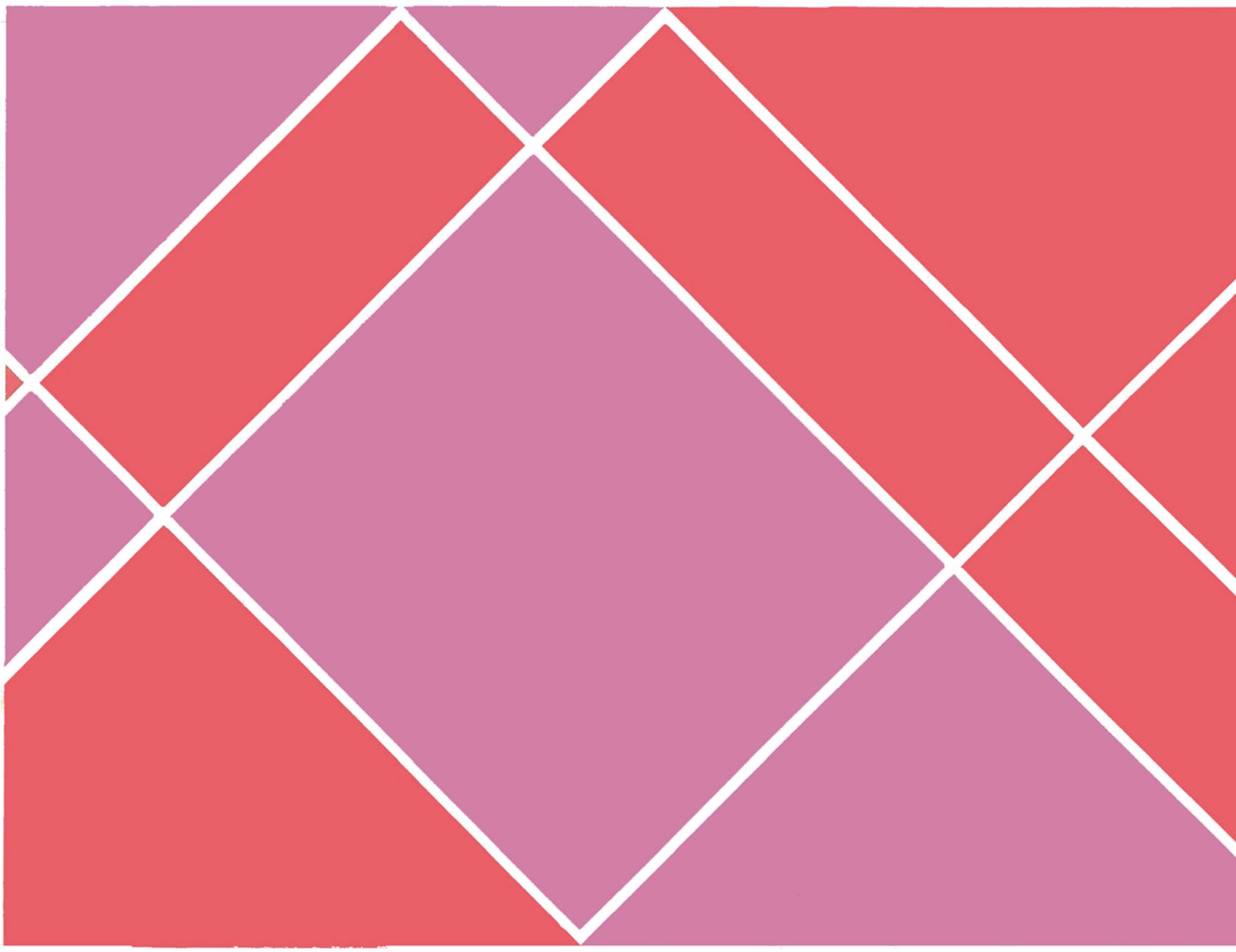
TOYOTA

LAND CRUISER

REPAIR MANUAL

ALL SEASON TYPE AIRCONDITIONING SYSTEM



RAC—015

FOREWORD

This manual has been published to provide the technician with comprehensive service information for the Toyota LAND CRUISER air conditioner system.
Following these procedures will help insure a professional repair of the system when required and provide the customer with maximum performance.

This manual contains basic theory, diagnosis, component description, and repair procedures for the air conditioning system. All information are the latest at the time of publication.

As for compressor repair, please refer to the booklet "Air Conditioning Compressor Repair Manual : Type 6P127A we issued.

It is recommended that this manual should be kept ready available for reference at all times.

We reserve the right to make any changes in this manual, at any time, without notice.

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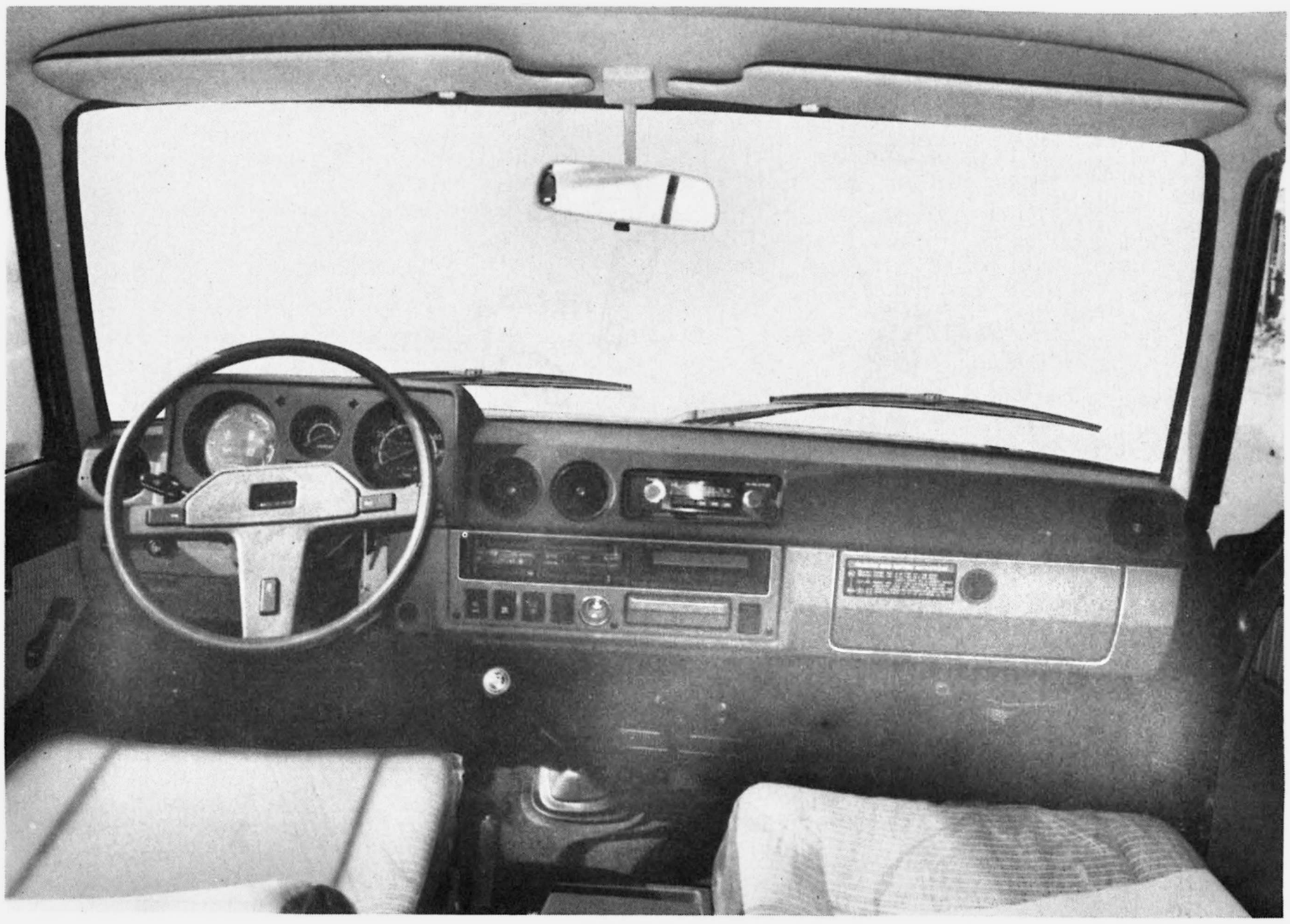
I. EXPLODED VIEW OF AIR CONDITIONING SYSTEM

I-1. INSTRUMENT PANEL LAYOUT



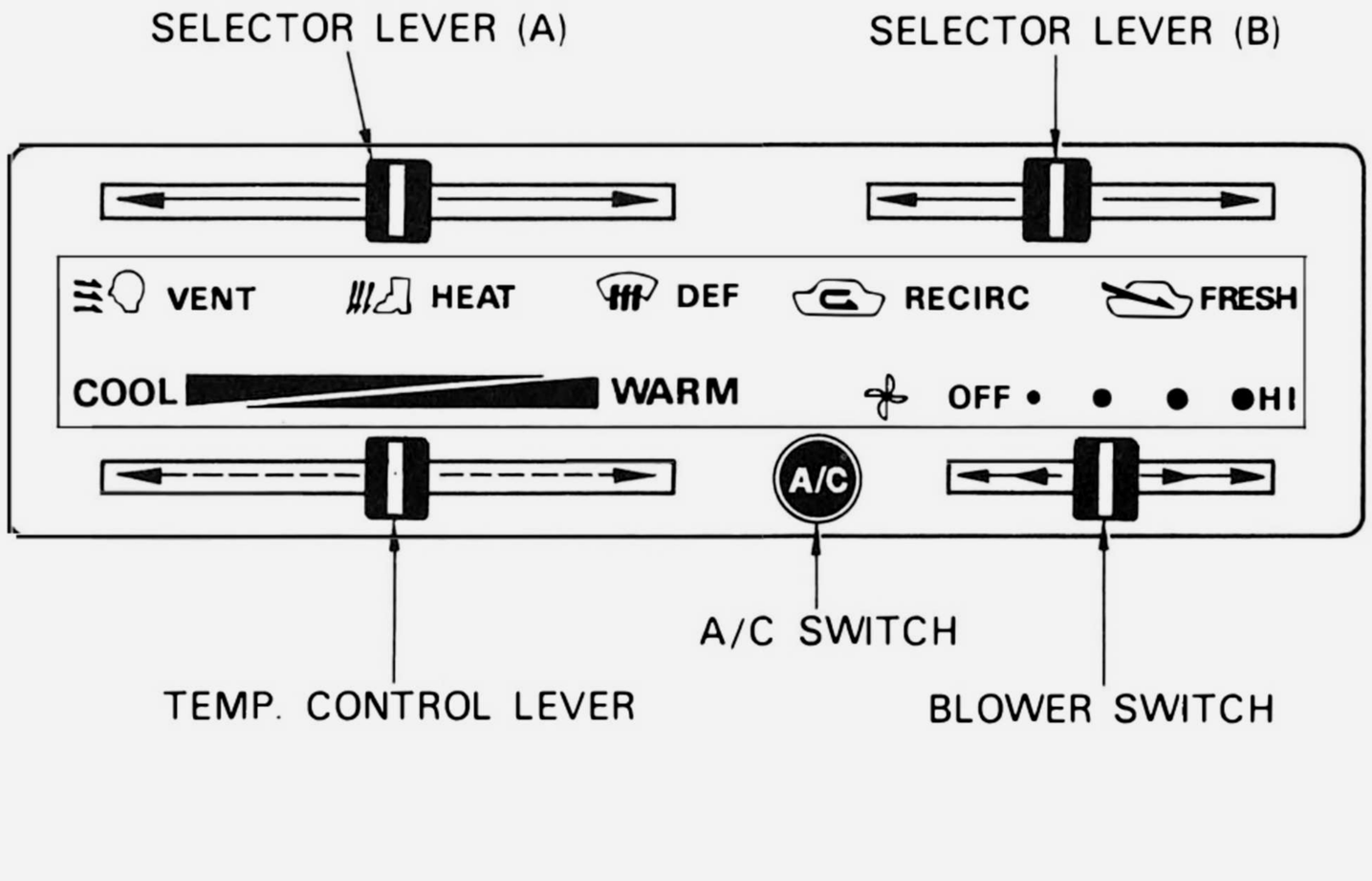
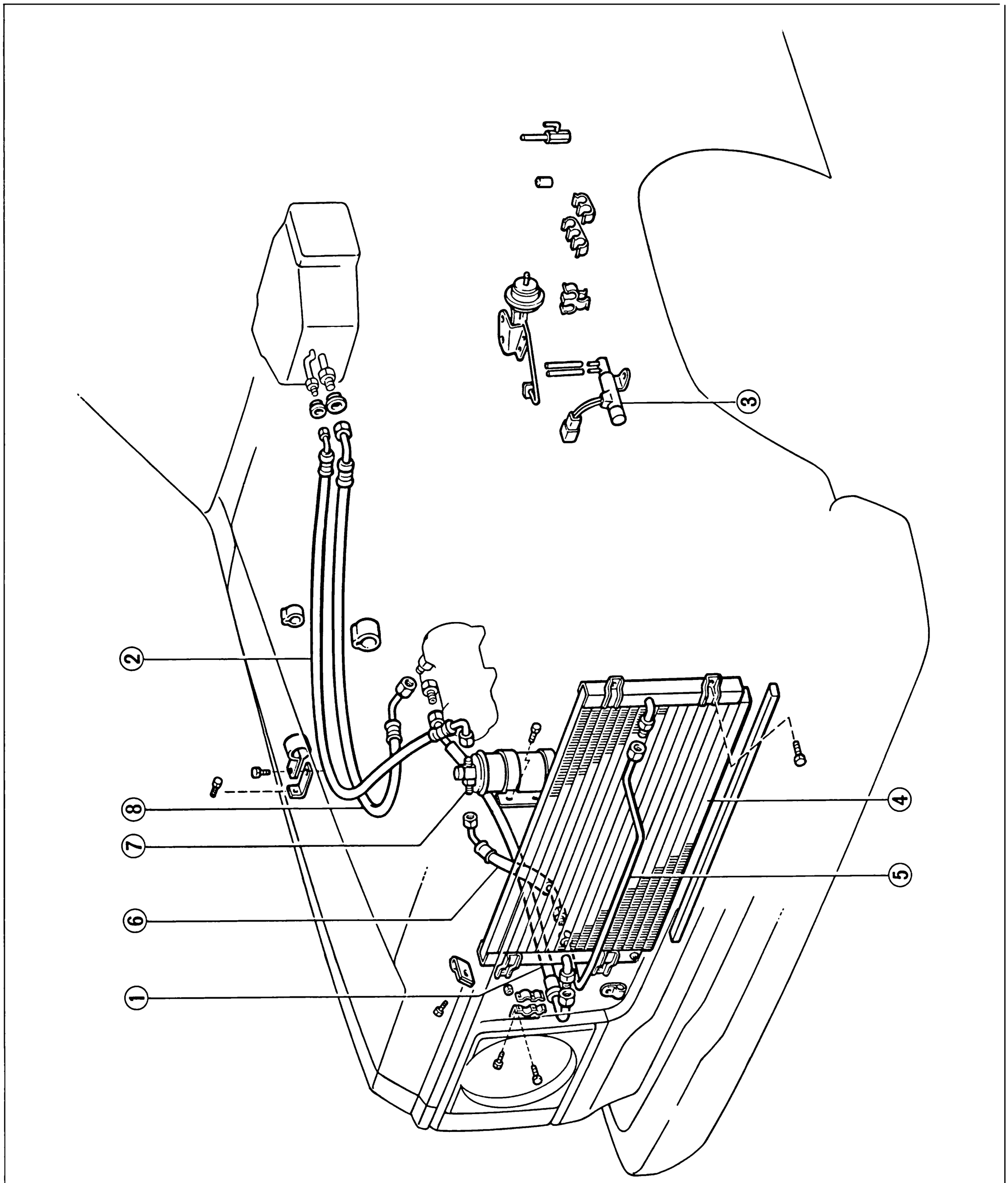


