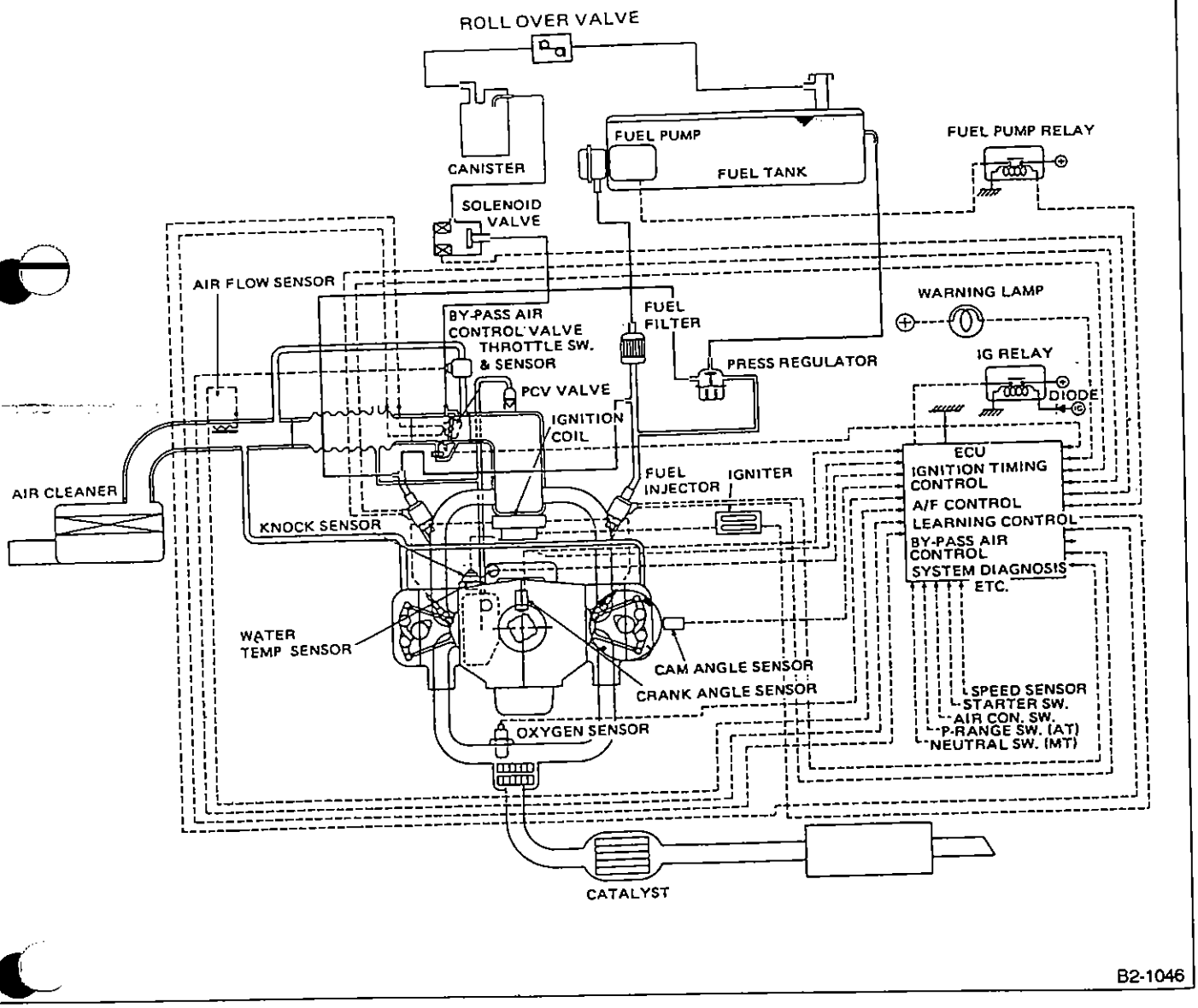
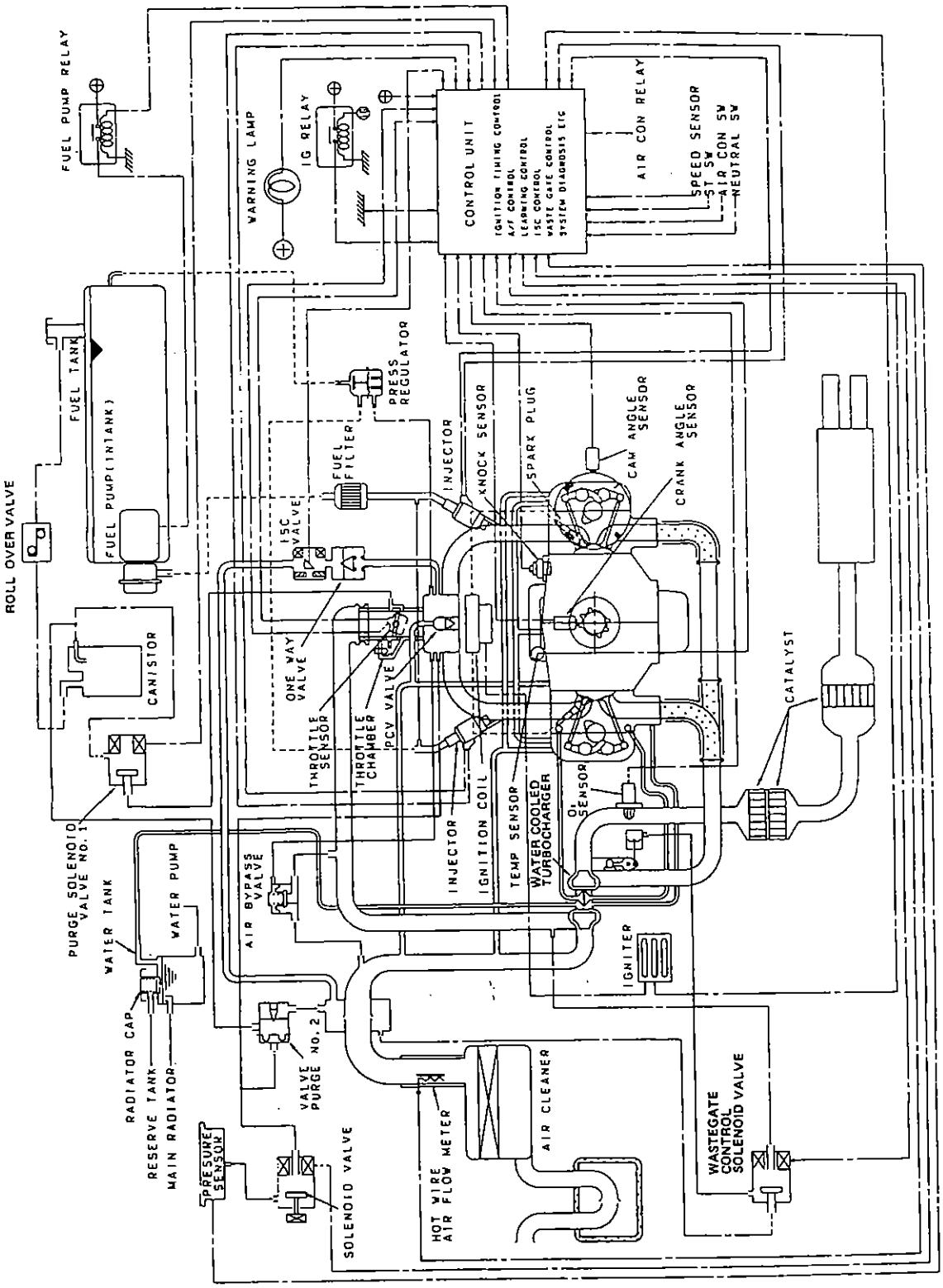


Fig. 1

[TURBO]



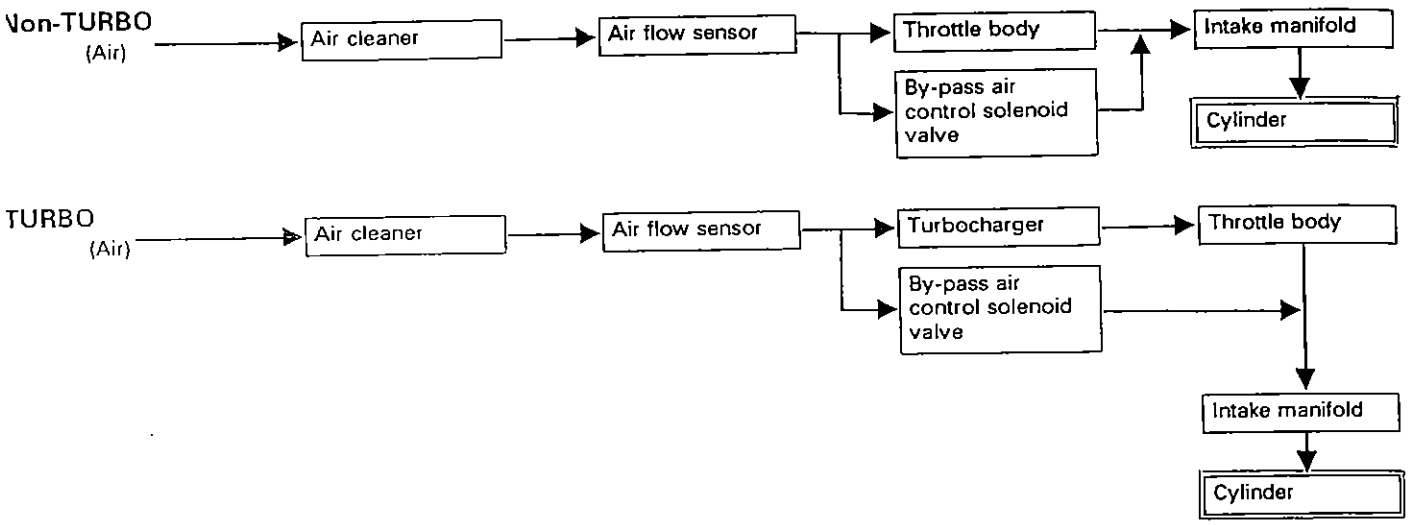
B2-1048

Fig. 2

2. Air Line

GENERAL

Air is drawn in and filtered by the air cleaner is metered and sent to the throttle body via the air intake boot. In a TURBO model, air is filtered by the air cleaner and metered by the air flow sensor. Air is then supercharged by the turbocharger, and sent to the throttle body via the air intake boot. From the throttle body, the air is regulated by the open-close operation of the throttle valve and is delivered to the intake manifold. It is then distributed to the respective cylinders to mix with fuel injected by the fuel injectors. Thus, the air-fuel mixture is delivered into the cylinder. Part of the air branched at the upstream of the throttle body is sent to the by-pass air control valve which regulates engine idle speed.



FLOW SENSOR

The MFI system employs a hot-film type (Non-TURBO) or hot-wire type (TURBO) air flow sensor.

These air flow sensors convert the amount of air taken into the engine into an electric signal by utilizing the heat transfer phenomenon between the incoming air and a heating resistor (hot film or hot wire) located in the air intake.

The features of these flow sensor types are as follows:

1) High-altitude compensation is made automatically.
2) Quick response.
3) There are no moving parts.
4) They are compact.

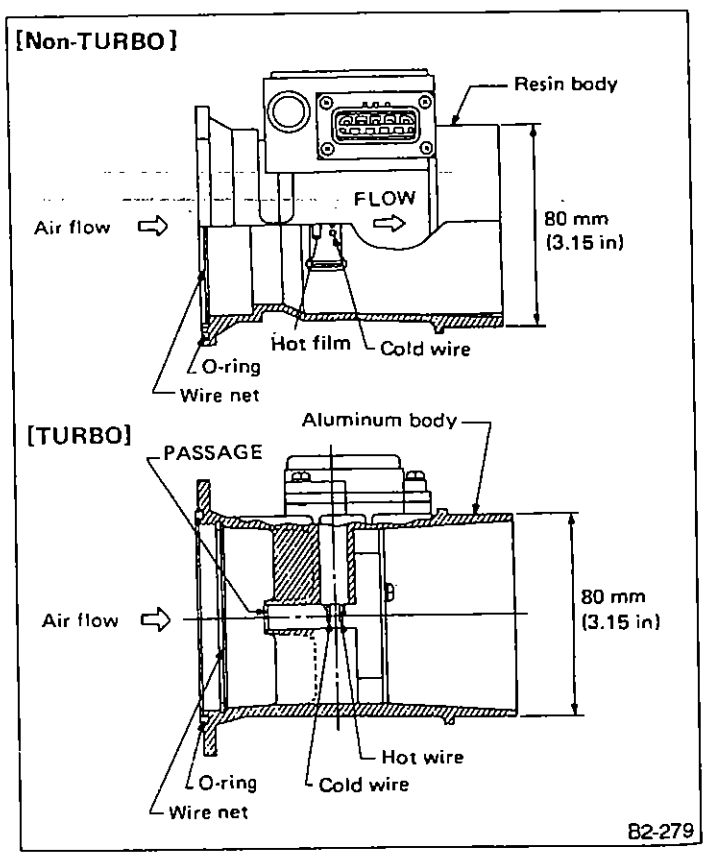


Fig. 3

3. THROTTLE BODY

In response to the depressing stroke of the throttle pedal, the throttle body opens/closes its valve to regulate the air volume to be taken in the combustion chamber.

During idling, the throttle valve is almost fully closed and the air flow through the throttle body is less than that passing through the carburetor.

More than half of the air necessary for idling is supplied to the intake manifold via the by-pass air control valve. And the by-pass air control valve properly controls the number of revolutions in idling, so it does not need to be adjusted.

4. THROTTLE SENSOR

A throttle position sensor is provided with a potentiometer and idle switch interlocked with the throttle valve shaft is utilized.

This throttle position sensor sends the MPFI control unit a potentiometer output signal corresponding to the opening of the throttle valve and an idle switch signal that turns ON only when the throttle is opened nearly to the idle position.

Using these signals, the MPFI control unit precisely controls the air-fuel ratio during acceleration and deceleration as well as idling.

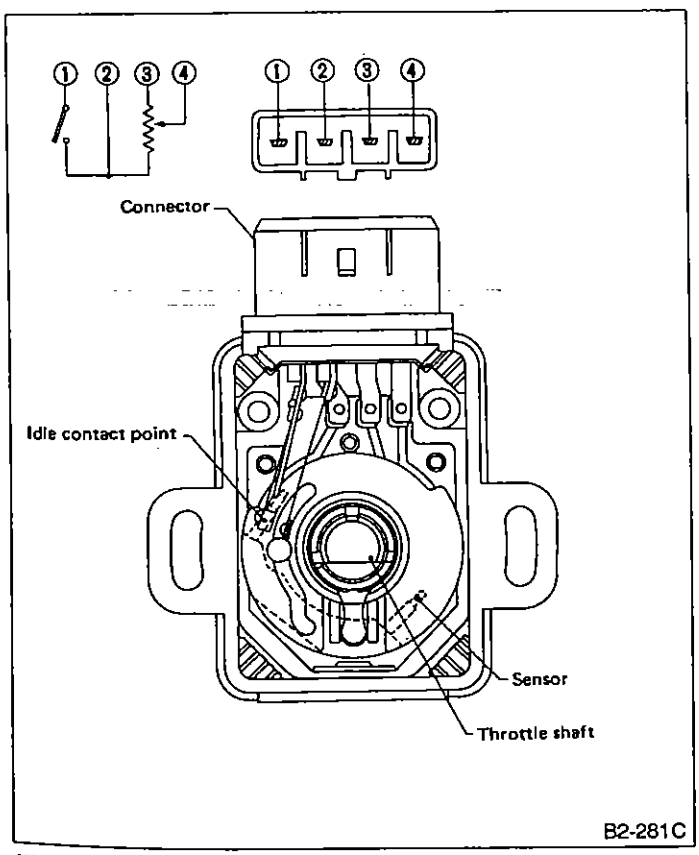


Fig. 4

5. BY-PASS AIR CONTROL SOLENOID VALVE

The by-pass air control solenoid valve consists of an air cut valve, duty control valve, intake air passage and a coolant passage.

The air cut valve contains a bimetallic substance which responds to coolant temperature, and a duty control valve which is operated by a signal sent from the ECU.

When the coolant temperature is low, the air cut valve is fully opened by the action of the bimetallic substance so that the air flow required for low coolant temperatures is maintained.

The ECU controls the duty control valve to bring the operating engine speed as close to preset idle speed as possible.

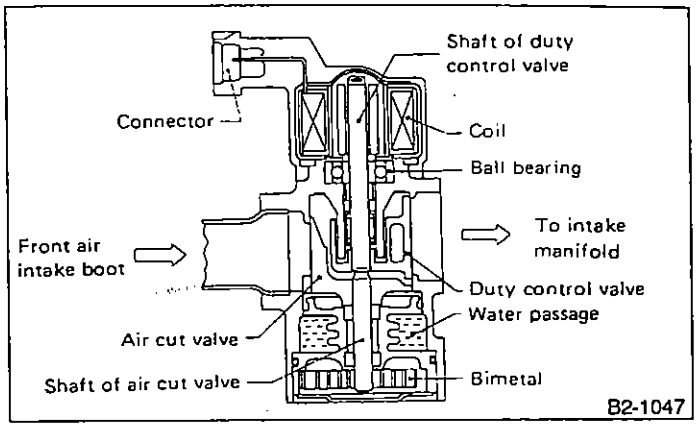


Fig. 5

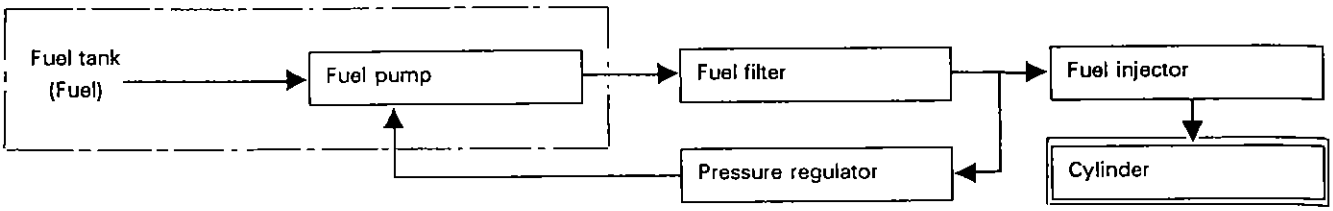
3. Fuel Line

GENERAL

Fuel is pressurized by the fuel pump built into the fuel tank and is delivered to fuel injectors by way of the fuel pipe and fuel filter. Fuel is regulated to the optimum pressure level by the pressure regulator on the way to the injectors.

From the injectors, fuel is injected into the intake manifold where it is mixed with intake air, and is then delivered to the respective cylinders.

Fuel injection timing and the amount of fuel injected is regulated by the ECU.



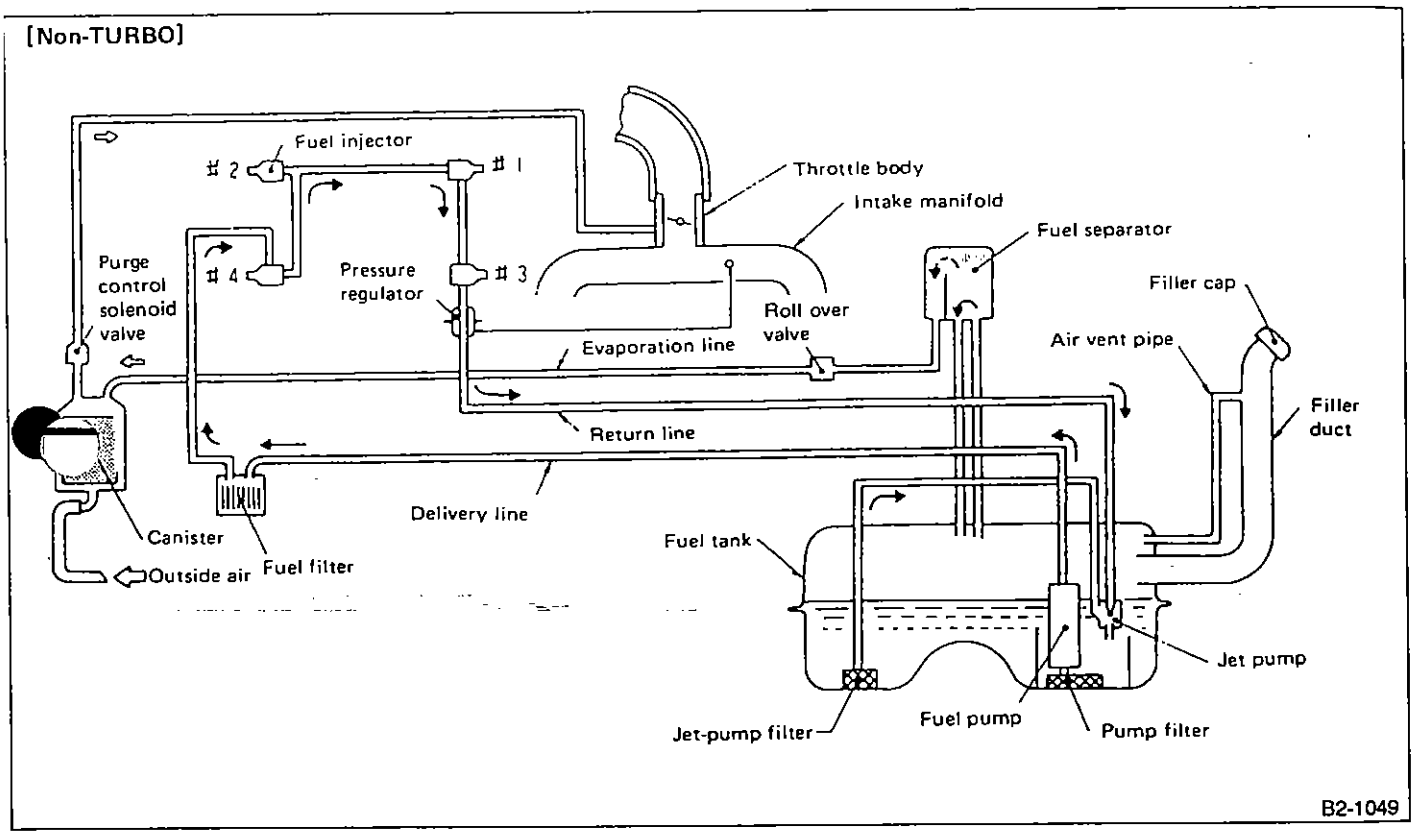


Fig. 6

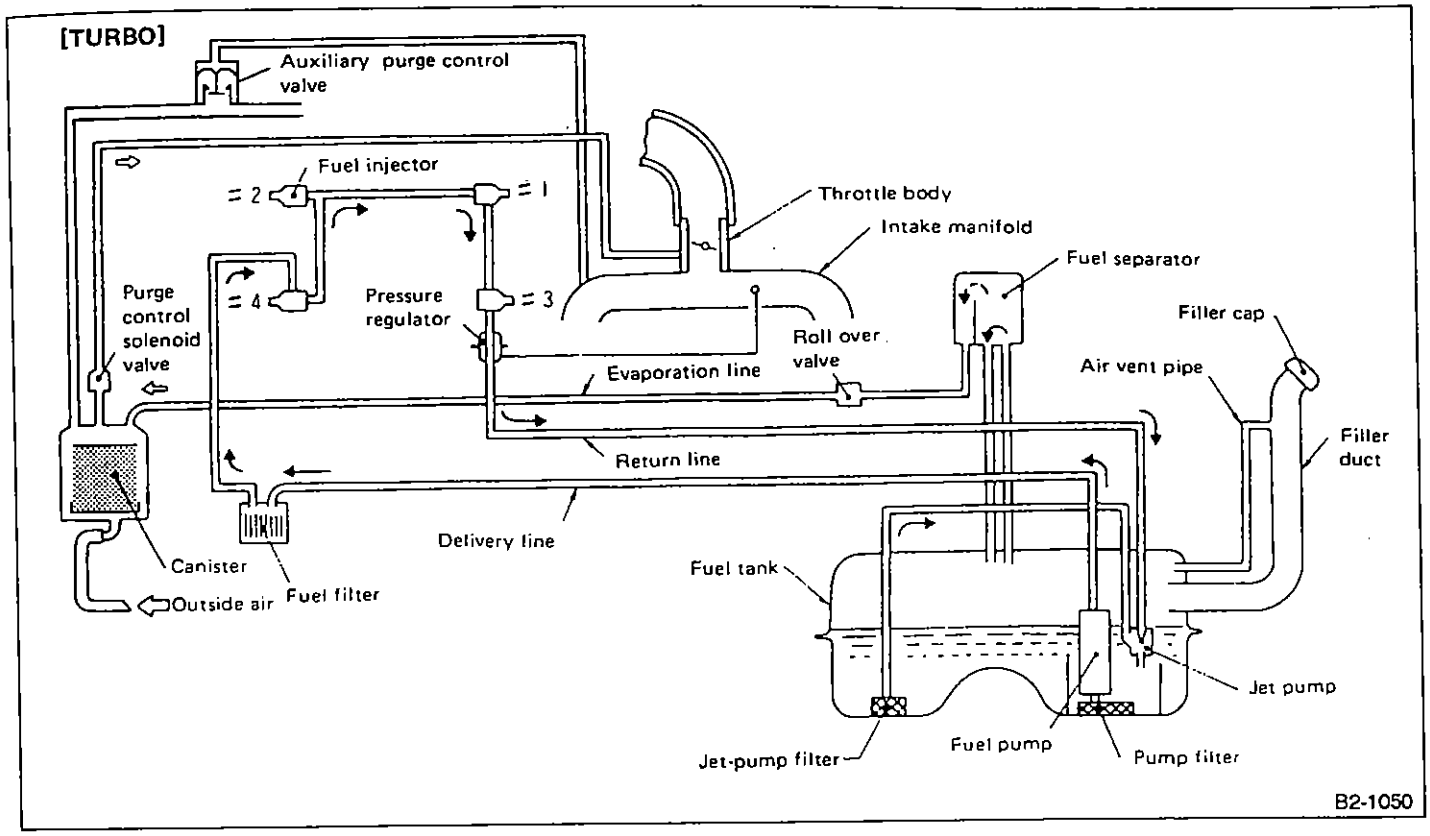
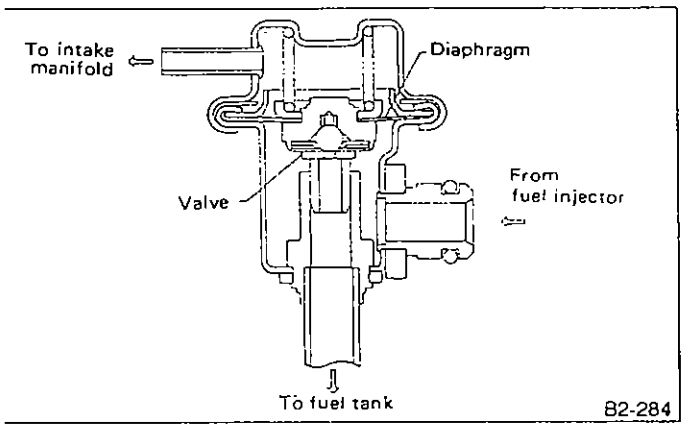

[TURBO]
Auxiliary purge control valve
Fuel injector
= 2
= 1
= 4
= 3
Purge control solenoid valve
Pressure regulator
Throttle body
Intake manifold
Fuel separator
Filler cap
Roll over valve
Evaporation line
Air vent pipe
Filler duct
Return line
Delivery line
Canister
Outside air
Fuel filter
Fuel tank
Jet pump
Jet-pump filter
Fuel pump
Pump filter
B2-1050

Fig. 7

2. PRESSURE REGULATOR

The pressure regulator is divided into the fuel chamber and spring chamber by the diaphragm as illustrated below. Fuel is fed to the fuel chamber through the fuel inlet connected with the injector. A difference in pressure between the fuel chamber and the spring chamber connected with the intake manifold causes the diaphragm to be pushed down, and fuel is fed back to the fuel tank through the return line.

By returning fuel so as to balance the above pressure difference and the spring force, the fuel pressure is kept at a constant level 250.1 kPa (2.55 kg/cm^2, 36.3 psi) against the intake manifold pressure.



3. FUEL INJECTOR

The MPFI system employs a gallery type (side-feed type) fuel injector.

The gallery type fuel injector is installed in the fuel pipe to allow cooling of the injector by the fuel.

The features of this type of fuel injector are as follows:

1) High heat resistance
2) Low driving noise
3) Easy to service
4) Small size

The fuel injector injects fuel according to the valve open signal received from the ECU.

The nozzle is attached on the top of the fuel injector. The needle valve (Non-TURBO) or ball valve (TURBO) is lifted by the solenoid coil through the plunger on arrival of the valve open signal.

Since the injection opening, the lifted level of valve and the regulator-controlled fuel pressure are kept constant, the amount of fuel to be injected can be controlled only by the valve open signal from the ECU.

The fuel injector of TURBO models is designed to inject a greater amount of fuel than that of Non-TURBO models, thus providing higher engine output.

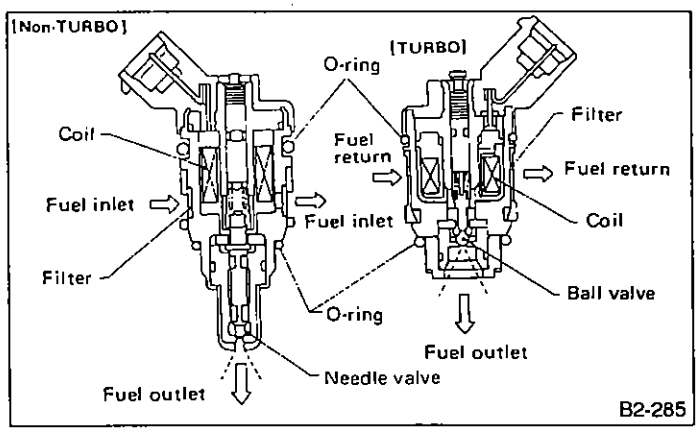


Fig. 9

4. Sensor and Switch

1. O_2 SENSOR

The O_2 sensor is used to sense oxygen concentration in the exhaust gas. If the fuel ratio is leaner than the stoichiometric ratio in the mixture (i.e. excessive amount of air), the exhaust gas contains more oxygen. To the contrary, if the fuel ratio is richer than the stoichiometric ratio, the exhaust gas contains hardly any oxygen.

Therefore, examination of the oxygen concentration in exhaust gas makes it possible to show whether the air/fuel ratio is leaner or richer than the stoichiometric ratio.

The O_2 sensor has a zirconia tube (ceramic) which generates voltage if there is a difference in oxygen concentration between the inside and outside of the tube. Platinum is coated on the inside and outside of the zirconia tube for the purpose of catalysis and electrode provision. The hexagon screw on the outside is grounded to the exhaust pipe, and the inside is connected to the ECU through the harness.

A ceramic heater is employed to improve performance at low temperature.

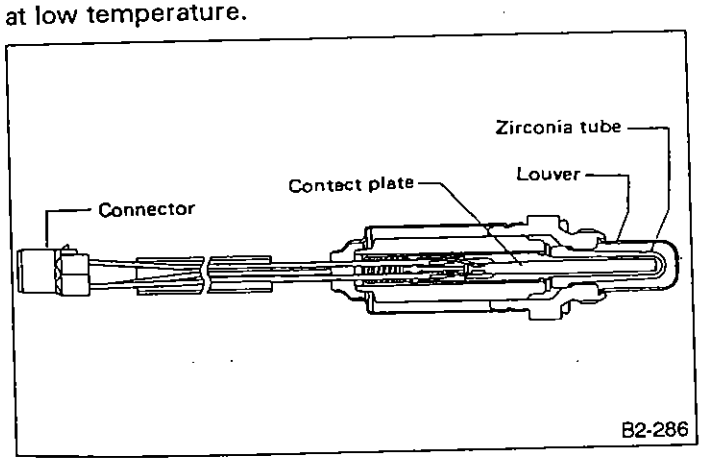


Fig. 10

When rich air-fuel mixture is burnt in the cylinder, the oxygen in the exhaust gases reacts almost completely through the catalytic action of the platinum coating on the surface of the zirconia tube. This results is a very large difference in the oxygen concentration between the inside and outside, and the electromotive force generated is large.

When a lean air-fuel mixture is burnt in the cylinder, oxygen remains in the exhaust gases even after the catalytic action, and this results in a small difference in the oxygen concentration. The electromotive force is very small.

The difference in oxygen concentration changes greatly in the vicinity of the optimum air-fuel ratio, and hence the change in the electromotive force is also large. By inputting this information into the MPFI control unit, the air-fuel ratio of the supplied mixture can be determined easily. The O_2 sensor does not generate much electromotive force when the temperature is low. The characteristics of the electromotive force stabilize at temperature of approximately 300 to 400°C (572 to 752°F).

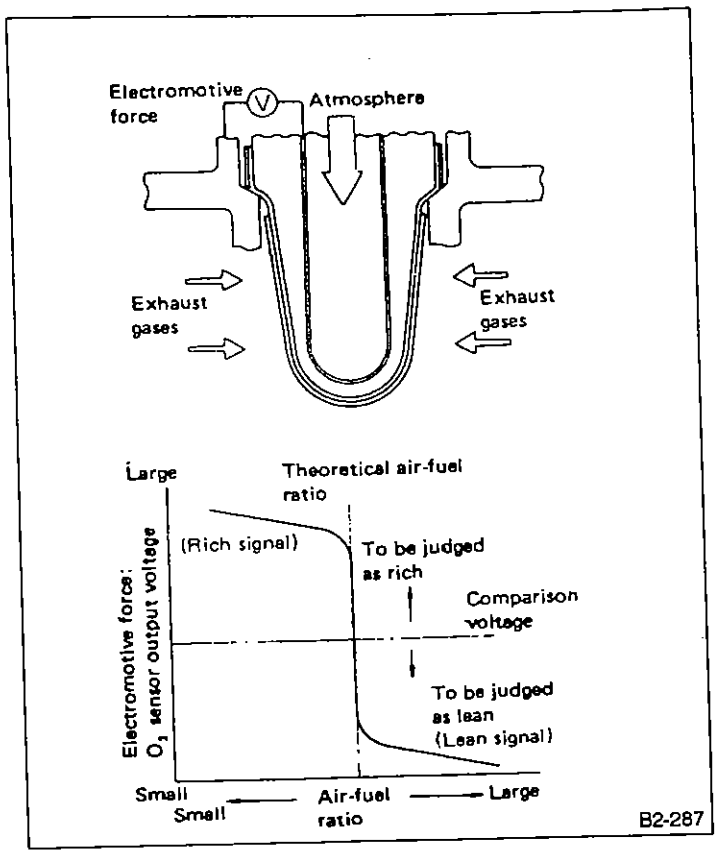


Fig. 11

2. WATER TEMPERATURE SENSOR

The water temperature sensor is located on the water pipe which is made of aluminum alloy. Its thermistor changes resistance with respect to temperature. A water temperature signal converted into resistance is transmitted to the ECU to control the amount of fuel injection, ignition timing, purge control solenoid valve, etc.

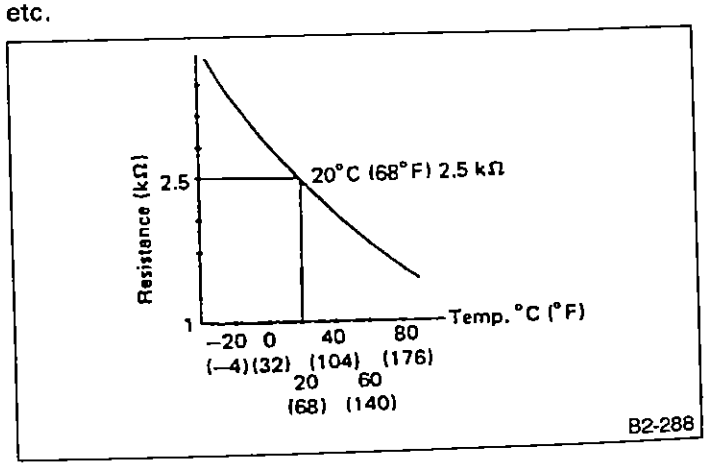


Fig. 12

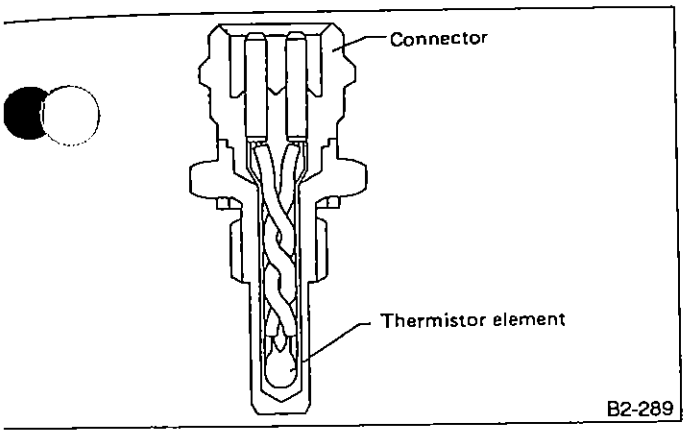


Fig. 13

3. KNOCK SENSOR

The knock sensor is installed on the cylinder block, and senses knocking signals from each cylinder.

This knock sensor is a piezo-electric type which converts knocking vibrations into electric signals.

It consists of a piezo-electric element, weight, and case.

If knocking occurs in the engine, the weight in the case moves causing the piezo-electric element to generate a voltage.

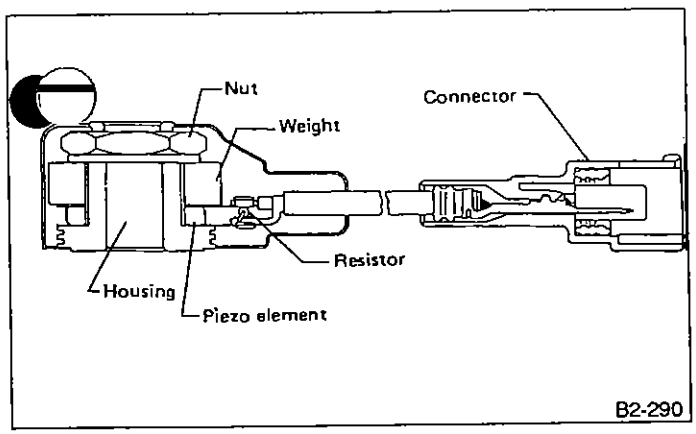


Fig. 14

4. CRANK ANGLE SENSOR

The crank angle sensor is installed on the oil pump, located in the front center portion of the cylinder block, to detect the crank angle position. It is designed so that the ECU accurately reads the number of pulses which occur when protrusions provided at the perimeter of the crank sprocket (rotating together with the crankshaft) cross the crank angle sensor.

The crank angle sensor is a molded type which consists of a magnet, pick-ups, coil, terminals, etc.

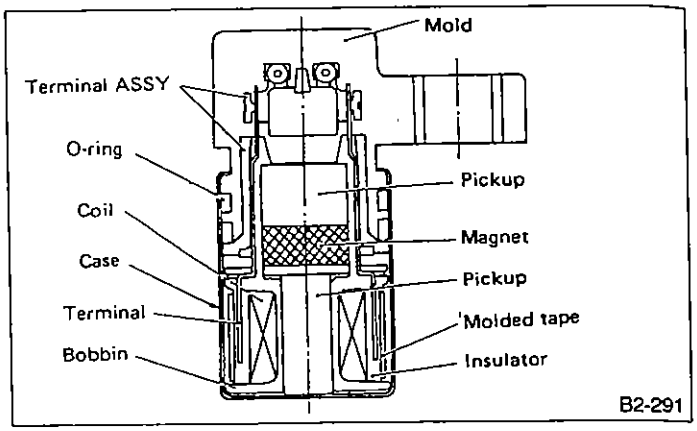


Fig. 15

Function

The crank sprocket is provided with six protrusions. Crank rotation causes these protrusions to cross the crank angle sensor so that magnetic fluxes in the coil change with the change in air gap between the sensor pickup and the sprocket. The change in air gap induces an electromotive force which is transmitted to the ECU.

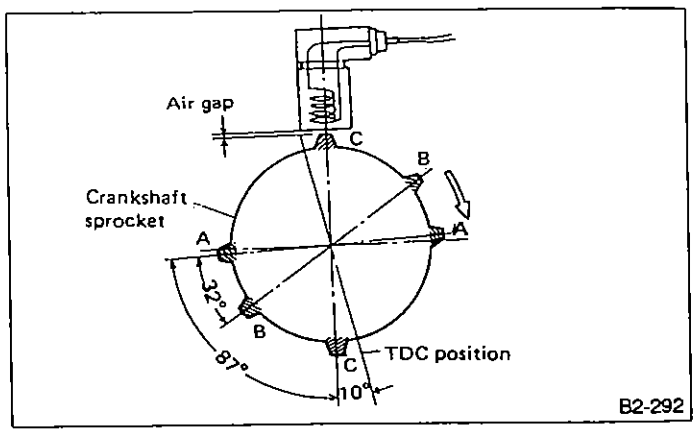


Fig. 16

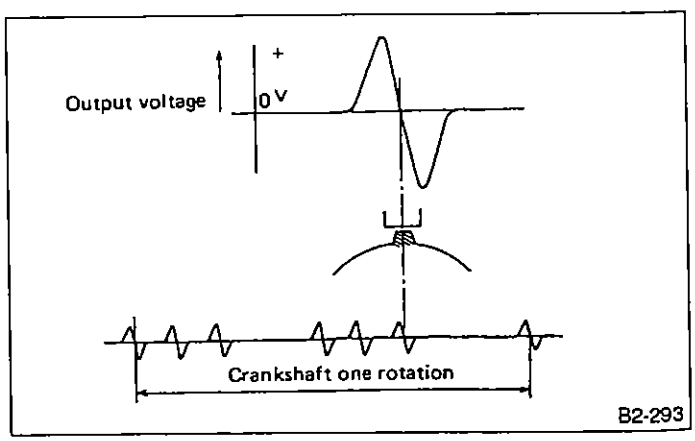


Fig. 17

5. CAM ANGLE SENSOR

The cam angle sensor is located on the left-hand camshaft support to detect the combustion cylinder at any one moment.

It is designed so that the ECU accurately reads the number of pulses which occur when protrusions provided on the back of the LH camshaft-drive sprocket cross the sensor.

Internal construction and the basic operating principle of the cam angle sensor are similar to those of the crank angle sensor. A total of seven protrusions (one each at two locations, two at one location and three at one location) are arranged in four equal parts of the sprocket, as shown below.

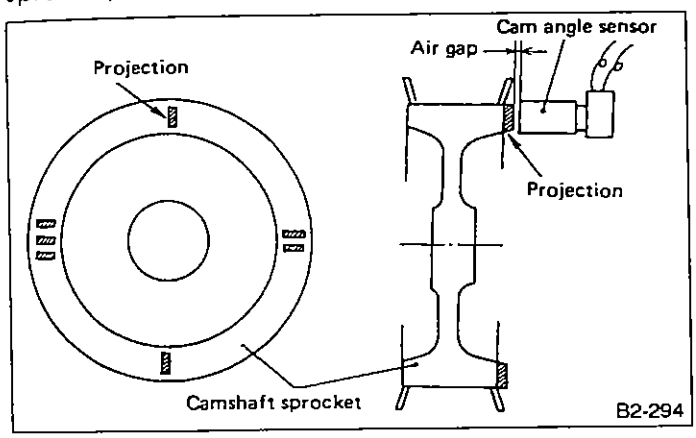


Fig. 18

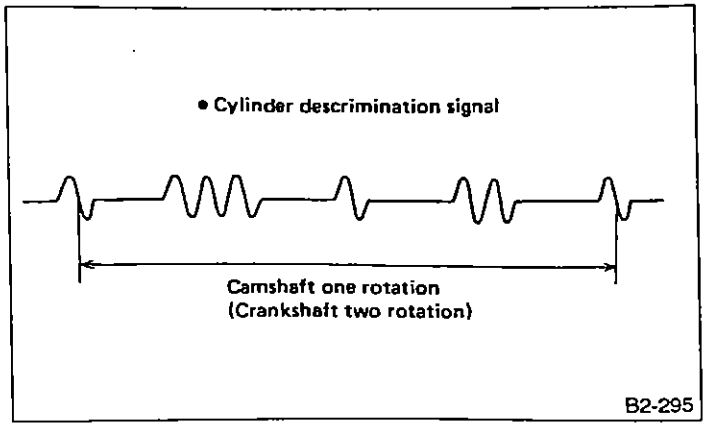


Fig. 19

6. VEHICLE SPEED SENSOR 2

The vehicle speed sensor 2 consists of a magnet rotor which is rotated by a speedometer cable and a reed switch. It is built into the combination meter.

One rotation of the magnet rotor turns the reed switch on and off four times to produce a digital signal. The digital signal is used as a vehicle speed signal which is transmitted to the ECU.

7. ATMOSPHERIC PRESSURE SENSOR (Non-TURBO)

The atmospheric pressure sensor is built into the ECU. It utilizes an "absolute" pressure sensor design. Its purpose is to detect the atmospheric pressure used to compensate for pressure at high altitudes and to maintain driving stability.

The signal from this sensor is also used for "shift control" of the automatic transmission at high altitudes.

. A/C (Air Conditioning) SWITCH AND RELAY

he A/C switch turns the A/C system on or off. The eration of the switch is transmitted to the ECU. cut relay breaks the current flow to the com- ressor, through the use of an output signal from the ECU, for a certain period of time when a "full-throttle" signal (emitted from the throttle sensor) enters the ECU while the compressor is operating. This prevents the degradation of acceleration performance and stabilizes driving performance.

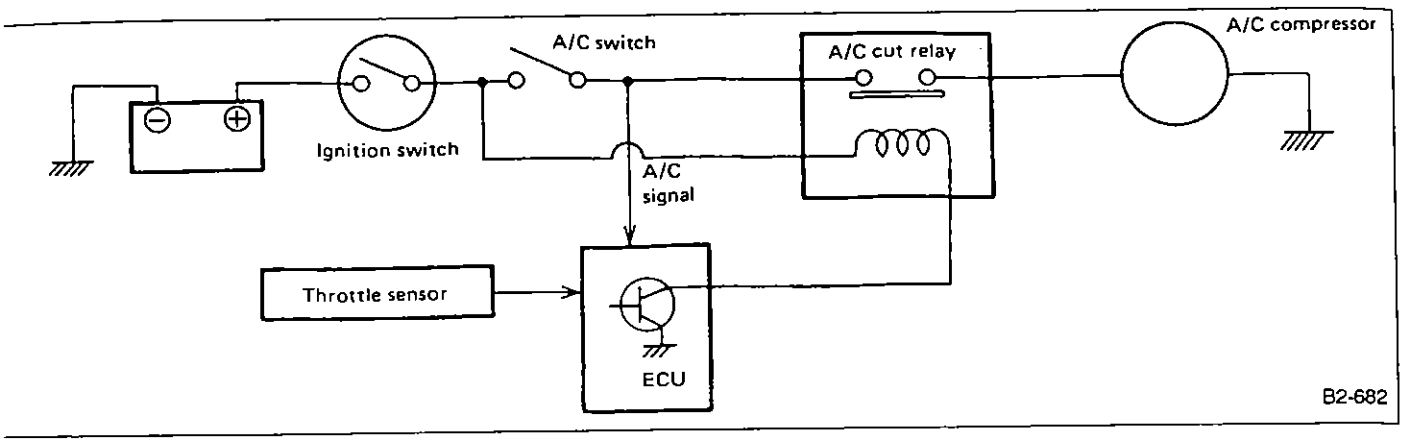


Fig. 20

9. PRESSURE SENSOR AND PRESSURE EXCHANGE SOLENOID VALVE (TURBO)

TURBO models have, in the inside of their engine compartment, a pressure sensor and a pressure exchange solenoid which switches pressure inlets so that the pressure sensor can detect both the atmospheric pressure and intake manifold pressure.

This selection of pressure inlet is performed by the pressure exchange solenoid valve according to the signal sent from the ECU. The output from the pressure sensor is entered into the ECU, which then sends out a signal for controlling the supercharging pressure to the wastegate control duty solenoid valve.

I percharging pressure exceeds the preset value, the fuel is cut by the ECU.

5. Control System

1. GENERAL

The ECU receives signals sent from various sensors and switches to judge the engine operating condition and emits output signals to provide the optimum control and/or functioning of various systems.
Major items governed by the ECU are as follow:

- Fuel injection control
- Ignition system control
- By-pass air control (Idle speed control)
- Canister purge control
- Radiator fan control
- Fuel pump control
- Air conditioner cut control
- Self-diagnosis function
- Fail-safe function
- Wastegate control (TURBO)

2. INPUT AND OUTPUT SIGNALS

	Unit	Function	Non-TURBO	TURBO
Input signal	Air flow sensor	Detects the amount of intake air.	O	O
	Throttle sensor	Detects the throttle position.	O	O
	Idle switch	Detects a fully-closed throttle.	O	O
	O_2 sensor	Detects the density of O_2 in exhaust gases.	O	O
	Crank angle sensor	Detects engine speed.	O	O
	Cam angle sensor	Detects the relative cylinder positions.	O	O
	Water temperature sensor	Detects the coolant temperature.	O	O
	Knock sensor	Detects engine knocking.	O	O
	Vehicle speed sensor 2	Detects vehicle speed.	O	O
	Ignition switch	Detects ignition switch operation.	O	O
	Starter switch	Detects the condition of engine cranking	O	O
	Inhibitor switch (A/T)	Detects shift positions.	O	O
	A/C switch	Detects the ON-OFF operation of the A/C switch.	O	O
	Atmospheric pressure sensor	Detects atmospheric pressure.	O	
	Pressure sensor	Detects atmospheric pressure and intake manifold pressure.		O
Output signal	Fuel injector	Inject fuel.	O	O
	Ignition signal	Turns primary ignition current on or off.	O	O
	Fuel pump relay	Turns the fuel pump relay on or off.	O	O
	A/C control relay	Turns A/C control relay on or off.	O	O
	Radiator fan control relay	Turns radiator fan control relay on or off.	O	O
	By-pass air control solenoid valve	Adjusts the amount of by-pass air flowing through the throttle valve.	O	O
	Check engine light	Indicates trouble.	O	O
	Purge control solenoid valve	Controls the amount of canister purge through the throttle body.	O	O
	Pressure exchange solenoid valve	Switches pressure detection line between atmospheric pressure and intake manifold pressure.		O
	Wastegate control solenoid valve	Controls the supercharging pressure.		O

3. INPUT AND OUTPUT SIGNAL DIAGRAM

Non-TURBO]

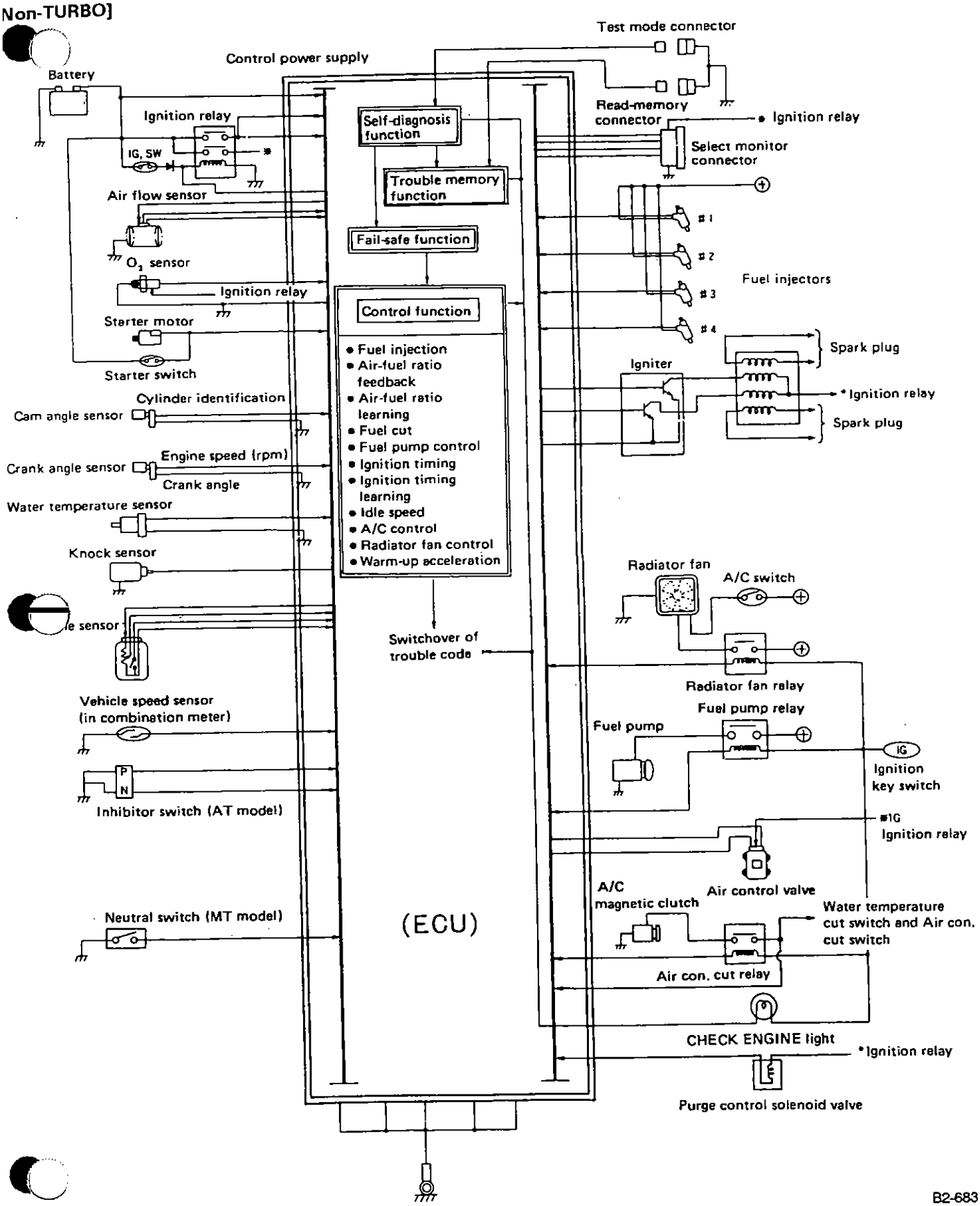


Fig. 21

[TURBO]

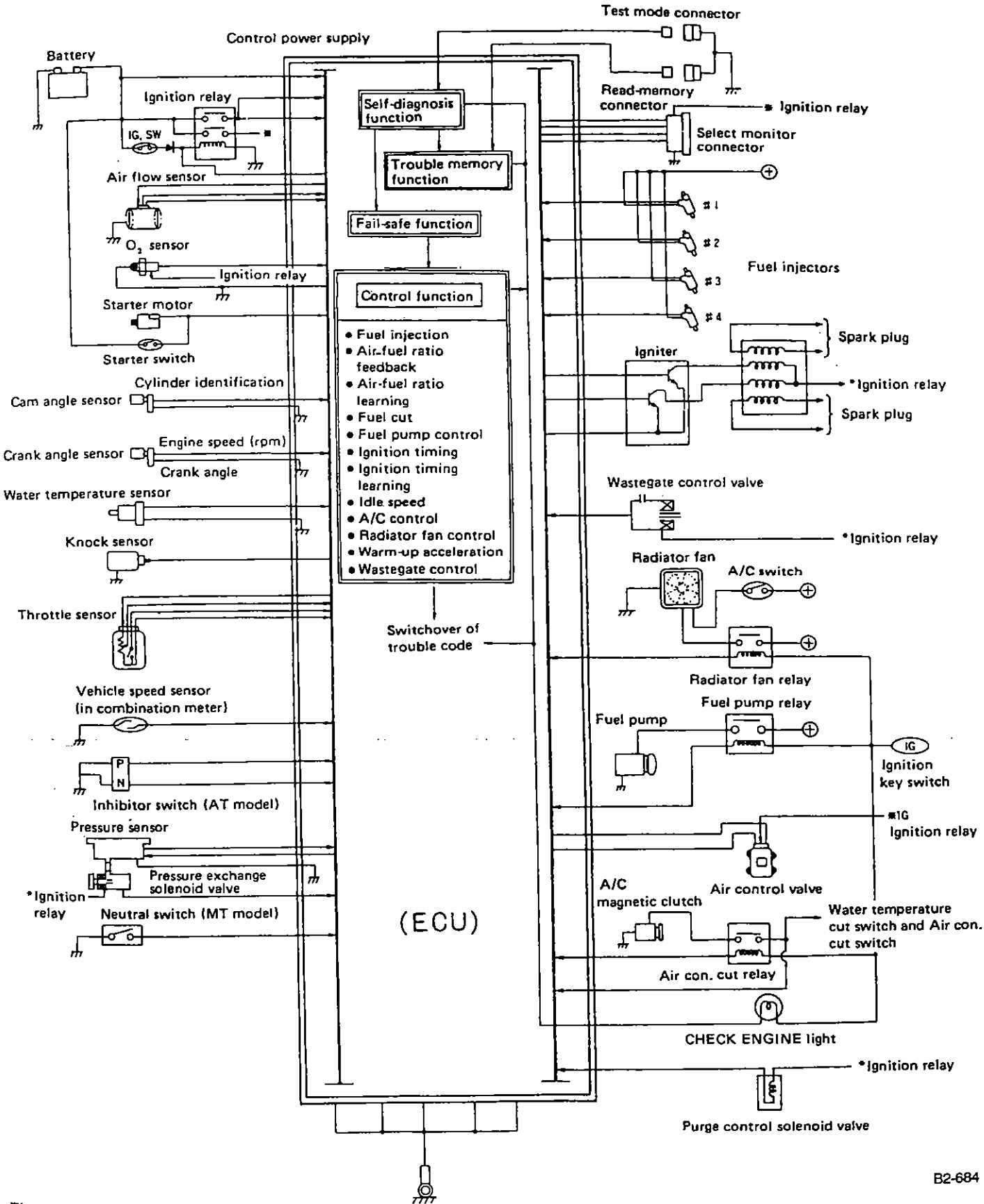

Test mode connector
Control power supply
Battery
Ignition relay
Self-diagnosis function
Read-memory connector
*Ignition relay
Select monitor connector
IG, SW
Trouble memory function
Air flow sensor
Fail-safe function
#1
#2
#3
#4
Fuel injectors
O2 sensor
Ignition relay
Control function
Starter motor
• Fuel injection
• Air-fuel ratio feedback
• Air-fuel ratio learning
• Fuel cut
• Fuel pump control
• Ignition timing
• Ignition timing learning
• Idle speed
• A/C control
• Radiator fan control
• Warm-up acceleration
• Wastegate control
Spark plug
Igniter
*Ignition relay
Spark plug
Starter switch
Cylinder identification
Cam angle sensor
Engine speed (rpm)
Crank angle sensor
Crank angle
Water temperature sensor
Wastegate control valve
*Ignition relay
Knock sensor
Radiator fan
A/C switch
Throttle sensor
Switchover of trouble code
Radiator fan relay
Vehicle speed sensor (in combination meter)
Fuel pump relay
Fuel pump
IG
Ignition key switch
P
N
Inhibitor switch (AT model)
*IG
Ignition relay
Pressure sensor
Air control valve
A/C magnetic clutch
Pressure exchange solenoid valve
*Ignition relay
Neutral switch (MT model)
(ECU)
Water temperature cut switch and Air con. cut switch
Air con. cut relay
CHECK ENGINE light
*Ignition relay
Purge control solenoid valve
B2-684

Fig. 22

1. FUEL INJECTION CONTROL

The ECU receives signals emitted from various sensors [illegible]rol the amount of fuel injected and the fuel [illegible] timing. Sequential fuel injection control is utilized over the entire engine operating range except during standing starts.

The amount of fuel injected by the injector valve is dependent upon the length of time it remains open. The optimum fuel injection timing is determined by transmitting a signal to the injector from the ECU according to varying engine operations. Feedback control is also accomplished by means of a learning control. As a result, the fuel injection control system is highly responsive and accurate in design and structure.

The sequential fuel injection system is designed so that fuel is injected at a specific time to provide maximum air intake efficiency for each cylinder. In other words, fuel injection is completed just before the intake valve begins to open.

1) Fuel injection characteristics

Fuel injection timing is basically expressed as indicated below:

(1) During engine starts:
Duration of fuel injection
= Duration of fuel injection during engine starts

(2) During normal operation:
[illegible]asic duration of fuel injection x correction factor + voltage correction time

- Basic duration of fuel injection ..... The basic length of time fuel is injected. This is determined by two factors—the amount of intake air detected by the air flow sensor and the engine speed (rpm) monitored by the crank angle sensor.
- Duration of fuel injection during engine starts ..... Determined according to the engine coolant temperature detected by a signal emitted from the water temperature sensor to improve starting ability.
- Voltage correction time ..... Compensates for the fuel injector's time lag affected by the battery voltage.

2) Correction coefficients

Correction coefficients are used to correct the basic duration of fuel injection so that the air-fuel ratio meets the requirements of varying engine operations.

These correction coefficients are classified as follows:

(1) Air-fuel ratio coefficient:
Allotted to provide the optimum air-fuel ratio in relation to engine speed and the basic amount of fuel [illegible]cted.

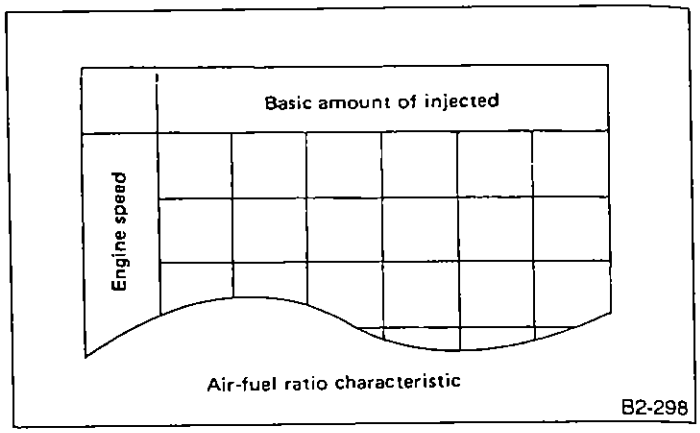


Fig. 23

(2) Start increment coefficient:
Increases the amount of fuel injected only when cranking the engine, which improves starting ability.

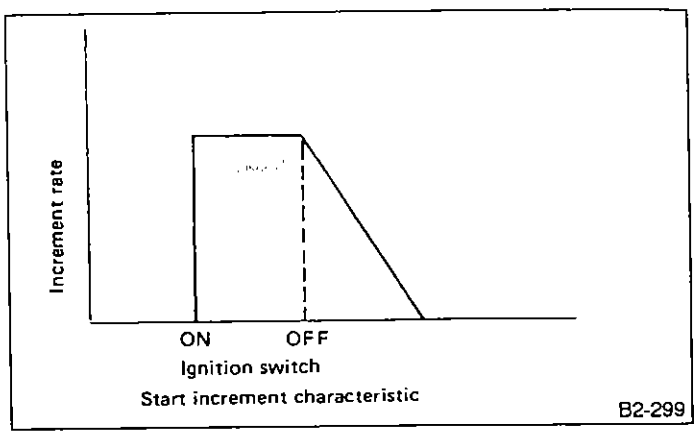


Fig. 24

(3) Water temperature increment coefficient:
Used to increase the amount of fuel injected in relation to a signal emitted from the water temperature sensor for easier starting of a cold engine. The lower the water temperature, the greater the increment rate.

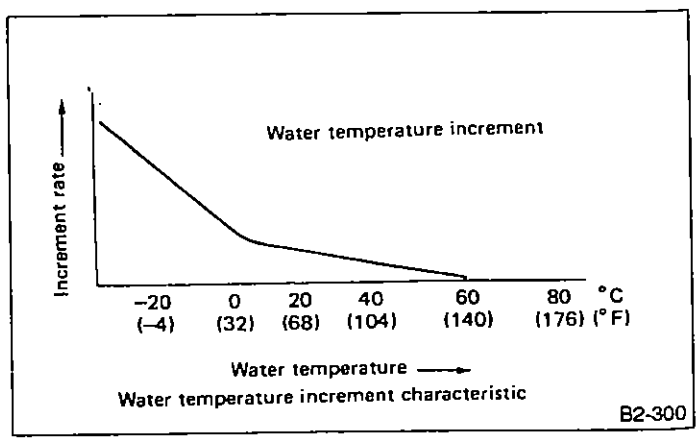


Fig. 25

(4) After-start increment coefficient:
Increases the amount of fuel injected for a certain period of time immediately after the engine starts to

stabilize engine operation.

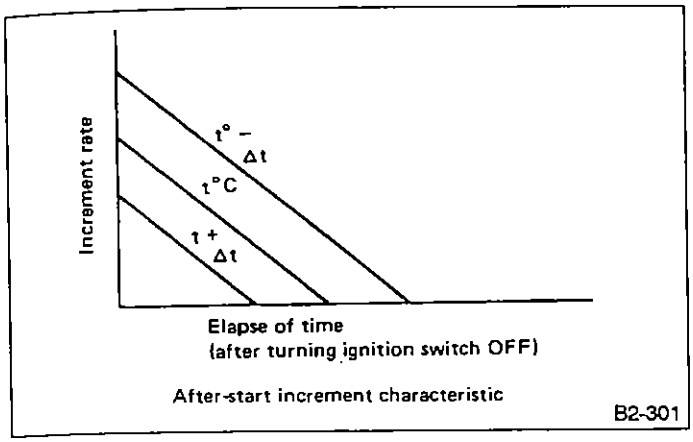


Fig. 26

(5) Full increment coefficient:
Increases the amount of fuel injected by a signal emitted from the throttle sensor in relation to a signal emitted from the air flow sensor.

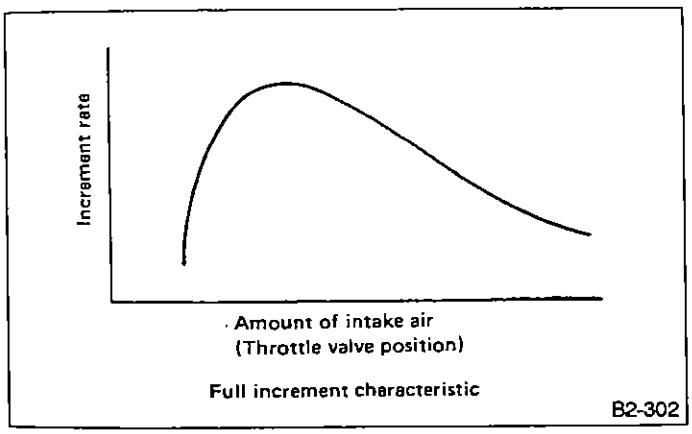


Fig. 27

(6) Acceleration increment coefficient:
Compensates for time lags of air flow measurement and/or fuel injection during acceleration to provide quick response.

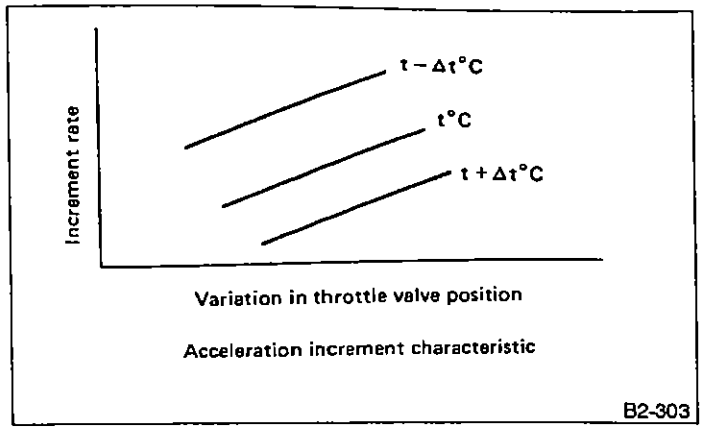


Fig. 28

3) Air-fuel ratio feedback coefficient "alpha"
This feedback coefficient utilizes the O_2 sensor's electromotive force (voltage) as a signal to be entered into the ECU. When low voltage is entered, the ECU judges it as a lean mixture, and when high voltage is entered, it is judged as a rich mixture. In other words, when the air-fuel ratio is richer than the theoretical air-fuel ratio, the amount of fuel injected is decreased. When it is leaner, the amount of fuel injected is increased. In this way, the air-fuel ratio is compensated so that it comes as close to the theoretical air-fuel ratio as possible on which the three-way catalyst acts most effectively. (CO, HC and NOx are also reduced when the air-fuel ratio is close to theoretical air-fuel ratio.)

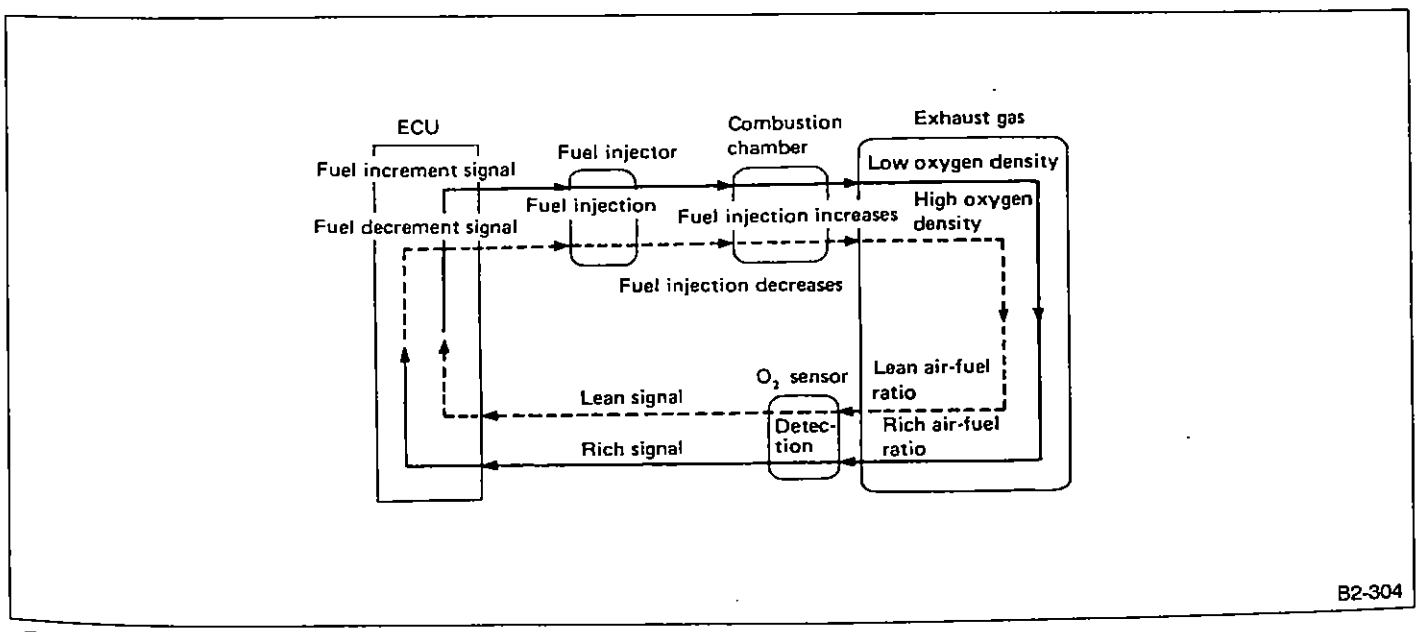


Fig. 29

Learning control system

a conventional air-fuel feedback control system, the [redacted]ount of fuel injected (according to engine [redacted]eed [redacted]d various loads) is stored in the memory. After e ECU receives a signal emitted from the O_2 sensor, e basic amount of fuel injected is corrected so that it is ose to the theoretical air-fuel ratio. This means that the eater the air-fuel ratio is corrected, the lesser the ntrol accuracy.

SUBARU engines, however, an air-fuel ratio learning ntrol system constantly memorizes the amount of rrection required in relation to the basic amount of el to be injected (the basic amount of fuel injected is etermined after several cycles of fuel injection), so that e correction affected by feedback control is mini-ized. Thus, quick response and accurate control of ariations in air-fuel ratio, sensors' and actuators' char-cteristics during operation, as well as in the air-fuel atio with the time of engine operation, are achieved. In ddition, accurate control contributes much to stability f exhaust gases and driving performance.

5. IGNITION SYSTEM CONTROL

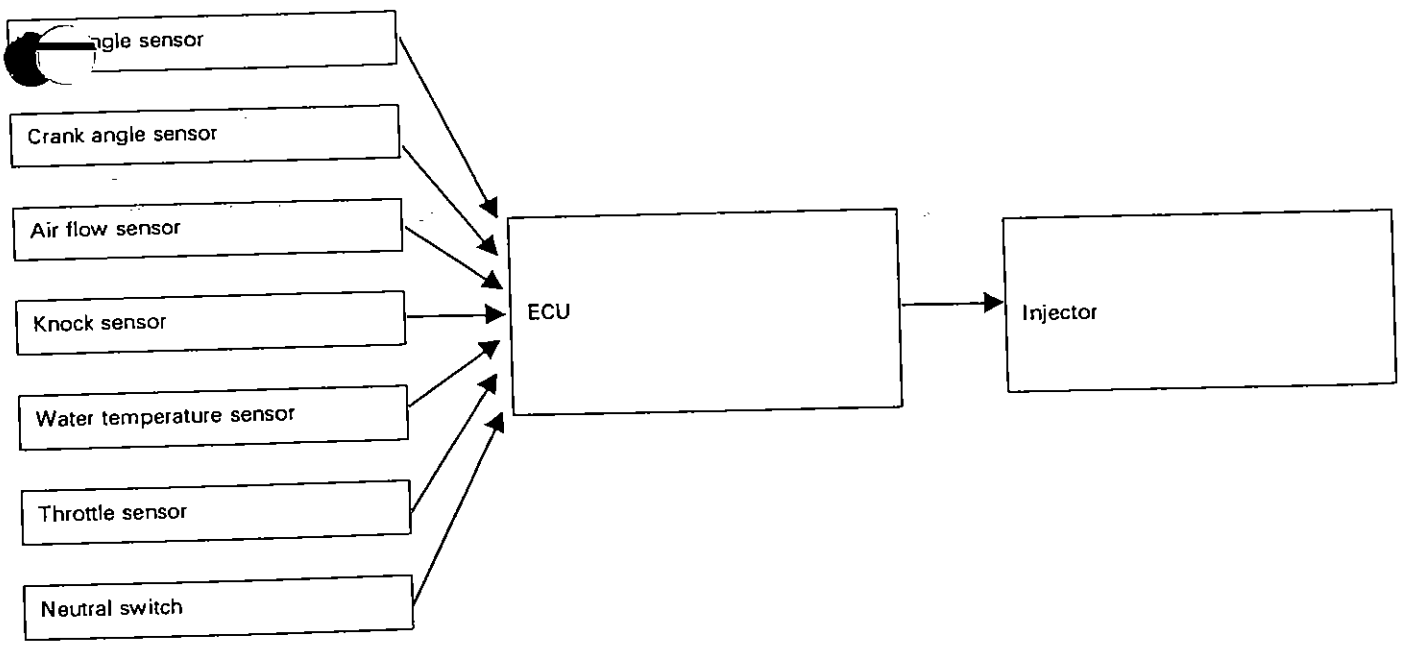
The ECU receives signals emitted from the air flow sensor, water temperature sensor, crank angle sensor, cam angle sensor, knock sensor, etc., to judge the operating condition of the engine. It then selects the optimum ignition timing stored in the memory and immediately transmits a primary current OFF signal to the ignitor to control the ignition timing.

While the ECU receives signals emitted from the knock sensor, it is controlled so that advanced ignition timing is maintained immediately before engine knock occurs. This system control type features a quick-to-response learning control method by which data stored in the ECU memory is processed in comparison with information emitted from various sensors and switches.

Thus, the ECU constantly provides the optimum ignition timing in relation to output, fuel consumption, exhaust gas, etc., according to various engine operating conditions, the octane rating of the fuel used, etc.

Two ignition coils are used - one for the #1 and #2 cylinders, and one for the #3 and #4 cylinders. A simultaneous ignition type is employed for #1 and #2 cylinders on one hand, and #3 and #4 cylinders on the other.

This eliminates the distributor and achieves maintenance-free operation.



• Ignition control under normal engine conditions
Between the 97° signal and the 65° signal, the ECU measures the engine revolutions, and by using this data it decides the dwell set timing and ignition timing according to the engine condition.

• Ignition control under starting conditions
Engine revolutions fluctuate at the starting condition, so the ECU cannot control the ignition timing. When such a condition exists, ignition timing is fixed at 10° BTDC by using the 10° signal.

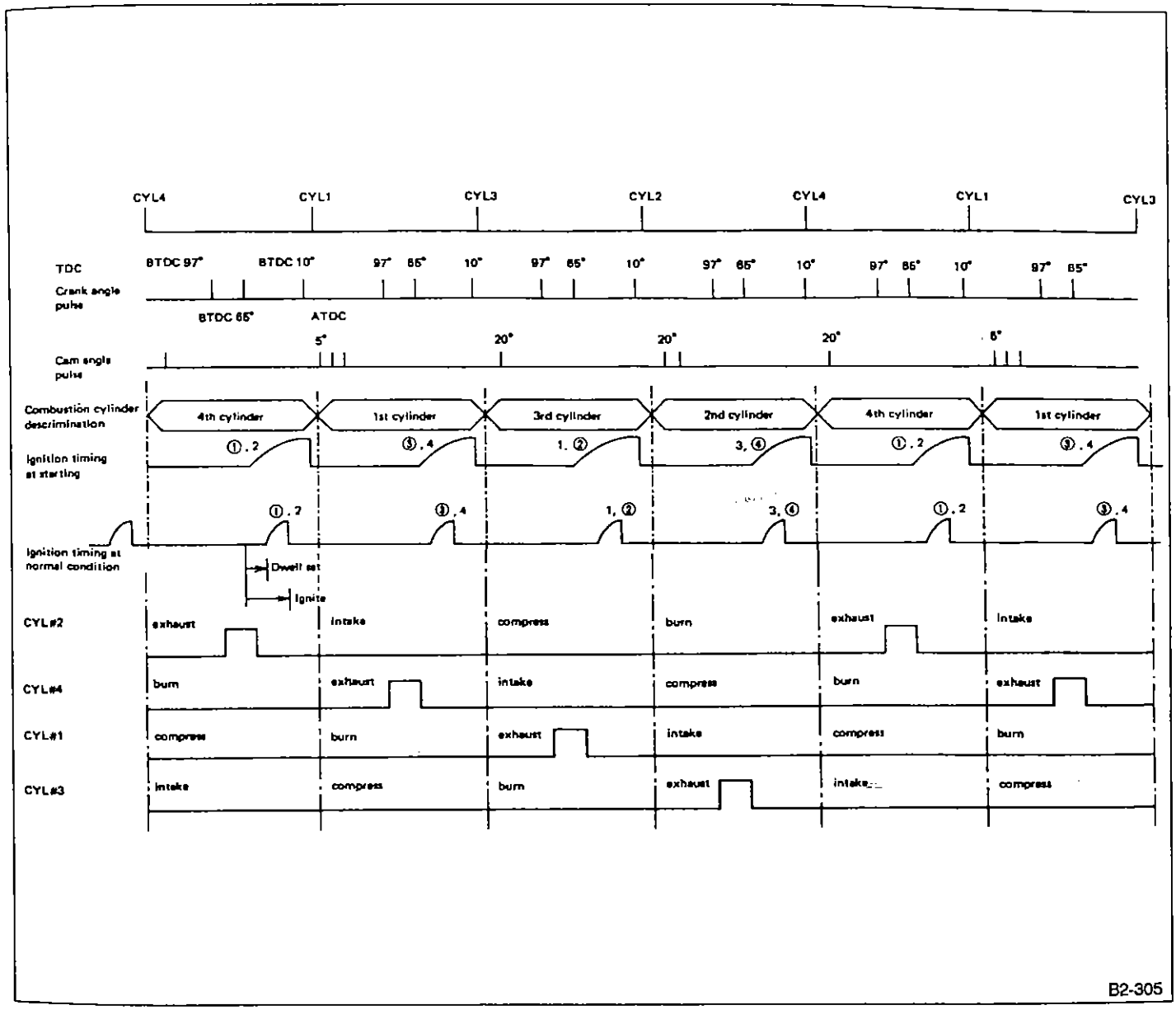


Fig. 30

6. BY-PASS AIR CONTROL (IDLE SPEED CONTROL)

ECU activates the by-pass air control valve in [illegible] to control the amount of by-pass air flowing through the throttle valve in relation to signals emitted from the crank angle sensor, cam angle sensor, water temperature sensor and A/C switch, so that the proper idle speed specified for each engine load is achieved.
The by-pass air control valve utilizes a duty solenoid design so that the amount of valve "lift" is determined by a certain operating frequency. For this reason, the by-pass air flow is regulated by controlling the duty ratio. The relationship between the duty ratio, valve lift and by-pass air flow is as follows:

Duty ratio (high) → Increases valve lift and by-pass air flow.

Bypass air control features the following advantages:

1. Compensation for engine speed under A/C (air condition-ing) system and electrical loads.
2. Increase in idle speed during early stage of warm-up period.
3. A dashpot function during the time the throttle valve is quickly closed.
4. Prevention of engine speed variations over time.

Diagram

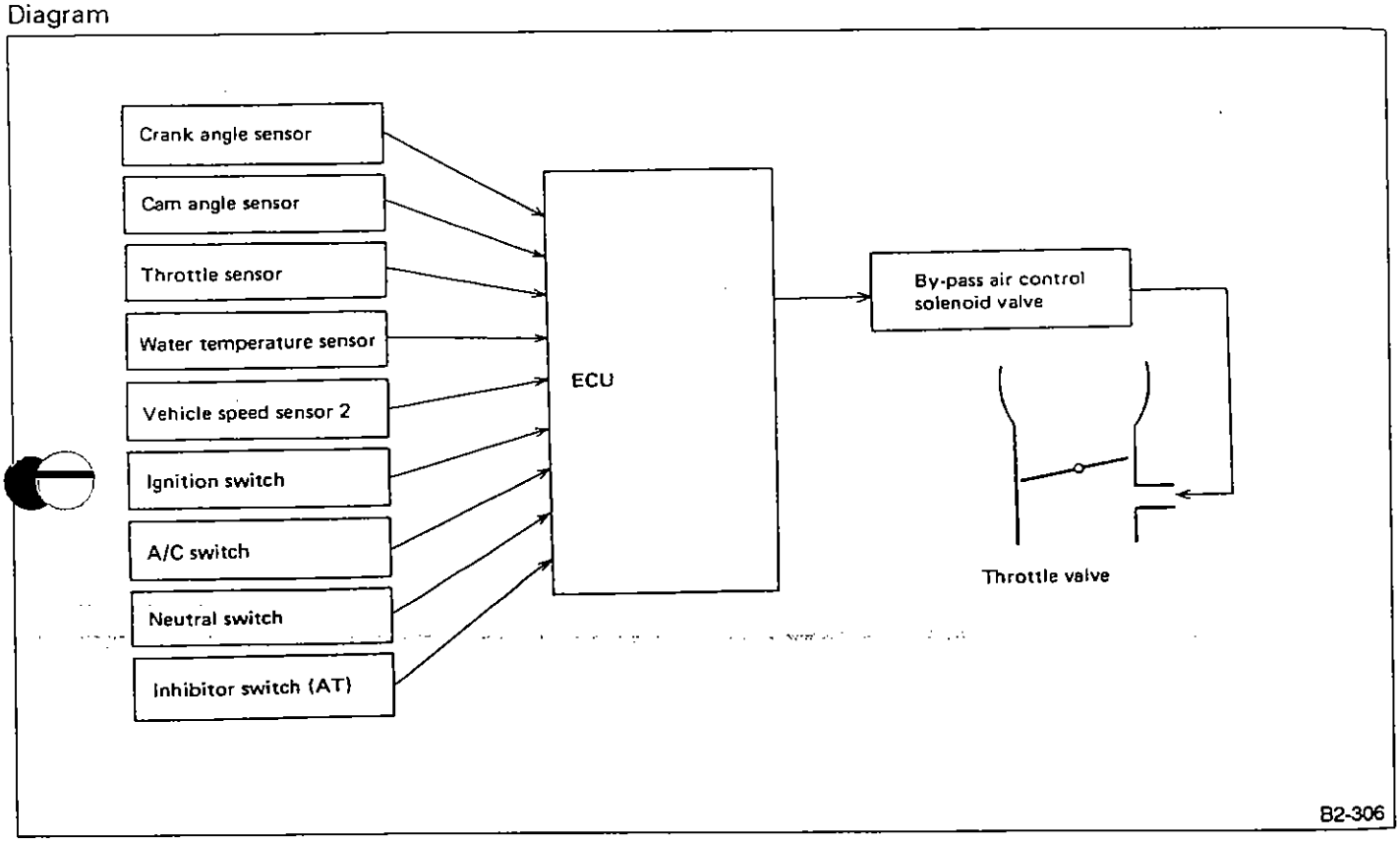


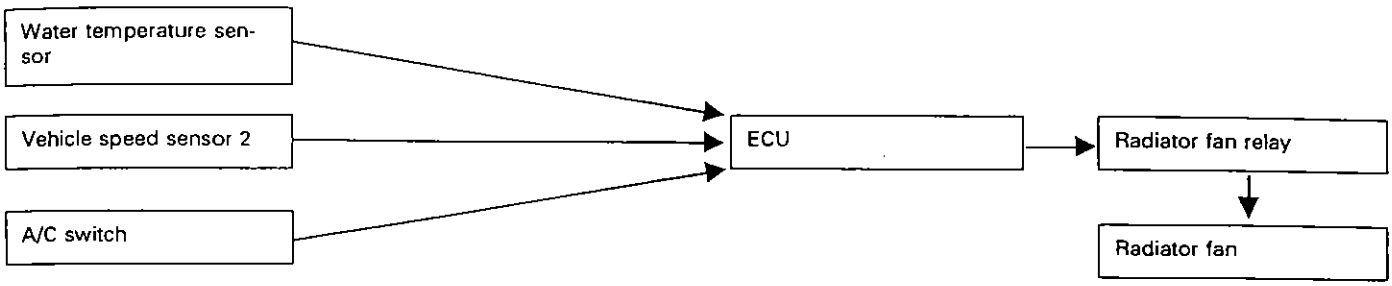
Fig. 31

7. CANISTER PURGE CONTROL

The ECU receives signals emitted from the water temperature sensor, vehicle speed sensor and crank angle sensor to control the purge control solenoid.
Canister purge takes place during operation of the vehicle except under certain conditions (during idle, etc.).
The purge line is connected to the throttle chamber to purge fuel evaporation gas from the canister according to the amount of intake air.

8. RADIATOR FAN CONTROL

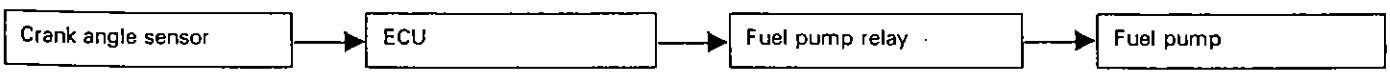
The ON-OFF control of the radiator fan (for models which are not equipped with an air conditioning system) is governed by the ECU which receives signals sent from the water temperature sensor and vehicle speed sensor. On models which are equipped with an air conditioning system, the ECU receives signals sent from the water temperature sensor, vehicle speed sensor and A/C switch. These signals simultaneously turn ON or OFF the main radiator fan and A/C sub fan as well as setting them at "HI" or "LO" speed.



9. FUEL PUMP CONTROL

The ECU receives a signal emitted from the crank angle sensor and turns the fuel pump relay ON or OFF to control fuel pump operation. To improve safety, the fuel pump will stop if the engine stalls with the ignition switch ON.

Ignition switch ON	Fuel pump relay	Fuel pump
A certain period of time (after ignition switch is turned ON)	ON	Operates
While cranking the engine	ON	Operates
While engine is operating	ON	Operates
When engine stops	OFF	Does not operate



0. A/C CUT CONTROL

When the ECU receives a "full-open" signal emitted from the throttle sensor while the air conditioning system is operating, the A/C cut relay turns off for a certain period of time to stop the compressor. This prevents degradation of output during acceleration and stabilizes driveability.

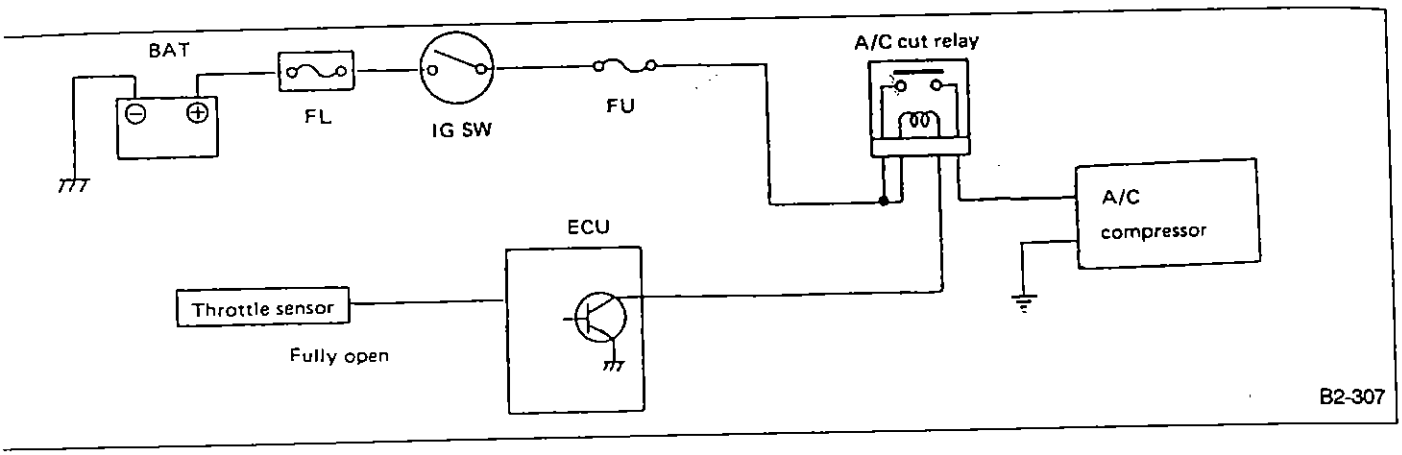
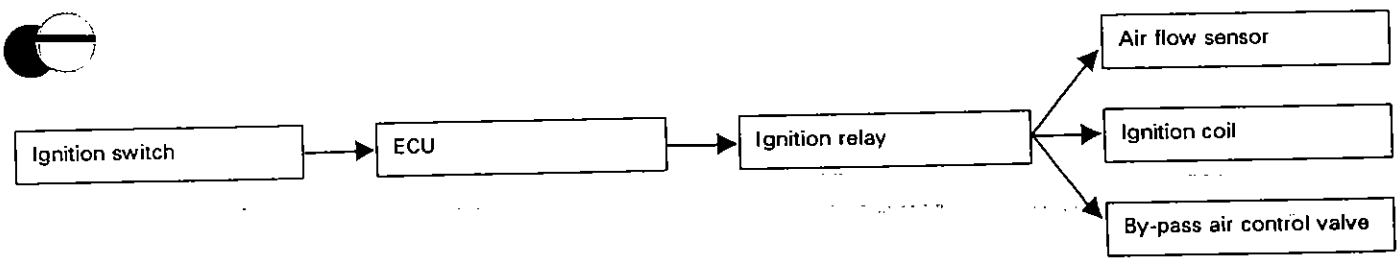


Fig. 32

11. POWER SUPPLY CONTROL

When the ECU receives an ON signal emitted from the ignition switch, current flows through the ignition relay. This turns the ignition relay ON so that power is supplied to the ignition coil, air flow sensor, by-pass air control valve, etc.

Power to the above parts is turned off five seconds after the ECU receives an OFF signal from the ignition switch. The fuel injectors stop fuel injection immediately after the ignition switch is turned OFF because the injection signal is cut off.



12. WASTEGATE CONTROL (TURBO)

The ECU computes the objective supercharging pressure according to the signals sent from the crank angle sensor, air flow sensor, throttle sensor, pressure sensor, and water temperature sensor. The ECU then sends a signal to the duty solenoid valve so as to attain the computed objective supercharging pressure.

The duty solenoid valve, according to the signal from the ECU, leaks out the pressure applied to the wastegate valve controller so that the supercharging pressure at which the wastegate valve opens reaches the objective level. By this method, engine performance in acceleration or in high altitude is compensated.

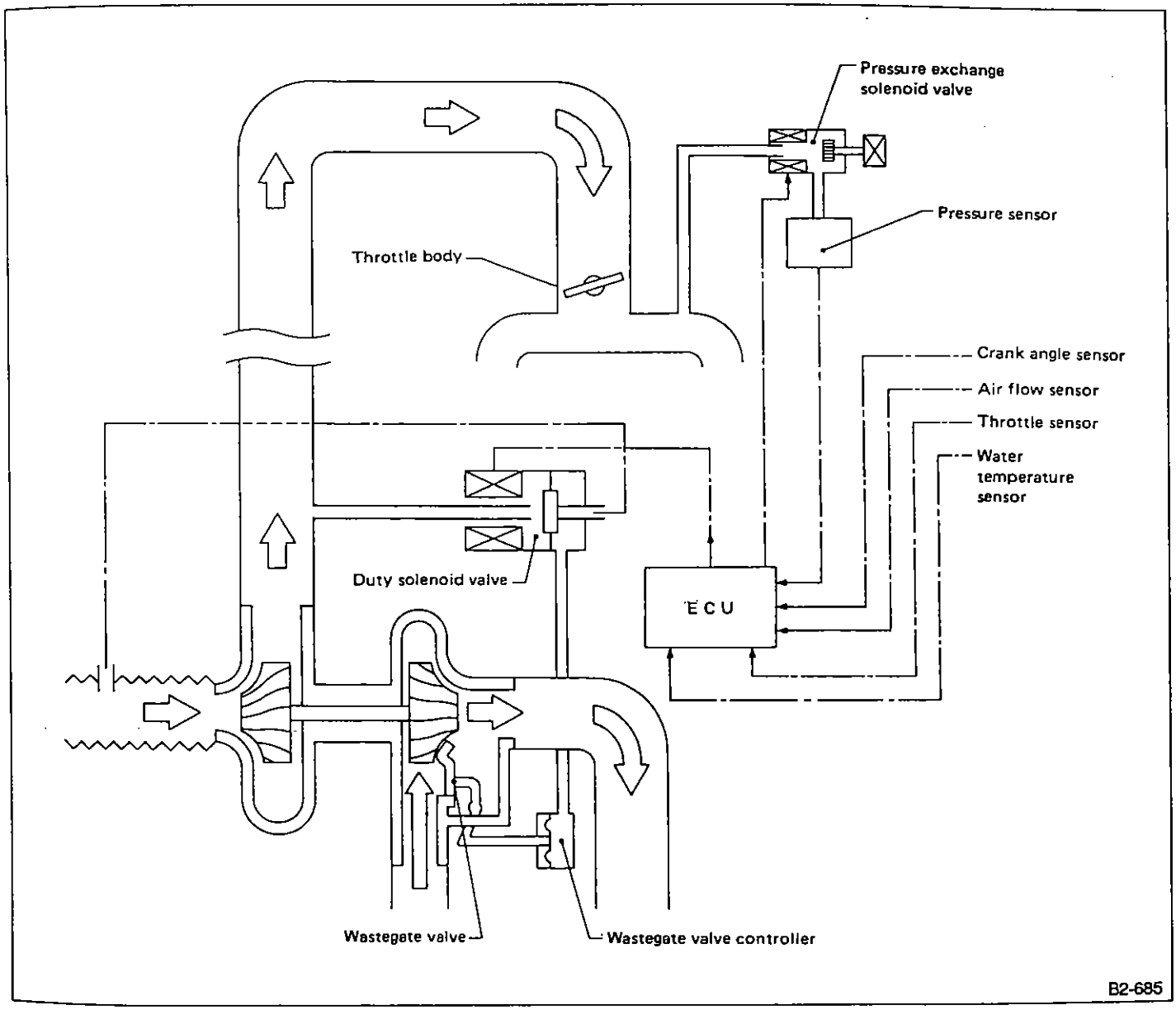


Fig. 33

5. Self-diagnosis System

GENERAL

The diagnosis system detects and indicates a fault in various inputs and outputs of the complex electronic control. The warning light (CHECK ENGINE light) on the instrument panel indicates occurrence of a fault or trouble.
Further, against such a failure or sensors as may disable the drive, the fail-safe function is provided to ensure the minimal driveability.

2. FUNCTION OF SELF-DIAGNOSIS

The self-diagnosis function has four modes: U-check mode, Read memory mode, D-check mode and Clear memory mode. Two connectors (Read memory and Test mode) and a light (CHECK ENGINE light) are used. The connectors are for mode selection and the light monitors the type of problem.

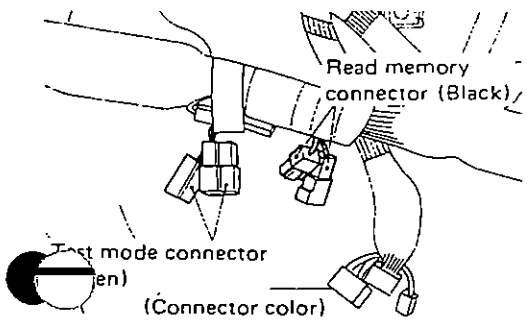


Fig. 34

Refer to C.6-3 [W0600] for the location of connectors.

- Relationship between modes and connectors

Mode	Engine	Read memory connector	Test mode connector
U-check	Ignition ON	DISCONNECT	DISCONNECT
Read memory	Ignition ON	CONNECT	DISCONNECT
D-check	Ignition ON (engine on)	DISCONNECT	CONNECT
Clear memory	Ignition ON (engine on)	CONNECT	CONNECT

- U-check mode

The U-check is a user-oriented mode in which only the MPFI components necessary for start-up and drive are diagnosed. On occurrence of a fault, the warning light (CHECK ENGINE light) is lighted to indicate to the user that the dealer's inspection is necessary. The diagnosis of other parts which do not give significant adverse effect to start-up and drive are excluded from this mode in order to avoid unnecessary uneasiness to be taken by the user.

- Read memory mode

This mode is used by the dealer to read past problems (even when the vehicle's monitor lights are off). It is most effective in detecting poor contact or loose connections of connectors, harnesses, etc.

- D-check mode

This mode is used by the dealer to check the entire MPFI system and detect faulty parts.

- Clear memory mode

This mode is used by the dealer to clear the trouble code from the memory after the affected part is repaired.

3. BASIC OPERATION OF SELF-DIAGNOSIS SYSTEM

• No TROUBLE

Mode	Read memory connector	Test mode connector	Condition	CHECK ENGINE light
U-check	X	X	Ignition switch ON (Engine OFF)	ON
			Engine ON	OFF
Read memory	O	X	Ignition switch ON (Engine OFF)	Blink
			Engine ON	ON
D-check	X	O	Ignition switch ON (Engine OFF)	ON
			Engine ON	OFF → Blink*
Clear memory	O	O	Ignition switch ON (Engine OFF)	ON
			Engine ON	OFF → Blink*

• TROUBLE

Mode	Read memory connector	Test mode connector	Condition	CHECK ENGINE light
U-check	X	X	Ignition switch ON	ON
Read memory	O	X	Ignition switch ON	Trouble code (memory)
D-check	X	O	Engine ON	Trouble code**
Clear memory	O	O	Engine ON	Trouble code**

* When the engine operates at a speed greater than 2,000 rpm for more than 40 seconds, the check engine light blinks. However, when all check items check out "O.K.',' even before the 40 seconds is reached, the check engine light blinks.

** When the engine operates at a speed greater than 2,000 rpm for more than 40 seconds, a trouble code is emitted.

4. FAIL-SAFE FUNCTION

For the part which has been judged faulty in the self-diagnosis, the ECU generates the associated pseudo signal (only when convertible to electric signal) and carries out the computational processing. In this fashion, the fail-safe function is performed.

5. TROUBLE CODES AND FAIL-SAFE OPERATION

Trouble code	Item	Contents of diagnosis	Fail- safe operation	Non-TURBO	TURBO
11	Crank angle sensor	No signal entered from crank angle sensor, but signal (corresponding to at least one rotation of crank) entered from cam angle sensor.	—	O	O
12	Starter switch	Abnormal signal emitted from starter switch.	Turns starter switch signal OFF.	O	O
13	Cam angle sensor	No signal entered from cam angle sensor, but signal (corresponding to at least two rotations of cam) entered from crank angle sensor.	—	O	O
14	Injector #1	Fuel injector inoperative. (Abnormal signal emitted from monitor circuit.)	—	O	O
15	Injector #2		—	O	O
16	Injector #3		—	O	O
17	Injector #4		—	O	O
21	Water temperature sensor	Abnormal signal emitted from water temperature sensor.	Adjusts water to a specific temperature. Maintains radiator fan "ON" to prevent overheating.	O	O
22	Knock sensor	Abnormal voltage produced in knock sensor monitor circuit.	Sets in regular fuel map and retards ignition timing.	O	O
23	Air flow sensor	Abnormal voltage input entered from air flow sensor.	Controls the amount of fuel (injected) in relation to engine speed and throttle sensor position.	O	O
[illegible]	By-pass air control solenoid valve	Air control valve inoperative. (Abnormal signal produced in monitor circuit.)	Prevents abnormal engine speed using "fuel cut" in relation to engine speed, vehicle speed and throttle sensor position.	O	O
31	Throttle sensor	Abnormal voltage input entered from throttle sensor.	Sets throttle sensor's voltage output to a fixed value.	O	O
32	O_2 sensor	O_2 sensor inoperative.	—	O	O
33	Vehicle speed sensor 2	Abnormal voltage input entered from vehicle speed sensor.	Sets vehicle speed signal to a fixed value.	O	O
35	Purge control solenoid valve	Solenoid valve inoperative.	—	O	O
41	A/F learning control	Faulty learning control function.	—	O	O
42	Idle switch	Abnormal voltage input entered from idle switch.	Judges OFF operation.	O	O
44	Wastegate control solenoid valve	Solenoid valve inoperative.	—		O
45	Atmospheric pressure sensor	Faulty sensor.	Sets sensor to 760 mmHg.	O	
	Pressure sensor and pressure exchange solenoid valve	Faulty sensor or pressure exchange solenoid valve inoperative.	Prevents abnormal supercharging pressure using "fuel cut" in relation to engine load.		O
49	Air flow sensor	Use of improper air flow sensor.	—	O	O
51	Neutral switch	Abnormal signal entered from neutral switch.	—	O	O
51	Inhibitor switch	Abnormal signal entered from inhibitor switch.	—	O	O
52	Parking switch	Abnormal signal entered from parking switch.	—	O	O

7. Turbocharger System

1. GENERAL

The turbocharger performs supercharging with use of the wasted energy in the high temperature exhaust gas. It provides the following features:

1) Less power loss with use of the exhaust gas energy.
2) Light in weight and compact in size for better adaptability.
3) Better matching with the engine load.
4) Easy and efficient adjustment of the supercharge pressure by bypassing through the exhaust gas passage.

The turbocharger system for recent passenger cars places emphasis on low speed rather than high speed. More specifically, its supercharging performance is designed to be effective even at low engine speed with larger torque for enhancing both the fuel efficiency and power output. (In contrast, the conventional turbocharger is effective only at high engine speed.) The turbocharging effective at low engine speed minimizes a drawback of the conventional system which must take a certain time before the supercharging becomes effective through acceleration from low speed.

In the engineering of this turbocharger system, particular consideration has been given to the above performance. With the optimum turbocharger design and the suitable tuning of intake and exhaust systems, it is capable of providing powerful torque even at low speed, quick response and superb operability.

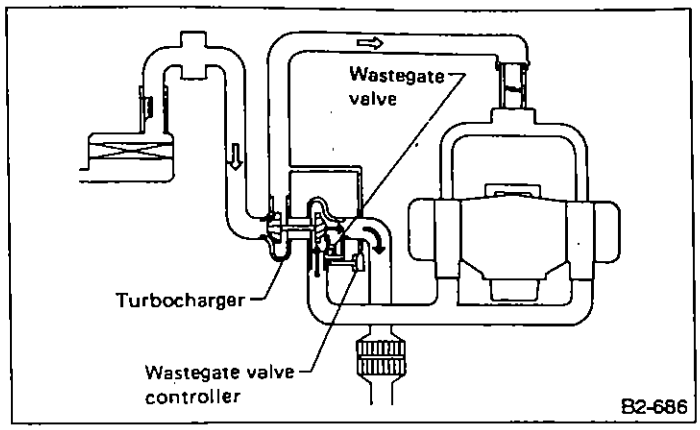


Fig. 35

While the supercharging pressure is lower than the predetermined level, the wastegate valve is closed so that all the exhaust gas is carried through the turbine.

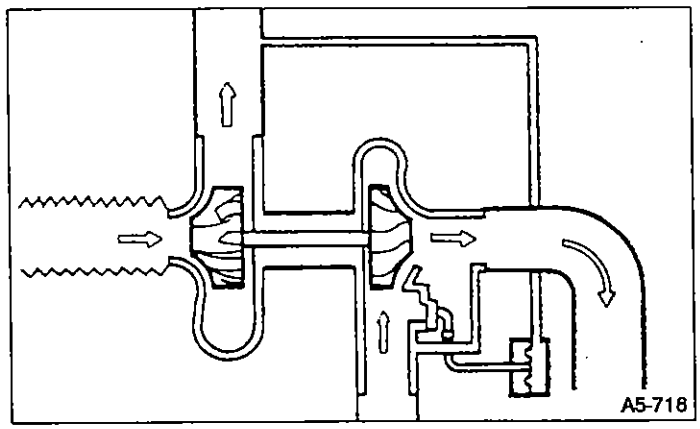


Fig. 36

2. REGULATION OF SUPERCHARGING PRESSURE

1) Basic function of the wastegate valve

As the engine speed increases with the opening of the throttle valve, the amount of exhaust gas increases. This leads to increase in the rotational speed of turbine (approx. 20,000 to 120,000 rpm), the supercharging pressure and the output.

However, excessive supercharging pressure may cause occurrence of the knocking and heavier thermal load on such a part as piston. In the worst case, the engine may be damaged or broken. To prevent this, the wastegate valve and its controller are equipped. By sensing the supercharging pressure, the wastegate valve restricts it below a predetermined level.

hen it reaches the predetermined level, the wastegate ntroller lets the supercharging pressure to press the m, causing the linked wastegate valve to open. /astegate-valve opened, a part of the exhaust is is allowed to flow into the exhaust gas pipe by /passing the turbine.
his decreases the turbine rotating energy to keep the upercharging pressure constant.
means $P_2 - P_1$ = constant
P_1: Atmospheric pressure
P_2: Supercharging pressure

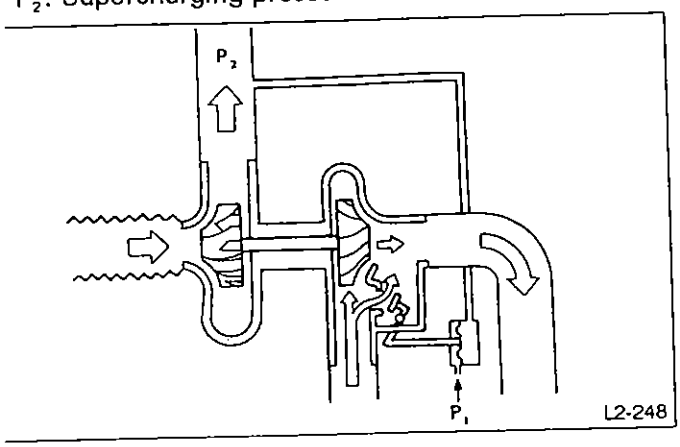


Fig. 37

2) Concept of the wastegate valve control

The higher the altitude, the lower the atmospheric (P_1) and supercharging pressure (P_2). The duty solenoid valve acts as a control to maintain maximum supercharging pressure (P_2) under absolute pressure.

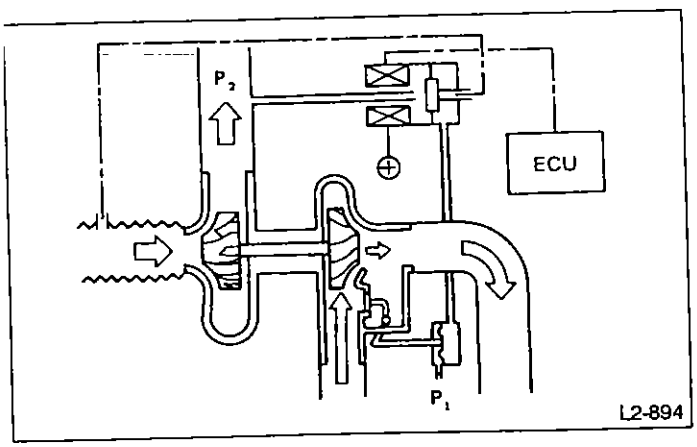


Fig. 38

Max. P_2 = const (Absolute pressure 161.3 kPa (1,210 mmHg, 47.64 inHg)

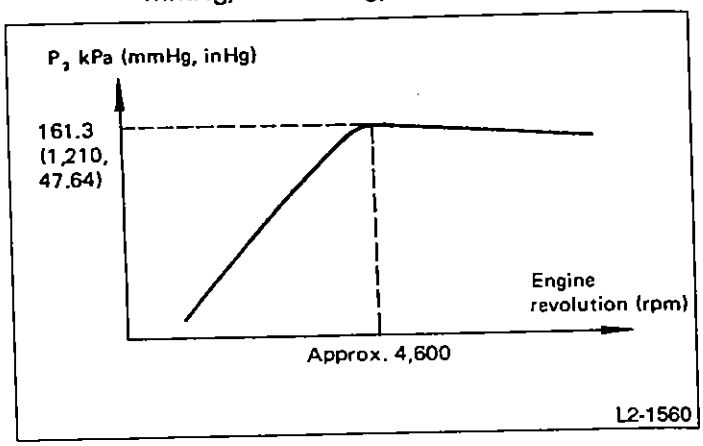


Fig. 39

3. LUBRICATION OF TURBOCHARGER

The turbocharger is lubricated by the engine oil branched out from the oil pump. Since the turbocharger turbine and the compressor shaft reach a maximum of several hundred thousand revolutions per minute, the full-floating type bearings are used to form desirable lubrication films on their inside and outside during running.

Further the oil supplied to the turbocharger also plays an important role of cooling the heat from exhaust gas in the turbine not to propagate to the bearings.

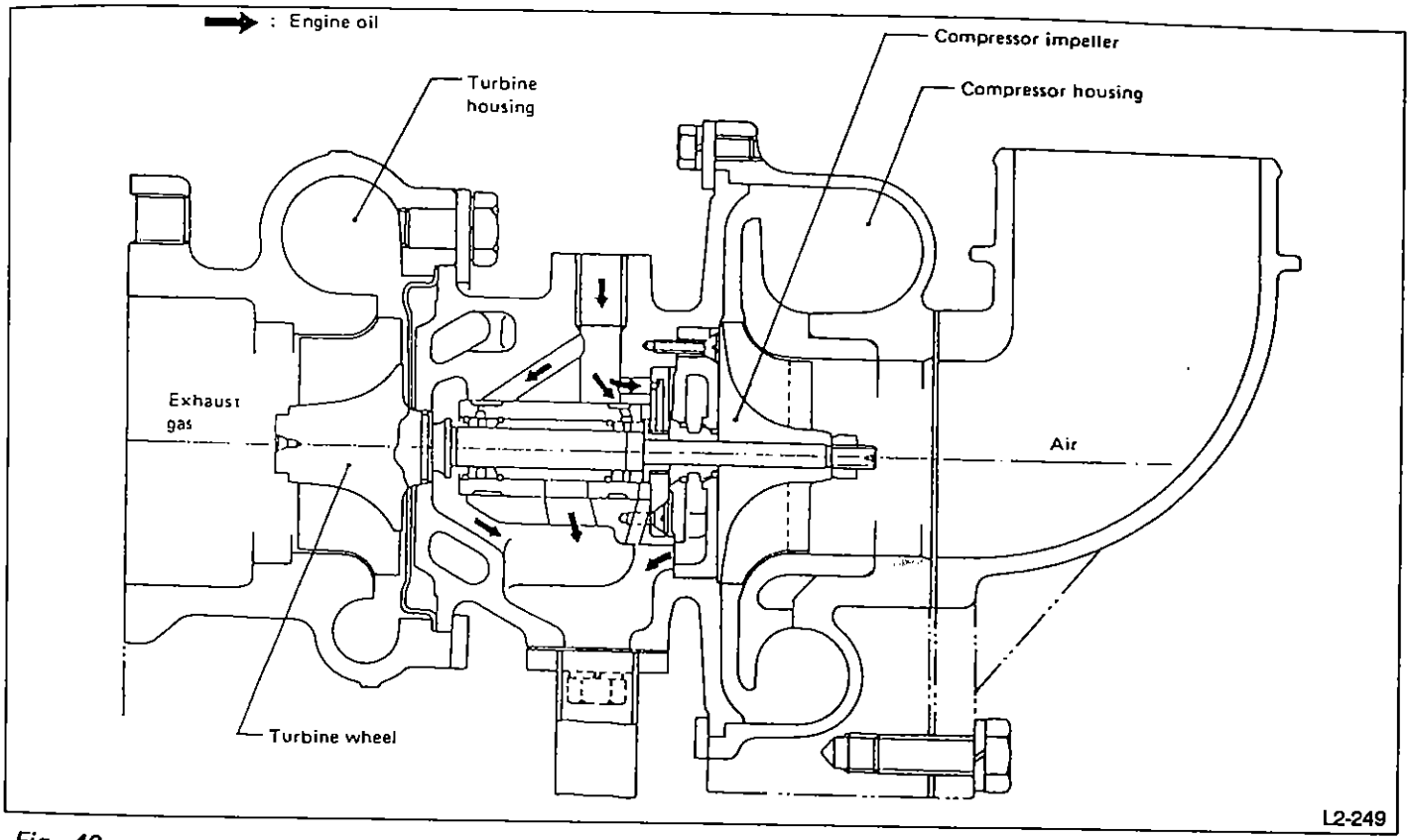


Fig. 40

4. COOLING OF TURBOCHARGER

The turbocharger is water cooled for higher reliability and durability. The coolant from the coolant drain hose under the engine cylinder head is led to the coolant passage, through a pipe, provided in the turbocharger bearing housing. After cooling the bearing housing, the coolant is led into the coolant filler tank through a pipe.

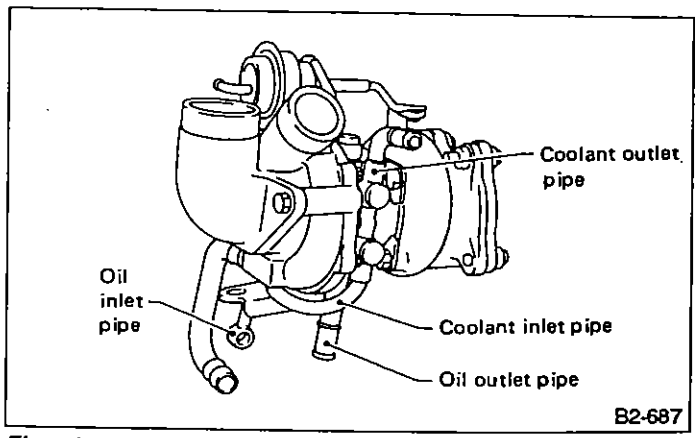
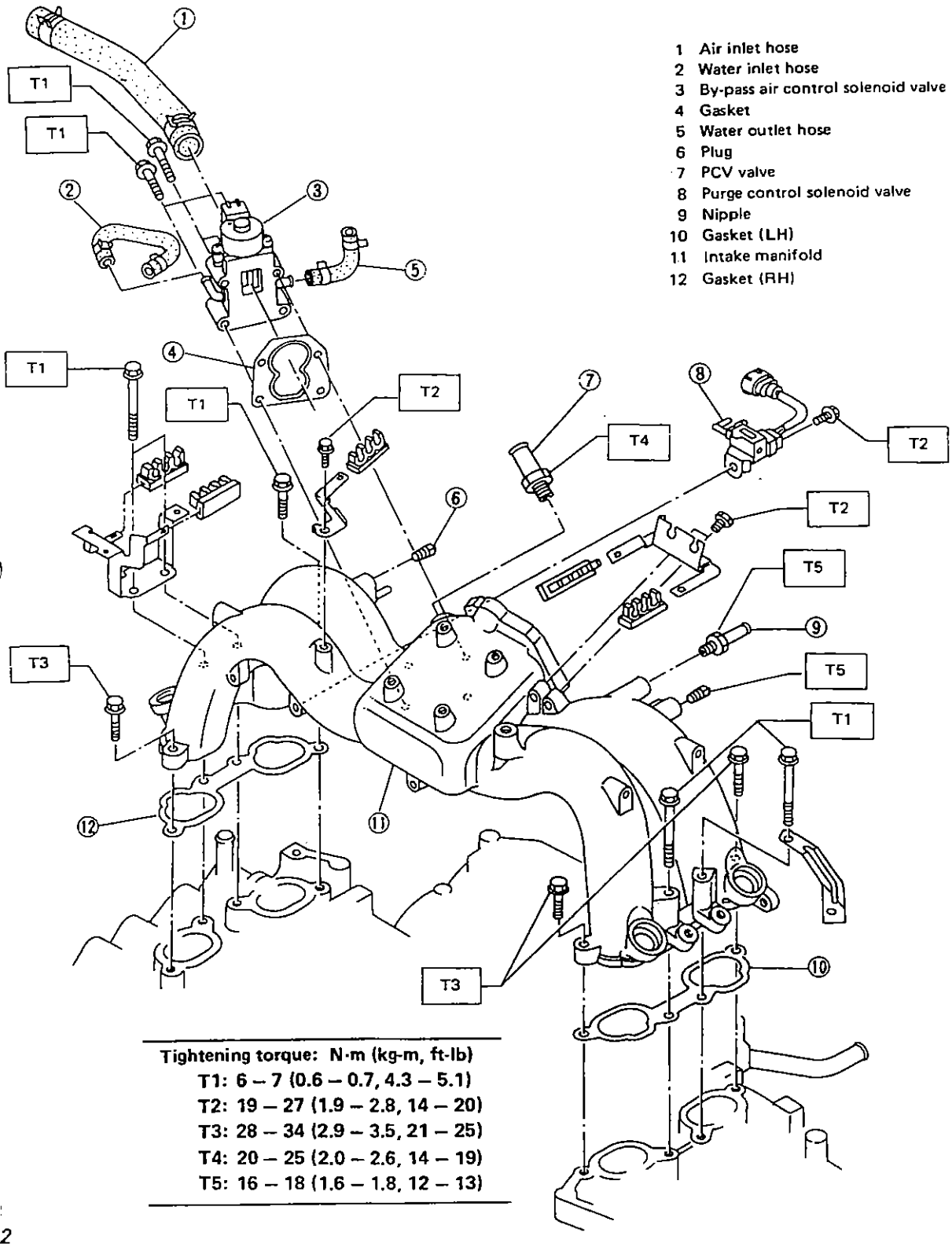


Fig. 41

C COMPONENT PARTS

ake Manifold

I. NON-TURBO MODEL



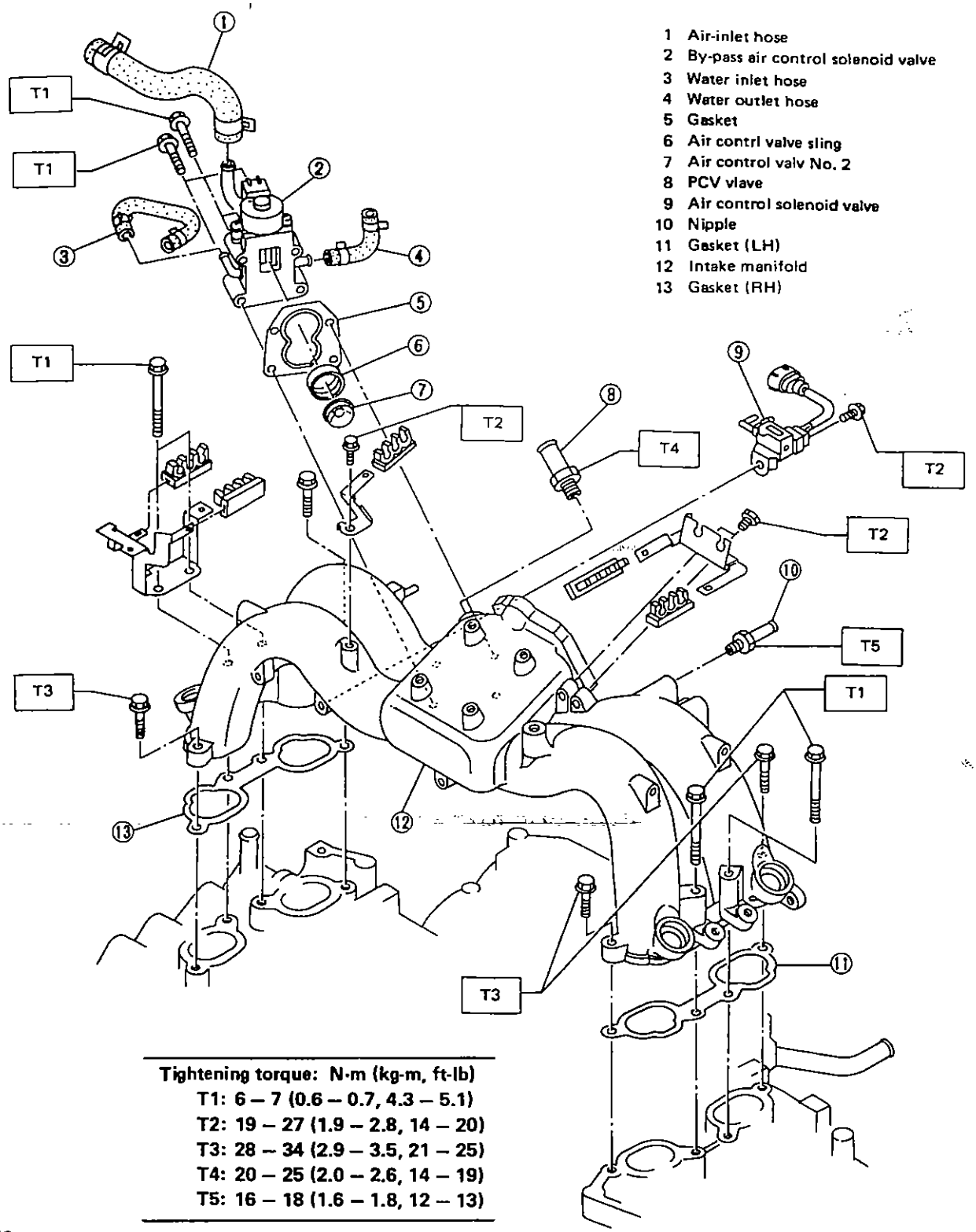
1 Air inlet hose
2 Water inlet hose
3 By-pass air control solenoid valve
4 Gasket
5 Water outlet hose
6 Plug
7 PCV valve
8 Purge control solenoid valve
9 Nipple
10 Gasket (LH)
11 Intake manifold
12 Gasket (RH)

Tightening torque: N·m (kg-m, ft-lb)
T1: 6 – 7 (0.6 – 0.7, 4.3 – 5.1)
T2: 19 – 27 (1.9 – 2.8, 14 – 20)
T3: 28 – 34 (2.9 – 3.5, 21 – 25)
T4: 20 – 25 (2.0 – 2.6, 14 – 19)
T5: 16 – 18 (1.6 – 1.8, 12 – 13)

B2-1011

Fig. 42

2. TURBO MODEL

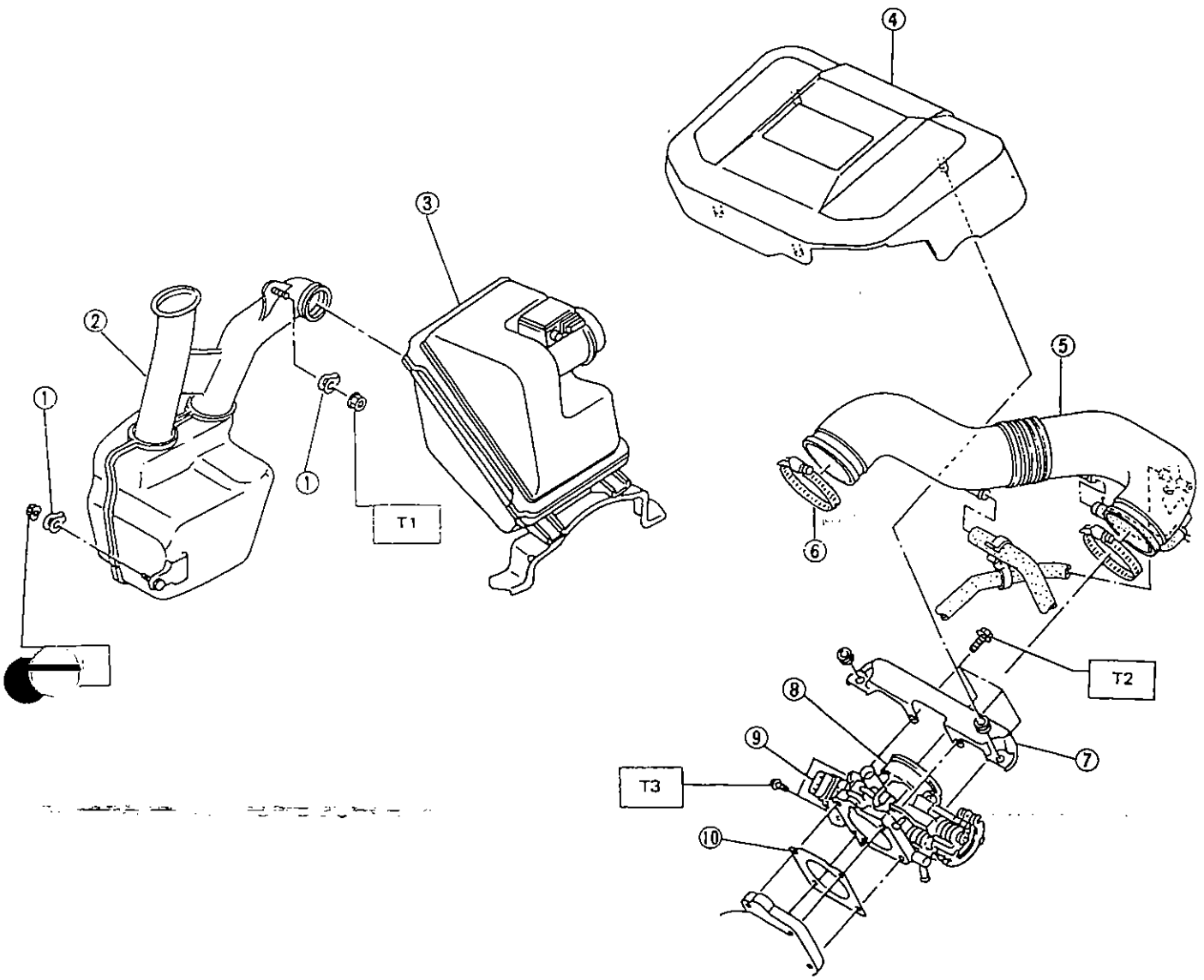


Tightening torque: N·m (kg-m, ft-lb)
T1: 6 – 7 (0.6 – 0.7, 4.3 – 5.1)
T2: 19 – 27 (1.9 – 2.8, 14 – 20)
T3: 28 – 34 (2.9 – 3.5, 21 – 25)
T4: 20 – 25 (2.0 – 2.6, 14 – 19)
T5: 16 – 18 (1.6 – 1.8, 12 – 13)

Fig. 43

2. Air Intake Duct and Throttle Body

I-TURBO MODEL



Tightening torque: N·m (kg-m, ft-lb)
T1: 6.4 – 8.3 (0.65 – 0.85, 4.7 – 6.1)
T2: 19 – 23 (1.9 – 2.3, 14 – 17)
T3: 2 – 3 (0.2 – 0.3, 1.4 – 2.2)

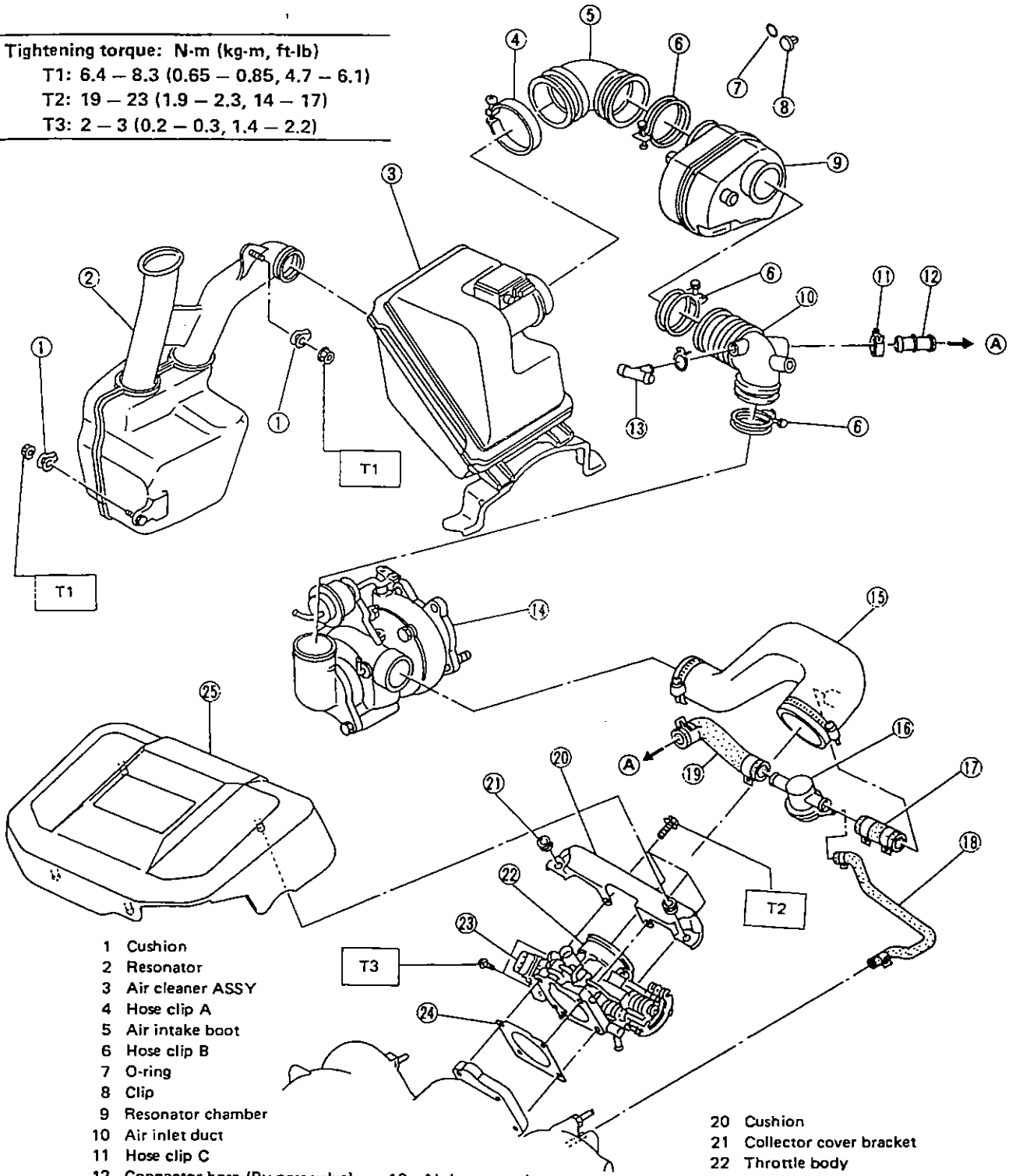
1 Cushion
2 Resonator
3 Air cleaner ASSY
4 Collector cover
5 Air intake boot
6 Clamp
7 Collector bracket
8 Throttle body
9 Throttle sensor
10 Gasket

B2-1013

Fig 44

2. TURBO MODEL

Tightening torque: N·m (kg-m, ft-lb)
T1: 6.4 – 8.3 (0.65 – 0.85, 4.7 – 6.1)
T2: 19 – 23 (1.9 – 2.3, 14 – 17)
T3: 2 – 3 (0.2 – 0.3, 1.4 – 2.2)

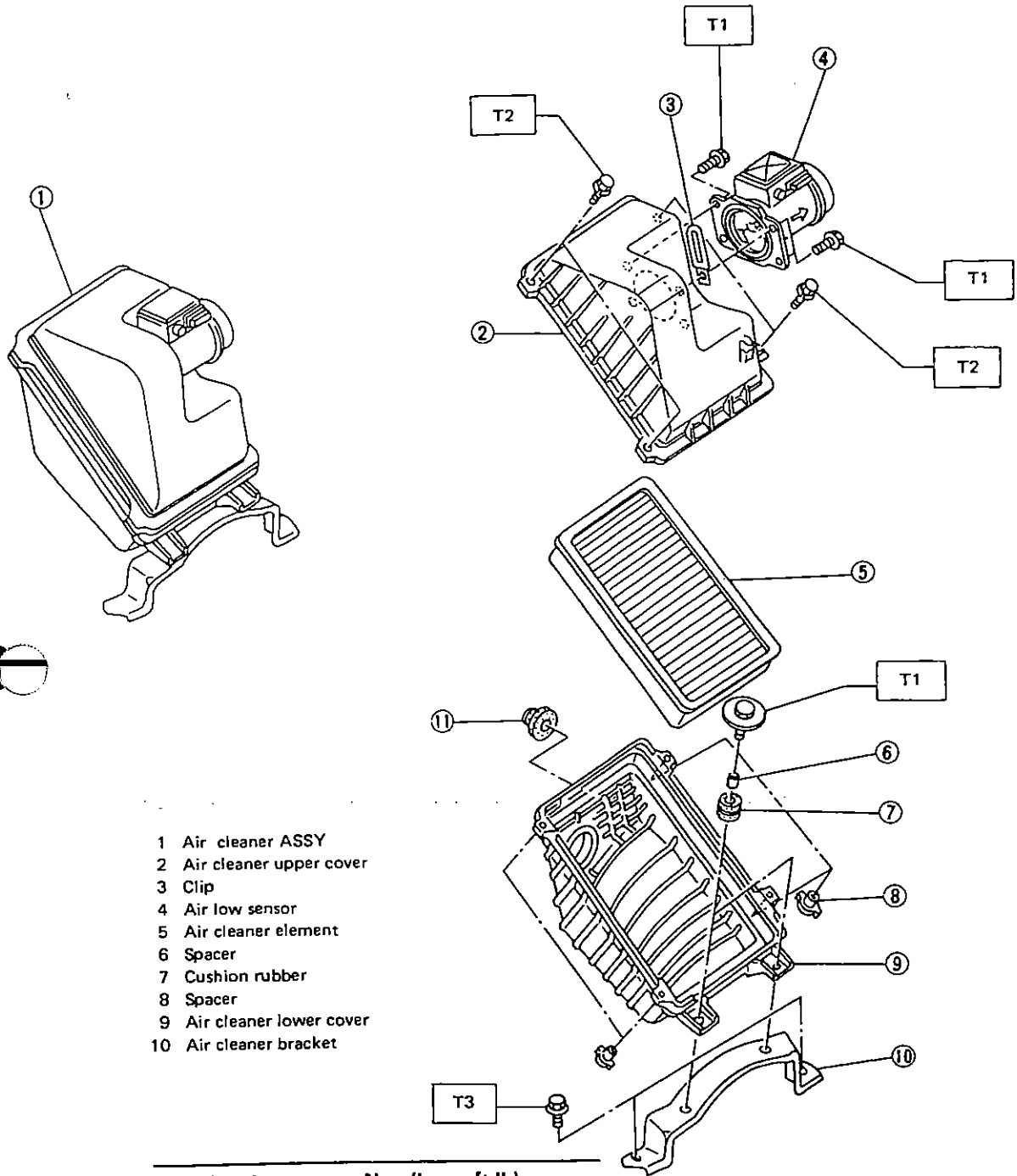


1 Cushion
2 Resonator
3 Air cleaner ASSY
4 Hose clip A
5 Air intake boot
6 Hose clip B
7 O-ring
8 Clip
9 Resonator chamber
10 Air inlet duct
11 Hose clip C
12 Connector hose (By-pass valve)
13 Connector hose (PCV valve)
14 Turbocharger unit
15 Air outlet duct
16 Air by-pass valve
17 Connector hose A (To intake duct)
18 By-pass valve vacuum hose
19 Connector hose B (To boot B)
20 Cushion
21 Collector cover bracket
22 Throttle body
23 Throttle sensor
24 Gasket
25 Collector cover

Fig. 45

B2-1014

3. Air Cleaner



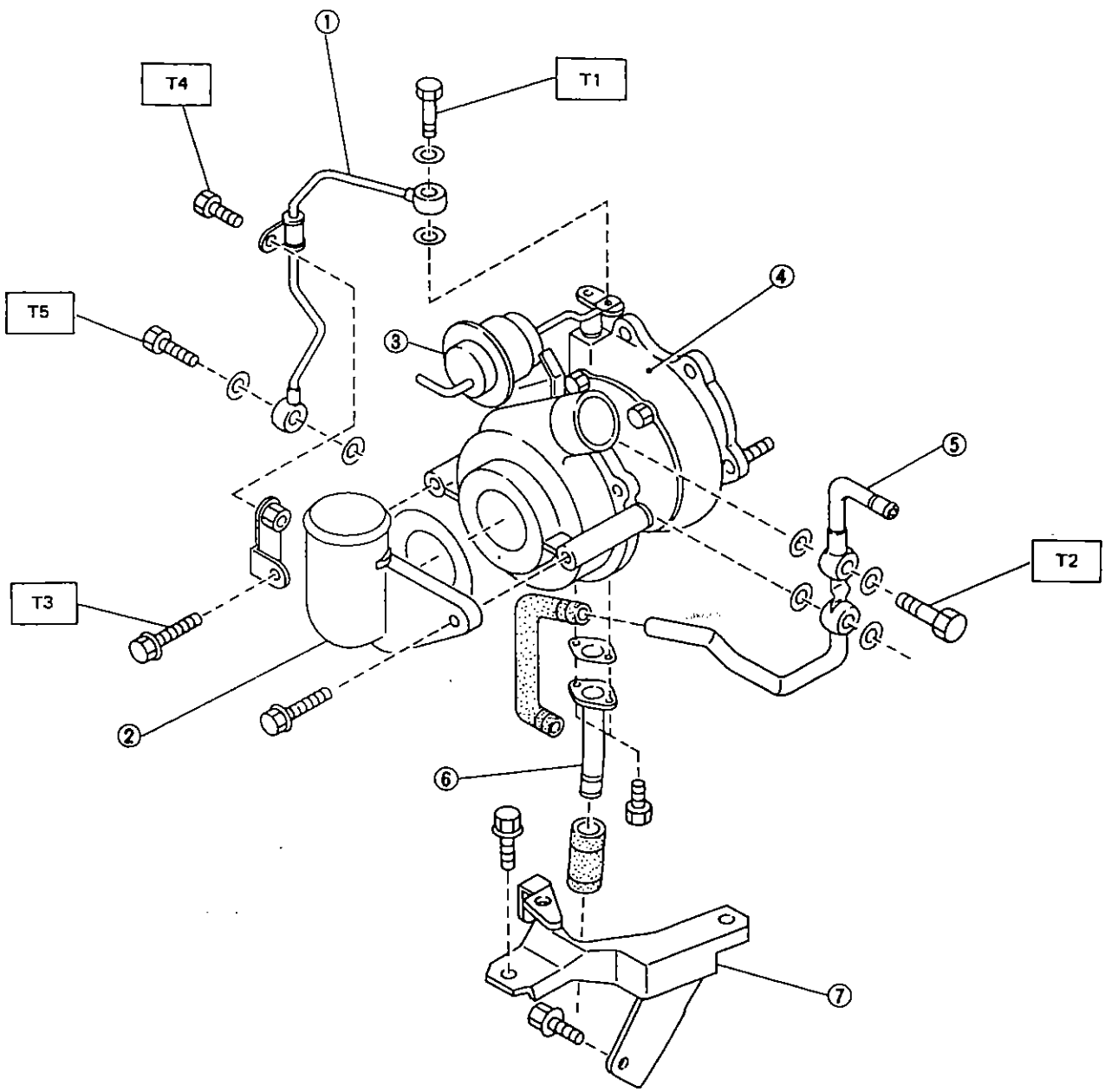
1 Air cleaner ASSY
2 Air cleaner upper cover
3 Clip
4 Air low sensor
5 Air cleaner element
6 Spacer
7 Cushion rubber
8 Spacer
9 Air cleaner lower cover
10 Air cleaner bracket

Tightening torque: N·m (kg-m, ft-lb)
T1: 4.4 – 7.4 (0.45 – 0.75, 3.3 – 5.4)
T2: 2.5 – 4.4 (0.25 – 0.45, 1.8 – 3.3)
T3: 27 – 37 (2.8 – 3.8, 20 - 27)

B2-1015

Fig. 46

4. Turbocharger Unit



1 Oil inlet pipe
2 TURBO inlet duct
3 Wastegate valve controller
4 Turbocharger
5 TURBO cooling pipe
6 Oil outlet pipe
7 Bracket

Tightening torque: N·m (kg-m, ft-lb)
T1: 14.7 – 17.7 (1.50 – 1.80, 10.8 – 13.0)
T2: 21.1 – 24.0 (2.15 – 2.45, 15.6 – 17.7)
T3: 22 – 24 (2.2 – 2.4, 16 – 17)
T4: 4.4 – 5.4 (0.45 – 0.55, 3.3 – 4.0)
T5: 21.1 – 24.0 (2.15 – 2.45, 15.6 – 17.7)

B2-688

Fig. 47

W SERVICE PROCEDURE

1. Turbocharger System

A: TROUBLE DIAGNOSIS

If the turbocharger system fails, any of the following phenomena can occur.

1) Excessively high supercharging pressure:
   (1) Engine knocking
2) Excessively low supercharging pressure:
   (1) Lack of engine power
   (2) Poor acceleration performance
   (3) Considerable fuel consumption
3) Oil leak from turbocharger:
   (1) Excessive oil consumption
   (2) White exhaust smoke

(However, the phenomena 2) can also result from other causes, such as air leakage from the intake system, exhaust system leakage or obstruction, incorrect ignition timing, malfunctioning knock control system, defects in the MPFI control system.)

B: REMOVAL AND INSPECTION

1. WASTEGATE VALVE

1) Check connecting hose between wastegate valve, turbocharger and duty solenoid valve for looseness or disconnection, as well as cracks and damage.
2) Disconnect the wastegate valve control connecting hose from actuator, and connect checking rubber hose. Plug the disconnected rubber hose.
3) Apply air pressure [59 to 69 kPa (0.6 to 0.7 kg/cm^2, 9 to 10 psi)] to the checking rubber hose, and see whether the wastegate valve link operates or not.

Excessive pressure may cause damage to the wastegate valve control diaphragm. Be sure to check that the pressure is 59 to 69 kPa (0.6 to 0.7 kg/cm^2, 9 to 10 psi) with a pressure gauge before applying.

2. SUPERCHARGING PRESSURE

1) Disconnect rubber hose from pressure exchange solenoid valve and attach a branch connector. Lead the rubber hose into the passenger compartment, and connect it to the positive pressure gauge.
2) Disconnect two rubber hoses from duty solenoid valve and connect these hoses using a connector. Plug duty solenoid valve.
3) After warming up engine, make a test run. Read the supercharging pressure on the positive pressure gauge when the vehicle is running at approximately 4,600 rpm with fully open throttle.

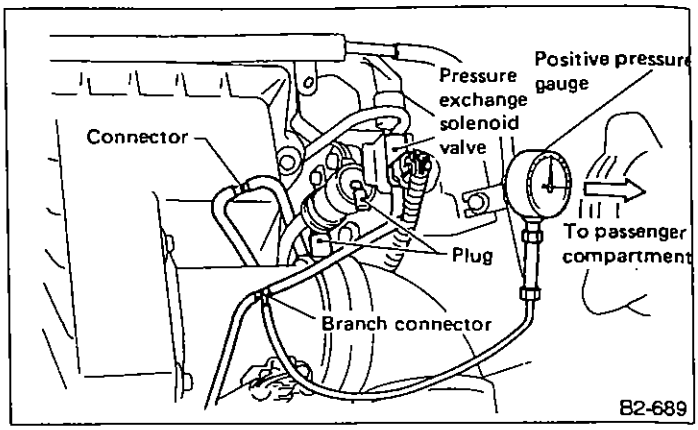


Fig. 48

Phenomenon	Judgement
Supercharging pressure is in the 42.7 to 50.7 kPa (320 to 380 mmHg, 12.60 to 14.96 inHg) range.	Normal
Supercharging pressure exceeds the 50.7 kPa (380 mmHg, 14.96 inHg) upper limit.	
(1) Cracked or disconnected wastegate valve control rubber hoses	Replace or connect rubber hose.
(2) Inoperative and closed wastegate valve	Replace turbocharger.
Supercharging pressure is below the 42.7 kPa (320 mmHg, 12.60 inHg) lower limit.	Faulty turbocharger. ↓ Replace turbocharger.

3. TURBOCHARGER

1) Oil leakage from the exhaust gas side (turbine side)

Remove the center exhaust pipe and examine the turbocharger from the exhaust gas side.
If there are excessive carbon deposits on the turbine exhaust side, oil is leaking from the turbine.
(In this case, oil may also be leaking from between the turbine chamber and bearing chamber.)

2) Oil leakage from the inlet side (blower side)

(1) The turbocharger is not necessarily leaking oil when oil is present on the blower side. The oil is likely to have come from oil mists contained in the blowby gases flow in the inlet system.
(2) When oil is leaking from the inlet system, it is accompanied by a rattle from the turbocharger shaft when it moves in an axial or radial direction. Remove the turbocharger from the engine and determine if the shaft rattles.
(Limit of rattling: Measure with a dial gauge.)
   a. Axial rattling:
   0.09 mm (0.0035 in) xp-37

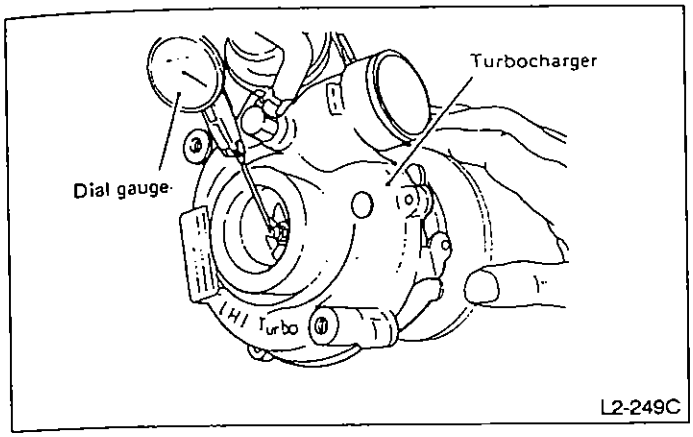


Fig. 49

b. Radial rattling:
0.17 mm (0.0067 in) when the turbine side and blower side of the shaft are moved circumferentialy at the same time.

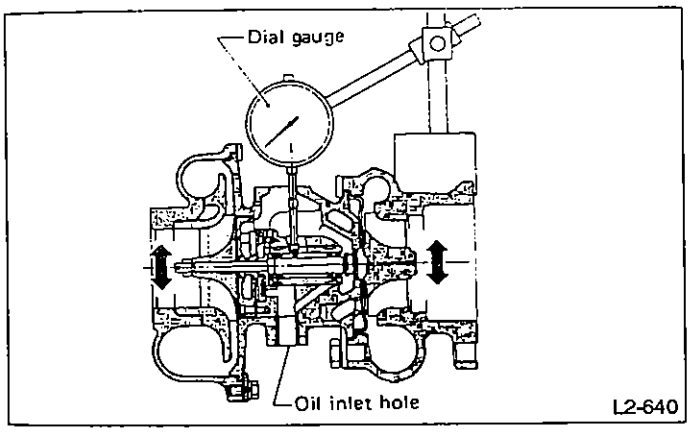


Fig. 50

If anything unusual is found, replace the turbocharger.
a. The turbocharger proper cannot be disassembled or adjusted.

b. When removing and installing the turbocharger, do not allow dirt and dust to enter the inlet and outlet openings of the turbine and blower. Any foreign matter allowed to enter, will undoubtedly damage the turbine and blower blades as soon as the turbocharger goes into operation again.
c. Likewise, cover the open end of the front exhaust pipe. If foreign matter is allowed to enter, the turbine blades will be instantaneously destroyed when the turbocharger is put into operation.
3) Oil leakage from the connection of the oil delivery pipe
Visually inspect the connections of the oil delivery pipe with the turbocharger and oil pump. If oil is leaking, replace the washer of the union screw and tighten it to the specified tightening torque.

Tightening torque:
14.7 — 17.7 N•m
(1.50 — 1.80 kg-m, 10.8 — 13.0 ft-lb)

4) Coolant leakage from connection of the cooling pipe
Visually check the connection between turbocharger and cooling pipe, between engine cylinder head and cooling pipe, and the hose clamped area for leakage of coolant. If leakage is detected, replace the washer at the union screw, and tighten the screw to the specified torque. Check the hose for cracks and damage at the clamped area before tightening the clamp. If the hose is faulty, replace with a new one.

Tightening torque:
22 - 25 N•m
(2.2 — 2.5 kg-m, 16 — 18 ft-lb)

T TROUBLESHOOTING AIRBAG

1. Supplemental Restraint System "Airbag"

Airbag system wiring harness is routed near the MPFI control unit (ECU), main relay and fuel pump relay.

a. All Airbag system wiring harness and connectors are colored yellow. Do not use electrical test equipment on these circuit.

b. Be careful not to damage Airbag system wiring harness when servicing the MPFI control unit (ECU), main relay and fuel pump relay.

2. Precautions

1) Never connect the battery in reverse polarity.
- The MPFI control unit will be destroyed instantly.
- The fuel injector and other part will be damaged in just a few minutes more.

2) Do not disconnect the battery terminals while the engine is running.
- A large counter electromotive force will be generated in the alternator, and this voltage may damage electronic parts such as ECU (MPFI control unit), etc.

3) Before disconnecting the connectors of each sensor and the ECU, be sure the turn off the ignition switch.

4) Before removing ECU from the located position, disconnect two cables on battery.
- Otherwise, the ECU may be damaged.

5) The connectors to each sensor in the engine compartment and the harness connectors on the engine side and body side are all designed to be waterproof. However, it is still necessary to take care not to allow water to get into the connectors when washing the vehicle, or when servicing the vehicle on a rainy day.

6) Every MPFI-related part is a precision part. Do not drop them.

7) Observe the following cautions when installing a radio in MPFI equipped models.

a. The antenna must be kept as far apart as possible from the control unit.
(The ECU is located under the steering column, inside of the instrument panel lower trim panel.)

b. The antenna feeder must be placed as far apart as possible from the ECU and MPFI harness.

c. Carefully adjust the antenna for correct matching.

d. When mounting a large power type radio, pay special attention to items a. thru c. above.
- Incorrect installation of the radio may affect the operation of the ECU.

7) Before disconnecting the fuel hose, disconnect the fuel pump connector and crank the engine for more than five seconds to release pressure in the fuel system. If engine starts during this operation, run it until it stops.

3. Pre-inspection

Before troubleshooting, check the following items which might affect engine problems:

1. Power supply

1) Measure battery voltage and specific gravity of electrolyte.

Standard voltage: 12 V
Specific gravity: Above 1.260

2) Check the condition of the main and other fuses, and harnesses and connectors. Also check for proper grounding.

2. Caps and plugs

1) Check that the fuel cap is properly closed.
2) Check that the oil filler cap is properly closed.
3) Check that the oil level gauge is properly inserted.

3. Intake manifold vacuum pressure

1) After warming up the engine, measure intake manifold vacuum pressure while at idle.

Standard vacuum pressure:
Non-TURBO
More than – 66.7 kPa (– 500 mmHg, – 19.69 in Hg)
TURBO
More than – 65.3 kPa (– 490 mmHg, – 19.29 inHg)

Refer to C.2-2 [W5A0].

2) Unusual vacuum pressure occurs because of air leaks, fuel or engine problems. In such a case, engine idles roughly.

4. Fuel pressure

1) Release fuel pressure
Refer to C.2-8 [W1A0].
2) Connect fuel pressure gauge between fuel filter and hose, and measure fuel pressure at idling.
Refer to C.2-8 [W2A0].

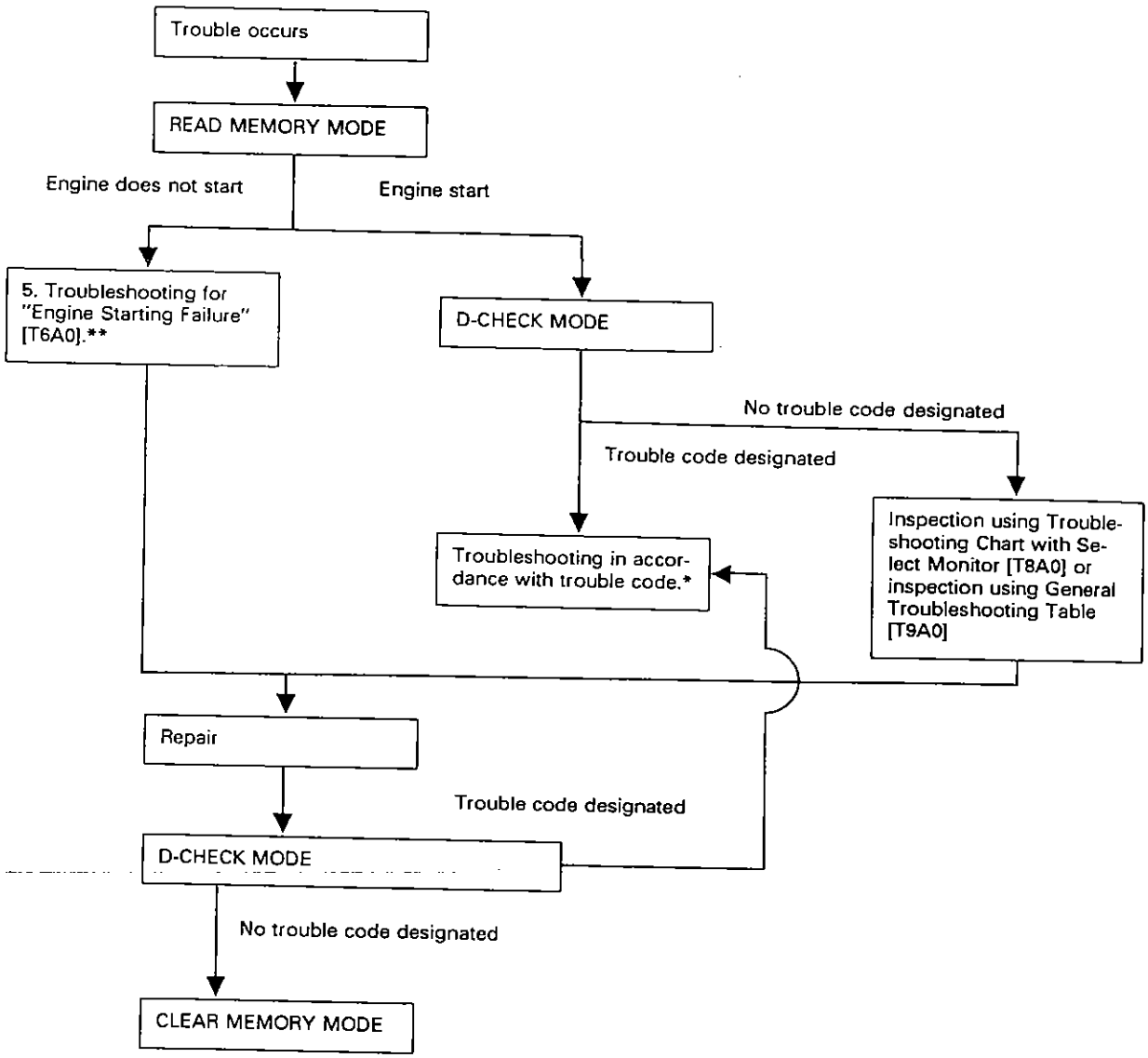
Fuel pressure:
177 — 206 kPa (1.8 — 2.1 kg/cm², 26 — 30 psi)

5. Engine grounding

Make sure the engine grounding terminal is properly connected to the engine.

4. Troubleshooting Chart for Self-diagnosis System

BASIC TROUBLESHOOTING PROCEDURE



*: When more than one trouble code is outputted, begin troubleshooting with the smallest trouble code number and proceed to the next higher code.
After correcting each problem, conduct the D-check and ensure that the corresponding trouble code no longer appears.

**: When a trouble code is displayed in the read-memory mode, conduct troubleshooting measures which correspond with the code.

a. Check the connector while it is connected unless specified otherwise.
b. Be sure to check again from the beginning in order to prevent secondary trouble caused by repair work.
c. When checking with the vacuum hose disconnected from the vacuum switch at engine "ON", be sure to plug the hose.

B: LIST OF TROUBLE CODE

1. TROUBLE CODE

Trouble code	Item	Content of diagnosis	Non-TURBO	TURBO
11.	Crank angle sensor	No signal entered from crank angle sensor, but signal entered from cam angle sensor.	O	O
12.	Starter switch	Abnormal signal emitted from ignition switch.	O	O
13.	Cam angle sensor	No signal entered from cam angle sensor, but signal entered from crank angle sensor.	O	O
14.	Injector #1	Fuel injector inoperative. (Abnormal signal emitted from monitor circuit.)	O	O
15.	Injector #2			
16.	Injector #3			
17.	Injector #4			
21.	Water temperature sensor	Abnormal signal emitted from water temperature sensor.	O	O
22.	Knock sensor	Abnormal voltage produced in knock sensor monitor circuit.	O	O
23.	Air flow sensor	Abnormal voltage input entered from air flow sensor.	O	O
24.	By-pass air control solenoid valve	By-pass air control sdenoid valve inoperative (Abnormal signal emitted from monitor circuit.)	O	O
31.	Throttle sensor	Abnormal voltage input entered from throttle sensor.	O	O
32.	O_2 sensor	O_2 sensor inoperative.	O	O
33.	Vehicle speed sensor 2	Abnormal voltage input entered from speed sensor.	O	O
35.	Purge control solenoid valve	Solenoid valve inoperative.	O	O
41.	AF (Air/fuel) learning control	Faulty learning control function.	O	O
42.	Idle switch	Abnormal voltage input entered from idle switch.	O	O
45.	Atmospheric pressure sensor	Faulty sensor.	O	
49.	Air flow sensor	Use of improper air flow sensor.	O	O
51.	Neutral switch (MT)	Abnormal signal entered from neutral switch.	O	O
51.	Inhibitor switch (AT)	Abnormal signal entered from inhibitor switch.	O	O
52.	Parking switch	Abnormal signal entered from parking switch.	O	O
44.	Wastegate control solenoid valve	Wastegate control solenoid valve inoperative.		O
45.	Pressure sensor and pressure exchange solenoid valve	Faulty sensor or pressure exchange solenoid valve inoperative.		O

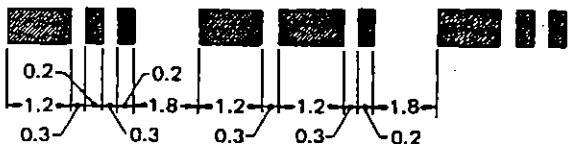
2. HOW TO READ TROUBLE CODE (FLASHING)

The CHECK ENGINE light flashes the code corresponding to the faulty part.
The long segment (1.2 sec on) indicates a "ten", and the short segment (0.2 sec on) signifies "one".

Example:

When only one part has failed:
Flashing code 12
(unit: second)

When two or more parts have failed:
Flashing codes 12 and 21
(unit: second)



B2-311

Fig. 51

C: READ MEMORY MODE

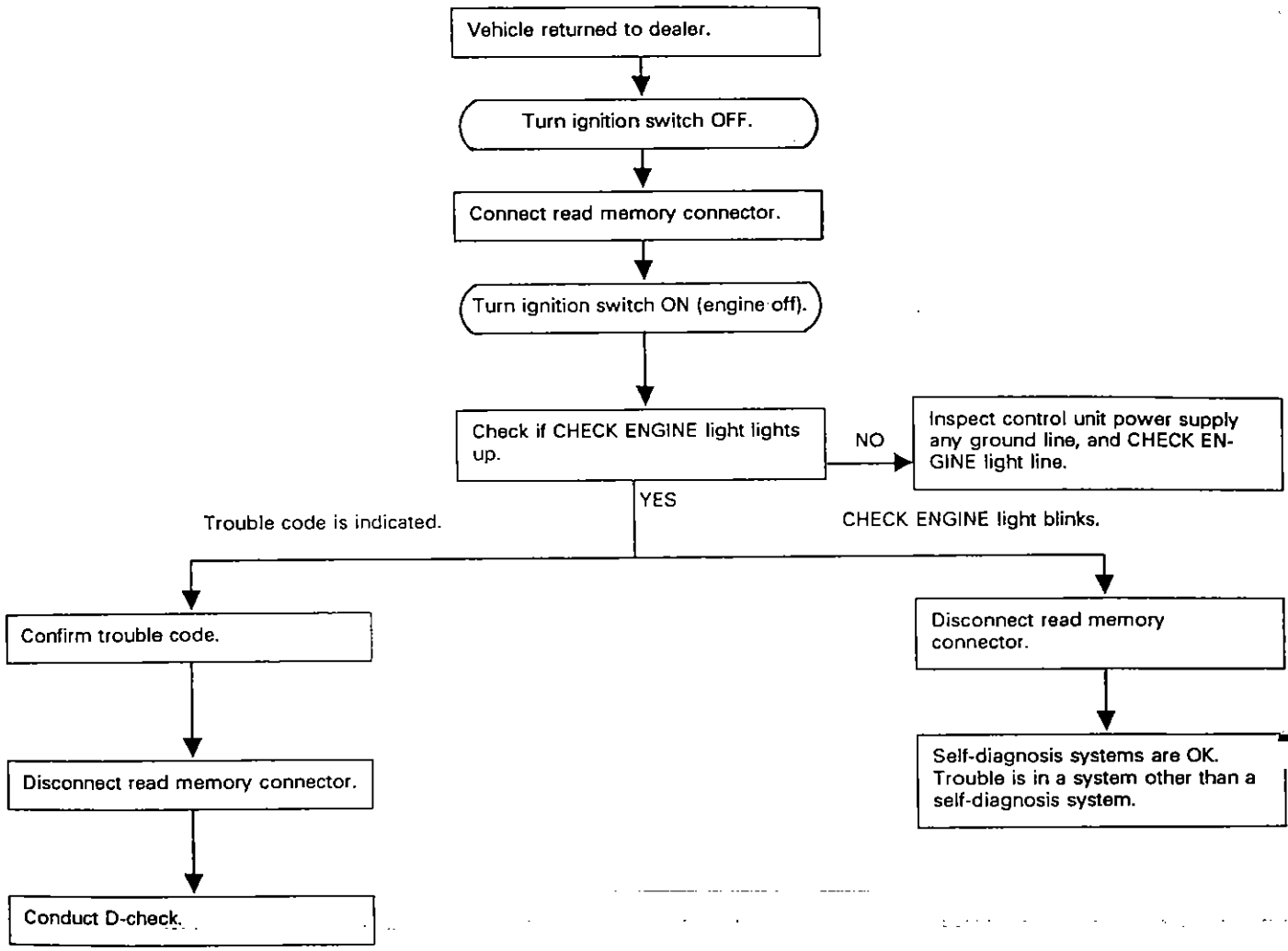


Fig. 52

D: D-CHECK MODE

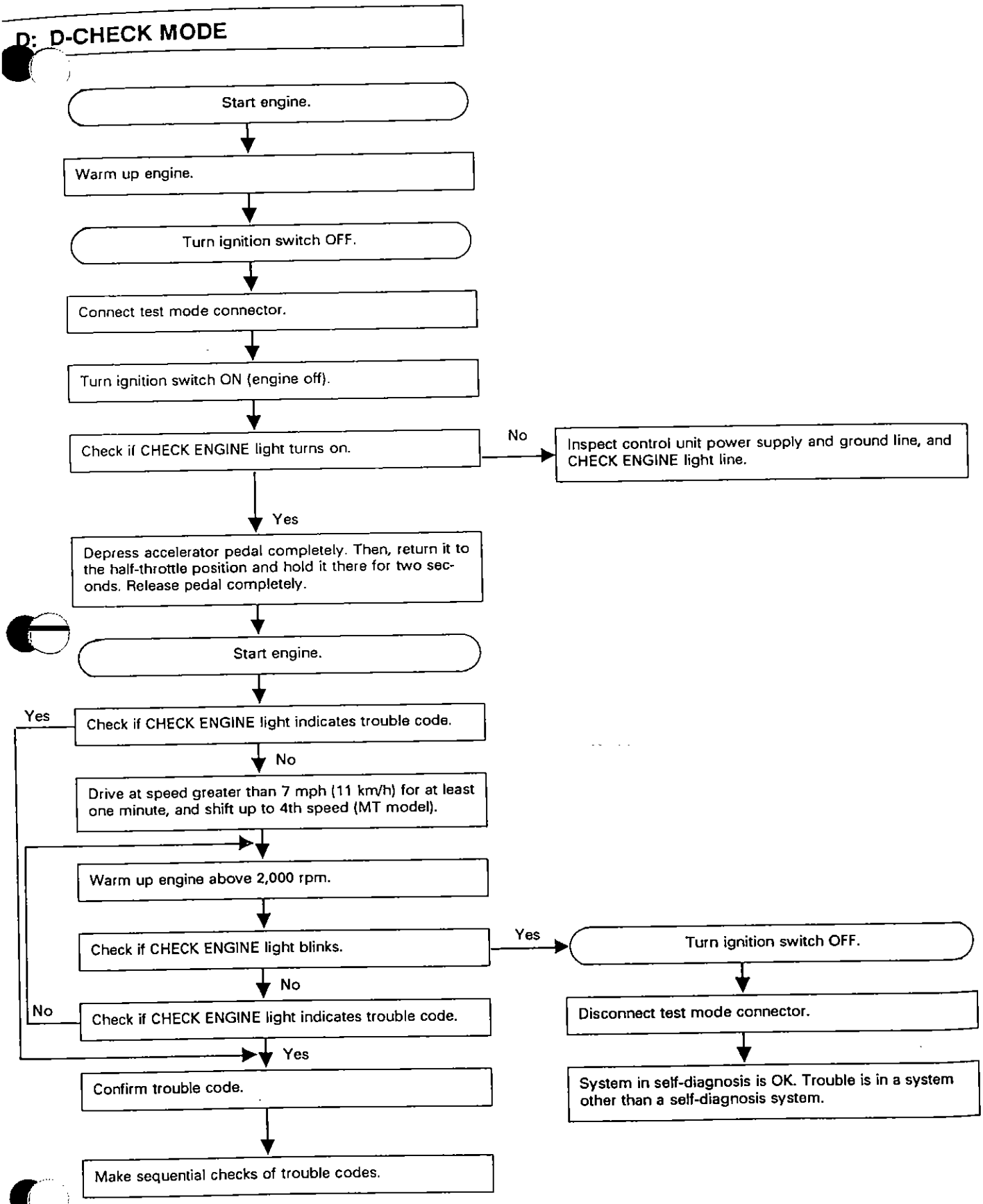


Fig. 53

E: CLEAR MEMORY MODE

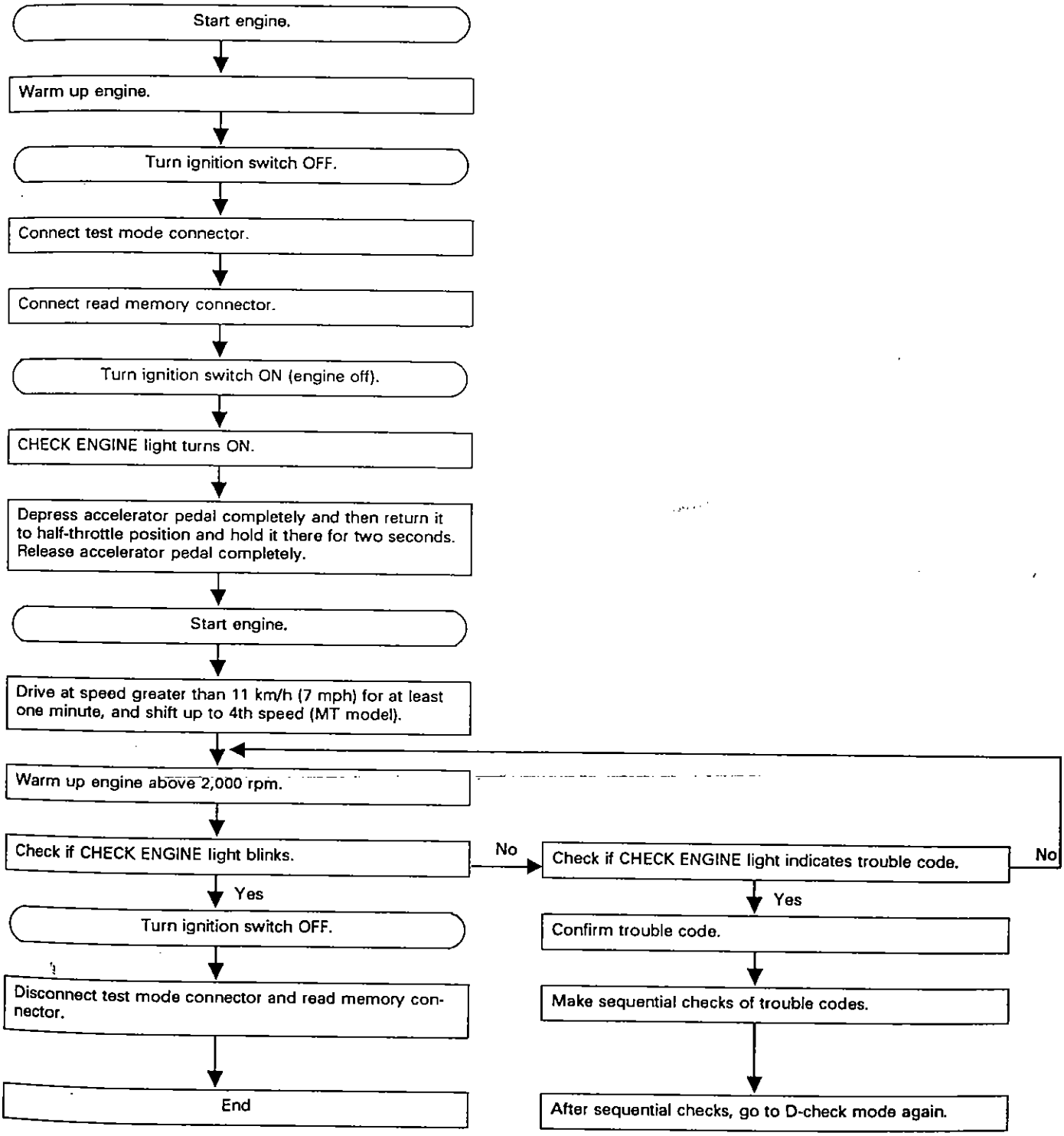


Fig. 54

5. Output Modes of Select Monitor

FUNCTION MODE

Applicable cartridge of select monitor: No. 498348800

MODE	Contents	Abbr.	Unit	Contents of display	Non-TURBO	TURBO
F00	PROM ID Number	YEAR	—	Model year of vehicle to which select monitor is connected	O	O
F01	Battery Voltage	VB	V	Battery voltage supplied to control unit	O	O
F02	Vehicle Speed Sensor	VSP	m/h	Vehicle speed inputted from vehicle speed sensor 2	O	O
F03	Vehicle Speed Sensor	VSP	km/h	Vehicle speed inputted from vehicle speed sensor 2	O	O
F04	Engine speed	EREV	rpm	Engine speed inputted from crank angle sensor	O	O
F05	Water Temp Sensor	TW	deg F	Coolant temperature inputted from water temperature sensor	O	O
F06	Water Temp Sensor	TW	deg C	Coolant temperature inputted from water temperature sensor	O	O
F07	Ignition Timing	ADVS	deg	Ignition timing determined by ECU in relation to signals sent from various sensors	O	O
F08	Air Flow Sensor	QA	V	Voltage inputted from air flow meter	O	O
F09	Load Data	LDATA	—	Engine load value determined by related sensor signals	O	O
F10	Throttle Sensor	THV	V	Voltage inputted from throttle position sensor	O	O
F11	Injector Pulse Width	TIM	mS	Duration of pulse flowing through injectors	O	O
F12	Air Control Valve	ISC	%	"Duty" ratio flowing through air control valve	O	O
F13	O_2 Sensor	O_2	V	Voltage outputted from O_2 sensor	O	O
F14	O_2 Max	O_2 max	V	Maximum voltage outputted from O_2 sensor	O	O
F15	O_2 Min	O_2 min	V	Minimum voltage outputted from O_2 sensor	O	O
F16	ALPHA	ALPHA	%	AF correction ratio determined in relation to signal outputted from O_2 sensor	O	O
F17	Knock Sensor	RTRD	deg	Ignition timing correction determined in relation to signal inputted from knock sensor	O	O
F19	Atmospheric Sensor	BARO.P	mmHg	—	O	
F18	Wastegate control	WGC	%	"Duty" ratio of wastegate control solenoid valve		O
F19	Atmospheric pressure	BARO.P	mmHg	Atmospheric pressure input from pressure sensor		O
F20	Manifold pressure	MANI.P	mmHg	Intake manifold pressure input from pressure sensor		O
FA0	ON ↔ OFF Signal	—	—	—	O	O
FA1	ON ↔ OFF Signal	—	—	—	O	O
FA3	ON ↔ OFF Signal	—	—	—	O	O
FB0	Trouble Code	DIAG	—	Trouble code in U- or D-check mode	O	O
FB1	Trouble Code	DIAG	—	Trouble code in read memory mode	O	O
FC0	Clear Memory	—	—	(Used to clear memory)	O	O

2. ON ↔ OFF SIGNAL LIST

MODE	LED No.	Contents	Display	LED "ON" requirements	Non-TURBO	TURBO
FA0	1	Ignition SW	IG	Ignition switch "ON"	O	O
	2	AT/MT discrimination	AT	AT models only	O	O
	3	Test Mode	UD	Test mode connector connected	O	O
	4	Read Memory	RM	Read-memory connector connected	O	O
	5	—	—	—		
	6	—	—	—		
	7	Neutral SW	NT	Neutral switch "ON"	O	O
	8	Parking SW	PK	Parking switch "ON" [AT]	O	O
	9	Fed./Cal. Discrimination	FC	49-state and Canada model only	O	O
	10	—	—	—		
FA1	1	Idle SW	ID	Idle switch "ON"	O	O
	2	A/C SW	AC	Air conditioner switch "ON"	O	O
	3	A/C Relay	AR	Air conditioner relay "ON"	O	O
	4	Radiator Fan	RF	Radiator fan in operation	O	O
	5	—	—	—		
	6	Fuel Pump Relay	FP	Fuel pump relay in operation	O	O
	7	Purge control solenoid valve	CN	Purge control solenoid valve	O	O
	8	Knock Sensor	KS	Engine knocks occur	O	O
	9	Pressure exchange solenoid valve	BR	Atmospheric pressure is being measured (solenoid "ON")		O
	10	—	—	—		
FA3	1	—	—	—		
	2	—	—	—		
	3	—	—	—		
	4	—	—	—		
	5	—	—	—		
	6	—	—	—		
	7	—	—	—		
	8	—	—	—		
	9	—	—	—		
	10	O_2 Monitor	O_2	A/F ratio is rich.	O	O

;. Control Unit I/O Signal

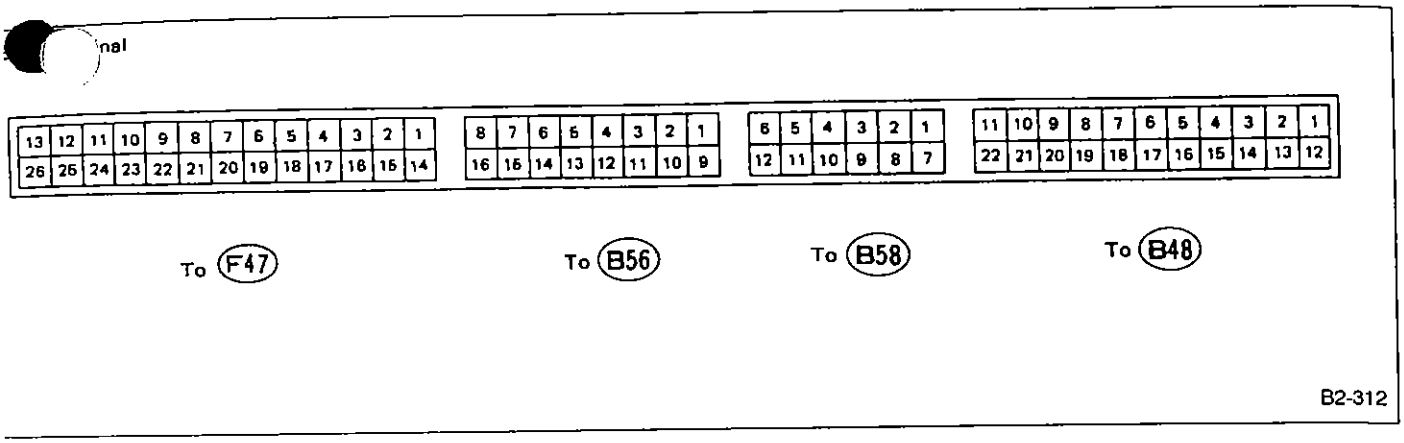


Fig. 55

Content			Connector No.	Terminal No.	Signal (V)			Note
					Ig SW		Engine ON (Idling)	
					OFF	ON (Engine OFF)		
Crank angle sensor	Non-TURBO	Signal (+)	B56	1	—	0	*	*Sensor output waveform
		Signal (−)	B56	2	—	0	0	
		Shield	B56	3	—	0	0	
	TURBO	Signal (+)	B58	4	—	0	*	*Sensor output waveform
		Signal (−)	B58	5	—	0	0	
		Shield	B58	6	—	0	0	
Cam angle sensor	Non-TURBO	Signal (+)	B58	4	—	0	*	*Sensor output waveform
		Signal (−)	B58	5	—	0	0	
		Shield	B58	6	—	0	0	
	TURBO	Signal (+)	B56	1	—	0	*	*Sensor output waveform
		Signal (−)	B56	2	—	0	0	
		Shield	B56	3	—	0	0	
Air flow sensor		Power supply	B48	8	—	10 - 13	13 - 14	—
		Signal	B48	9	—	0 - 0.3	0.8 - 1.2	—
		GND	B48	10	—	0	0	—
		Shield	B48	1•9	—	0	0	—
Throttle sensor		Signal	B58	2	—	Fully closed: 4.7 Fully opened: 1.6	Fully closed: 4.7 Fully opened: 1.6	—
		Power supply	B58	3	—	5	5	—
		GND	B58	1	—	0	0	—
		Shield	B58	7	—	0	0	—
O_2 sensor	Non-TURBO	Signal	B48	6	—	(AT) 0.6 (MT) 0	Rich mixture: 0.7 (AT), 1.0 (MT) Lean mixture: 0 (AT), 0.2 (MT)	
		Shield	B48	17	—	0	0	—
	TURBO	Signal	B48	6	—	0	Rich mixture: 1.0 Lean mixture: 0.2	
		Shield	B48	17	—	0	0	—
Knock sensor		Signal	B56	5	—	3 - 4	3 - 4	—
		Shield	B56	4	—	0	0	—
Water temperature sensor			B48	7	0	0.7 - 1.0	0.7 - 1.0	*After warm-up
[illegible] speed sensor			B58	11	—	0 or 5	0 or 5	"5" and "0" are repeatedly displayed when vehicle is driven.