Fig. 1-1

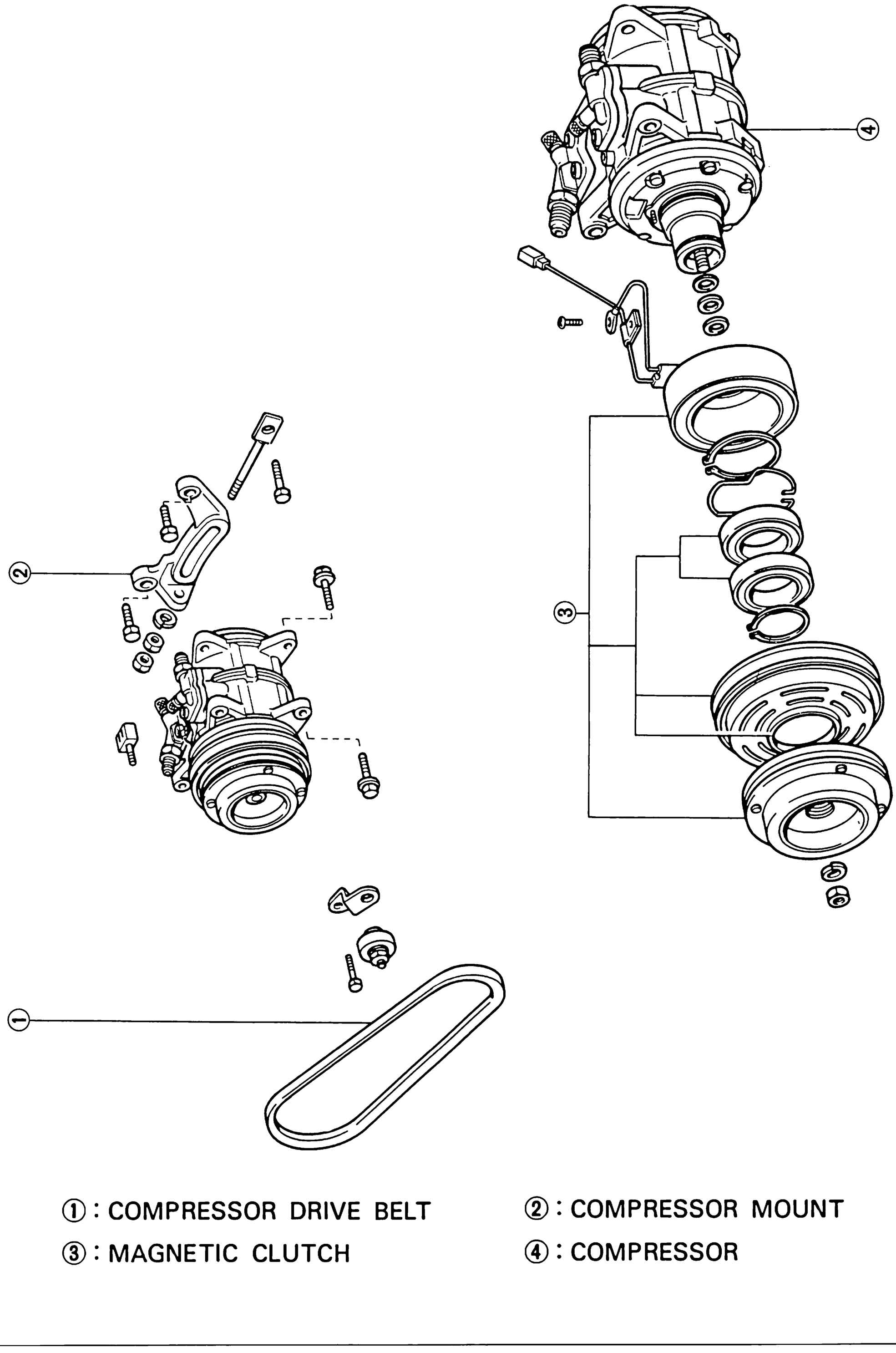
I-2. ENGINE COMPARTMENT



①: DISCHARGE FLEXIBLE HOSE
②: LIQUID LINE HOSE
③: VACUUM SWITCHING VALVE
④: CONDENSER
⑤: LIQUID LINE TUBE
⑥: LIQUID LINE HOSE
⑦: RECEIVER
⑧: SUCTION FLEXIBLE HOSE

Fig. 1-2

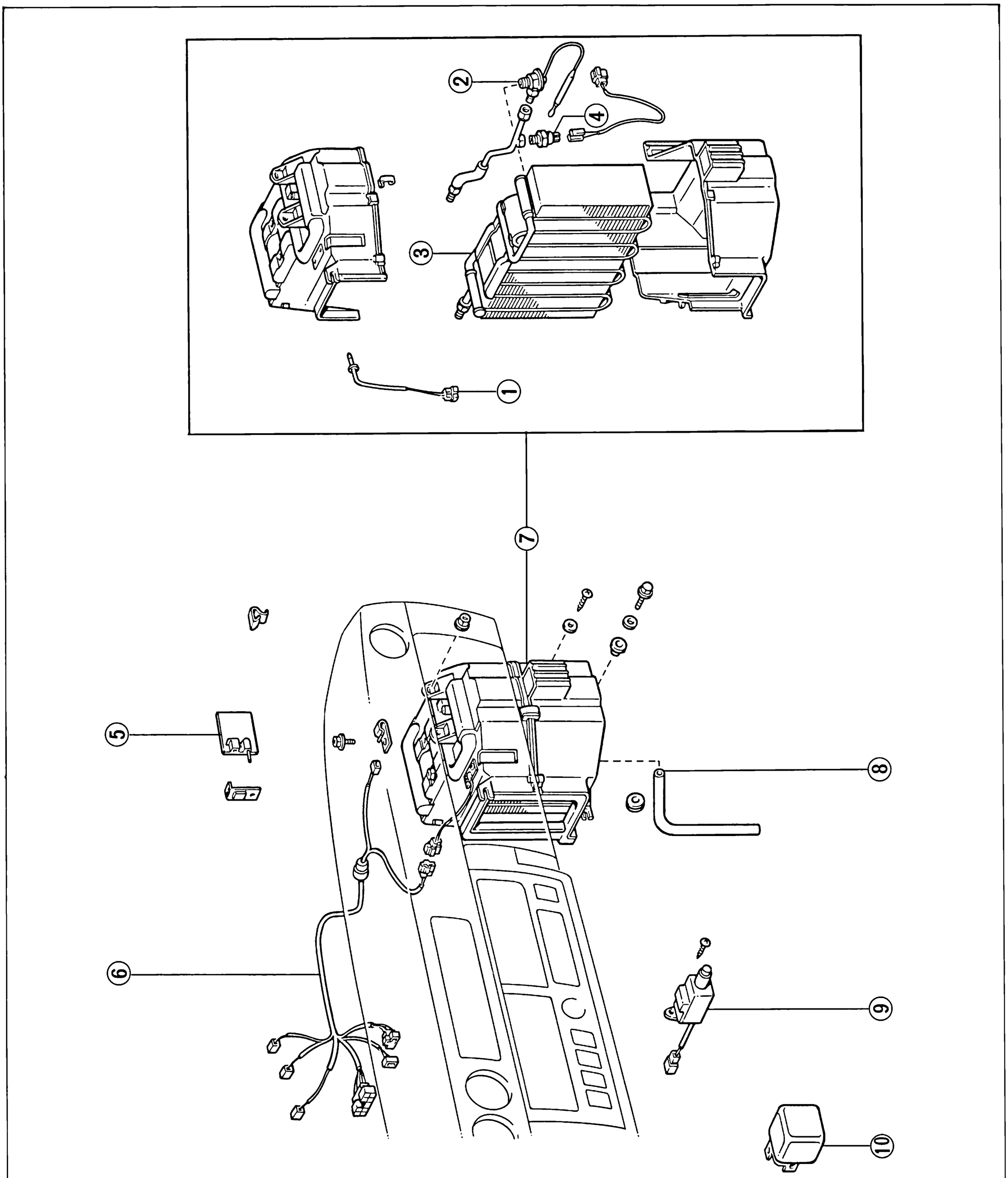
I-3. COMPRESSOR



①: COMPRESSOR DRIVE BELT
②: COMPRESSOR MOUNT
③: MAGNETIC CLUTCH
④: COMPRESSOR

Fig. 1-3

I-4. PASSENGER COMPARTMENT



①: THERMISTOR
②: EXPANTION VALVE
③: EVAPOLATOR
④: PRESSURE SWITCH
⑤: IDLING STABILIZER AMPRIFIER
⑥: A/C WIRE HARNESS
⑦: COOLING UNIT
⑧: DRAIN HOSE
⑨: A/C SWITCH
⑩: RELAY

Fig. 1-4

II. DESCRIPTION OF SYSTEM COMPORNENTS

II-1. REFRIGERATION CYCLE

1. COMPRESSOR

The compressor is a pump designed to raise the pressure of the refrigerant through compression by a piston. When pressure is increased, temperature also rises. Refrigerant vapor at high temperature will condense rapidly into a liquid when cooled in the condenser.

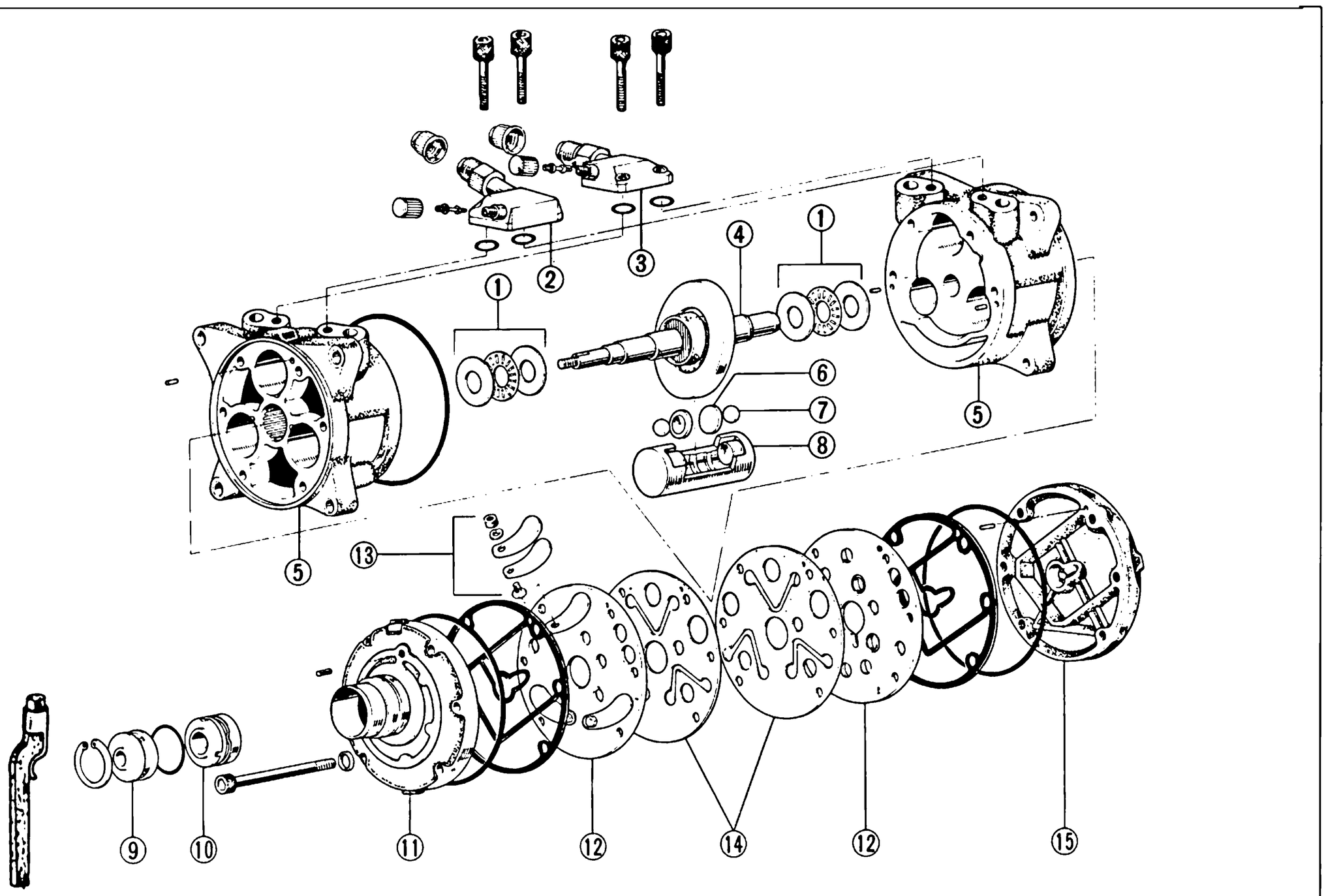
The compressor is mounted onto the engine cylinder housing with the mounting bracket and is driven by the engine while the magnetic clutch is engaged.

1-A. 6P148 COMPRESSOR

The compressor which is used for the LAND CRUISER is 6P148 compressor.

6P148 compressor is a swash plate type compressor which has three duble-pistons, six cylinders and a swash plate.

The general construction of 6P148 compressor is indicated in Fig. II-1.



① : THRUST BEARING
② : DISCHARGE SERVICE VALVE
③ : SUCTION SERVICE VALVE
④ : SHAFT
⑤ : CYLINDER BLOCK
⑥ : SHOE
⑦ : BALL
⑧ : PISTON
⑨ : SEAL PLATE
⑩ : SHAFT SEAL
⑪ : FRONT HOUSING
⑫ : VALVE PLATE
⑬ : DISCHARGE REED VALVE
⑭ : SUCTION REED VALVE
⑮ : REAR HOUSING
⑯ : OIL DRAIN GUIDE

Fig. II-1

1-B. OPERATION OF REED VALVES

A) While the piston is on the down-stroke (suction stroke);

The discharge reed valve is held closed by action of the piston and refrigerant pressure above it, at the same time, the suction reed valve is opened allowing low-pressure gas to enter.

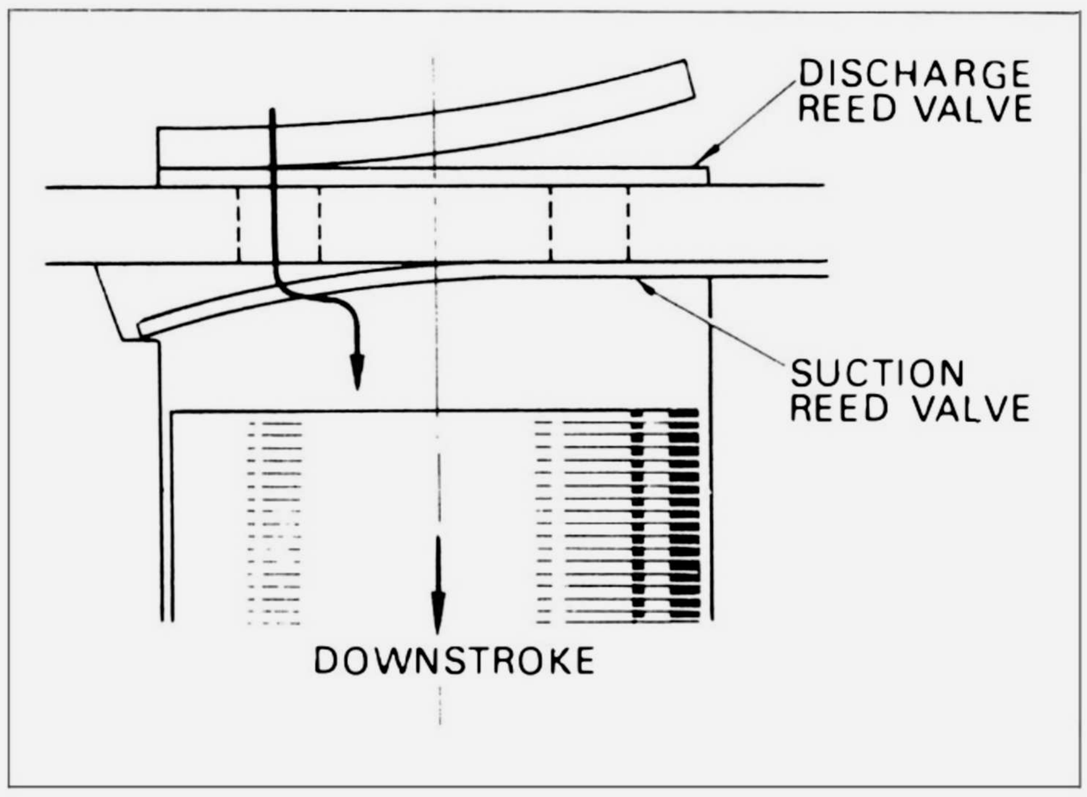


Fig. II-2

B) While the piston is on the upstroke (discharge stroke);

Refrigerant is forced through the discharge reed valve and it is sent to the condenser as a high pressure — high temperature vapor.
At the same time, the suction reed valve is held closed by the discharge pressure.