Content			Connector No.	Terminal No.	Signal (V)			Note
					Ig SW		Engine ON (Idling)	
					OFF	ON (Engine OFF)		
Pressure sensor (TURBO only)	Signal		B48	4	—	10 - 13	2.4 ↔ 2.7	—
	Power supply		B48	3	—	5	5	—
	GND		B48	5	—	0	0	—
Idle switch			B56	6	—	ON:0, OFF:4.6	ON:0, OFF:4.6	—
49-state and Canada/ California identification			B56	11	—	—	—	49-state and Canada:12 California:0
Starter switch			B56	10	—	0	0	Cranking: 10 to 14
Air conditioner switch			B56	9	—	ON:10 - 13, OFF:0	ON:13 - 14, OFF:0	—
Ignition switch			B58	12	0	10 - 13	13 - 14	—
Neutral switch			B58	10	—	[AT] N Range: 0 Other: 8, min. [MT] N Position: 8, min. Other: 0	[AT] N Range: 0 Other: 8, min. [MT] N Position: 8, min. Other: 0	
Parking switch [AT]			B58	9	—	P Range: 0 Other: 8, min.	P Range: 0 Other: 8, min.	—
Test mode connector	Non-TURBO		B56	13	—	[AT] 10 - 13 [MT] 5	[AT] 13 - 14 [MT] 5	[AT] When connected: 0
	TURBO		B56	13	—	5	5	When connected: 0
Read memory connector	Non-TURBO		B56	12	—	[AT] 10 - 13 [MT] 5	[AT] 13 - 14 [MT] 5	[AT] When connected: 0
	TURBO		B56	12	—	5	5	When connected: 0
AT/MT identification	Non-TURBO		B48	20	—	[AT] 0 [MT] 5	[AT] 0 [MT] 5	—
	TURBO		B48	20	—	5	5	—
Back-up power supply			B48	15	10 - 13	10 - 13	13 - 14	—
Control unit power supply			B48	2	0	10 - 13	13 - 14	
			B48	13	0	10 - 13	13 - 14	—
Ignition control	Non-TURBO	#1, #2	F47	10	—	[AT] 0.01 [MT] 0	—	—
		#3, #4	F47	9	—	[AT] 0.01 [MT]0	—	—
	TURBO	#1, #2	F47	10	—	0	—	—
		#3, #4	F47	9	—	0	—	—
Fuel injector		#1	F47	13	10 - 13	10 - 13	13 - 14	—
		#2	F47	12	10 - 13	10 - 13	13 - 14	—
		#3	F47	11	10 - 13	10 - 13	13 - 14	—
		#4	F47	26	10 - 13	10 - 13	13 - 14	—
By-pass air control solenoid valve	Non-TURBO	OPEN end	F47	2	—	[AT] 7 [MT] 12 → *0	—	*1 min. after ignition switch ON.
		CLOSE end	F47	1	—	[AT] 6 [MT] 0	—	—
	TURBO	OPEN end	F47	2	—	0 → *12	—	*1 min. after ignition switch ON.
		CLOSE end	F47	1	—	12 → *0	—	
Fuel pump relay control			F47	23	—	ON: 0 OFF: 10 - 13	0	—
Air conditioner cut relay control			F47	22	—	ON: 0 Off: 10 - 13	ON: 0 OFF: 13 - 14	—
Radiator fan control			F47	17	—	ON: 0 OFF: 10 - 13	ON: 0 OFF: 13 - 14	—
Self-shutoff control			F47	5	—	10 - 13	13 - 14	—
Wastegate control (TURBO only)			F47	3	—	10 - 13	13 - 14	—
CHECK ENGINE light			F47	19	—	—	—	Light "ON": 1, max. Light "OFF": 10 - 14

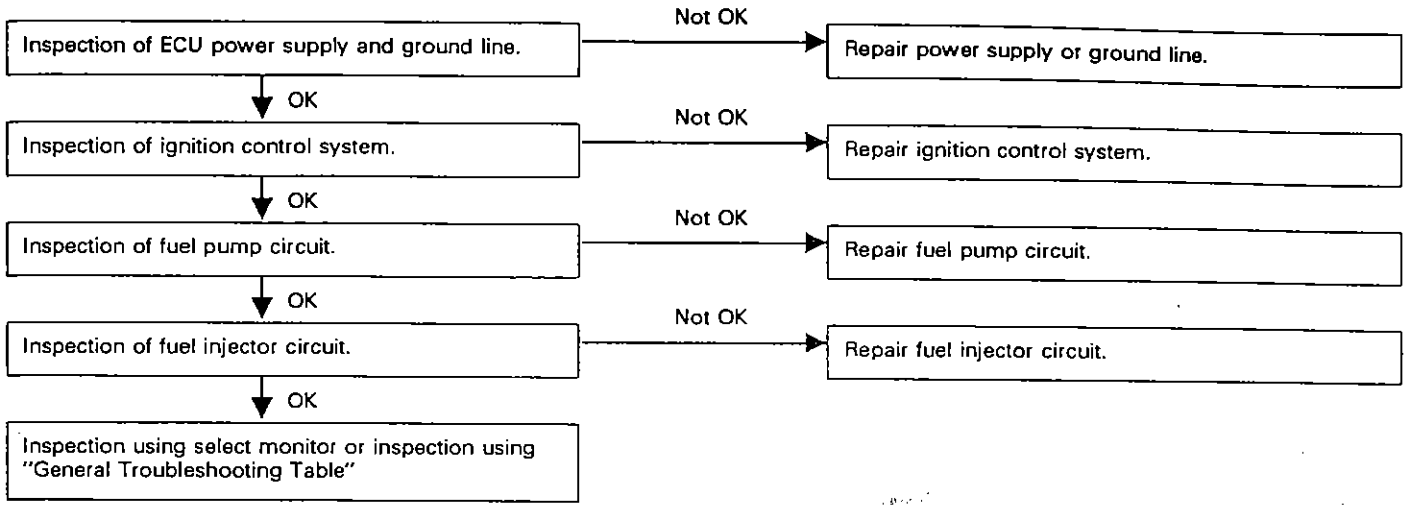
Content	Connector No.	Terminal No.	Signal (V)			Note
			Ig SW		Engine ON (Idling)	
			OFF	ON (Engine OFF)		
Pressure exchange solenoid valve (TURBO only)	F47	20	—	ON: 0 OFF: 10 - 13	ON: 0 OFF: 13 - 14	—
Engine tachometer output	B56	16	—	—	—	—
Purge control solenoid valve	F47	6	—	ON: 0 OFF: 10 - 13	ON: 0 OF: 13 - 14	—
Atmospheric pressure sensor (Non-TURBO only)	B48	16	—	—	—	—
GND (sensors)	B48	21	—	0	0	—
GND (injectors)	F47	24	—	0	0	—
	F47	25	—	0	0	—
GND (ignition system)	F47	15	—	0	0	—
GND (power supply)	F47	14	—	0	0	—
GND (control systems)	B48	11	—	0	0	—
	B48	22	—	0	0	—
Select Monitor Signal	B56	8	—	—	—	—
	B56	7	—	—	—	—

*: For manufacture

7. Troubleshooting for Engine Starting Failure

A: BASIC TROUBLESHOOTING CHART

When engine cranks but does not start, troubleshoot in accordance with the following chart.

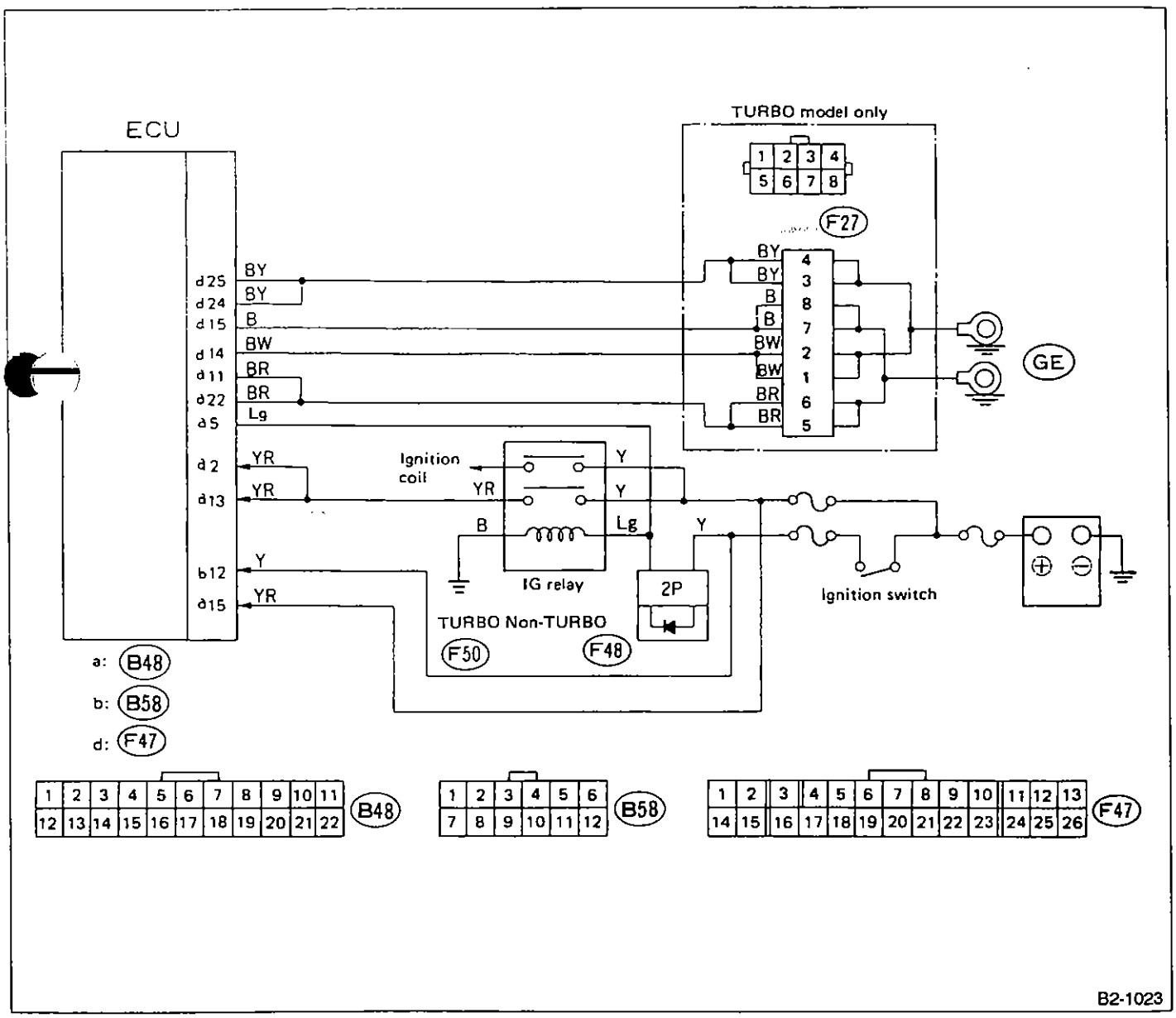


B: CONTROL UNIT POWER SUPPLY AND GROUND LINE

1 Check voltage between ECU and body.
- Not OK → Repair power harness/connector.
- OK ↓

2 Check grounding circuit.
- Not OK → Repair harness/connector.
- OK ↓

Check ignition system.



1. Check voltage between ECU and body.

1) Turn the ignition switch to "ON."
2) Measure voltage between ECU connector terminals and body.

Connector & Terminal/Specified voltage:
(B58) No. 12 — Body/10 V, min.
(B48) No. 15 — Body/10 V, min.
(B48) No. 2 — Body/10 V, min.
(B48) No. 13 — Body/10 V, min.

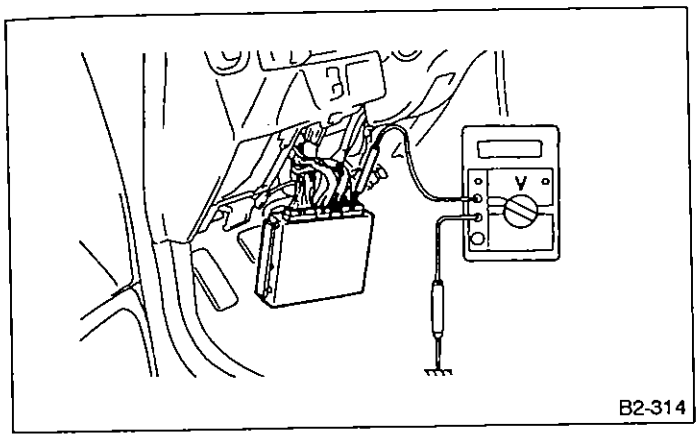


Fig. 57

2. Check grounding circuit.

1) Disconnect ECU connector.
2) Check continuity between ECU connector terminals and body.

Connector & Terminal/Specified resistance:
(F47) No. 24 — Body/0 Ω
(F47) No. 25 — Body/0 Ω
(F47) No. 14 — Body/0 Ω
(F47) No. 15 — Body/0 Ω
(B48) No. 11 — Body/0 Ω
(B48) No. 22 — Body/0 Ω

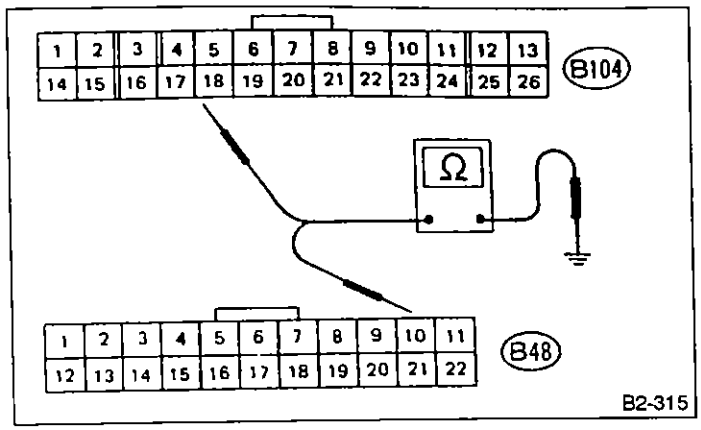


Fig. 58

C: IGNITION CONTROL SYSTEM

1. Check ignition system for sparks.
   - OK → Check fuel pump system.
   - Not OK ↓
2. Check voltage at ignition coil's positive (+) terminal.
   - Not OK → Repair power harness or connector.
   - OK ↓
3. Check condition of ignition coil.
   - Not OK → Replace ignition coil.
   - OK ↓
4. Check input signal at igniter.
   - Not OK → Poor igniter ground terminal contact. Replace igniter.
   - OK ↓
5. Check harness between ECU and igniter.
   - Not OK → Repair harness/connector.
   - OK ↓

Repair ECU terminal poor contact. (Replace ECU.)

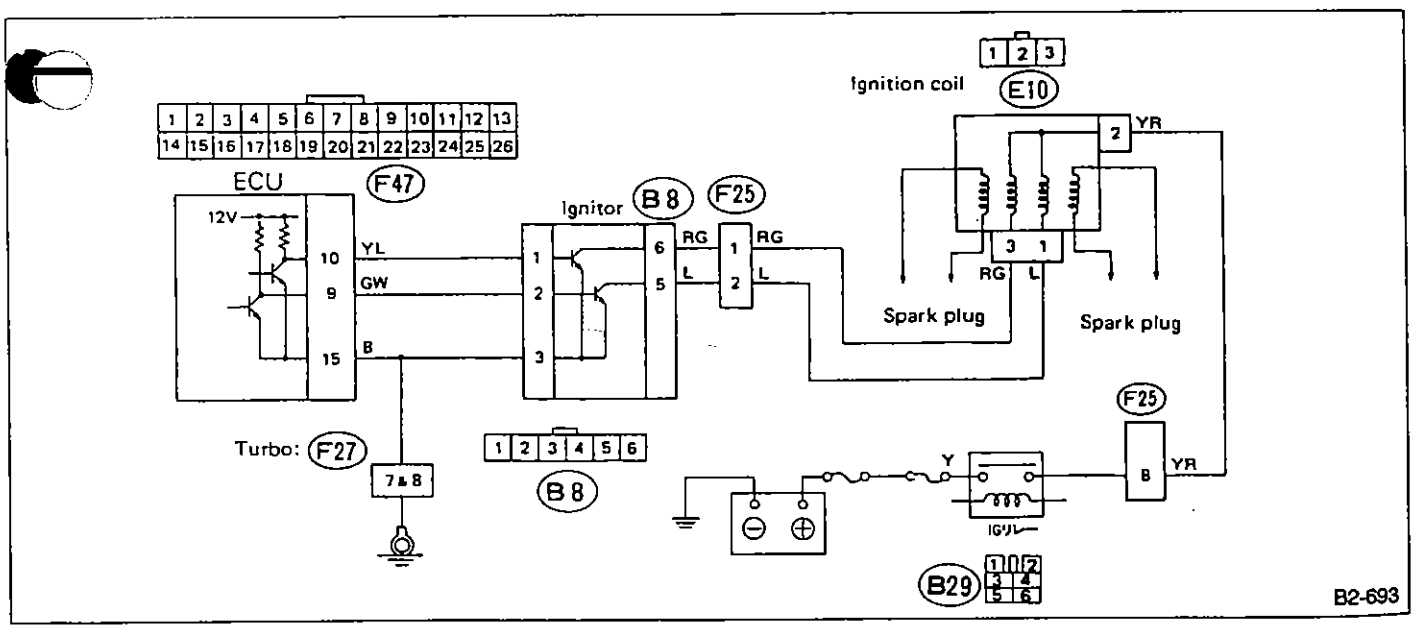


Fig. 59

1. Check ignition system for sparks.

1) Remove plug cord cap from each spark plug.
2) Install new spark plug on plug cord cap. (Do not remove spark plug from engine.)
3) Contact spark plug's thread portion on engine.
4) Crank engine to check that spark occurs at each plug.

2. Check voltage at ignition coil's positive (+) terminal.

1) Turn ignition switch to " ON."
2) Measure voltage between positive terminal of ignition coil connector and body.

Connector & Terminal/Specified voltage:
(E10) No. 2 — Body/10 V, min.

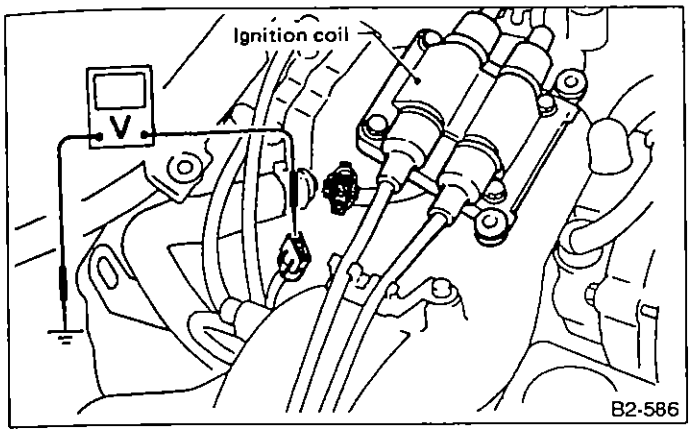


Fig. 60

3. Check condition of ignition coil.

1) Disconnect ignition coil connector.
2) Remove ignition coil from engine.
3) Measure resistance of ignition coil's primary and secondary windings.

- Primary side

Connector & Terminal/Specified resistance:
(E10) No. 2 — No. 1/0.7 Ω
(E10) No. 2 — No. 3/0.7 Ω

- Secondary side

Connector & Terminal/Specified resistance:
#1 — #2/13.8 kΩ(HITACHI), 21 kΩ(DIAMOND)
#3 — #4/13.8 kΩ(HITACHI), 21 kΩ(DIAMOND)

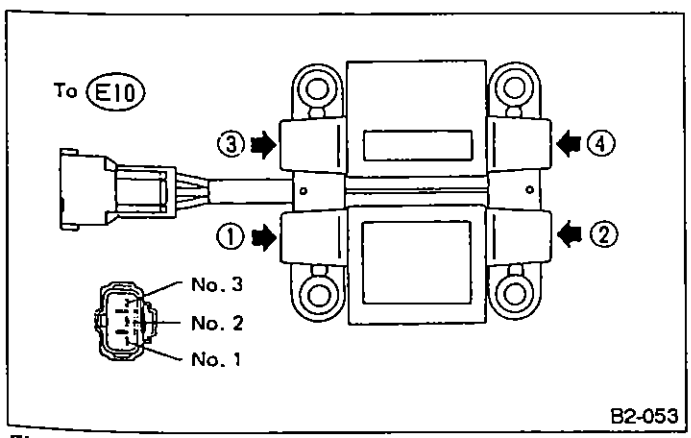


Fig. 61

4. Check input signal at igniter.

Check if voltage varies synchronously with engine revolution when cranking, while monitoring voltage between igniter connector and body.

Connector & Terminal
(B8) No. 1 — Body/0.1 V, min.
(B8) No.2 — Body/0.1 V, min.

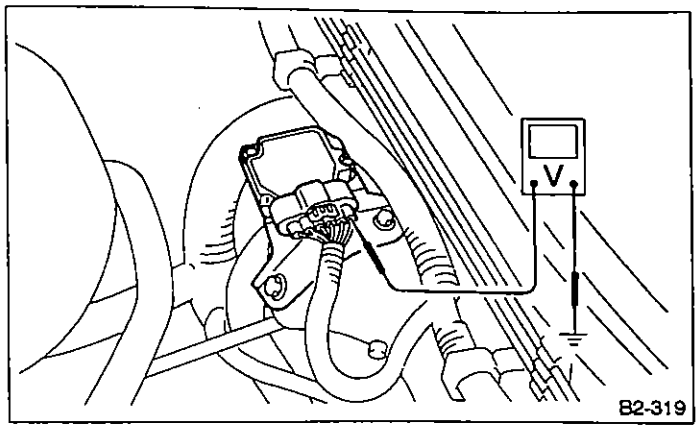


Fig. 62

5. Check harness between ECU and igniter.

1) Disconnect ECU connector and ignitor connector.
2) Check discontinuity between ECU- and igniter- connector terminals.

Connector & Terminal/Specified resistance:
(F47) No. 9 — (B8) No. 2/0 Ω
(F47) No. 10 — (B8) No. 1/0 Ω
(F47) No. 15 — (B8) No. 3/0 Ω
(B8) No. 3 — Body/0Ω

3) Measure resistance between connector terminals and body to check shortcircuit.

Connector & Terminal/Specified resistance:
(B8) No. 1 — Body/1 MΩ min.
(B8) No. 2 — Body/1 MΩ min.

D: FUEL PUMP CIRCUIT

1. Check operation of fuel pump in D-check mode.
   - OK → Check fuel injector system.
   - Not OK ↓
2. Check fuel pump relay.
   - Not OK → Replace fuel pump relay.
   - OK ↓
3. Check voltage between fuel pump relay and body.
   - Not OK → Repair power harness or connector.
   - OK ↓
4. Check voltage between ECU and body.
   - Not OK → Repair ECU terminal poor contact/grounding line. (Replace ECU)
   - OK ↓
5. Check terminal voltage of fuel pump.
   - Not OK → Repair harness/connector between fuel pump and relay.
   - OK ↓
6. Check fuel pump.
   - Not OK → Replace fuel pump.
   - OK ↓

fuel pump grounding circuit.

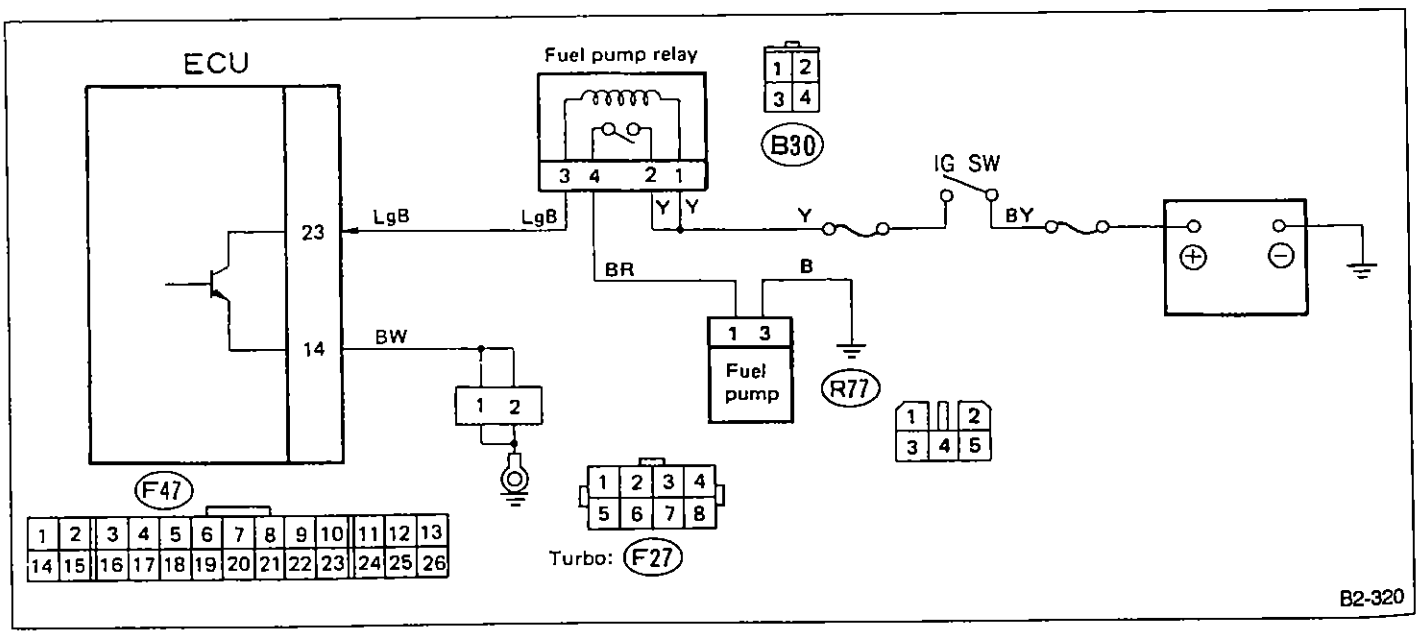


Fig. 63

1. Check operation of fuel pump in D-check mode.

1) Connect test-mode connector.
2) Turn ignition switch to "ON."
3) Check fuel pump for proper operation.

2. Check fuel pump relay.

1) Disconnect fuel pump relay connector and remove relay from bracket.
2) Measure resistance of relay coil.

Terminal/Specified resistance:
No. 1 — No. 3/70 Ω

3) Connect battery (12 volts) to fuel pump relay coil terminals and check continuity between switching terminals. (Relay must issue clicks).

Terminal/Specified resistance:
No. 2 — No. 4/0 Ω
(No. 1: Battery ⊕)
(No. 3: Battery ⊖)

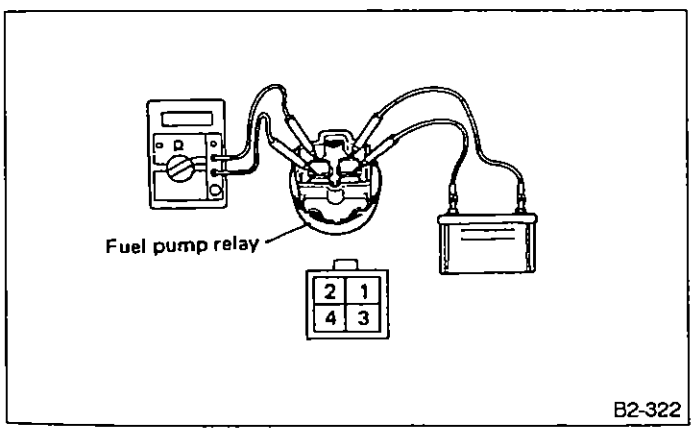


Fig. 64

3. Check voltage between fuel pump relay and body.

1) Turn ignition switch to "OFF," and remove fuel pump relay. (Do not disconnect connector.)
2) Measure voltage between fuel pump relay connector and body.

Connector & Terminal/Specified voltage:
(B30) No. 1 — Body/10 V, min.

4. Check voltage between ECU and body.

1) Turn ignition switch to "ON."
2) Measure voltage when ignition switch is in "ON." Also measure voltage when cranking the engine.

Connector & Terminal/Specified voltage:
(F47) No. 23 — Body/
10 V, min. (Ignition ON)
0 V (when cranking the engine)

5. Check terminal voltage of fuel pump.

1) Remove access lid of fuel pump located in trunk compartment and remove fuel pump connector.
2) Measure voltage between connector and body while cranking the engine.

Connector & Terminal/Specified voltage:
(R77) No. 1 — Body/10 V, min.

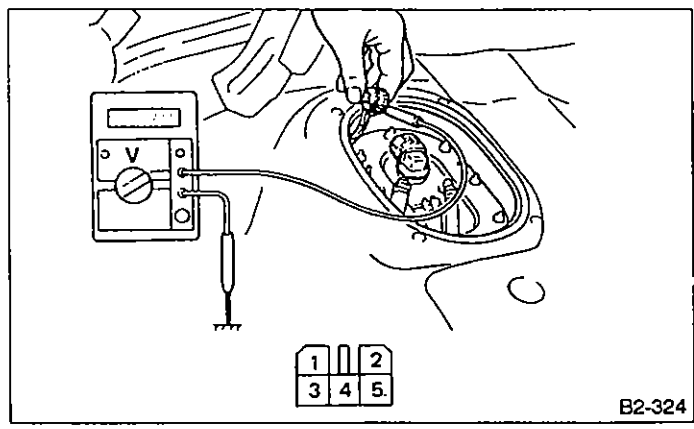


Fig. 65

6. Check fuel pump.

1) Disconnect fuel pump connector.
2) Connect 12-volt battery to proper fuel pump connector terminal and GND terminal to check fuel pump operation.

Terminal:
No. 1 → Battery ⊕
No. 3 → Battery ⊖

E: FUEL INJECTOR CIRCUIT

1. Check each fuel injector for operation.
   - OK → Check fuel pressure.
   - Not OK ↓
2. Check voltage at fuel injector's power terminal.
   - Not OK → Repair harness/connector.
   - OK ↓
3. Check fuel injectors.
   - Not OK → Replace fuel injector.
   - OK ↓
4. Check voltage at each ECU terminal.
   - Not OK → Repair harness/connector.
   - OK ↓
5. Check harness connector between ECU and body.
   - Not OK → Repair harness/connector.
   - OK ↓

Repair ECU terminal poor contact. (Replace ECU.)

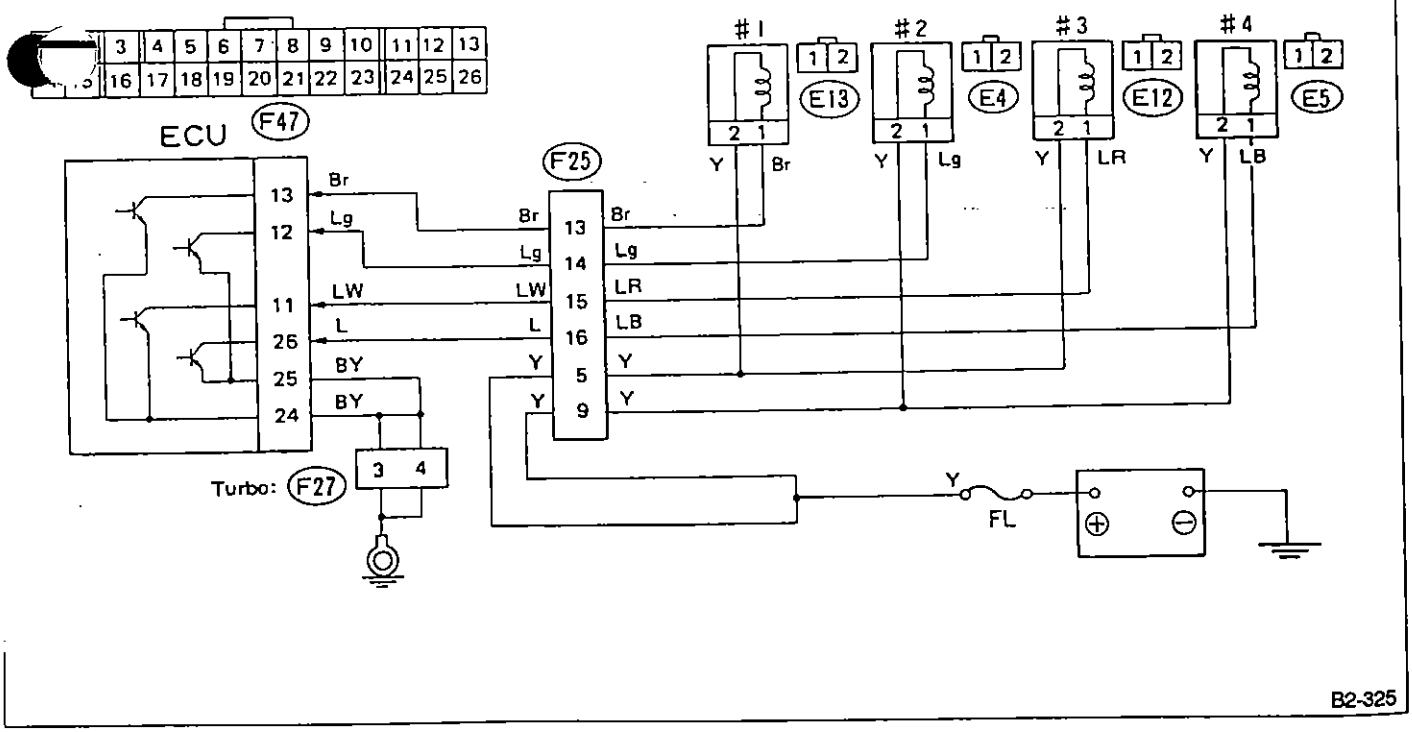


Fig. 66

1. Check each fuel injector for operation.

While cranking the engine, check that each fuel injector emits 'operating' sound. Use a sound scope or attach a screwdriver to injector for this check.

2. Check voltage at fuel injector power terminal.

1) Disconnect connector from injector.
2) Measure voltage between injector connector power terminal and body.

Connector & Terminal/Specified voltage:
(E12) No. 2 — Body/10 V, min.
(E4) No. 2 — Body/10 V, min.
(E13) No. 2 — Body/10 V, min.
(E5) No. 2 — Body/10 V, min.

3. Check fuel injectors.

1) Disconnect connector from injector.
2) Measure resistance between injector terminals.

Specified resistance:
11 — 12 Ω

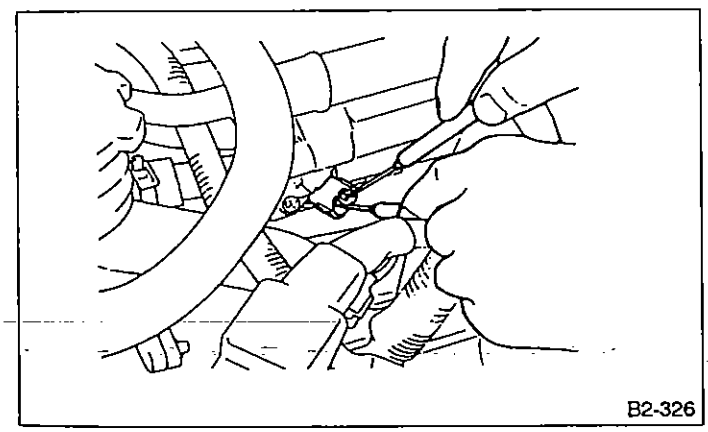


Fig. 67

4. Check voltage at each ECU terminal.

Measure voltage between each fuel injector terminal of ECU connector and body.
(Fuel injector connector is connected.)

Connector & Terminal/Specified voltage:
(F47) No. 11 — Body/10 V, min.
(F47) No. 12 — Body/10 V, min.
(F47) No. 13 — Body/10 V, min.
(F47) No. 26 — Body/10 V, min.

5. Check harness connector between ECU and body.

1) Disconnect connector from ECU.
2) Measure resistance between ECU connector and body.

Connector & Terminal/Specified resistance:
(F47) No. 24 — Body/0 Ω
(F47) No. 25 — Body/0 Ω

Troubleshooting Chart with Trouble Code

)UBLE CODE (11) —CRANK ANGLE SENSOR—

ONTENT OF DIAGNOSIS:
o signal entered from crank angle sensor, but signal
:orresponding to at least one rotation of crank) entered
om cam angle sensor

TROUBLE SYMPTOM:
- Engine stall
- Restarting impossible

1. Check crank angle sensor.
   - Not OK → Replace crank angle sensor.
   - OK ↓
2. Check harness connector between ECU and crank angle sensor.
   - Not OK → Repair harness/connector.
   - OK ↓

Repair ECU terminal poor contact. (Replace ECU.)

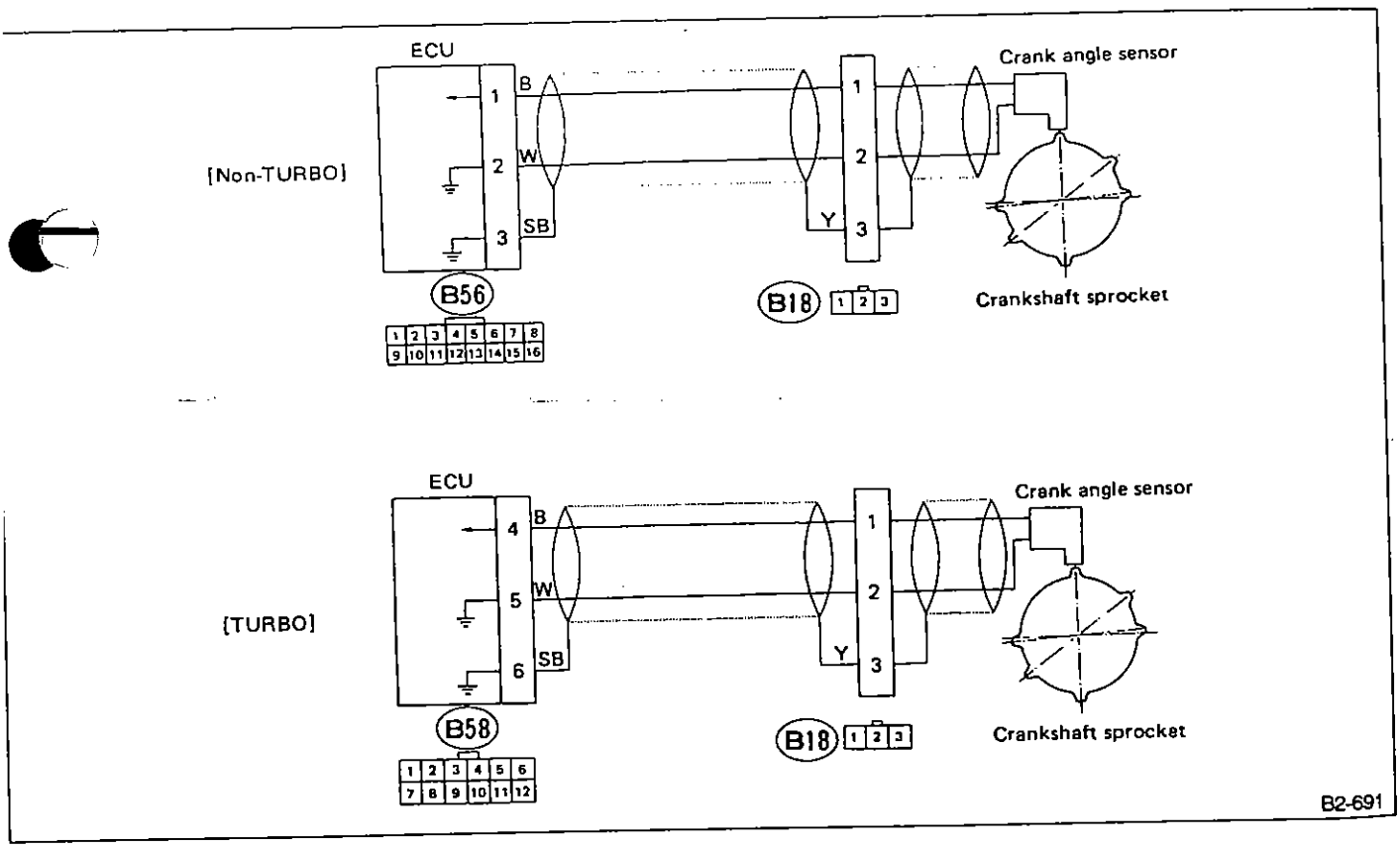


Fig. 68

1. Check crank angle sensor.

1) Disconnect crank angle sensor connector.

2) Check if voltage varies synchronously with engine revolutions when cranking, while monitoring voltage between crank angle sensor connector terminals (AC 0.1 V, min.).

Terminal:
No. 1 — No. 2

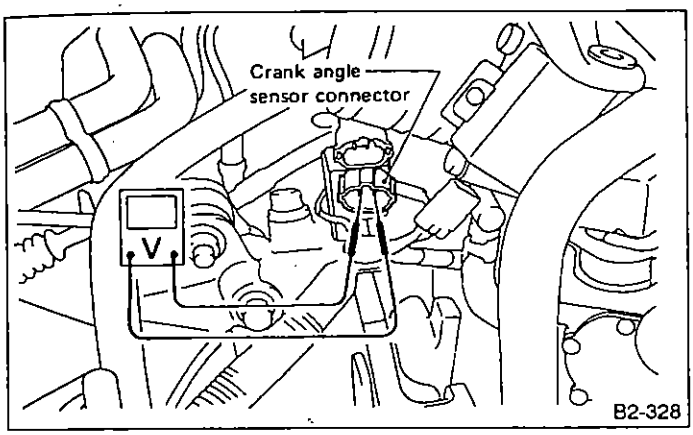


Fig. 69

2. Check harness connector between ECU and crank angle sensor.

1) Disconnect connectors from ECU and crank angle sensor.

2) Measure resistance between ECU connector and angle sensor connector.

Connector & Terminal/Specified resistance:
Non-TURBO
(B56) No. 1 — (B18) No. 1/0 Ω
(B56) No. 2 — (B18) No. 2/0 Ω
(B56) No. 3 — (B18) No. 3/1 Ω max.
TURBO
(B58) No. 4 — (B18) No. 1/0 Ω
(B58) No. 5 — (B18) No. 2/0 Ω
(B58) No. 6 — (B18) No. 3/1 Ω max.

3) Measure resistance between crank angle sensor connector and body.

Connector & Terminal/Specified resistance:
(B18) No. 1 — Body/1 MΩ min.
(B18) No. 2 — Body/1 MΩ min.

4) Connect ECU connector and measure resistance between crank angle sensor sealed terminal and body.

Connector & Terminal/Specified resistance:
(B18) No. 3 — Body/1 Ω max.

5) Disconnect cam angle sensor connector and measure resistance between sealed terminal and body.

Connector & Terminal/Specified resistance:
(B17) No. 3 — Body/1 Ω max.

B: TROUBLE CODE (12) — STARTER SWITCH —

CONTENT OF DIAGNOSIS:
Abnormal signal emitted from ignition starter switch

TROUBLE SYMPTOM:
Failure of engine to start

1. Check operation of starter motor.
   - Not OK → Repair starter motor circuit or replace starter motor.
   - OK ↓
2. Check voltage between ECU and body.
   - OK → Repair ECU terminal poor contact. (Replace ECU.)
   - Not OK ↓
3. Check harness connector between ECU and starter motor.
   - Not OK → Repair harness/connector.
   - OK ↓

Repair ECU terminal poor contact. (Replace ECU.)

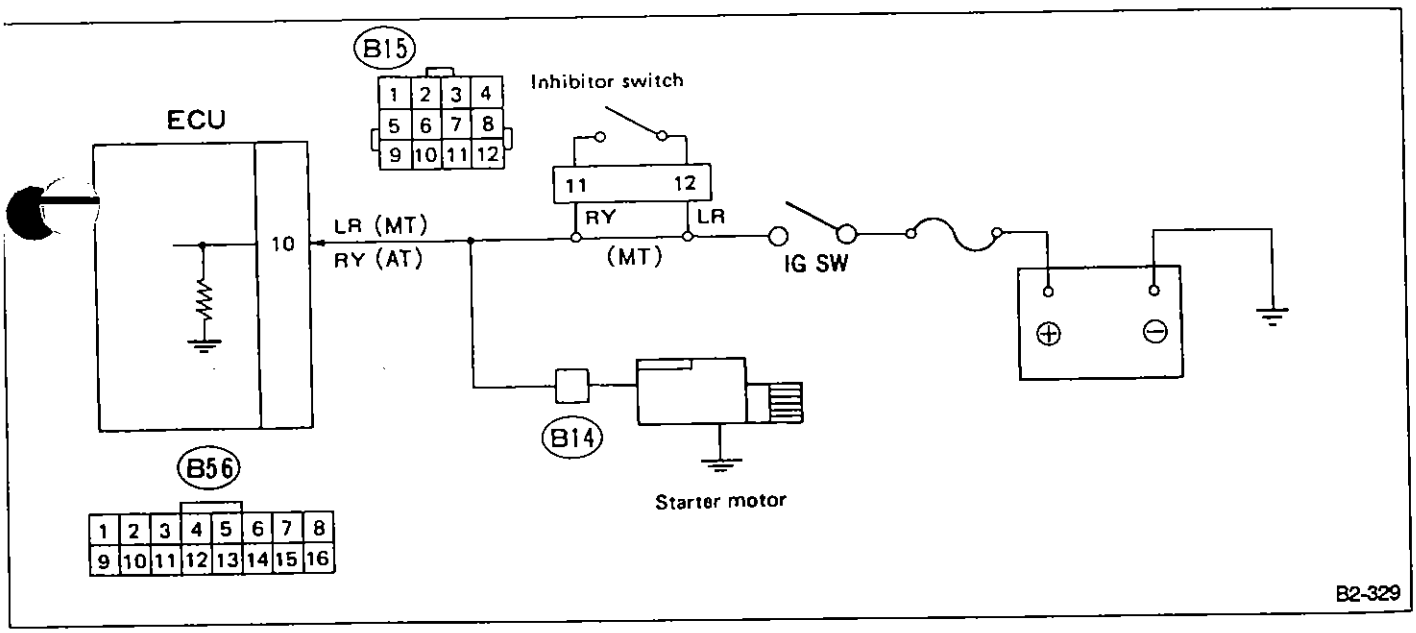


Fig. 70

1. Check operation of starter motor.
Turn ignition switch to "ST" to ensure that starter motor functions.

2. Measure voltage between ECU and body.
Measure voltage between ECU connector terminal and body while cranking the engine.

Connector & Terminal/Specified voltage:
(B56) No. 10 — Body/9 — 12 V

3. Check harness connector between ECU and starter motor.
1) Disconnect connectors from ECU and starter motor.
2) Measure resistance between ECU connector and starter motor connector.

Connector & Terminal/Specified resistance:
(B56) No. 10 — (B14) No. 1/0 Ω

3) Measure resistance between starter motor connector and body.

Connector & Terminal/Specified resistance:
(B14) No. 1 — Body/1 MΩ min.

C: TROUBLE CODE (13) — CAM ANGLE SENSOR —

CONTENT OF DIAGNOSIS:
No signal entered from cam angle sensor, but signal (corresponding to at least two rotations of cam) entered from crank angle sensor

TROUBLE SYMPTOM:
- Engine stall
- Failure of engine to start

1. Check cam angle sensor.
   - Not OK → Replace cam angle sensor.
   - OK ↓
2. Check harness connector between ECU and cam angle sensor.
   - Not OK → Repair harness/connector.
   - OK ↓

Repair ECU terminal poor contact. (Replace ECU.)

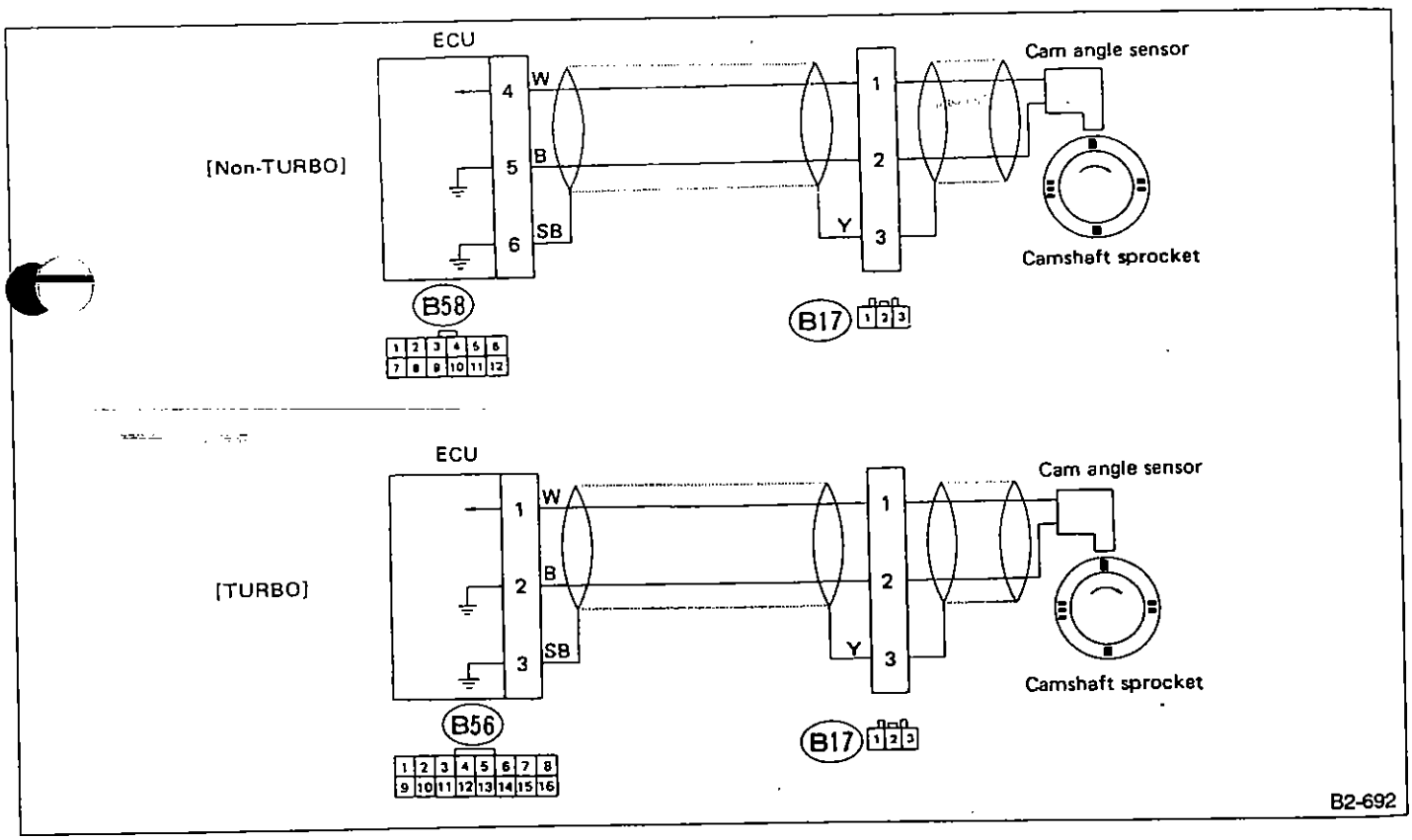


Fig. 71

1. Check cam angle sensor.

1) Disconnect cam angle sensor connector.

2) Check if voltage varies synchronously with engine revolutions when cranking, while monitoring voltage between cam angle sensor connector terminals (AC 0.1 V, min.).

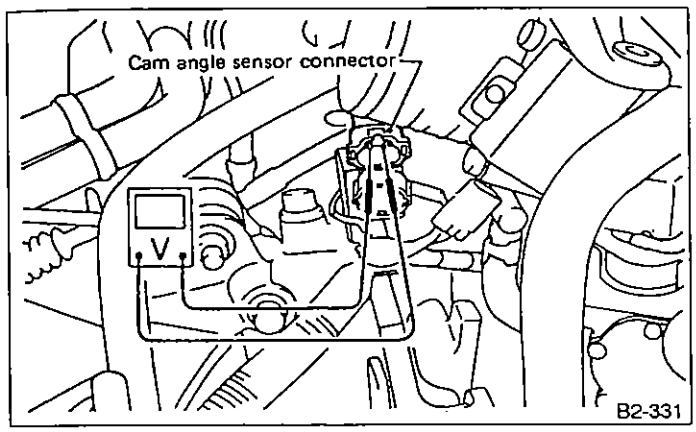


Fig. 72

2. Check harness connector between ECU and cam angle sensor.

1) Disconnect connectors from ECU and cam angle sensor.

2) Measure resistance between ECU connector and cam angle sensor connector.

Connector & Terminal/Specified resistance:
Non-TURBO
(B58) No. 4 — (B17) No. 1/0 Ω
(B58) No. 5 — (B17) No. 2/0 Ω
(B58) No. 6 — (B17) No. 3/1 Ω max.
TURBO
(B56) No. 1 — (B17) No. 1/0 Ω
(B56) No. 2 — (B17) No. 2/0 Ω
(B56) No. 3 — (B17) No. 3/1 Ω max.

3) Measure resistance between cam angle sensor connector and body.

Connector & Terminal/Specified resistance:
(B17) No. 1 — Body/1 MΩ min.
(B17) No. 2 — Body/1 MΩ min.

4) Connect ECU connector and measure resistance between cam angle sensor sealed terminal and body.

Connector & Terminal/Specified resistance:
(B17) No. 3 — Body/1 Ω max.

5) Disconnect crank angle sensor connector and measure resistance between sealed terminal and body.

Connector &Terminal/Specified resistance:
(B18) No. 3 — Body/1 Ω max.

D: TROUBLE CODE (14, 15, 16, 17) — FUEL INJECTOR —

CONTENT OF DIAGNOSIS:
Fuel injector inoperative

TROUBLE SYMPTOM:
- Engine stall
- Erroneous idling
- Rough driving

1.	Check each fuel injector for operation.	OK	Check fuel pressure.
2.	Check voltage at fuel injector's power terminal .	Not OK	Repair harness/connector.
3.	Check fuel injectors.	Not OK	Replace fuel injector.
4.	Check voltage at each ECU terminal.	Not OK	Repair harness/connector.
5.	Check harness connector between ECU and body.	Not OK	Repair harness/connector.
	Repair ECU terminal poor contact. (Replace ECU.)		

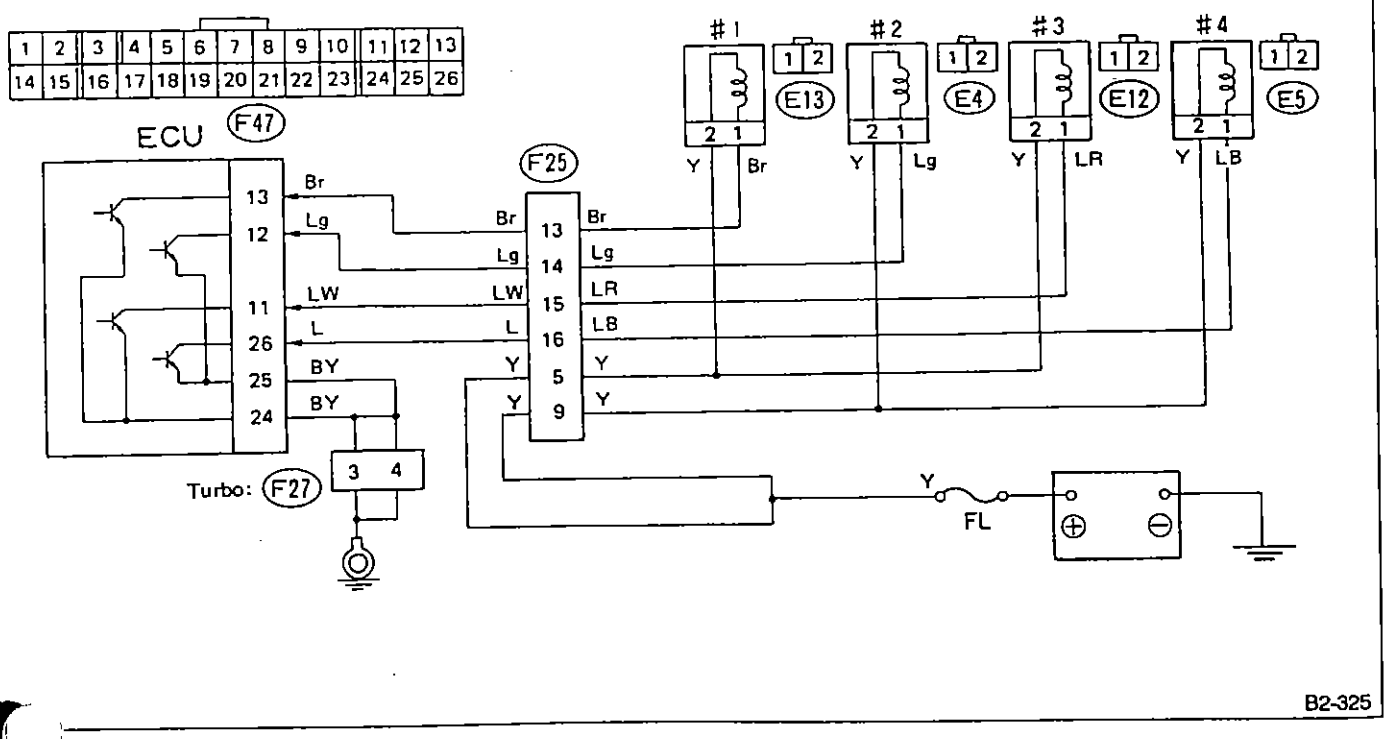


Fig. 73

1. Check each fuel injector for operation.
While cranking the engine, check that each fuel injector emits "operating" sound. Use a sound scope or attach a screwdriver to injector for this check.

2. Check voltage at fuel injector power terminal.
1) Disconnect connector from injector.
2) Measure voltage between injector connector power terminal and body.

Connector & Terminal/Specified voltage:
(E12) No. 2 — Body/10 V, min.
(E4) No. 2 — Body/10 V, min.
(E13) No. 2 — Body/10 V, min.
(E5) No. 2 — Body/10 V, min.

3. Check fuel injectors.
1) Disconnect connector from injector.
2) Measure resistance between injector terminals.

Specified resistance
11 — 12 Ω

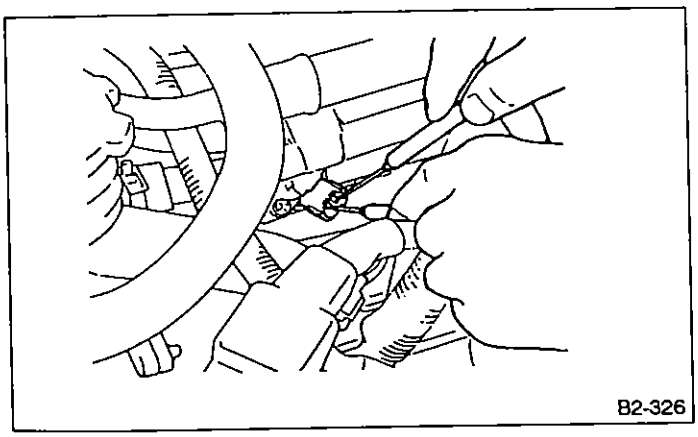


Fig. 74

4. Check voltage at each ECU terminal.
Measure voltage between each fuel injector terminal of ECU connector and body.
(Fuel injector connector is connected.)

Connector & Terminal/Specified voltage:
(F47) No. 11 — Body/10 V, min.
(F47) No. 12 — Body/10 V, min.
(F47) No. 13 — Body/10 V, min.
(F47) No. 26 — Body/10 V, min.

5. Check harness connector between ECU and body.
1) Disconnect connector from ECU.
2) Measure resistance between ECU connector and body.

Connector & Terminal/Specified resistance:
(F47) No. 24 — Body/0 Ω
(F47) No. 25 — Body/0 Ω

E: TROUBLE CODE (21) — WATER TEMPERATURE SENSOR —

CONTENT OF DIAGNOSIS:
Abnormal signal emitted from water temperature sensor

TROUBLE SYMPTOM:
- Hard to start
- Erroneous idling
- Poor driving performance

1. Check water temperature sensor.
   - Not OK → Replace water temperature sensor.
   - OK ↓
2. Check voltage between ECU and body.
   - OK → Repair ECU terminal poor contact. (Replace ECU.)
   - Not OK ↓
3. Check harness connector between ECU and water temperature sensor.
   - Not OK → Repair harness/connector .
   - OK ↓

Repair ECU terminal poor contact. (Replace ECU.)

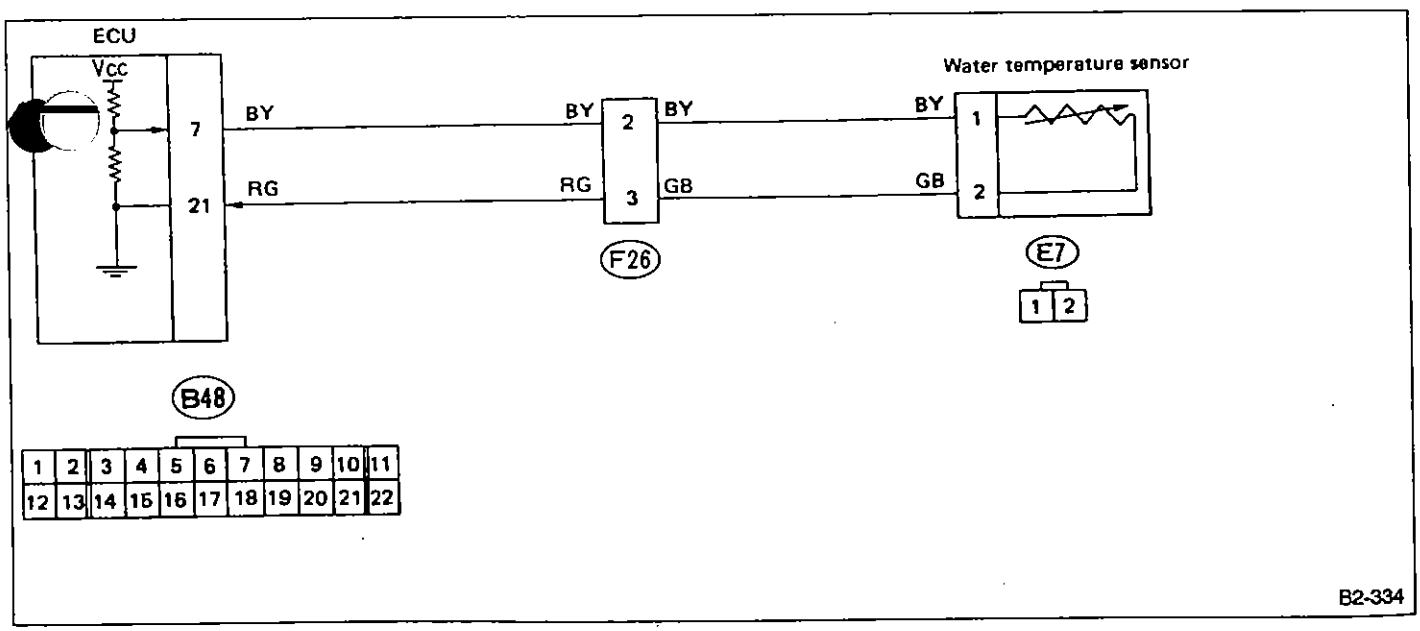


Fig. 75

1. Check water temperature sensor.

1) Disconnect connector from water temperature sensor.

2) Measure resistance between water temperature sensor terminals.

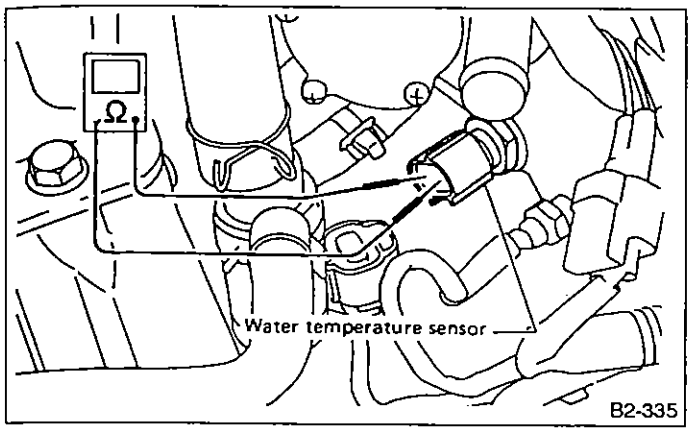


Fig. 76

Specified resistance:
2.0 — 3.0 kΩ [20°C (68°F)]
0.3 — 0.4 kΩ [80°C (176°F)]

2. Check voltage between ECU and body.

1) Turn ignition switch to "ON."

2) Measure voltage between ECU connector terminal and body. (Water temperature sensor connector is connected.)

Connector & Terminal/Specified voltage:
(B48) No. 7 — Body/0.6 — 4.5 V

3. Check harness connector between ECU and water temperature sensor.

1) Disconnect ECU connector and water temperature sensor connector.

2) Measure resistance between ECU connector and water temperature connector.

Connector & Terminal/Specified resistance:
(B48) No. 7 — (E7) No. 1/0 Ω
(B48) No. 21 — (E7) No. 2/0 Ω

3) Measure resistance between water temperature sensor connector and body after connector (i4) has been disconnected.

Connector & Terminal/Specified resistance:
(E7) No. 1 — Body/1 MΩ min.
(E7) No. 2 — Body/1 MΩ min.

F: TROUBLE CODE (22) — KNOCK SENSOR —

CONTENT OF DIAGNOSIS:
Abnormal voltage produced in knock sensor.

TROUBLE SYMPTOM:
Poor driving performance

1. Check voltage between ECU and body.
   - OK → Repair ECU terminal poor contact. (Replace ECU.)
   - Not OK ↓
2. Check knock sensor.
   - Not OK → Replace knock sensor.
   - OK ↓
3. Check harness connector between ECU and knock sensor.
   - Not OK → Repair harness/connector .
   - OK ↓

Repair ECU terminal poor contact. (Replace ECU.)

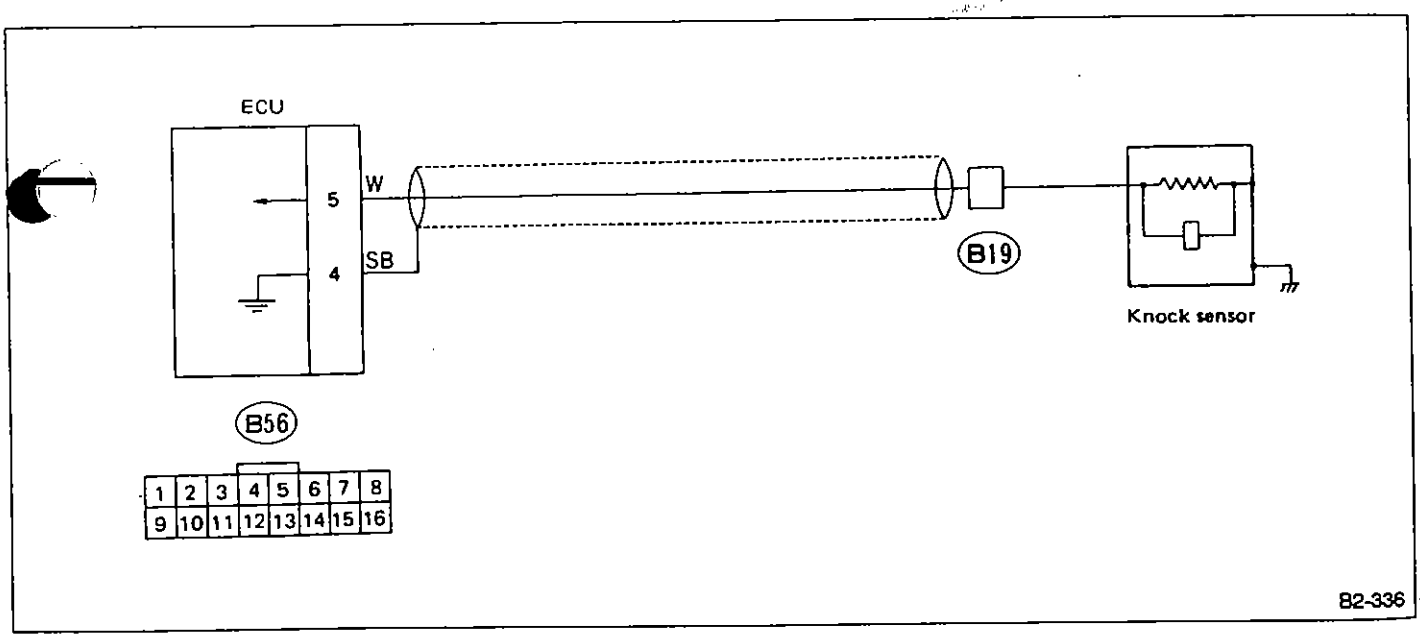


Fig. 77

1. Check voltage between ECU and body.

1) Turn ignition switch to "ON."
2) Measure voltage between ECU connector terminal and body.

Connector & Terminal/Specified voltage:
(B56) No. 5 — Body/3 — 4 V

2. Check knock sensor.

1) Disconnect connector from knock sensor.
2) Measure resistance between knock sensor terminals and body.

Connector & Terminal/Specified resistance:
(B19) No. 1 — Body/Approx. 560 kΩ

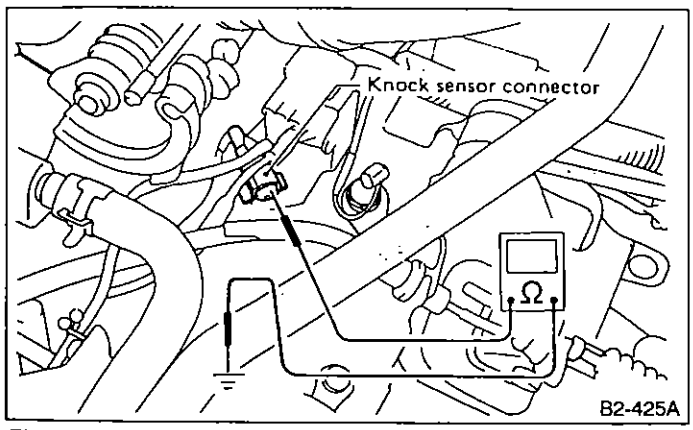


Fig. 78

3. Check harness connector between ECU and knock sensor.

1) Disconnect connectors from ECU and knock sensor
2) Measure resistance between ECU and knock sensor connectors.

Connector & Terminal/Specified resistance:
(B56) No. 5 — (B19) No. 1/0 Ω

3) Measure resistance between knock sensor connector and body.

Connector & Terminal/Specified resistance:
(B19) No. 1 — Body/1 MΩ min.

G: TROUBLE CODE (23) — AIR FLOW SENSOR —

CONTENT OF DIAGNOSIS:
Abnormal voltage input entered from air flow sensor

TROUBLE SYMPTOM:
- Erroneous idling
- Engine stall
- Poor driving performance

1. Check voltage between ECU and body.
   - OK → Repair ECU terminal poor contact. (Replace ECU.)
   - Not OK ↓
2. Check harness connectors between ECU and air flow sensor, and between air flow sensor and ground.
   - Not OK → Repair harness/connector.
   - OK ↓

Replace air flow sensor.

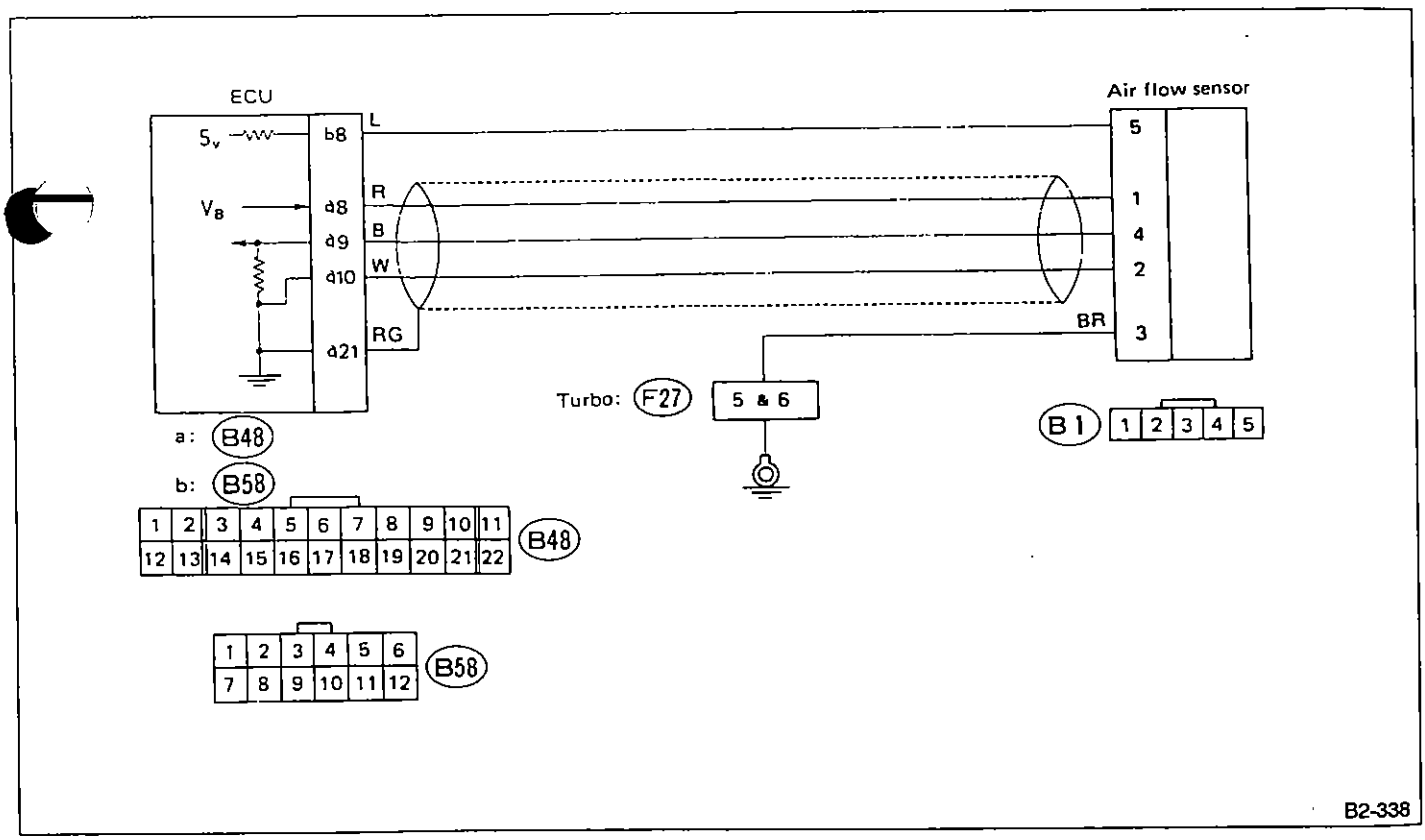


Fig. 79

1. Check voltage between ECU and body.

1) Turn ignition switch to "ON."
2) Measure voltage between ECU connector terminal and body.

Connector & Terminal/Specified voltage:
(B48) No. 8 — Body/
10 — 13 V (Engine OFF)
13 — 14 V (Engine at idle)
(B48) No. 9 — Body/
0 — 0.3 V (Engine OFF)
0.8 — 1.2 V (Engine at idle)
(B48) No. 10 — Body/
0 V (Engine OFF)
0 V (Engine at idle)

2. Check harness connector between ECU and air flow sensor.

1) Disconnect ECU and air flow sensor connectors.
2) Measure resistance between ECU and air flow sensor connectors.

Connector & Terminal/Specified resistance:
(B48) No. 8 — (B1) No. 1/0 Ω
(B48) No. 9 — (B1) No. 4/0 Ω
(B48) No. 10 — (B1) No. 2/0 Ω

3. Measure resistance between air flow sensor connector and body.

Connector & Terminal/Specified resistance:
(B1) No. 1 — Body/1 MΩ min.
(B1) No. 4 — Body/1 MΩ min.
(B1) No. 2 — Body/1 MΩ min.
(B1) No. 3 — Body/0 Ω

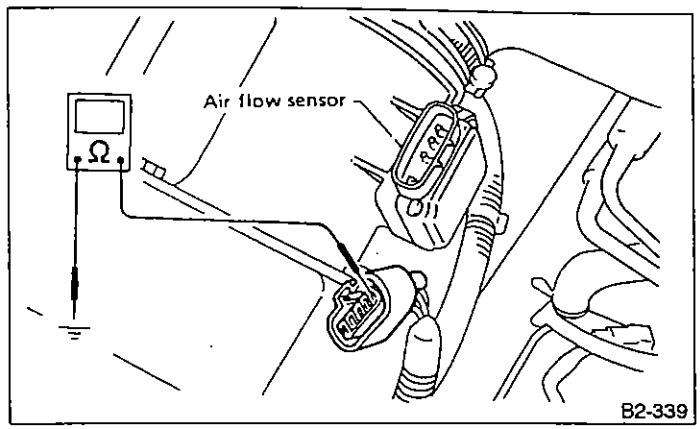


Fig. 80

H: TROUBLE CODE (24) — BY-PASS AIR CONTROL SOLENOID VALVE —

CONTENT OF DIAGNOSIS:
Solenoid valve inoperative

TROUBLE SYMPTOM:
- Erroneous idling
- Engine stall
- Engine breathing

1.	Check power voltage at by-pass air control solenoid valve.	Not OK	Repair harness connector/fusible link between by-pass air control solenoid valve and battery.
	↓ OK		
2.	Check by-pass air control solenoid valve.	Not OK	Replace solenoid valve.
	↓ OK		
3.	Check voltage between ECU and body.	OK	Repair ECU terminal poor contact. (Replace ECU.)
	↓ Not OK		
4.	Check harness connector between ECU and air control valve.	Not OK	Repair harness/connector.
	↓ OK		
	Repair ECU terminal poor contact. (Replace ECU.)		

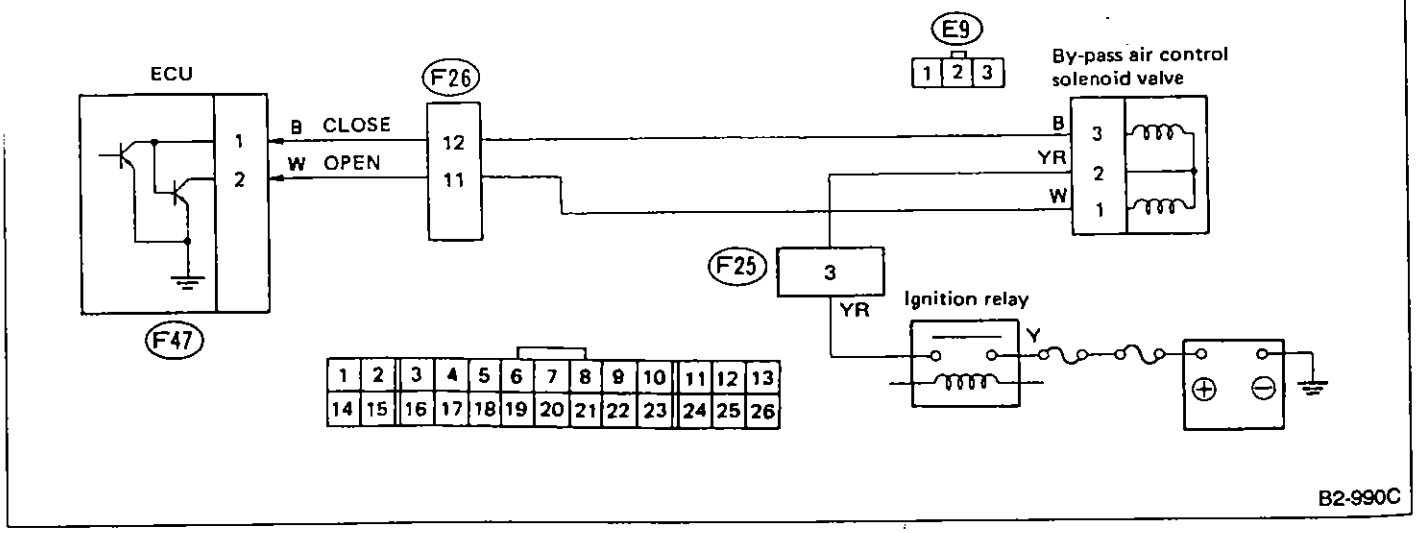


Fig. 81

1. Check power voltage by-pass air control solenoid valve.

1) Turn ignition switch to "ON."
2) Measure voltage between by-pass air control solenoid valve connector terminal and body.

Connector & Terminal/Specified voltage:
(E9) No. 2 — Body/10 V, min.

2. Check by-pass air control solenoid valve.

1) Disconnect connector from by-pass air control solenoid valve.
2) Measure resistance between solenoid valve terminals.

Connector & Terminal/Specified resistance:
Non-TURBO
No. 1 — No. 2/9 Ω
No. 2 — No. 3/9 Ω
TURBO
No. 1 — No. 2/9 Ω
No. 2 — No. 3/9 Ω

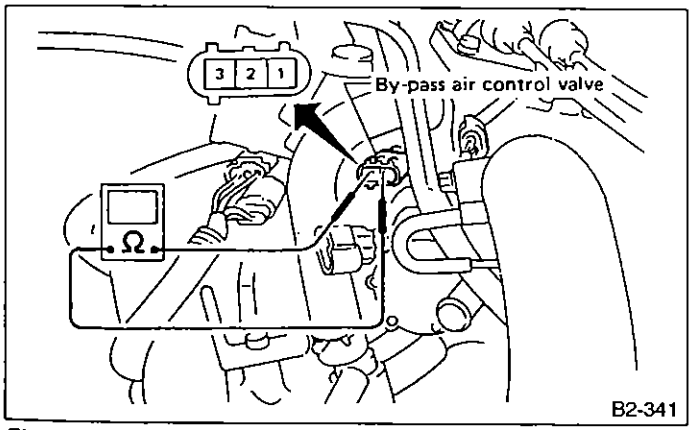


Fig. 82

3. Check voltage between ECU and body.

1) Turn ignition switch to "ON."
2) Measure voltage between ECU connector terminal and body.

Connector & Terminal/Specified voltage:
Non-TURBO
(F47) No. 2 — Body/7 V
(F47) No. 1 — Body/6 V
TURBO
(F47) No. 2 — Body/0 V → 12 V*
(F47) No. 1 — Body/12 V → 0 V*

*: 1 min after ignition switch ON.

4. Check harness connector between ECU and by-pass air control solenoid valve.

1) Disconnect connectors from ECU and by-pass air control solenoid valve.
2) Measure resistance between ECU connector and solenoid valve connector.

Connector & Terminal/Specified resistance:
(F47) No. 2 — (E9) No. 1/0 Ω
(F47) No. 1 — (E9) No. 3/0 Ω

3) Measure resistance between solenoid valve connector and body.

Connector & Terminal/Specified resistance:
(E9) No. 1 — Body/1 MΩ min.
(E9) No. 3 — Body/1 MΩ min.

I: TROUBLE CODE (31) — THROTTLE SENSOR —

CONTENT OF DIAGNOSIS:
Abnormal voltage input entered from throttle sensor.

TROUBLE SYMPTOM:
- Erroneous idling
- Engine stall
- Poor driving performance

1. Check voltage between ECU and body.
   - OK → Repair ECU terminal poor contact and harness. (Replace ECU.)
   - Not OK ↓
2. Check throttle sensor.
   - Not OK → Replace throttle sensor.
   - OK ↓
3. Check harness connector between ECU and throttle sensor.
   - Not OK → Repair harness/connector.
   - OK ↓

Repair ECU terminal poor contact. (Replace ECU.)

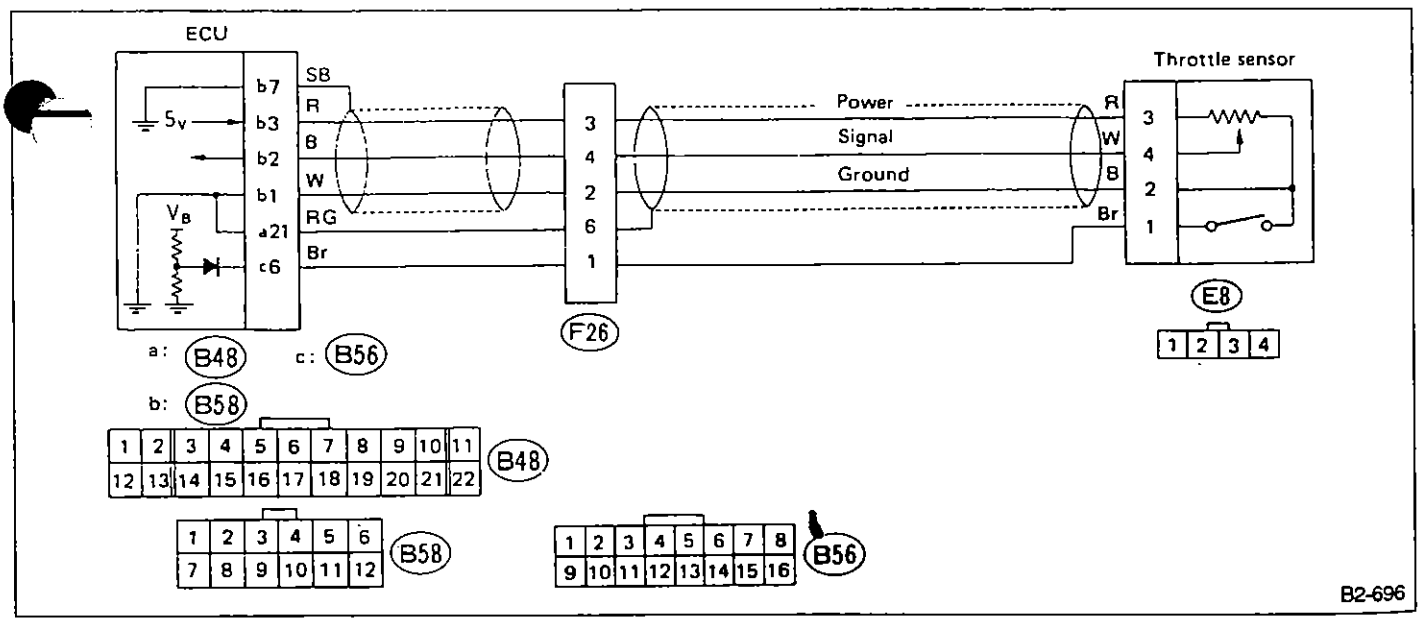


Fig. 83

1. Check voltage between ECU and body.

1) Turn ignition switch to "ON."
2) Measure voltage between ECU connector terminal and body.