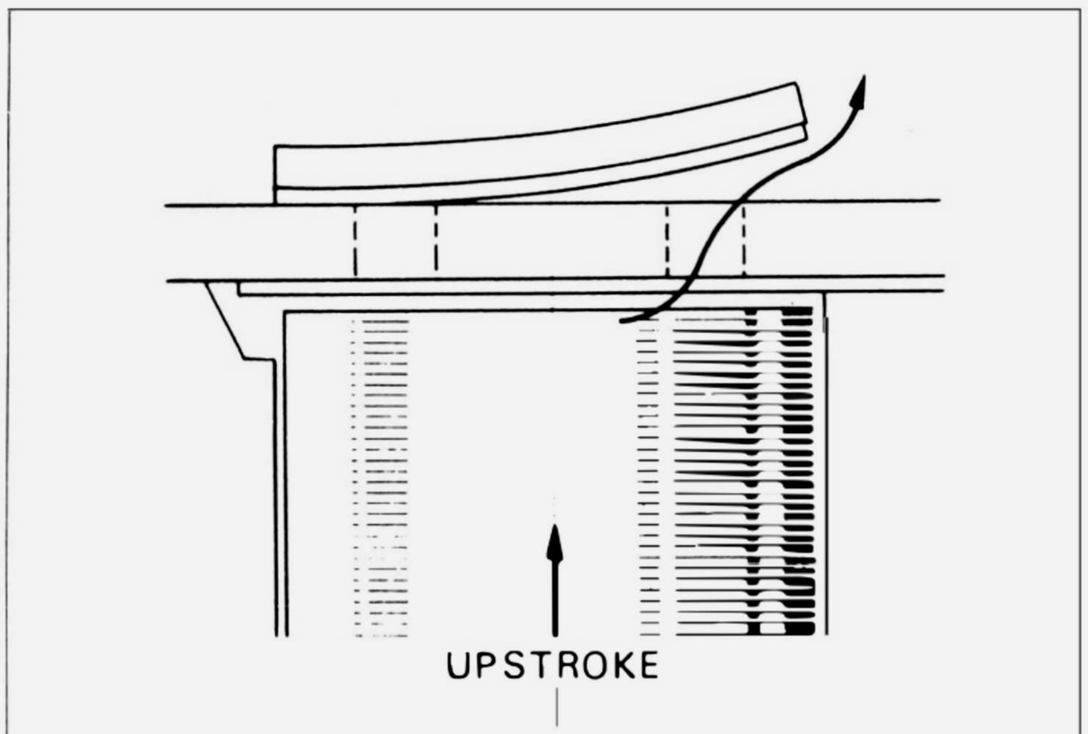


Fig. II-3

2. CONDENSER

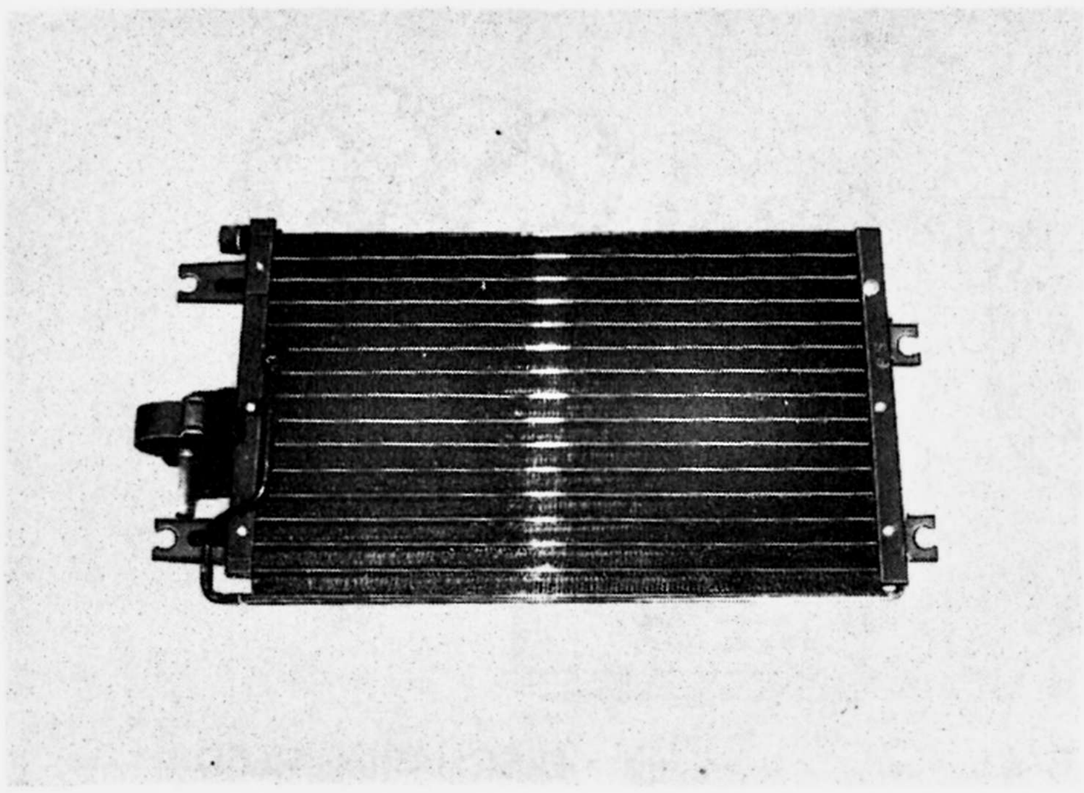


Fig. II-4

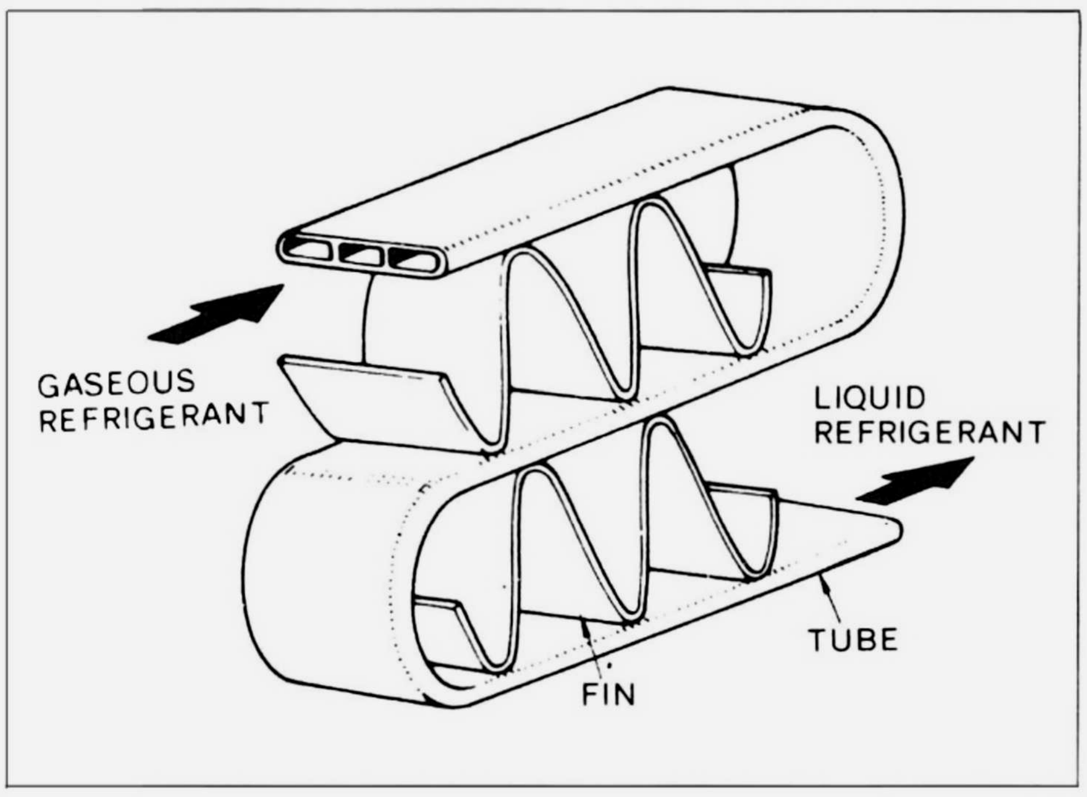


Fig. II-5

The condenser which is composed of tubes and cooling fins functions as a heat exchanger.

Fig. III-5 shows the principle of the condenser.

The high pressure — high temperature refrigerant vapor which is sent from the compressor flows through the condenser tubes and is cooled by air passing through the condenser.

At this time, refrigerant vapor gives off its heat to the outside air, and the vapor condenses into the liquid.

3. RECEIVER/DRYER

The receiver/dryer is used for three purposes.

A) The receiver section is a storage compartment for refrigerant.
It is the function of receiver to insure that a steady flow of liquid refrigerant may be supplied to the thermostatic expansion valve.

B) The dryer section is simply a bag of desiccant, such as silica gel, that is capable of absorbing and holding a small quantity of moisture.

C) The sight glass is installed on the top of receiver.
Amount of refrigerant charged is very important for the efficiency of the air conditioner.
The sight glass is used to check the amount of refrigerant.

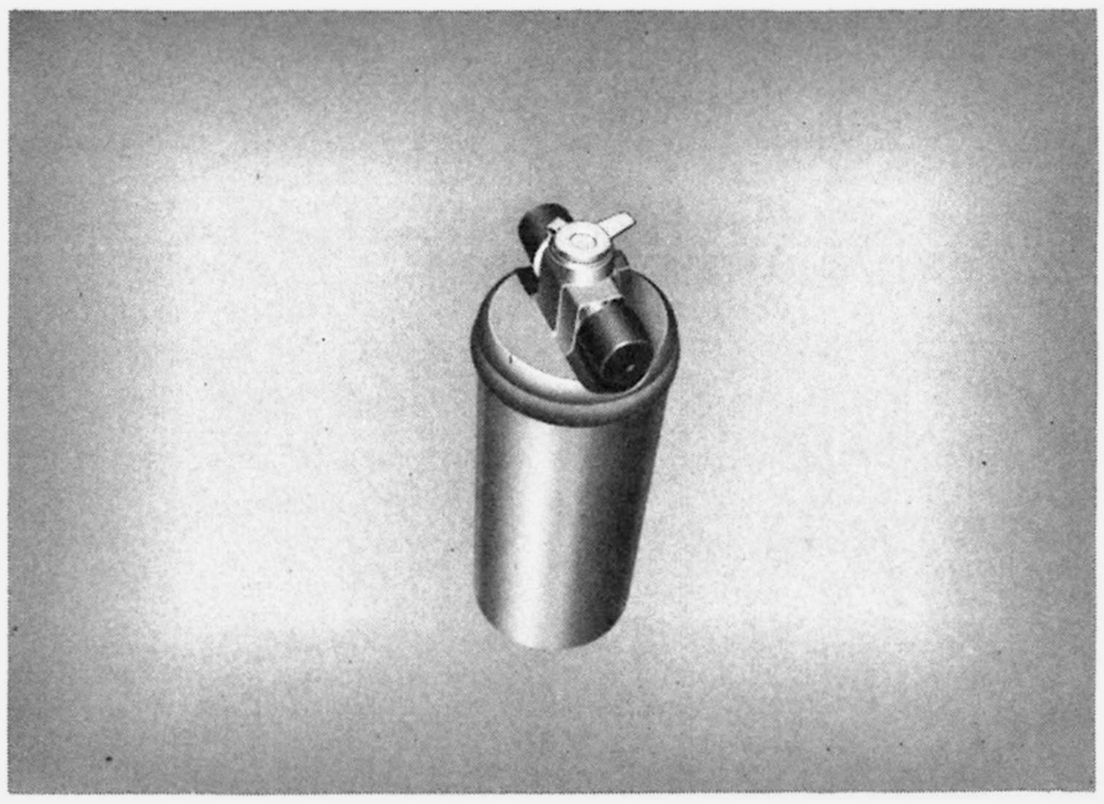


Fig. II-6

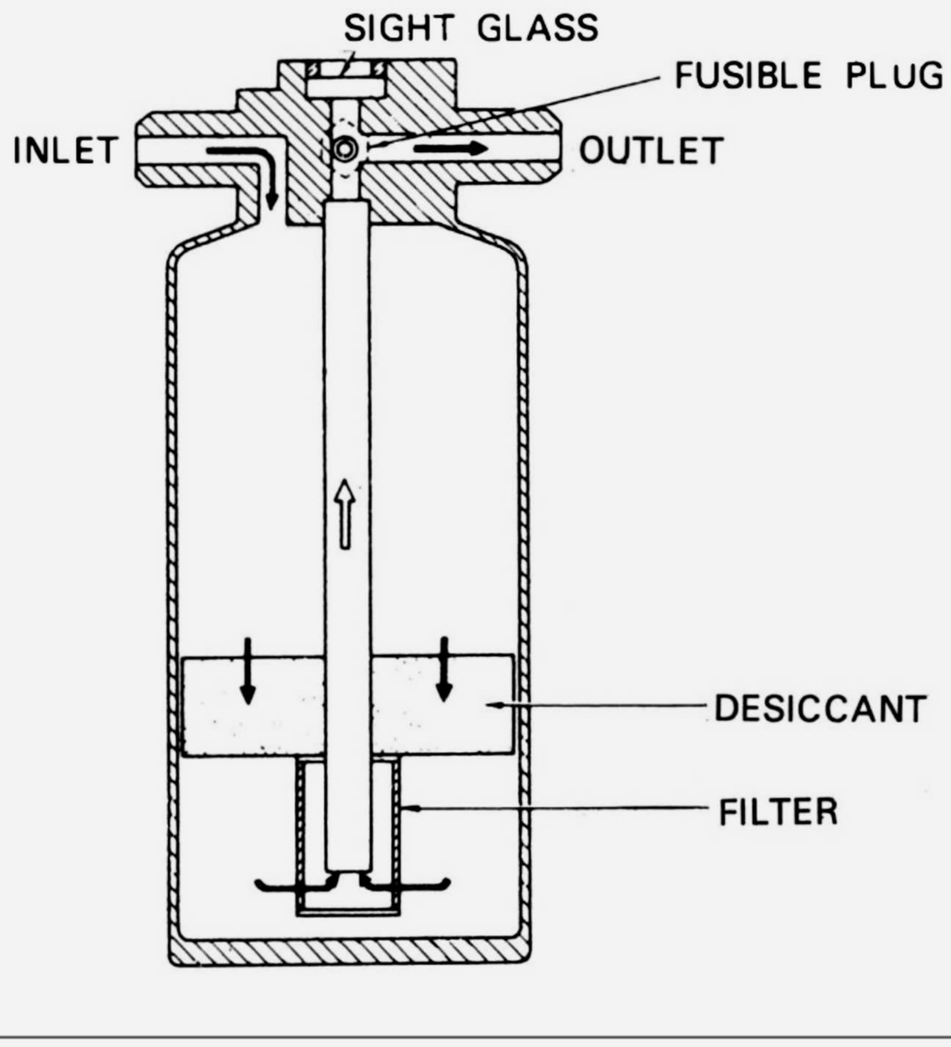


Fig. II-7

Safety device

When the temperature and pressure inside the condenser or receiver goes up abnormally due to poor radiation of the condenser or excessively heated components, the fusible plug melts 100—106°C (212—223°F) under 30 kg/cm of inside receiver and releases the pressurized R-12 thus, preventing damage to the entire system.

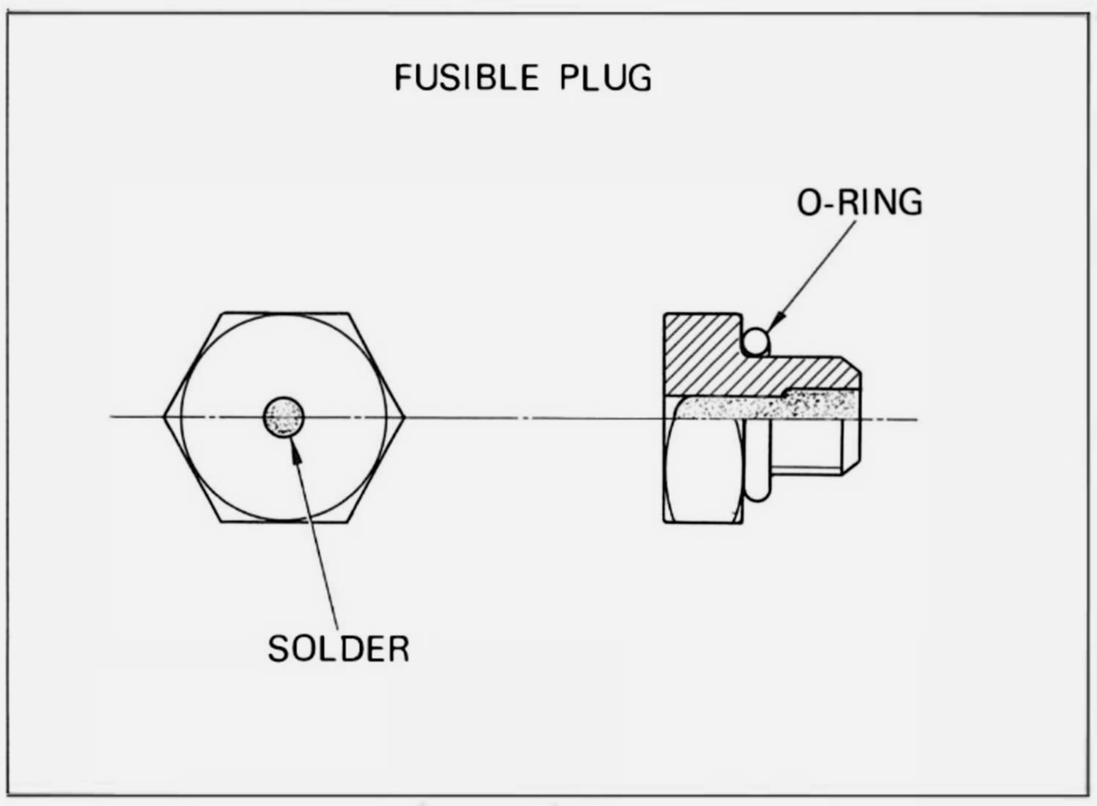


Fig. II-8

4. EXPANSION VALVE

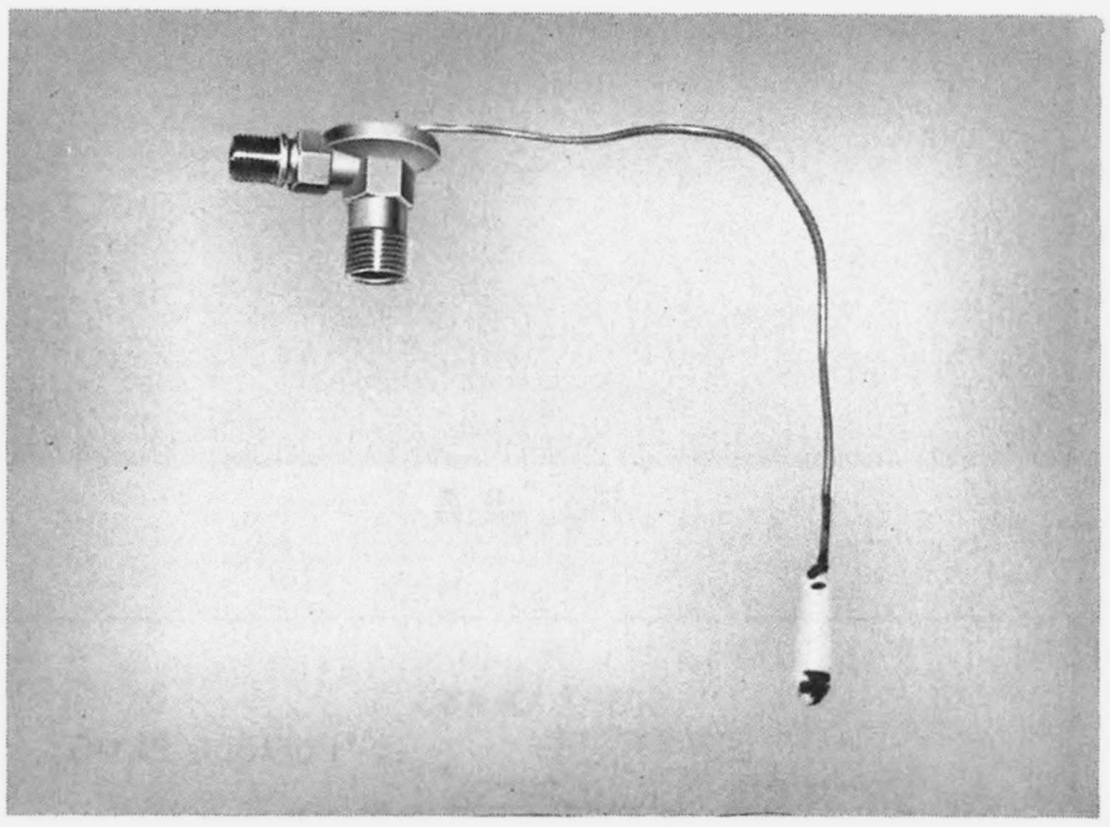


Fig. II-9

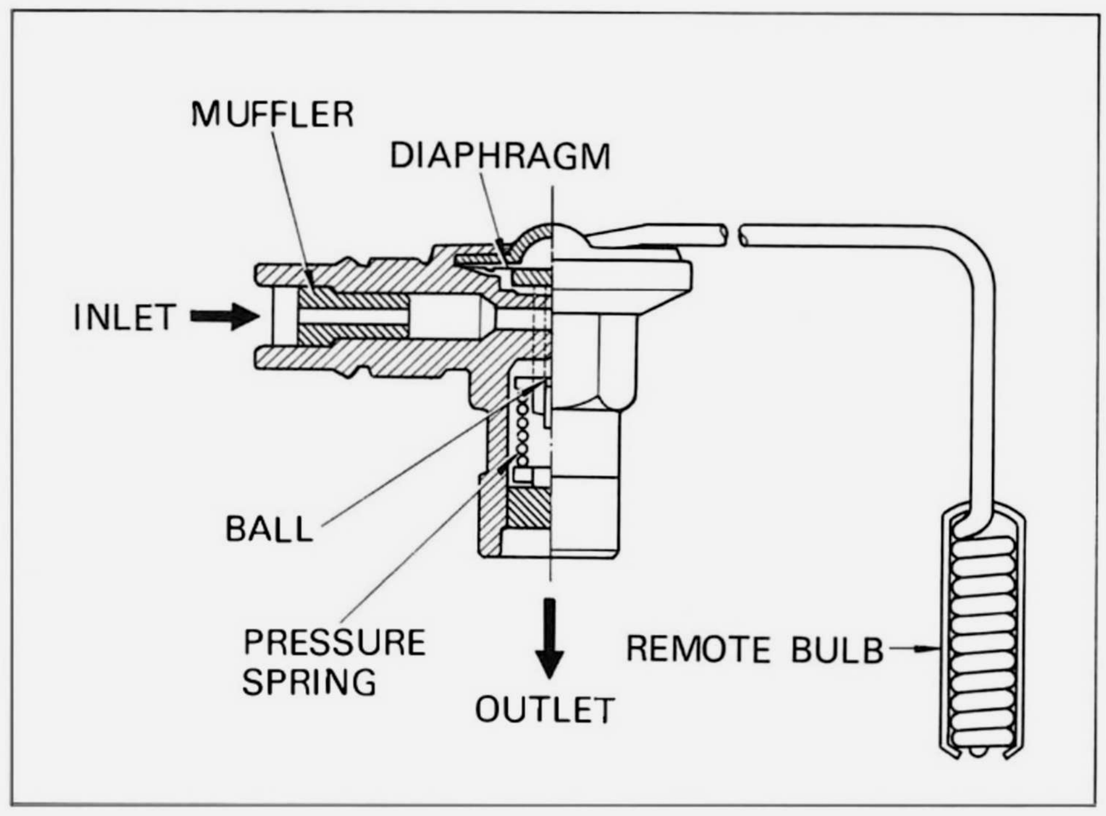


Fig. II-10

The function of the expansion valve is to spray the high pressure liquid refrigerant flowing from the receiver into the evaporator through a small orifice.

The liquid refrigerant is then converted into a low pressure vapor by sudden expansion.

The car interior will not be cooled sufficiently if the expansion valve outlet is too small.

If it is too large, frost will be produced on the evaporator, decreasing cooling efficiency.

Thus the size of the orifice is controlled according to various conditions.

Operation

A) When the compressor is not engaged, pressures P_1 and P_2 are same and the spray hole is closed by the spring tension, preventing the liquid refrigerant from flowing back into the compressor.

B) With the compressor engaged, P_2 will decrease when the ball is pressed down and the refrigerant starts to evaporate inside the evaporator tube. (In other words, the cooling action starts.)

C) When the remote bulb is cooled by the evaporator outlet tube, P_1 will decrease and the ball will go up again and will be stabilized at a certain point.

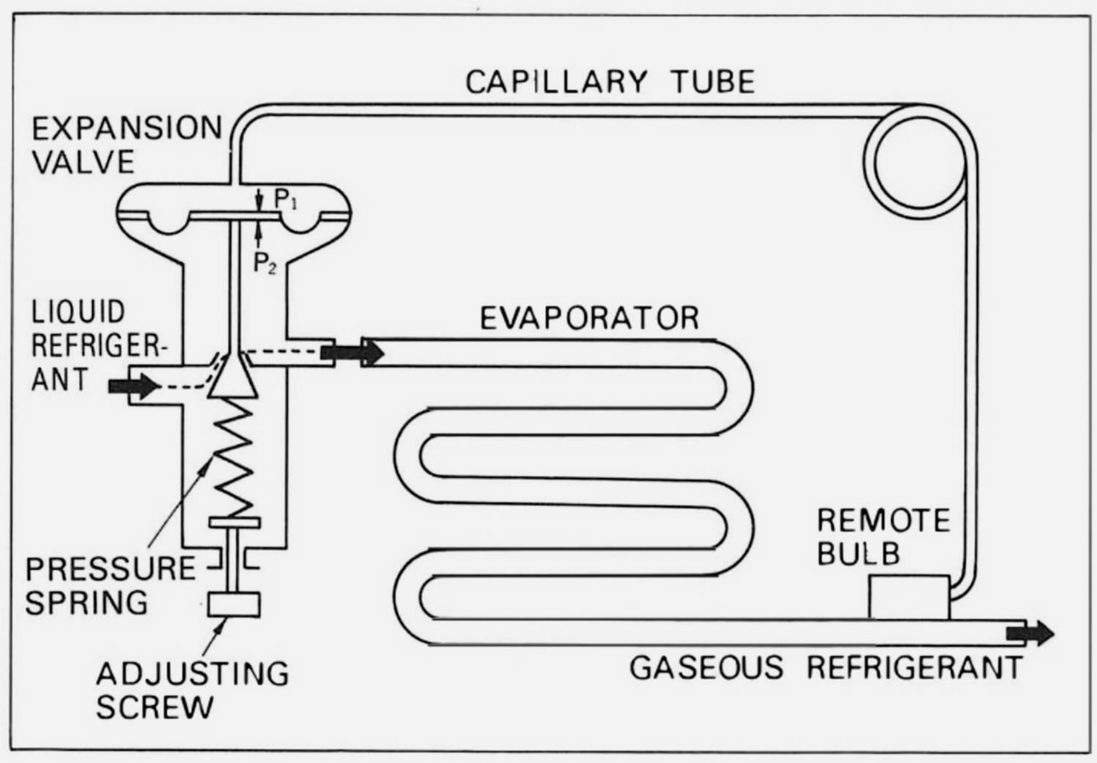


Fig. II-11

5. EVAPORATOR

The purpose of the evaporator is just opposite to that of the condenser.

The state of the refrigerant immediately after the expansion valve is 100% liquid.

As soon as the liquid pressure drops, it starts to boil, or evaporate and in so doing absorbs or takes on heat. (latent heat of evaporator)

The heat is absorbed from the air passing through the cooling fins of the evaporator and lowers the air temperature.

If too much refrigerant is sent into the evaporator, it will not cool because the pressure of refrigerant will be higher and it will not boil away so easily.

Also, the evaporator filled with liquid refrigerant eliminates a place for the

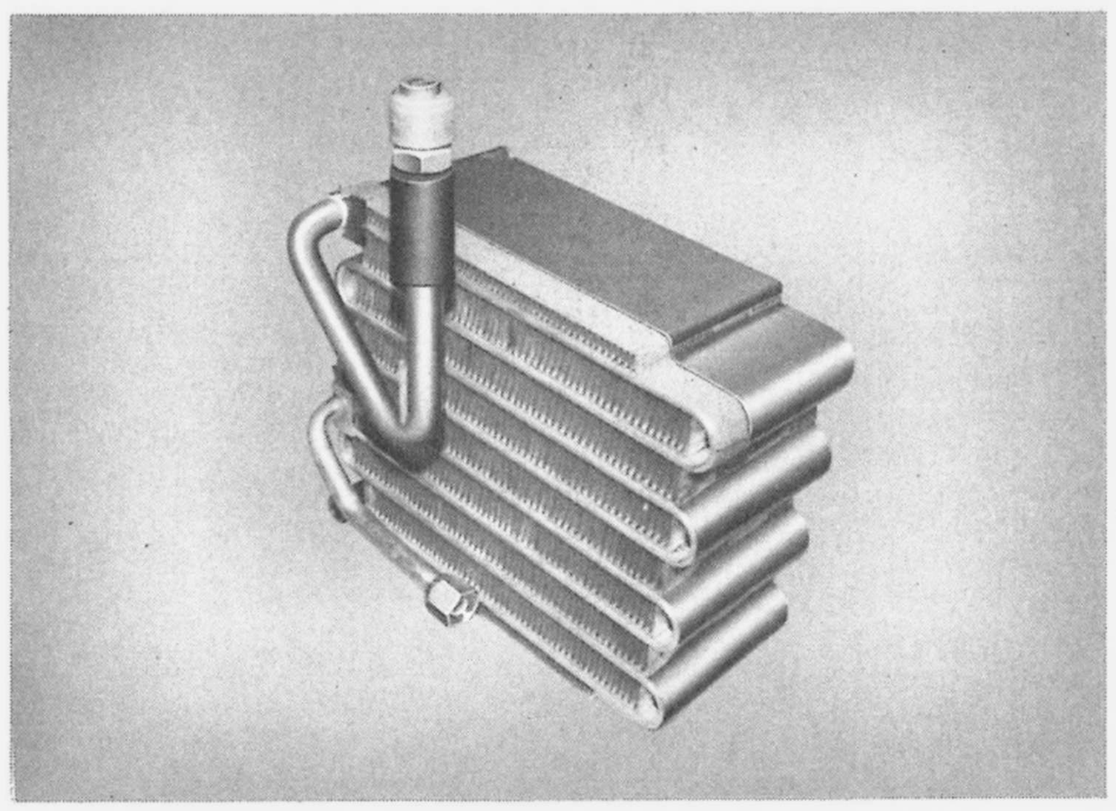


Fig. II-12

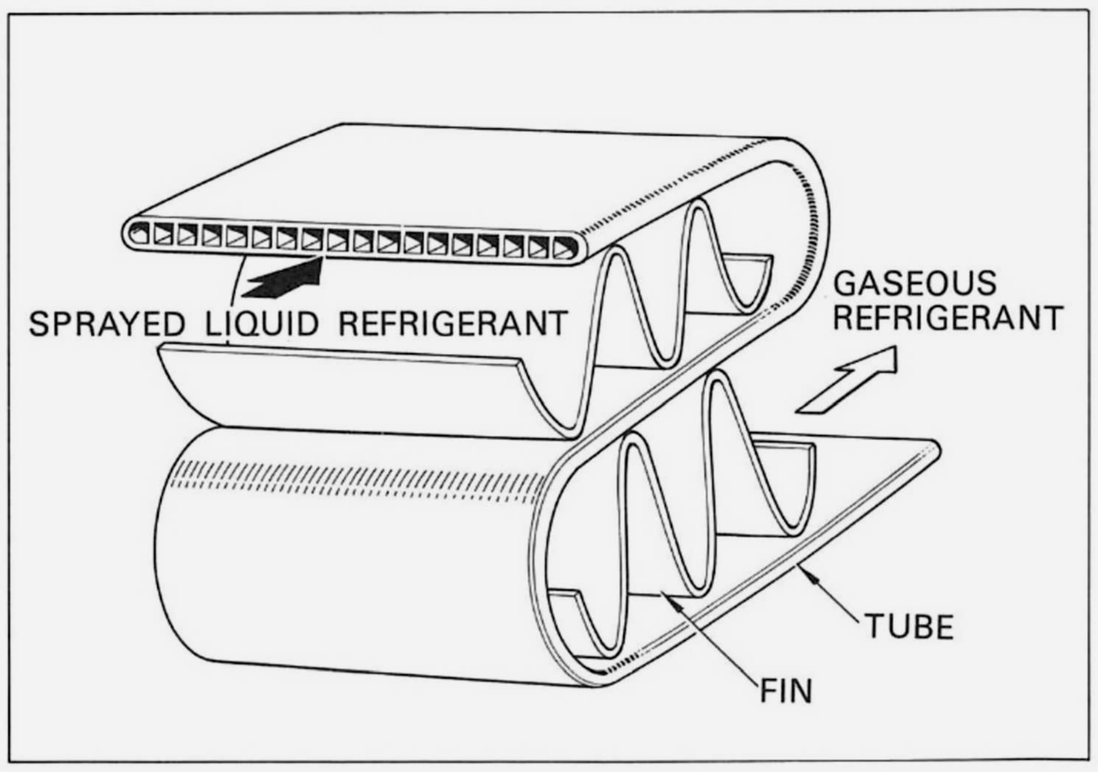


Fig. II-13

refrigerant to properly vaporize which is necessary in order for it to take on heat. A flooding condition of the evaporator allows an excess of liquid refrigerant to leave the evaporator and will cause serious damage to the compressor.

If too little refrigerant is sent into the evaporator, we refer to the system as being starved.

Again the evaporator will not cool because the refrigerant will vaporize, or boil off, long before it passes through the evaporator.

Refrigerant properly metered into the evaporator should allow for 100% liquid just after the expansion valve, and 100% gas at the outlet of the compressor.

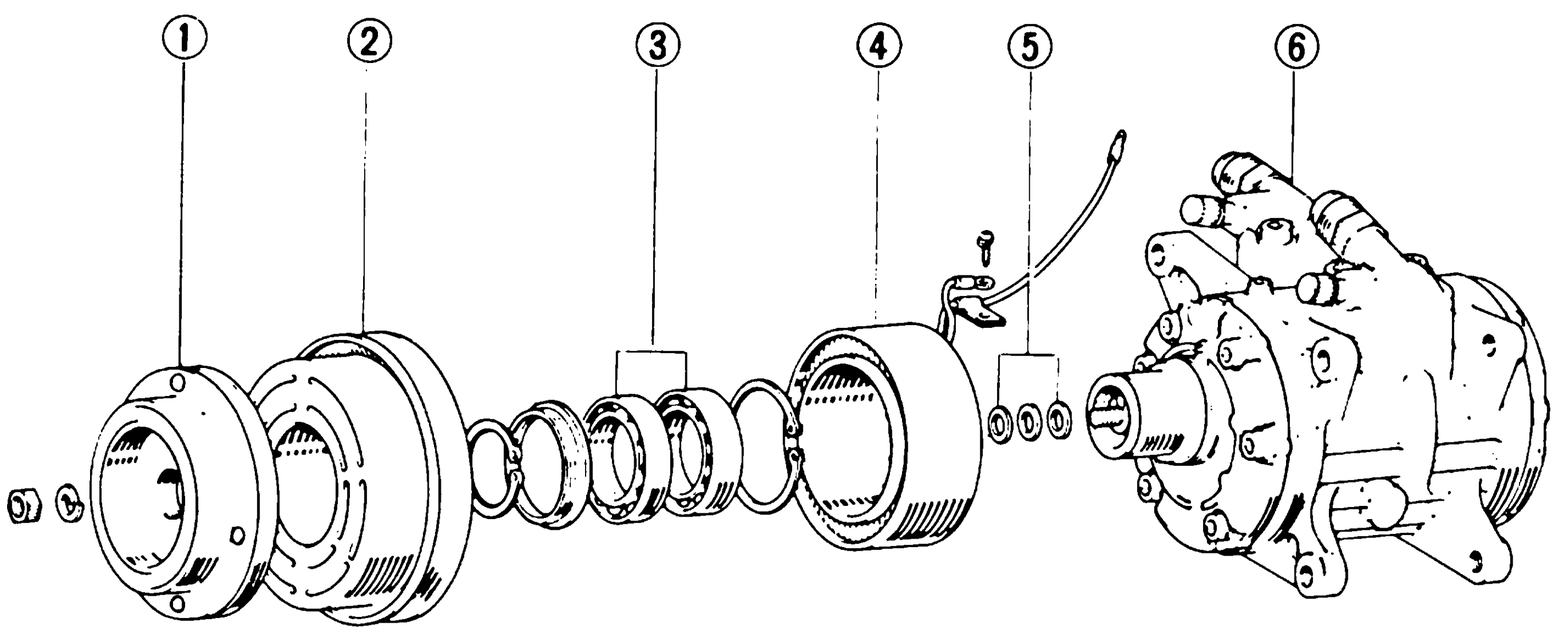
II-2. ELECTRICAL CIRCUIT

1. MAGNETIC CLUTCH

A magnetic clutch consists of a pulley, rotor w/pulley and pressure plate to engages the drive pulley and the compressor magnetically.

The stator is fixed on the compressor housing, and the pressure plate is attached on the compressor shaft.

Tow ball bearings are used between the inner surface of the rotor and the front housing of the compressor.