Connector & Terminal/Specified voltage:
(B58) No. 2 — Body/
4.4 — 4.8 V (Throttle is fully closed.)
0.7 — 1.6 V (Throttle is fully open.)
(Ensure voltage smoothly decreases as throttle valve changes from "closed" to "open".)
(B58) No. 3 — Body/5 V
(B58) No. 1 — Body/0 V

2. Check throttle sensor.

1) Disconnect connector from throttle sensor.
2) Measure resistance between throttle sensor terminals.

Connector & Terminal/Specified resistance:
No. 2 — No. 3/12 kΩ

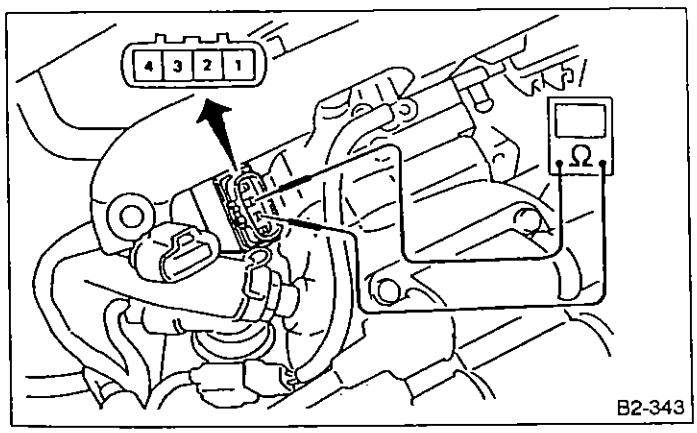


Fig. 84

3) Measure resistance between terminals while slowly opening throttle valve from the "closed" position.

Terminal/Specified resistance:
No. 2 — No. 4/ 10 — 12 kΩ (Throttle is fully closed.)
3 — 5 kΩ (Throttle is fully open.)
Ensure resistance increases in response to throttle valve opening.

3. Check harness connector between ECU and throttle sensor.

1) Disconnect connectors from ECU and throttle sensor.
2) Measure resistance between ECU connector and throttle sensor connectors.

Connector & Terminal/Specified resistance:
(B58) No. 1 — (E8) No. 2 /0 Ω
(B58) No. 2 — (E8) No. 4 /0 Ω
(B58) No. 3 — (E8) No. 3 /0 Ω

3) Measure resistance between throttle sensor connector and body.

Connector & Terminal/Specified resistance:
(E8) No. 2 — Body/1 MΩ min.
(E8) No. 4 — Body/1 MΩ min.
(E8) No. 3 — Body/1 MΩ min.

J: TROUBLE CODE (32) — O_2 SENSOR —

CONTENT OF DIAGNOSIS:
O_2 sensor inoperative

TROUBLE SYMPTOM:
- Failure of engine to start
- Erroneous idling
- Poor driving performance
- Engine stall

1. Check voltage between ECU and body.
   - OK → Repair ECU terminal poor contact. (Replace ECU.)
   - Not OK → 2. Check O_2 sensor.
2. Check O_2 sensor.
   - Not OK → Replace O_2 sensor.
   - OK → 3. Check harness connector between ECU and O_2 sensor.
3. Check harness connector between ECU and O_2 sensor.
   - Not OK → Repair harness/connector.
   - OK → Repair ECU terminal poor contact. (Replace ECU.)

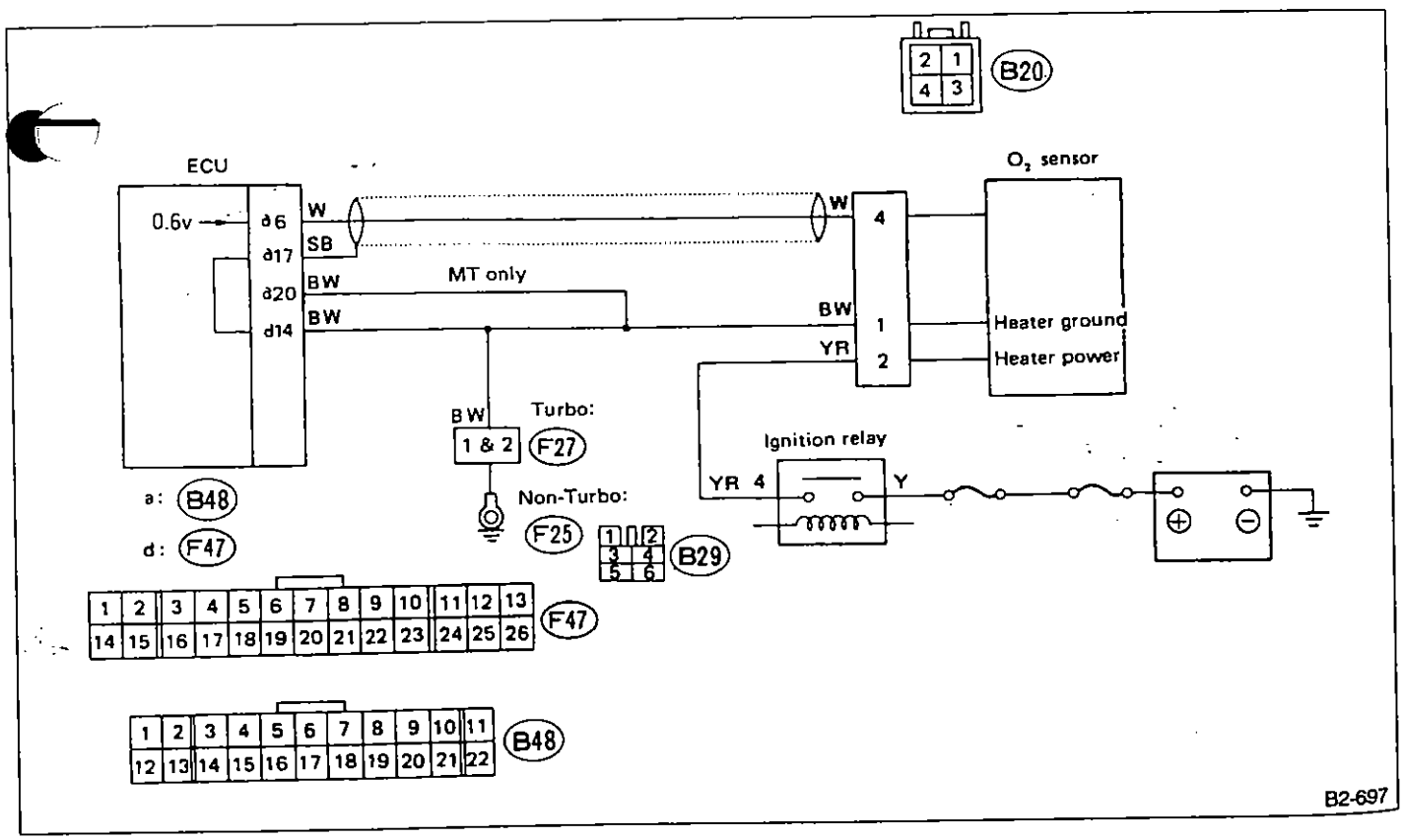


Fig. 85

1. Check voltage between ECU and body.
Measure voltage between ECU connector terminal and body while idling engine.

Connector & Terminal/Specified voltage:
(B48) No. 6 — Body/0.1 — 1.0 V

Problems in heater circuit causes O_2 sensor to deactivate.

2. Check O_2 sensor.
1) Idle engine.
2) Disconnect O_2 sensor connector.
3) Measure voltage between O_2 sensor terminal and body.

Connector & Terminal/Specified voltage:
No. 4 — Body/0.1 — 1.0 V

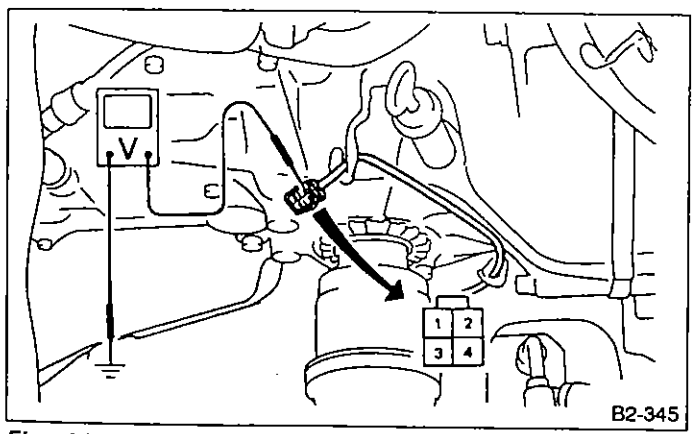


Fig. 86

3. Check harness connector between ECU and O_2 sensor.
1) Disconnect connectors from ECU and O_2 sensor.
2) Measure resistance between ECU connector and O_2 sensor connector.

Connector & Terminal/Specified resistance:
(B48) No.6 — (B20) No. 4/0 Ω

3) Measure resistance between O_2 sensor connector and body.

Connector & Terminal/Specified resistance:
(B20) No. 4 — Body /1 MΩ min.

C: TROUBLE CODE (33) — VEHICLE SPEED SENSOR 2 —

ONTENT OF DIAGNOSIS:
bnormal voltage input entered from vehicle speed sen-
or 2

TROUBLE SYMPTOM:
- Erroneous idling
- Engine stall
- Poor driving performance

1. Check voltage between ECU and body.
   - OK → Repair ECU terminal poor contact. (Replace ECU.)
   - Not OK ↓
2. Check harness connector between ECU and vehicle speed sensor 2.
   - Not OK → Repair harness/connector.
   - OK ↓
3. Check vehicle speed sensor 2.
   - Not OK → Replace combination meter.
   - OK ↓

Repair ECU terminal poor contact. (Replace ECU.)

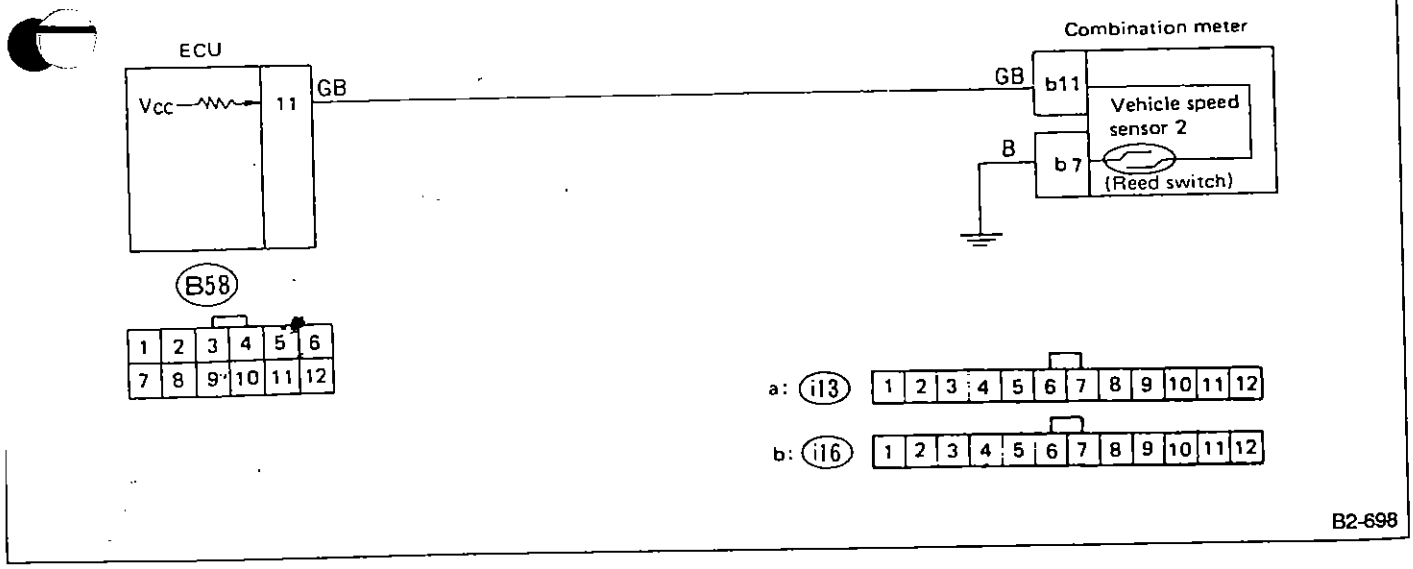


Fig. 87

1. Check voltage between ECU and body.

1) Raise vehicle and support with safety stands.
Ensure all four wheels are off the ground (AWD model).
2) Measure voltage between ECU connector terminal and body while slowly driving wheels.

Connector & Terminal/Specified voltage:
(B58) No. 11 — Body/0 ↔ 5 V

2. Check harness connector between ECU and vehicle speed sensor 2.

1) Remove connector from ECU and combination meter.
2) Measure resistance between ECU connector and combination meter connector.

Connector & Terminal/Specified resistance:
(B58) No. 11 — (i16) No. 11/0 Ω

3) Measure resistance between combination meter connector and body.

Connector & Terminal/Specified resistance:
(i16) No. 11 — Body/1 MΩ min.
(i16) No. 7 — body/ 0 Ω

3. Check vehicle speed sensor 2.

1) Remove combination meter.
2) Disconnect connectors from combination meter.
3) Insert a screwdriver into portion occupied by meter cable and rotate rotor.
4) Check that resistance across combination meter terminals deflects four times per gear rotation.

Connector & Terminal/Specified resistance:
(i16) No. 11 — (i16) No. 7/0 ↔ 1 MΩ min

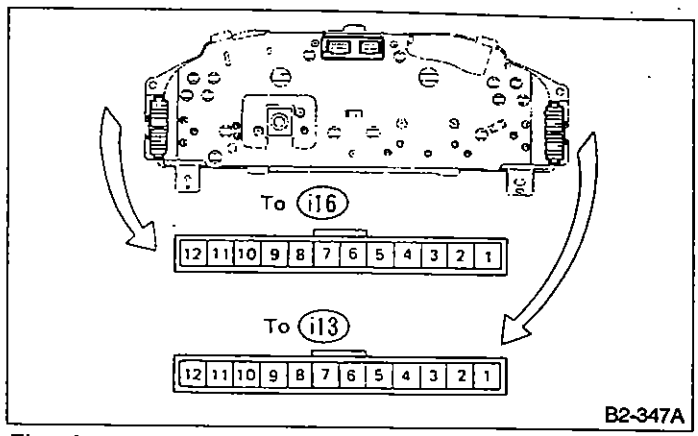


Fig. 88

L: TROUBLE CODE (35) — PURGE CONTROL SOLENOID VALVE —

CONTENT OF DIAGNOSIS:
Solenoid valve inoperative

TROUBLE SYMPTOM:
- Erroneous idling

1. Check voltage between ECU and body.
   - OK → Repair ECU terminal poor contact. (Replace ECU.)
   - Not OK ↓
2. Check purge control solenoid valve.
   - Not OK → Replace purge control solenoid valve.
   - OK ↓
3. Check harness connector between ECU and purge control solenoid valve.
   - Not OK → Repair harness/connector.
   - OK ↓

Repair ECU terminal poor contact.
(Replace ECU.)

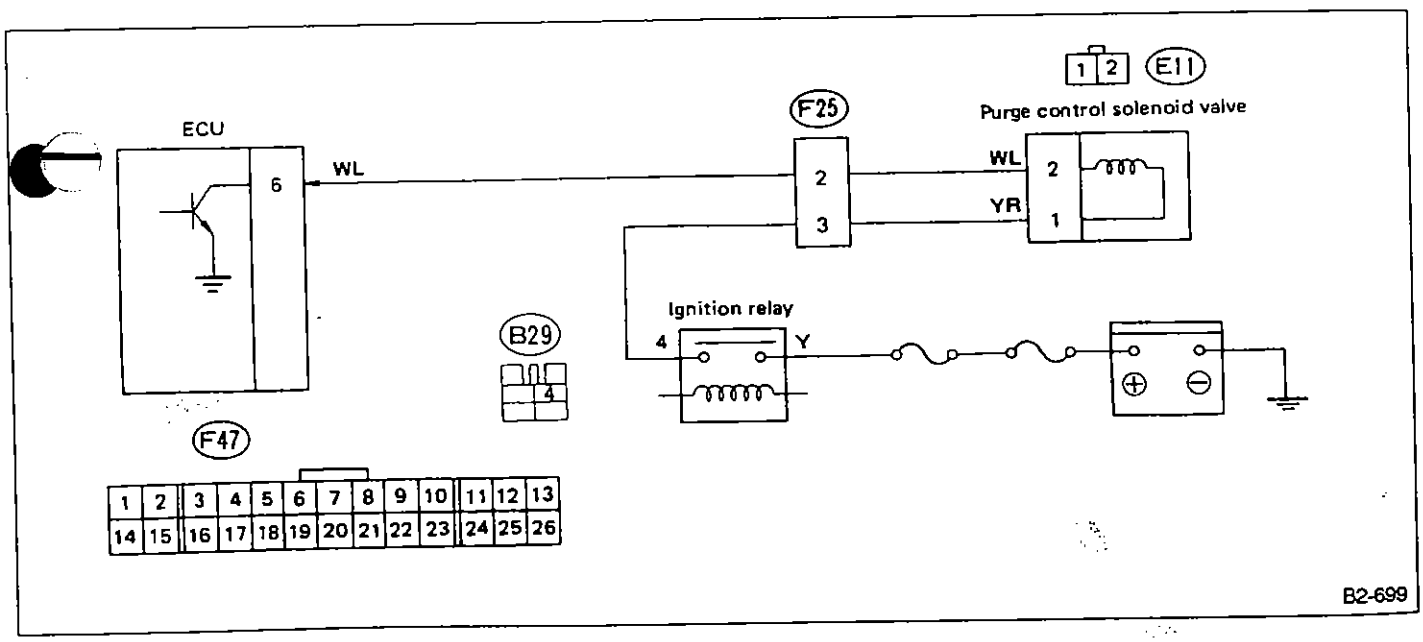


Fig. 89

1. Check voltage between ECU and body.

1) Turn ignition switch to "ON" with engine OFF.
2) Measure voltage between ECU connector terminal and body.

Connector & Terminal/Specified voltage:
F47 No. 6 — Body/10 — 13 V

2. Check purge control solenoid valve.

1) Disconnect connector from solenoid valve.
2) Measure resistance between solenoid valve terminals.

Specified resistance:
36 Ω [at 20°C (68°F)]

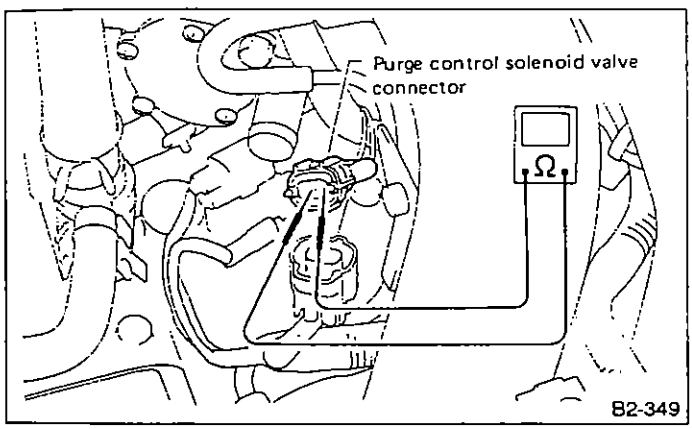


Fig. 90

3. Check harness connector between ECU and purge control solenoid valve.

1) Disconnect connectors from ECU and solenoid valve.
2) Measure resistance between ECU connector and solenoid valve connector.

Connector & Terminal/Specified resistance:
(F47) No. 6 — (E11) No. 2/0 Ω

3) Measure resistance between solenoid valve connector and body.

Connector & Terminal/Specified resistance:
(E11) No. 2 — Body/1 MΩ min.

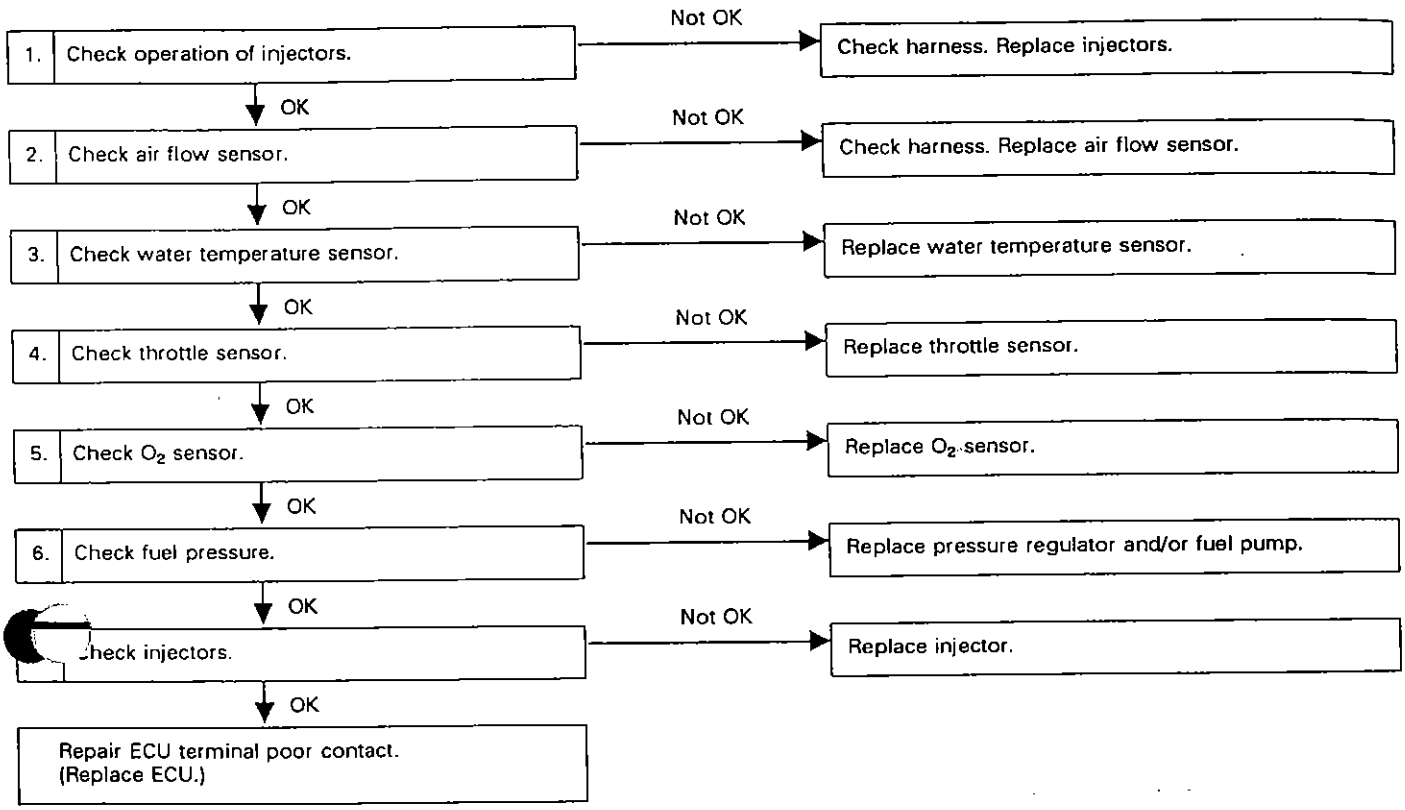
4) Disconnect ground and positive terminals from battery in that order.
5) Measure resistance between solenoid valve connector and battery's positive terminal.

Connector & Terminal/Specified resistance:
(E11) No. 1 — (+) terminal/0 Ω

M: TROUBLE CODE (41) — AIR-FUEL RATIO CONTROL SYSTEM —

CONTENT OF DIAGNOSIS:
Faulty learning control system

TROUBLE SYMPTOM:
- Erroneous idling
- Engine stall



N: TROUBLE CODE (42) — IDLE SWITCH —

CONTENT OF DIAGNOSIS:
Abnormal voltage input entered from idle switch

TROUBLE SYMPTOM:
- Erroneous idling
- Engine stall
- Poor driving performance

1. Check voltage between ECU and body.
   - OK → Repair ECU terminal poor contact. (Replace ECU.)
   - Not OK ↓
2. Check idle switch.
   - Not OK → Adjust idle switch. (Replace idle switch.)
   - OK ↓
3. Check harness connector between ECU and idle switch.
   - Not OK → Repair harness/connector.
   - OK ↓

Repair ECU terminal poor contact. (Replace ECU.)

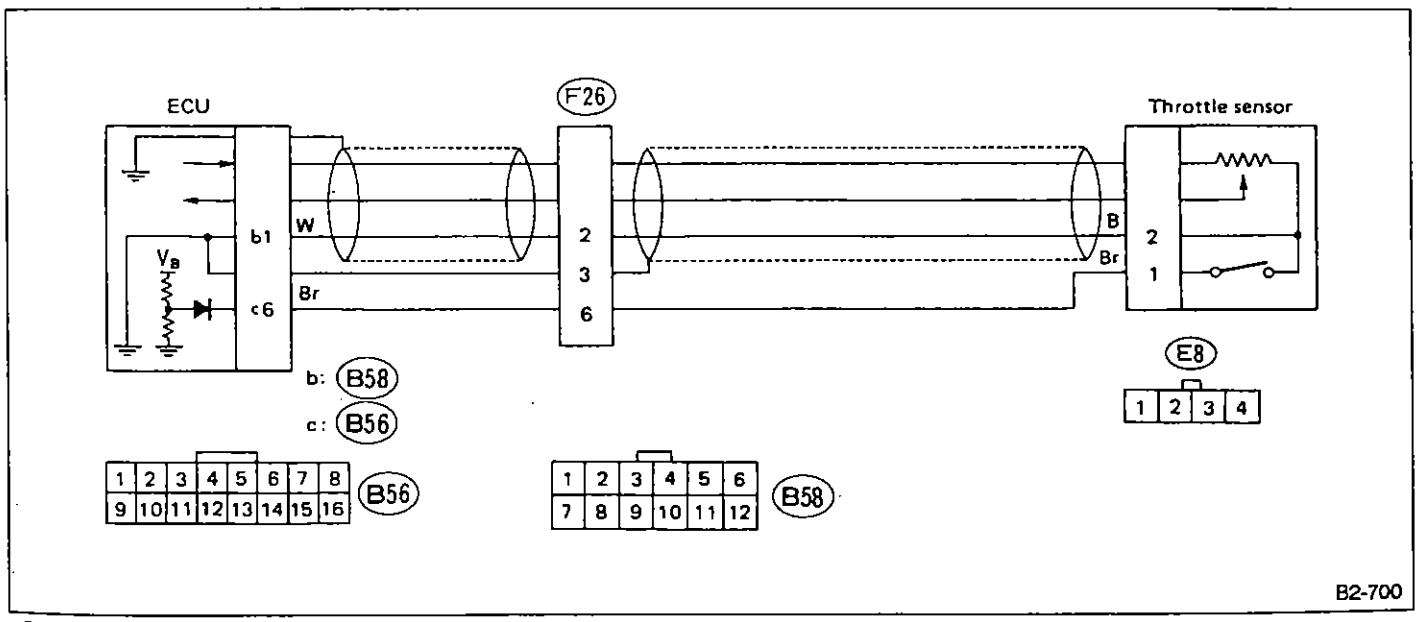


Fig. 91

Check voltage between ECU and body.

Turn ignition switch to "ON."

[redacted] ire voltage between ECU connector terminal [redacted]

onnector & Terminal/Specified voltage:
(B56) No. 6 — Body/ 0 V (Throttle is fully closed.)
Approx. 5 V (Throttle is open.)

. Check idle switch.

) Disconnect connector from throttle sensor.
) Check continuity between throttle sensor idle switch erminals.

erminal/Specified resistance:
No. 1 — No. 2 /0 Ω (Throttle is fully closed.)
1 MΩ min. (Throttle is fully open.)

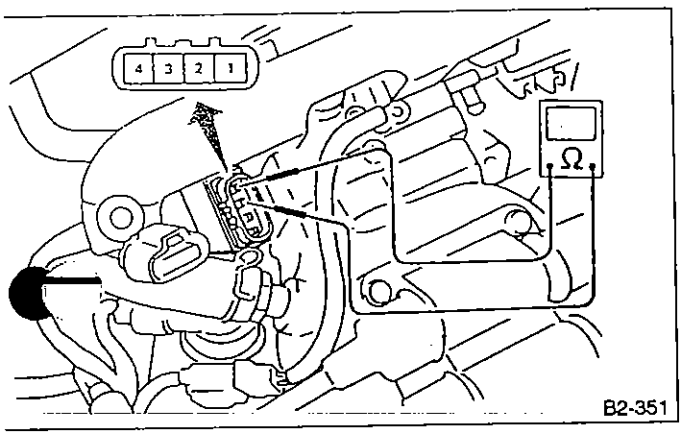


Fig. 92

3) If resistance is outside specifications, adjust idle switch as follows (Before replacement of throttle sensor):
Insert a thickness gauge between the stopper screw of the throttle body and the stopper (Portion G), and check for continuity between terminal No. 1 and No. 2.
(1) Make sure that No.1 and No. 2 are conducting when the throttle is closed fully.
(2) Make sure that No. 1 and No. 2 are conducting when the thickness gauge is 0.7 mm (0.028 in).
(3) Make sure that No. 1 and No. 2 are not conducting when the thickness gauge is 0.9 mm (0.035 in).
(4) If the above standards are not satisfied, loosen the screws (two) securing the throttle sensor to the throttle body, and turn the throttle sensor main body until the correct adjustment is obtained.

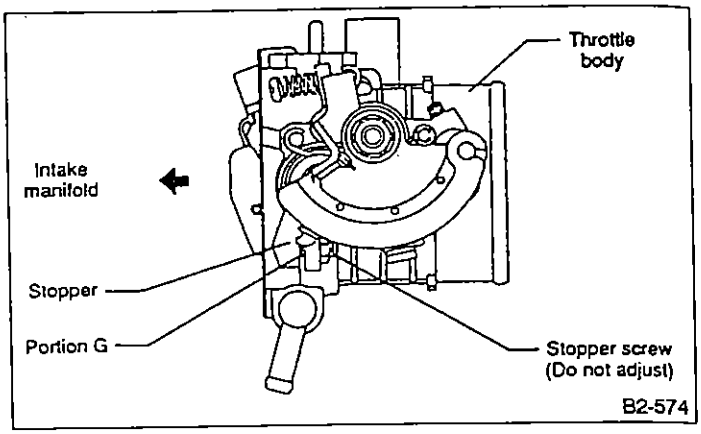


Fig. 93

3. Check harness connector between ECU and idle switch.

1) Disconnect connectors from ECU and throttle sensor.
2) Measure resistance between ECU connector and throttle sensor connector.

Connector & Terminal/Specified resistance:
(B56) No. 6 — (E8) No. 1/0 Ω
(B58) No. 1 — (E8) No. 2/0 Ω

3) Measure resistance between throttle sensor connector and body.

Connector & Terminal/Specified resistance:
(E8) No. 1 — Body/1 MΩ min.
No. 2 — Body/1 MΩ min.

O: TROUBLE CODE (45) — ATMOSPHERIC PRESSURE SENSOR [Non-TURBO] —

CONTENT OF DIAGNOSIS:
Faulty atmospheric pressure sensor inside ECU

TROUBLE SYMPTOM:
- Erroneous idling
- Failure of engine to start

When trouble code 45 appears on display, replace ECU.

P: TROUBLE CODE (49) — AIR FLOW SENSOR —

CONTENT OF DIAGNOSIS:
Use of improper air flow sensor

TROUBLE SYMPTOM:
- Erroneous idling
- Failure of engine to start

When trouble code 49 appears on display, check the specifications of air flow sensor and ECU. Replace air flow sensor (or ECU) with one of a proper type.
- Non-TURBO model : Hot film type air flow sensor (JECS)
- TURBO model : Hot wire type air flow sensor (HITACHI)

Q: TROUBLE CODE (51) — NEUTRAL SWITCH (MT) —

CONTENT OF DIAGNOSIS:
Abnormal signal entered from neutral switch

TROUBLE SYMPTOM:
Erroneous idling

1. Check voltage between ECU and body.
   - OK → Repair ECU terminal poor contact. (Replace ECU.)
   - Not OK ↓
2. Check neutral switch.
   - Not OK → Replace neutral switch.
   - OK ↓
3. Check harness connector between ECU and neutral switch.
   - Not OK → Repair harness/connector.
   - OK ↓

Repair ECU terminal. Repair contact. (Replace ECU.)

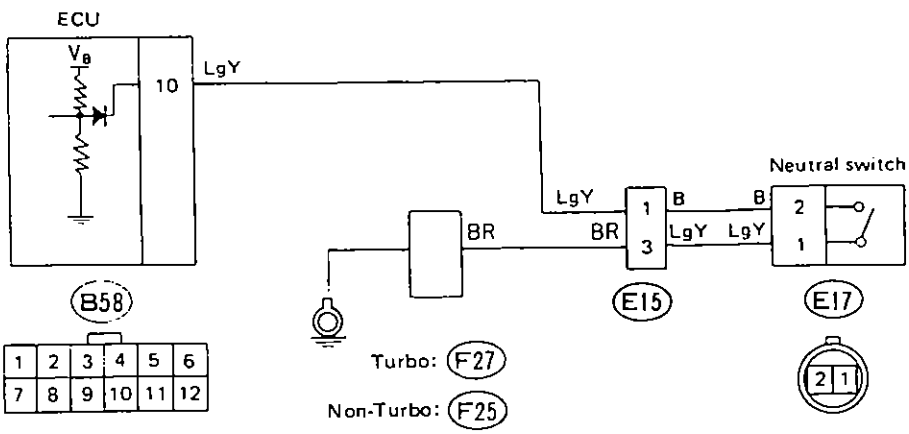


Fig. 94

1. Check voltage between ECU and body.

1) Turn ignition switch to "ON."
2) Measure voltage between ECU connector terminal and body.

Connector & Terminal/Specified voltage:
(B58) No. 10 — Body/Approx. 8 V, min. (Neutral position)
0 V (Other than neutral position)

2. Check neutral switch.

1) Disconnect transmission connectors.
2) Measure resistance between neutral switch terminals while shifting shift lever from Neutral to any other position.

Connector & Terminal / Specified resistance:
(E15) No. 1 — No. 3 / 1 MΩ min. (Neutral position)
0 Ω (Other than neutral position)

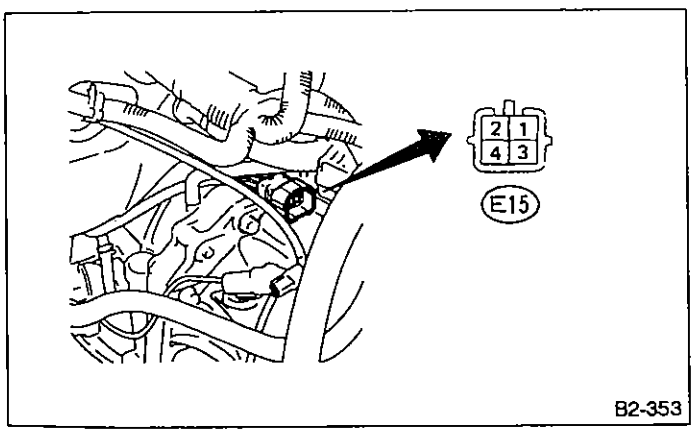


Fig. 95

3. Check harness connector between ECU and neutral switch.

1) Disconnect connectors from ECU and neutral switch.
2) Measure resistance between ECU connector and neutral switch connector.

Connector & Terminal/Specified resistance:
(B58) No. 10 — (E17) No. 2/0 Ω

3) Measure resistance between neutral switch connector and body.

Connector & Terminal/Specified resistance:
(E17) No. 1 — Body/1 MΩ min.
(E17) No. 2 — Body/0 Ω

R: TROUBLE CODE (51) — INHIBITOR SWITCH (AT) —

CONTENT OF DIAGNOSIS:
Abnormal signal entered from inhibitor switch

TROUBLE SYMPTOM:
Erroneous idling

1. Check voltage between ECU and body.
   - OK → Repair ECU terminal poor contact. (Replace ECU.)
   - Not OK ↓
2. Check inhibitor switch.
   - Not OK → Adjust inhibitor switch Neutral position.
   - OK ↓
3. Check harness connector between ECU and inhibitor switch.
   - Not OK → Repair harness/connector.
   - OK ↓

Repair ECU terminal poor contact. (Replace ECU.)

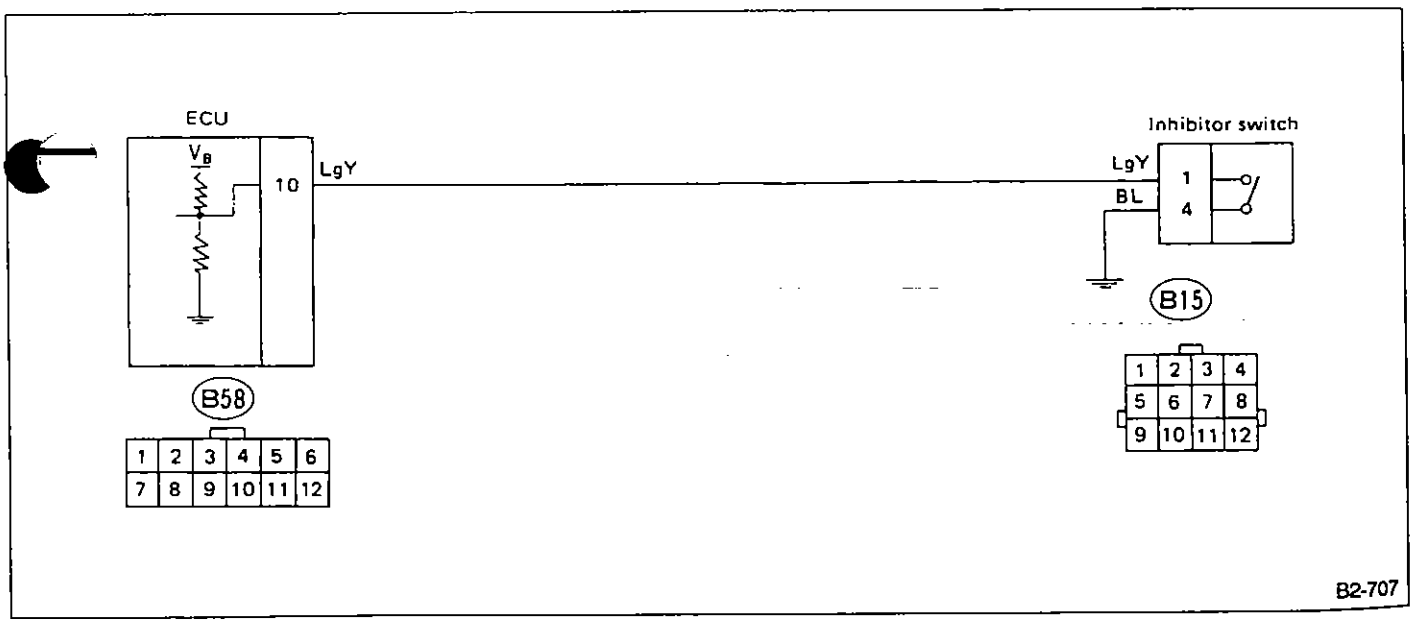


Fig. 96

1. Check voltage between ECU and body.

1) Turn ignition switch to "ON."
2) Measure voltage between ECU connector terminal and body.

Connector & Terminal/Specified voltage:
(B58) No. 10 — Body/0 V (N Range)
8 V, min. (Other than N Range)

2. Check inhibitor switch.

1) Disconnect transmission connectors.
2) Measure resistance between inhibitor switch terminals while shifting select lever from Neutral to any other position.

Connector & Terminal/Specified resistance:
(E18) No. 1 — No. 4/ 0 Ω (N Range)
1 MΩ min. (Other than N Range)

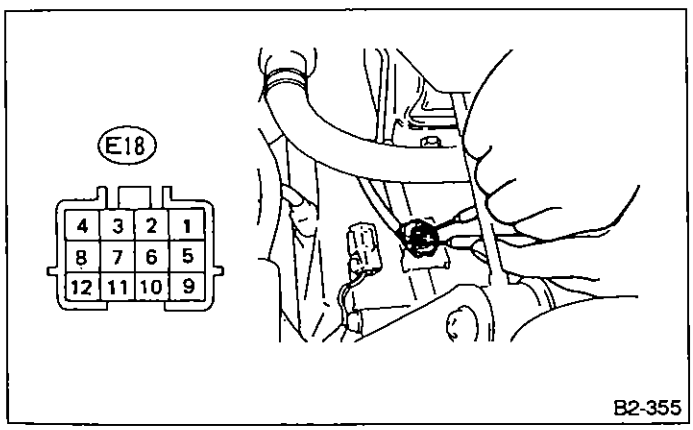


Fig. 97

3. Check harness connector between ECU and inhibitor switch.

1) Disconnect connectors from ECU and inhibitor switch.
2) Measure resistance between ECU connector and inhibitor switch connector.

Connector & Terminal/Specified resistance:
(B58) No. 10 — (B15) No. 1/0 Ω

3) Measure resistance between inhibitor switch connector and body.

Connector & Terminal/Specified resistance:
(B15) No. 1 — Body/1 MΩ min.
(B15) No. 4 — Body/0 Ω

S: TROUBLE CODE (52) — PARKING SWITCH (AT) —

:ONTENT OF DIAGNOSIS:
\bnormal signal entered from parking switch

TROUBLE SYMPTOM:
- Erroneous idling
- Poor warm-up performance with select lever in "P"

1. Check voltage between ECU and body.
   - OK → Repair ECU terminal poor contact. (Replace ECU.)
   - Not OK ↓
2. Check inhibitor switch.
   - Not OK → Replace inhibitor switch or adjust inhibitor switch Neutral position.
   - OK ↓
3. Check harness connectors between ECU and inhibitor switch, and between inhibitor switch and GND.
   - Not OK → Repair harness connector.
   - OK ↓

Repair ECU terminal poor contact. (Replace ECU.)

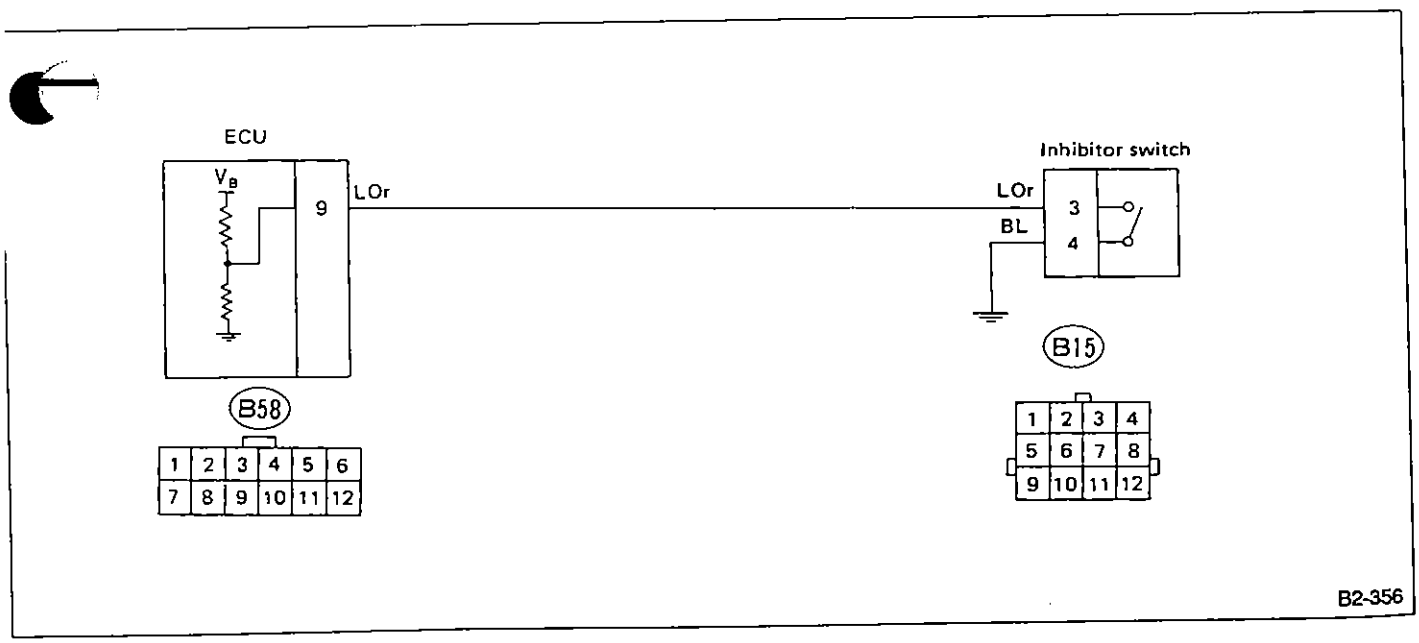


Fig. 98

1. Check voltage between ECU and body.

1) Turn ignition switch to "ON."
2) Measure voltage between ECU connector terminal and body.

Connector & Terminal/Specified voltage:
(B58) No. 9 — Body/Approx. 0 V (P Range)
8 V, min. (Other than P Range)

2. Check inhibitor switch.

1) Disconnect connector from inhibitor switch.
2) Measure resistance between inhibitor switch terminals while shifting select lever from Neutral to any other position.

Connector & Terminal/Specified resistance:
(E18) No. 3 — No. 4/ 0 Ω(P Range)
1 MΩ, min. (Other than P Range)

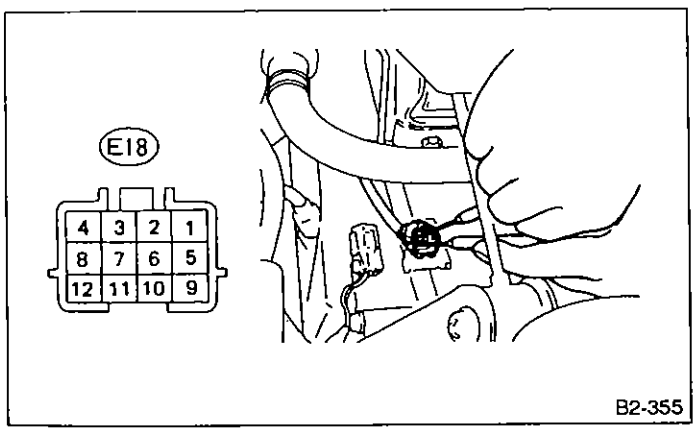


Fig. 99

3. Check harness connector between ECU and inhibitor switch.

1) Disconnect connectors from ECU and inhibitor switch.
2) Measure resistance between ECU connector and inhibitor switch connector.

Connector & Terminal/Specified resistance:
(B58) No. 9 — (B15) No. 3/0 Ω

3) Measure resistance between inhibitor switch connector and body.

Connector & Terminal/Specified resistance:
(B15) No. 3 — Body/1 MΩ min.
(B15) No. 4 — Body/0 Ω

T: TROUBLE CODE (44) — WASTEGATE CONTROL SOLENOID VALVE [TURBO] —

CONTENT OF DIAGNOSIS:
Wastegate control solenoid valve inoperative.

TROUBLE SYMPTOM:
Poor driving performance

1. Check voltage between ECU and body.
   - OK → Repair ECU terminal poor contact. (Replace ECU.)
   - Not OK ↓
2. Check wastegate control solenoid valve.
   - Not OK → Replace solenoid valve.
   - OK ↓
3. Check harness connector between ECU and solenoid valve.
   - Not OK → Repair harness/connector.
   - OK ↓

Repair ECU terminal poor contact.
(Replace ECU.)

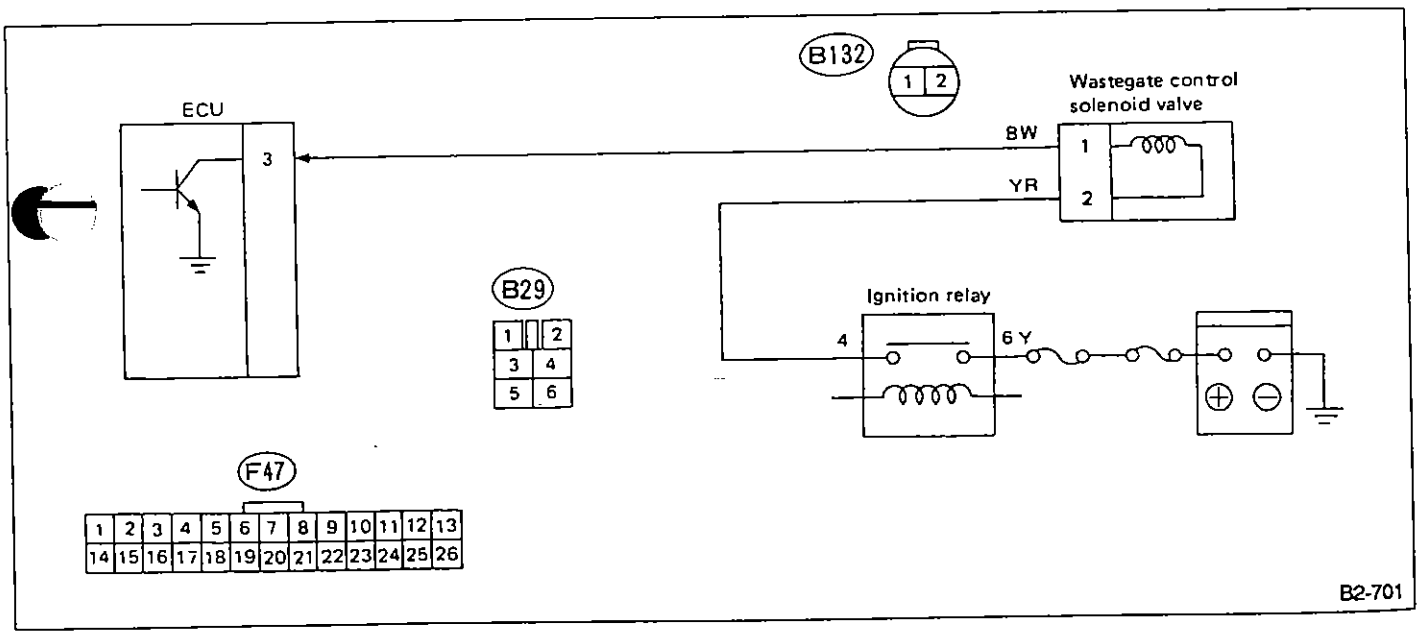


Fig. 100

1. Check voltage between ECU and body.

1) Turn ignition switch to "ON".
2) Measure voltage between ECU connector terminal and body.

Connector & Terminal/Specified voltage:
(F47) No. 3 — Body/10 V, min.

2. Check wastegate control solenoid valve.

1) Disconnect connector from wastegate control solenoid valve.
2) Measure resistance between wastegate control solenoid valve terminals.

Terminal/Specified resistance:
No. 1 — No. 2/20 Ω

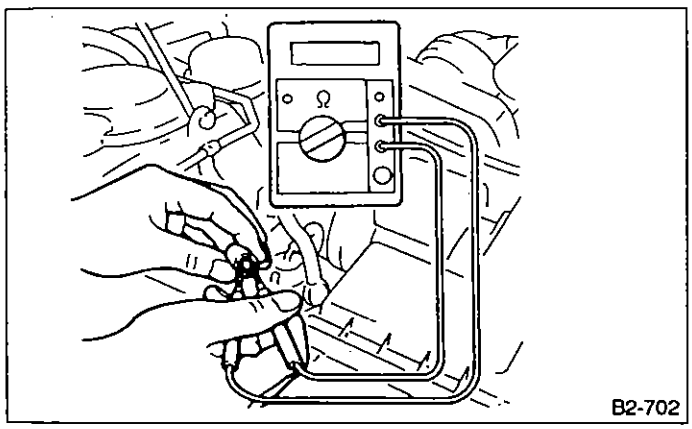


Fig. 101

3. Check harness connector between ECU and wastegate control solenoid valve.

1) Disconnect connector from ECU and wastegate control solenoid valve.
2) Check continuity between ECU connector and solenoid valve connector.

Connector & Terminal/Specified resistance:
(F47) No. 3 — (B132) No. 1/0 Ω

3) Measure resistance between ECU connector and body.

Connector & Terminal/Specified resistance:
(F47) No. 3 — Body/1 MΩ min.

4) Measure resistance between solenoid valve connector and body.

Connector & Terminal/Specified resistance:
(B132) No. 1 — Body/1 MΩ min.

5) Disconnect connector from solenoid valve and ignition relay.
6) Measure resistance between solenoid valve connector and ignition relay connector.

Connector & Terminal/Specified resistance:
(B132) No. 2 — (B29) No. 4/0 Ω

U: TROUBLE CODE (45) — PRESSURE SENSOR, PRESSURE EXCHANGE SOLENOID VALVE [TURBO] —

CONTENT OF DIAGNOSIS:
Abnormal voltage input entered from pressure sensor
Solenoid valve inoperative

TROUBLE SYMPTOM:
Poor driving performance

1. Check rubber hose between pressure sensor and pressure exchange solenoid valve, and between pressure exchange solenoid valve and intake manifold.
   - Not OK → Repair rubber hose.
   - OK ↓
2. Check pressure sensor.
   - Not OK → Replace pressure sensor.
   - OK ↓
3. Check pressure exchange solenoid valve.
   - Not OK → Replace pressure exchange solenoid valve.
   - OK ↓
4. Check voltage between ECU and body.
   - OK → Repair ECU terminal poor contact. (Replace ECU.)
   - Not OK ↓
5. Check harness connector between ECU and pressure sensor.
   - Not OK → Repair harness/connector.
   - OK ↓
6. Check harness connector between ECU and pressure exchange solenoid valve.
   - Not OK → Repair harness/connector.
   - OK ↓
7. Check harness connector between pressure exchange solenoid valve and battery.
   - Not OK → Repair harness/connector.
   - OK ↓

Repair ECU terminal poor contact. (Replace ECU.)

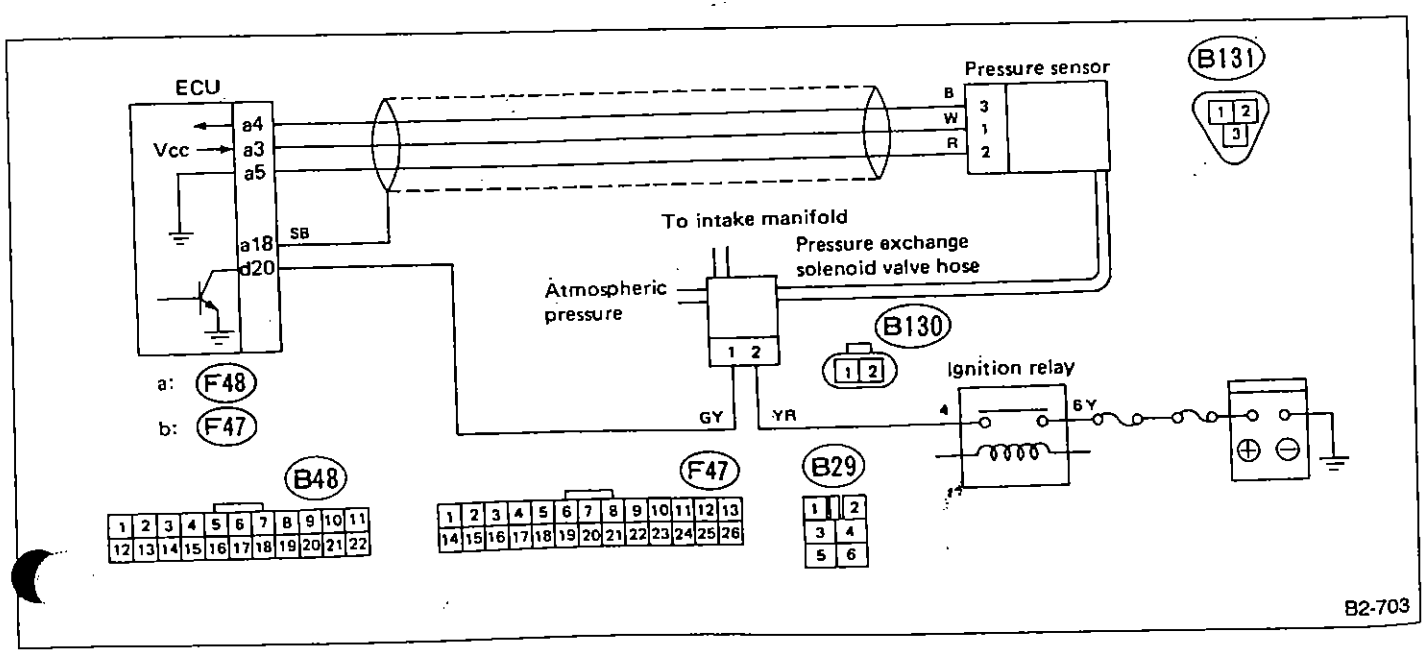


Fig. 102

1. Check rubber hose between pressure sensor and pressure exchange solenoid valve, and between pressure exchange solenoid valve and intake manifold.

1) Visually check the connection between pressure sensor and rubber hose, between pressure exchange solenoid valve and rubber hose, and between intake manifold and rubber hose.
2) Check rubber hose for cracks and damage.

2. Check pressure sensor.

1) Disconnect connector from pressure sensor.
2) Apply 5-volt voltage across terminals No. 1 and No. 2, then connect terminal No. 1 to positive side and terminal No. 2 to negative side.
3) Install vacuum pump to hose fitting on pressure sensor.
4) Measure voltage across terminals when pressure is applied to pressure sensor.

Connector & Terminal/Specified voltage:
(B131) No. 2 — No. 3/3.1 V at 26.7 kPa (200 mmHg, 7.87 inHg)
2.6 V at 0 kPa (0 mmHg, 0 inHg)
2.1 V at – 26.7 kPa (– 200 mmHg, – 7.87 inHg)

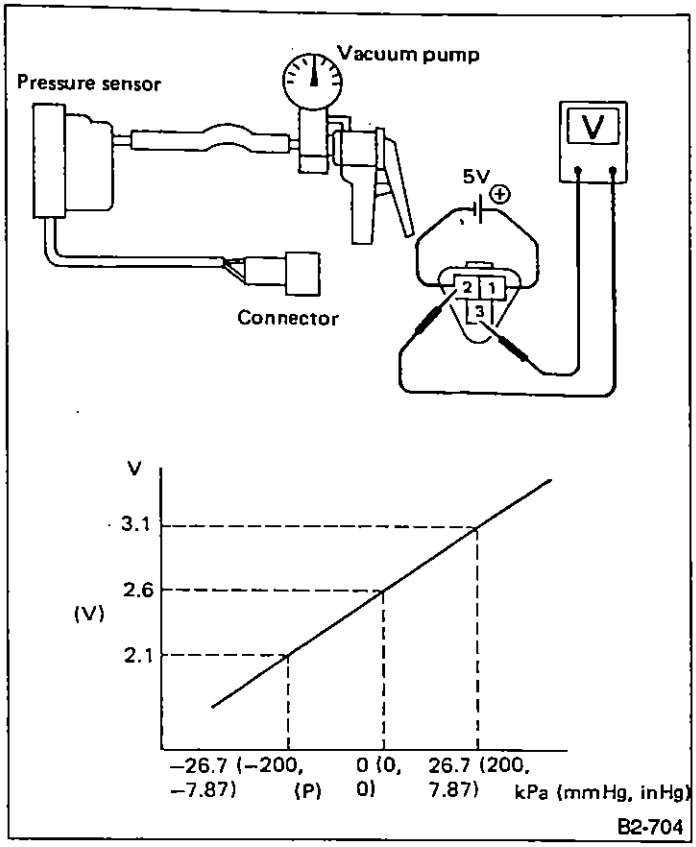


Fig. 103

3. Check pressure exchange solenoid valve.

1) Disconnect connector from pressure exchange solenoid valve.
2) Measure resistance across terminals.

Connector & Terminal/Specified resistance:
(B130) No. 1 — No. 2/37 ↔ 48 Ω

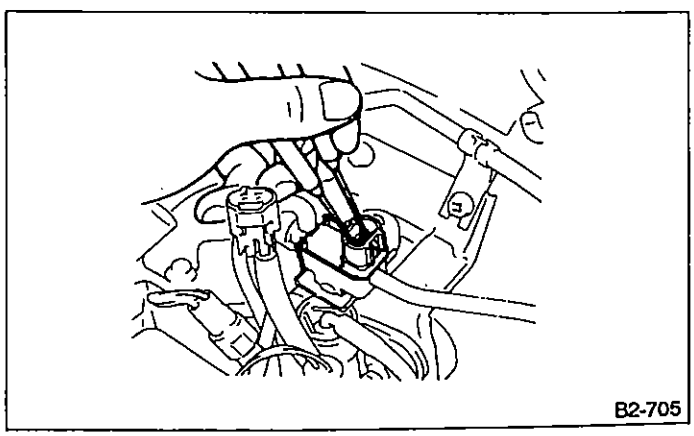


Fig. 104

. Check voltage between ECU and body.

) Connect connector and rubber hose to pressure

ect connectors to pressure exchange solenoid alve.

) Turn ignition switch to "ON".

) Measure voltage between ECU connector terminal nd body.

:onnector & Terminal/Specified voltage:
(B48) No. 3 — Body/5 V
(B48) No. 4 — Body/2.4 — 2.7 V
(B48) No. 5 — Body/0 V
(F47) No. 20 — Body/0 V or 10 — 13 V

i. Check harness connector between ECU and pressure sensor.

:) Disconnect connectors from ECU and pressure sen-ior.

2) Measure resistance between ECU connector and pressure sensor connector.

Connector & Terminal/Specified resistance:
(B48) No. 3 — (B131) No. 1/0 Ω
(B48) No. 4 — (B131) No. 3/0 Ω
(B48) No. 5 — (B131) No. 2/0 Ω

sure resistance between ECU connector terminal and body.

Connector & Terminal/Specified resistance:
(B48) No. 3 — Body/1 MΩ min.
(B48) No. 4 — Body/1 MΩ min.
(B48) No. 5 — Body/1 MΩ min.

6. Check harness connector between ECU and pressure exchange solenoid valve.

1) Disconnect connectors from ECU and pressure exchange solenoid valve.

2) Measure resistance between ECU connector and pressure exchange solenoid valve connector.

Connector & Terminal/Specified resistance:
(F47) No. 20 — (B130) No. 1/0 Ω

3) Measure resistance between ECU connector terminal and body.

Connector & Terminal/Specified resistance:
(F47) No. 20 — Body/1 MΩ min.

7. Check harness connector between pressure exchange solenoid valve and battery.

1) Disconnect connectors from pressure exchange solenoid valve and ignition relay.

2) Measure resistance between pressure exchange solenoid valve connector and ignition relay connector.

Connector & Terminal/Specified resistance:
(B29) No. 4 — (B130) No. 2/0 Ω

9. Troubleshooting Chart with Select Monitor

BASIC TROUBLESHOOTING CHART

If no trouble codes appear in the Read Memory, U-Check or D-check mode (although problems have occurred or are occurring), measure performance characteristics of sensors, actuators, etc., in the "F" mode (select-monitor function), and compare with the "basic data" to determine the cause of problems.

Applicable cartridge of select monitor: No. 498348800 (TURBO and Non-TURBO)

Problem occurs No trouble codes appear in Read Memory, U-Check or D-check mode.

↓

Measure each item in "F" mode (select-monitor function).

↓

Refer to "General Troubleshooting Table" [T900] for inspection order.

↓

Compare measured value with "specified data." Determine item which is outside "specified data".

↓

* Check sensor or actuator corresponding with item outside "specified data."

↓

*When item is not constantly outside "specified data," problem may be due to poor harness contact. Disconnect or connect affected sensor/actuator connector or shake its harness to check if trouble code appears.

A: MODE F01 — Battery voltage (VB) —

CONDITION:
(1) Ignition switch "ON"
(2) Idling after warm-up

SPECIFIED DATA:
10 — 13 V (Ignition switch ON, engine OFF)
13 — 14 V (Engine at idle)

- Probable cause (item outside specified data)

1.	Battery	→ Check battery voltage and electrolyte's specific gravity.
2.	Charging system	→ • Check regulating voltage. (under no load) • Check alternator.

B: MODE F02 — Vehicle speed signal (VSP) —

CONDITION:
Raise vehicle until all wheels are off ground, and support with safety stands. Operate vehicle at constant speed.

SPECIFICATION DATA:
Compare speedometer with monitor indications. Probable cause (if indications are different)

- Probable cause (item outside specified data)

1.	Vehicle speed sensor 2	→ Check if sensor is in operation. (Refer to [T7KO].) ↓ OK Replace ECU.

F03 = Vehicle speed signal: Vehicle speed is indicated in kilometer per hour (km/h).

C: MODE F04 — Engine speed (EREV) —

CONDITION:
Operate engine at constant speed.

SPECIFIED DATA:
Compare engine speeds indicated on engine tester monitor.

- Probable cause (if outside specified data)

1.	Cam angle sensor	→ Check cam angle sensor output signal. (Refer to [T7C0])
2.	Crank angle sensor	→ Check crank angle sensor output signal.

OK ↓

Check crank angle sensor output signal.

OK ↓

Replace ECU.

D: MODE F06 — Water temperature sensor signal (TW) —

CONDITION:
Idling after warm-up

SPECIFIED DATA:
80 — 95 deg C

- Probable cause (if outside specified data)

1.	Water temperature sensor	→ Check water temperature sensor. (Refer to [T7E0].)

OK ↓

Replace ECU.

F05 = Water temperature signal (TW): To be indicated in "deg F".

E: MODE F07 — Ignition timing —

CONDITION:
(1) While idling after warm-up
(2) Gear in neutral position

SPECIFIED DATA:
12 deg — 28 deg (Non-TURBO model)

9 deg — 21 deg (TURBO model, Neutral SW OFF)
15 deg (TURBO model, Neutral SW ON)

• Probable cause (if items outside specified data)

1.	L Data (specified amount of fuel injection)	Check "F09" mode (engine under loads).
		↓ OK
2.	Air flow sensor	Check "F08" mode (air flow signal)
		↓ OK
3.	Throttle sensor	Check throttle sensor. (Refer to [T7I0].)
		↓ OK
4.	Knock sensor	Check knock sensor. (Refer to [T7F0].)
		↓ OK
5.	Idle switch	Check idle switch. (Refer to [T7N0].)
		↓ OK
		Replace ECU.

F: MODE F08 — Air flow signal (QA) —

CONDITION:
Idling after warm-up

SPECIFIED DATA:
0.8 — 1.2 V

• Probable cause (if outside specified data)

1. Air flow sensor

→ Compare air flow sensor signal voltage with specified data QA.
(QA voltage equals air flow sensor signal voltage.)

Not OK ↓ OK

Not OK → Replace ECU.

OK → Replace air flow sensor.

G: MODE F09 — Engine under loads (L DATA) —

CONDITION:
Idling after warm-up

SPECIFIED DATA:
15 — 20 (Non-TURBO)
30 — 50 (TURBO)

• Probable cause (if outside specified data)

1. Air flow sensor → Check "F08" mode.
2. Engine speed (rpm) → Check "F04" mode.
3. Cam angle sensor → Check cam angle sensor. (Refer to [T7C0].)
4. Crank angle sensor → Check crank angle sensor. (Refer to [T7A0].)

→ Replace ECU.

H: MODE F10 — Throttle sensor signal

CONDITION:
Check while changing from "fully-closed" to "fully-open" throttle valve.

SPECIFIED DATA:
4.7 V → 1.6 V
*Engine throttle change must be smooth.

- Probable cause (if outside specified data)

1.	Throttle sensor	→ Check throttle sensor. (Refer to [T7I0].) ↓ OK Replace ECU.

I: MODE F11 — Fuel injection duration (TIM)

CONDITION:
Idling after warm-up

SPECIFIED DATA:
3.0 — 3.7 ms (Non-TURBO)
2.0 — 3.5 ms (TURBO)

- Probable cause (if outside specified data)

1.	Engine under load (L DATA)	Check "F09" mode.
2.	Correction coefficient of air-fuel ratio (ALPHA)	Check "F16" mode.
3.	Water temperature sensor	Check "F06" mode .
4.	O_2 sensor	Check "F13" mode.
5.	Idle switch	Check idle switch. (Refer to [T7M0].)
6.	Vehicle speed sensor 2	Check "F03" mode .
7.	Air flow sensor	Check "F08" mode .
8.	By-pass air control solenoid valve	Check "F12" mode .
9.	Battery voltage	Check "F01" mode.

OK

J: MODE F12 — By-pass air control solenoid valve (ISC)

CONDITIONS:
(1) Idling after warm-up
(2) Air conditioner 'OFF'
(3) Radiator fan 'OFF'
(4) Battery voltage: Greater than 13 volts
(5) Sea level (Not height altitudes)

SPECIFIED DATA:
25 — 40 % (Non-TURBO)
30 — 45% (TURBO)

- Probable cause (if outside specified data)

1.	Water temperature sensor	Check "F06" mode.
		↓ OK
2.	Idle switch	Check idle switch. (Refer to [T7M0].)
		↓ OK
3.	Neutral switch	Check neutral switch. (Refer to [T7P0].)
		↓ OK
4.	Parking switch	Check parking switch. (Refer to [T7R0].)
		↓ OK
		Replace ECU.

K: MODE F13 — O_2 sensor (O_2)

CONDITION:
Idling after warm-up

SPECIFIED DATA:
0 — 1.0 V

- Probable cause (if outside specified data)

1.	Duration of fuel injection (TIM)	Check "F11" mode.
		↓ OK
2.	O_2 sensor	Check O_2 sensor. (Refer to [T7J0].)
		↓ OK
		Replace ECU.

L: MODE F14 — Maximum O_2 sensor signal voltage (O_2 Max.)

CONDITION:
Idling after warm-up

SPECIFIED DATA:
0.7 — 1.0 V

- Probable cause (if outside specified data)

1. Duration of fuel injection (TIM) → Check "F11" mode.
   OK
2. O_2 sensor → Check O_2 sensor. (Refer to [T7J0].)
   OK
   Replace ECU.

M: MODE F15 — Minimum O_2 sensor signal voltage (O_2 Min.)

CONDITION:
Idling after warm-up

SPECIFIED DATA:
0 — 0.2 V

- Probable cause (if outside date)

1. Duration of fuel injection (TIM) → Check "F11" mode.
   OK
2. O_2 sensor → Check O_2 sensor. (Refer to [T7J0].)
   OK
   Replace ECU.

N: MODE F16 — Correction coefficient of air-fuel ratio (ALPHA)

CONDITION:
Idling after warm-up

SPECIFIED DATA:
— 1.6 to + 1.6

- Probable cause (if outside specified data)

1. O_2 sensor → Check "F13" mode.
   OK ↓
2. Air flow sensor → Check "F08" mode.
   OK ↓
3. Injector → Check "F11" mode.
   OK ↓
   Replace ECU.

O: MODE F17 — Correction value of ignition timing (RTRD)

CONDITION:

SPECIFIED DATA:
— 10 to + 10 deg

- Probable cause (if outside specified data)

1. Knock sensor → Check knock sensor. (Refer to [T7F0].)
   OK ↓
   Replace ECU.

P: MODE F19 — Atmospheric pressure (BARO. P) [Non-TURBO]

CONDITION:
Ground surface (not high altitudes)

SPECIFIED DATA:
*760 mmHg

*"—9 to 10 mmHg" changes at an altitude of 100 meters.

- Probable cause (if outside specified data)

1.	Atmospheric sensor	Replace ECU.

Q: MODE F18 — Wastegate control duty (WGC) [TURBO] —

CONDITION:
When engine is running

SPECIFIED DATA:
*16% (at 6,000 rpm) — 70% (at idle)

*Not high altitudes

• Probable cause (if outside specified data)

1. Atmospheric pressure or Intake manifold pressure → Check "F19" mode.
   - OK → Check "F20" mode.
   - OK → Check "F10" mode.
   - OK → Replace ECU.

2. Throttle sensor → Check "F10" mode.
   - OK → Replace ECU.

R: MODE F19 — Atmospheric pressure (BARO. P) [TURBO] —

CONDITION:
At sea level surface (not high altitudes)
Engine at idle

SPECIFIED DATA:
*760 mmHg

*"– 9 to 10 mmHg" changes at an altitude of 100 meters.

• Probable cause (if outside specified data)

1. Pressure sensor → Check pressure sensor. (Refer to [T7T0].)
   - OK → Check pressure exchange solenoid valve. (Refer to [T7T0].)
   - OK → Replace ECU.

2. Pressure exchange solenoid valve → Check pressure exchange solenoid valve. (Refer to [T7T0].)
   - OK → Replace ECU.

S: MODE F20 — Intake manifold pressure (MANI. P) [TURBO] —

CONDITION:
After warming up, engine at idle

SPECIFIED DATA:
– 400 to – 550 mmHg

• Probable cause (if outside specified data)

1.	Pressure sensor	Check pressure sensor. (Refer to [T7T0].)
2.	Pressure exchange solenoid valve	Check pressure exchange solenoid valve. (Refer to [T7T0].)

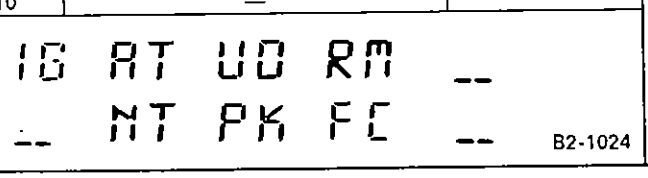
OK

OK

Replace ECU.

T: MODE FA0 — ON ↔ OFF SIGNAL —

Description		
LED No.	Signal name	Presentation
1	Ignition switch	IG
2	AT/MT discrimination	AT
3	Test mode	UD
4	Read memory	RM
5	—	—
6	—	—
7	Neutral switch	NT
8	Parking position switch	PK
9	Fed./Cal. discrimination	FC
10	—	—



B2-1024

Requirement for LED "ON"

1. Ignition switch is turned to "ON".
2. Vehicle is AT model.
3. Test mode connector is connected.
4. Read memory connector is connected.
7. Selector lever is in "N" position on AT model, or gear shift lever is in neutral position on MT model.
8. Selector lever is in "P" position [AT model].
9. 49-states and Canada model

Fig. 105

U: MODE FA1 — ON ↔ OFF SIGNAL —

Description		
	Signal name	Presentation
1	Idle switch	ID
2	A/C switch	AC
3	A/C relay	AR
4	Radiator fan	RF
5	—	—
6	Fuel pump relay	FP
7	Purge control solenoid valve	CN
8	Knock sensor	KS
9	Pressure exchange solenoid valve	BR
10	—	—

B2-1025

Requirement for LED "ON"

1. Throttle valve is fully closed.
2. A/C switch is turned to "ON".
3. A/C relay is in "ON".
4. Radiator fan is in operation.
6. Fuel pump relay is in operation.
7. Purge control solenoid valve is in operation.
8. Engine knocks occur.
9. Atmospheric pressure is being measured. (solenoid valve is in operation.)

Fig. 106

V: MODE FA3 — ON ↔ OFF SIGNAL —

Description			Requirement for LED "ON"
LED No.	Signal name	Presentation	
1	—	—	10. A/F ratio is rich
2	—	—	
3	—	—	
4	—	—	
5	—	—	
6	—	—	
7	—	—	
8	—	—	
9	—	—	
10	O_2 monitor	O2	

-- -- -- -- --
-- -- -- -- 02

B2-1026

Fig. 107

0. General Troubleshooting Table

riority of "parts to check" is shown by figures (1, 2, 3, ... 14).

Symptom	Parts to check	ECU power supply	Air flow sensor	Water temperature sensor	Idle switch	Throttle sensor	Fuel pump	Pressure regulator	Fuel injector	Igniter (power transistor)	Ignition coil	Spark plug	Knock sensor	Cam angle sensor	Crank angle sensor	By-pass air control solenoid valve	O_2 sensor	Waste-gate control solenoid valve
Failure of engine to start	Initial combustion does not occur.	1	10	11			5	6	7	2	3	4		8	9			
	Initial combustion occurs.	1		10			2	3	4	5	6	7		8	9	11		
	Engine stalls after initial combustion.	1	2	7		8	4	5	6	11	12	13		9	10	3		
	Rough idling	1	3	12	8	7	4	5	6	9	10	11		13	14	2	15	16
	Hard to drive at constant speed	1	4	6	8	7	3	2	9	12	13	14		10	11		5	15
	Poor acceleration/deceleration	1	2	6	7	8	3	4	5	13	14	15	9	11	12	10	10	2
	Poor return to idle			3	2											1		
	Backfire			3	4	5		6	7					2	1			
	Knocking		1	2				4	5				3		6			7
	Excessive fuel consumption		3	4				1	2									
	Shocks while driving	1	8						7	4	5	6		2	3			
	Poor engine revving		2	3	4	5		1										
Remarks		Include engine grounding circuit.														Check hoses.		Check hoses.

SUBARU®

1992

SERVICE MANUAL

S SPECIFICATIONS AND SERVICE DATA

SPECIFICATIONS

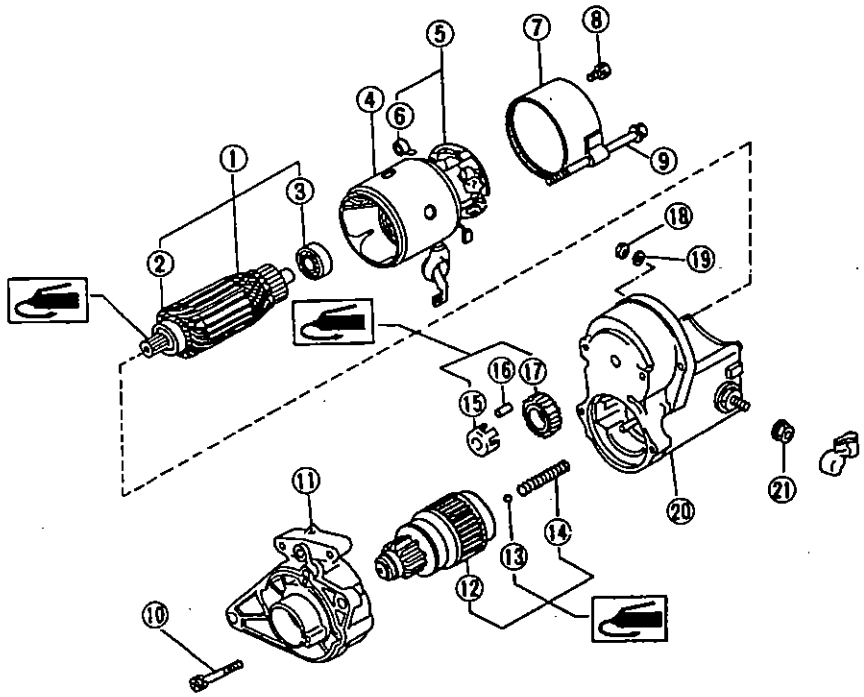
Item			Designation	
Starter	Type		Reduction type	
	Model		[MT] 128000-7190	[AT] 128000-7200
	Manufacturer		NIPPONDENSO	
	Voltage and Output		12 V — 1.0 kW	12 V — 1.4 kW
	Direction of rotation		Counterclockwise (when observed from pinion)	
	Number of pinion teeth		9	
	No-load characteristics	Voltage	11 V	
		Current	90 A or less	
		Rotating speed	3,000 rpm or more	3,350 rpm or more
	Load characteristics	Voltage	8 V	
		Current	280 A or less	370 A or less
		Torque	10 N•m (1.0 kg-m, 7 ft-lb)	14 N•m (1.4 kg-m, 10 ft-lb)
		Rotating speed	900 rpm or more	880 rpm or more
	Lock characteristics	Voltage	5 V	
		Current	800 A or loss	735 A or less
		Torque	27 N•m (2.8 kg-m, 20 ft-lb) or more	
Alternator	Type		Rotating-field three-phase type, Voltage regulator built-in type	
	Model		LR170-732B	
	Regulator type		TR1Z-102	
	Manufacturer		HITACHI	
	Voltage and Output		12 V — 85 A	
	Polarity on ground side		Negative	
	Rotating direction		Clockwise (when observed from pulley side)	
	Armature connection		3-phase Y-type	
	Rectifying system		Full wave rectification by six self-contained silicone diodes	
	Revolution speed at 13.5 V 20°C (68°F)		1,000 rpm or less	
	Output current		1,500 rpm — 33 A or more 3,000 rpm — 66 A or more 6,000 rpm — 80 A or more	
	Regulated voltage		14.1 — 14.7 V [20°C (68°F)]	

Item		Designation	
Ignition coil	Model	[MT] F-569-01R	[AT] CM12-100
	Manufacturer	DIAMOND	HITACHI
	Primary coil resistance	0.62 — 0.76 Ω	0.63 — 0.77 Ω
	Secondary coil resistance	17.9 — 24.5 kΩ	10.4 — 15.6 kΩ
	Insulation resistance between primary terminal and case	More than 50 MΩ	More than 10 MΩ
Spark plug	Type and Manufacturer	BKR6E-11 ..... NGK K2OPR-U11 ..... Nippondenso RC7YC4 ..... Champion	
	Thread size mm	14, P = 1.25	
	Spark gap mm (in)	1.0 — 1.1 (0.039 — 0.043)	

C COMPONENT PARTS

1. Starter

1. MT: 128000-7190



1 Armature
2 Ball bearing
3 Ball bearing
4 Yoke
5 Brush holder
6 Brush spring
7 End frame
8 Screw & washer
9 Through bolt
10 Screw & washer
11 Starter housing
12 Overrunning clutch
13 Steel ball
14 Spring
15 Retainer
16 Roller
17 Starter pinion
18 Nut
19 Spring washer
20 Magnet switch
21 Nut

B6-675

Fig. 1

2. AT: 128000-7200

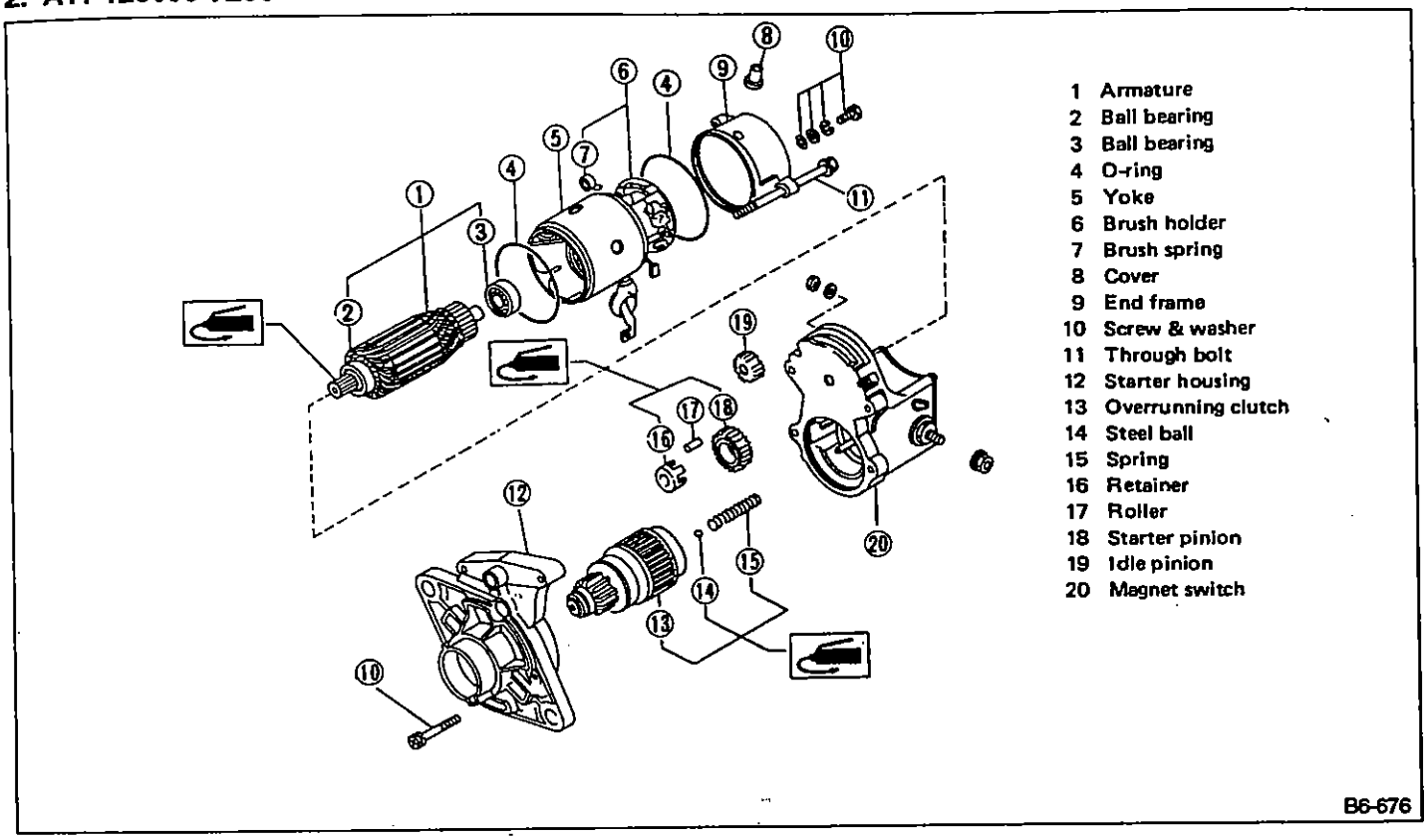
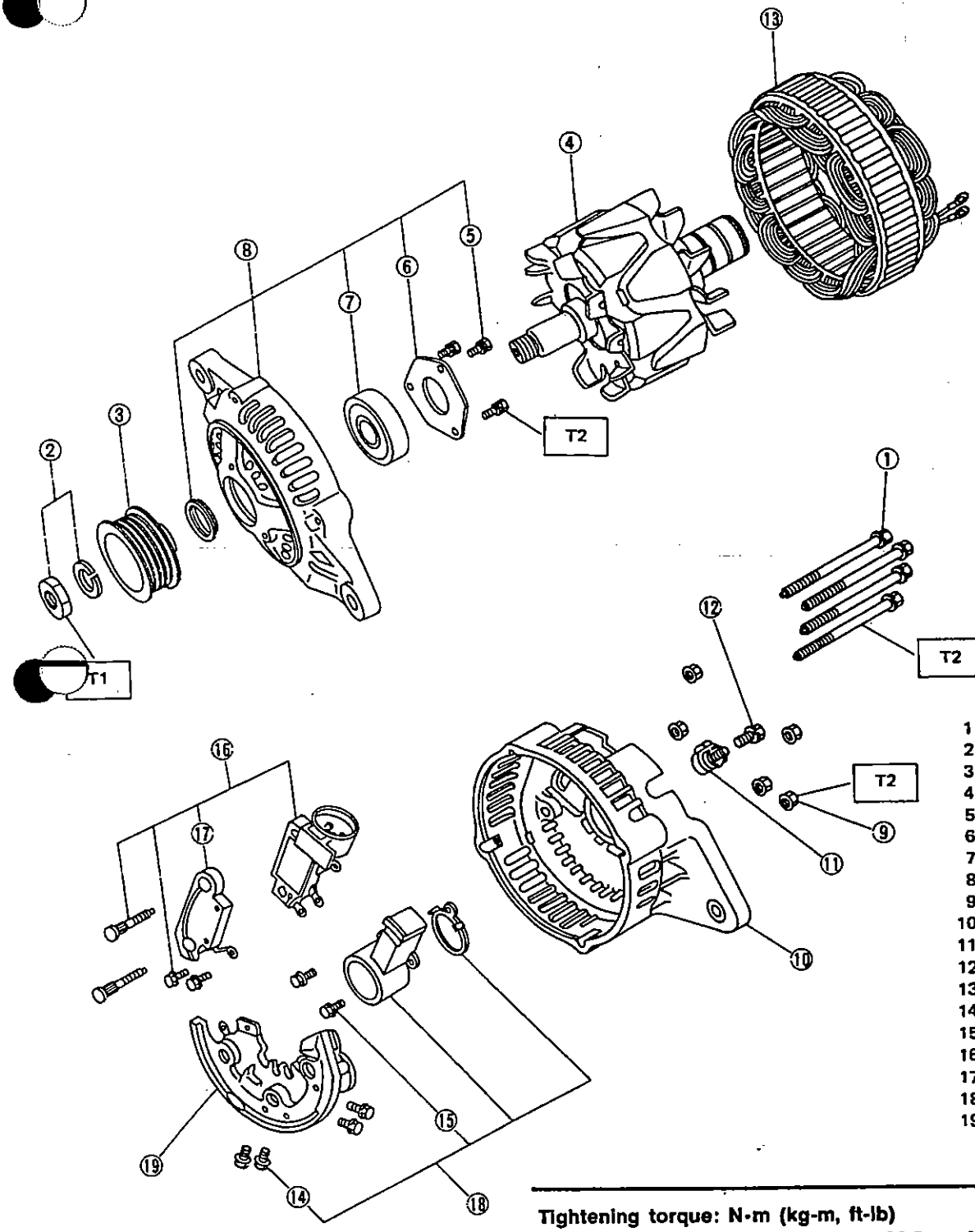


Fig. 2

2. Alternator



1 Through bolt
2 Pulley nut ASSY
3 Pulley
4 Rotor ASSY
5 Screw
6 Bearing retainer
7 Ball bearing
8 Front cover ASSY
9 Nut
10 Rear cover
11 BAT terminal bolt
12 Bolt
13 Stator
14 Bolt
15 Bolt
16 IC regulator ASSY
17 Condenser
18 Brush holder ASSY
19 Diode ASSY

Tightening torque: N·m (kg-m, ft-lb)
T1: 49.0 — 63.7 (5.00 — 6.50, 36.2 — 47.0)
T2: 3.1 — 3.9 (0.32 — 0.40, 2.3 — 2.9)

B6-030

Fig. 3

W SERVICE PROCEDURE

1. Starter

A: TEST

1. MAGNETIC SWITCH

a. The following magnetic switch tests should be performed with specified voltage applied.
b. Each test should be conducted within 3 to 5 seconds. Power to be furnished should be one-half the rated voltage.

1) Pull-in test
Connect two battery negative leads onto magnetic switch body and terminal C respectively. Then connect battery positive lead onto terminal 50. Pinion should extend when lead connections are made.

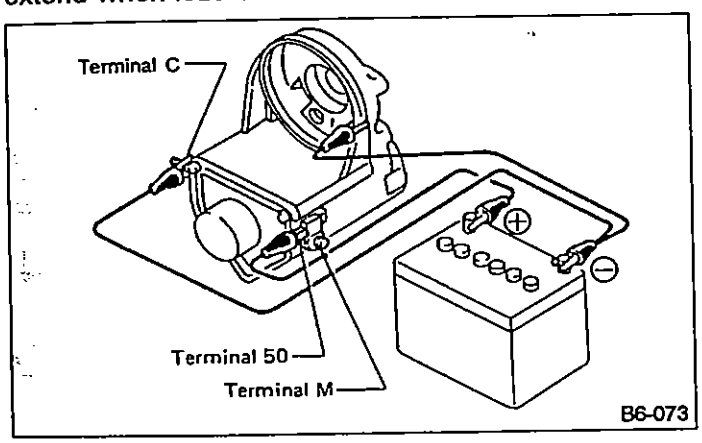


Fig. 4

2) Holding-in test
Disconnect lead from terminal C with pinion extended. Pinion should be held in the extended position.

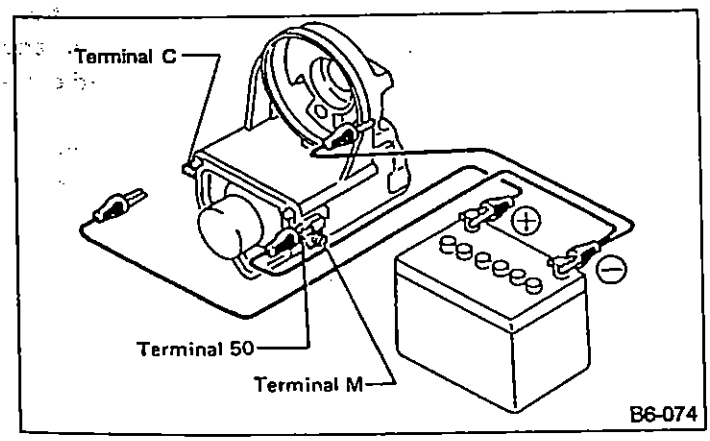


Fig. 5

3) Return test
Connect two battery negative leads onto terminal 50 and onto switch body respectively. Then connect battery positive lead onto terminal C. Next, disconnect lead from terminal 50. Pinion should return immediately.

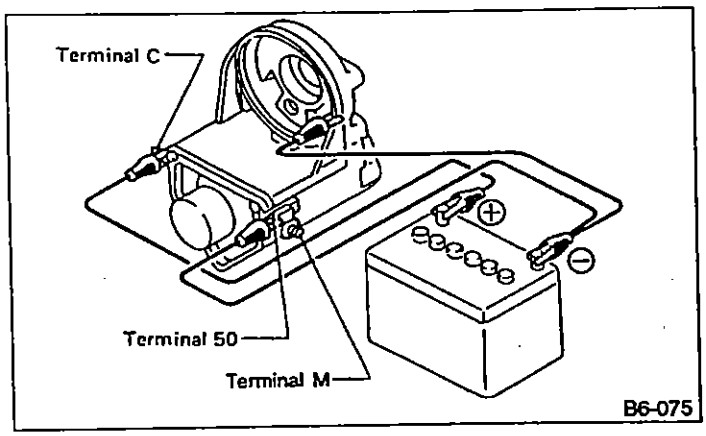


Fig. 6

2. PERFORMANCE TEST

The starter is required to produce a large torque and high rotating speed, but these starter characteristics vary with the capacity of the battery. It is therefore important to use a battery with the specified capacity whenever testing the starter.
The starter should be checked for the following three items.

1. No-load testMeasure the maximum rotating speed and current under a no-load state.
2. Load test: Measure the magnitude of current needed to generate the specified torque and rotating speed.
3. Stall test: Measure the torque and current when the armature is locked.

1) No-load test
Run single starter under no-load state, and measure its rotating speed, voltage, and current, using the specified battery. Measured values must meet the following standards:

No-load test (Standard):
Voltage/Current
11 V/90 A max.
Rotating speed
MT: 3,000 rpm min.
AT: 3,350 rpm min.

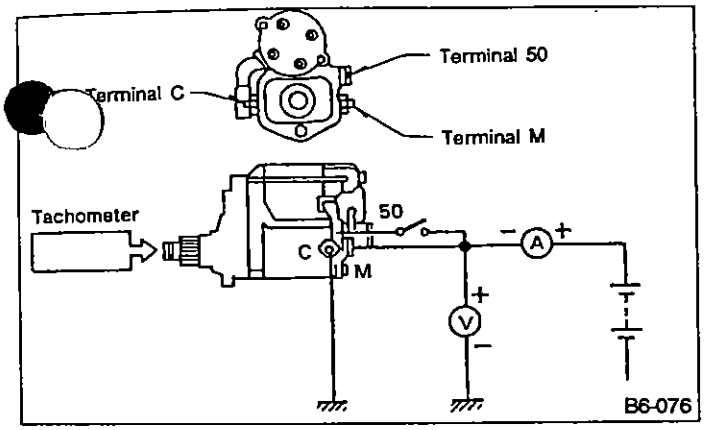


Fig. 7

2) Load test (For reference)
Perform this test to check maximum output of starter. Use test bench which is able to apply load (brake) to starter. Measure torque value and rotating speed under the specified voltage and current conditions while controlling braking force applied to starter.
Change engagement position of overrunning clutch and make sure it is not slipping.

Load test (Standard):

MT	**Voltage/Load**
	8 V/10 N•m (1.0 kg-m, 7 ft-lb)
	Current/Speed
	280 A max./900 rpm min.
	Voltage/Load
	8 V/14 N•m (1.4 kg-m, 10 ft-lb)
	Current/Speed
	370 A max./880 rpm min.

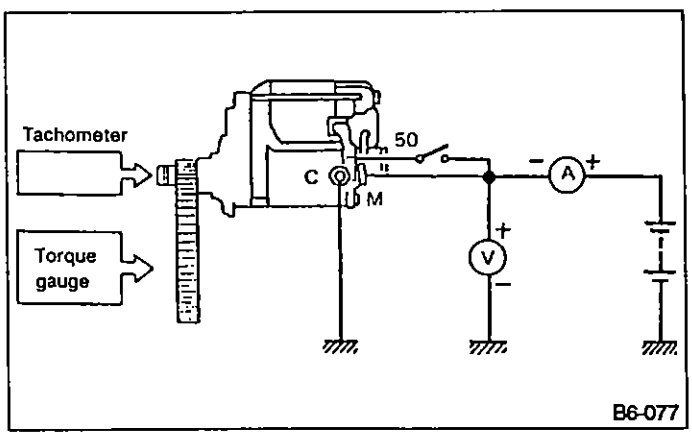


Fig. 8

3) Stall test
Using the same test equipment used for load test, apply brake to lock starter armature. Then measure voltage, current, and torque values.
Measured values must meet the following standard.

Stall test (Standard):

MT	**Voltage/Current**
	5 V/800A max.
	Torque
	27 N•m (2.8 kg-m, 20 ft-lb) min.
AT	**Voltage/Current**
	5 V/735 A max.
	Torque
	27 N•m (2.8 kg-m, 20 ft-lb) min.

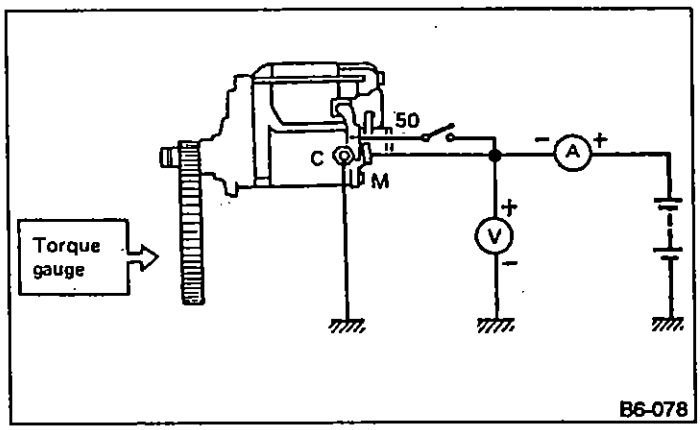


Fig. 9

Low rotating speed or excessive current during no-load test may be attributable to high rotating resistance of starter due to improper assembling.
Small current and no torque during stall test may be attributable to excessive contact resistance between brush and commutator; whereas, normal current and insufficient torque may be attributable to shorted commutator or poor insulation.
Starter can be considered normal if it passes no-load and stall tests; therefore, load test may be omitted.

B: DISASSEMBLY

1) Disconnect lead wire from magnetic switch.

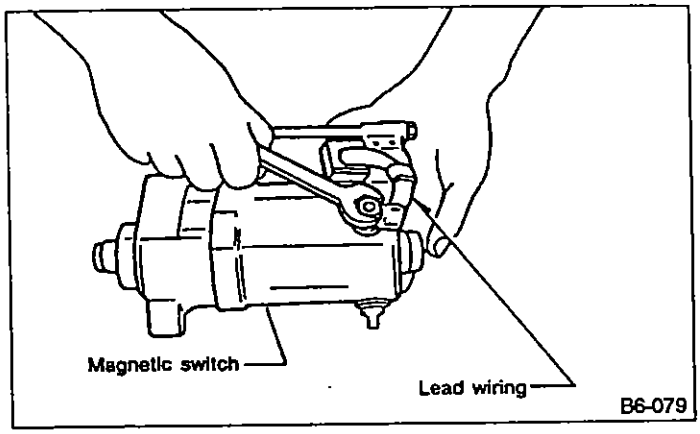


Fig. 10

2) Remove through-bolts from end frame.

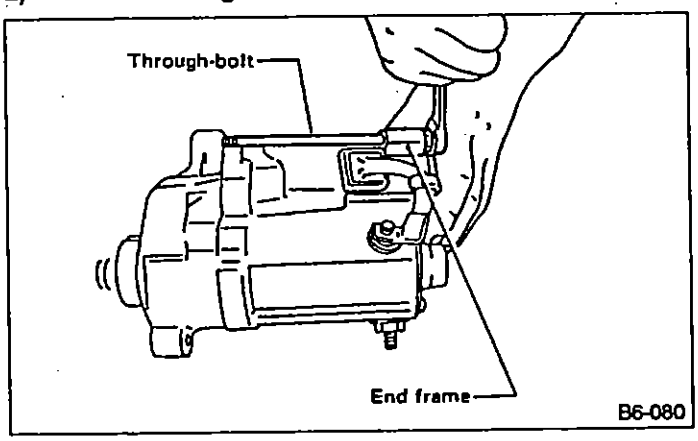


Fig. 11

3) Remove yoke from magnetic switch.

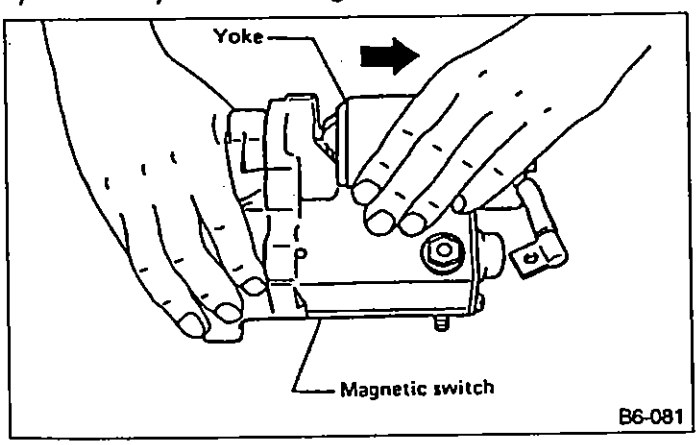


Fig. 12

4) Remove screws securing end frame to brush holder.

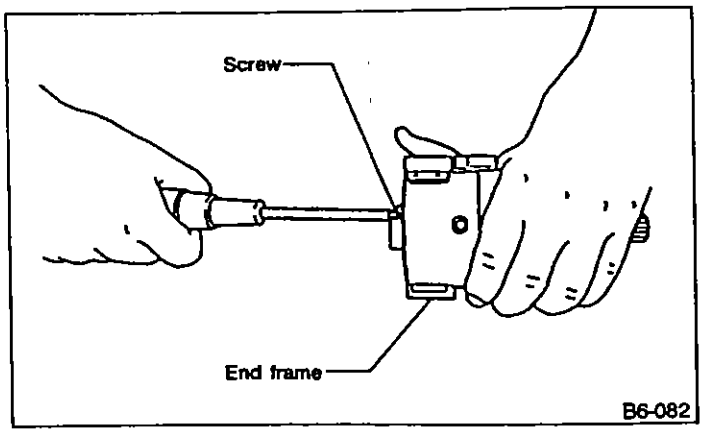


Fig. 13

5) Separate yoke from end frame.

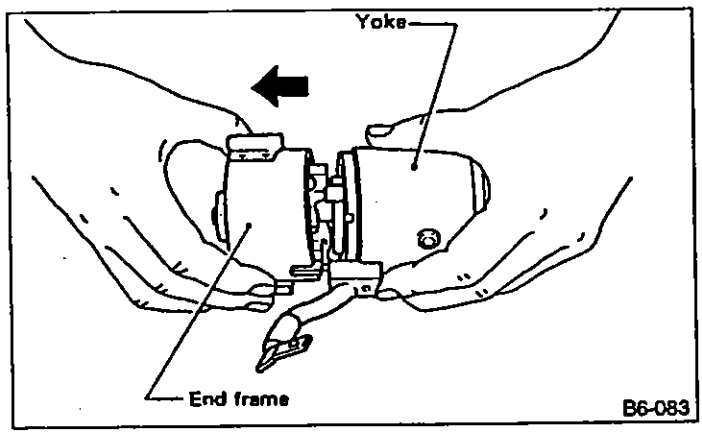


Fig. 14

6) Remove brush by lifting up positive (+) side brush spring using long-nose pliers.
Be careful not to damage brush and commutator.

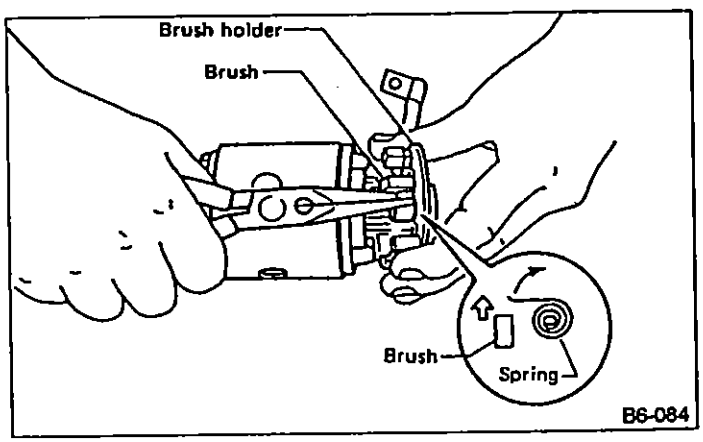


Fig. 15

7) Remove armature from yoke.
Be careful not to drop armature.

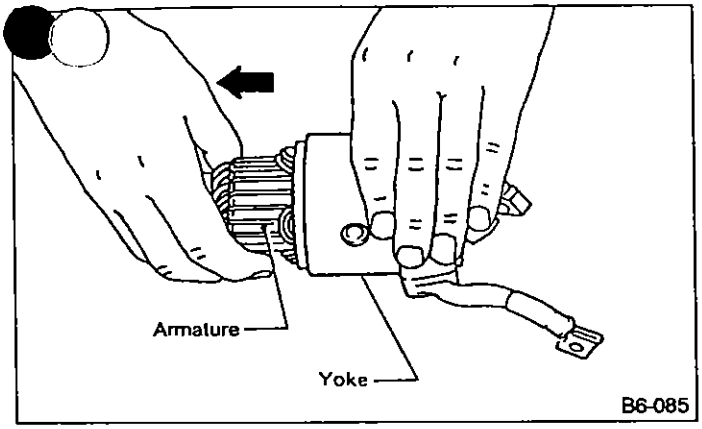


Fig. 16

8) Remove screws securing magnetic switch to housing.

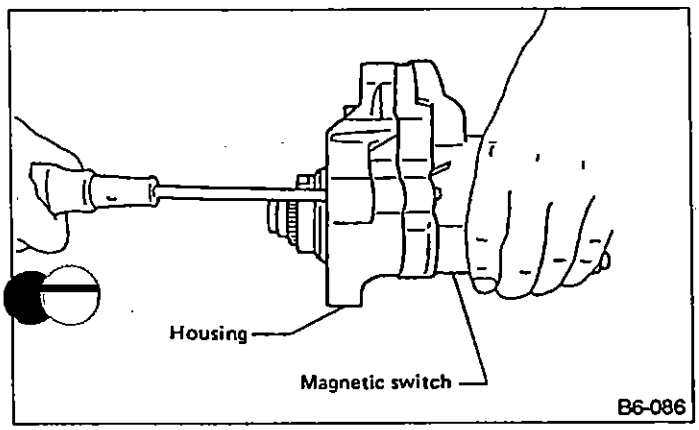


Fig. 17

Remove housing from magnetic switch.

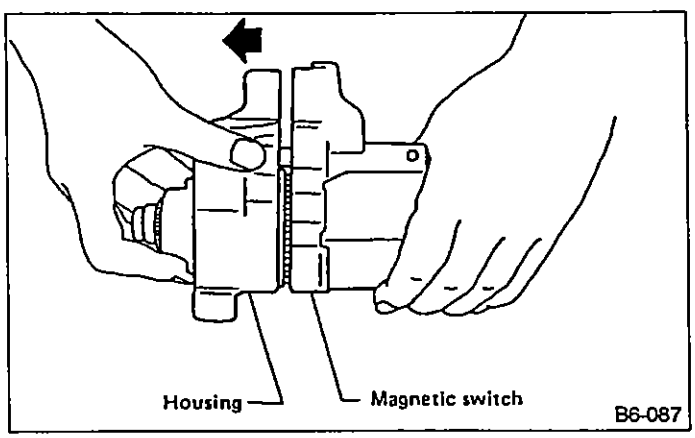


Fig. 18

9) Remove clutch from housing.

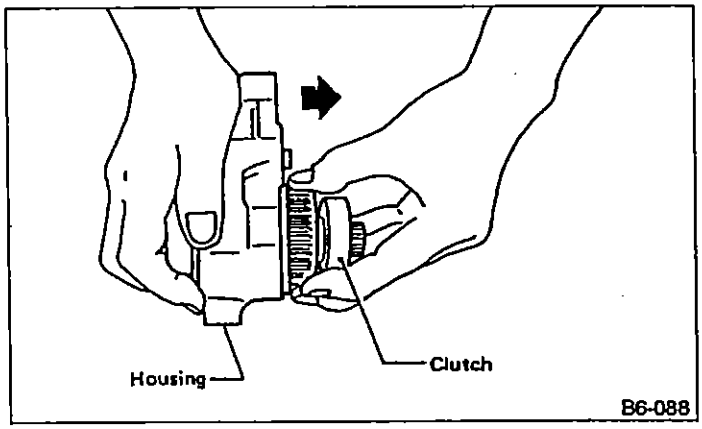


Fig. 19

10) Take out steel ball from clutch.
Be careful not to lose steel ball.

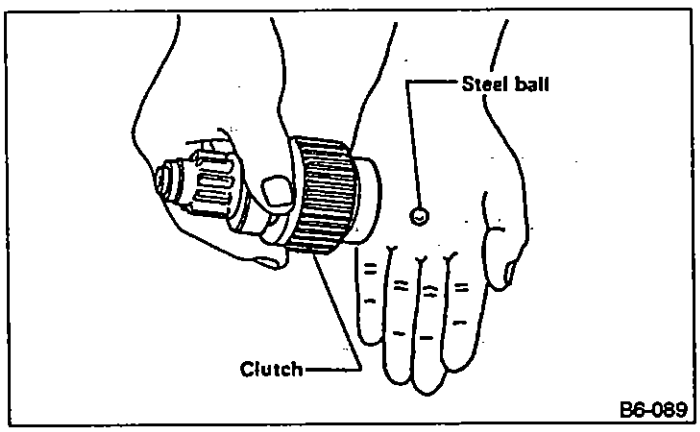


Fig. 20

11) Remove idle gear from housing.

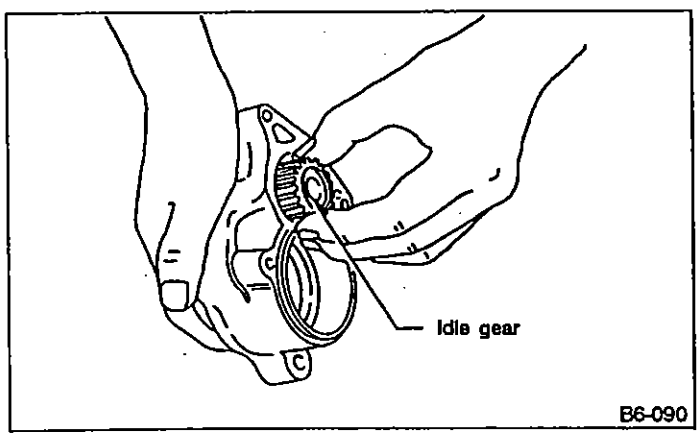


Fig. 21

12) Remove retainer and roller from housing.
Be careful not to drop retainer and roller.

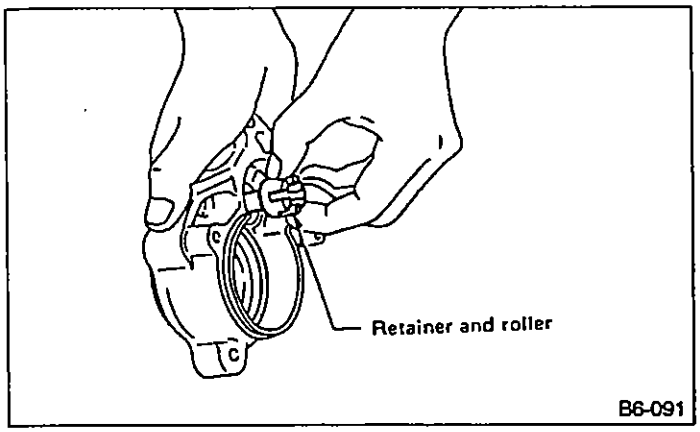


Fig. 22

13) Remove coil spring from magnetic switch.

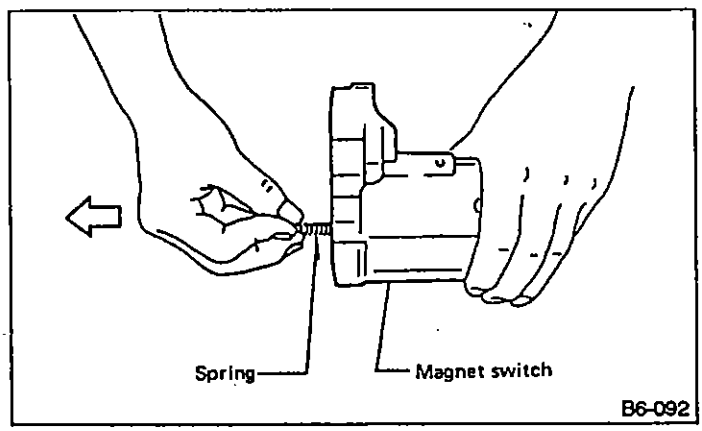


Fig. 23

C: INSPECTION AND REPAIR

1. ARMATURE

1) Layer test
Check armature coil for shortcircuit between layers by using growler tester.

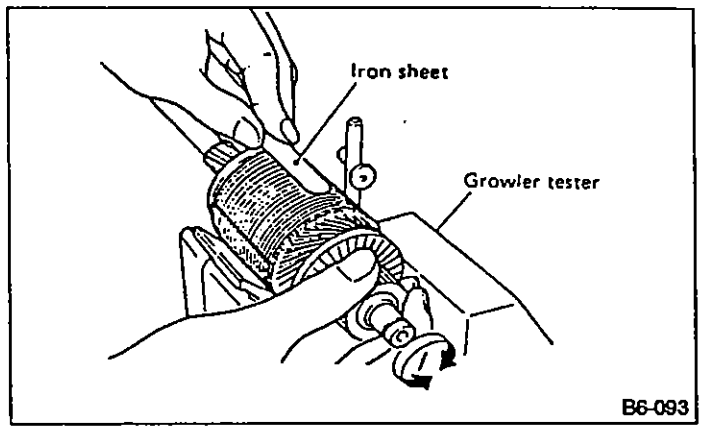


Fig. 24

If any shortcircuit exists in armature coil, circulating current is generated by alternating flux of growler tester, and the affected portion of the armature core is magnetized.
If an iron piece is brought close to that portion, it will vibrate, locating the shortcircuit.
Before performing the test, thoroughly remove carbon powder, etc. from around the commutator.
2) Insulation test
Check insulation between commutator and armature core using 500 V megger.
Insulation resistance should be 0.1 MΩ or larger.

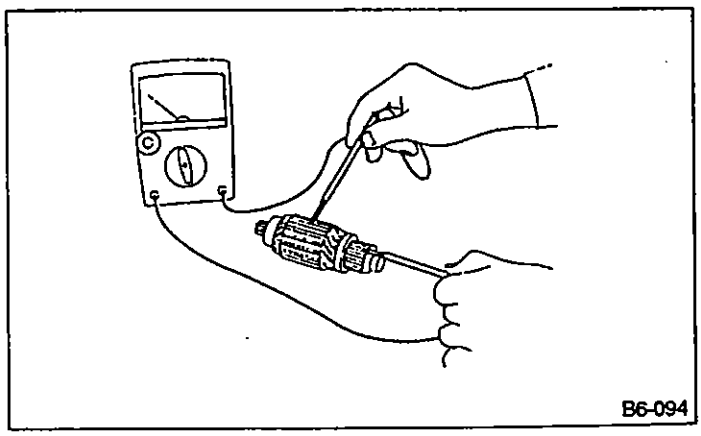


Fig. 25

3) Check commutator for out of roundness.
Use dial gauge to check that commutator is round. Repair commutator using lathe if uneven wear is found.

Out of roundness:
Standard
0.02 mm (0.0008 in) or less
Limit
0.05 mm (0.0020 in)

Be sure to perform this check after checking armature shaft for bend.

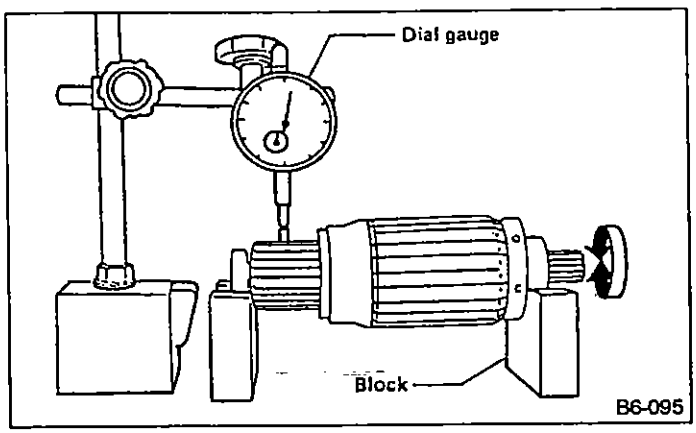


Fig. 26

If commutator surface is rough, polish with fine grain paper (#300); if burnt excessively, correct by cutting with a lathe.
In repairing commutator with lathe, do not reduce commutator O.D. by more than 1 mm (0.04 in) from its original (standard) value. Excessive cutting will hamper commutator durability.
After repairing, polish finished surface with sand paper.

Commutator O.D.:
Standard
30 mm (1.18 in)
Limit
29 mm (1.14 in)

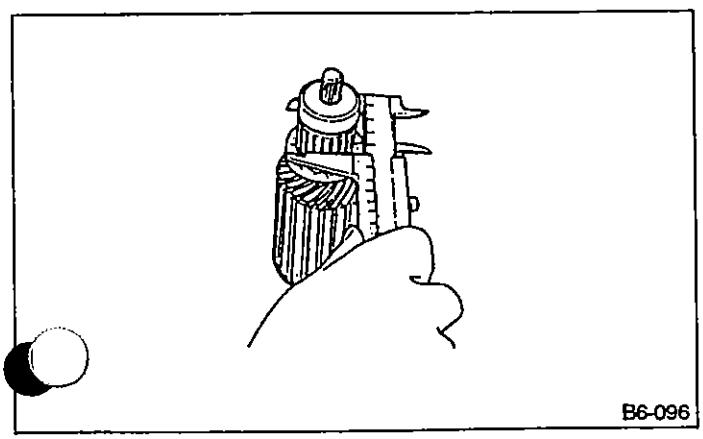


Fig. 27

4) Under-cutting of commutator
If commutator segments wear and mica insulation between segments stand higher than segment face, proper rectification is hampered.

Depth of mica:
Standard
0.5 — 0.8 mm (0.020 — 0.031 in)
Limit
0.2 mm (0.008 in)

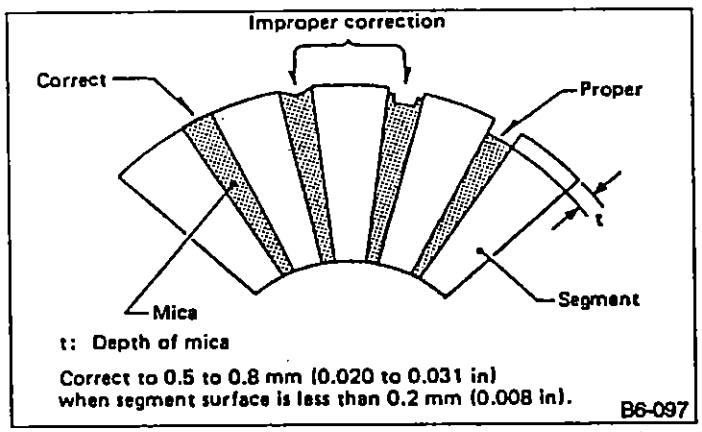


Fig. 28

2. BEARING

1) Inspection
(1) Rotate bearing by hand; no binding should exist.
(2) Rotate bearing rapidly; no abnormal noise should be heard.

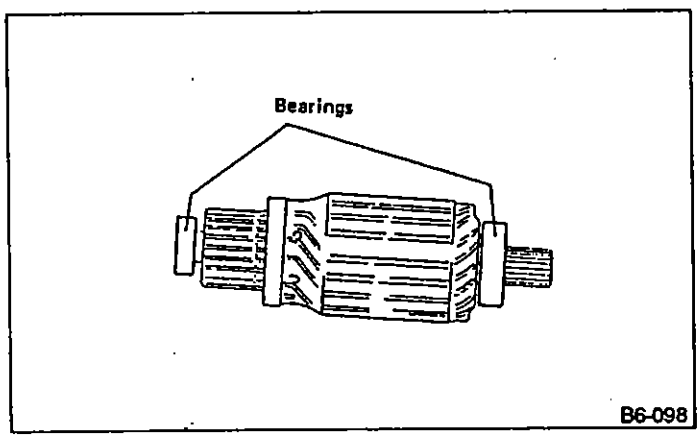


Fig. 29

2) Replacement
Pull out bearing using a jig as shown in Figure.

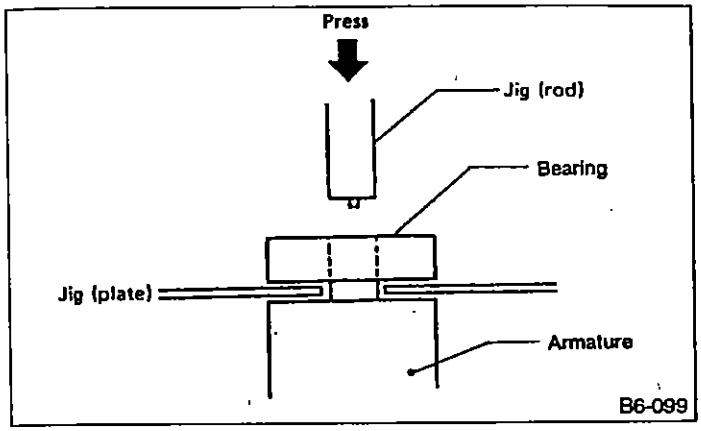


Fig. 30

3. YOKE

1) Testing field coil for open circuit
Check field coil for continuity using circuit tester. Continuity should exist.

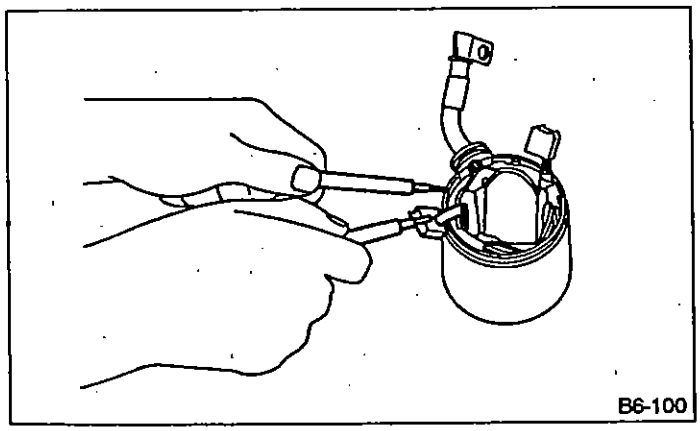


Fig. 31

2) Checking carbon brush
If carbon brush length has been reduced by more than 1/3 the original length, or if brush contact area has been reduced largely due to brush breakage, replace carbon brush.

Brush length:
1.4 kW type (AT)
Standard 15 mm (0.59 in)
Limit 10 mm (0.39 in)
1.0 kW type (MT)
Standard 13 mm (0.51 in)
Limit 8.5 mm (0.335 in)

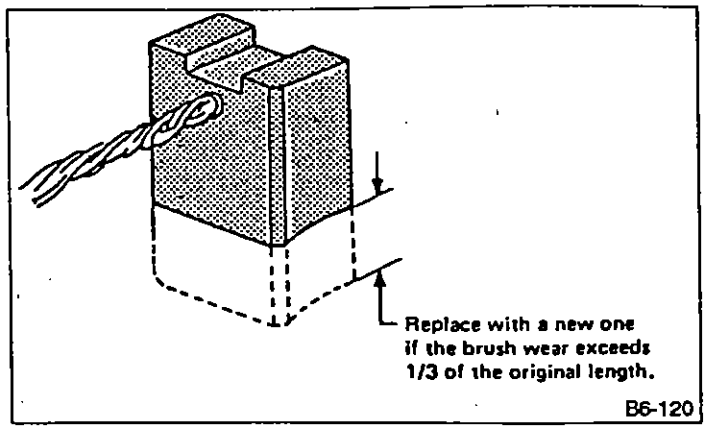


Fig. 32

4. BRUSH HOLDER

Measure insulation resistance of brush holder using Megger.

Insulation resistance:
0.1 MΩ or over

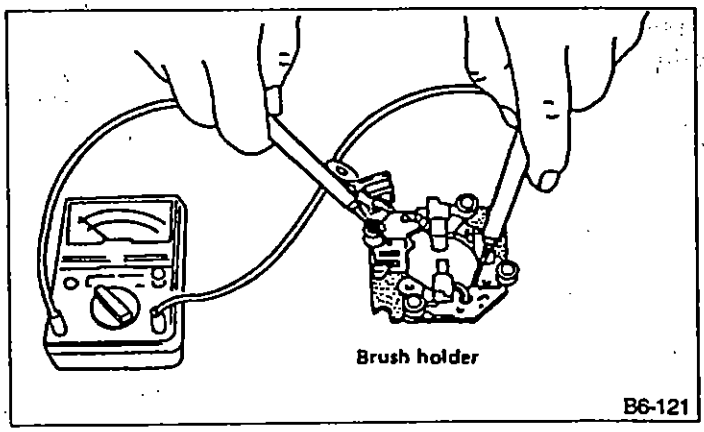


Fig. 33

5. CLUTCH

Check that pinion can be rotated in normal direction

pinion gear for wear, damage, rusting, or binding during rotation.

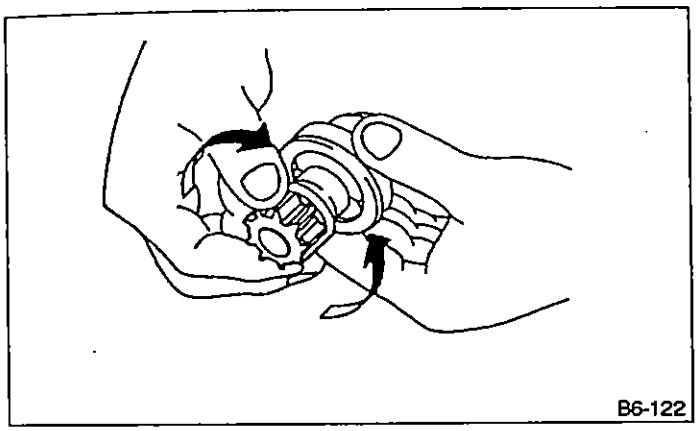


Fig. 34

D: ASSEMBLY

Assembly is in the reverse order of disassembly procedures. Observe the following:

1) Before assembling, lubricate disassembled parts at the points shown in Fig. 1 and Fig. 2.

ESSO BEACON 325 SCHELL ALVANIA GREASE RA	or equivalent

2) Assembling magnetic switch, clutch, and housing

To assemble, first install clutch to magnetic switch, then install idle gear, and finally install clutch.

a. Do not forget to install steel ball and coil spring to clutch.

b. Attach bearing to idle gear beforehand.

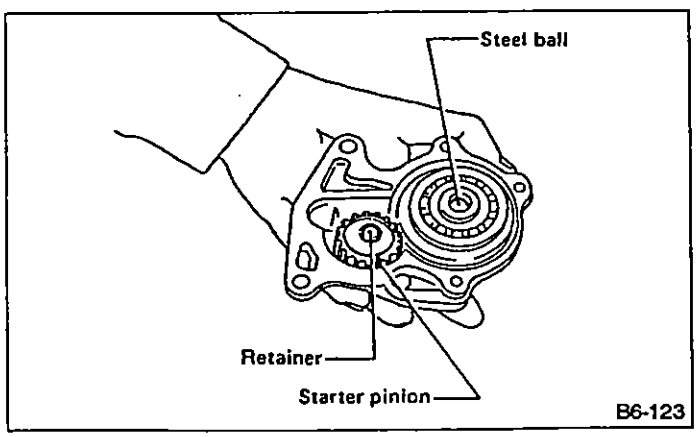


Fig. 35

3) Installing armature to yoke

Do not forget to put felt washer on armature shaft bearing.

4) Installing brushes

Assemble brush holder to yoke as shown, then assemble two yoke-side brushes to brush holder.

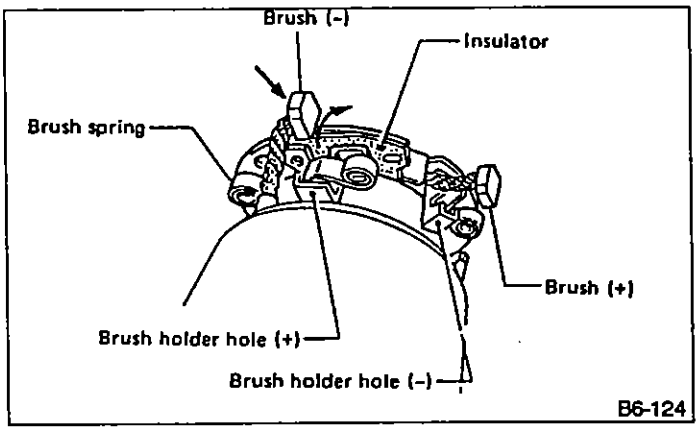


Fig. 36

5) Installing end frame

When assembling end frame to yoke, align notched portion of end frame with lead wire grommet.

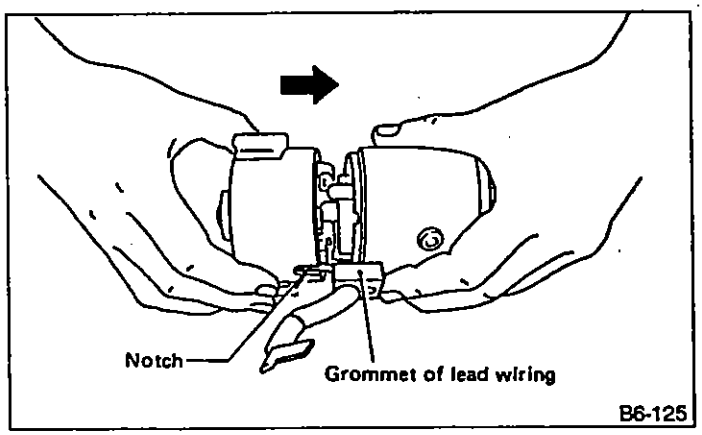


Fig. 37

) Installing yoke
When installing yoke to magnetic switch, align notch of oke with protrusion of magnetic switch.

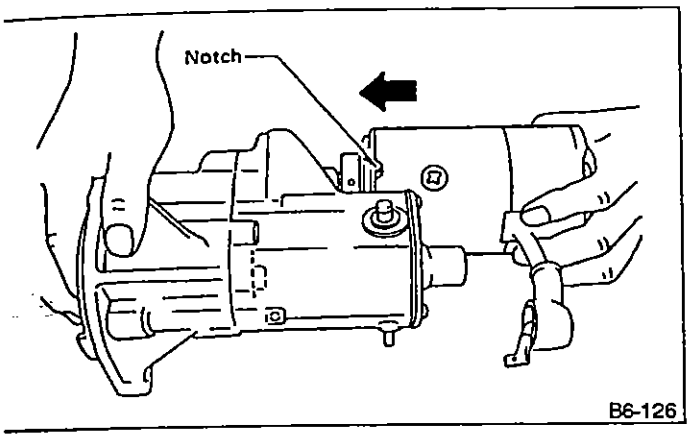


Fig. 38

2. Alternator

A: TEST

1. PRECAUTION

Prepare the following measuring equipment:
(1) DC voltmeter (V): 0 — 30 V
(2) DC ammeter (A): 0 — 100 A
(3) Variable resistor: 0 — 0.25 Ω, 1 kW
(4) Resistor: 0.25Ω, 25 W
(5) Switch (SW1 and SW2): 12 V
(6) Test lamp: 12 V, 1.4 W

- Connect test leads [of at least 8 mm² (0.012 sq in) in cross-sectional area and shorter than 2.5 m (8.2 ft)] in line "Y" (between alternator B terminal and battery positive terminal), and in line "Z" (between battery negative terminal and terminal E).
- Use switches SW1 and SW2 having as low a resistance as possible.

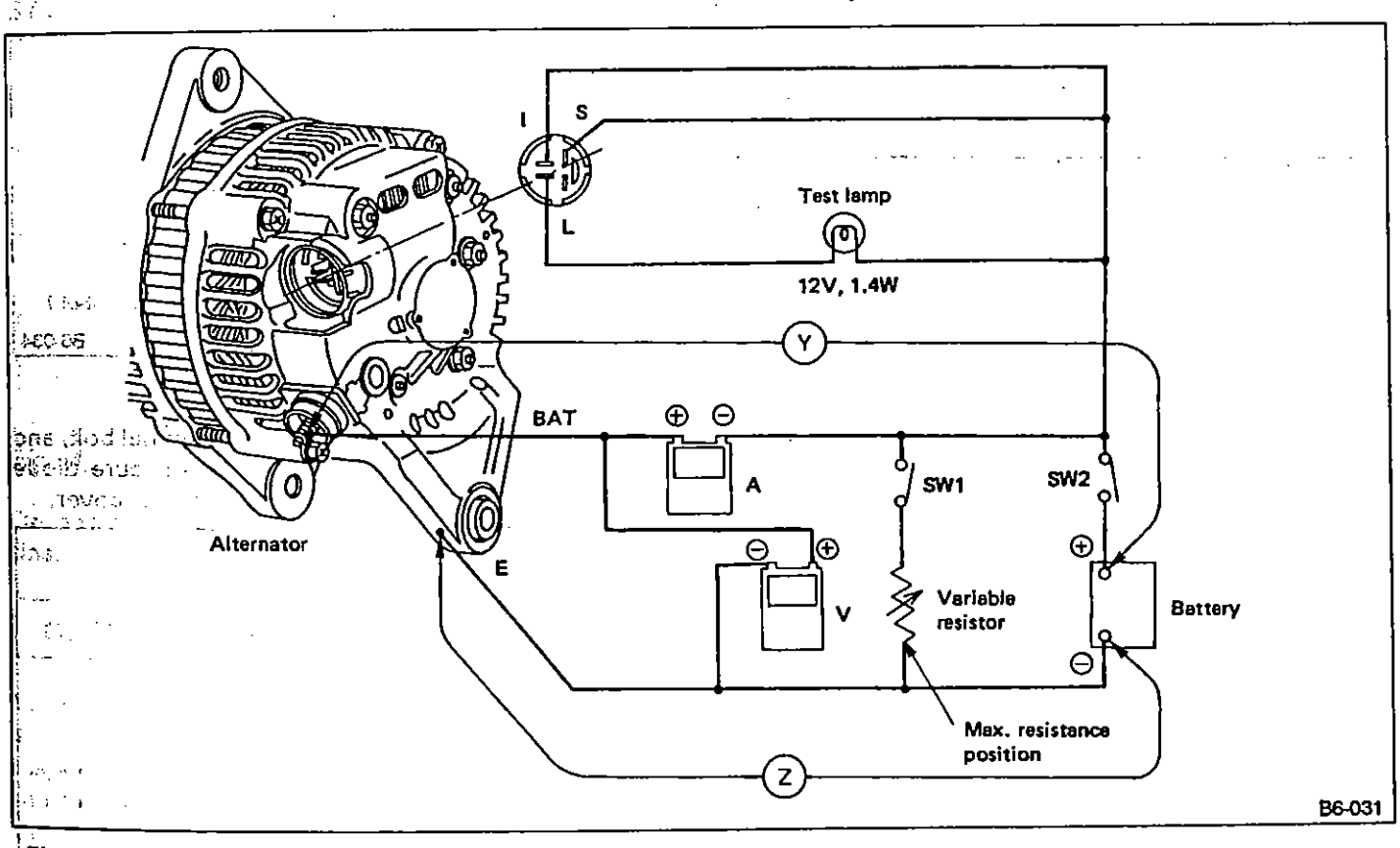


Fig. 39

2. REGULATING VOLTAGE MEASUREMENT

1) Open switch SW1 and close switch SW2.
2) Operate alternator at a rated speed of 6,000 rpm.
3) Measure regulating voltage (while operating at 6,000 rpm). If it is in the 14.1 to 14.7 V range, alternator is functioning properly.

3. OUTPUT CURRENT MEASUREMENT

1) Set variable resistor at minimum resistance position. Close both SW1 and SW2.
2) While adjusting variable resistor, increase alternator speed so that voltmeter registers 13.5 volts.
3) Measure output current values when alternator speeds reach 1,500, 3,000 and 6,000 rpm, respectively.

1,500 rpm	Greater than 33A
3,000 rpm	Greater than 66A
6,000 rpm	Greater than 80A

4. ALTERNATOR SPEED AT 13.5 V

1) Open switch SW1, and close switch SW2. Gradually raise alternator speed, and read the speed when the voltage is 13.5 V.
2) The alternator is normal if it is turning at less than 1,000 rpm when the voltage is 13.5 V.

DISASSEMBLY

1) Remove through screws from alternator. Detach front cover with rotor from rear cover with stator by lightly tapping on front cover with a plastic hammer.

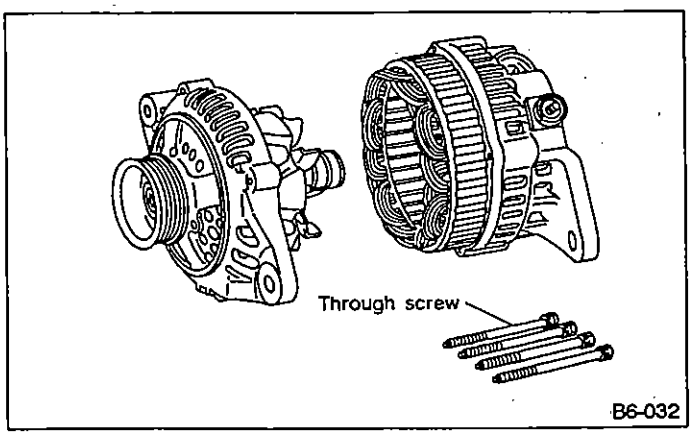


Fig. 40

2) Hold rotor with a vise and remove pulley nut.
When holding rotor with vise, insert aluminum plates on the contact surfaces of the vise to prevent rotor from damage.

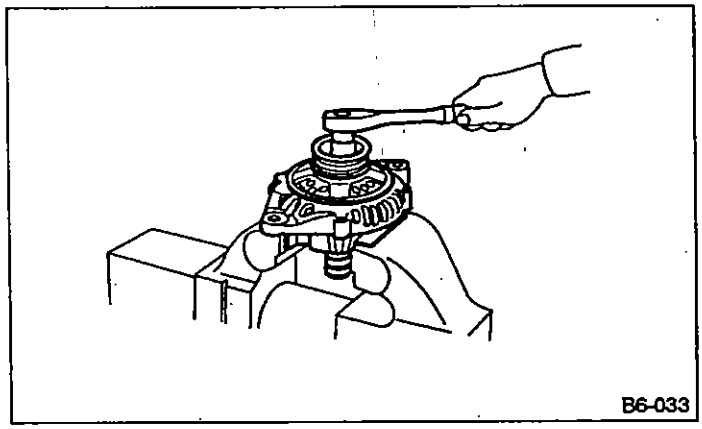


Fig. 41

3) Remove rotor from front cover.
4) Remove three screws from front cover and then bearing retainer and ball bearing.

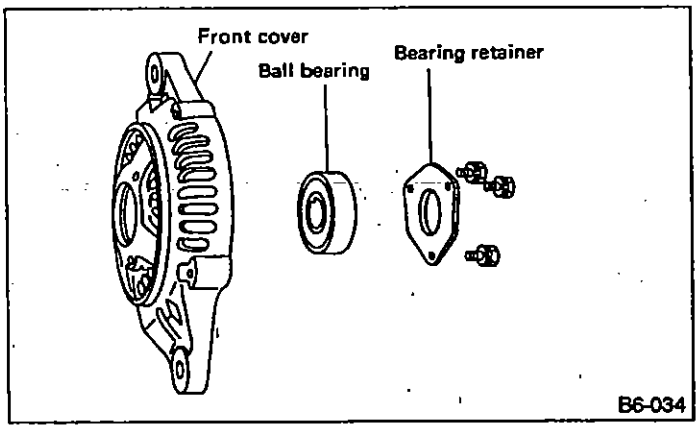


Fig. 42

5) Remove bolt which secure battery terminal bolt, and remove rear cover. Remove nuts which secure diode and IC regulator, and remove stator and rear cover.

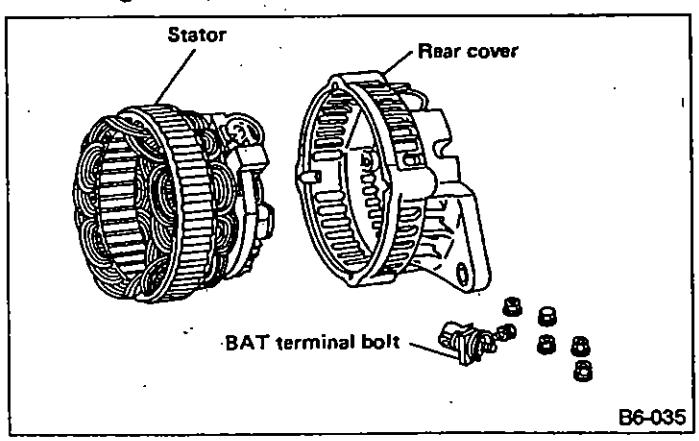


Fig. 43

6) Remove bolts which secure stator terminal to diode terminal, and remove stator.

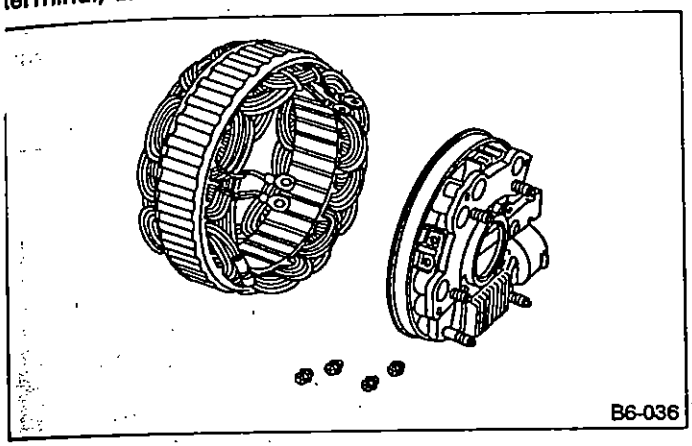


Fig. 44

7) Remove bolts which secure IC regulator ASSY, diode ASSY and brush holder, and separate these ASSY's.

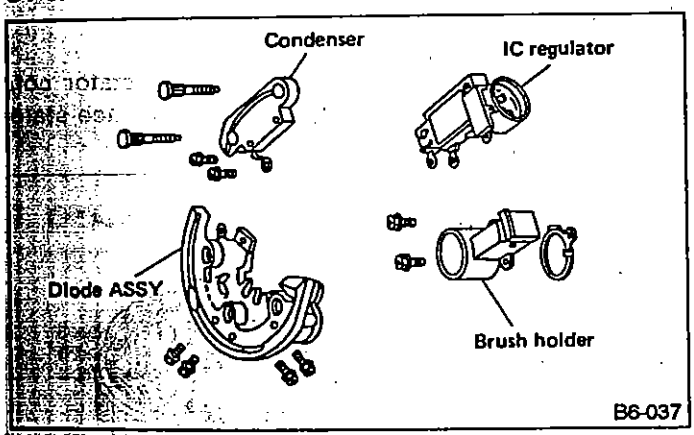


Fig. 45

Do not apply a shock or load to IC regulator cooling fins.

C: INSPECTION AND REPAIR

1. ROTOR

1) Slip ring surface

Inspect slip rings for contamination or any roughness of the sliding surface.

Clean or polish with #500 to #600 emery paper if defective.

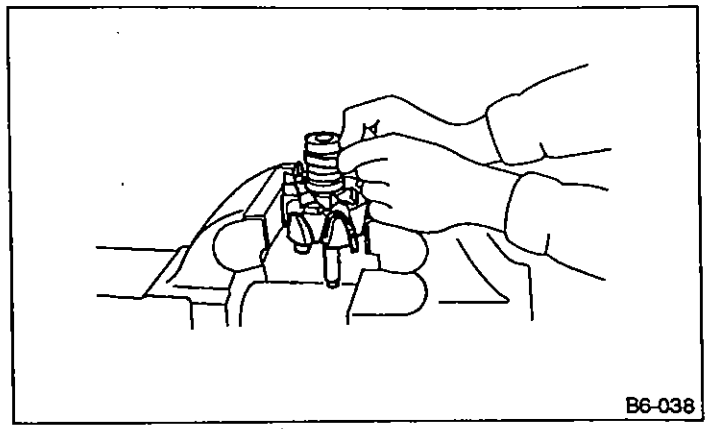


Fig. 46

2) Slip ring outside diameter

Measure slip ring outside diameter. If slip ring is worn, replace rotor ASSY.

Slip ring outside diameter:
Standard
27 mm (1.06 in)
Limit
26 mm (1.02 in)

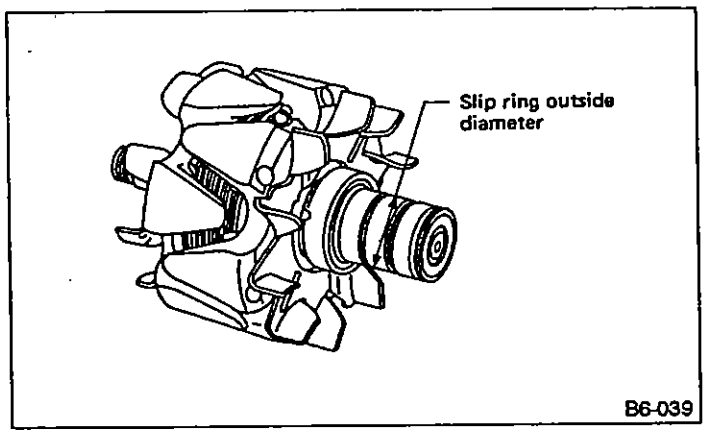


Fig. 47

3) Continuity test

Check continuity between slip rings. If continuity does not exist, replace rotor ASSY.

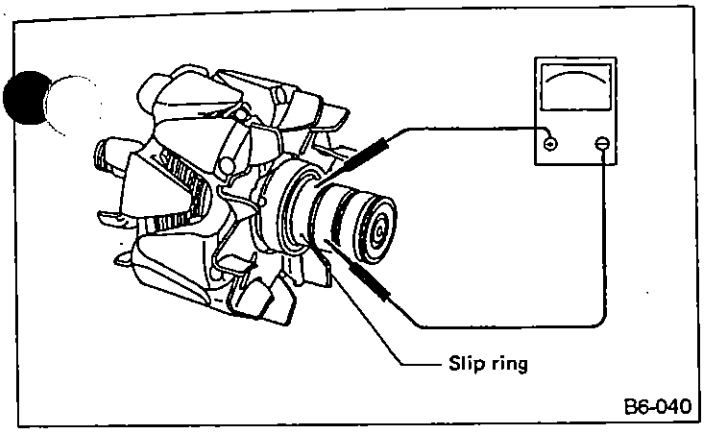


Fig. 48

4) Insulation test
Check continuity between slip ring and rotor core or shaft. If continuity exists, replace rotor ASSY.

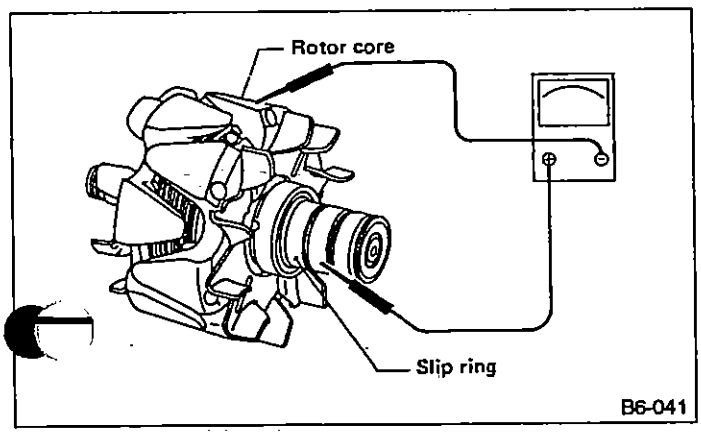


Fig. 49

5) Ball bearing
Check rear ball bearing. Replace it if it is noisy or if rotor does not turn smoothly.

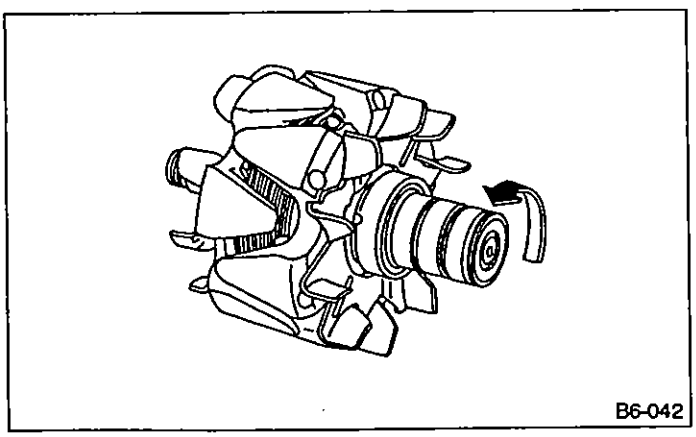


Fig. 50

2. STATOR

1) Continuity test
Inspect stator coil for continuity between its terminals. When there is no continuity between individual terminals, cable is broken.
Replace stator ASSY.

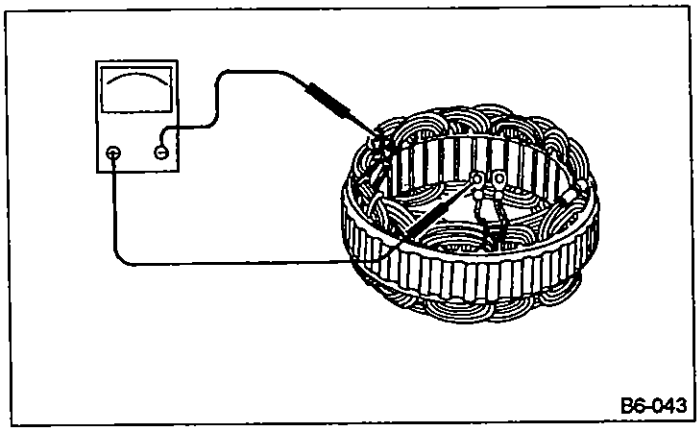


Fig. 51

2) Insulation test
Inspect stator coil for continuity between stator core and each terminal. If there is continuity, replace stator ASSY.

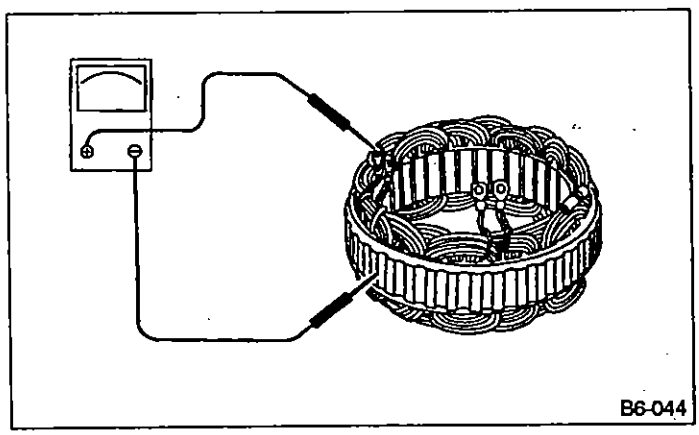


Fig. 52

3. BRUSH

Measure brush length. If brush is worn, replace brush holder ASSY.

Brush length (ℓ):
Standard
20.5 mm (0.807 in)
Limit
1.5 mm (0.059 in)

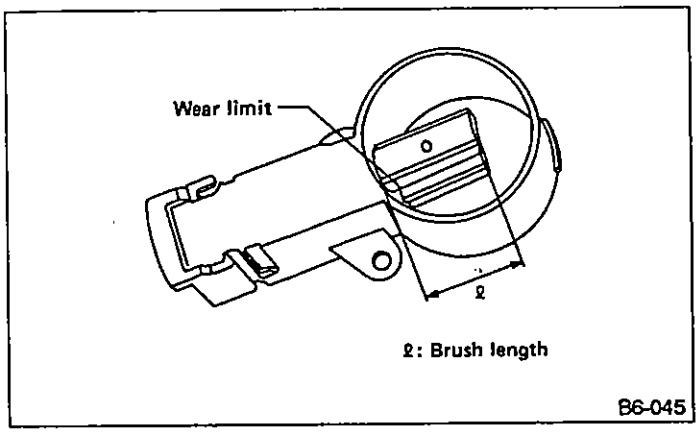


Fig. 53

4. DIODE ASSEMBLY

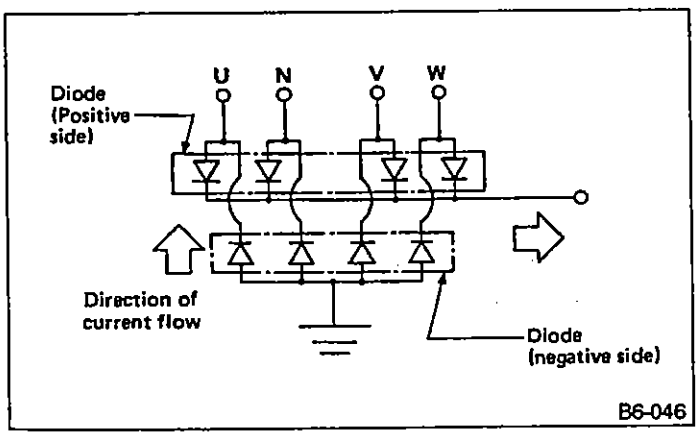


Fig. 54

The diode ASSY consists of eight diodes, four each being located on the positive and negative sides. The diode is necessary to restrict current flow to one direction.
Check all diodes, for continuity. If any diode is faulty, replace diode ASSY.
1) Diodes on "+" side

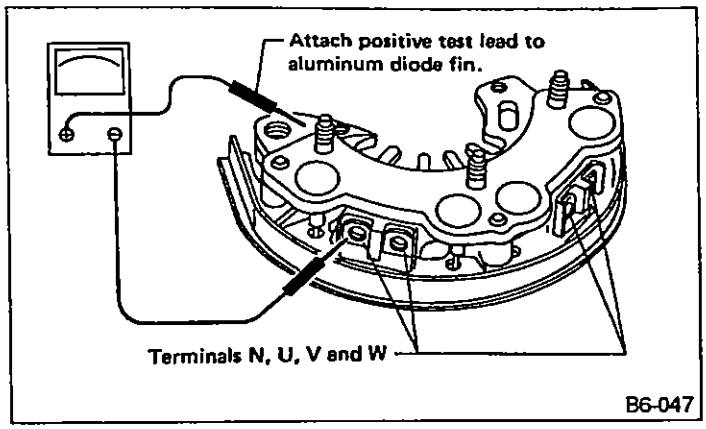


Fig. 55

Continuity of proper diodes on "+" side

BAT side / Terminal N, U, V and W	(+)	(−)
(+)	—	Continuity must not exist.
(−)	Continuity must exist.	—

2) Diodes on "−" side

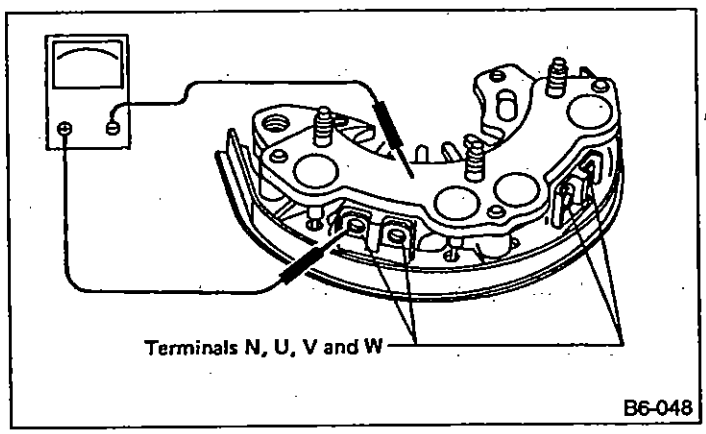


Fig. 56

Continuity of proper diodes on "−" side

"E" side / Terminal N, U, V and W	(+)	(−)
(+)	—	Continuity must exist.
(−)	Continuity must not exist.	—

Never use a high tension insulation tester, such as a meggar as it will damage diodes with its high tension.

5. IC REGULATOR

1) Prepare the following equipment:
   (1) Power supply: Variable 12 V DC
   (2) Lamp: L1 and L2, 12 V, 1.4 W, 2 each
   (3) Switch: SW1 and SW2, 12 V, 2 each
   (4) DC voltmeter (V): 0 — 50 V
2) Test procedure

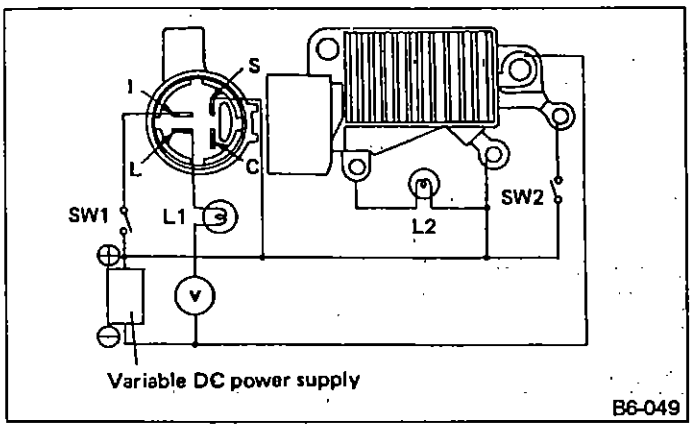


Fig. 57

(1) Open switches SW1 and SW2.
(2) Set variable DC power supply to 12 V.
(3) Close switch SW1 to check L1 and L2 lamp conditions.
(4) With switch SW1 closed, close switch SW2 to check L1 and L2.
(5) With both switches closed, gradually increase variable DC power supply. Check L1 and L2 lamp conditions when power supply reaches the specified voltage range.

Specified voltage range [at 25°C (77°F)]:
14.1 — 14.7 V

Step No.	Lamp L1	Lamp L2
(3)	ON (bright)	ON (dark)
(4)	OFF	ON (bright)
(5)	OFF	OFF

If any of the test results are not as indicated in the above table, replace IC regulator.

D: ASSEMBLY

To assemble, reverse order of disassembly procedures
a. Install a new ball bearing on rear of alternator.
b. Rear ball bearing has a ring placed in eccentric groove of the outer race. Part of this ring protrudes beyond the outer race. Before assembling the ring, rotate it so that the protrusion is reduced to a minimum. Replace rear cover if it is worn or damaged at bearing location.

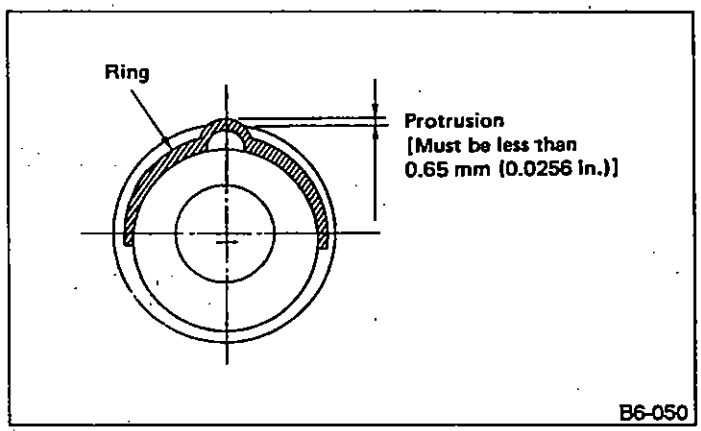
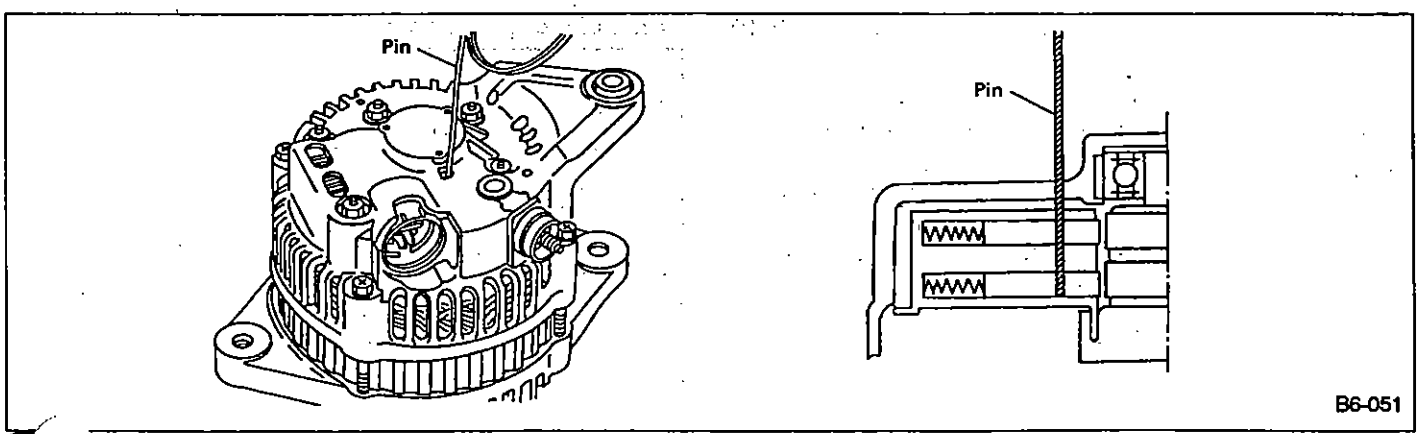


Fig. 58

c. When installing front and rear covers, insert pin from outside of rear cover. Insert brush into brush holder. After cover installation, remove the pin.



E: INSTALLATION

1) Install alternator to bracket on engine with bolts and tighten bolts lightly.
2) After installing drive belt, pull belt by moving alternator with adjusting bolt and tighten installing bolts.
3) Check belt tension.
4) Connect lead wires to alternator.

a. Be careful not to connect individual terminals erroneously.

b. Pay careful attention to battery polarity so that it may not be reversed by wrong connection. If polarities are reversed, battery will be shorted by diode, excessive current will flow, and diodes or wire harness may be damaged.

3. Spark Plug

A: DESCRIPTION

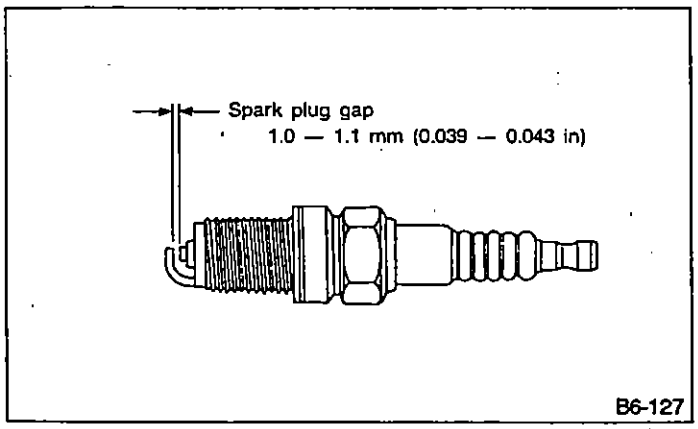


Fig. 60

The spark plugs are project type, having 14 mm (0.55 in) threads and 1.0 to 1.1 mm (0.039 to 0.043 in) gap.
All spark plugs installed on an engine, must be of the same heat range.

Spark plug
NGK:
BKR6E-11
NIPPONDENSO:
K20PR-U11
CHAMPION:
RC7YC-4

B: REMOVAL AND INSTALLATION

1) Remove spark plug cords by pulling boot, not cord itself.
2) Remove spark plugs.
3) When installing spark plugs on cylinder head, use spark plug wrench.

Tightening torque (Spark plug):
20 — 29 N•m (2 — 3 kg-m, 14 — 22 ft-lb)

The above torque should be only applied to new spark plugs without oil on their threads.
In case their threads are lubricated, the torque should be reduced by approximately 1/3 of the specified torque in order to avoid their over-stressing.
4) Connect spark plug cords.

C: INSPECTION

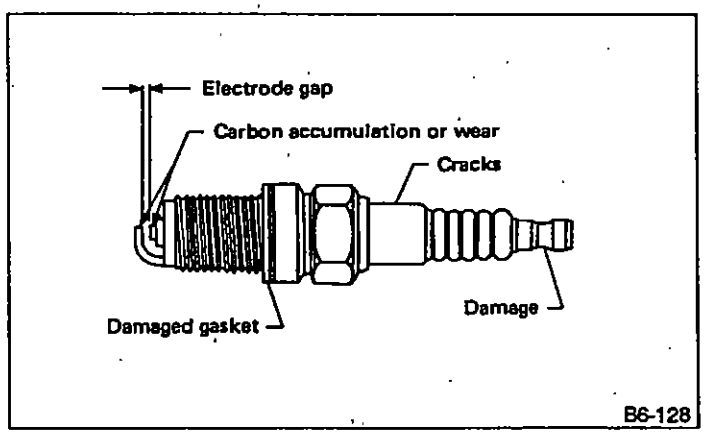


Fig. 61

Check electrodes and inner and outer porcelain of plugs, noting the type of deposits and the degree of electrode erosion.
1) Normal
Brown to grayish-tan deposits and slight electrode wear indicate correct spark plug heat range.

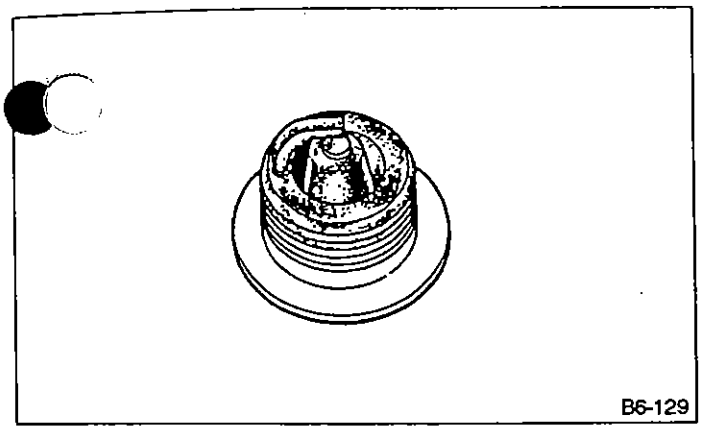


Fig. 62

2) Carbon fouled
Dry fluffy carbon deposits on insulator and electrode are mostly caused by slow speed driving in city, weak ignition, too rich fuel mixture, dirty air cleaner, etc.
It is advisable to replace with plugs having hotter heat range.

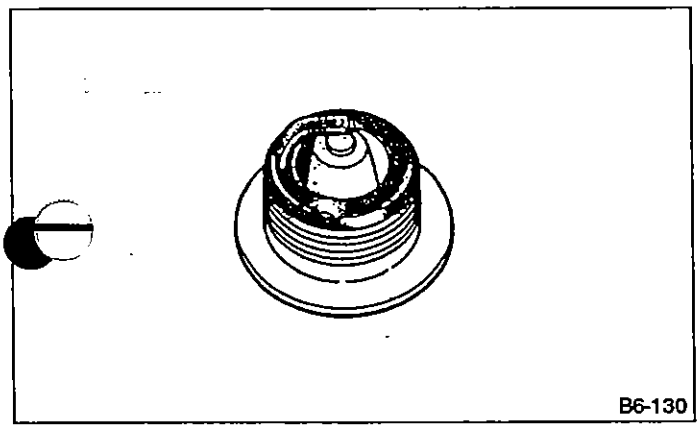


Fig. 63

3) Oil fouled
Wet black deposits show excessive oil entrance into combustion chamber through worn rings and pistons or excessive clearance between valve guides and stems. If same condition remains after repair, use a hotter plug.

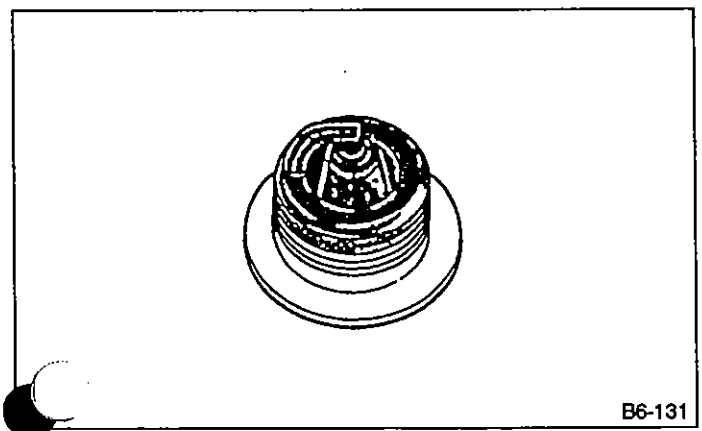


Fig. 64

4) Overheating
White or light gray insulator with black or gray brown spots and bluish burnt electrodes indicate engine overheating. Moreover, the appearance results from incorrect ignition timing, loose spark plugs, wrong selection of fuel, hotter range plug, etc. It is advisable to replace with plugs having colder heat range.

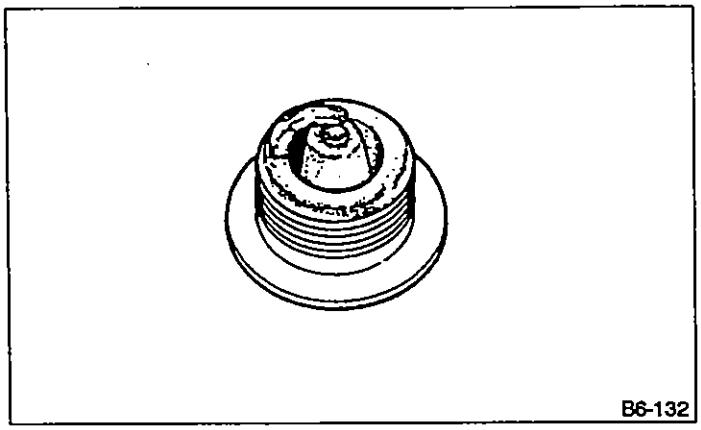


Fig. 65

D: CLEANING AND REGAPPING

Clean spark plugs in a sand blast type cleaner.
Avoid excessive blasting. Clean and remove carbon or oxide deposits, but do not wear away porcelain.
If deposits are too stubborn, discard plugs.
After cleaning spark plugs, recondition firing surface of electrodes with file. Then correct the spark plug gap to 1.0 to 1.1 mm (0.039 to 0.043 in) using a gap gauge.

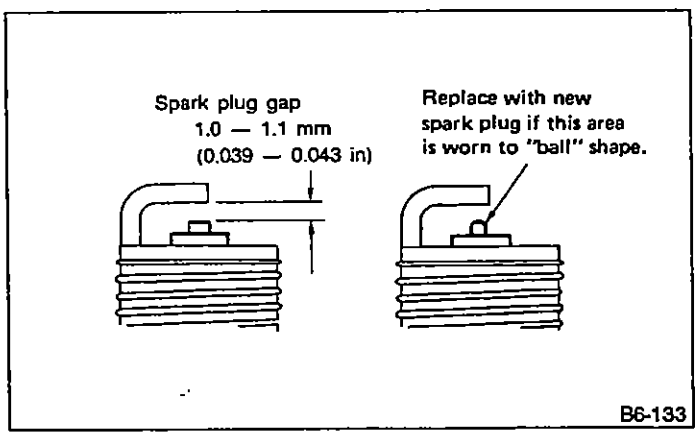


Fig. 66

4. Ignition Coil

A: REMOVAL AND INSTALLATION

1) Disconnect battery negative (−) terminals.
2) Remove intake manifold cover.
3) Disconnect wires from ignition coil.
4) Remove ignition coil.
5) To install, reverse the order of removal.

Be sure to connect wires to their proper positions. Failure to do so will damage unit.

B: INSPECTION

Using accurate tester, inspect the following items, and replace if defective.
1) Primary resistance
2) Secondary coil resistance

If the resistance is extremely low, this indicates the presence of a short-circuit.

Specified resistance:
[Primary side]
Between ① and ②
Between ③ and ④
(MT) 0.62 — 0.76 Ω
(AT) 0.63 — 0.77 Ω
[Secondary side]
Between terminal No. 1 and No. 2
Between terminal No. 3 and No. 2
(MT) 17.9 — 24.5 kΩ
(AT) 10.4 — 15.6 kΩ

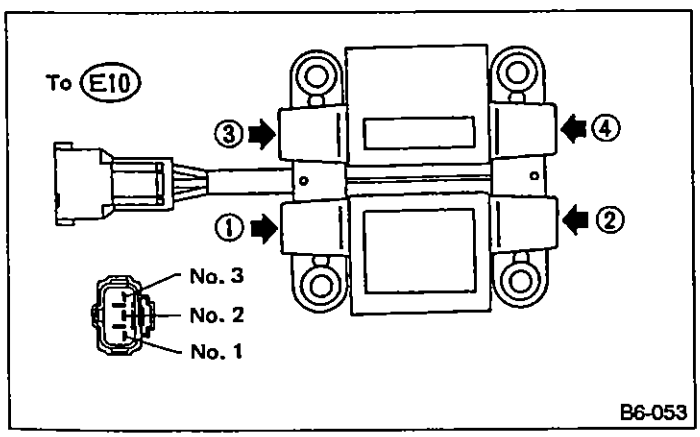


Fig. 67

3) Insulation between primary terminal and case: 10 MΩ or more.

5. Spark Plug Cord

A: INSPECTION

Check for:
1) Damage to cords, deformation, burning or rust formation of terminals.
2) Resistance values of cords.

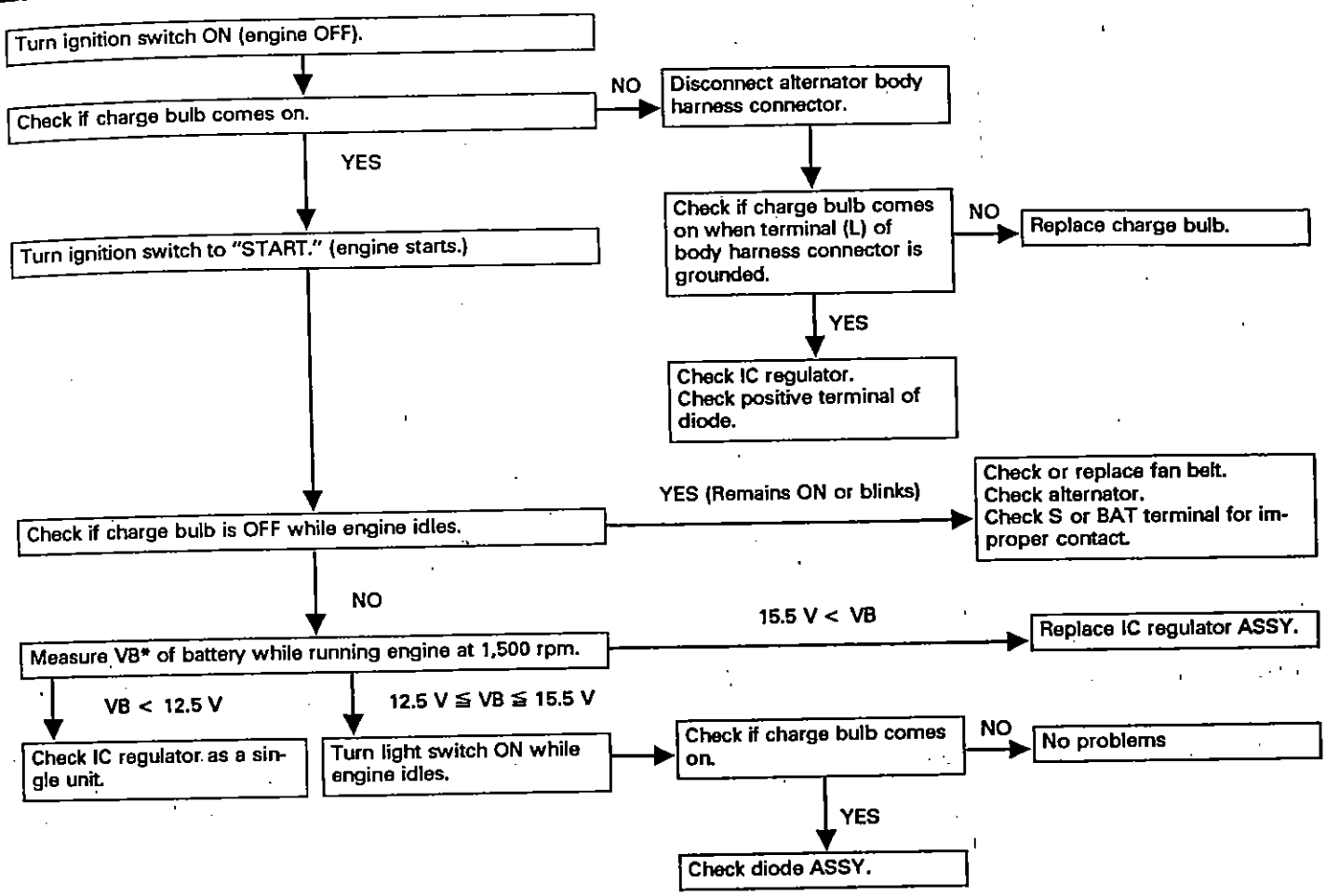
	Resistance value: kΩ	Length: mm (in)
#1 cord	4.95 — 11.56	540 (21.26)
#2 cord	4.86 — 11.33	550 (21.65)
#3 cord	4.95 — 11.56	540 (21.26)
#4 cord	5.24 — 12.23	600 (23.62)

T TROUBLESHOOTING

Starter

Trouble		Probable cause
Starter does not start.	Magnet switch does not operate (no clicks are heard).	Magnet switch poor contact or discontinuity of pull-in coil circuit Improper sliding of magnet switch plunger
	Magnet switch operates (clicks are issued).	Poor contact of magnet switch's main contact point
		Layer short of armature Contaminants on armature commutator High armature mica.
		Improper grounding of yoke field coil
		Insufficient carbon brush length
		Insufficient brush spring pressure
Starter starts but does not crank engine	Failure of pinion gear to engage ring gear	Worn pinion teeth
		Improper sliding of overrunning clutch
		Improper adjustment of stud bolt
	Clutch slippage	Faulty clutch roller spring
Starter starts but engine cranks too slowly.		Poor contact of magnet switch's main contact point
		Layer short of armature
		Discontinuity, burning or wear of armature commutator
		Poor grounding of yoke field coil
		Insufficient brush length
		Insufficient brush spring pressure
		Abnormal brush wear
Starter overruns		Magnet switch coil is a layer short.