① : PRESSURE PLATE
② : ROTOR
③ : ROTOR BEARING
④ : STATOR
⑤ : SHIM
⑥ : COMPRESSOR

Fig. II-14

Fig. II-14 indicates the construction of magnetic clutch combined with 6P148 compressor.

When current is fed to the stator coil, the magnetic force is applied to the clutch and the compressor is driven. See Fig. III-15.

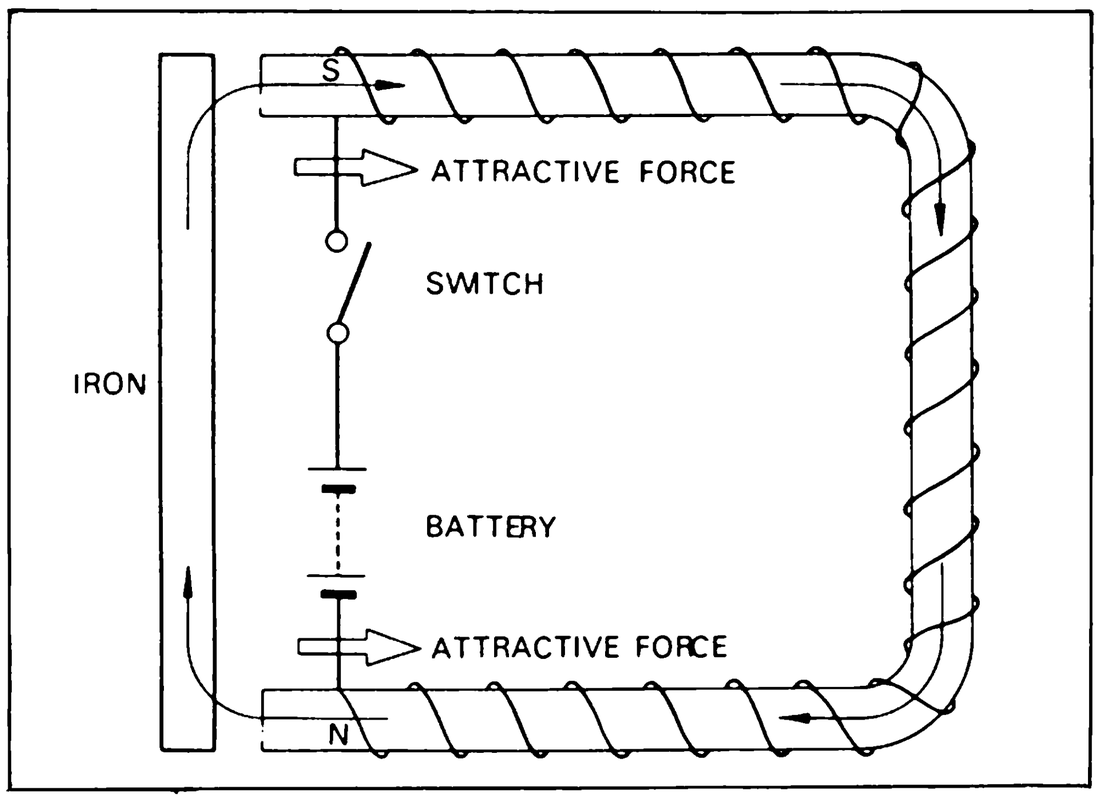


Fig. II-15

2. A/C SWITCH (for w/heater)

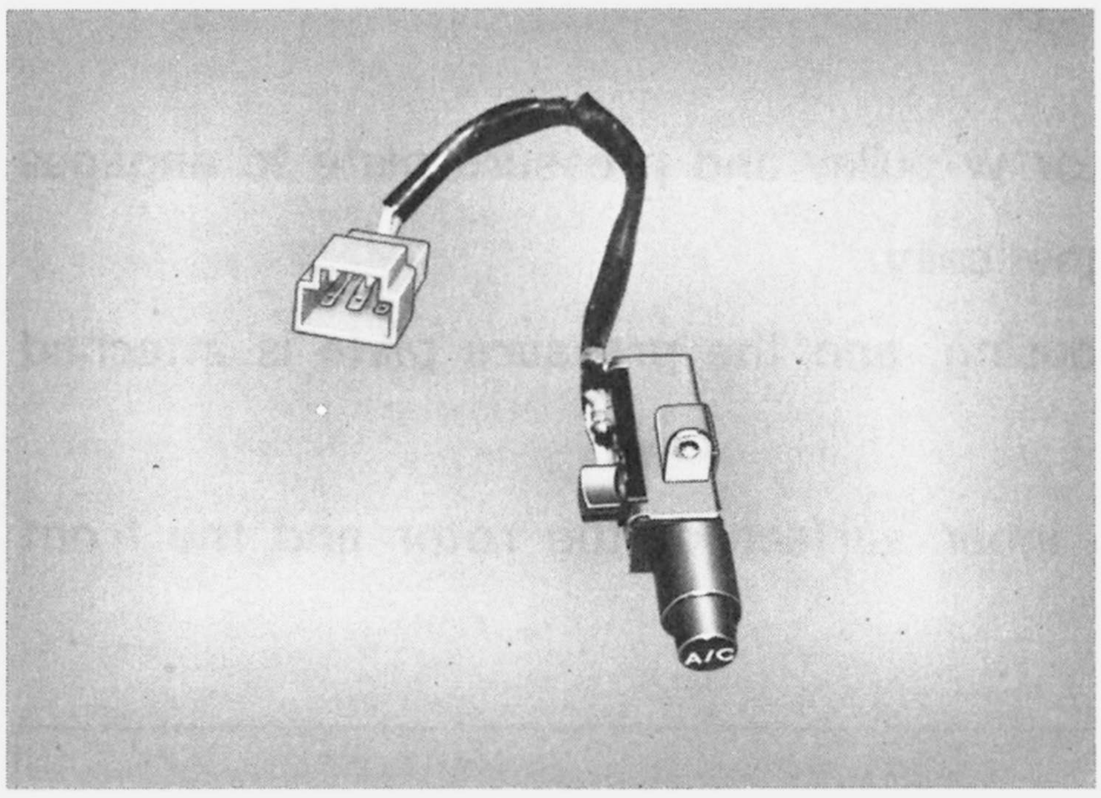


Fig. II-16

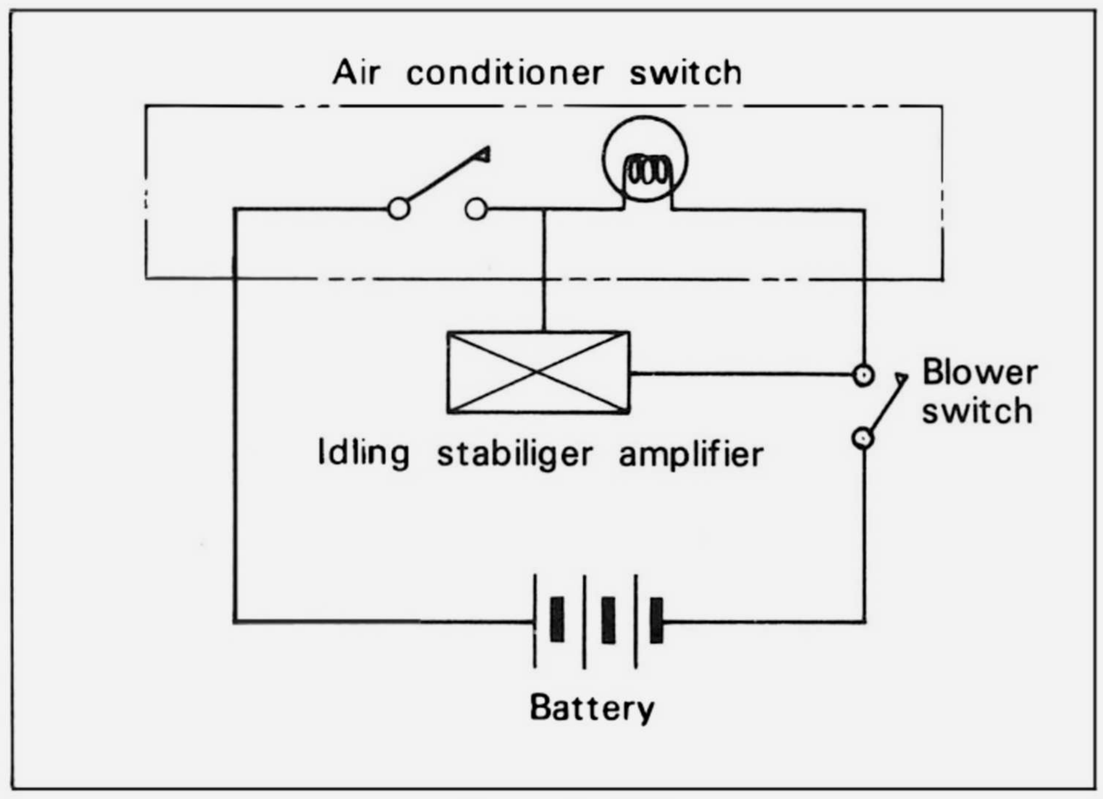


Fig. II-17

This is a simple on-off switch including an indicator lamp.

The circuit diagram is indicated in Fig. II-17.

When the switch turns on, a positive input of 12 volts applied to the idling slabilizer amplifier.

3. THERMISTOR

A thermistor is a temperature senser and is installed in front of the outside of evaporator to sense the temperature of the air discharged from the evaporator.

The electric characteristic of thermistor is shown in Fig. II-19.

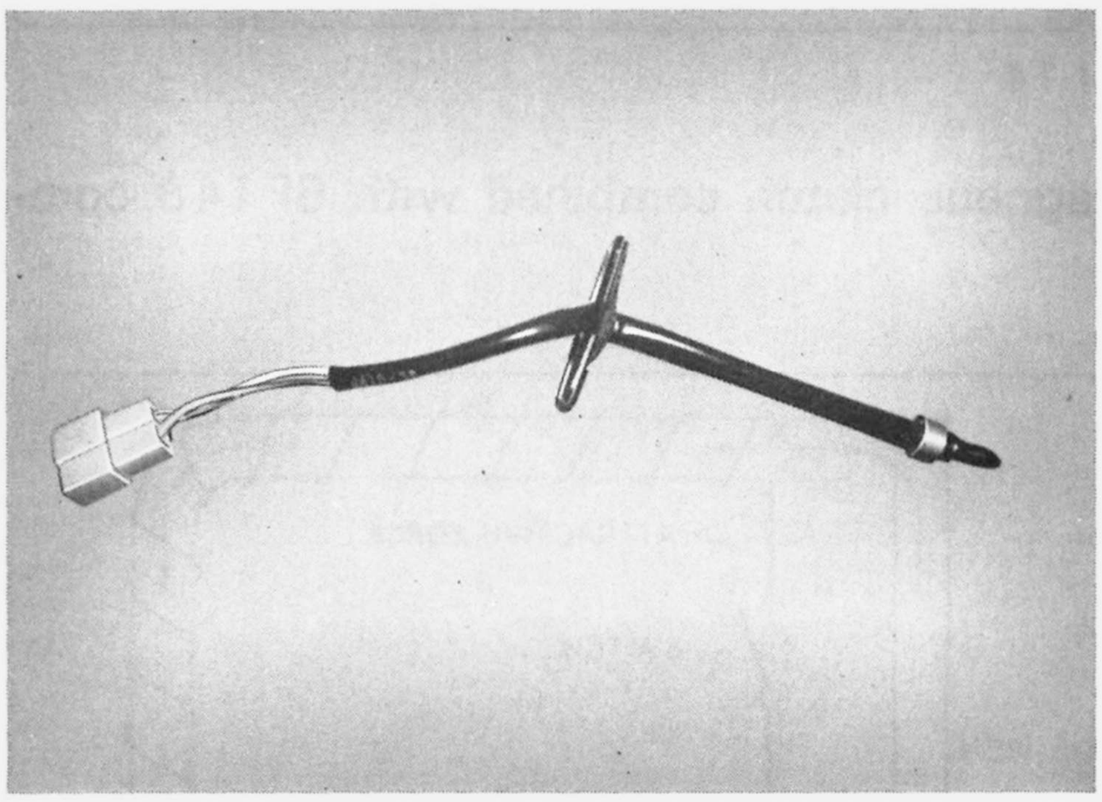


Fig. II-18

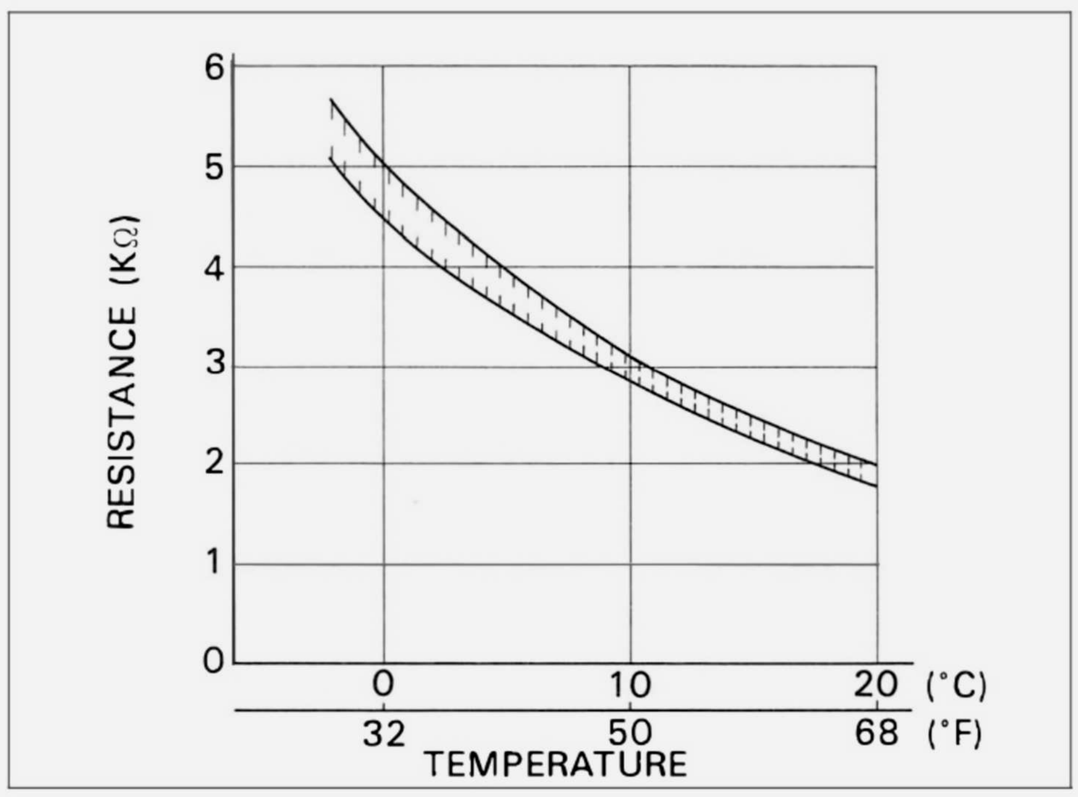


Fig. II-19

The lower the temperature, the larger the resistance of the thermostat will increase. The thermistor transforms the changes of temperature into the changes of resistance, in other words, into the changes of voltage. The voltage of thermistor is applied to the idling stabilizer amplifier. When the voltage of thermistor increases and reaches to the specified voltage, the amplifier makes the magnetic clutch turn off to prevent the evaporator from frosting.

4. PRESSURE SWITCH

The function of pressure switch is to prevent the compressor damage under the condition of excessive lack of refrigerant in the system.

The pressure switch is installed on the liquid line tube in the cooling unit to sense the refrigerant pressure at the high pressure line.