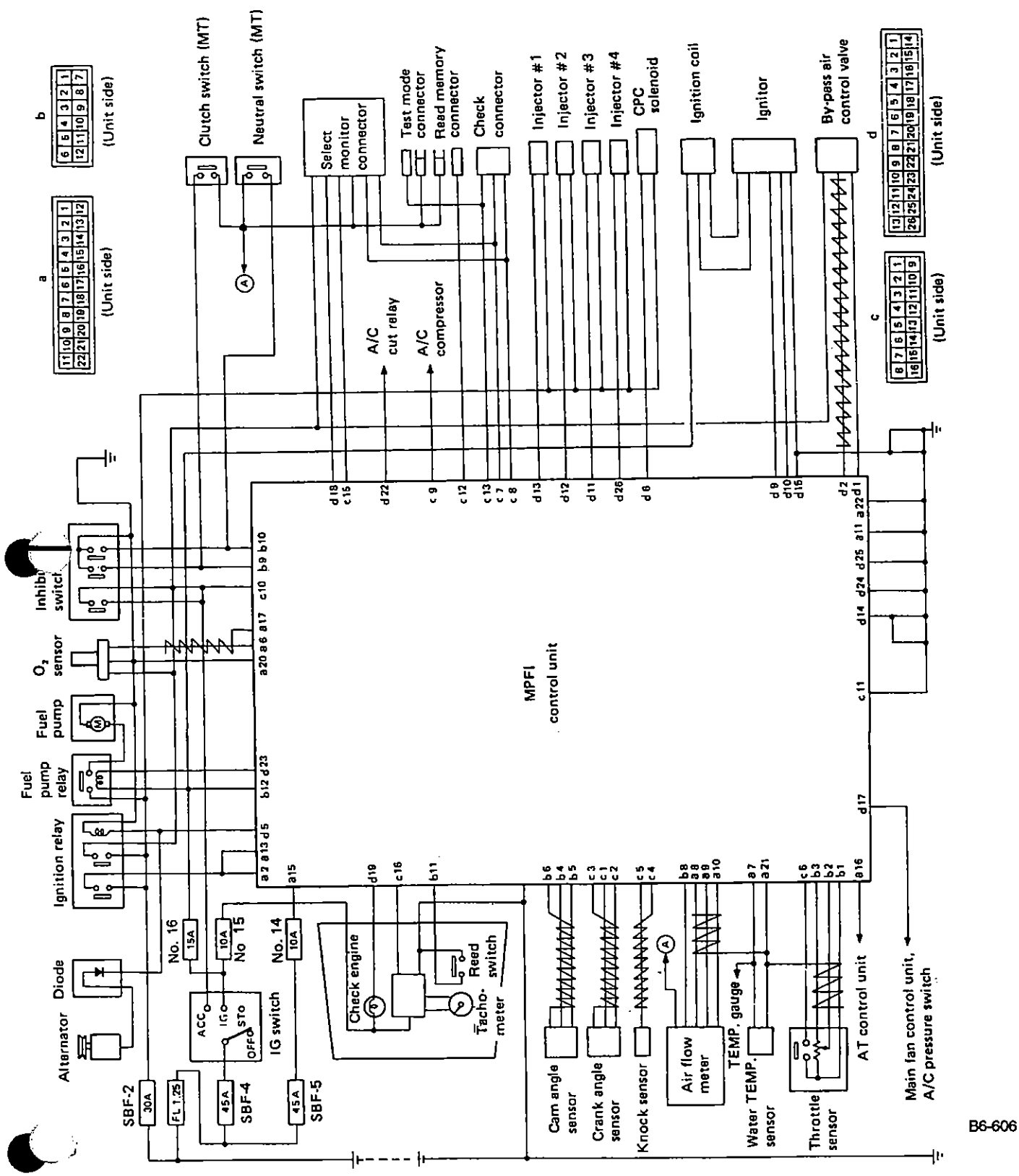
2. Alternator



*: Terminal voltage

4. Engine Electrical (MPFI)

SCHEMATIC



B6-606

5. Radiator Fan

A: SCHEMATIC

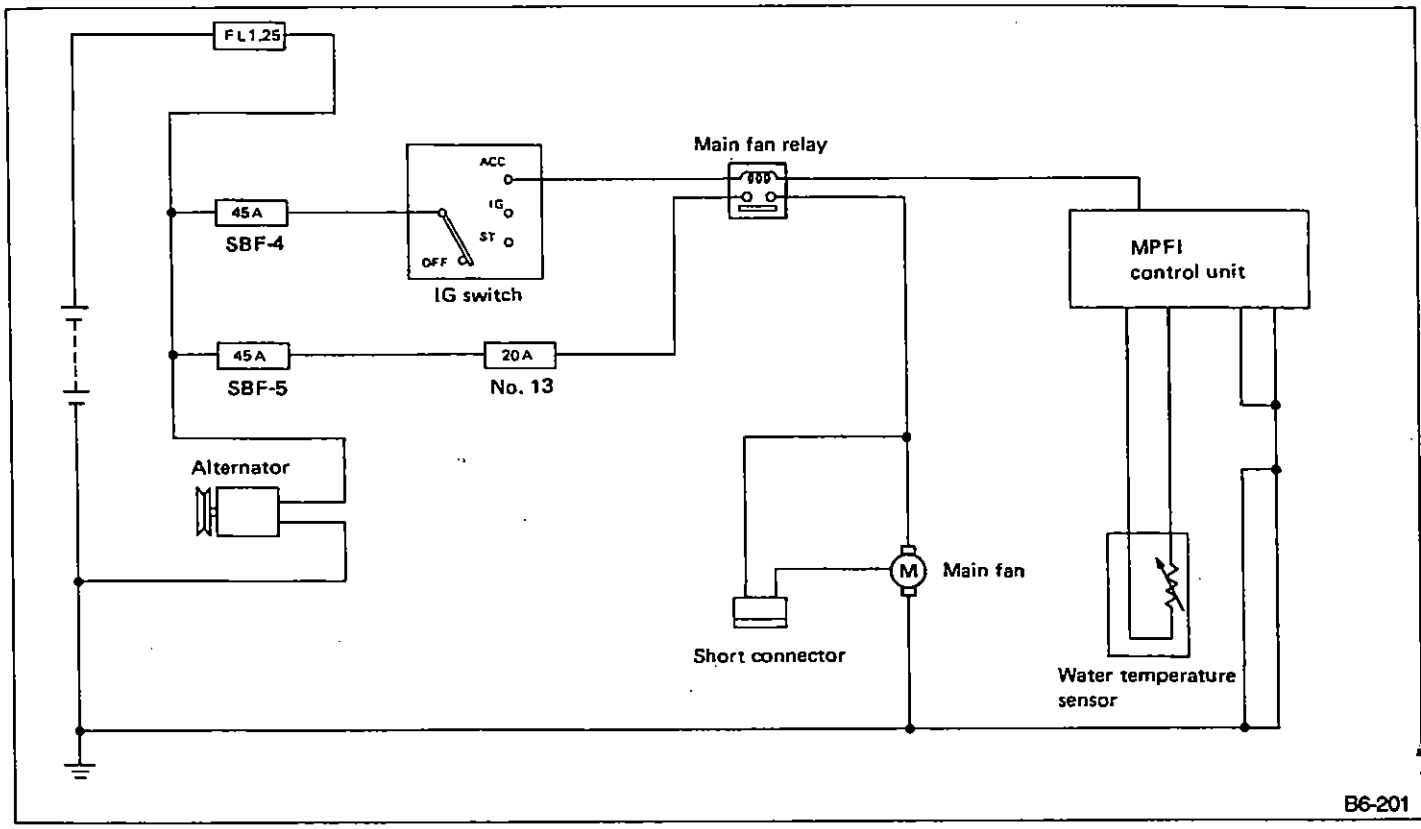


Fig. 16

6. Lighting AIRBAG

SCHEMATIC

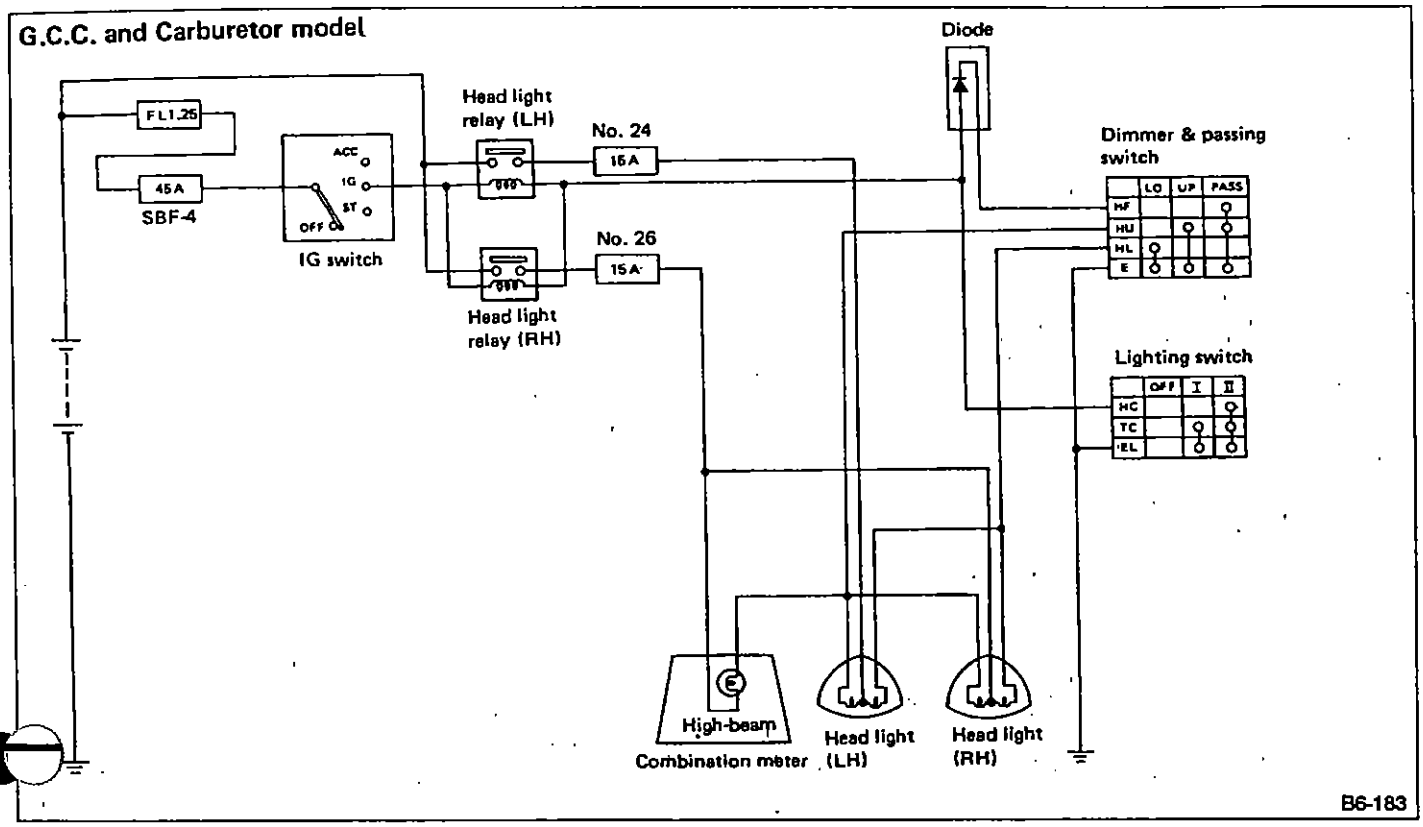


Fig. 17

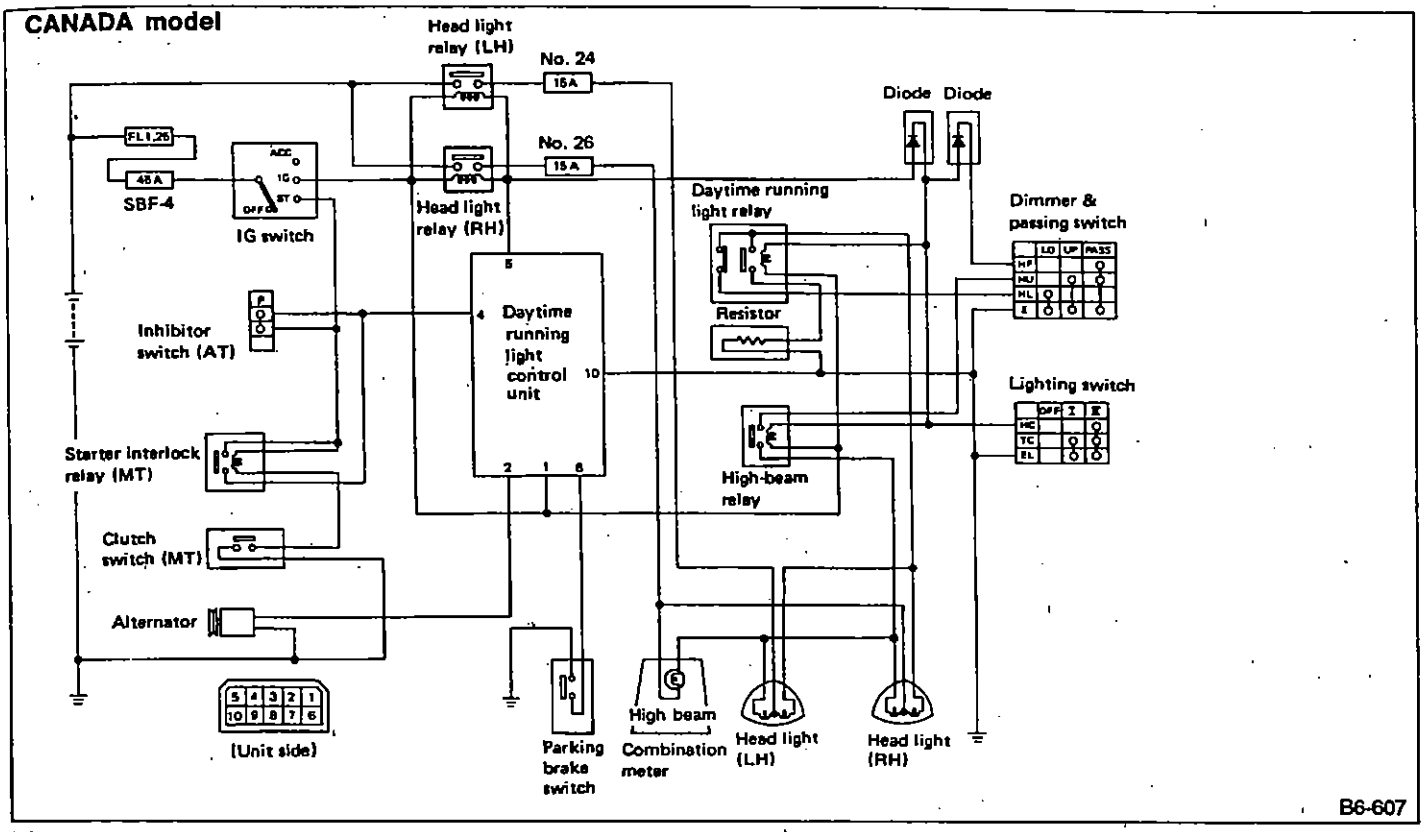

CANADA model
Head light relay (LH)
No. 24
15A
No. 26
15A
Head light relay (RH)
FL1.25
45A
SBF-4
IG switch
Inhibitor switch (AT)
Starter interlock relay (MT)
Clutch switch (MT)
Alternator
Daytime running light control unit
Diode
Diode
Daytime running light relay
Resistor
High-beam relay
Dimmer & passing switch
Lighting switch
(Unit side)
Parking brake switch
High beam
Combination meter
Head light (LH)
Head light (RH)
B6-607

Fig. 18

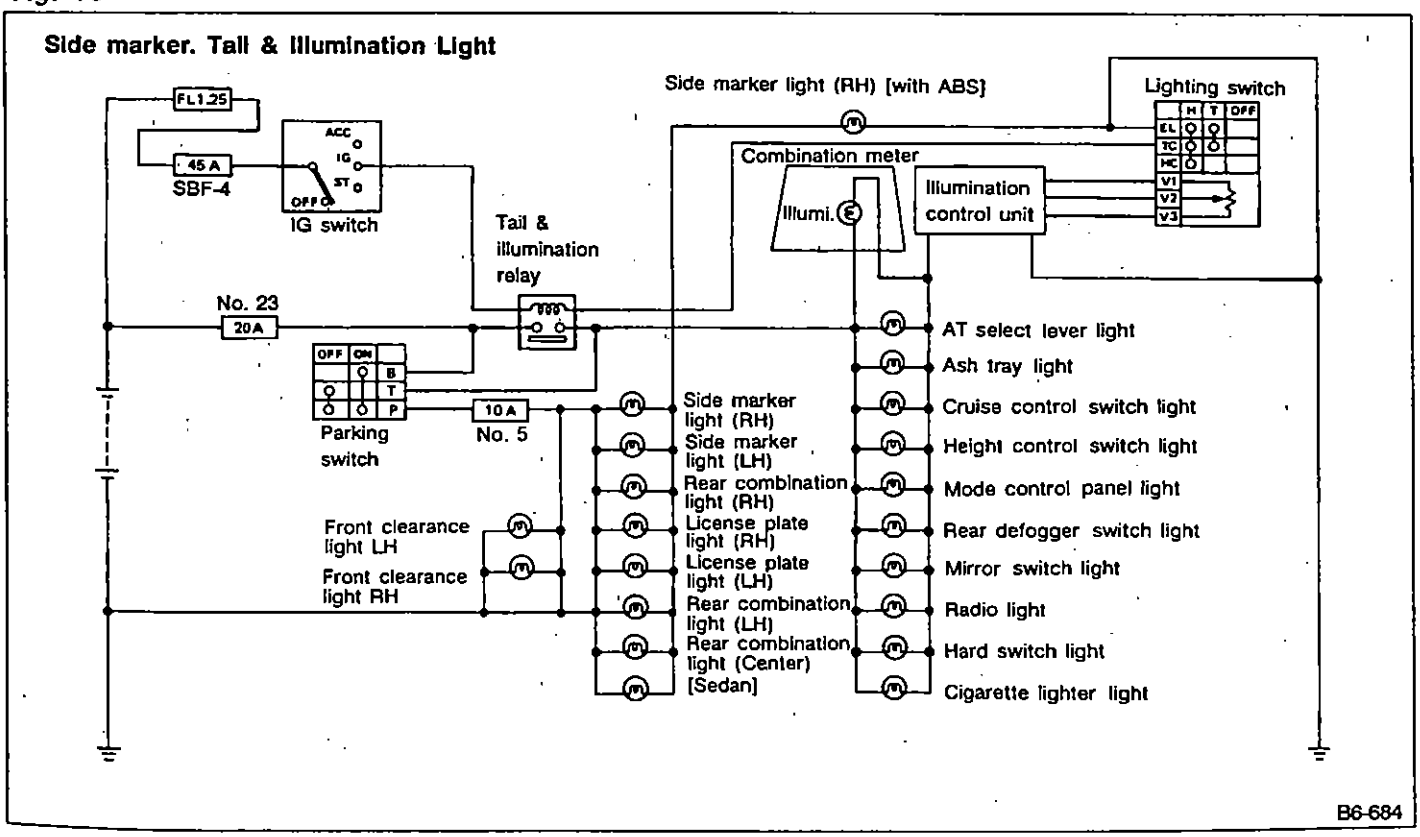

Side marker. Tail & Illumination Light
Side marker light (RH) [with ABS]
Lighting switch
Combination meter
Illumi.
Illumination control unit
FL1.25
45A
SBF-4
IG switch
Tail & illumination relay
No. 23
20A
Parking switch
10A
No. 5
Front clearance light LH
Front clearance light RH
Side marker light (RH)
Side marker light (LH)
Rear combination light (RH)
License plate light (RH)
License plate light (LH)
Rear combination light (LH)
Rear combination light (Center) [Sedan]
AT select lever light
Ash tray light
Cruise control switch light
Height control switch light
Mode control panel light
Rear defogger switch light
Mirror switch light
Radio light
Hard switch light
Cigarette lighter light
B6-684

Fig. 19

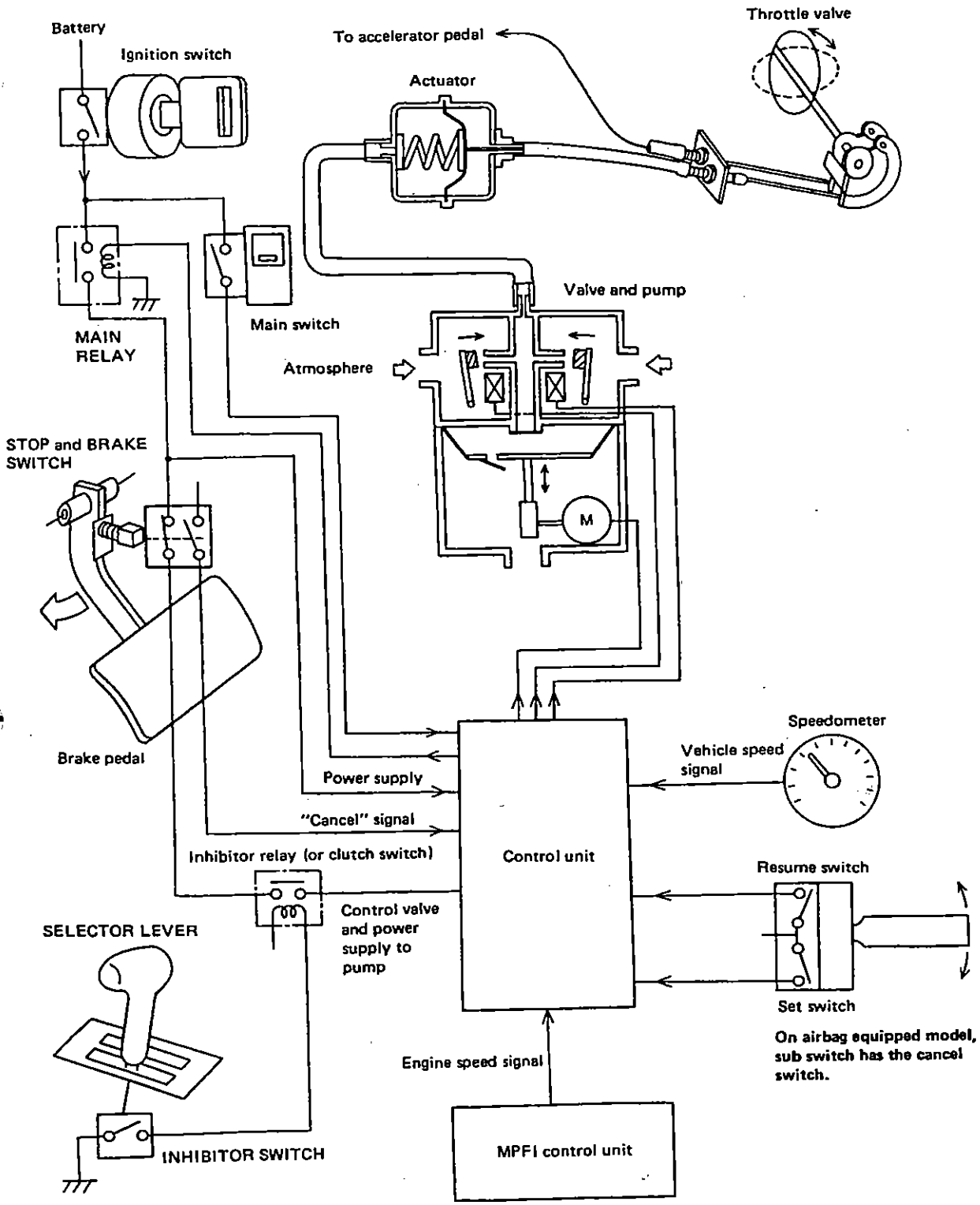

Battery
Ignition switch
To accelerator pedal
Throttle valve
Actuator
Valve and pump
Main switch
MAIN RELAY
Atmosphere
STOP and BRAKE SWITCH
M
Brake pedal
Speedometer
Vehicle speed signal
Power supply
"Cancel" signal
Inhibitor relay (or clutch switch)
Control unit
Resume switch
Control valve and power supply to pump
SELECTOR LEVER
Set switch
On airbag equipped model, sub switch has the cancel switch.
Engine speed signal
INHIBITOR SWITCH
MPFI control unit
B6-162

Fig. 113

B: DESCRIPTION

1. CONTROL AND OPERATION

Constant speed control	When actual driving speed is higher than "set" speed, cruise control system intermittently opens vent valve and moves throttle valve toward the close position. This occurs while comparing actual driving speed with "set" speed. When actual driving speed is lower than "set" speed, the system intermittently activates vacuum pump to move throttle valve toward the "open" direction.
"Set" control	When SET/COAST switch is pressed with main switch ON while vehicle is being driven a specifieds greater than 40 km/h (25 MPH), current flows so that vent and safety valves close. This then causes vacuum pump to intermittently activate to set throttle valve at position corresponding with accelerator pedal depression. Thus, vehicle is being driven at constant speed.
Deceleration control	When SET/COASTS switch is turned ON while vehicle is cruising, vent valve intermittently opens, partially closing throttle valve. This causes the vehicle to decelerate. When the switch is turned OFF, vehicle speed is stored in memory and vehicle is constantly driven at that speed.
Acceleration control	When RESUME/ACCEL switch is turned ON while vehicle is cruising, vacuum pump intermittently activates to partially open throttle valve. This causes vehicle to accelerate. When the switch is turned OFF, vehicle speed is stored in memory and vehicle is constantly driven at that speed.
Resume control	When RESUME/ACCEL switch is turned ON after cruise control is released, vehicle speed returns to that speed which was stored in memory just before cruise control was released. However, this occurs only when vehicle is being driven at a speed greater than 30 km/h (19 MPH).
Manual cancel control	When any of the following signals are entered, vent valve and safety valve open to release cruising speed. (1) Stop light switch ON signal (Brake pedal depressed) (2) Brake switch OFF signal (Brake pedal depressed) (3) Clutch switch OFF signal (Clutch pedal depressed — MT) (4) Inhibitor switch ON signal (Selector lever set to "N" — AT) (5) CANCEL switch ON signal (Sub switch pulled — Airbag equipped model)
Low speed limit control	When vehicle speed drops below 30 km/h (19 MPH), cruise control is automatically cancelled. The memorized speed will also be cleared. Cruise control at speed lower than 40 km/h (25 MPH) cannot be effected.
Release valve control	When vehicle speed increases 10 km/h (6 MPH) greater than memorized speed while vehicle is cruising (downgrade, etc.) actuator's vent valve as well as safety valve are turned OFF (to open to atmospheric pressure) so that vehicle decelerates. When vehicle decelerates within 8 km/h (5 MPH) greater than the memorized speed, vent and safety valve are turned ON (to shut out atmospheric pressure) so that cruise control resumes.
Auto, cancel control	When any of the following signals are entered while vehicle is cruising, actuator's vent valve as well as safety valve are turned OFF (to shut out atmospheric pressure). This cancels cruise control. (a) When vehicle speed drops below low speed limit 30 km/h (19 MPH), (b) When actuator's vent valve, safety valve, vacuum pump motor or harness circuit is shorted, (c) When actuator's vent valve, safety valve, vacuum pump or harness circuit are discontinued, (d) When ON signals are simultaneously emitted from SET/COAST and RESUME/ACCEL switches, or (e) When a vehicle speed signal that implies speed variation of greater than ± 25 km/h (± 16 MPH) per second is entered.

Cruise control unit compares the actual car speed detected by feedback signals from speed sensor incorporated in speedometer with the speed set in the memory memorized when set switch was turned on. A signal is then transmitted according to the difference between the two speeds.

This signal is transmitted to solenoid valves of valve ASSY located in engine compartment. The movement of actuator operates throttle valve through accelerator pedal and cable, thereby keeping the car speed constant.

SUBARU®

1992

SERVICE MANUAL

Precaution for Supplemental Restraint System "Airbag"
The Supplemental Restraint System "Airbag" helps to reduce the risk or severity of injury to the driver in a frontal collision.
The Supplemental Restraint System consists of an airbag module (located in the center of the steering wheel), sensors, a control unit, warning light, wiring harness and spiral cable.
Information necessary to service the safety is included in the "5-5. SUPPLEMENTAL RESTRAINT SYSTEM" of this Service Manual.
WARNING:
- To avoid rendering the Airbag system inoperative, which could lead to personal injury or death in the event of a severe frontal collision, all maintenance must be performed by an authorized SUBARU dealer.
- Improper maintenance, including incorrect removal and installation of the Airbag system, can lead to personal injury caused by unintentional activation of the Airbag system.
- All Airbag system electrical wiring harnesses and connectors are covered with yellow outer insulation. Do not use electrical test equipment on any circuit related to the Supplemental Restraint System "Airbag".

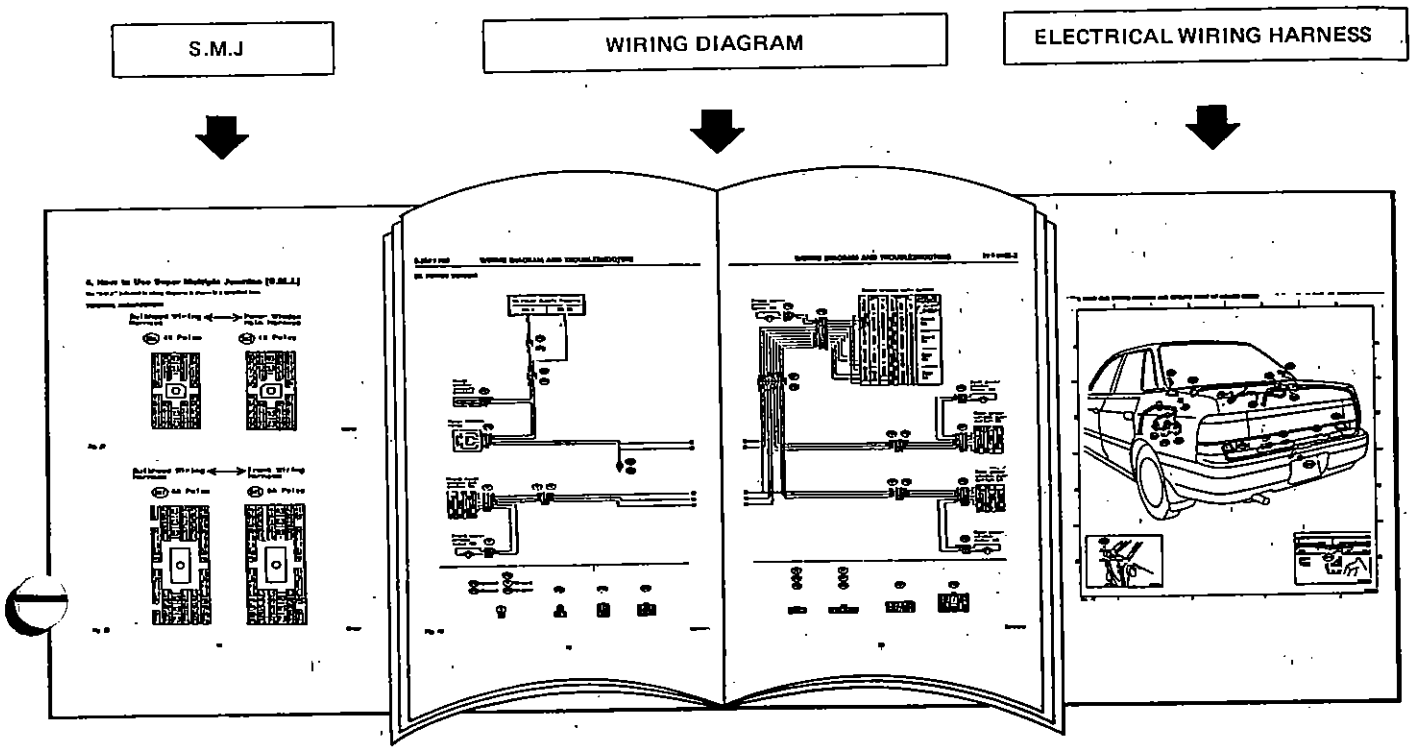
1. General Description

1. HOW TO USE THIS MANUAL

The description of the electrical system is divided into the charging system, starting system, etc.

1. First, open to the necessary electrical system section and wiring diagram.

2. Next, open the foldout page of the S.M.J. (super Multiple Junction) and that of the electrical wiring diagram. The S.M.J.'s terminal position is given, and by observing the electrical wiring harness' illustrations (front, instrument panel, etc.), the wiring diagram connector can be located.



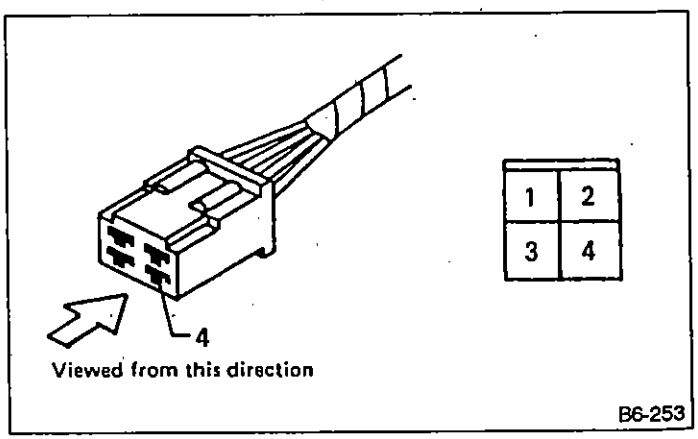
B6-240

Fig. 1

2. WIRING DIAGRAM

The wiring diagram of each system is illustrated so that you can understand the path through which the electric current flows from the battery. Sketches and codes are used in the diagrams. They should read as follows:

1) Each connector and its terminal position are indicated by a sketch of the connector in a disconnected state which is viewed from the front, as shown in figure.



B6-253

Fig. 2

2) The number of poles or pins, presence of a lock, and pin number of each terminal are indicated in the sketch of each connector.

In the sketch, the highest pole number refers to the number of poles which the connector has. For example, the sketch of the connector shown in Figure 3 indicates the connector has 9 poles.

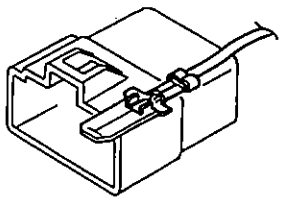
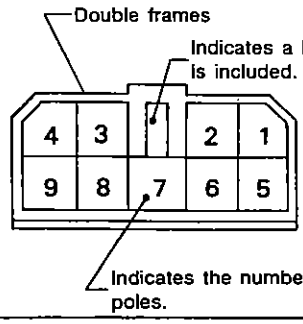
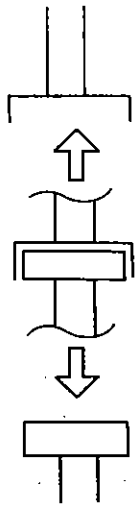
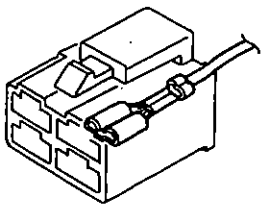
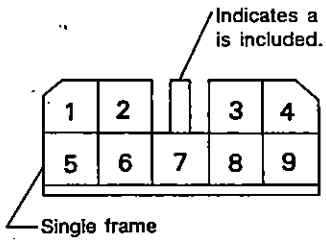
Connector used in vehicle	Connector shown in wiring diagram		
	Sketch	Symbol	Number of poles
			Numbered in order from upper right to lower left.
			Numbered in order from upper left to lower right.

Fig. 3

When one set of connectors is viewed from the front side, the pole numbers of one connector are symmetrical to those of the other. When these two connectors are connected as a unit, the poles which have the same number are joined.

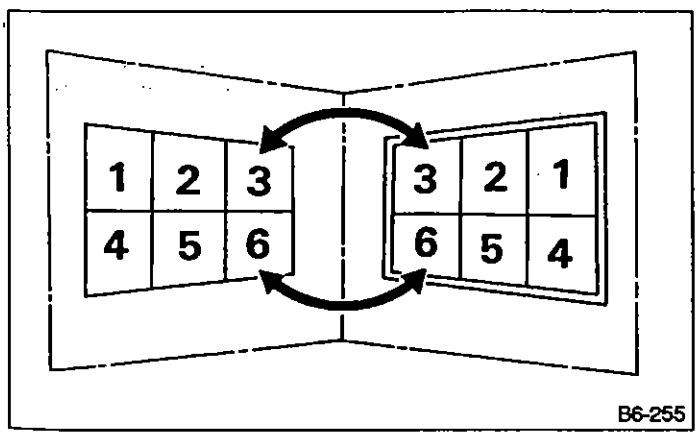


Fig. 4

3) Electrical wiring harness

The connectors are numbered along with the number of poles, external colors, and mating connections in the accompanying list.

4) The sketch of each connector in the wiring diagram usually shows the "A" side of the connector. The relationship between the wire color, terminal number and connector is described below.

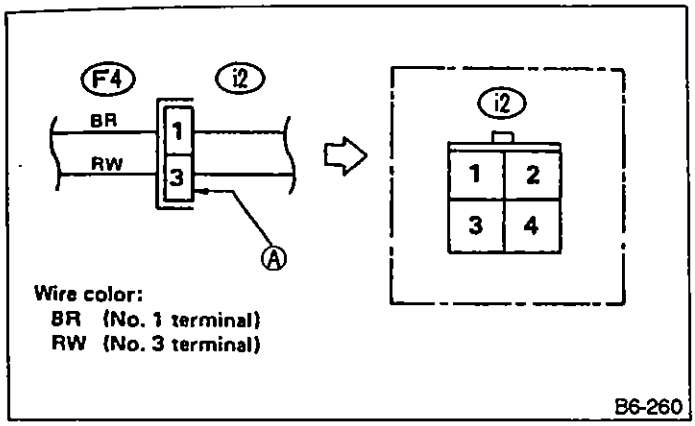


Fig. 5

c. A wire which runs in one direction from a connector terminal sometimes may have a different color from that which runs in the other direction from that terminal.

5) In wiring diagram, connectors which have no terminal number refer to one-pole types. Sketches of these connectors are omitted intentionally.

6) The following color codes are used to indicate the colors of the wires used.

Color code	Color
L	Blue
B	Black
Y	Yellow
G	Green
R	Red
W	White
Br	Brown
Lg	Light green
Gr	Gray
P	Pink
Or	Orange
Lb	Light Blue
SA	Sealed (Inner)
SB	Sealed (Outer)

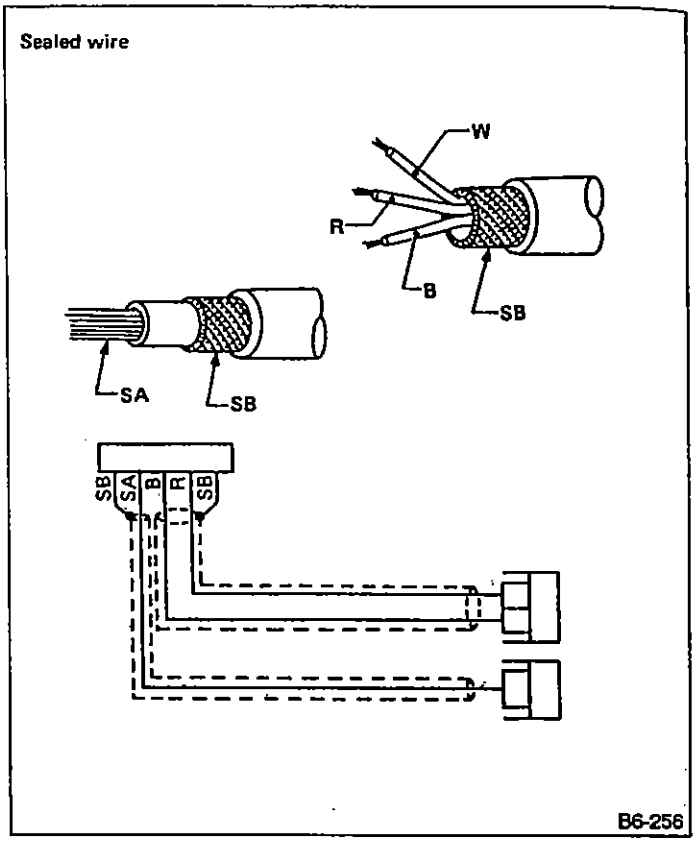


Fig. 6

7) The wire color code, which consists of two letters (or three letters including Br or Lg), indicates the standard color (base color of the wire covering) by its first letter and the stripe marking by its second letter.

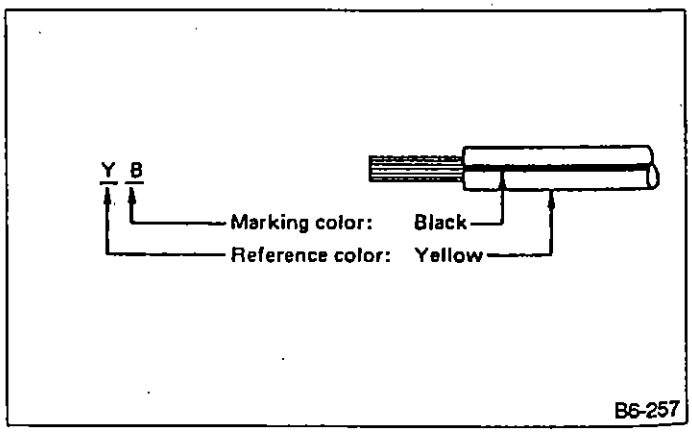


Fig. 7

8) The table below lists the nominal sectional areas and allowable currents of the wires.

Nominal sectional area mm^2	No. of strands/ strand diameter	Outside diameter of finished wiring mm	Allowable current Amps/ 40°C
0.3	7/0.26	1.8	7
0.5	7/0.32	2.2 (or 2.0)	12
0.75	30/0.18	2.6 (or 2.4)	16
0.85	11/0.32	2.4 (or 2.2)	16
1.25	16/0.32	2.7 (or 2.5)	21
2	26/0.32	3.1 (or 2.9)	28
3	41/0.32	3.8 (or 3.6)	38
5	65/0.32	4.6 (or 4.4)	51
8	50/0.45	5.5	67

a. The allowable current in the above table indicates the tolerable amperage of each wire at an ambient temperature of 40°C (104°F).

b. The allowable current changes with ambient temperature. Also, it changes if a bundle of more than two wires is used.

c. When replacing or repairing a wire, be sure to use the same size and type of the wire which was originally used.

9) Each unit is directly grounded to the body or indirectly groundes through a harness ground terminal. Different symbols are used in the wiring diagram to identify the two grounding systems.

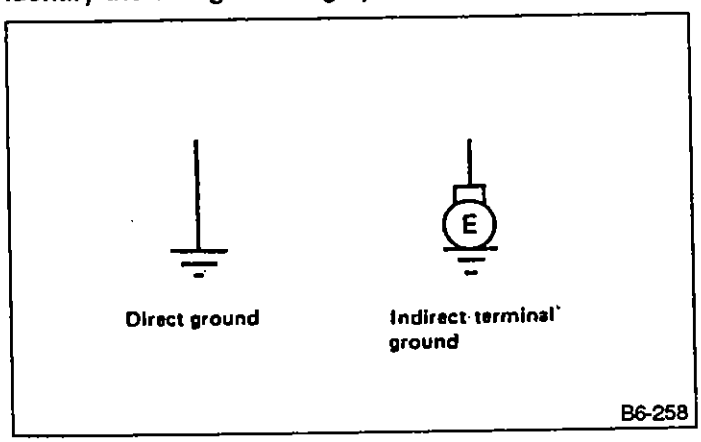


Fig. 8

The ground points shown in the wiring diagram refer to the following:

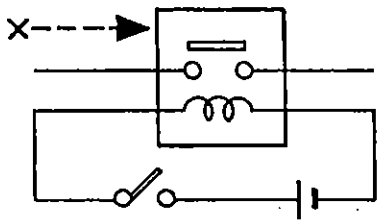
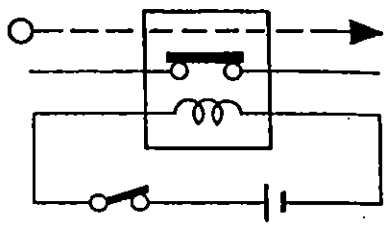
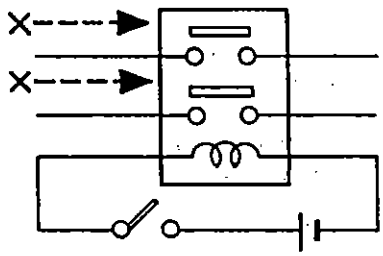
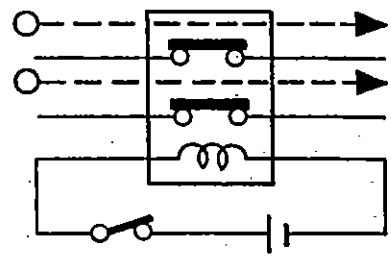
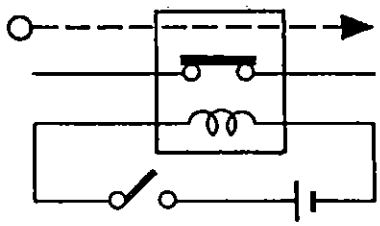
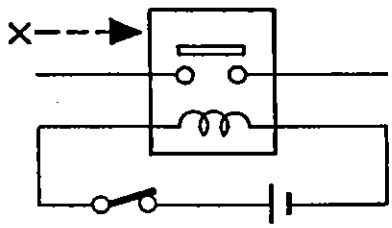
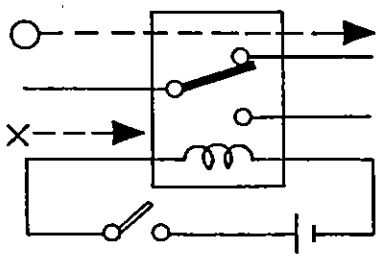
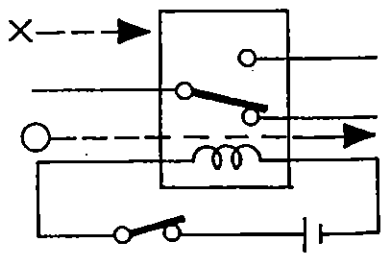
(GB) Body ground
(GE) Engine ground
(GR) Radio ground
(GD) Rear defogger ground

All wiring harnesses are provided with a ground point which should be securely connected.

10) Relays are ciassified as normally-open or normally-closed.

normally-closed relay has one or more contacts.

wiring diagram shows the relay mode when the energizing circuit is OFF.

Relay type		Energizing circuit OFF	Energizing circuit ON
Normally-open type	4-pole		
	6-pole		
Normally-closed type	4-pole		
Mixed type	5-pole		

B6-243

Fig. 9

Key to symbols:

○ →: Current flows.

X →: Current dose not flow.

11) Each connector number shown in the wiring diagram corresponds to that in the wiring harness. The location of each connector in the actual vehicle is determined by reading the first character of the connector (for example, a "F" for F8, "i" for i16, etc.) and the type of wiring harness.
The first character of each connector number refers to the area or system of the vehicle, as indicated in table below.

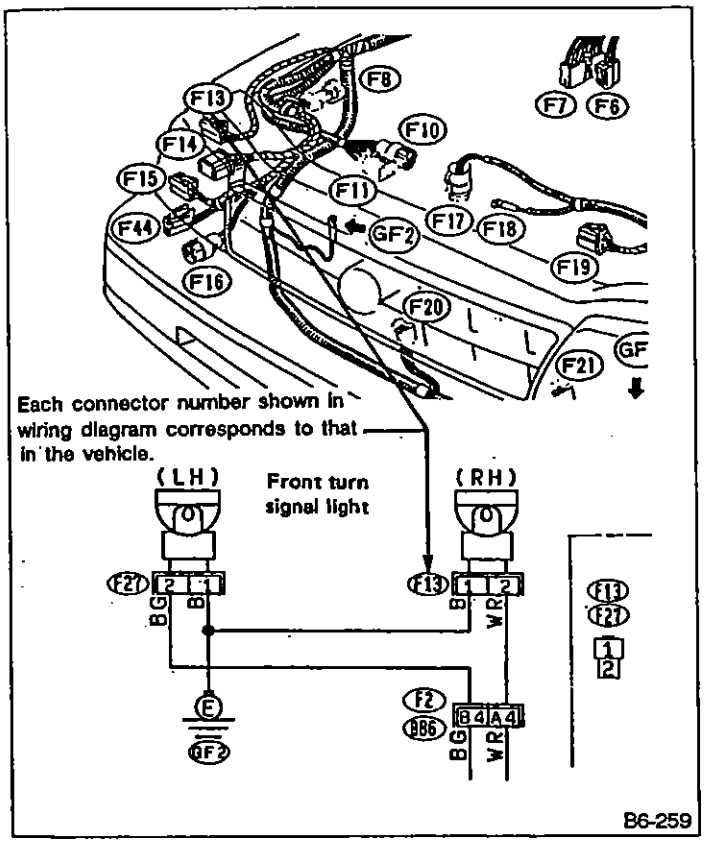


Fig. 10

Symbol	Wiring harness & Cord
F	Front
E	Engine, transmission, etc.
B	Bulkhead
i	Instrument panel
R	Rear & Rear gate
P	Power window & door

3. TROUBLESHOOTING PROCEDURES

The most important purpose of troubleshooting is to determine which part is malfunctioning quickly, to save time and labor.

1. Identification of trouble symptom
Determine what the problem is based on the symptom.

2. Probable cause of trouble
Look at the wiring diagram and check the system's circuit. Then check the switch, relay, fuse, ground, etc.

3. Location and repair of trouble
1) Using the troubleshooting narrow down the causes.
2) If necessary, use a voltmeter, ohmmeter, etc.
3) Before replacing certain component parts (switch, relay, etc.), check the power supply, ground, for open wiring harness, poor connectors, etc. If no problems are encountered, check the component parts.

4. Confirmation of system operation
After repairing, ensure that the system operates properly.

4. VOLTAGE MEASUREMENT

1) Using a voltmeter, connect the negative lead to a good ground point or negative battery terminal and the positive lead to the connector or component terminal.
2) Contact the positive probe of the voltmeter on connector (A).
The voltmeter will indicate a voltage.
3) Shift the positive probe to connector (B). The voltmeter will indicate no voltage.
With test setup held as it is, turn switch ON. The voltmeter will indicate a voltage and, at the same time, the light will come on.
4) The circuit is in good order. If a problem such as a lamp failing to light occurs, use the procedures outlined above to track down the malfunction.

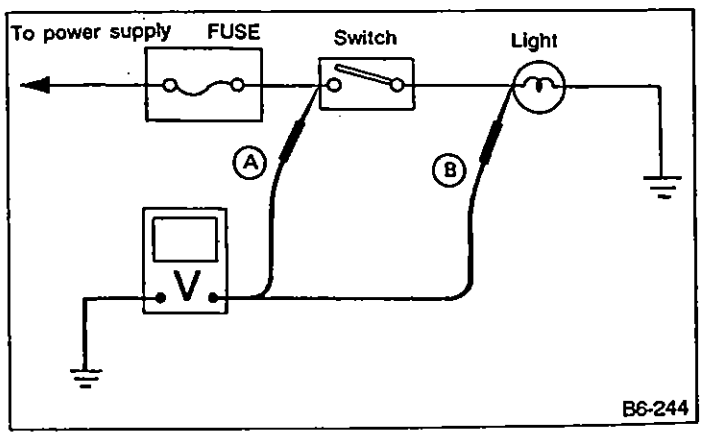


Fig. 11

5. CIRCUIT CONTINUITY CHECKS

1) Disconnect the battery terminal or connector so there is no voltage between the check points.
2) Contact the two leads of an ohmmeter to each of the check points.
If the circuit has diodes, reverse the two leads and check again.
2) Use an ohmmeter to check for diode continuity.
When contacting the negative lead to the diode positive side and the positive lead to the negative side, there should be continuity.
When contacting the two leads in reverse, there should be no continuity.

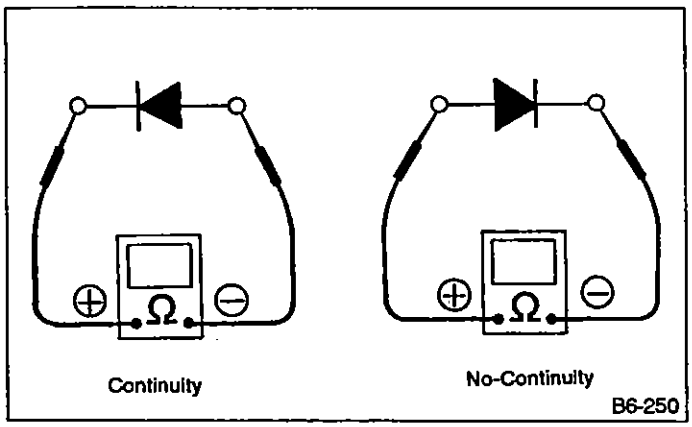


Fig. 12

Symbol "o—o" indicates that continuity exists between two points or terminals. For example, when a switch position is "3", continuity exists among terminals 1, 3 and 6, as shown in table below.

Terminal / Switch Position	1	2	3	4	5	6
OFF						
1	o				o	o
2	o			o		o
3	o		o			o
4	o	o				o

6. HOW TO DETERMINE AN OPEN CIRCUIT

1) Voltmeter Method
An open circuit is determined by measuring the voltage between respective connectors and ground using a voltmeter, starting with the connector closest to the power supply. The power supply must be turned ON so that current flows in the circuit. If voltage is not present between a particular connector and ground, the circuit between that connector and the previous connector is open.

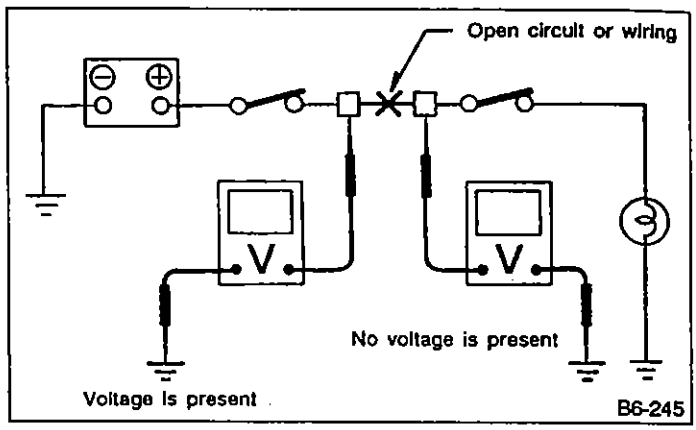


Fig. 13

2) Ohmmeter method
Disconnect all connectors affected, and check continuity in the wiring between adjacent connectors. When the ohmmeter indicates "infinite", the wiring is open.

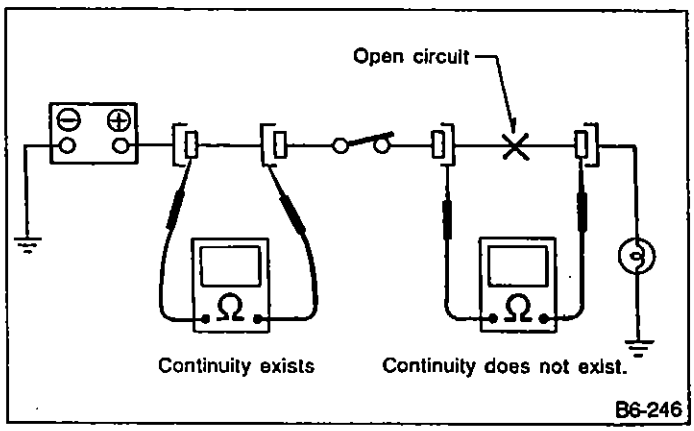


Fig. 14

7. HOW TO DETERMINE A SHORTCIRCUIT

1) Test lamp method

Connect a test lamp (rated at approximately 3 watts) in place of the blown fuse and allow current to flow through the circuit. Disconnect one connector at a time from the circuit, starting with the one located farthest from the power supply. If the test lamp goes out when a connector is disconnected, the wiring between that connection and the next connector (farther from the power supply) is shorted.

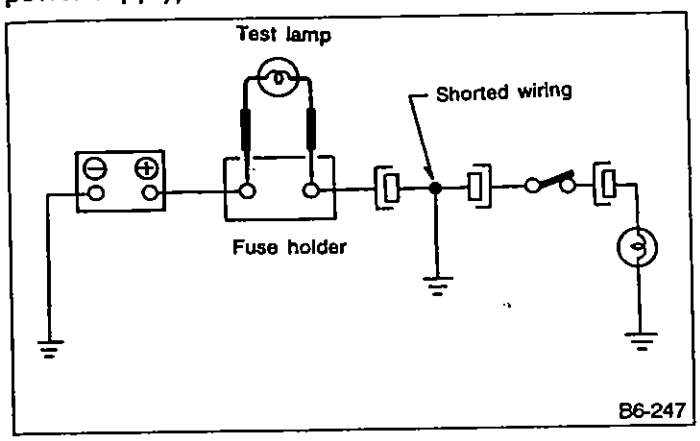


Fig. 15

2) Ohmmeter method

Disconnect all affected connectors, and check continuity between each connector and ground. When ohmmeter indicates continuity between a particular connector and ground, that connector is shorted.

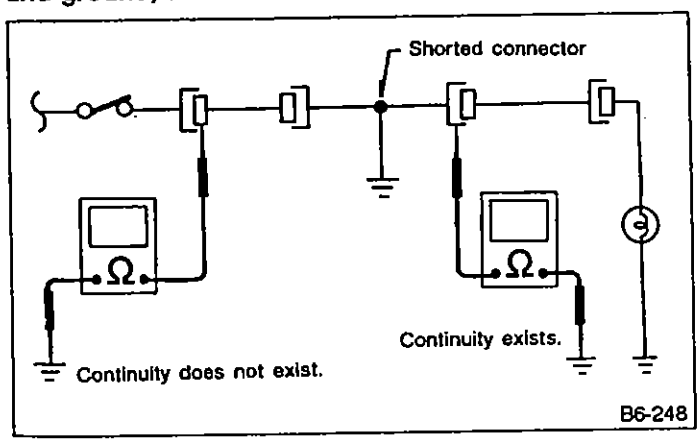


Fig. 16

2. Working Precautions AIRBAG

1. SUPPLEMENTAL RESTRAINT SYSTEM "AIRBAG"

Airbag system wiring harness is routed near other wiring harness.

1. All Airbag system wiring harness and connectors are colored yellow. Do not use electrical test equipment on these circuit.

2. Be careful not to damage Airbag system wiring harnesses.

2. PRECAUTIONS WHEN WORKING WITH THE PARTS MOUNTED ON THE VEHICLE

1) When working under a vehicle which is jacked up, always be sure to use safety stands.

2) The parking brake must always be applied during working. Also, in automatic transmission vehicles, keep the select lever set to the P (Parking) range.

3) Be sure the workshop is properly ventilated when running the engine. Further, be careful not to touch the belt or fan while the engine is operating.

4) Be careful not to touch hot metal parts, especially the radiator and exhaust system immediately after the engine has been shut off.

3. PRECAUTIONS IN TROUBLE DIAGNOSIS AND REPAIR OF ELECTRIC PARTS

1) The battery cable must be disconnected from the battery's (−) terminal, and the ignition switch must be set to the OFF position, unless otherwise required by the troubleshooting.

2) Securely fasten the wiring harness with clamps and slips so that the harness does not interfere with the body end parts or edges and bolts or screws.

3) When installing parts, be careful not to catch them on the wiring harness.

4) When disconnecting a connector, do not pull the wires, but pull while holding the connector body.

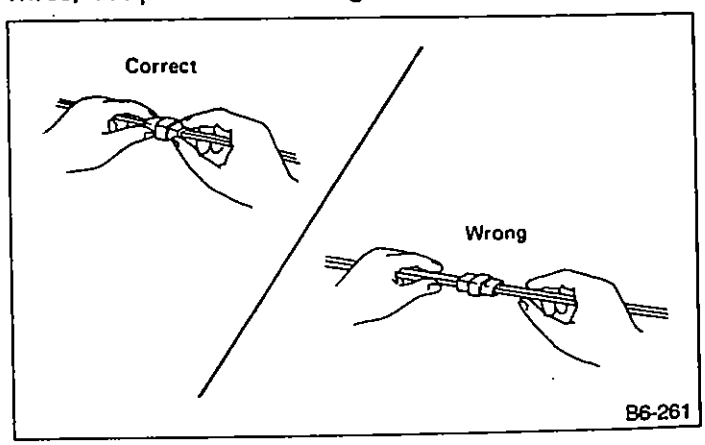


Fig. 17

5) Some connectors are provided with a lock. One type of such a connector is disconnected by pushing the lock, and the other, by moving the lock up. In either type the lock shape must be identified before attempting to disconnect the connector.
To connect, insert the connector until it snaps and confirm that it is tightly connected.

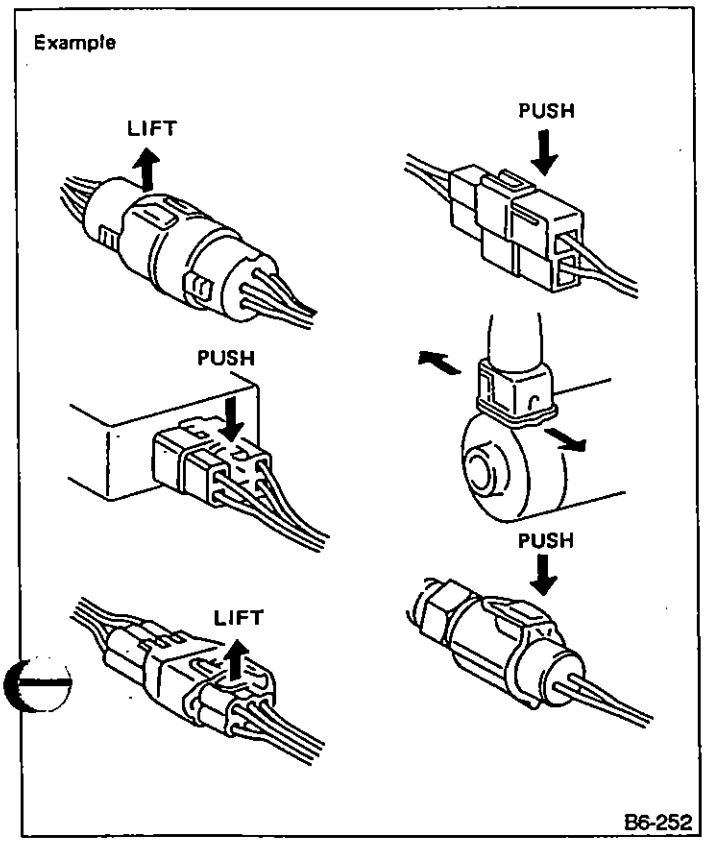


Fig. 18

6) When checking continuity between connector terminals, or measuring voltage across the terminal and ground, always contact tester probe(s) on terminals from the wiring connection side. If the probe is too thick to gain access to the terminal, use "mini" test leads.
To check water-proof connectors (which are not accessible from the wiring side), contact test probes on the terminal side being careful not to bend or damage the terminals.

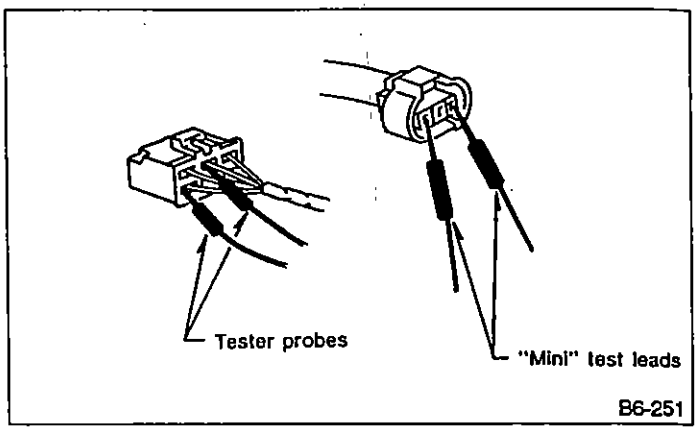


Fig. 19

7) Sensors, relays, electrical unit, etc., are sensitive to strong impacts.
Handle them with care so that they are not dropped or mishandled.

3. How to Use Wiring Diagram

RELAY

A symbol used to indicate a relay.

POWER SUPPLY ROUTING

A symbol is used to indicate the power supply in each wiring diagram.
"MB-5", "MB-6," etc., which are used as power-supply symbols throughout the text, correspond with those shown in the POWER SUPPLY ROUTING in the wiring diagram.
Accordingly, using the POWER SUPPLY ROUTING and wiring diagrams permits service personnel to understand the entire electrical arrangement of a system.

SYMBOLS OF WIRE CONNECTION AND CROSSING

Symbol — Refers to wires which are connected and branched at the "dot" point.

Symbol — Refers to wires which are crossed but not connected.

SYMBOLS AND ABBREVIATIONS

A number of symbols and abbreviations are used in each wiring diagram to easily identify parts or circuits.

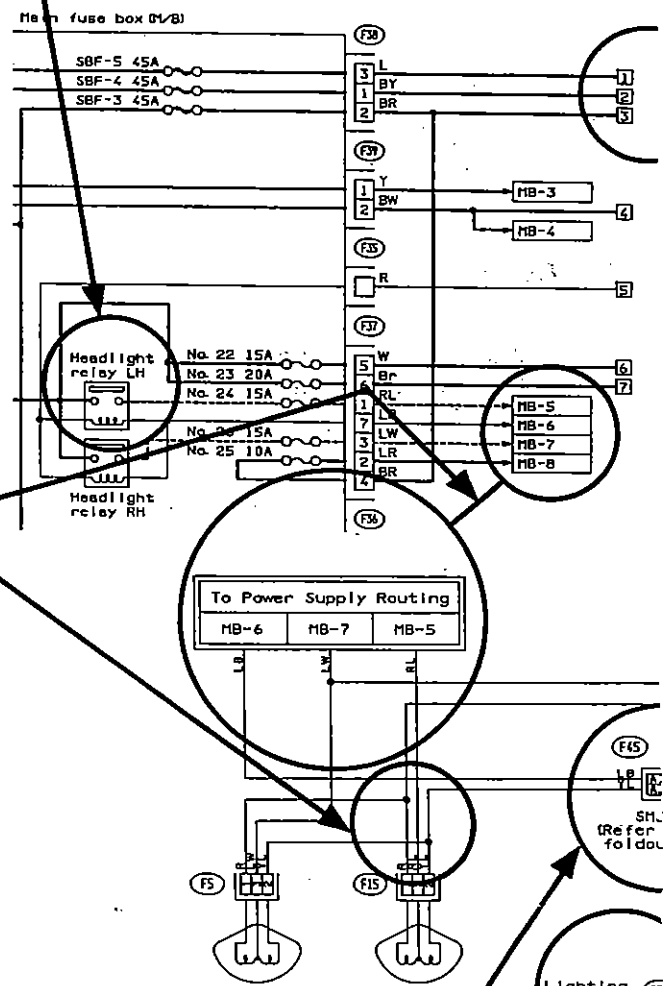


Fig. 20

S.M.J.

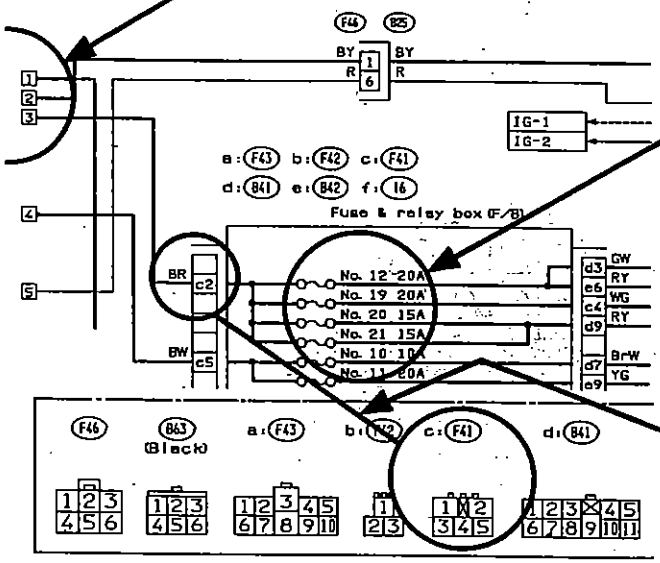
A symbol is used to indicate the terminal arrangement of the super multiple junction. The S.M.J. is not shown in respective wiring diagrams but is indicated on the next page.

DIODE

A symbol is used to

WIRING CONNECTION

Some wiring diagrams are indicated in foldouts for convenience. Wiring destinations are indicated where necessary by corresponding symbols (as when two pages are needed for clear indication), as shown below.

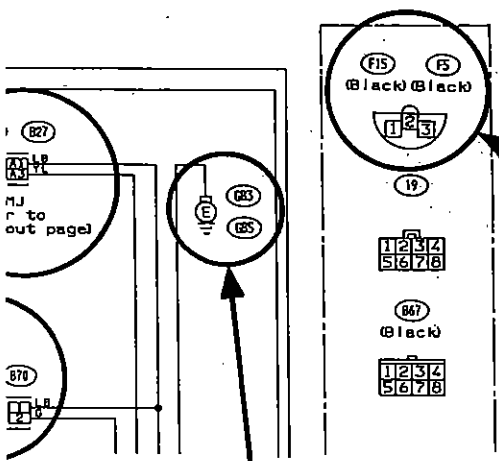


FUSE NO. & RATING

The "FUSE NO. & RATING" corresponds with that used in the fuse box (main fuse box, fuse and joint box.)

CONNECTOR

1. Each connector is indicated by a symbol.
2. Each terminal number is indicated in the corresponding wiring diagram in an abbreviated form.
3. For example, terminal number "C2" refers to No. 2 terminal of connector (C:F41) shown in the connector sketch.



B6-249

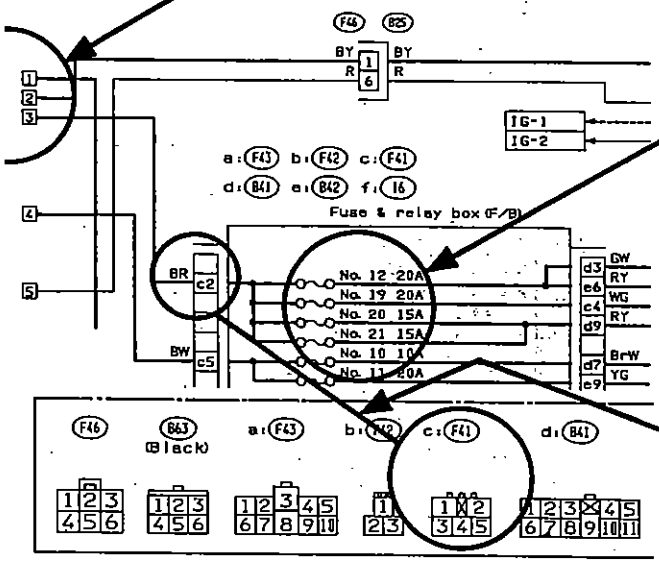
CONNECTOR SKETCH

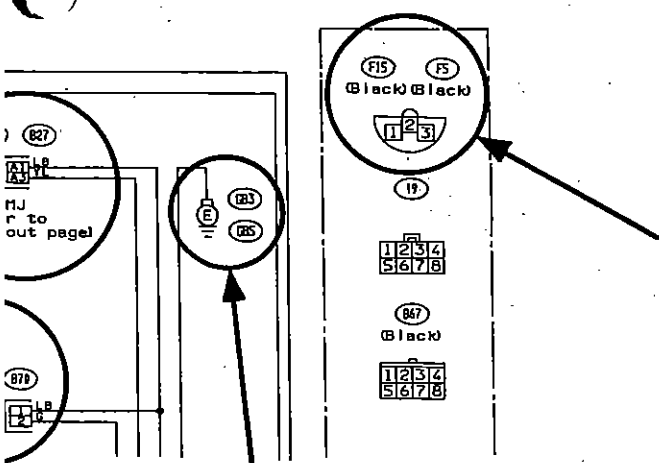
1. Each connector sketch clearly identifies the shape and color of a connector as well as terminal locations. Non-colored connectors are indicated in natural color.
2. When more than two types of connector number are indicated in a connector sketch, it means that the the same type connectors are used.

GROUND

Each grounding point can be located easily by referring to the corresponding wiring harness.

to indicate a diode.





B6-249

WIRING CONNECTION

Some wiring diagrams are indicated in foldouts for convenience. Wiring destinations are indicated where necessary by corresponding symbols (as when two pages are needed for clear indication), as shown below.

FUSE NO. & RATING

The "FUSE NO. & RATING" corresponds with that used in the fuse box (main fuse box, fuse and joint box.)

CONNECTOR

1. Each connector is indicated by a symbol.
2. Each terminal number is indicated in the corresponding wiring diagram in an abbreviated form.
3. For example, terminal number "C2" refers to No. 2 terminal of connector (C:F41) shown in the connector sketch.

CONNECTOR SKETCH

1. Each connector sketch clearly identifies the shape and color of a connector as well as terminal locations. Non-colored connectors are indicated in natural color.
2. When more than two types of connector number are indicated in a connector sketch, it means that the the same type connectors are used.

GROUND

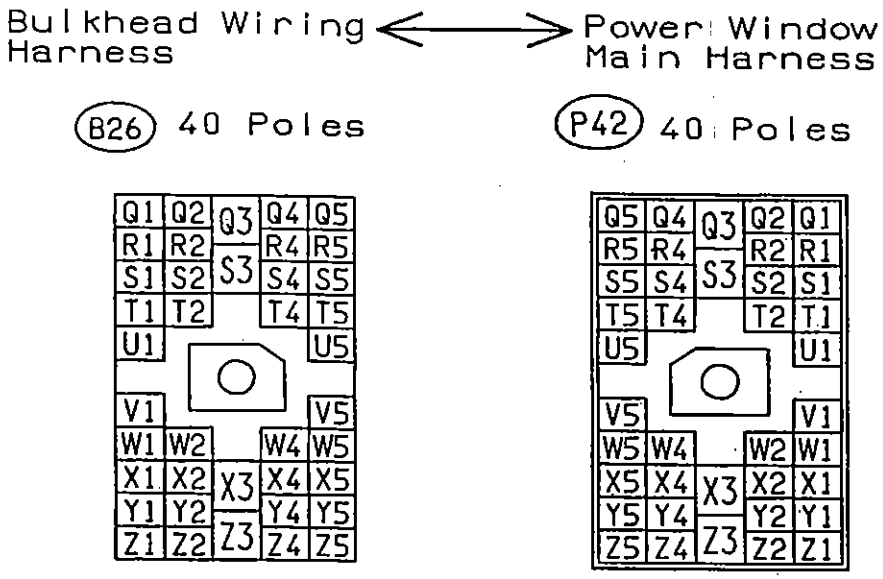
Each grounding point can be located easily by referring to the corresponding wiring harness.

...icate a diode.

4. How to Use Super Multiple Junction (S.M.J.)

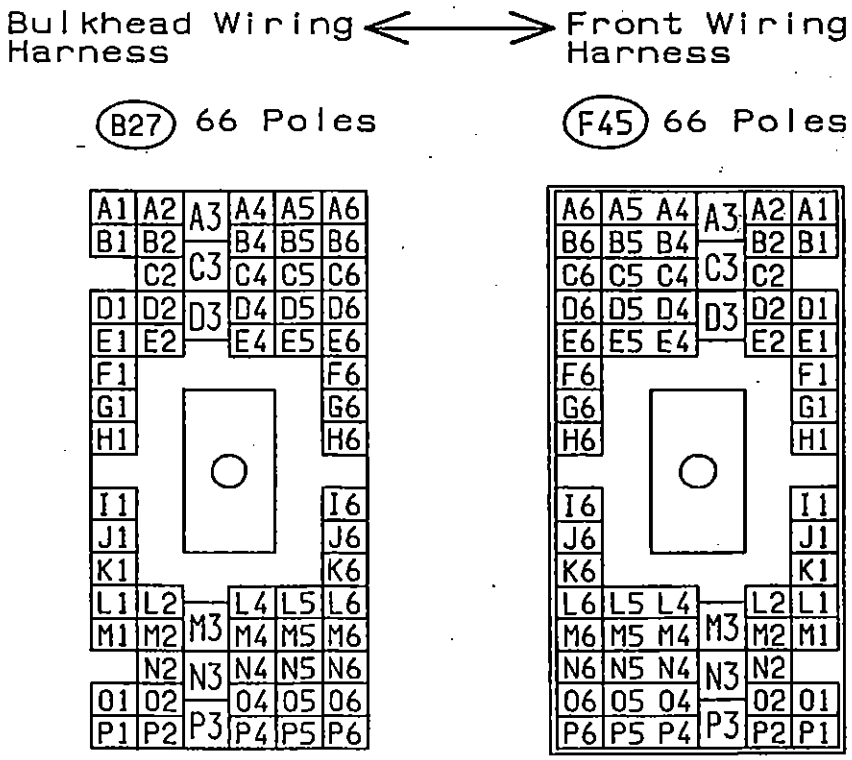
The "S.M.J." indicated in wiring diagrams is shown in a simplified from.

TERMINAL ARRANGEMENT



B6-238

Fig. 21



B6-239

Fig. 22

INSTALLATION

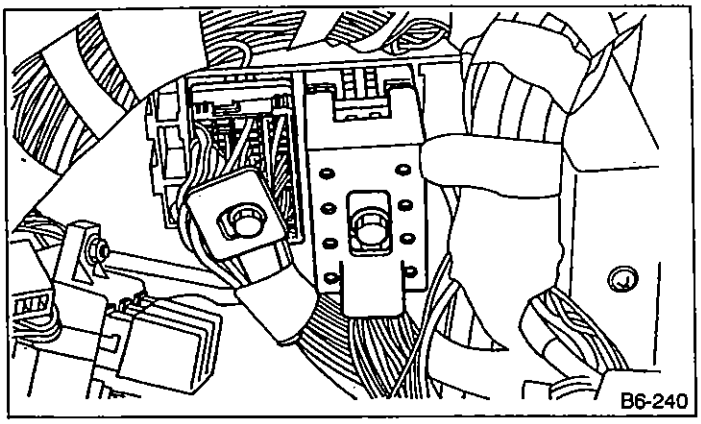


Fig. 23

Tightening torque:
4.4 — 7.4 N·m (45 — 75 kg-cm, 39 — 65 in-lb)

- **Align the cutout portion of one connector with that of other before tightening the connecting bolt.**
- **Do not tighten the bolt excessively since this may deform the connectors.**

EXPLANATION OF S.M.J. SHOWN IN THE WIRING DIAGRAM

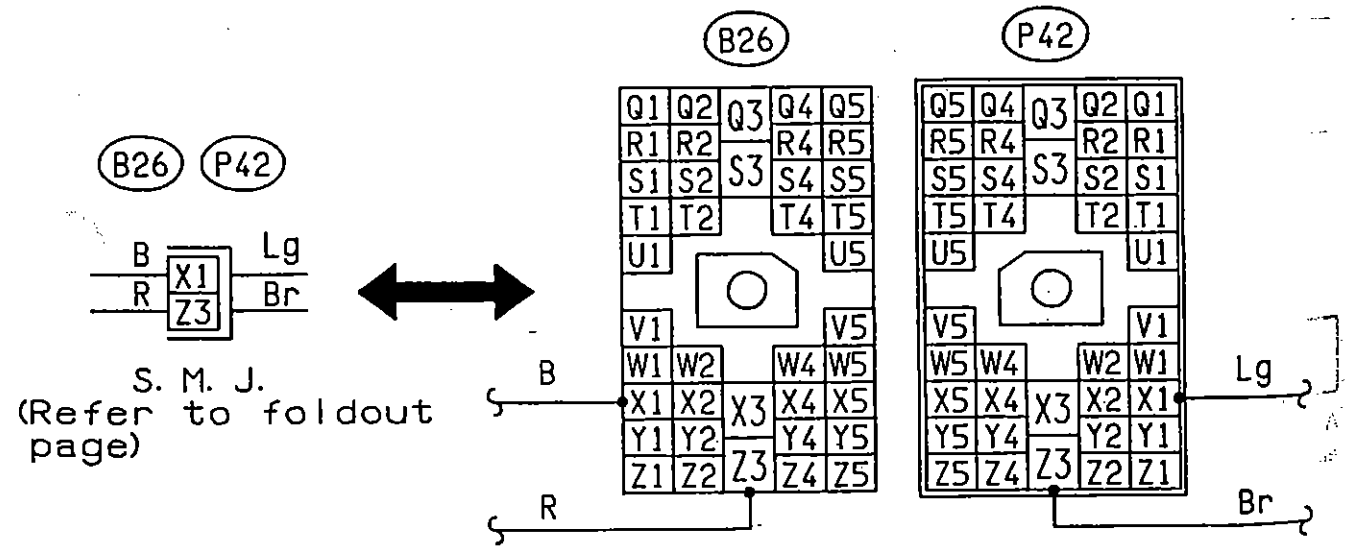


Fig. 24

5. Wiring Diagram and Troubleshooting

1. POWER SUPPLY ROUTING

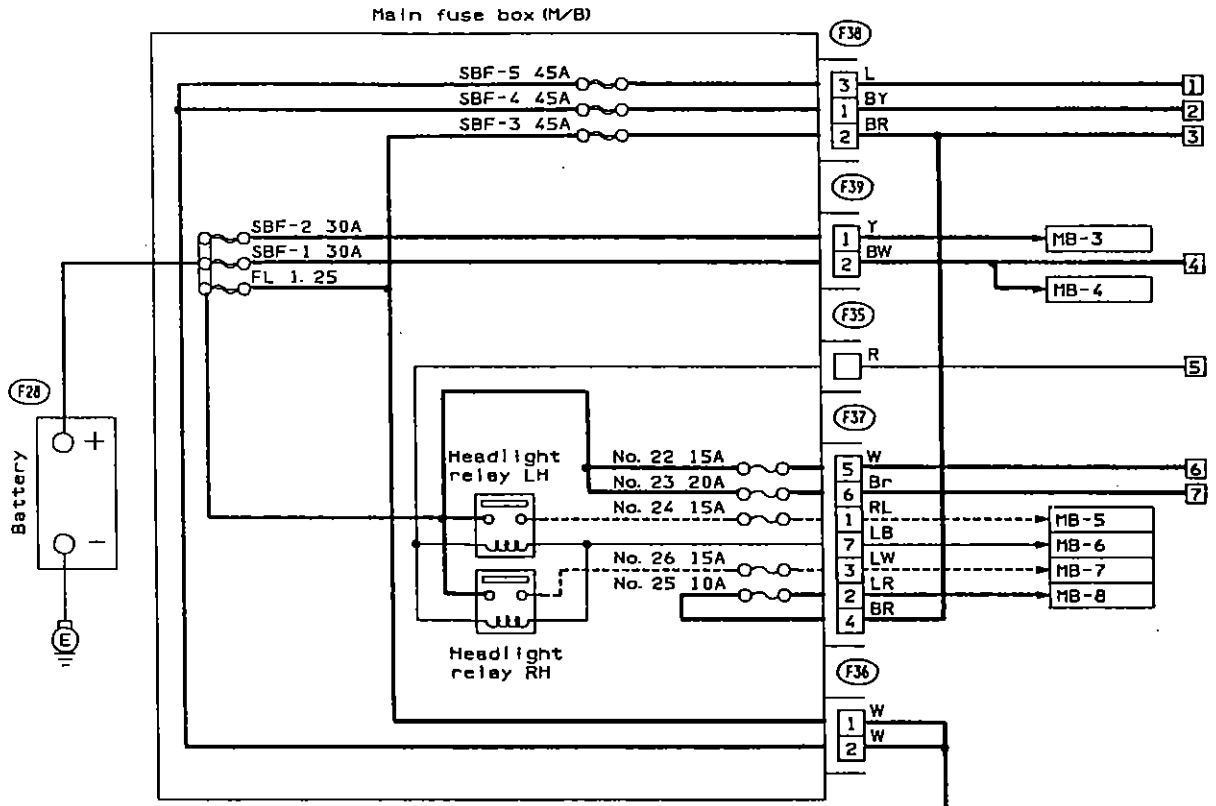


Fig. 25-1 Fig. 25-2

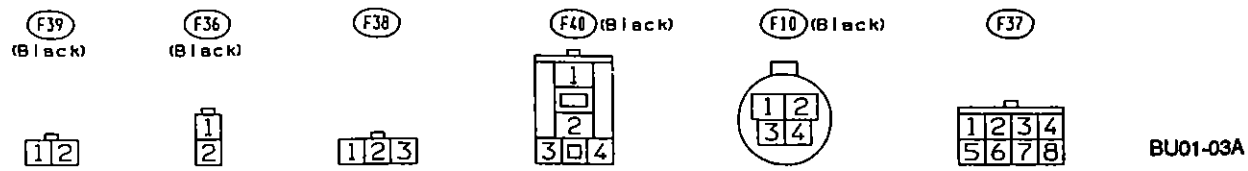
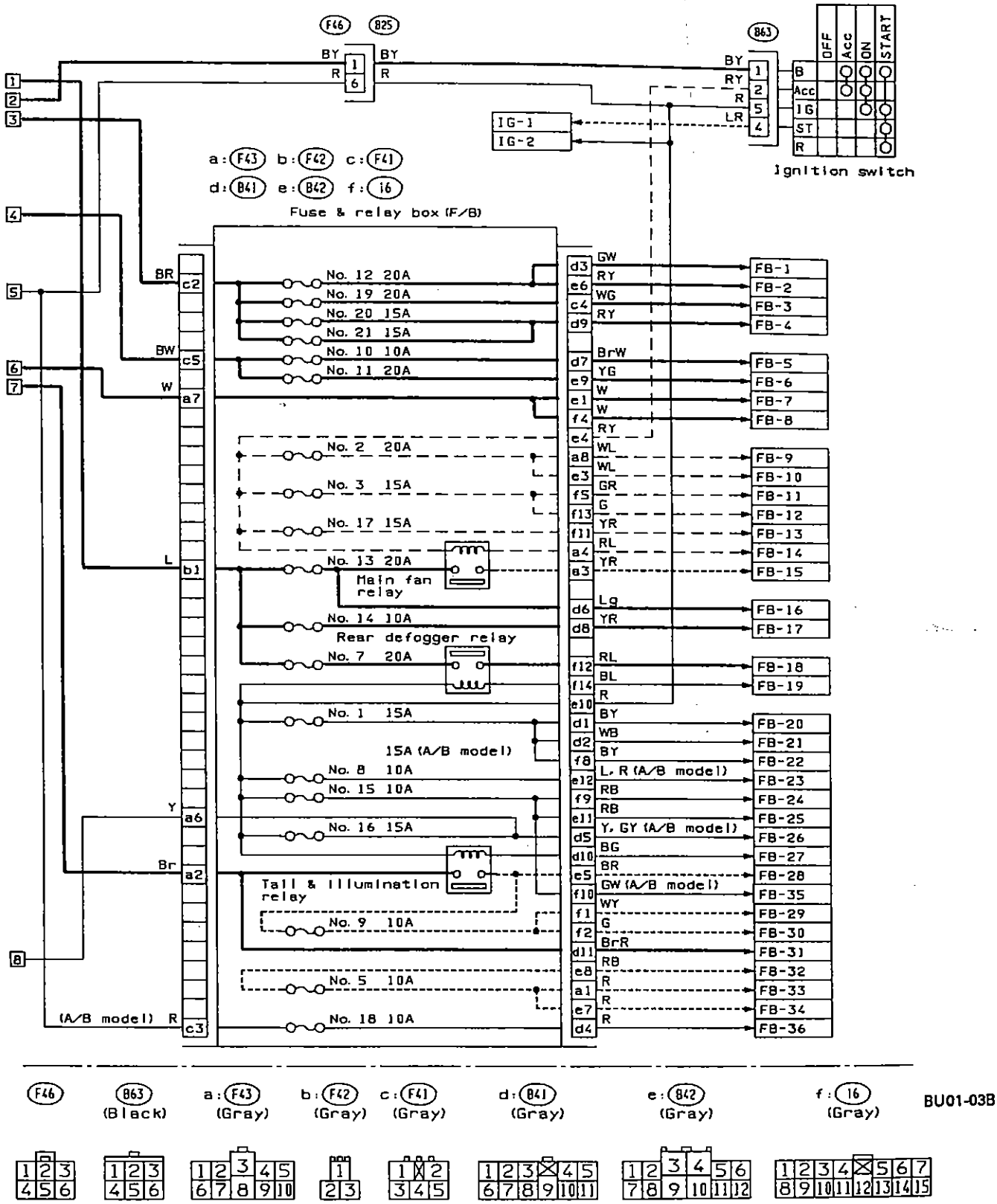


Fig. 25


F46
B25
B63
BY
R
BY
RY
R
LR
OFF
Acc
ON
START
B
Acc
IG
ST
R
IG-1
IG-2
Ignition switch
a: F43 b: F42 c: F41
d: B41 e: B42 f: 16
Fuse & relay box (F/B)
No. 12 20A
No. 19 20A
No. 20 15A
No. 21 15A
No. 10 10A
No. 11 20A
No. 2 20A
No. 3 15A
No. 17 15A
No. 13 20A
Main fan relay
No. 14 10A
Rear defogger relay
No. 7 20A
No. 1 15A
15A (A/B model)
No. 8 10A
No. 15 10A
No. 16 15A
Tail & illumination relay
No. 9 10A
No. 5 10A
(A/B model)
No. 18 10A
BR
BW
W
L
Y
Br
R
GW
RY
WG
BrW
YG
WL
GR
G
YR
RL
Lg
BL
WB
L, R (A/B model)
RB
Y, GY (A/B model)
BG
BR
GW (A/B model)
WY
BrR
FB-1
FB-2
FB-3
FB-4
FB-5
FB-6
FB-7
FB-8
FB-9
FB-10
FB-11
FB-12
FB-13
FB-14
FB-15
FB-16
FB-17
FB-18
FB-19
FB-20
FB-21
FB-22
FB-23
FB-24
FB-25
FB-26
FB-27
FB-28
FB-35
FB-29
FB-30
FB-31
FB-32
FB-33
FB-34
FB-36
F46
B63 (Black)
a: F43 (Gray)
b: F42 (Gray)
c: F41 (Gray)
d: B41 (Gray)
e: B42 (Gray)
f: 16 (Gray)
BU01-03B

2. CHARGING

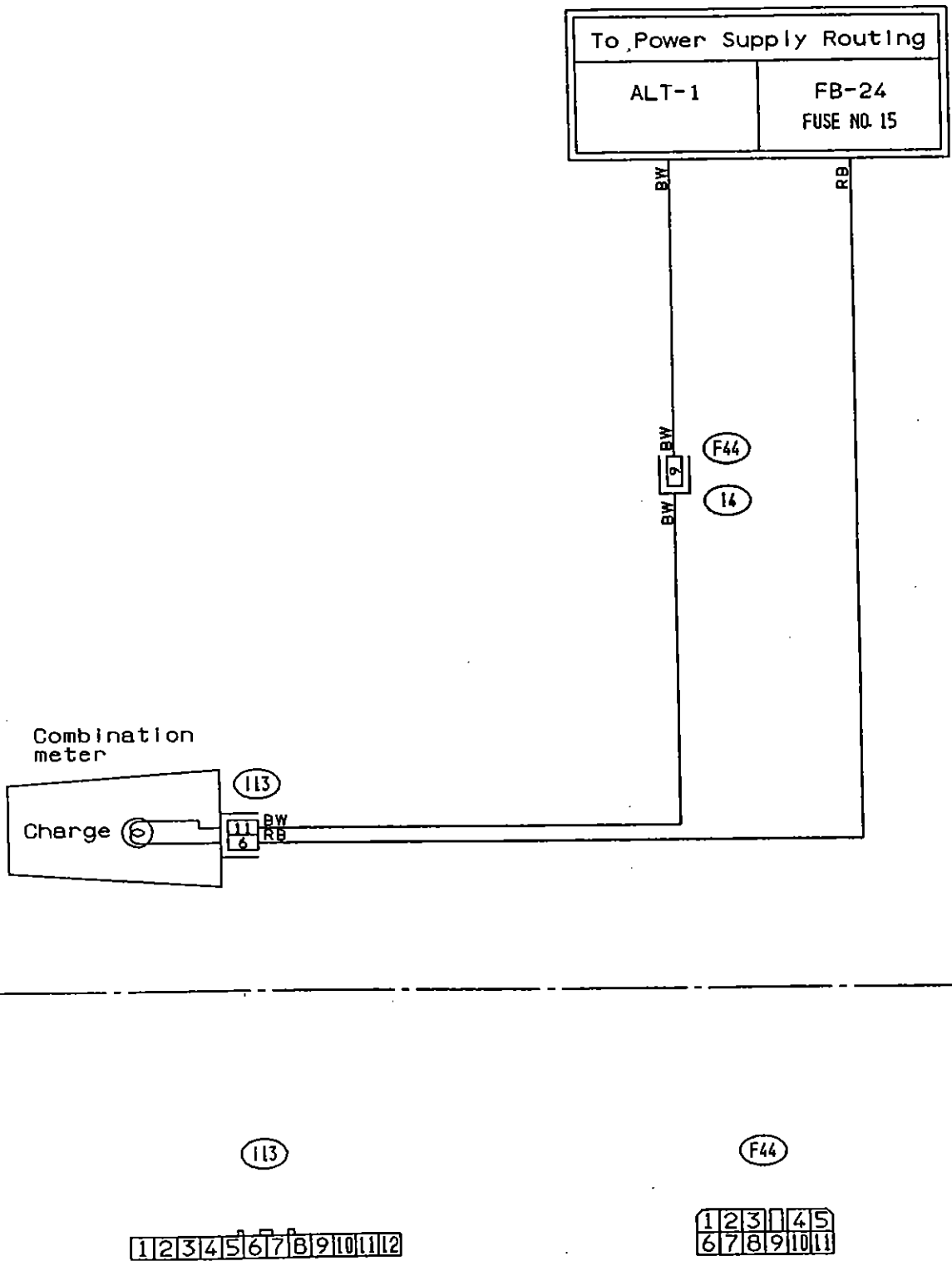
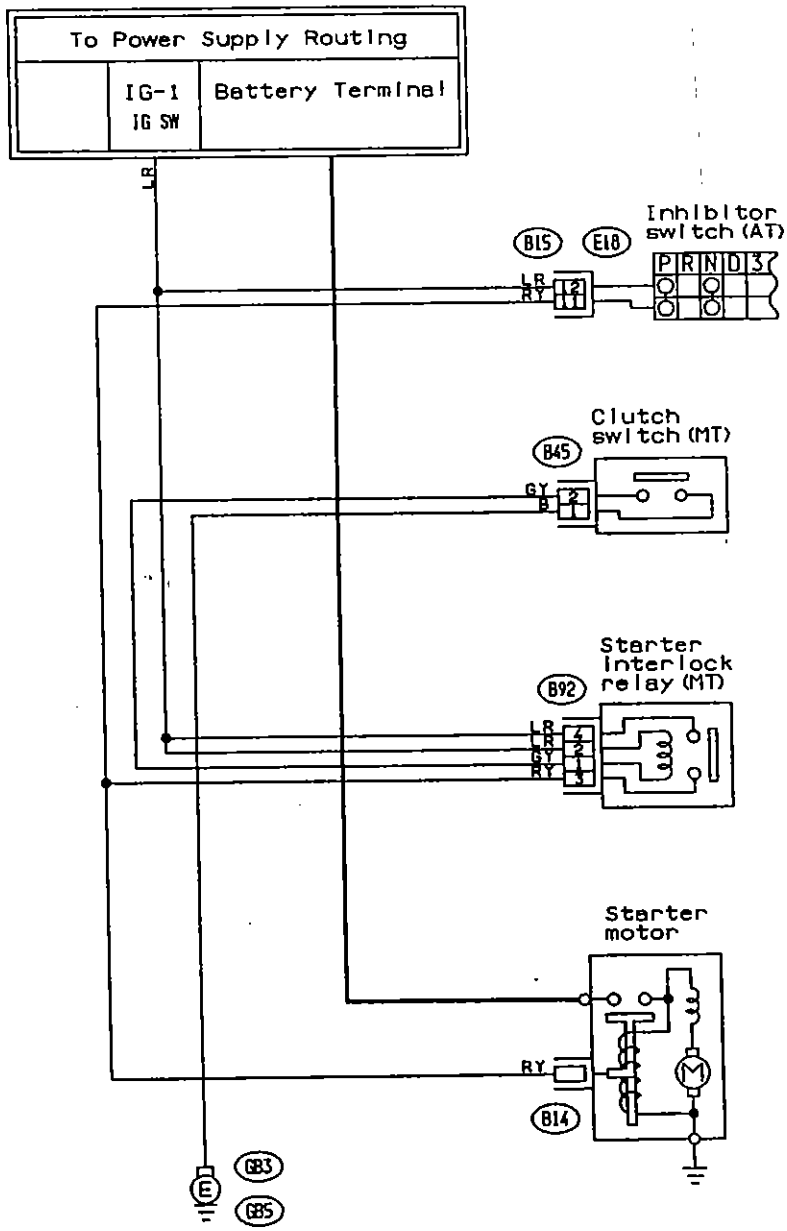
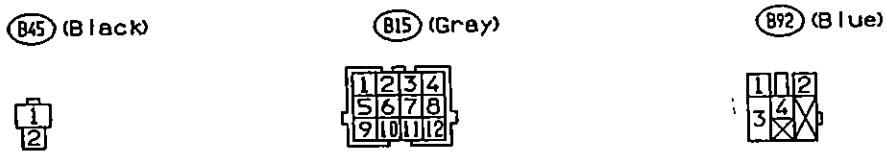


Fig. 26

3. STARTING



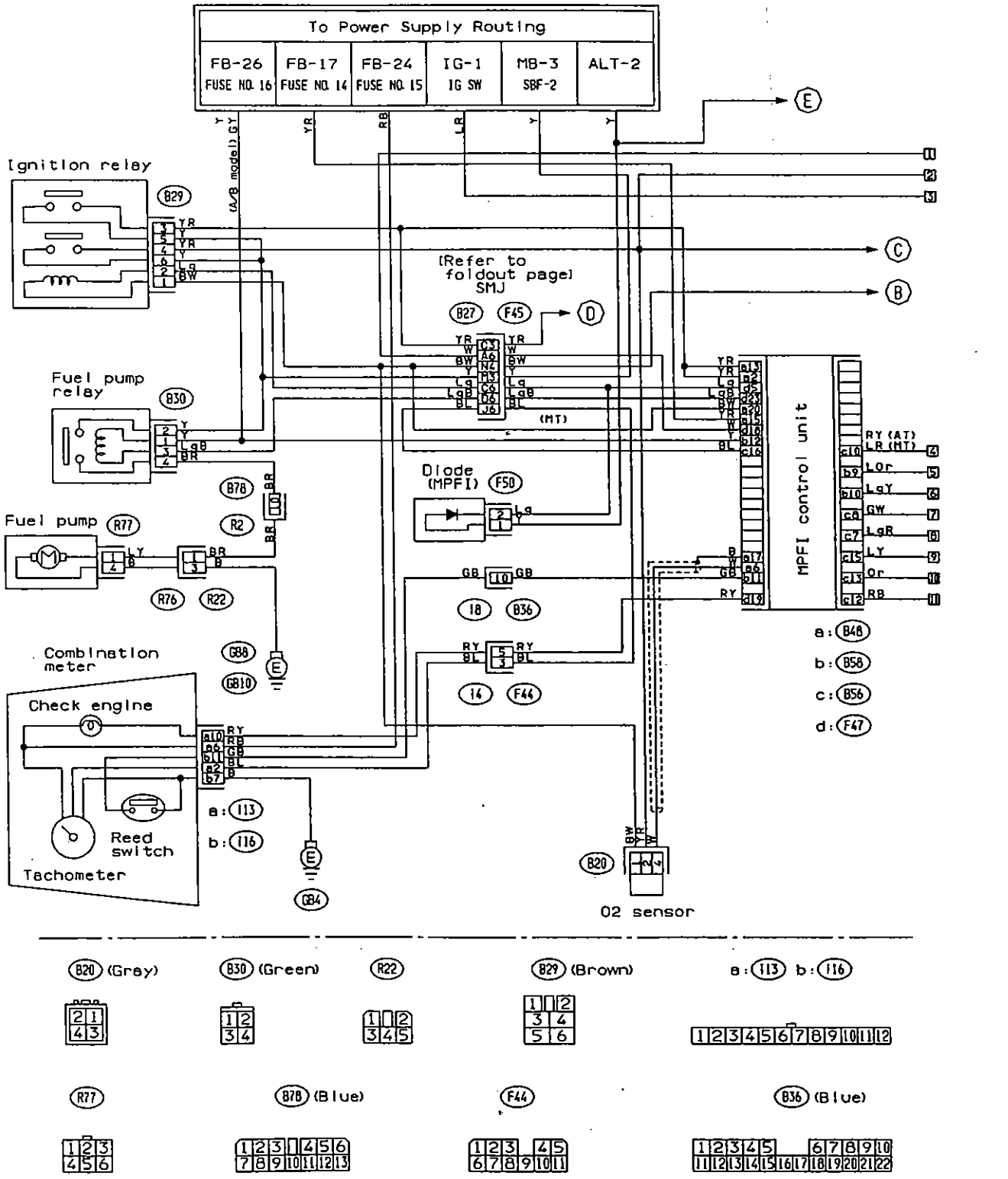


BU03-02

Fig. 27

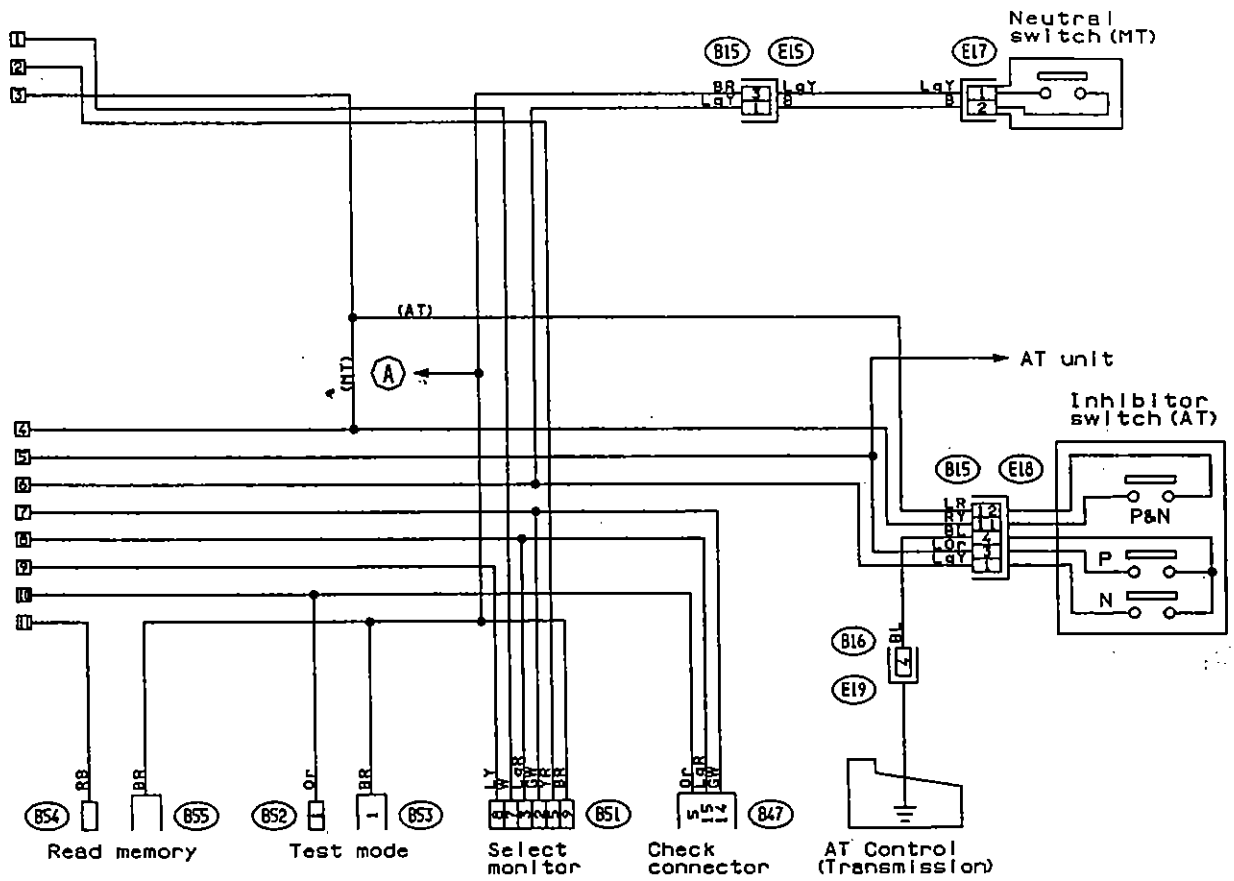
4. ENGINE ELECTRICAL

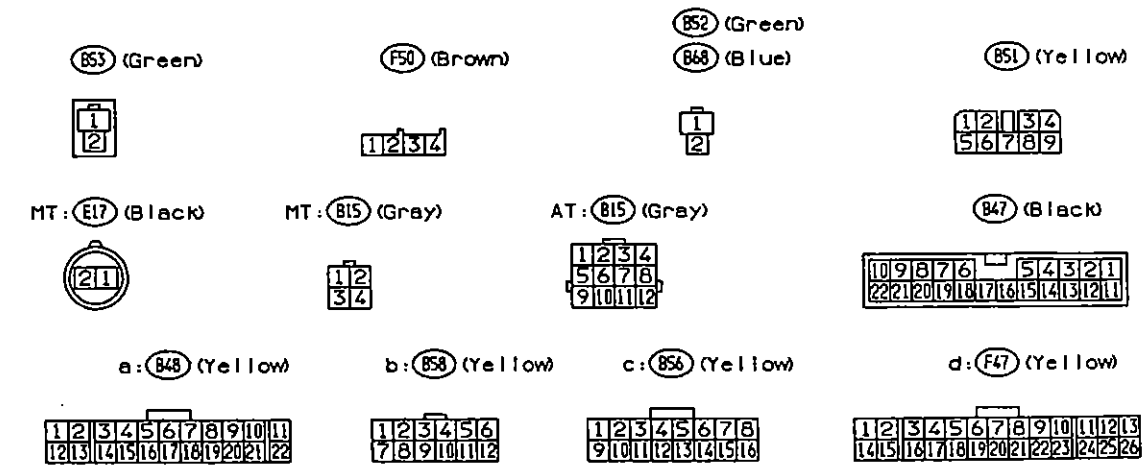
MPFI-Non-TURBO



BU10-04A

Fig. 28-1


Neutral switch (MT)
B15
E15
E17
(AT)
(MT)
A
AT unit
Inhibitor switch (AT)
B15
E18
P&N
P
N
B16
E19
B54
B55
B52
B53
B51
B47
Read memory
Test mode
Select monitor
Check connector
AT Control (Transmission)


B53 (Green)
F50 (Brown)
B52 (Green)
B68 (Blue)
B51 (Yellow)
MT : E17 (Black)
MT : B15 (Gray)
AT : B15 (Gray)
B47 (Black)
a : B48 (Yellow)
b : B58 (Yellow)
c : B56 (Yellow)
d : F47 (Yellow)

BU10-04B

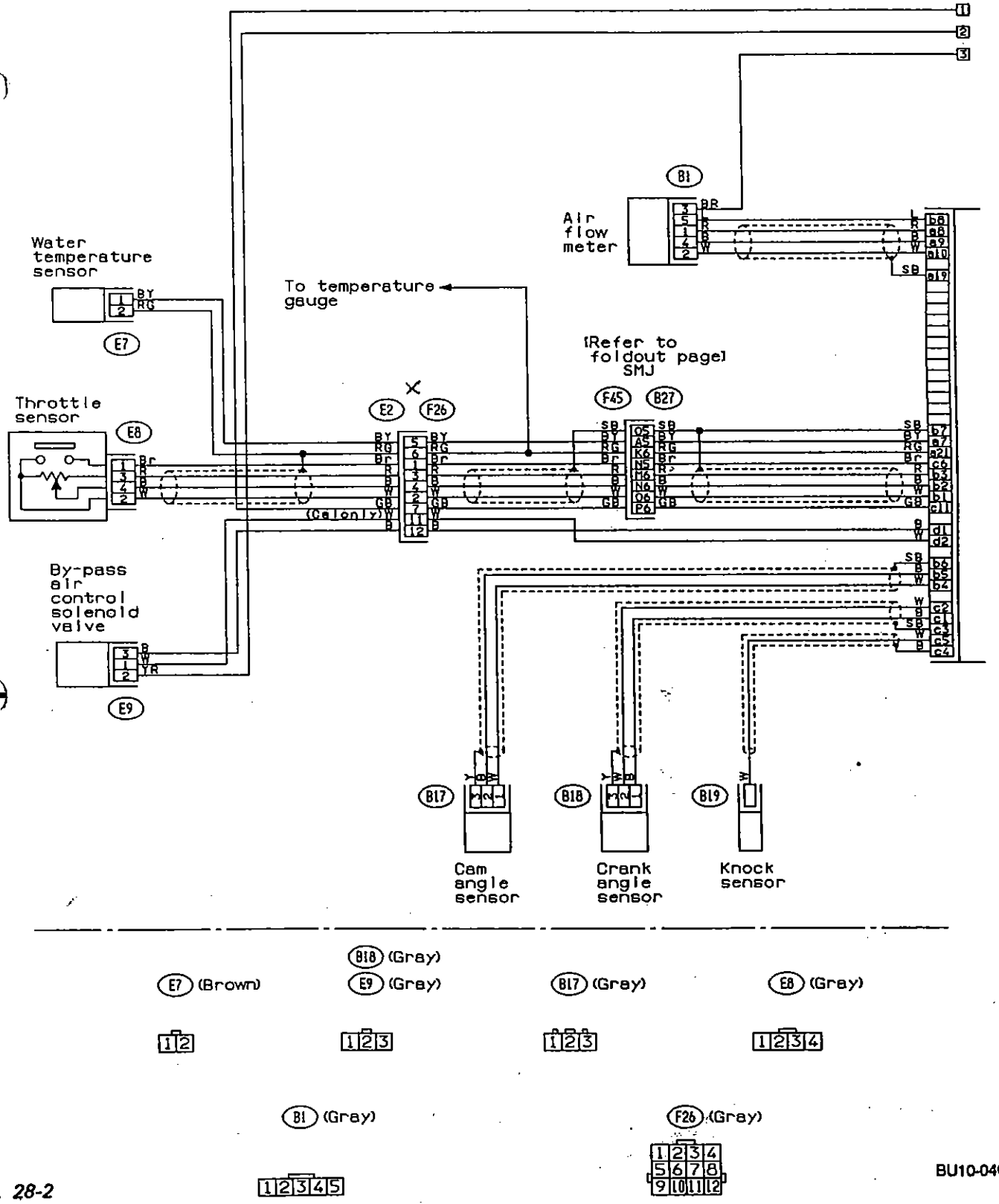
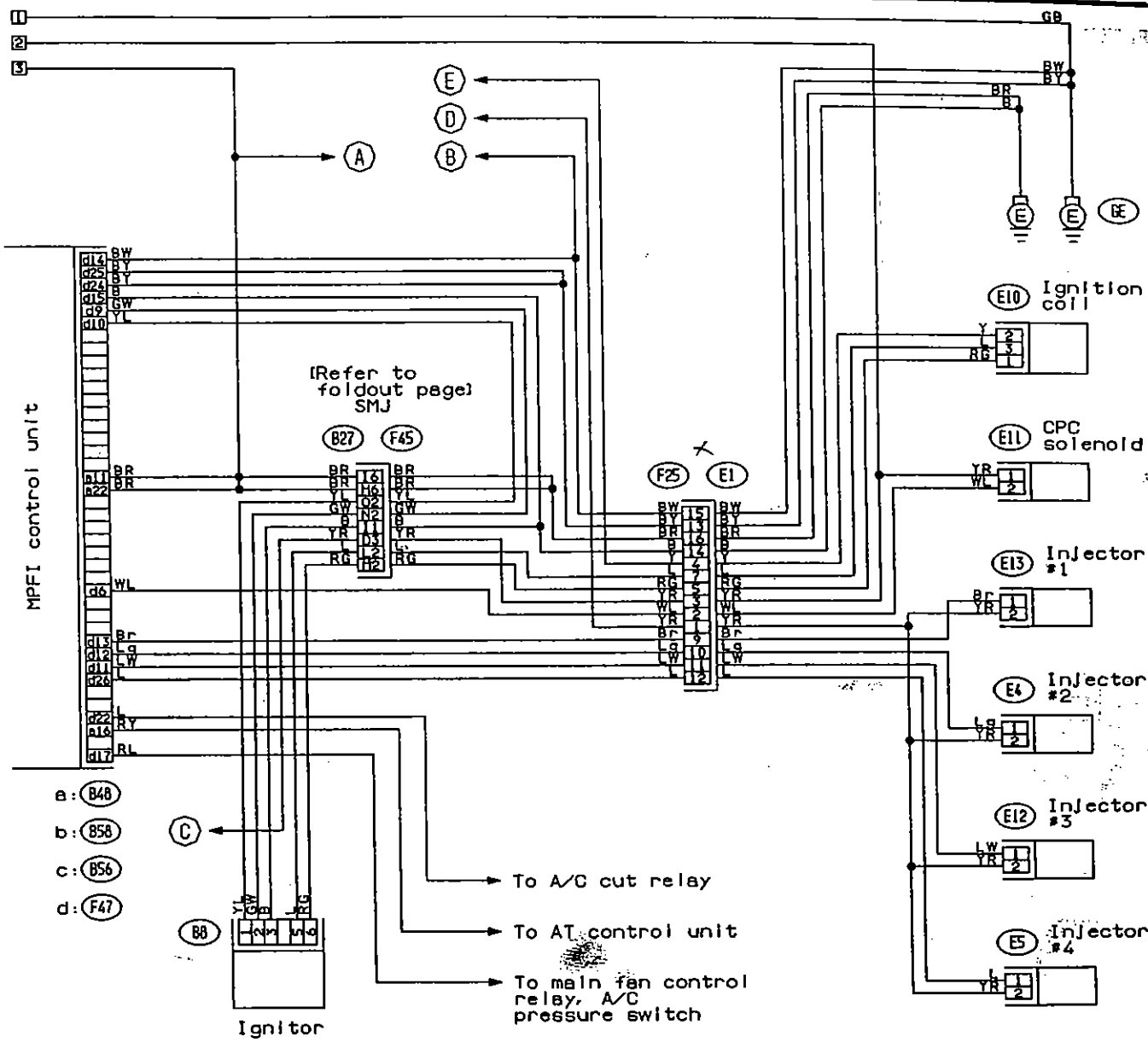
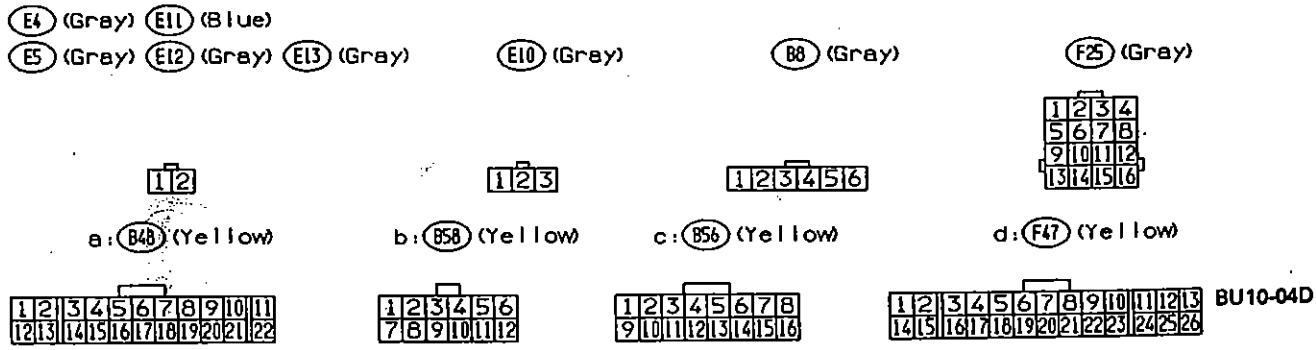
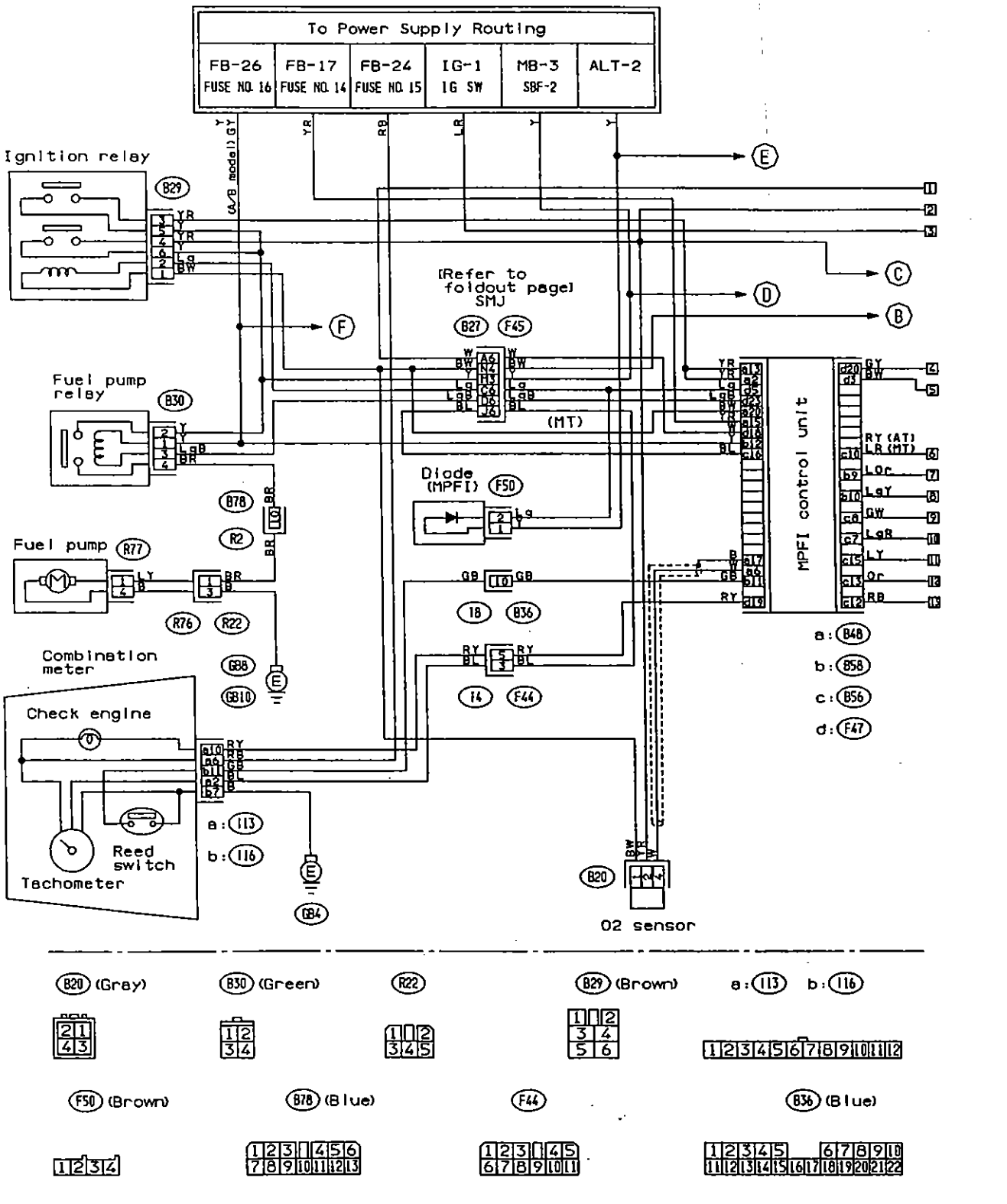

Water temperature sensor
E7
To temperature gauge
Air flow meter
B1
(Refer to foldout page) SMJ
F45
B27
Throttle sensor
E8
E2
F26
By-pass air control solenoid valve
E9
B17
B18
B19
Cam angle sensor
Crank angle sensor
Knock sensor
E7 (Brown)
B18 (Gray)
E9 (Gray)
B17 (Gray)
E8 (Gray)
B1 (Gray)
F26 (Gray)
BU10-04C

Fig. 28-2


MPFI control unit
(Refer to foldout page) SMJ
B27
F45
F25
E1
E10 Ignition coil
E11 CPC solenoid
E13 Injector #1
E4 Injector #2
E12 Injector #3
E5 Injector #4
a: B48
b: B58
c: B56
d: F47
B8
Ignitor
To A/C cut relay
To AT control unit
To main fan control relay, A/C pressure switch

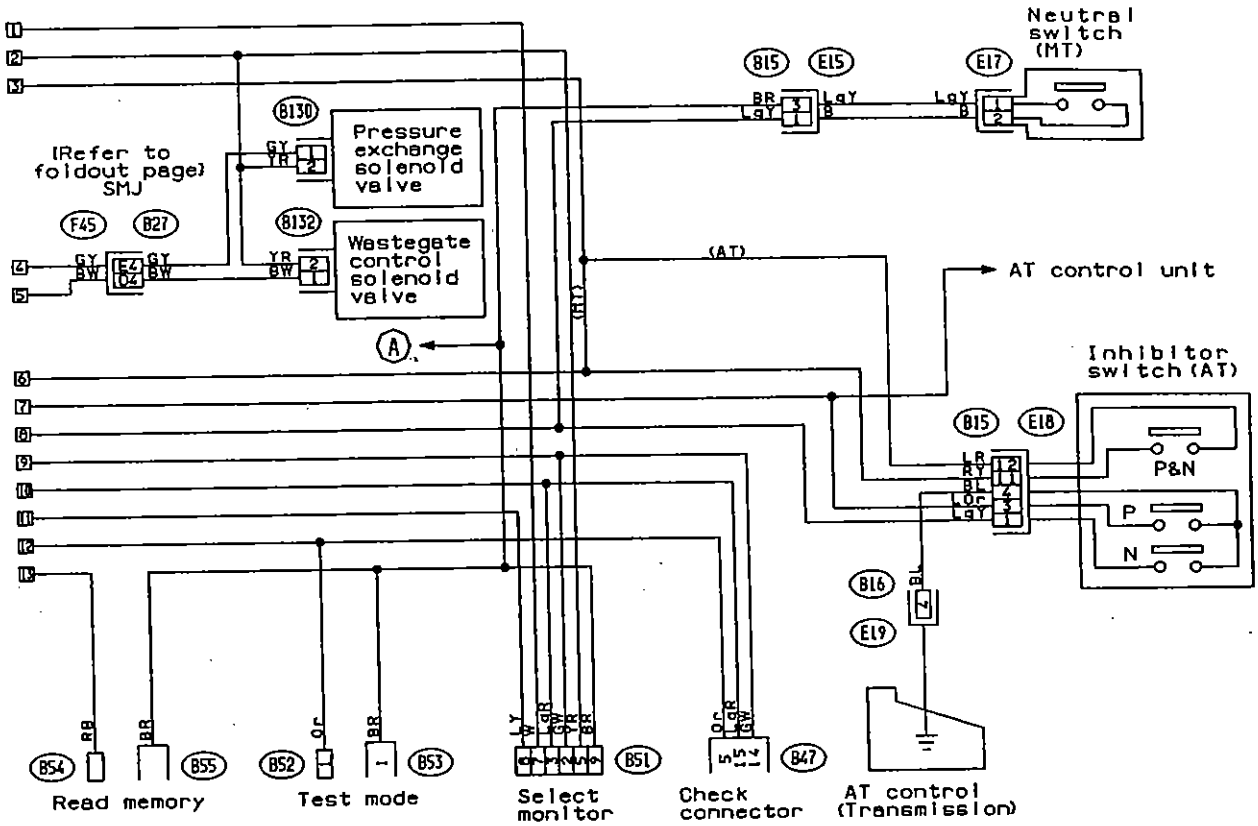

E4 (Gray) E11 (Blue)
E5 (Gray) E12 (Gray) E13 (Gray)
E10 (Gray)
B8 (Gray)
F25 (Gray)
a: B48 (Yellow)
b: B58 (Yellow)
c: B56 (Yellow)
d: F47 (Yellow)
BU10-04D

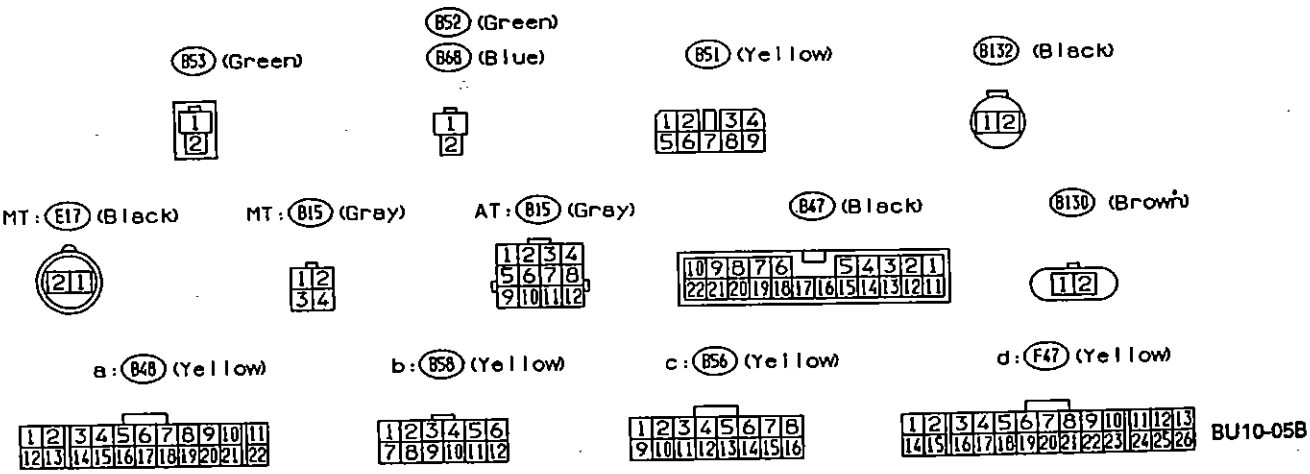
MPFI-TURBO



BU10-05A

Fig. 29-1


Neutral switch (MT)
B15
E15
E17
B130
Pressure exchange solenoid valve
(Refer to foldout page) SMJ
F45
B27
B132
Wastegate control solenoid valve
(AT)
AT control unit
(MT)
A
Inhibitor switch (AT)
B15
E18
P&N
P
N
B16
E19
B54
B55
B52
B53
B51
B47
Read memory
Test mode
Select monitor
Check connector
AT control (Transmission)


B52 (Green)
B53 (Green)
B68 (Blue)
B51 (Yellow)
B132 (Black)
MT: E17 (Black)
MT: B15 (Gray)
AT: B15 (Gray)
B47 (Black)
B130 (Brown)
a: B48 (Yellow)
b: B58 (Yellow)
c: B56 (Yellow)
d: F47 (Yellow)
BU10-05B

ORIGINAL

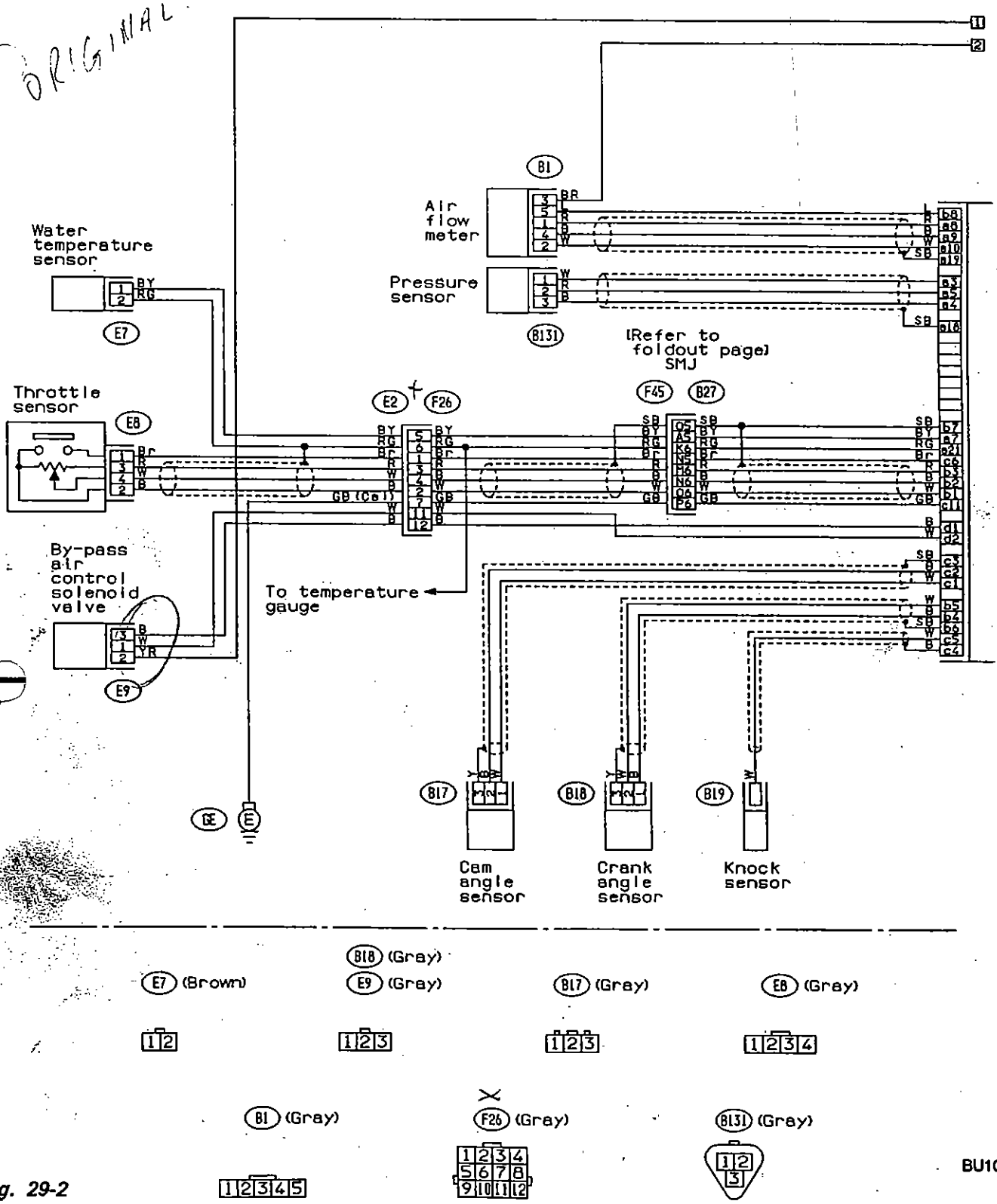
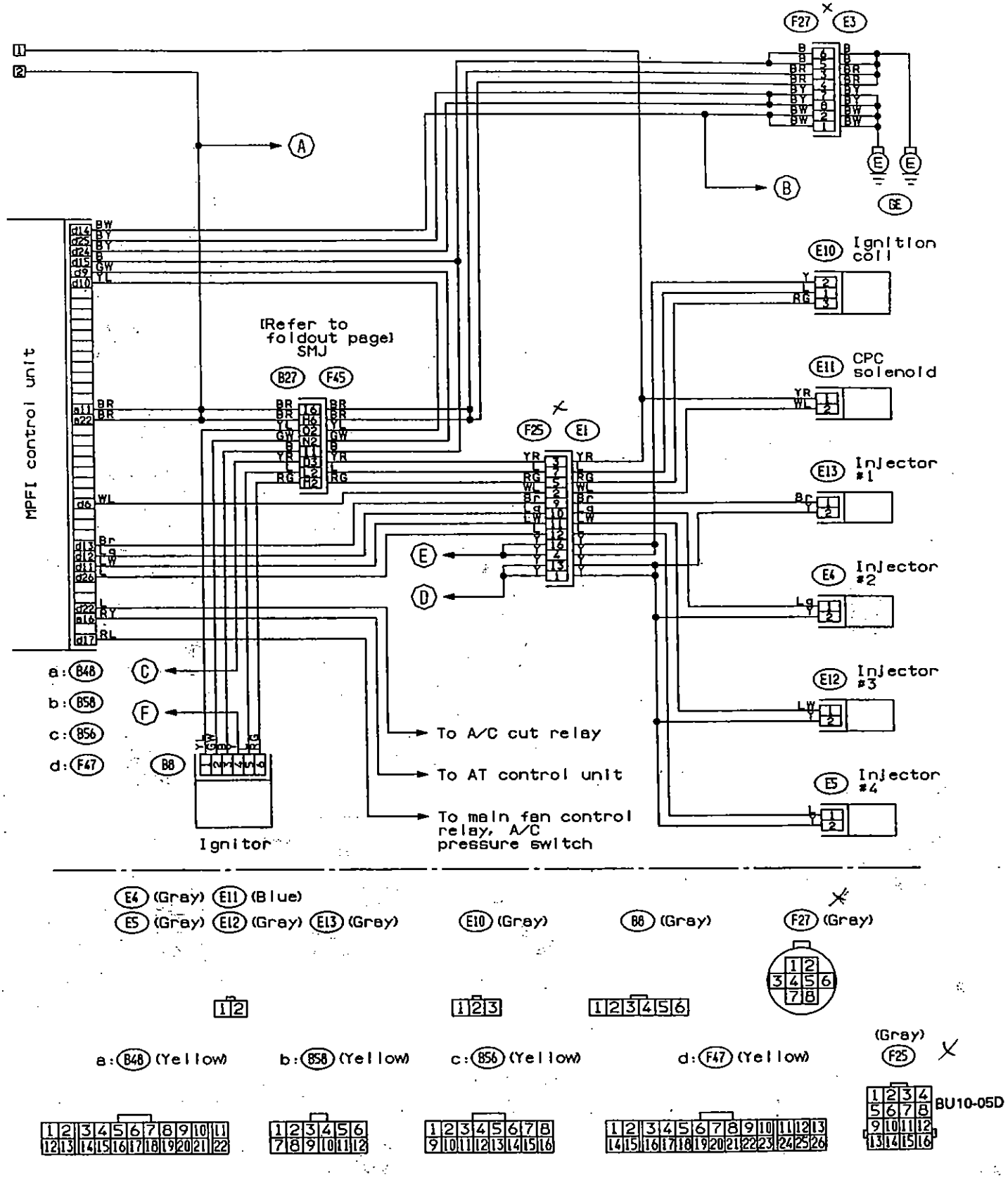


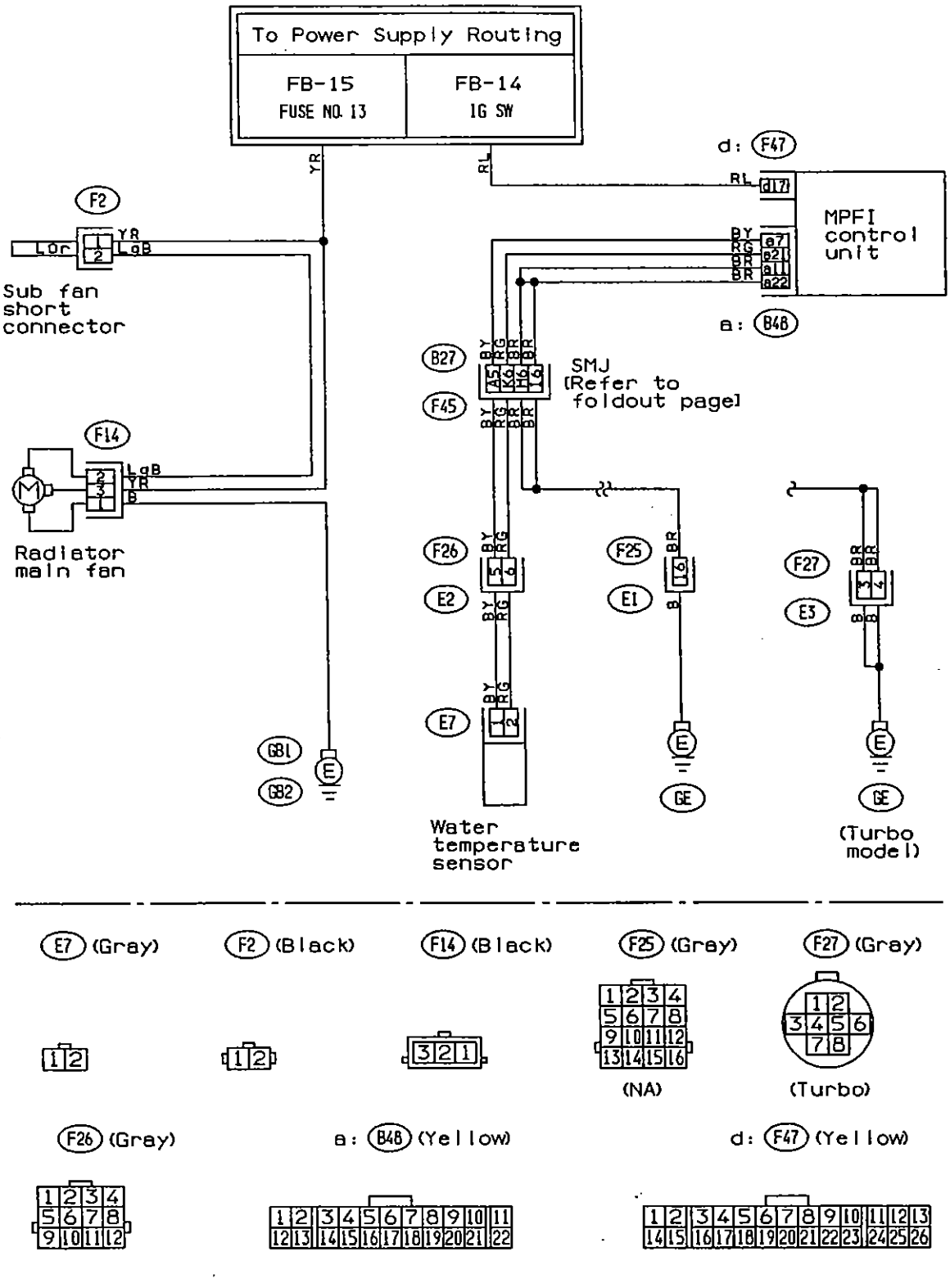
Fig. 29-2

BU10-05C


MPFI control unit
[Refer to foldout page] SMJ
B27
F45
F25
E1
F27
E3
E10 Ignition coil
E11 CPC solenoid
E13 Injector #1
E4 Injector #2
E12 Injector #3
E5 Injector #4
GE
A
B
C
D
E
F
a: B48
b: B58
c: B56
d: F47
B8
Ignitor
To A/C cut relay
To AT control unit
To main fan control relay, A/C pressure switch

E4 (Gray) E11 (Blue)
E5 (Gray) E12 (Gray) E13 (Gray)
E10 (Gray)
B8 (Gray)
F27 (Gray)
a: B48 (Yellow)
b: B58 (Yellow)
c: B56 (Yellow)
d: F47 (Yellow)
(Gray) F25
BU10-05D

5. RADIATOR FAN

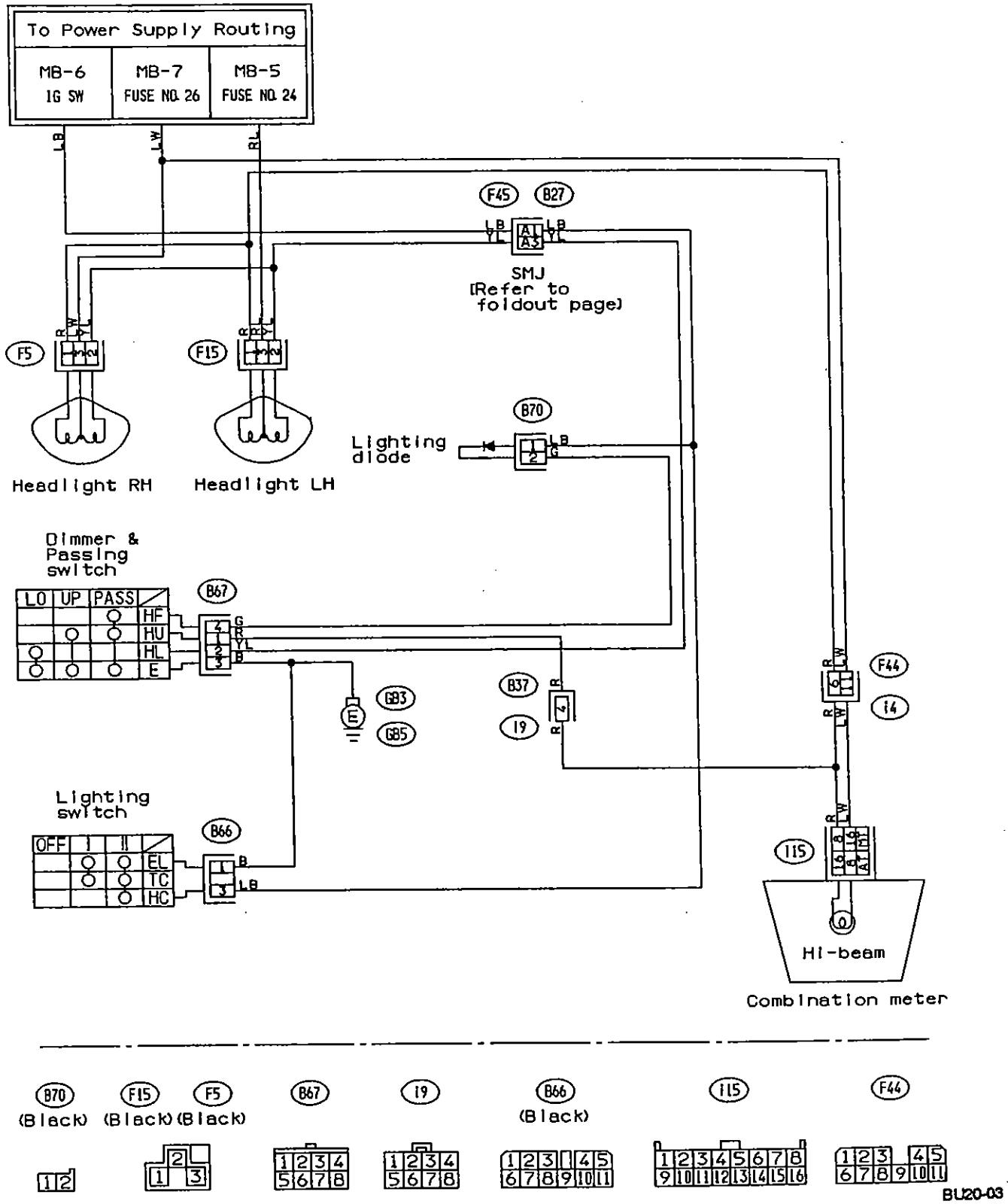


BU14-03

Fig. 30

6-1. LIGHTING (HEADLIGHT)

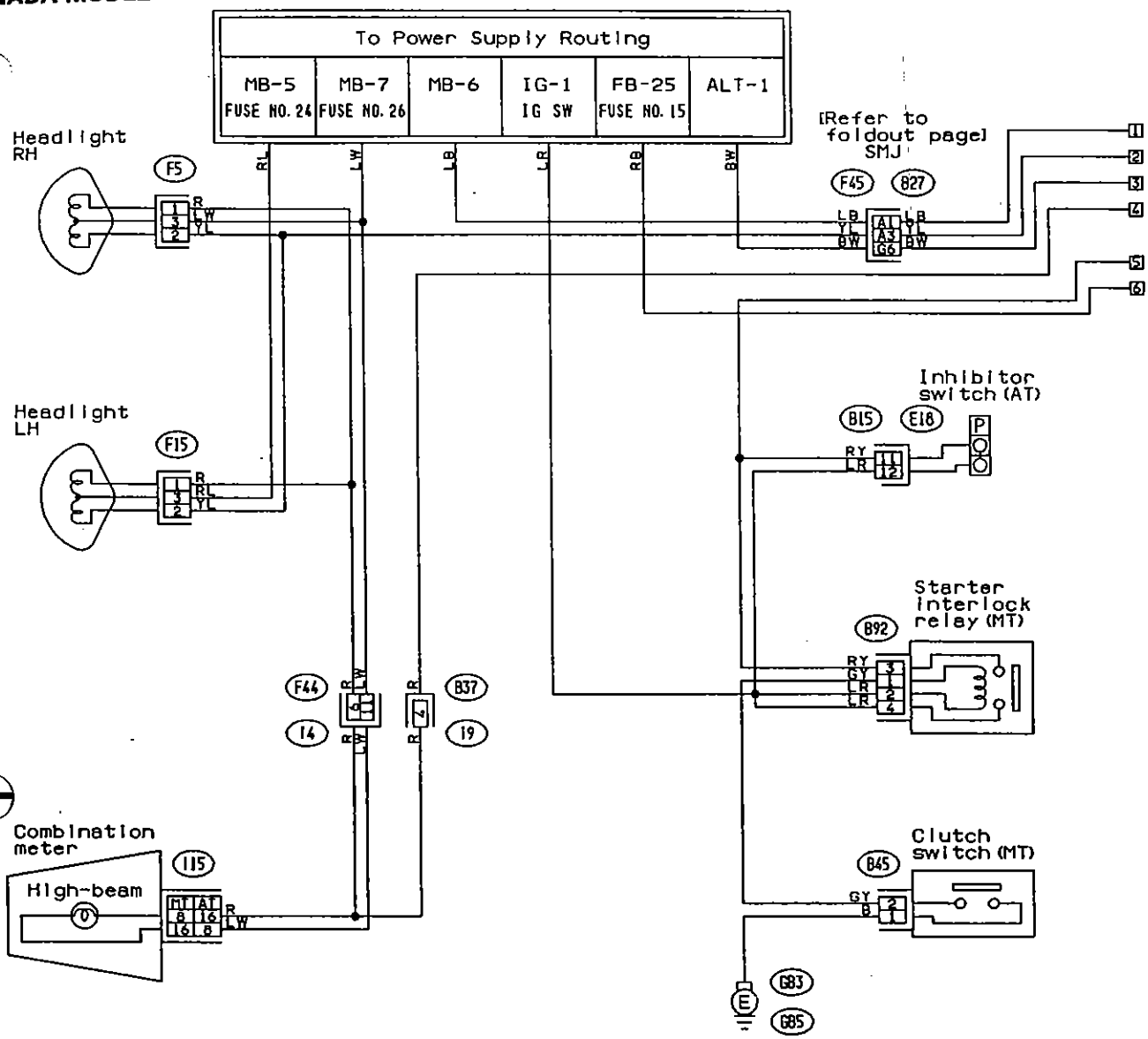
U.S. MODEL

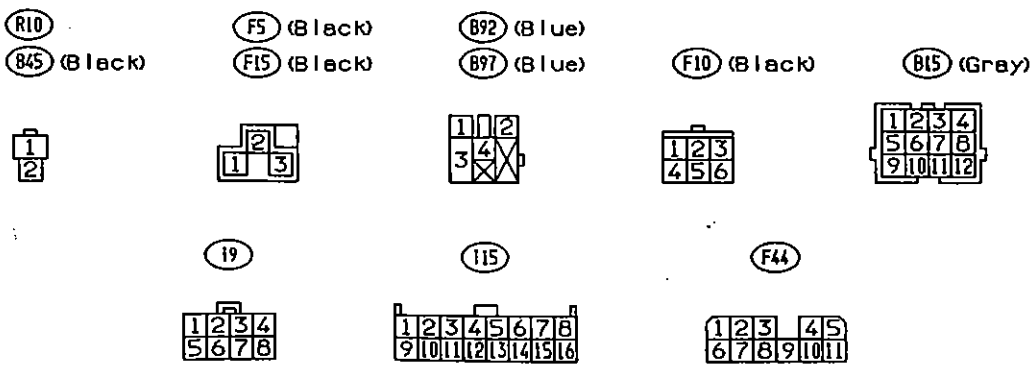


BU20-03

Fig. 31

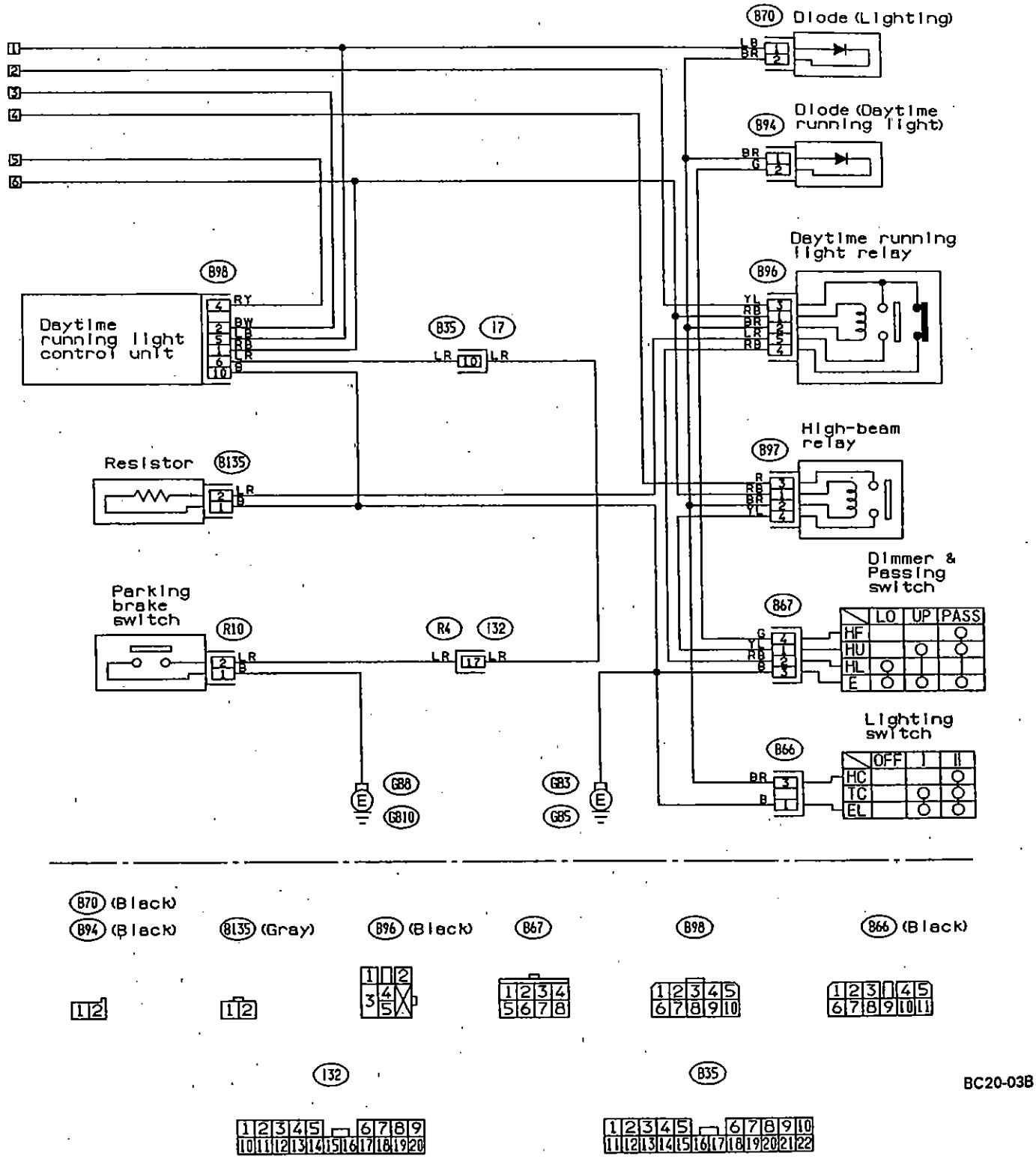
CANADA MODEL





BC20-03A

Fig. 32


B70 Diode (Lighting)
B94 Diode (Daytime running light)
Daytime running light relay
B96
B98
Daytime running light control unit
B35 17
Resistor B135
High-beam relay
B97
Dimmer & Passing switch
B67
LO UP PASS
HF
HU
HL
E
Parking brake switch
R10
R4 132
Lighting switch
B66
OFF I II
HC
TC
EL
G88
G810
G83
G85
B70 (Black)
B94 (Black)
B135 (Gray)
B96 (Black)
B67
B98
B66 (Black)
132
B35
BC20-03B

6-2. LIGHTING (TAIL•ILLUMINATION•etc.)

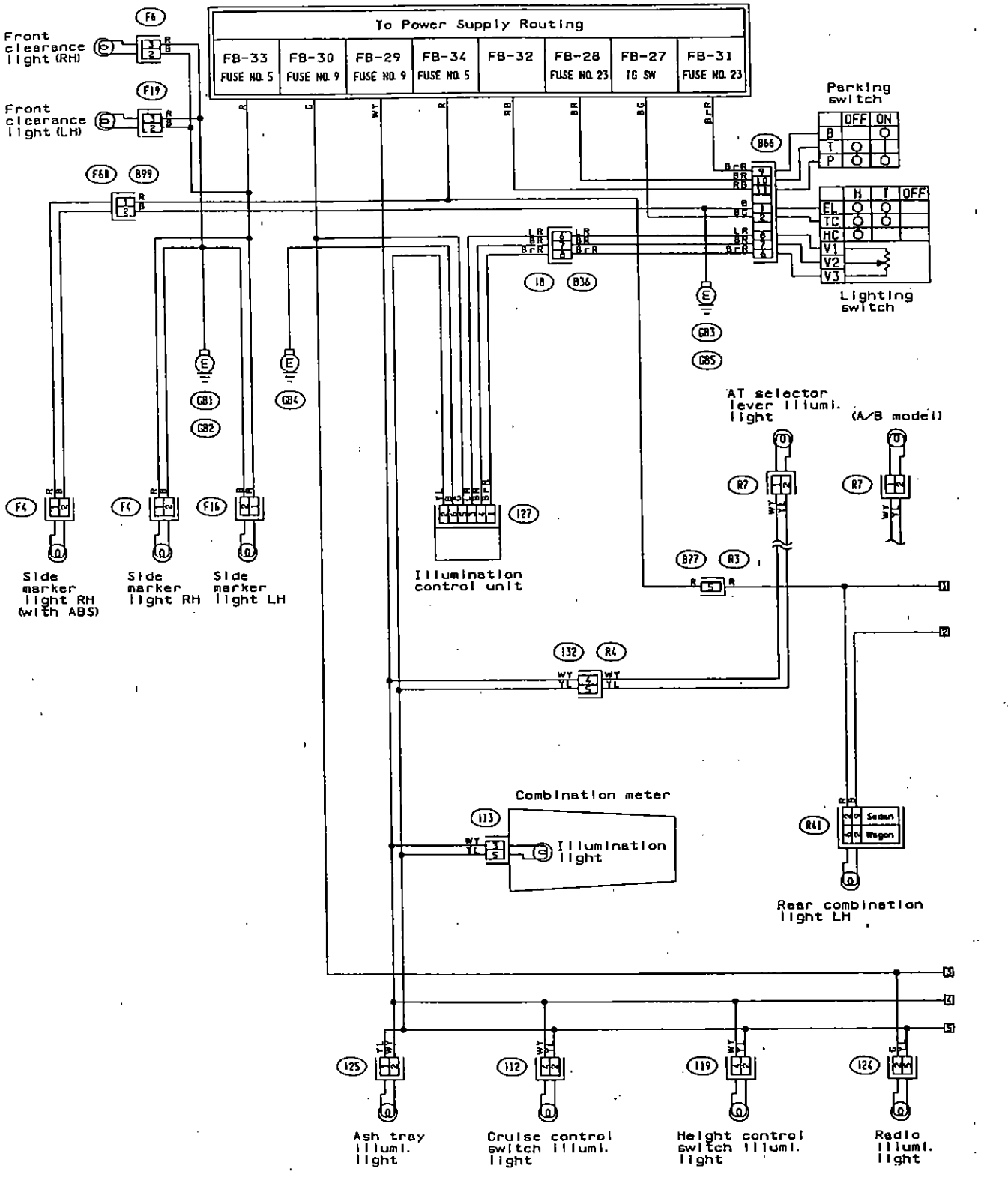
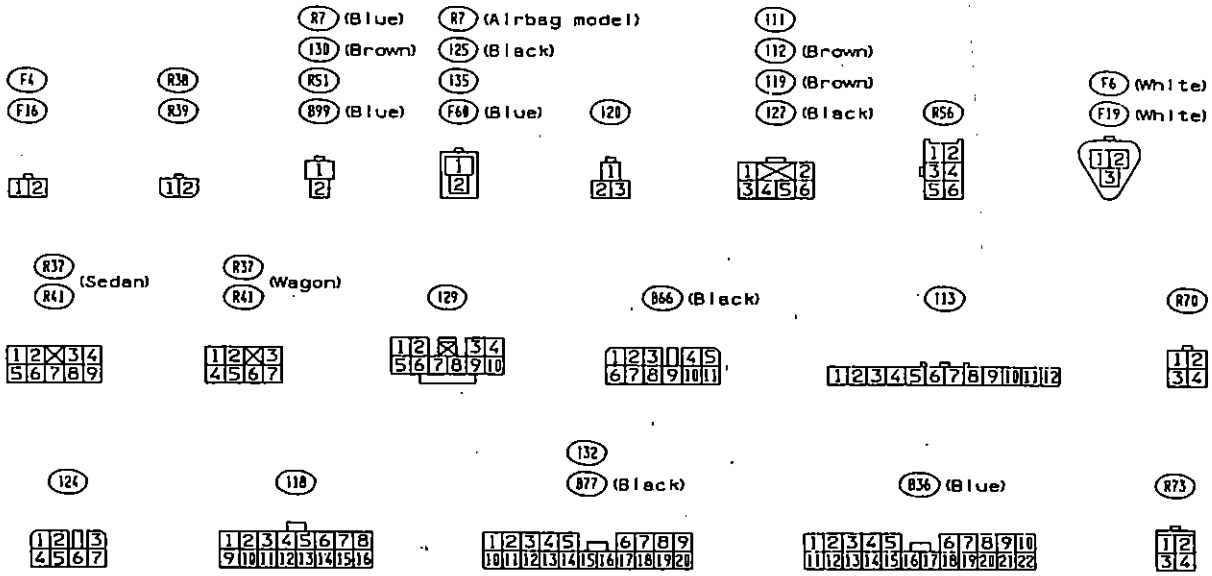
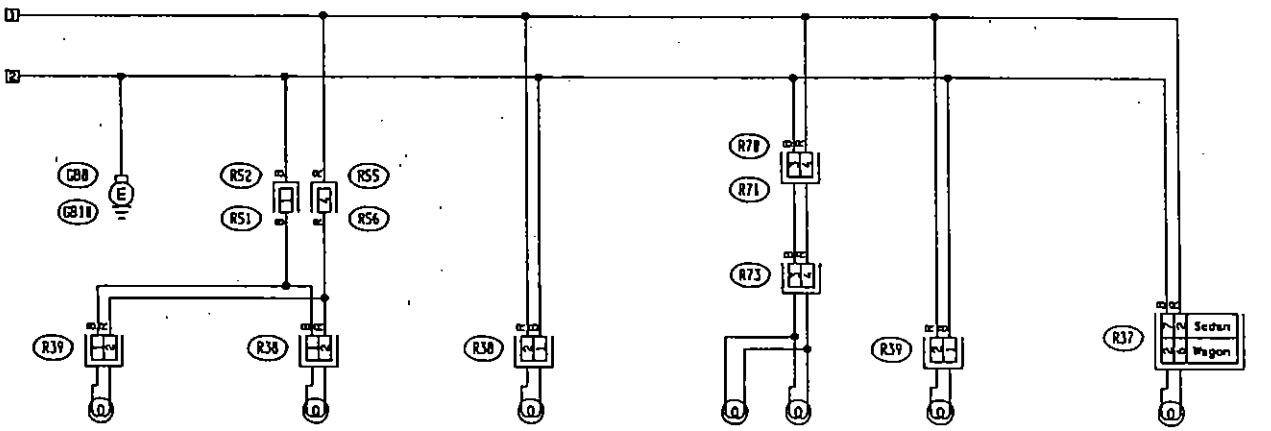
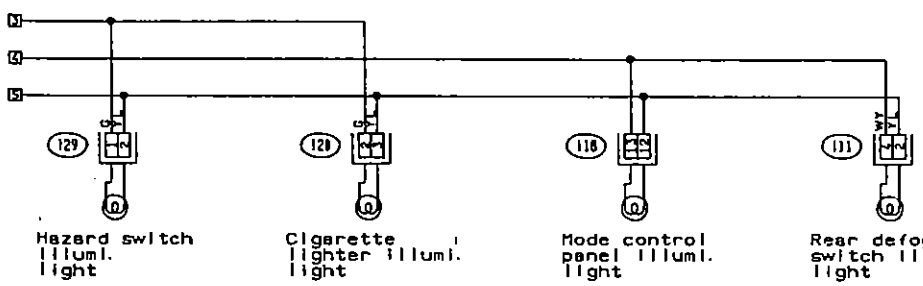


Fig. 33

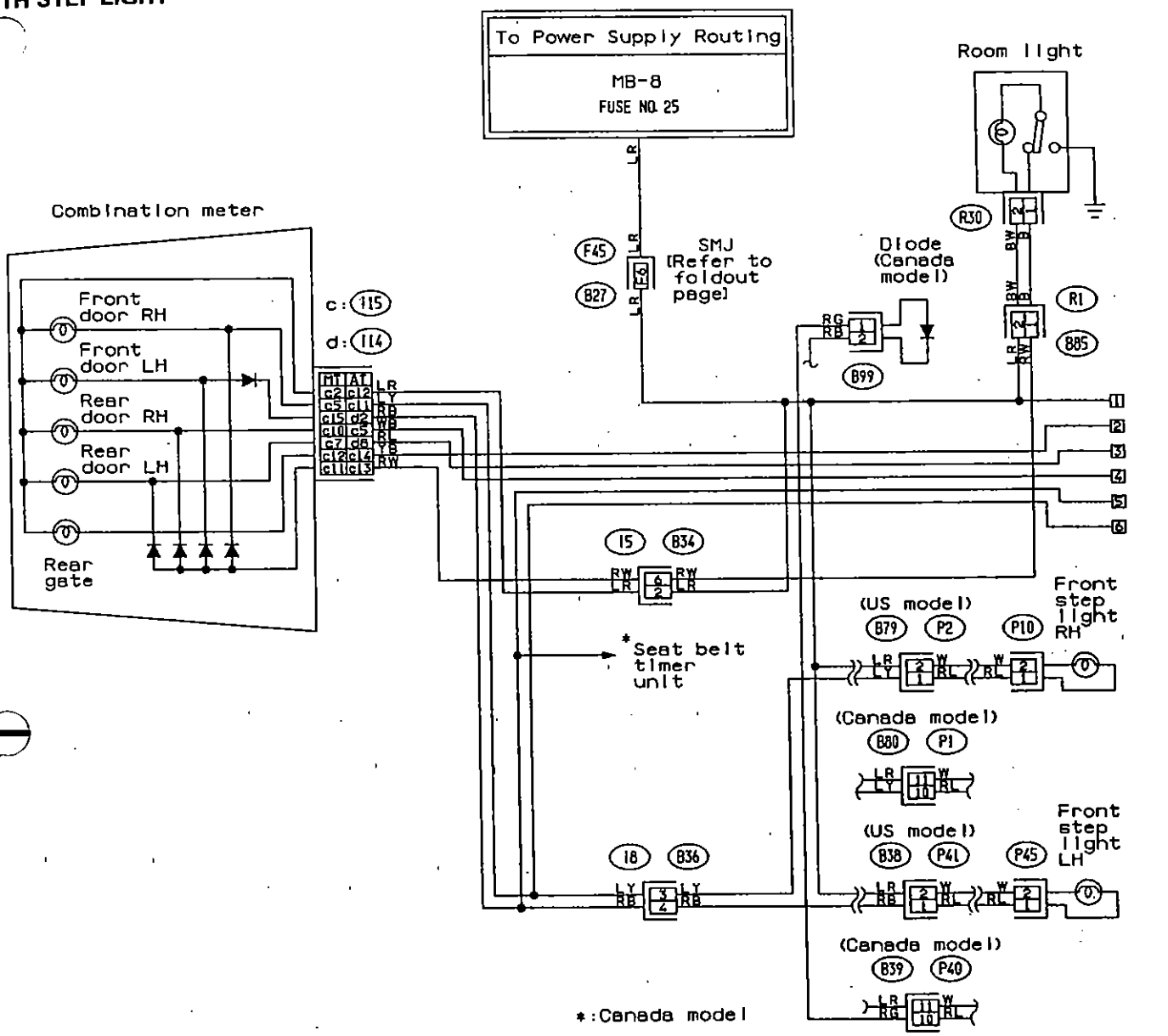

F4
F16
R38
R39
R7 (Blue)
130 (Brown)
R51
899 (Blue)
R7 (Airbag model)
125 (Black)
135
F68 (Blue)
120
111
112 (Brown)
119 (Brown)
127 (Black)
R56
F6 (White)
F19 (White)
R37
R41 (Sedan)
R37
R41 (Wagon)
129
B66 (Black)
113
R70
124
118
132
B77 (Black)
B36 (Blue)
R73


GB8
GB18
R52
R51
R55
R56
R78
R71
R73
R39
R38
R38
R39
R37
Sedan
Wagon
License plate light LH (Wagon)
License plate light RH (Wagon)
License plate light LH (Sedan)
Rear finisher light (Sedan)
License plate light RH (Sedan)
Rear combination light RH


129
128
118
111
Hazard switch illuml. light
Cigarette lighter illuml. light
Mode control panel illuml. light
Rear defogger switch illuml. light

BU21-05B

7. ROOM LIGHT AND DOOR SWITCH WITH STEP LIGHT



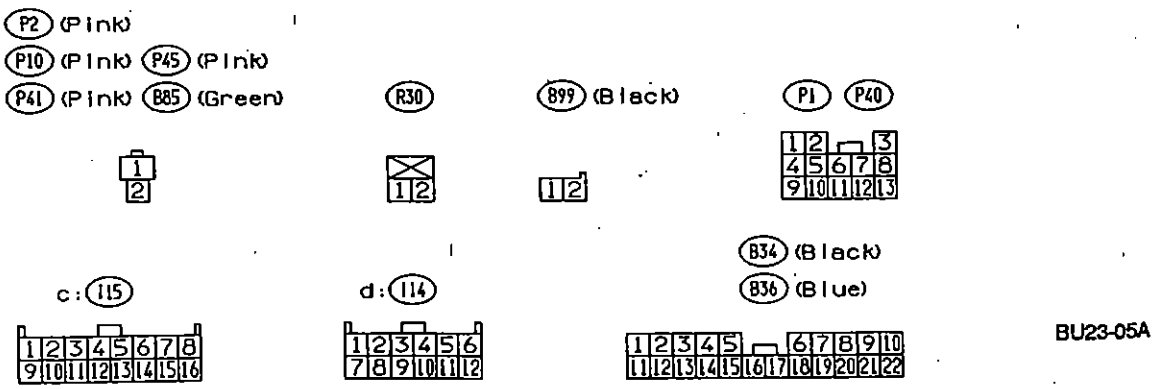
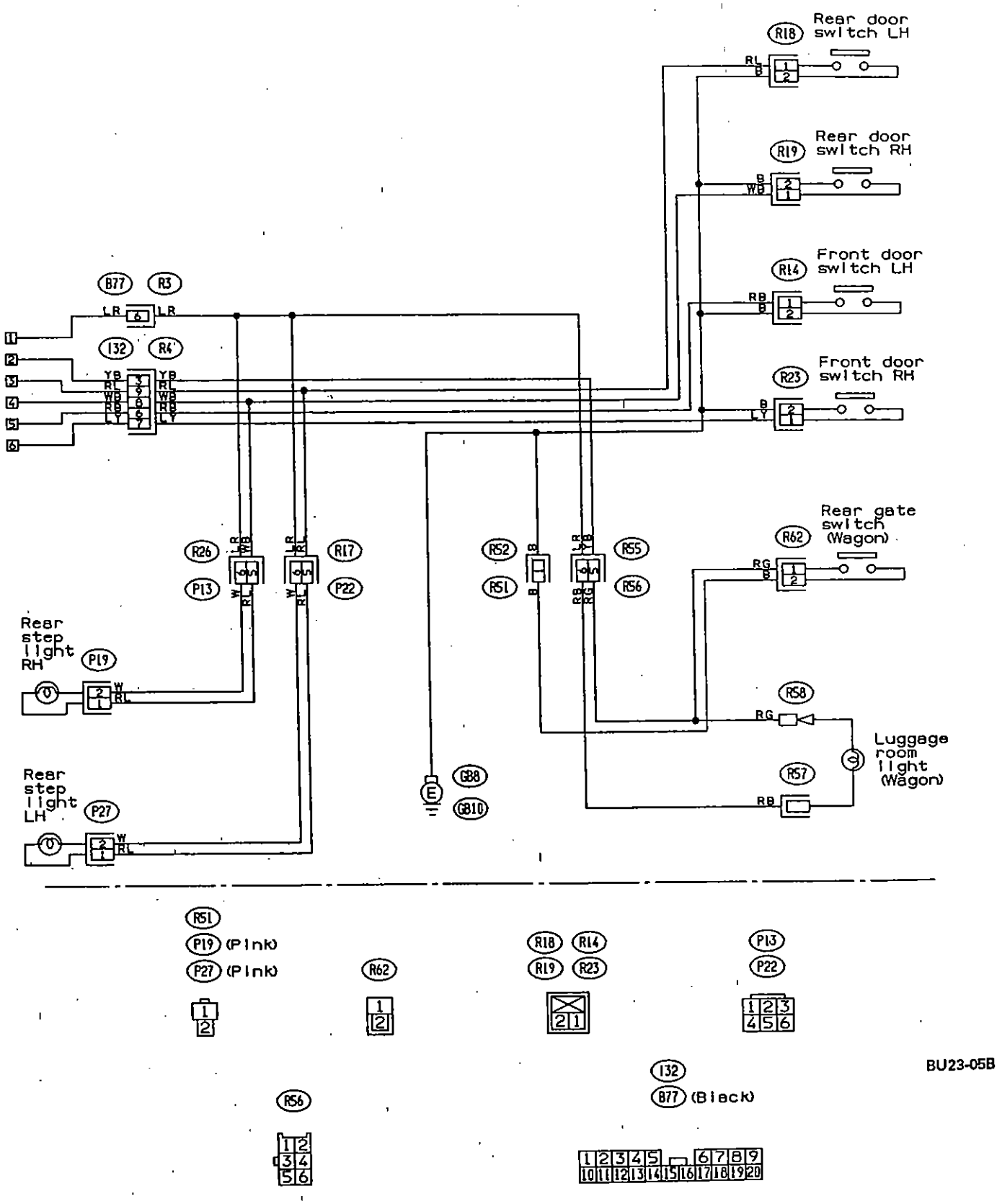
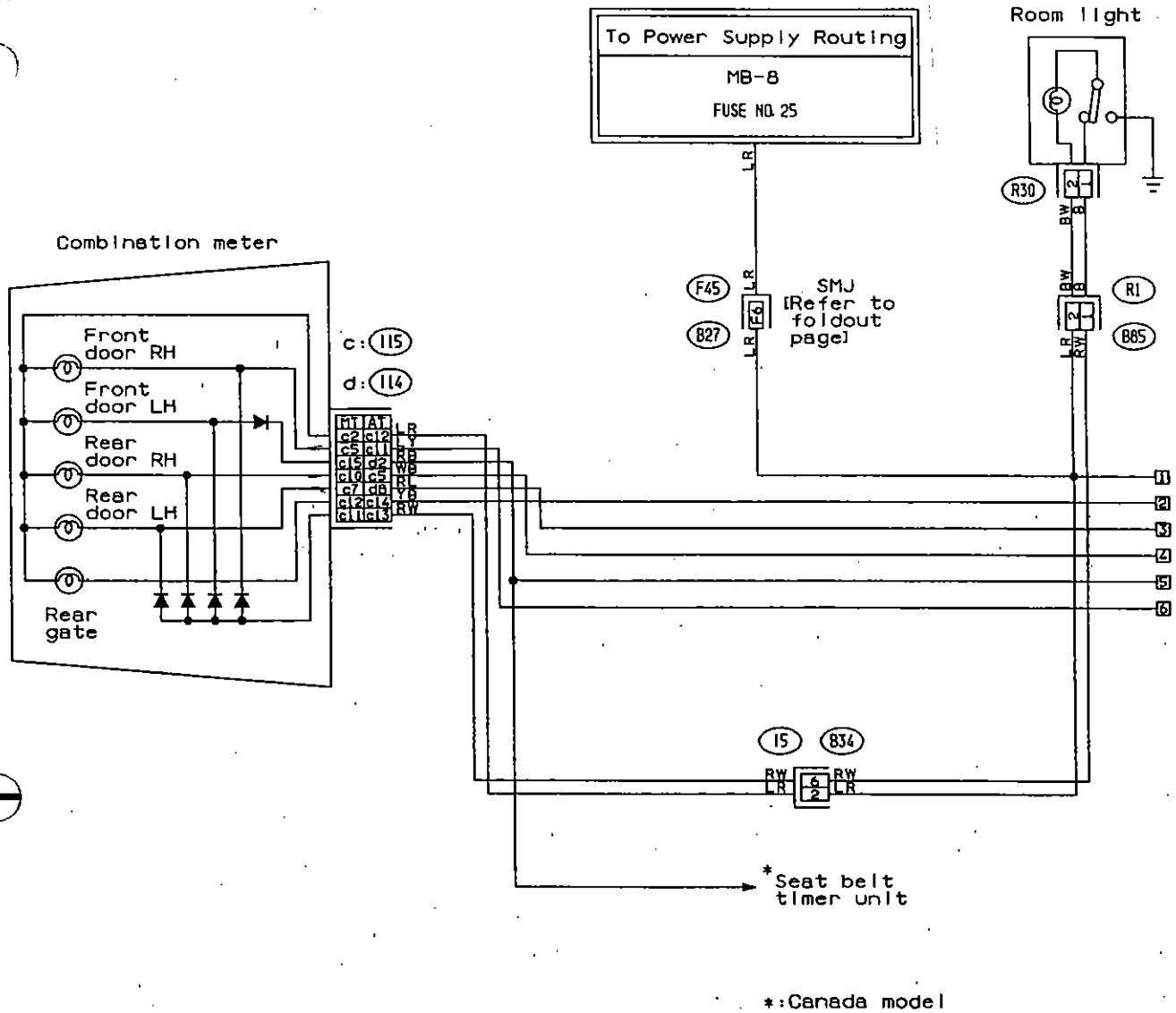
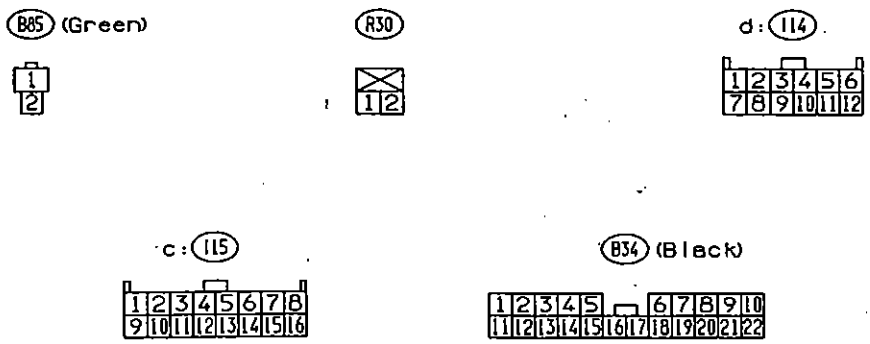