Structure and Operation

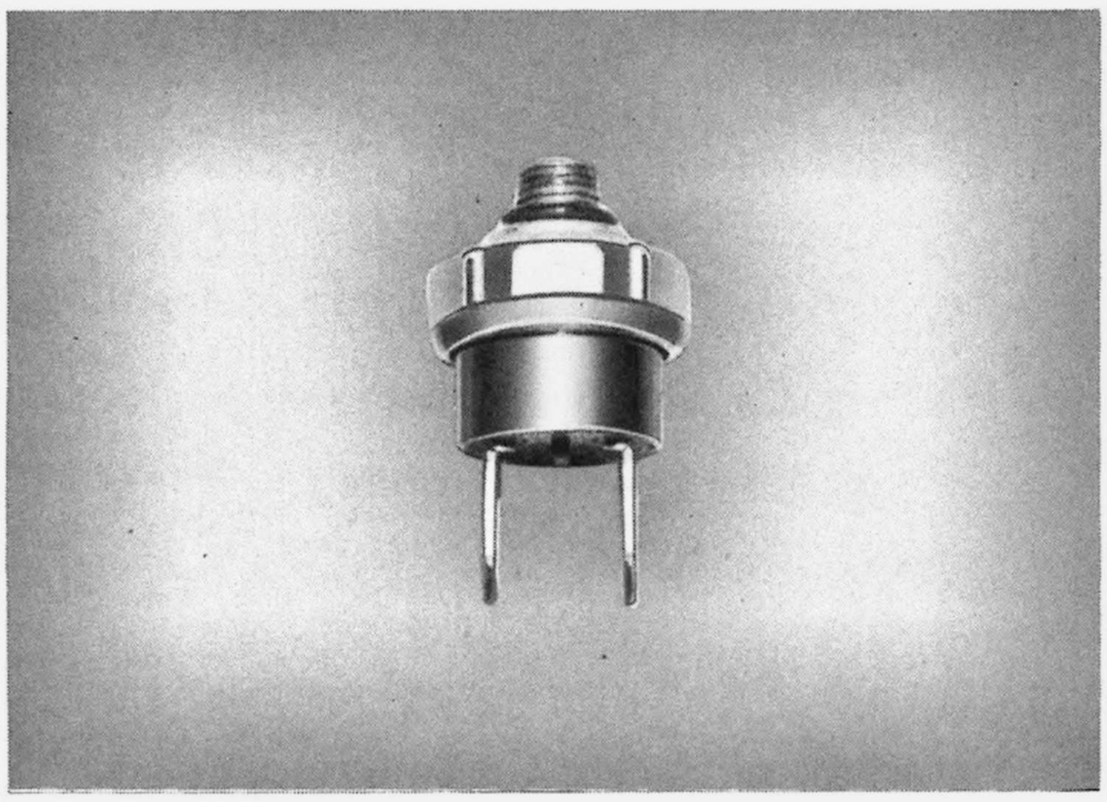


Fig. II-20

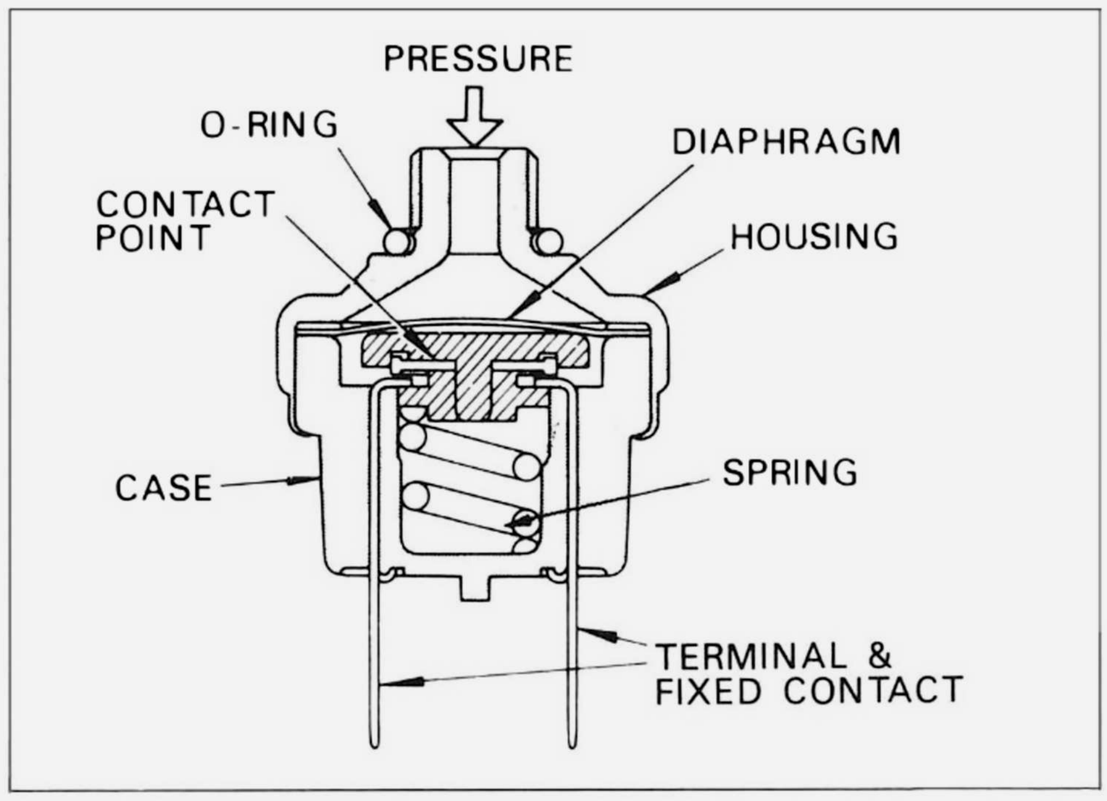


Fig. II-21

The structure of pressure switch is shown in Fig. III-21.

When the refrigerant pressure which pushes the diaphragm is higher than the spring force of switch, the contact point closes and the switch turns on.

When the refrigerant pressure is lower than the spring force, the contact point opens and the switch turns off.

Standard setting pressure: 2.11 ±0.21 kg/cm² (30 ±3 psi)

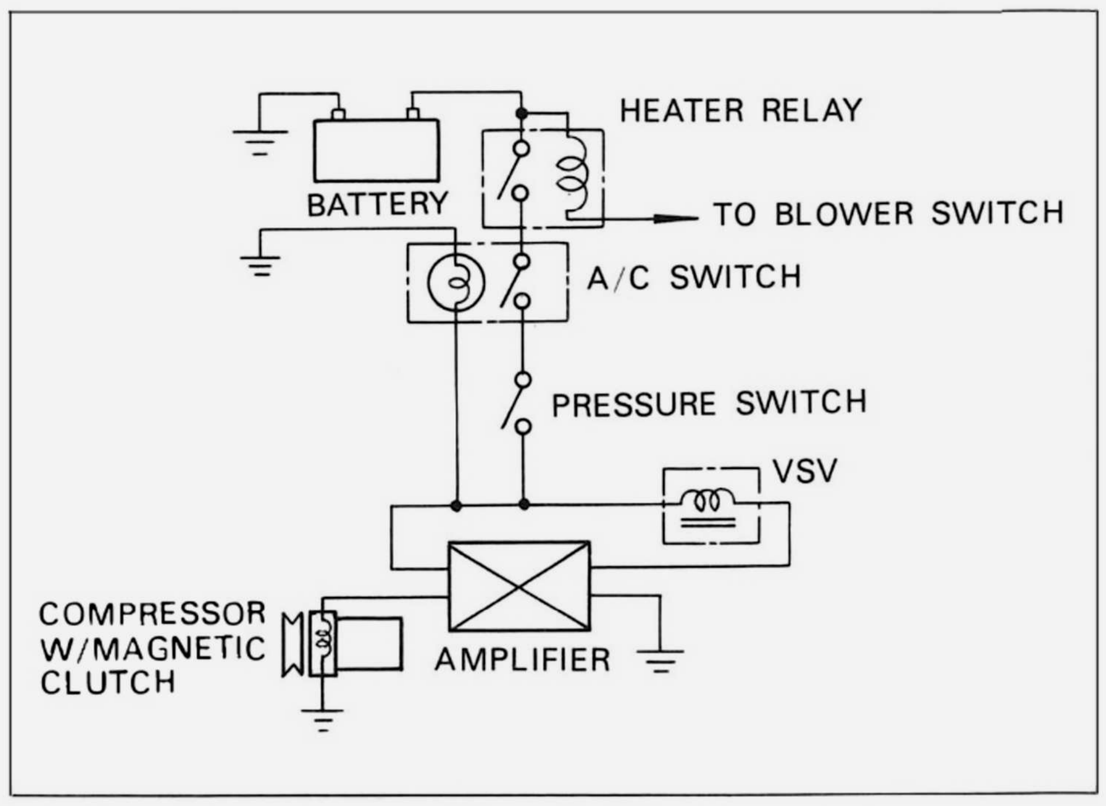
Actually the switch is turned on under the normal condition that the system is charged properly and the ambient temperature is higher than 0° C (32° F).

Circuit

The schematic circuit of compressor magnetic clutch including the pressure switch is shown in Fig. II-22.

All switches are connected in series.

The magnetic clutch can be turned on when the blower switch and the A/C switch are turned on under the condition that the refrigerant pressure is higher than 2.11 kg/cm (30 psi) and the ambient pressure is higher than 0°C (32° F).



(Only for F

Fig. II-22

5. VACUUM SWITCHING VALVE (Only for FJ60 Series)

Air conditioners for SS40 Series are equipped with idling speed control device.

The VSV (vacuum switching valve) is a component part of this device.

Construction of VSV is shown in Fig. II-23.

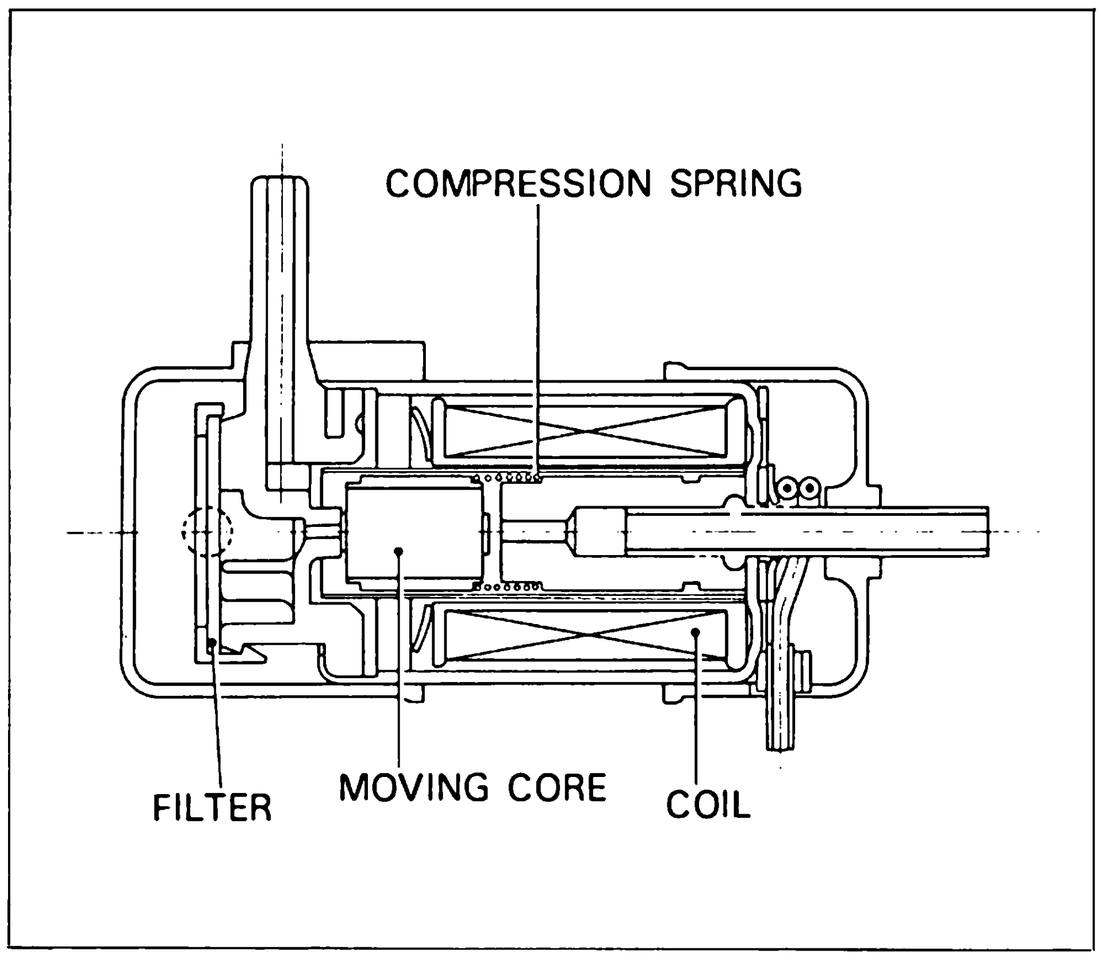


Fig. II-23

Operation (For FJ60 Series)

A) When switching on the air conditioner, current flows into the coil, and the VSV opens to vacuum source side by magnetic force.
Thus, the vacuum will act on the diaphragm to pull the diaphragm and link. See Fig. II-24.

B) Under above condition, the throttle valve will be pushed gradually and be held in a position that is slightly more opened than the idle position. See Fig. II-24.

C) When switching off the air conditioner, the VSV opens to atomosphere by compression spring.
Thus, the atomosphere pressure will act on the diaphragm to release the throttle valve setting and allow the throttle valve to return to the idle position. See Fig. II-25.

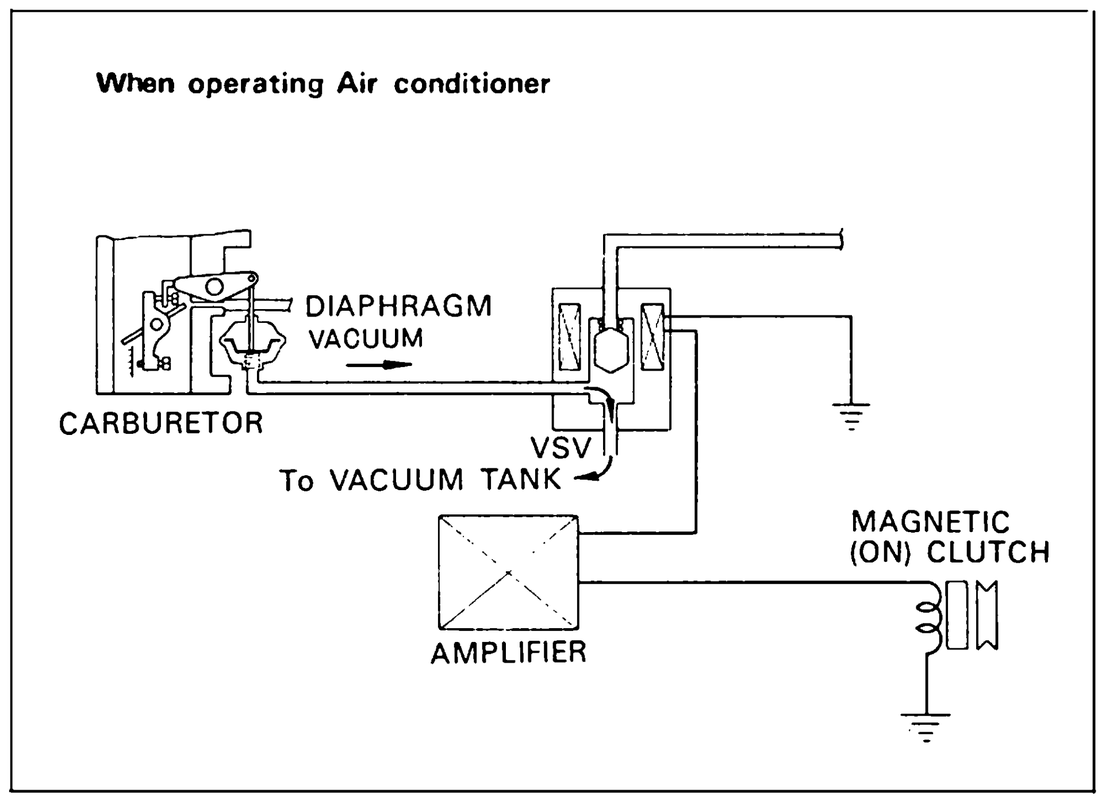


Fig. II-24

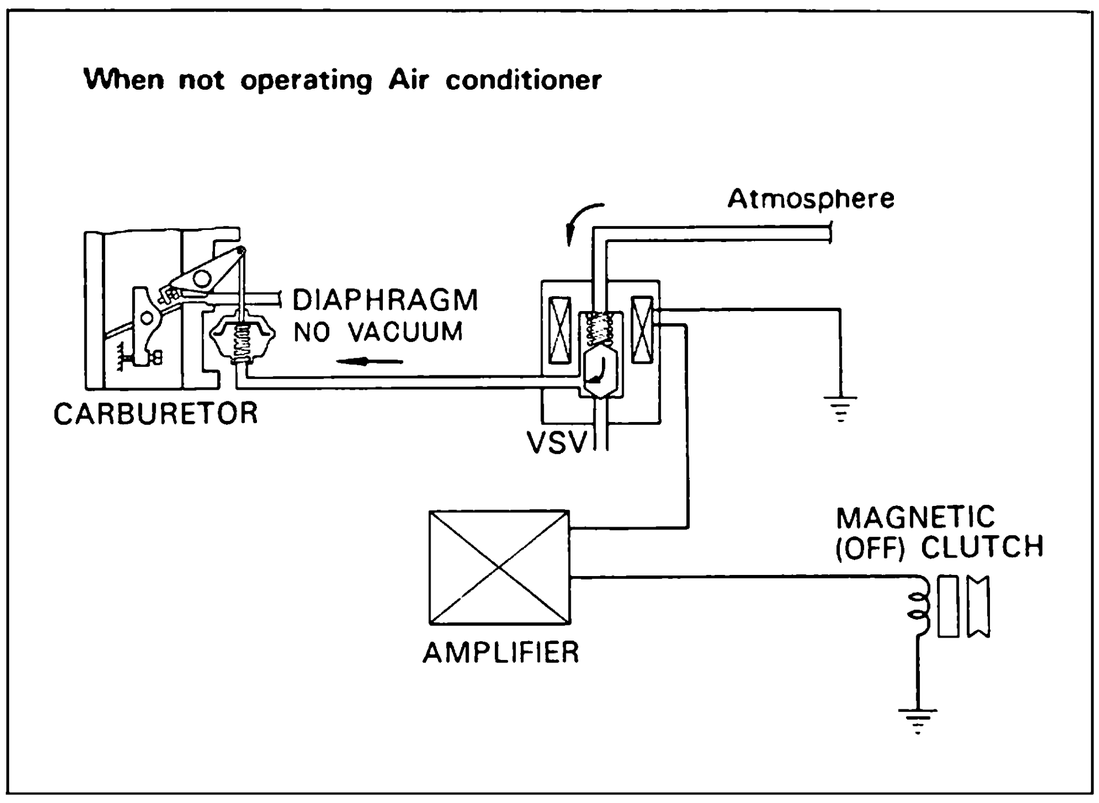


Fig. II-25

4. IDLING STABILIZER AMPLIFIER

The idling stabilizer amplifier consists of engine speed detecting circuit, temperature detecting circuit and relay.