Fig. 34


Rear door switch LH
R18
Rear door switch RH
R19
Front door switch LH
R14
Front door switch RH
R23
B77
R3
132
R4
R26
P13
R17
P22
R52
R51
R55
R56
Rear gate switch (Wagon)
R62
Rear step light RH
P19
Rear step light LH
P27
R58
Luggage room light (Wagon)
R57
G38
G810
(Pink)
(Pink)
(Black)
BU23-05B

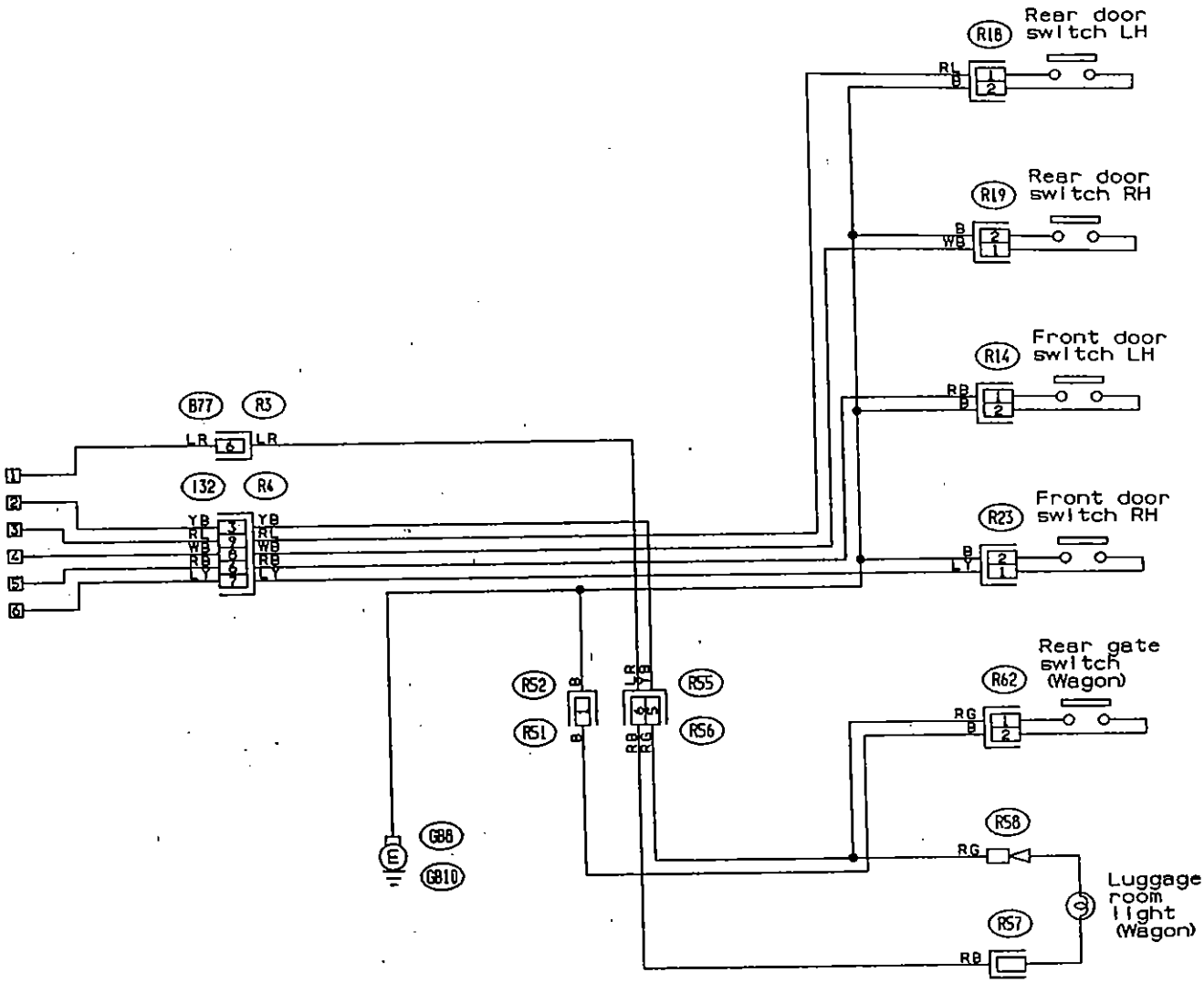
WITHOUT STEP LIGHT

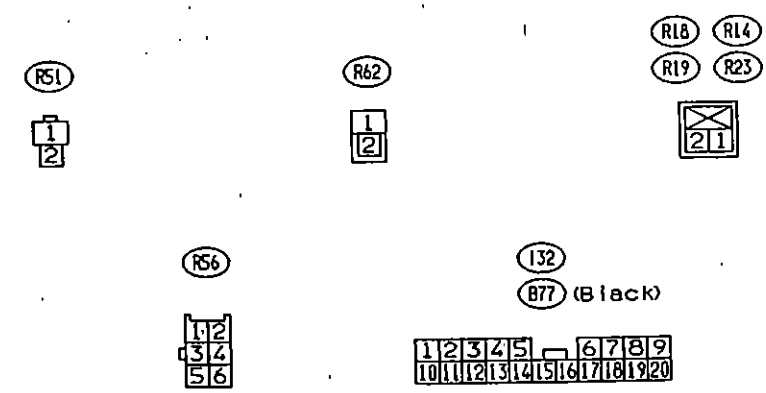




BU24-03A

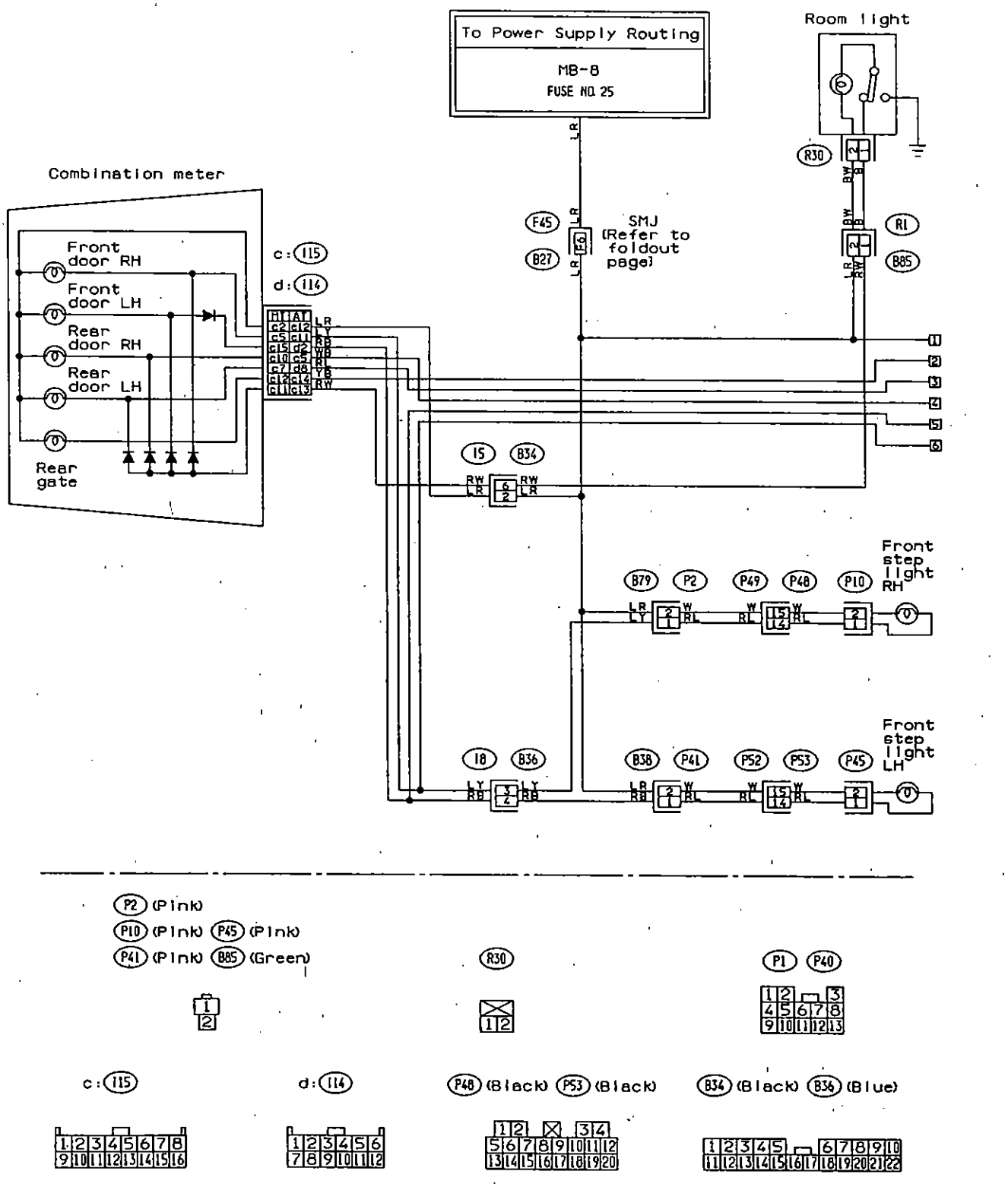
Fig. 35


R18
Rear door switch LH
R19
Rear door switch RH
R14
Front door switch LH
R23
Front door switch RH
B77
R3
132
R4
R52
R51
R55
R56
R62
Rear gate switch (Wagon)
R58
R57
GB8
GB10
Luggage room light (Wagon)


R51
R62
R18
R14
R19
R23
R56
132
B77 (Black)

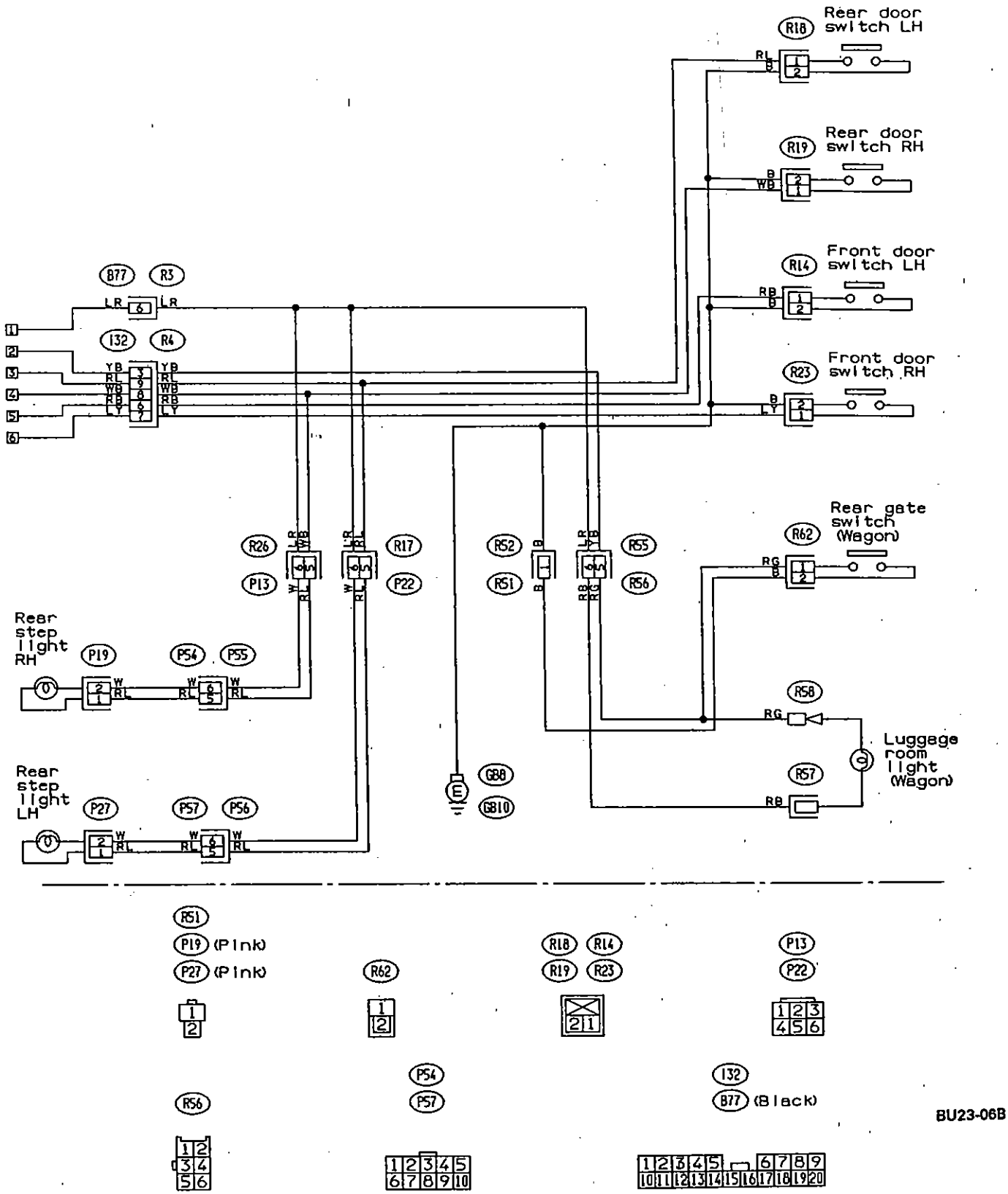
BU24-03B

S.I.A. MODEL



BU23-06A

Fig. 36


Rear door switch LH
R18
Rear door switch RH
R19
Front door switch LH
R14
Front door switch RH
R23
Rear gate switch (Wagon)
R62
B77
R3
132
R4
R26
P13
R17
P22
R52
R51
R55
R56
Rear step light RH
P19
P54
P55
Rear step light LH
P27
P57
P56
G88
G810
R58
R57
Luggage room light (Wagon)
R51
P19 (Pink)
P27 (Pink)
R62
R18
R14
R19
R23
P13
P22
R56
P54
P57
132
B77 (Black)
BU23-06B

8. STOP LIGHT

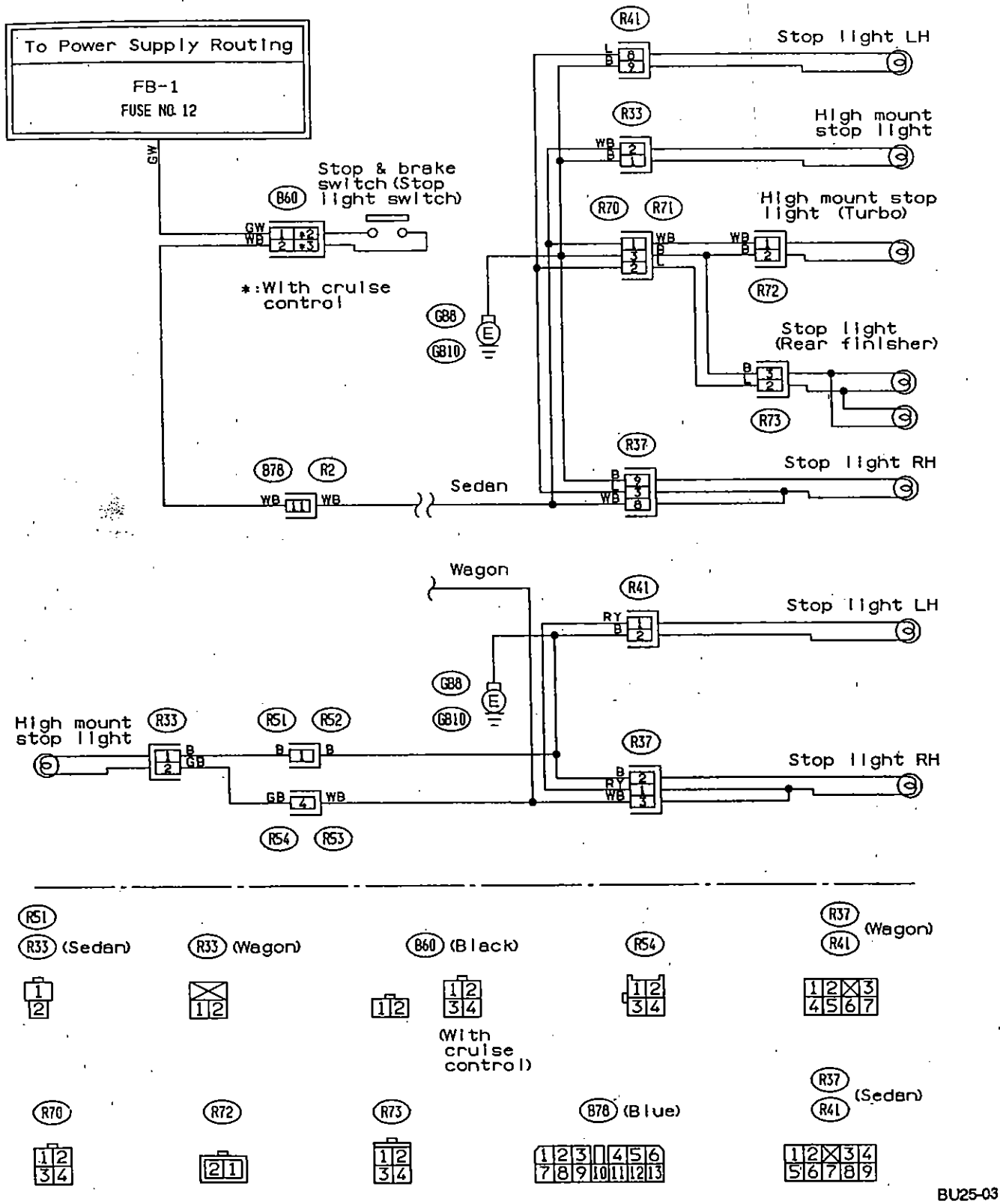


Fig. 37

9. TURN SIGNAL AND HAZARD

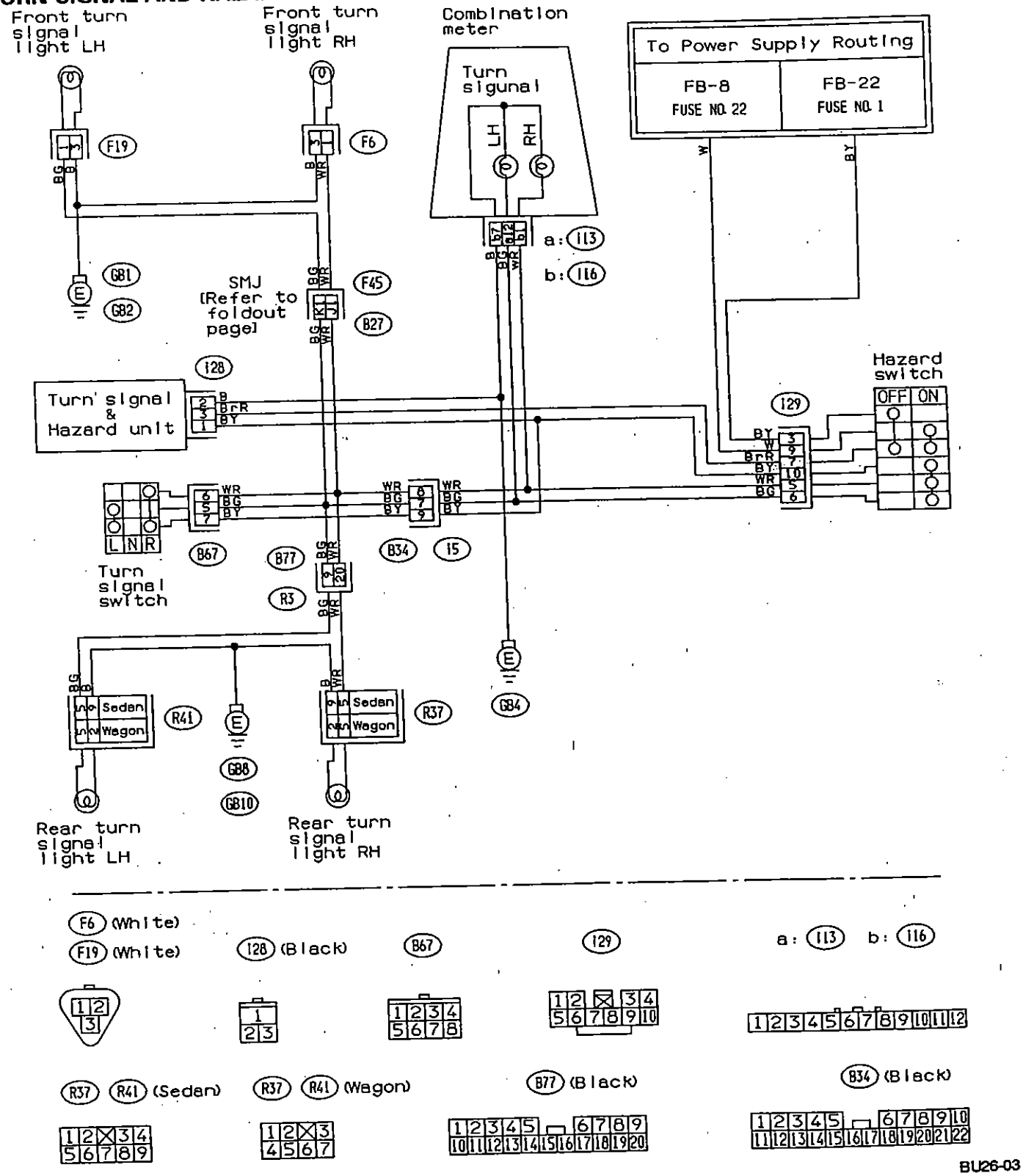
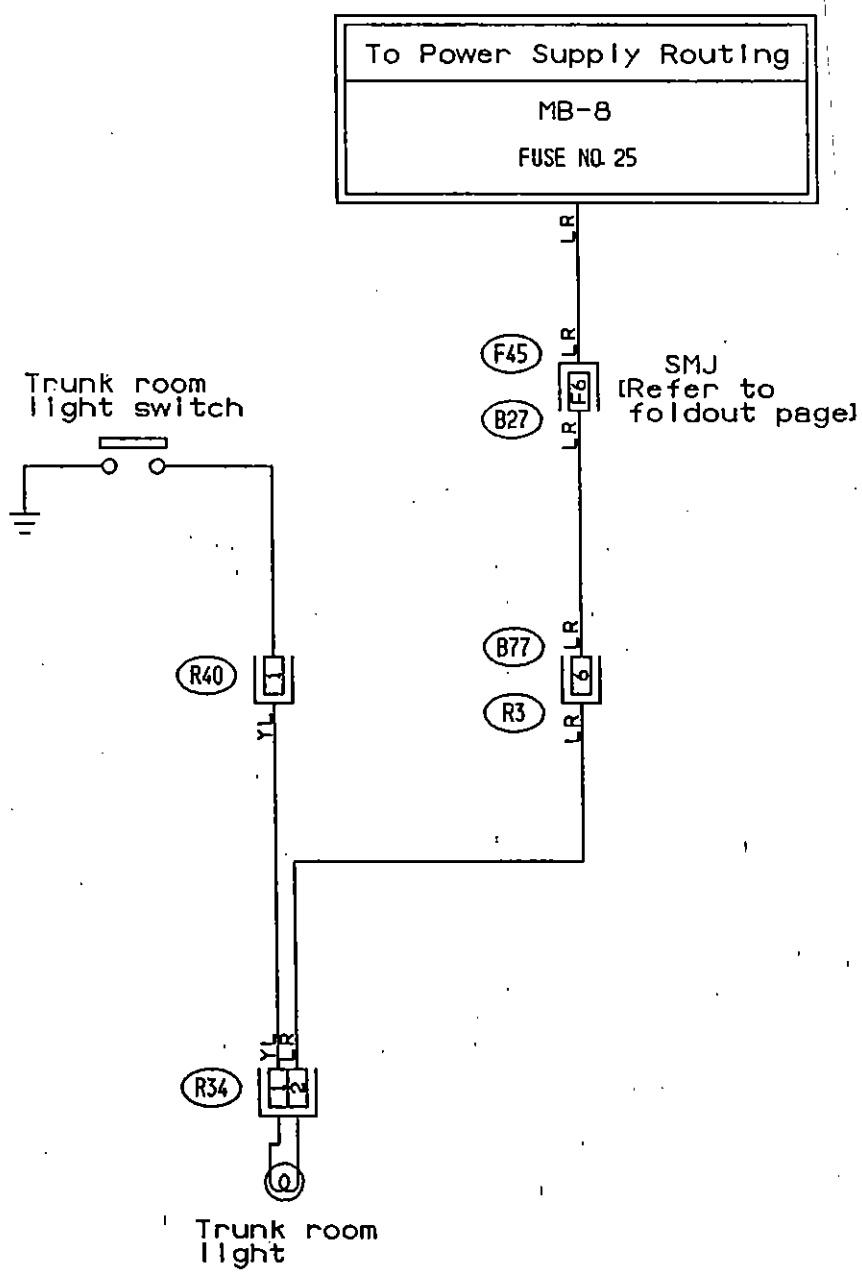


Fig. 38

10. TRUNK ROOM LIGHT



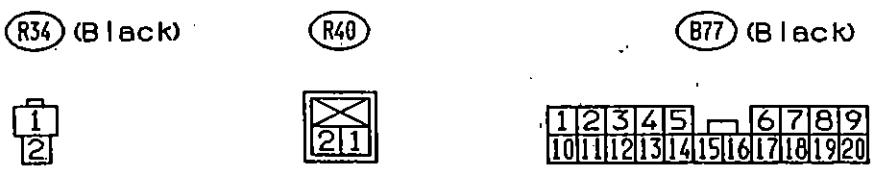


Fig. 39

11. BACK-UP LIGHT

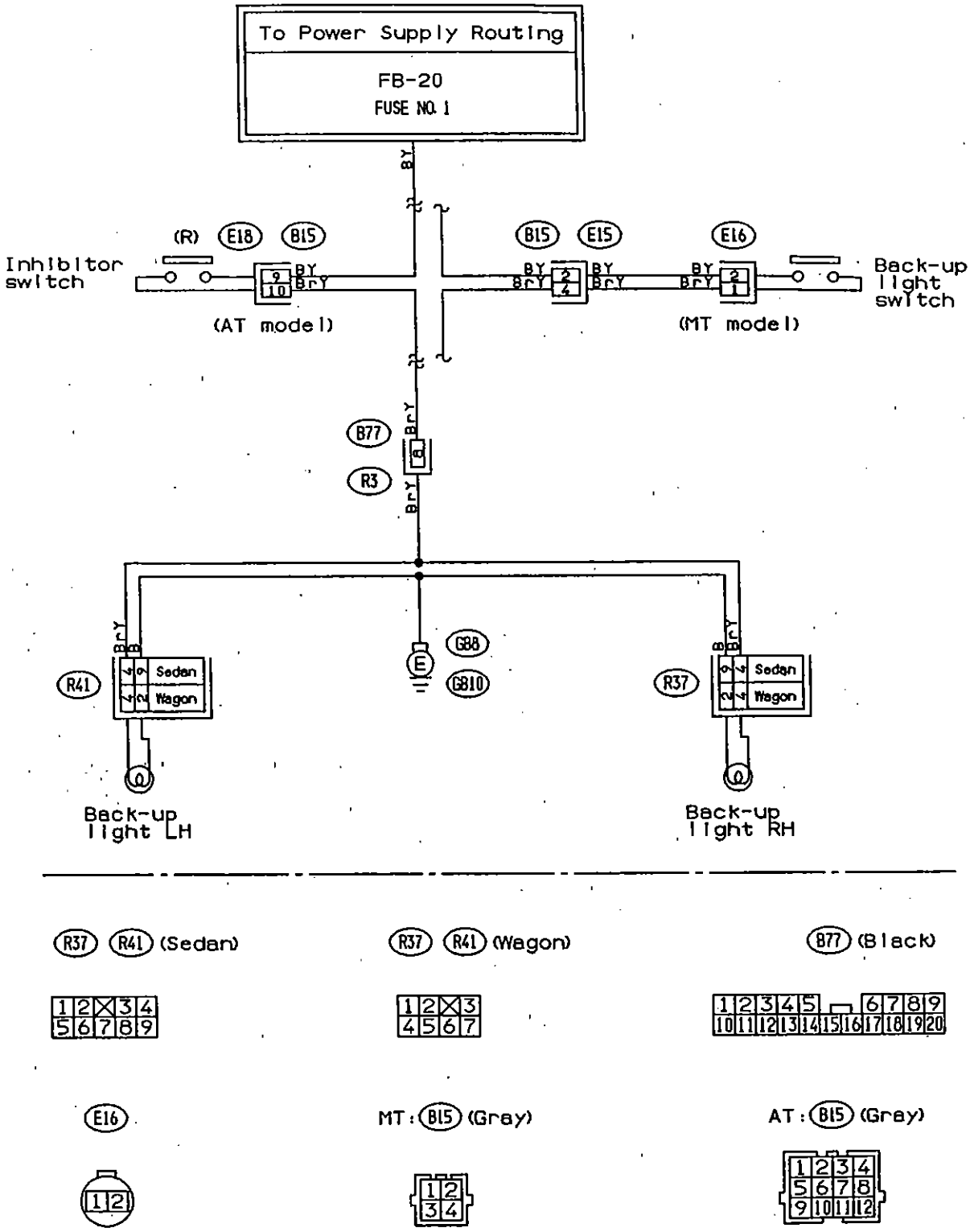
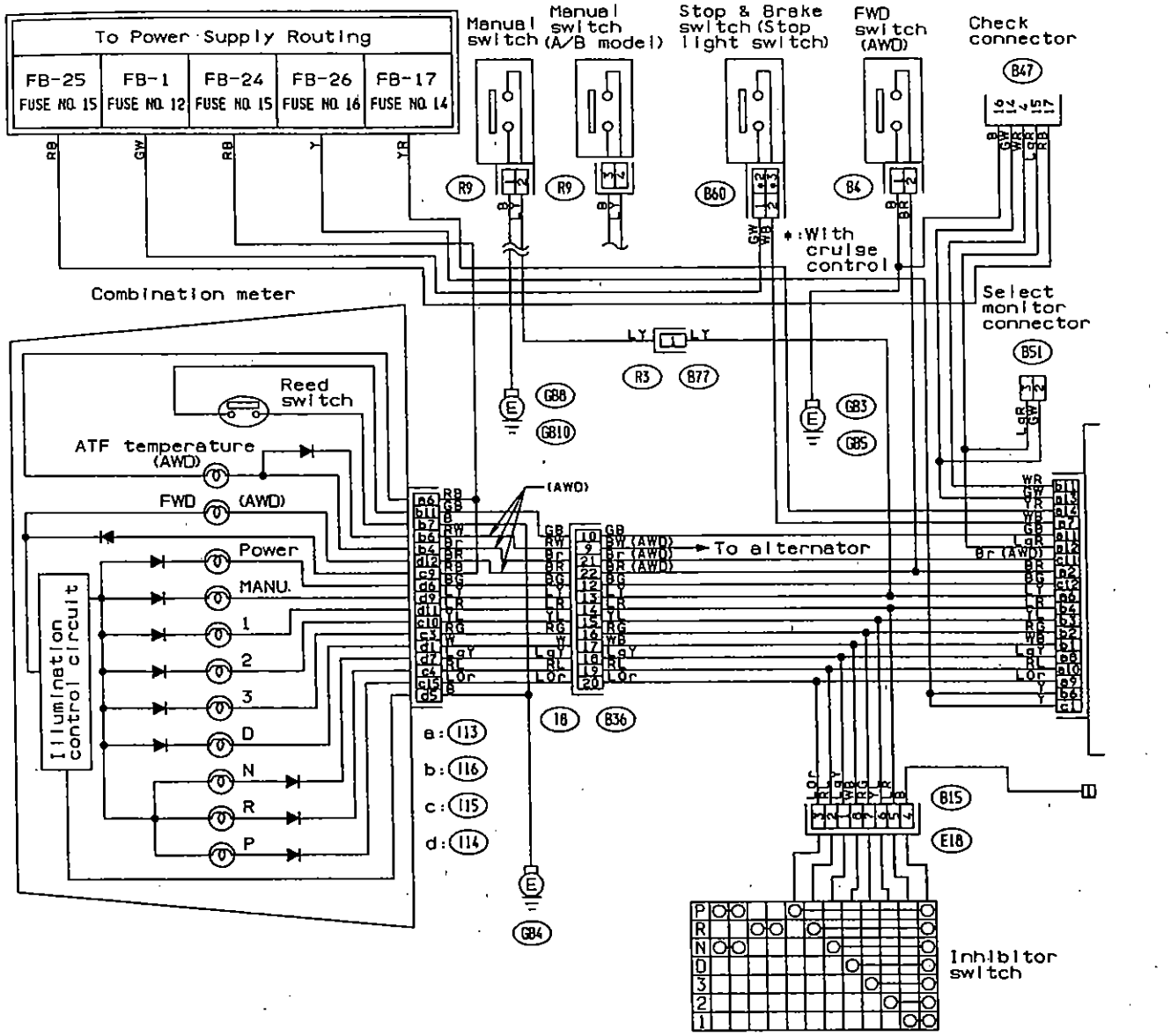


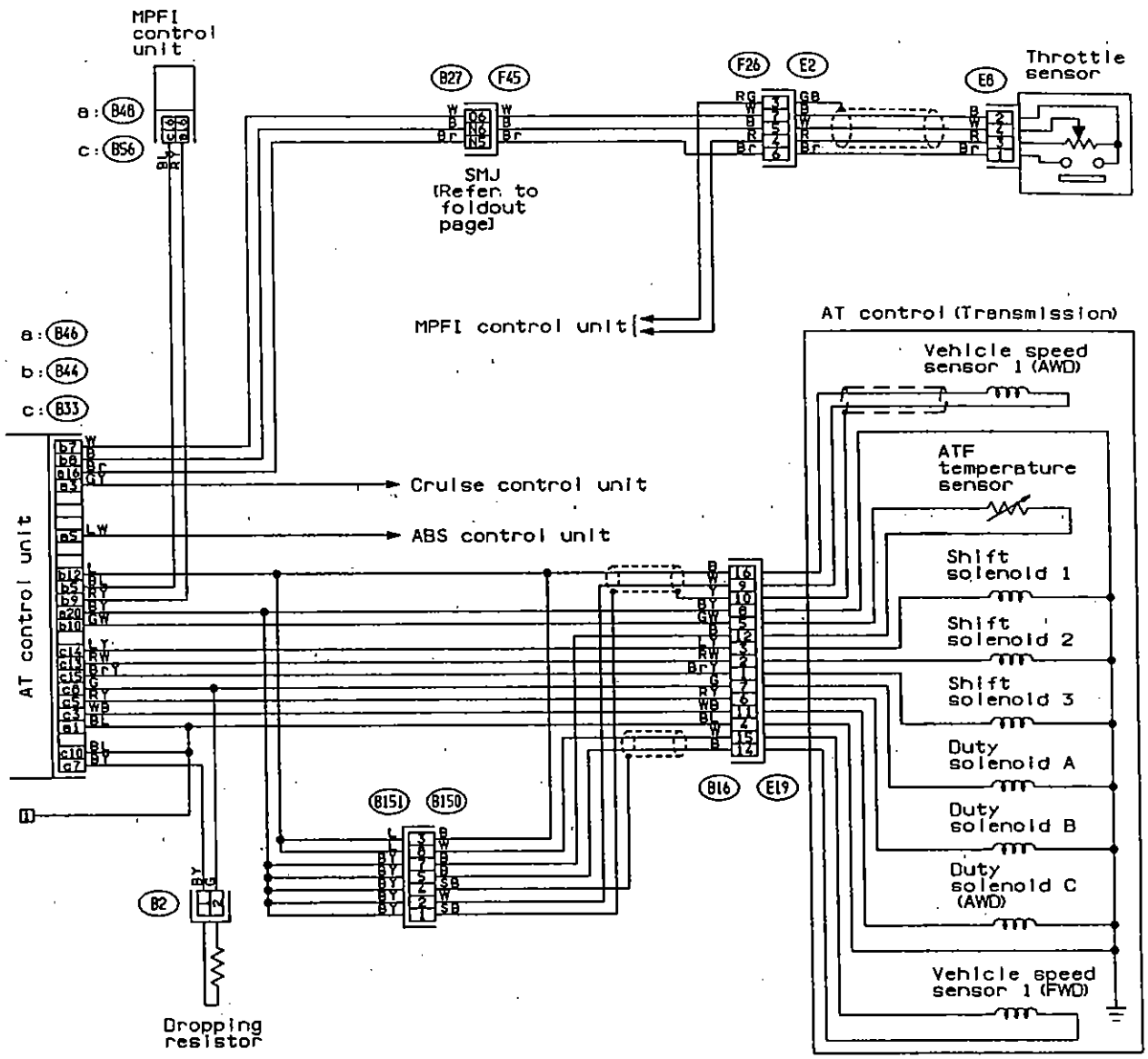
Fig. 40

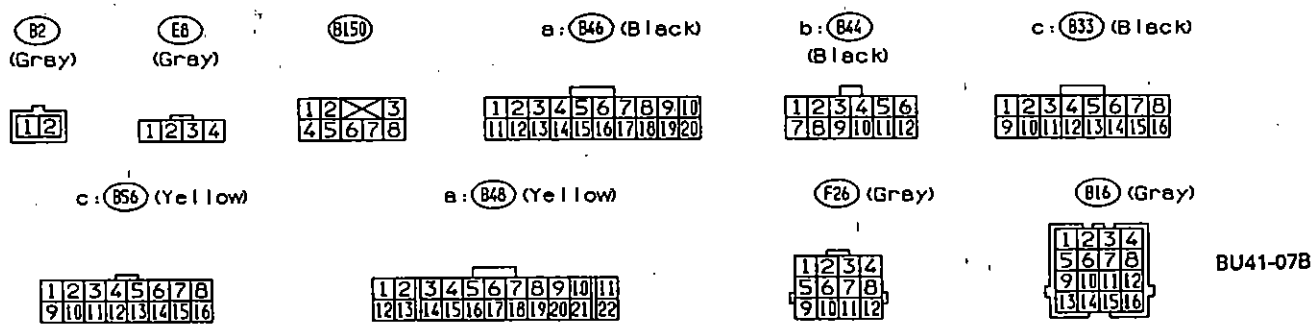
12. A/T CONTROL
NA (WITHOUT AIR SUSPENSION)



BU41-07A

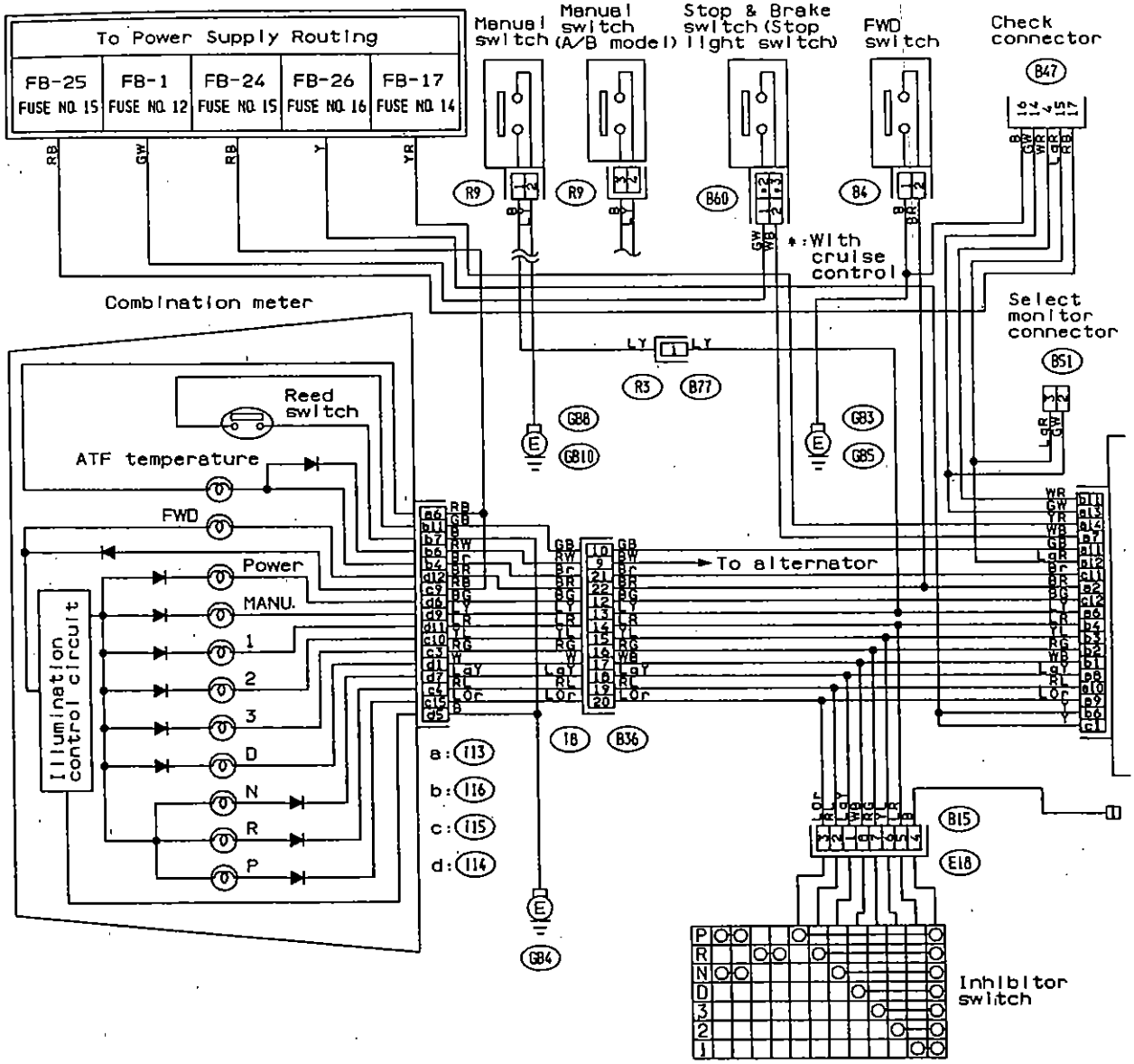
Fig. 41

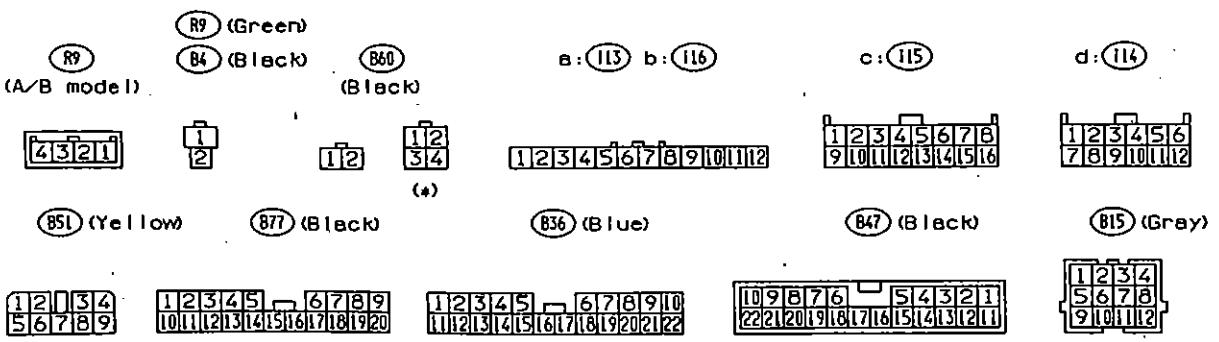

MPFI control unit
a: B48
c: B56
B27
F45
SMJ (Refer to foldout page)
F26
E2
E8
Throttle sensor
MPFI control unit
AT control (Transmission)
a: B46
b: B44
c: B33
AT control unit
Cruise control unit
ABS control unit
Vehicle speed sensor 1 (AWD)
ATF temperature sensor
Shift solenoid 1
Shift solenoid 2
Shift solenoid 3
Duty solenoid A
Duty solenoid B
Duty solenoid C (AWD)
Vehicle speed sensor 1 (FWD)
B16
E19
B151
B150
B2
Dropping resistor


B2 (Gray)
E8 (Gray)
B150
a: B46 (Black)
b: B44 (Black)
c: B33 (Black)
c: B56 (Yellow)
a: B48 (Yellow)
F26 (Gray)
B16 (Gray)

BU41-07B

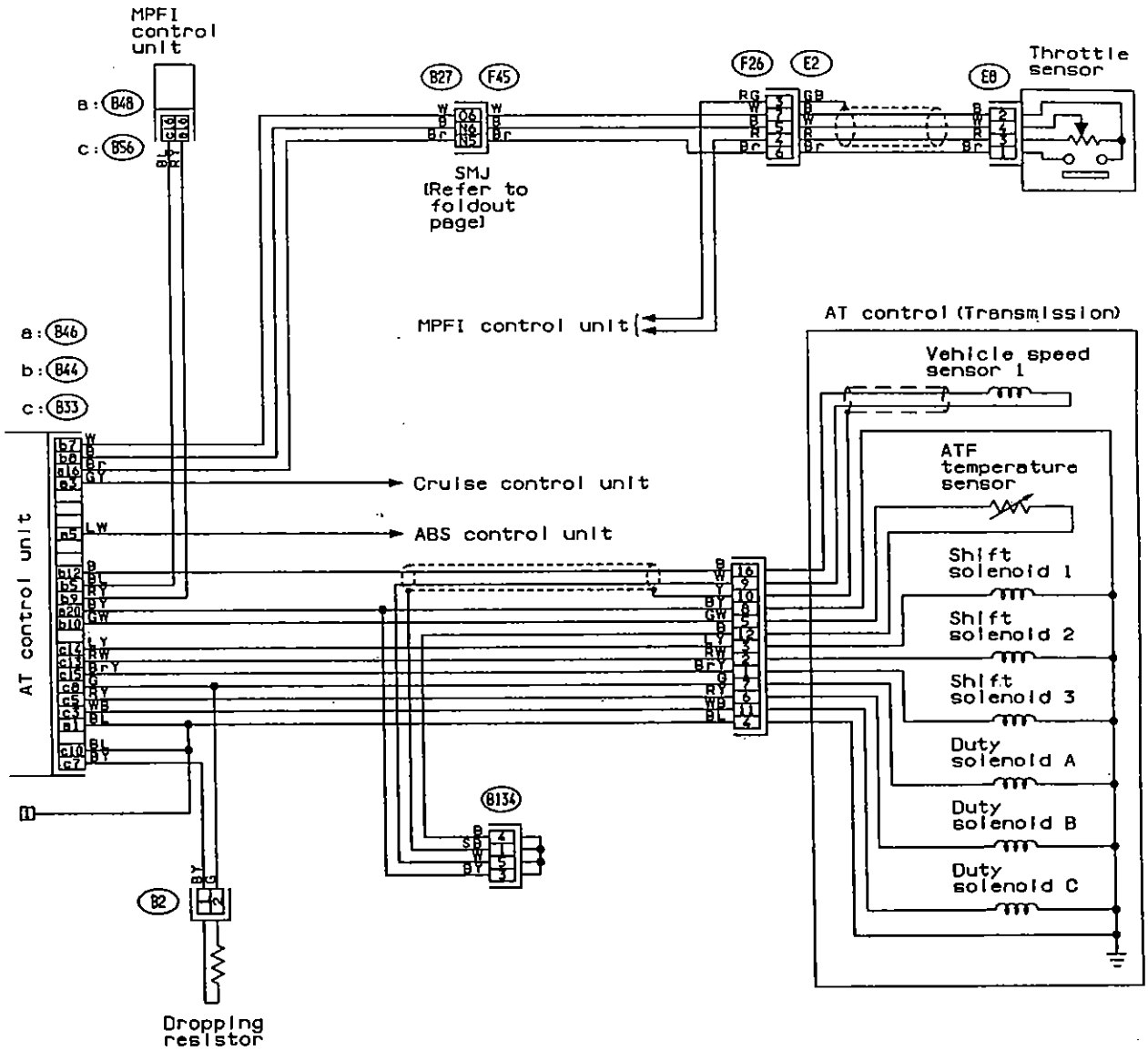
TURBO AND AIR SUSPENSION MODEL

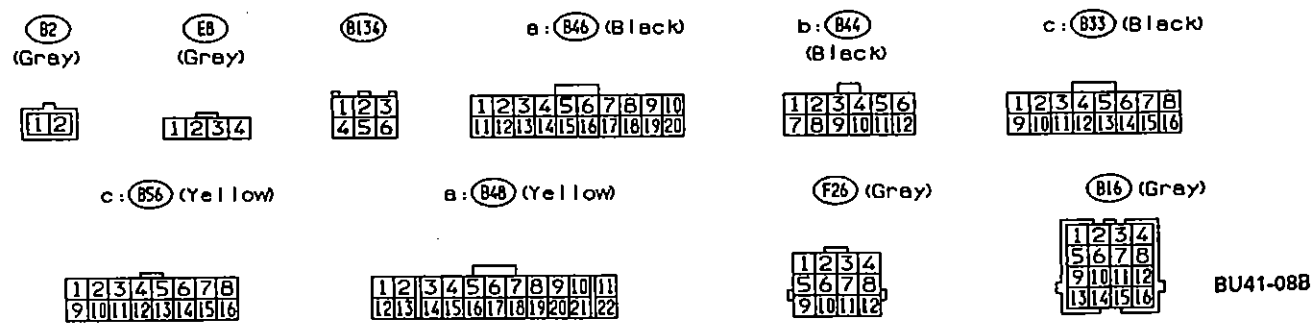




BU41-08A

Fig. 42


MPFI control unit
a: B48
c: B56
B27
F45
SMJ (Refer to foldout page)
F26
E2
E8
Throttle sensor
MPFI control unit
AT control (Transmission)
Vehicle speed sensor 1
ATF temperature sensor
Shift solenoid 1
Shift solenoid 2
Shift solenoid 3
Duty solenoid A
Duty solenoid B
Duty solenoid C
a: B46
b: B44
c: B33
AT control unit
Cruise control unit
ABS control unit
B134
B2
Dropping resistor


B2 (Gray)
E8 (Gray)
B134
a: B46 (Black)
b: B44 (Black)
c: B33 (Black)
c: B56 (Yellow)
a: B48 (Yellow)
F26 (Gray)
B16 (Gray)

BU41-08B

13. A/T SHIFT LOCK

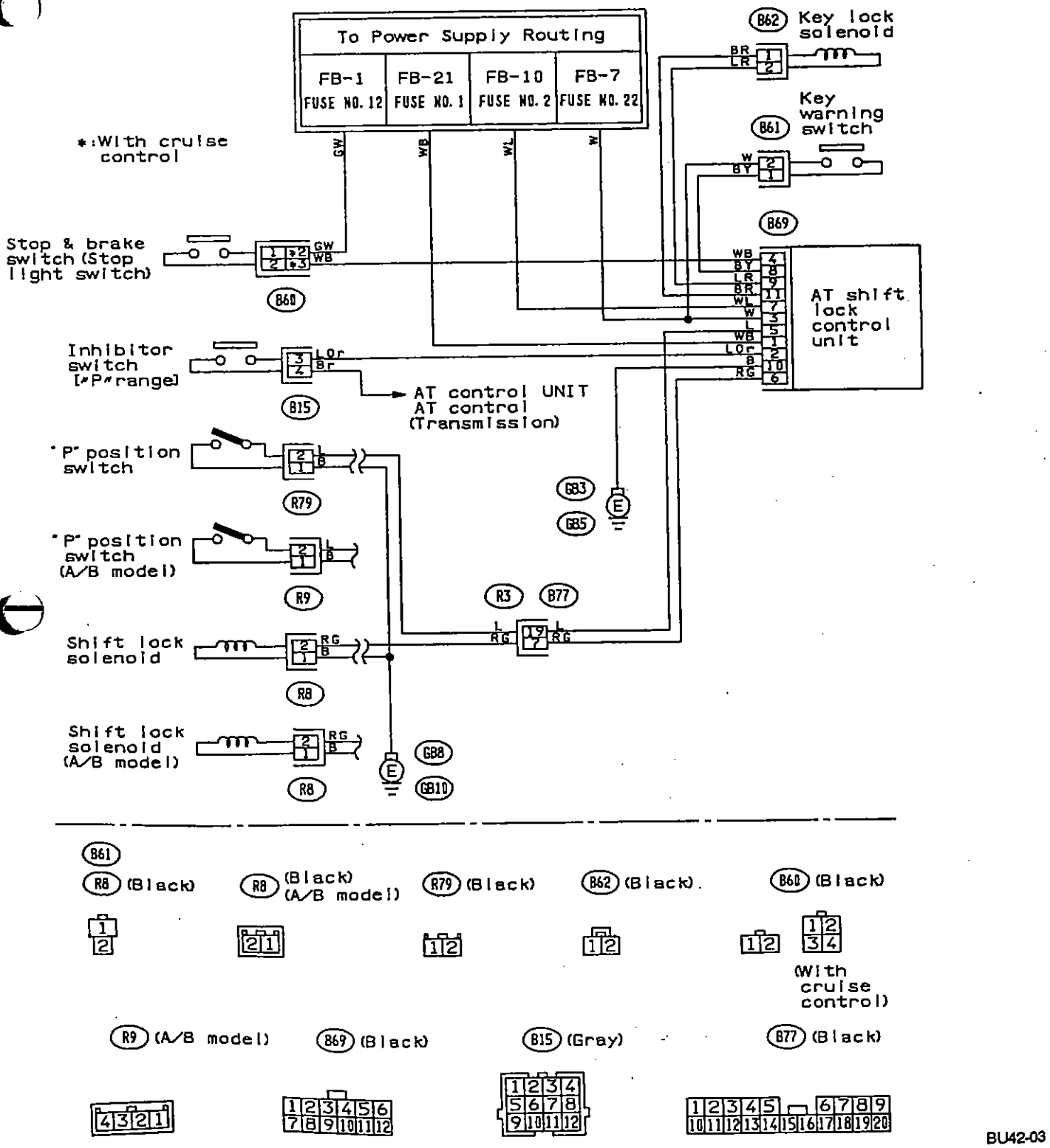
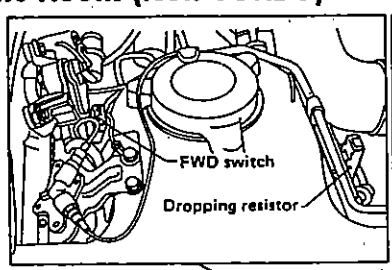


Fig. 43

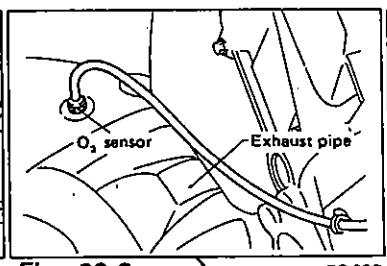
4 SENSOR•VALVE•SOLENOID•ETC.

(1) Engine Room (Non-TURBO)



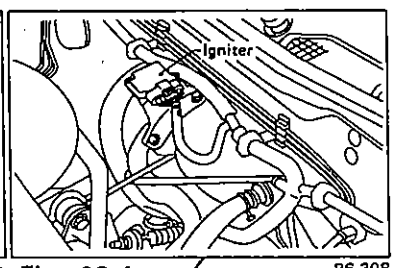
B6-305

Fig. 83-3



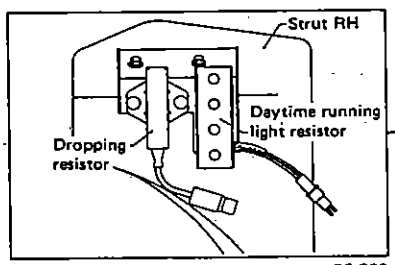
B6-337

Fig. 83-2



B6-308

Fig. 83-1



B6-329

Fig. 83-4

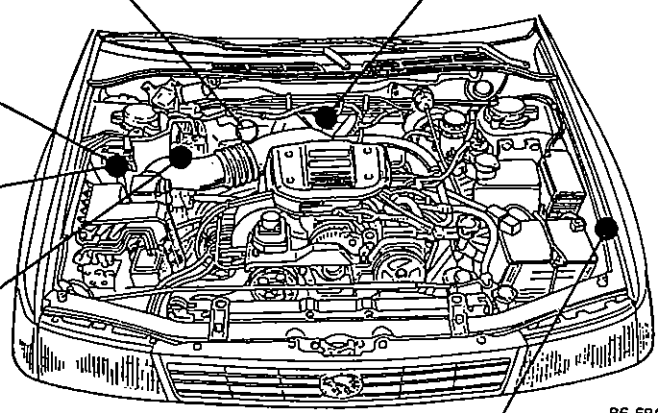
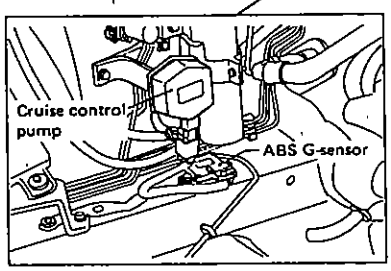
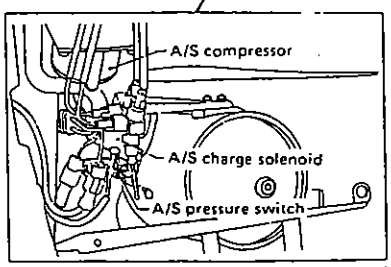

B6-680

Fig. 83



B6-307

Fig. 83-5



B6-315

Fig. 83-6

B6-680E

(2) Engine Room (TURBO)

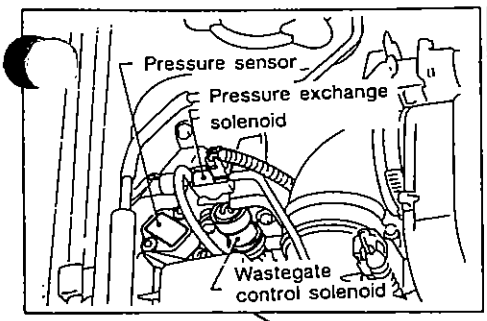


Fig. 84-3 B6-677

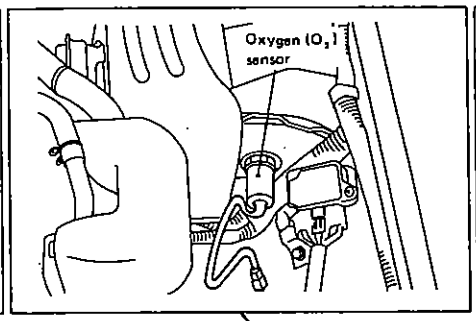


Fig. 84-2 B2-657

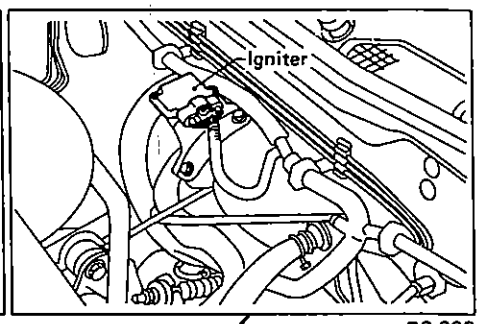


Fig. 84-1 B6-308

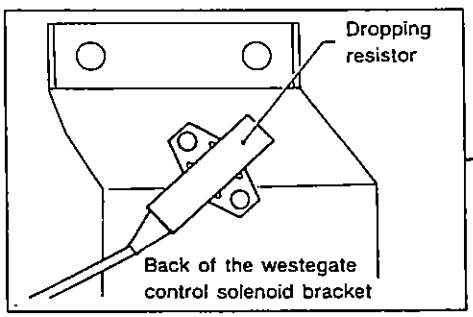
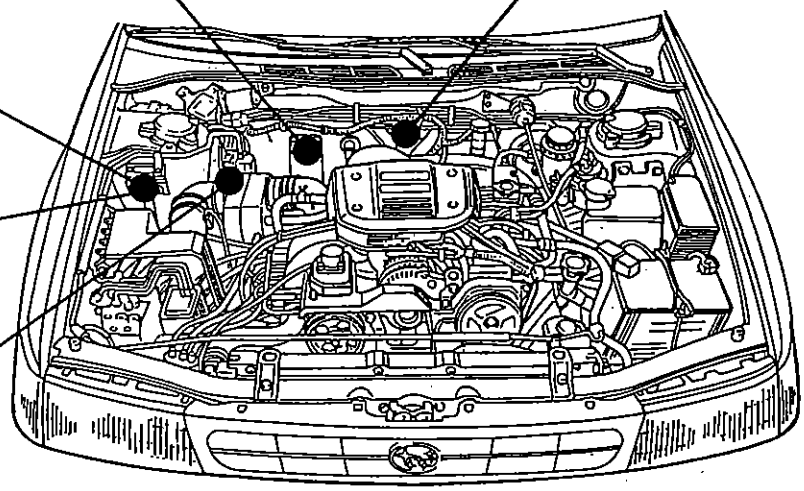


Fig. 84-4 B6-678



B6-679

Fig. 84

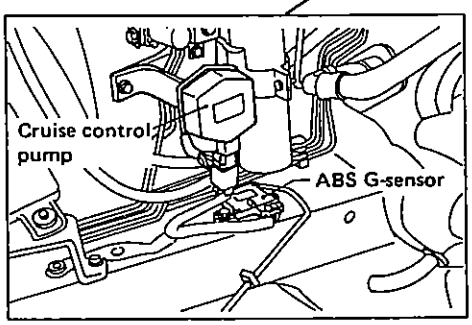


Fig. 84-5 B6-307

B6-679C

Fig. 84

(3) Engine

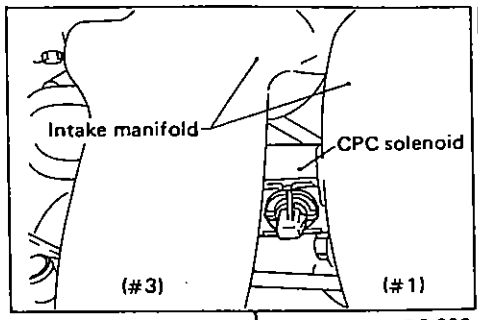


Fig. 85-1 B6-338

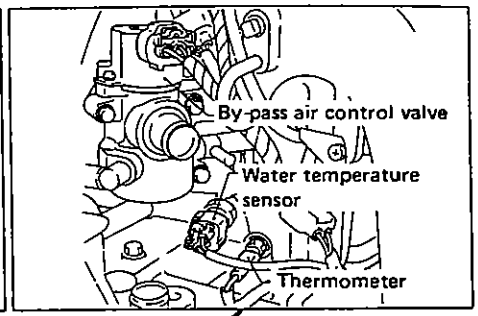


Fig. 85-2 B6-310

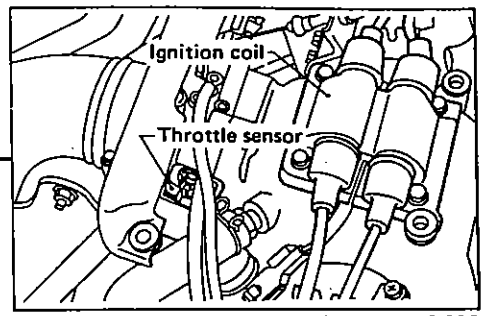


Fig. 85-3 B6-309

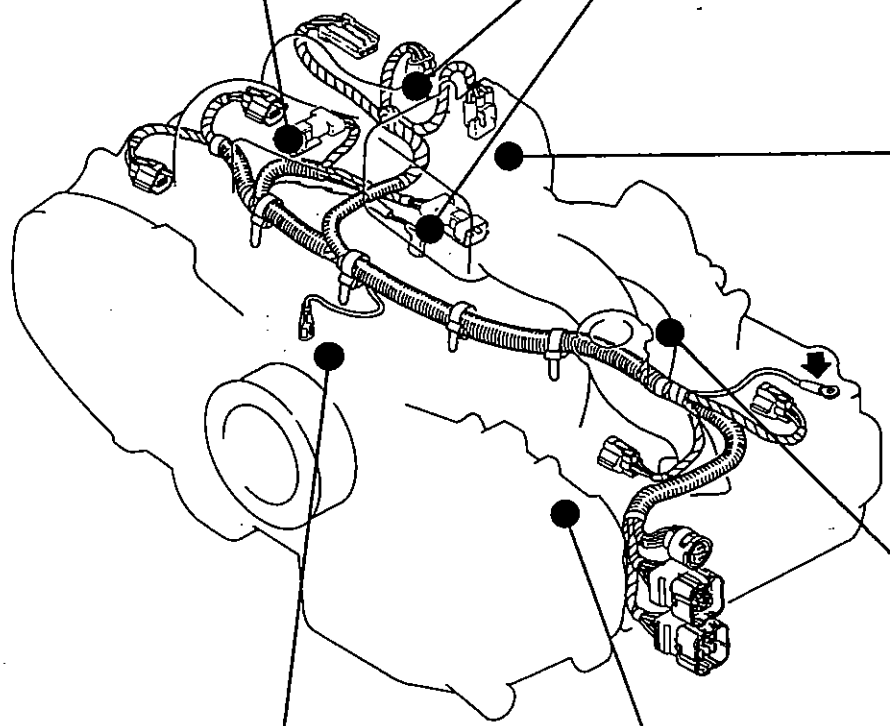


Fig. 85 B6-703

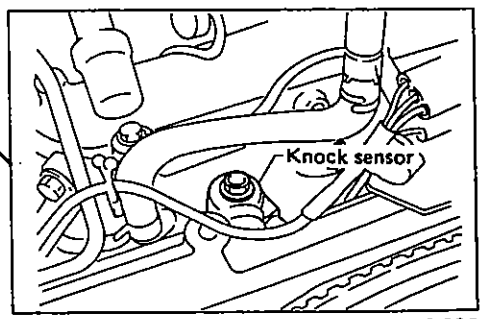


Fig. 85-4 B6-336

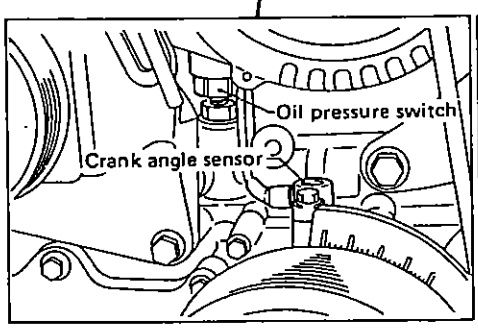


Fig. 85-6 B6-334

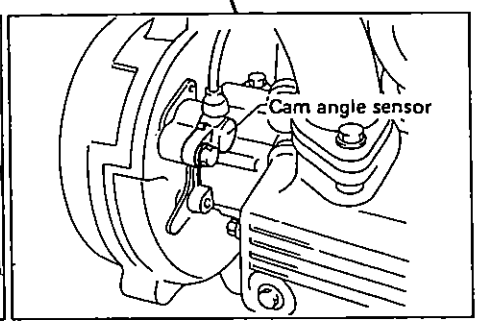


Fig. 85-5 B6-335

B6-703C

ector		Connecting to	
Color	Area	No.	Name
Gray	B—1		Air flow meter
Gray	B—2		Dropping resistor (AT)
Black	B—2		A/C pressure switch
Black	A—2		FWD switch (AT)
Gray	A—2		A/S front solenoid RH
Gray	A—2		A/S front sensor RH
	A—2		Wiper motor
Gray	A—3		Ignitor
Gray	B—3		Brake fluid level sensor
Black	A—3		A/S compressor relay
Gray	B—4		A/S front solenoid LH
Gray	B—3		A/S front sensor LH
Gray	B—3		ABS front sensor LH
Black	B—3		Starter (Magnet)
Gray	B—3	E18	Transmission (AT)
Gray	B—3	E15	Transmission cord (MT)
Gray	B—3	E19	Transmission (AT)
Gray	B—2		Cam angle sensor
Gray	B—2		Crank angle sensor
Gray	B—2		Knock sensor
Gray	B—2		O_2 sensor
Gray	B—2		Cruise control pump
Gray	B—2		ABS front sensor RH
Black	B—2		ABS G-sensor (MT)
Brown	B—2		Pressure exchange solenoid valve (Turbo model)
Gray	B—1		Pressure sensor (Turbo model)
Black	B—2		Wastegate control solenoid valve (Turbo model)
Gray	B—2		Daytime running light resistor (CANADA model)

2. BULKHEAD WIRING

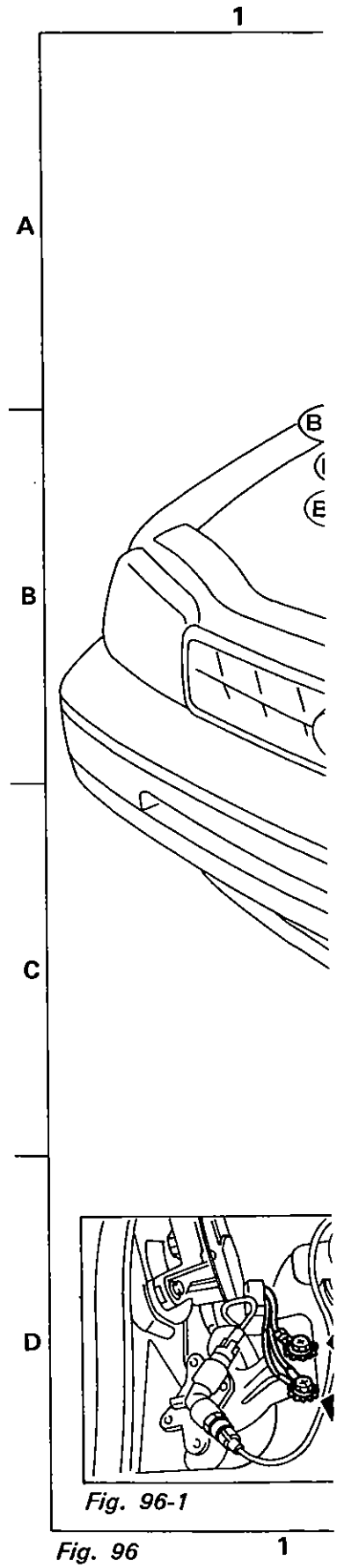


Fig. 96-1

Fig. 96

ARNESS AND GROUND POINT

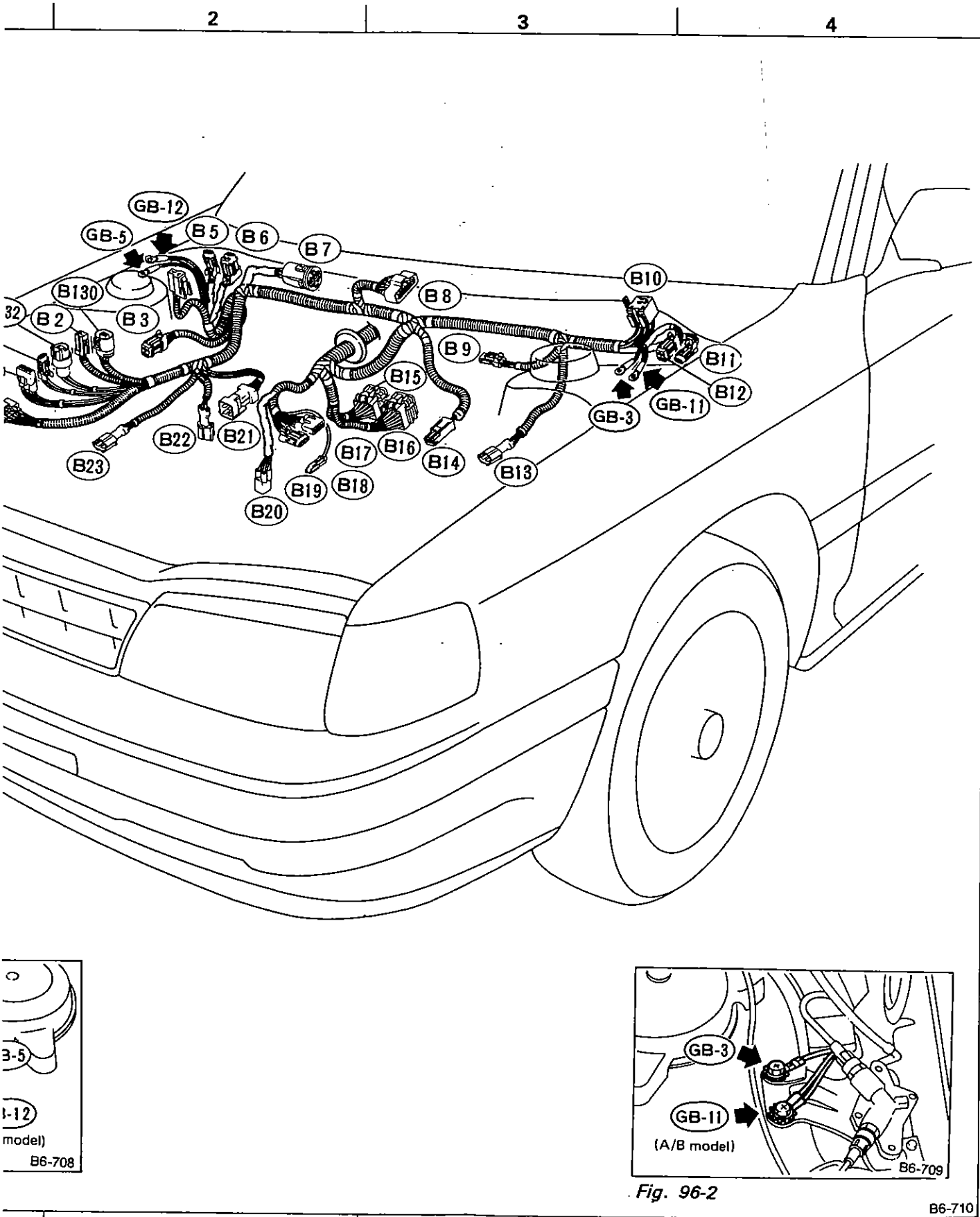


Fig. 96-2

Connector			Connecting to	
le	Color	Area	No.	Name
	Gray	C—3	F25	Front LH wiring harness
	Gray	B—3	F26	
	Gray	B—3	F27	Front LH wiring harness (Turbo model)
	Gray	B—3		Injector #2
	Gray	B—3		Injector #4
		A—2		Thermometer
	Brown	A—2		Water temperature sensor
	Gray	A—3		Throttle sensor
	Gray	A—2		By-pass air control valve
	Gray	A—2		Ignition coil
	Blue	A—2		CPC solenoid
	Gray	A—2		Injector #3
	Gray	A—2		Injector #1
	Black	B—2		Oil pressure switch

Connector			Connecting to	
ole	Color	Area	No.	Name
	Gray	C—2	B15	Bulkhead wiring harness (MT)
		D—2		Back-up light switch (MT)
	Black	D—2		Neutral switch (MT)
2	Gray	D—3	B15	Bulkhead wiring harness (AT)
6	Gray	D—3	B16	

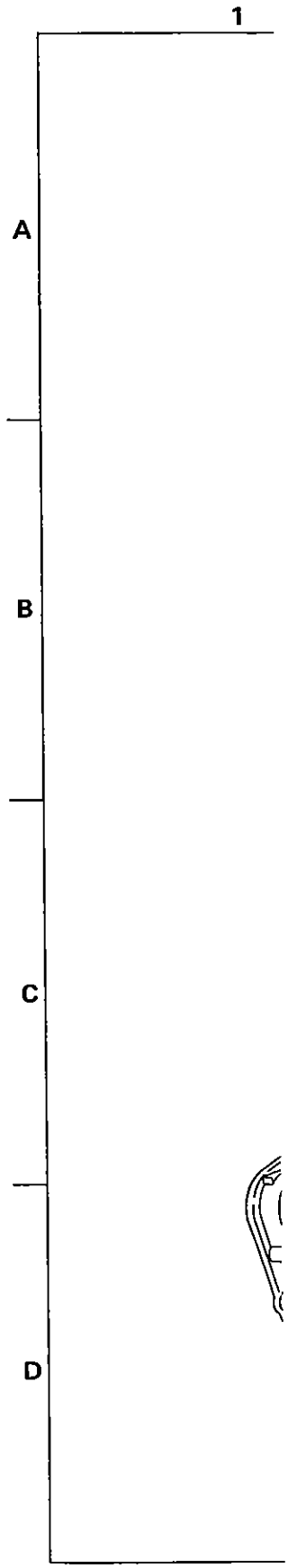


Fig. 97

SS • TRANSMISSION CORD AND GROUND POINT

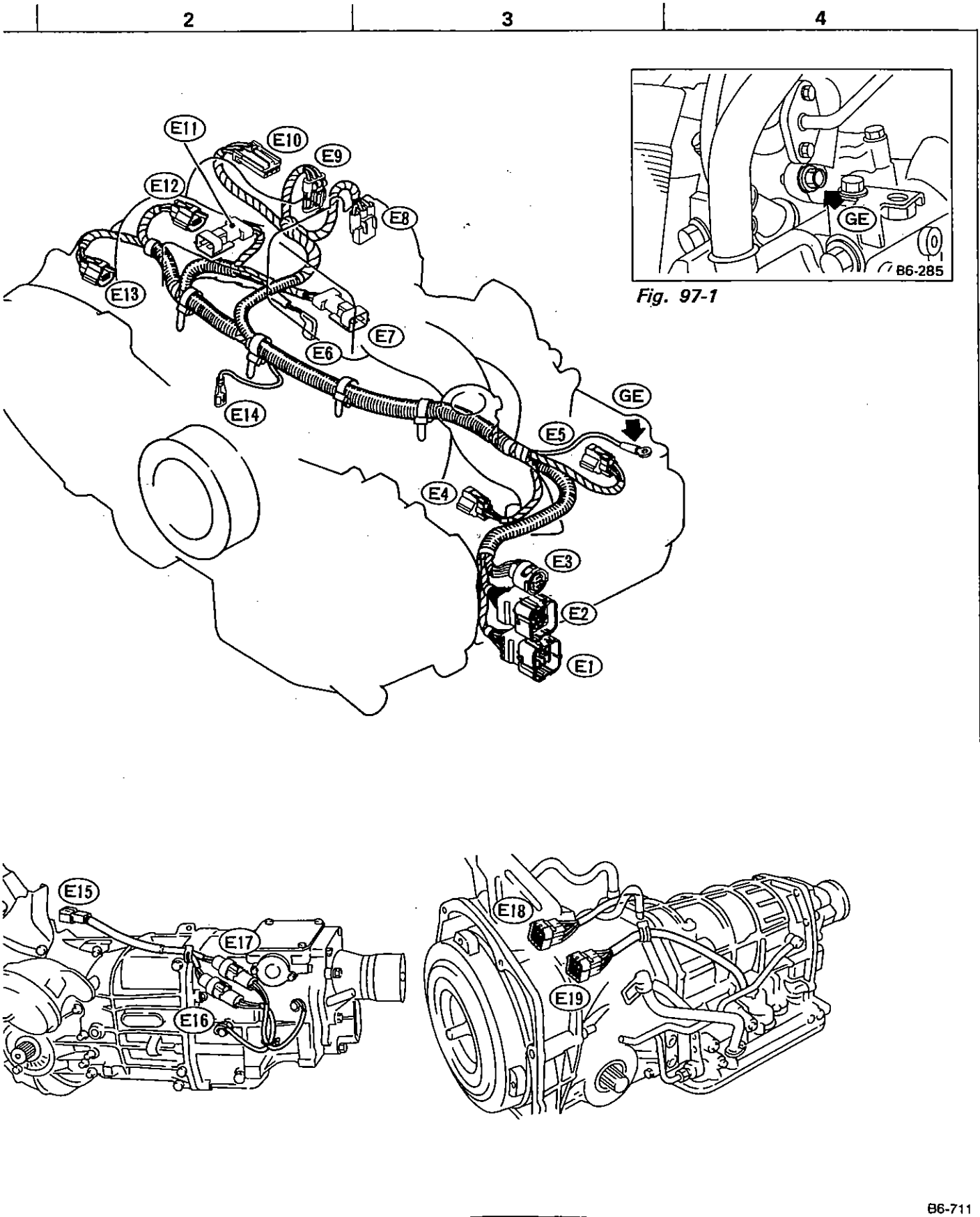


Fig. 97-1

	Connecting to	
Area	No.	Name
		Automatic shoulder belt limit switch LH
B—2	·46	Front wiring harness
B—1	P42	Power window main harness (SMJ)
B—2	F45	Front wiring harness (SMJ)
B—1		Blower relay
B—1		Ignition relay
B—1		Fuel pump relay
B—1	R11	Sunroof cord
C—1		AT control unit
C—1	i5	Instrument panel wiring harness
C—1	i7	
C—1	i8	
C—1	i9	
C—1	P41	Front door cord LH
C—1	P40	
C—1	P39	Power window main harness
C—1		F/B
C—1		
C—1		AT control unit
B—2		Clutch switch (MT)
C—1		AT control unit
C—3		Check connector
C—2		MPFI control unit
B—3		Select monitor connector
C—2	B53	Test mode connector
C—2	B52	
C—2	B55	Read memory connector
C—2	B54	
C—2		MPFI control unit
C—2		MPFI control unit
B—	?57	Shield joint connector
		Stop and Brake switch (with cruise control)
B—2		Stop light switch
C—2		Key warning switch
C—2		Key lock solenoid
C—2		Ignition switch
C—2		Combination switch
C—2		Cruise control sub-switch
C—2		Combination switch
C—2		Combination switch (Lighting switch)
B—3		AT shift lock control unit
B—3		Diode (Lighting)
B—3		Evaporator thermoswitch
B—3		A/C cut relay
B—4		FRESH/RECIRC actuator
B—4		Blower motor resistor
B—4		Blower motor
C—4	R3	Rear wiring harness
C—4	R2	
B—4	P2	Front door cord RH
B—4	P1	

Connector				Connecting to	
No.	Pole	Color	Area	No.	Name
B81	4		B—4		Cruise control unit
B82	20		B—4		
B83	4	White	B—4		Inhibitor relay (AT-cruise control)
B84	4	Black	B—4		Main relay (Cruise control)
B85	2	Green	B—4	R1	Room light cord
B86	3	Black	B—1		Horn relay
B87	2		A—4		Automatic shoulder belt limit switch RH
B88	2	Blue	B—2		Clutch switch (MT-cruise control)
B89	10	Brown	B—2		Mode actuator
B90	1		C—3		Diagnosis terminal (Ground)
B91	4	Black	C—3		Diagnosis connector
	6	Black	C—3		Diagnosis connector (Airbag model)
B92	4	Blue	B—3		Starter interlock relay (MT)
B93	2	Blue	B—3	i37	Instrument panel wiring harness
B94	2	Black	B—4		Diode (Daytime running light)
B95	2		B—4		Diode (AT-cruise control)
	4	Brown	B—4		Diode (AT-cruise control) (Canada model)
B96	5	Black	B—4		Daytime running light relay (Canada model)
B97	4	Blue	B—4		Daytime running light high beam relay (Canada model)
B98	10		B—4		Daytime running light control unit
B99	2	Blue	C—1		Diode (Seat belt) (Canada model)
B133	6		B—2		Shield joint connector (ABS)
B134	6		C—2		Shield joint connector (AT) (Turubo and air suspension model)
B140	7	Yellow	C—1	AB-1	Airbag harness
B150	8		C—2	B151	Shield joint connector (AT)
B151	8		C—2	B150	

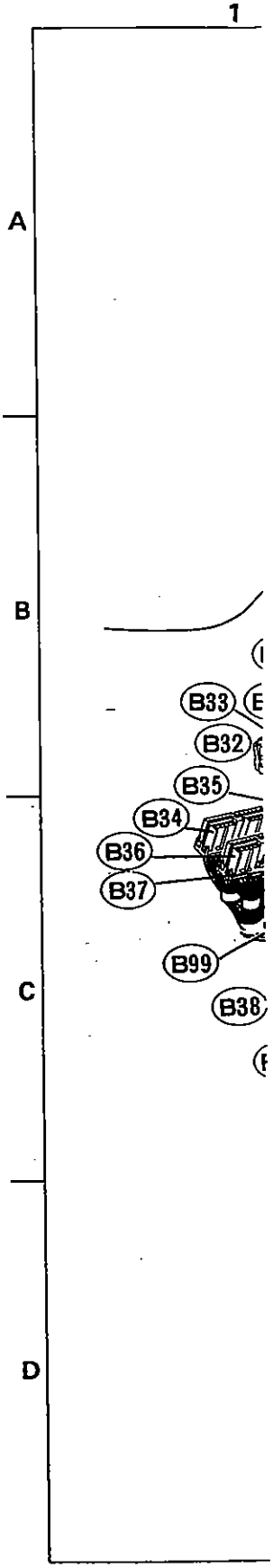
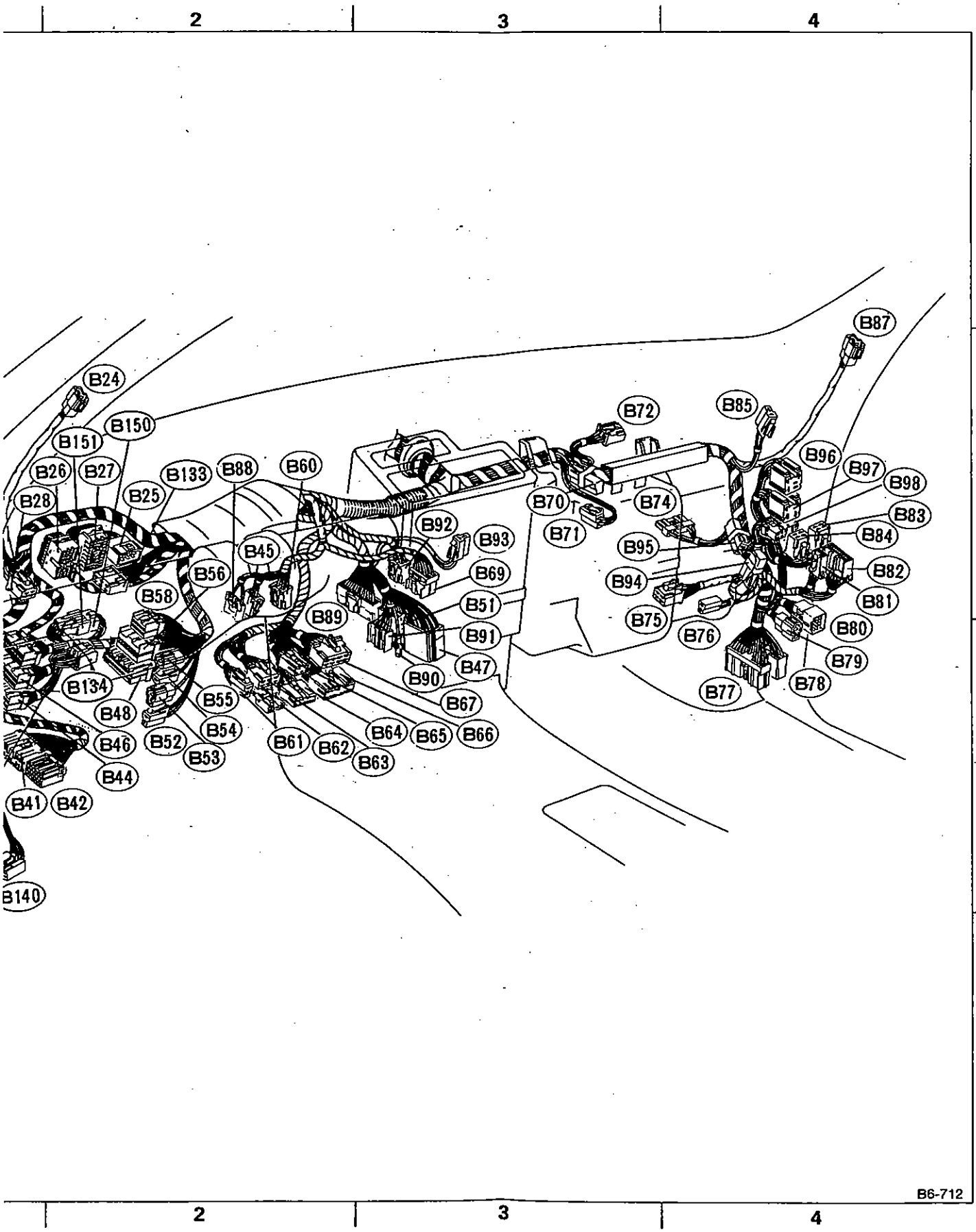


Fig. 98

RNESS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