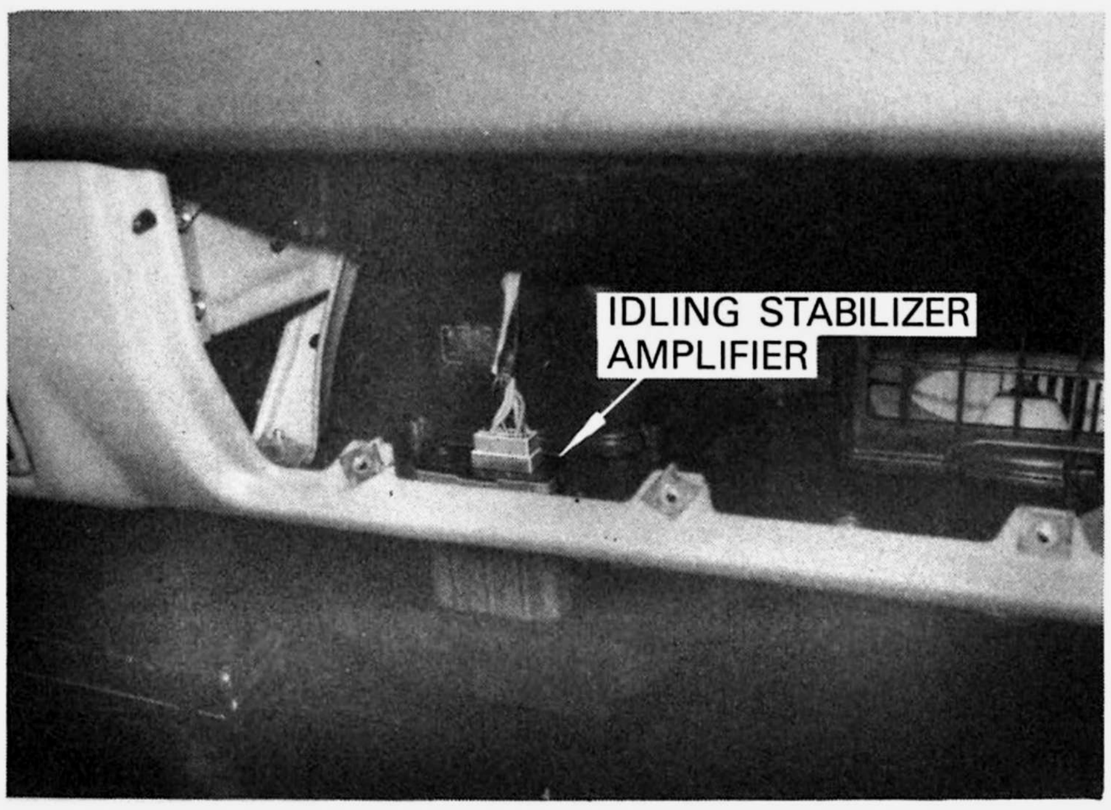


Fig. II-26

A) ENGINE SPEED DETECTING CIRCUIT;

If the air conditioner is turned on when the engine is idling, the engine may stop or overheat.
Hence at low speed rotation of the engine, the air conditioner has to be turned off.
The idling stabilizer amplifier detects the engine speed by the signal that is sent from the ignition coil.

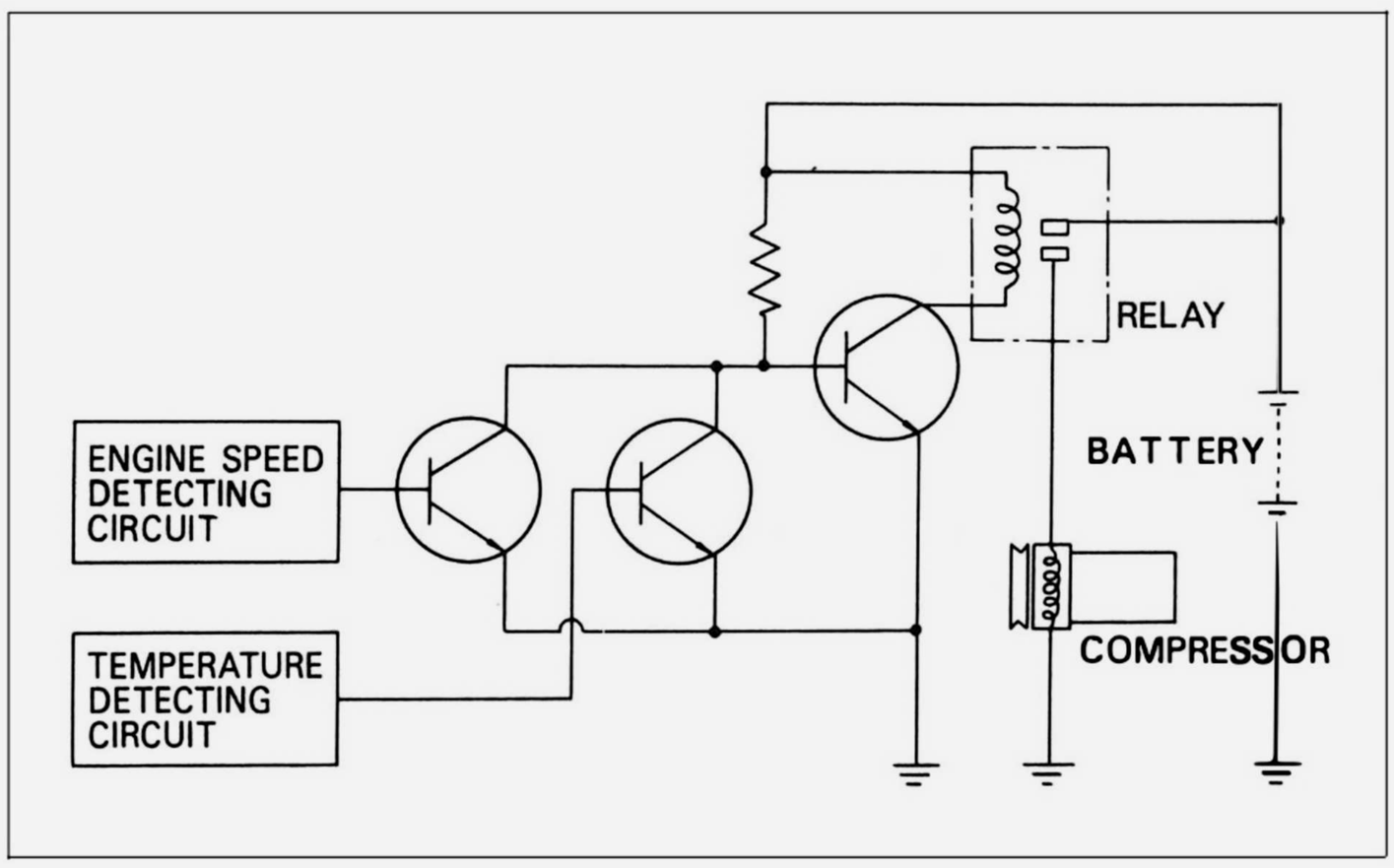


Fig. II-27

B) TEMPERATURE DETECTING CIRCUIT;

The thermistor is located in front of the evaporator core so as to sense the cool air temperature.
The resistance of thermistor varies according to surrounding air temperature. As the temperature rises, the resistance decreases and as the temperature lower, the resistance increases.
This vary of resistance turns into electrical signal to the idling stabilizer amplifier.

C) RELAY

When both electric signals from the ignition coil and the thermistor are simultaneously satisfied for specified condition, the amplifier flows the current into the relay.
The relay is a kind of magnetic switch.
It is turned on or turned off according to the current sent from the amplifier.
The magnetic clutch is turned on or turned off by this relay.

7. TEMP. CONTROL RESISTOR

(for the vehicle w/boost ventilator)

This resistor is combined with temp. control lever.

Moving the temp. control lever changes the resistance of the resistor to control the outlet air temperature by cutting off the compressor running.

And this resistor has the A/C switch in itself.

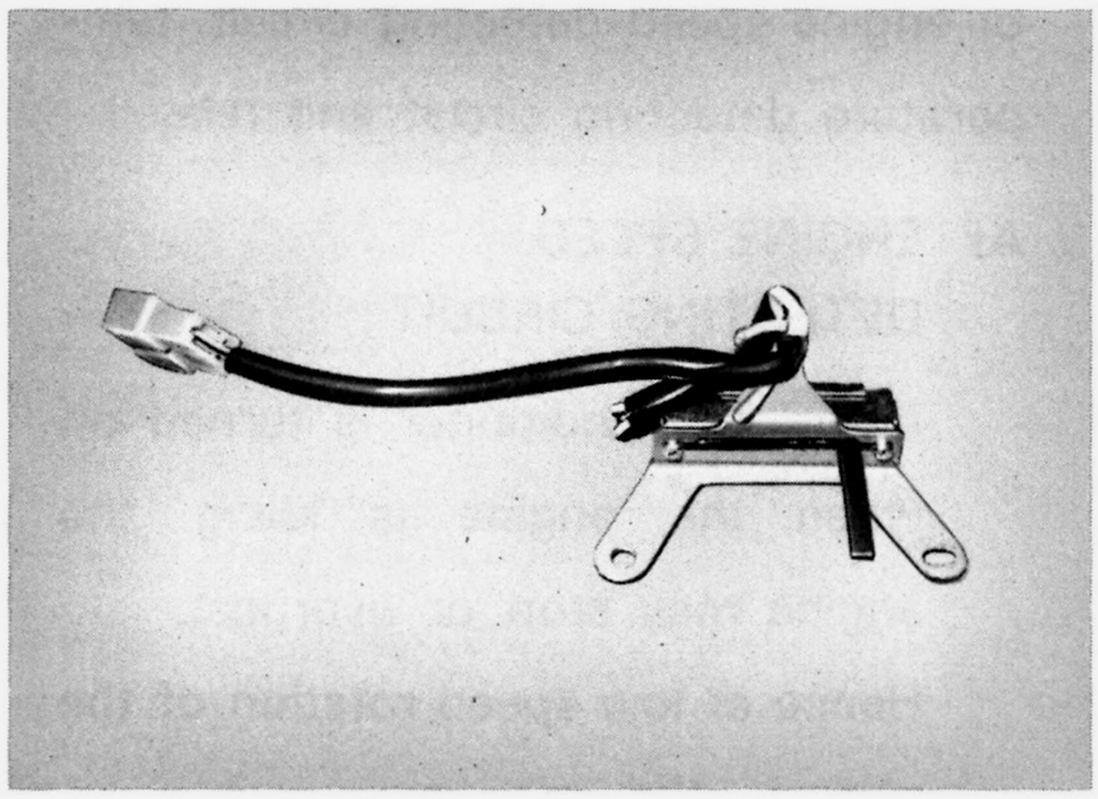
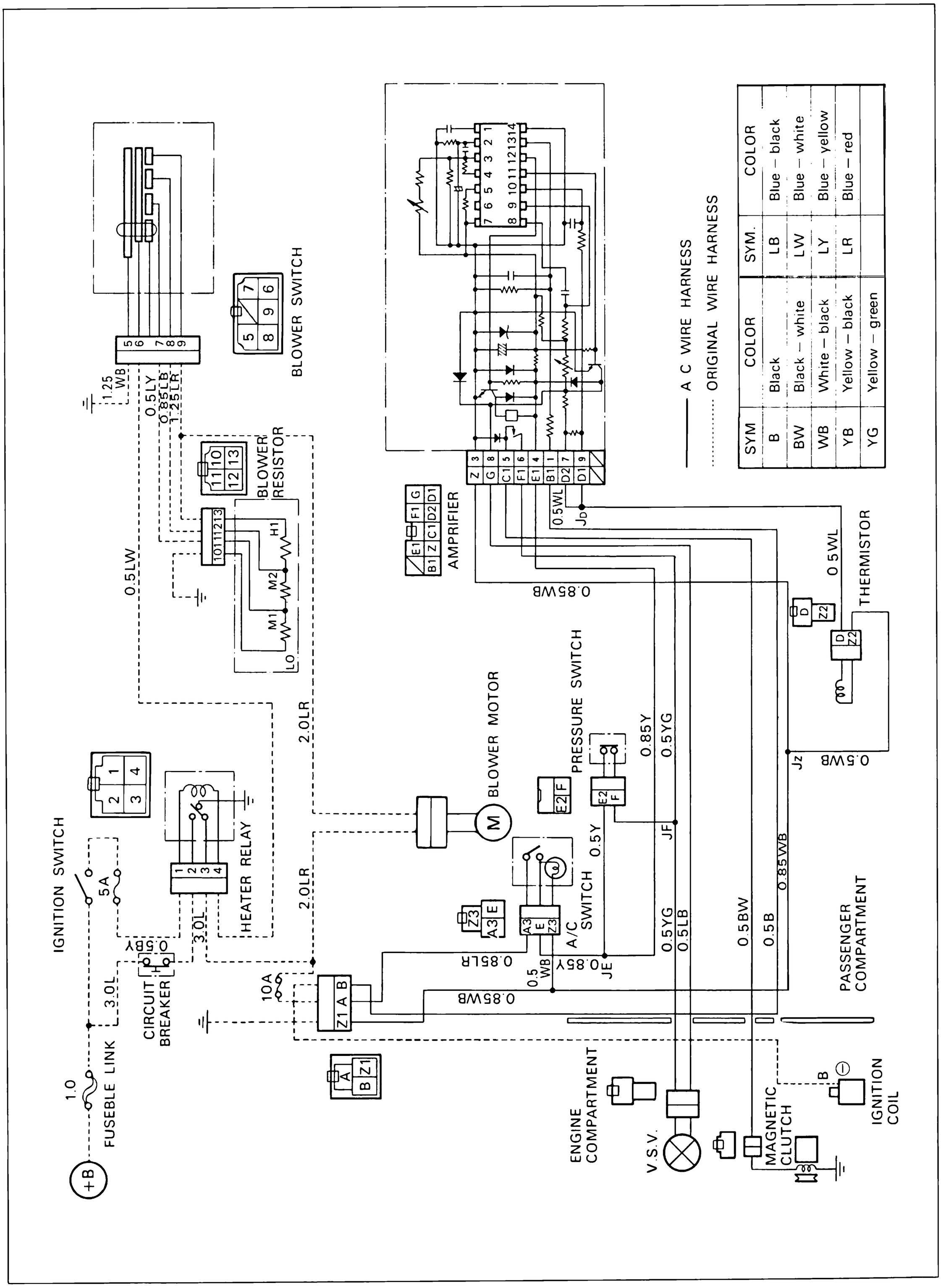


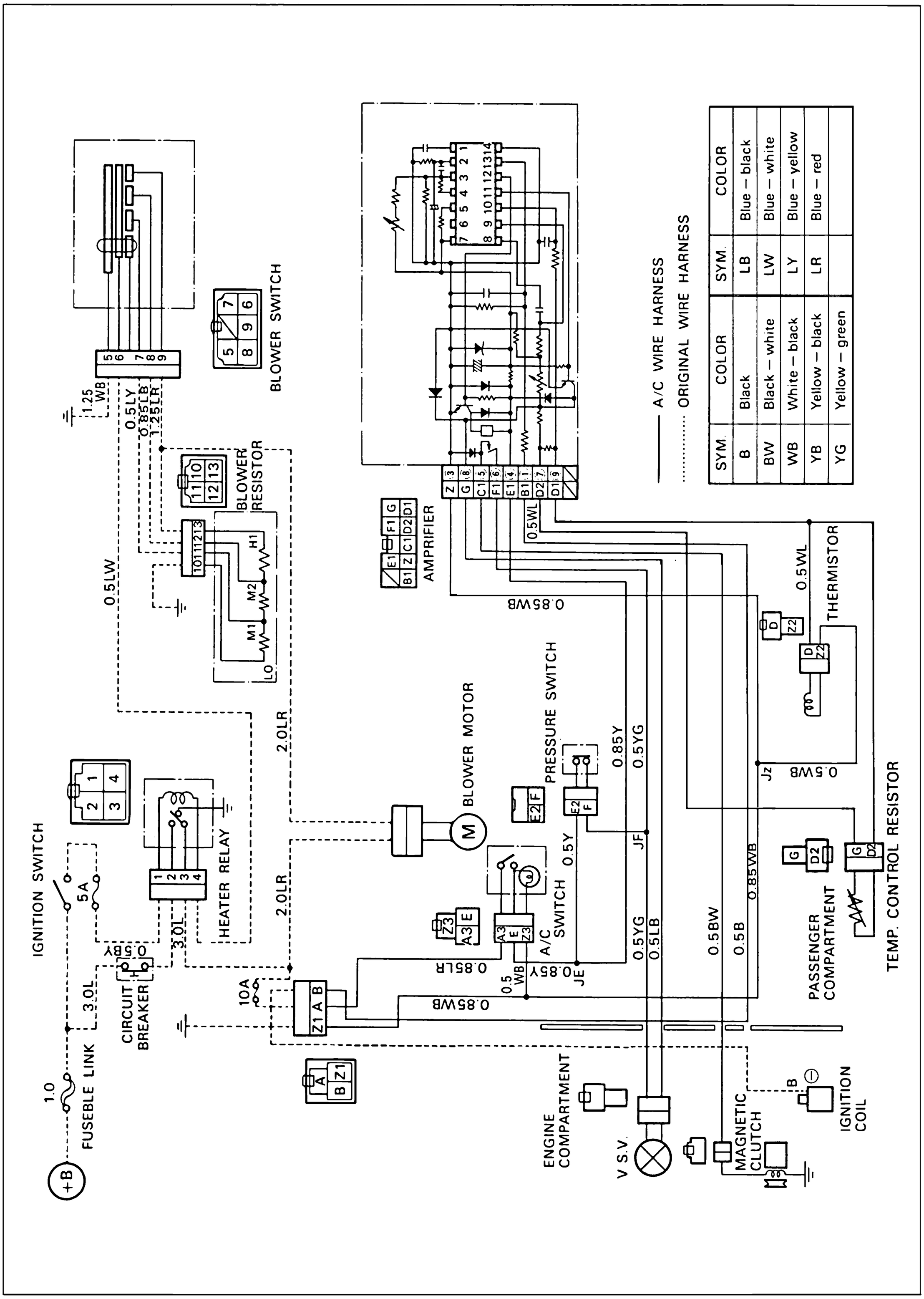
Fig. II-28

II-3. WIRING DIAGRAM

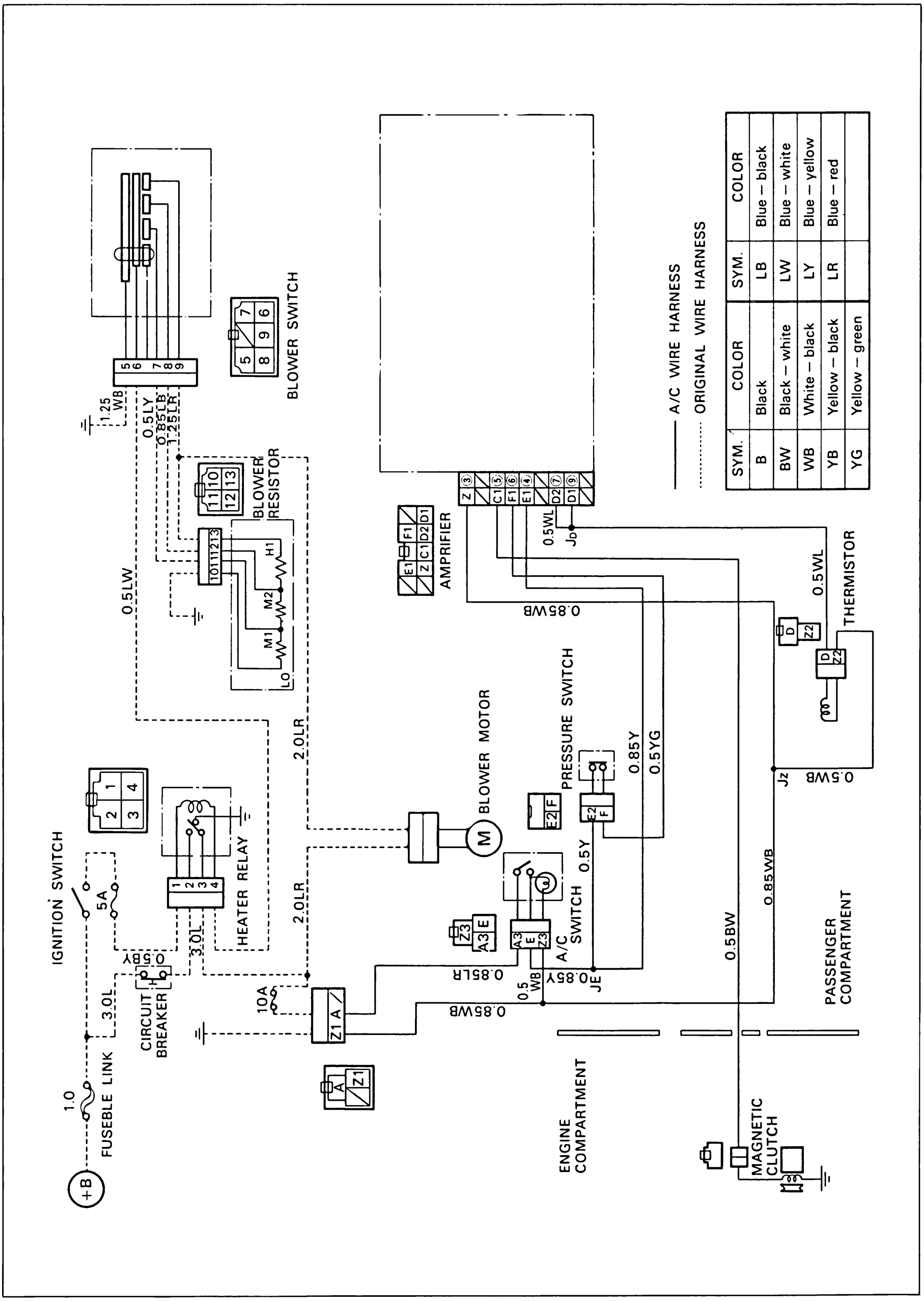
1. FJ60 Series (w/ heater)



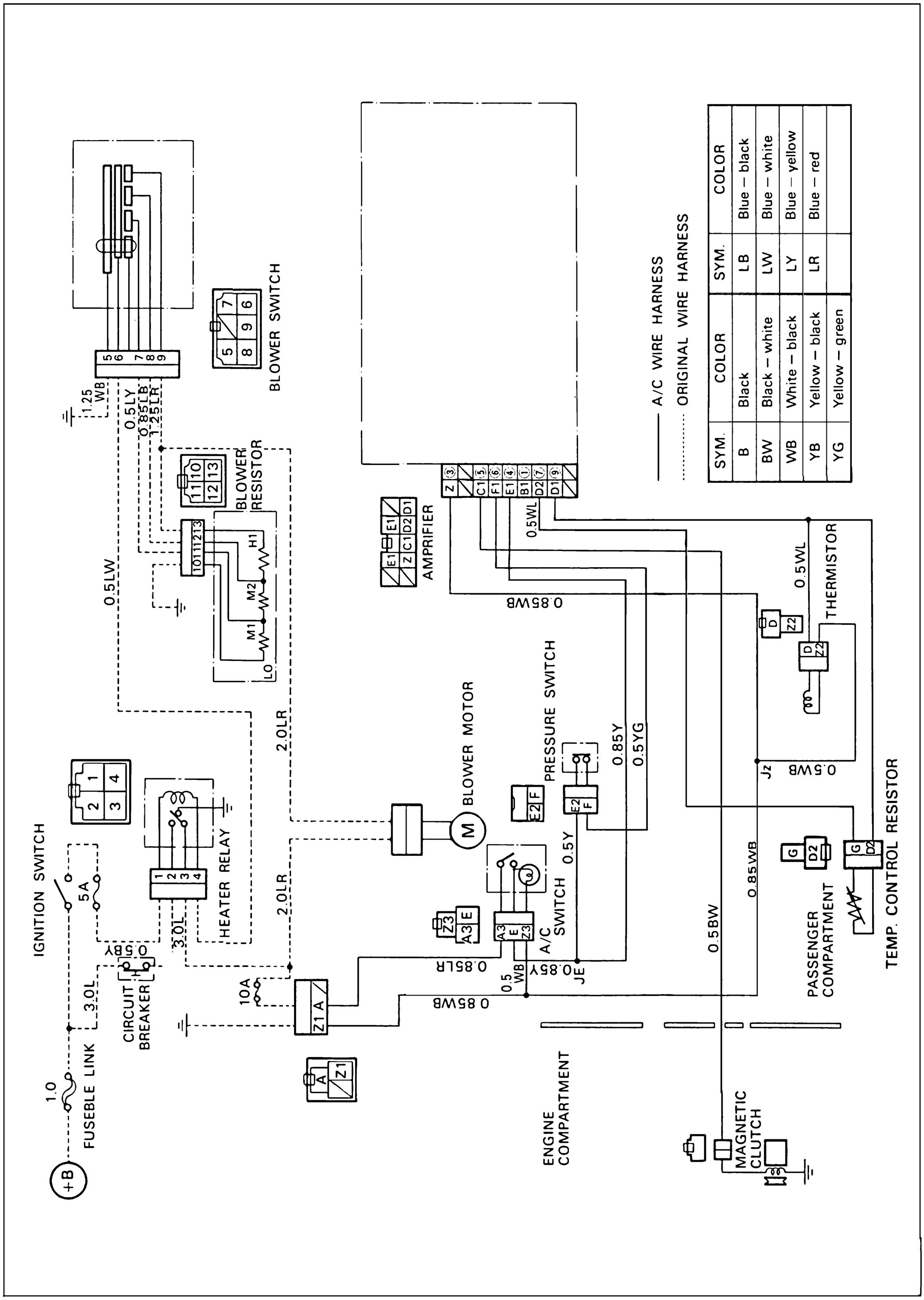
2. FJ60 Series (w/ boost ventilator)



3. BJ60, HJ60 Series (w/ heater)



4. BJ60, HJ60 Series (w/ boost ventilator)



III. AIR DISTRIBUTION SYSTEM

1. VEHICLES WITH HEATER

See the schematic diagram of the air distribution system.

A) Selection of recirculated air or fresh outside air is done with the door (D1) and the selector lever (B).

Moving the selector lever (B) to "RECIRC" will allow air inside the car to be recirculated.

Moving the selector lever (B) to "FRESH" will allow outside air to come in.

B) Temperature control of outlet air is done with the door (D2) and temp. control lever.

Moving the temp. control lever toward "WARM" position will move the door (D2) upward and open the heater water valve.

Moving the temp. control lever toward "COOL" position will move the door (D2) downward and close the heater water valve.

Setting the lever to max. "COOL" position will close the water valve completely.

C) Outlet air flow is controlled with the doors (D3), (D4), (D5) and the selector lever (A).

Moving the selector lever (A) to "VENT" position will move the doors (D3), (D4), (D5) to position ①.

Moving the selector lever (A) to "HEAT" position will move the doors (D3), (D4), (D5) to position ②.

Moving the selector lever (A) to "DEF" position will move the doors (D3), (D4), (D5) to position ③.

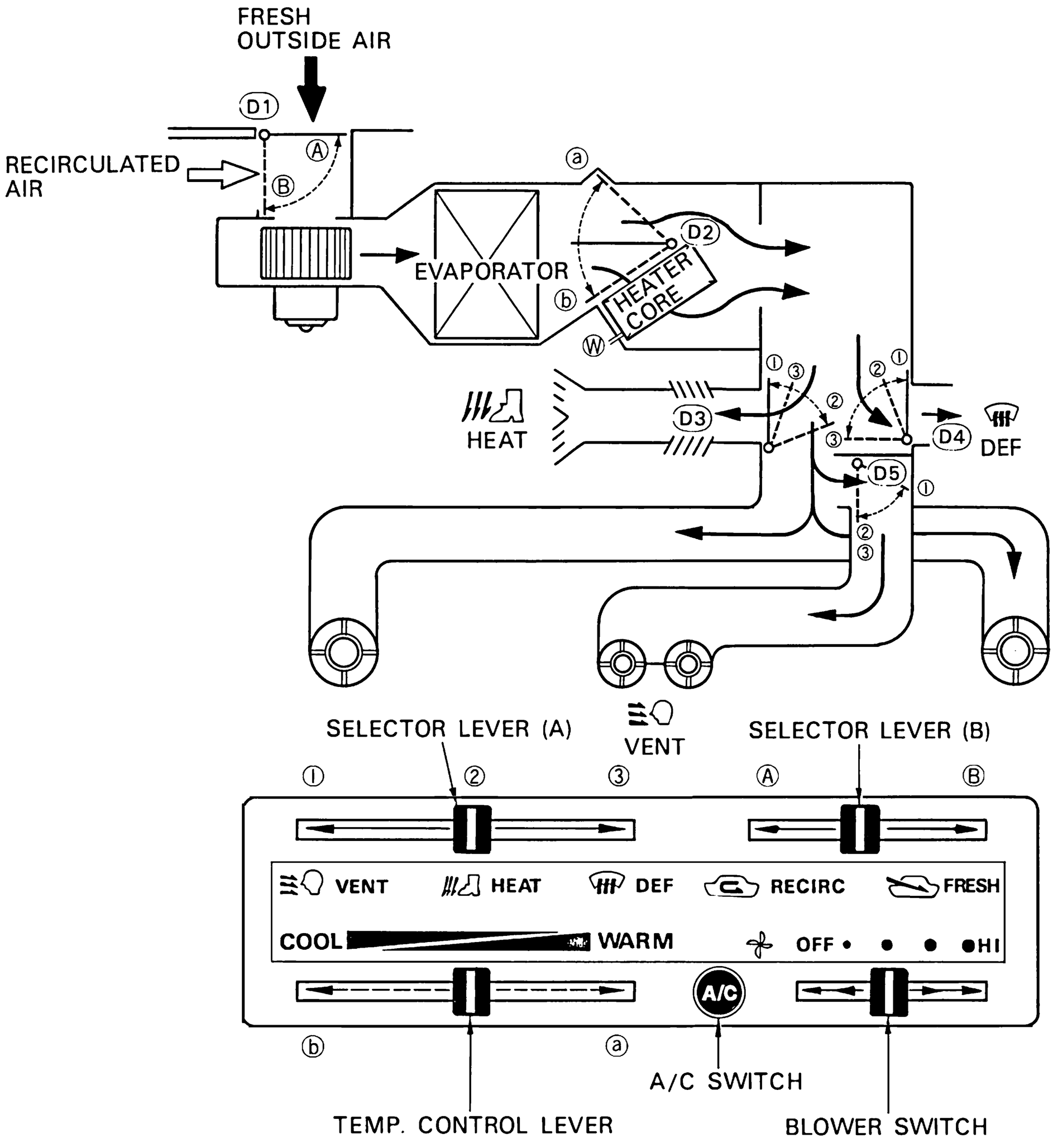
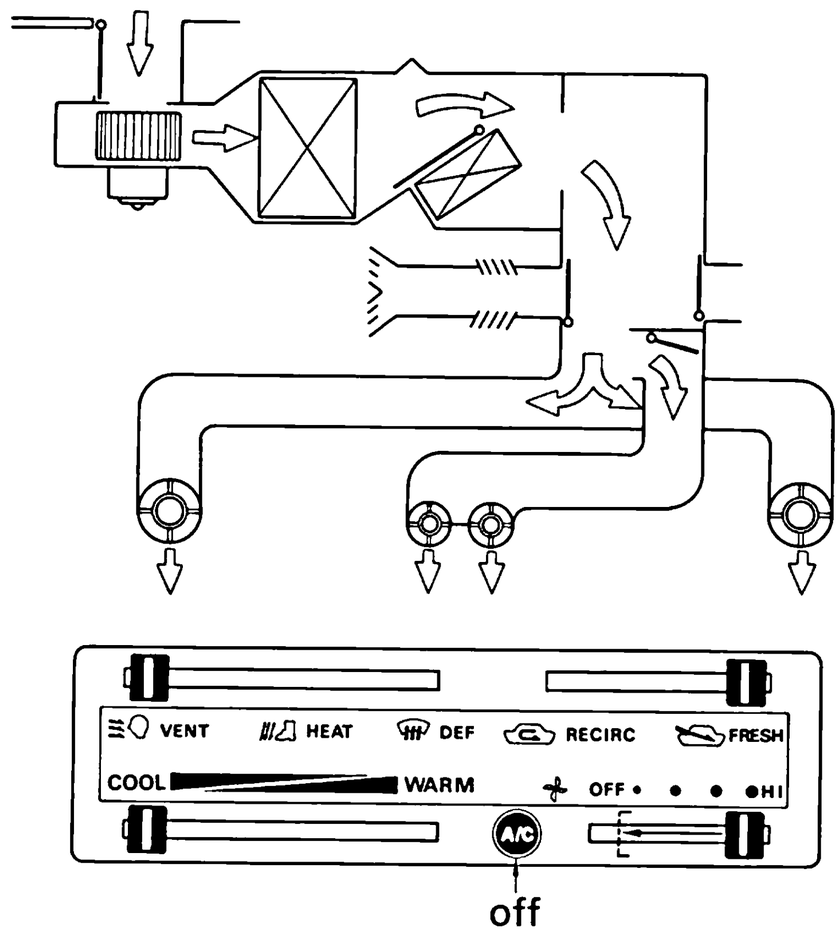
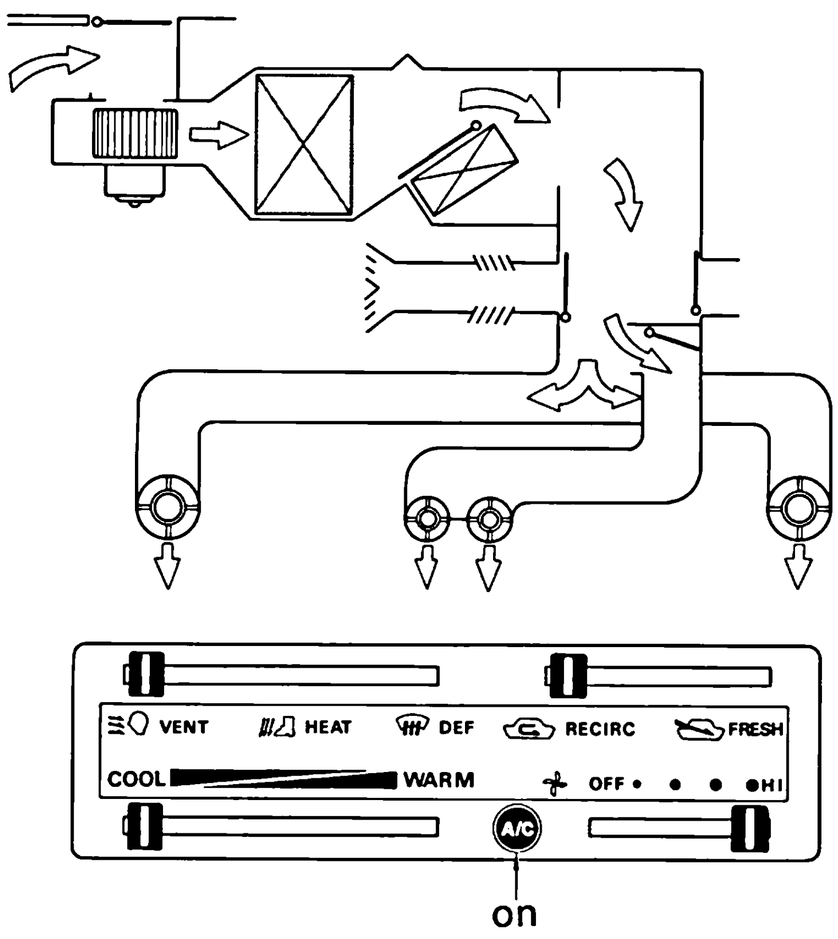
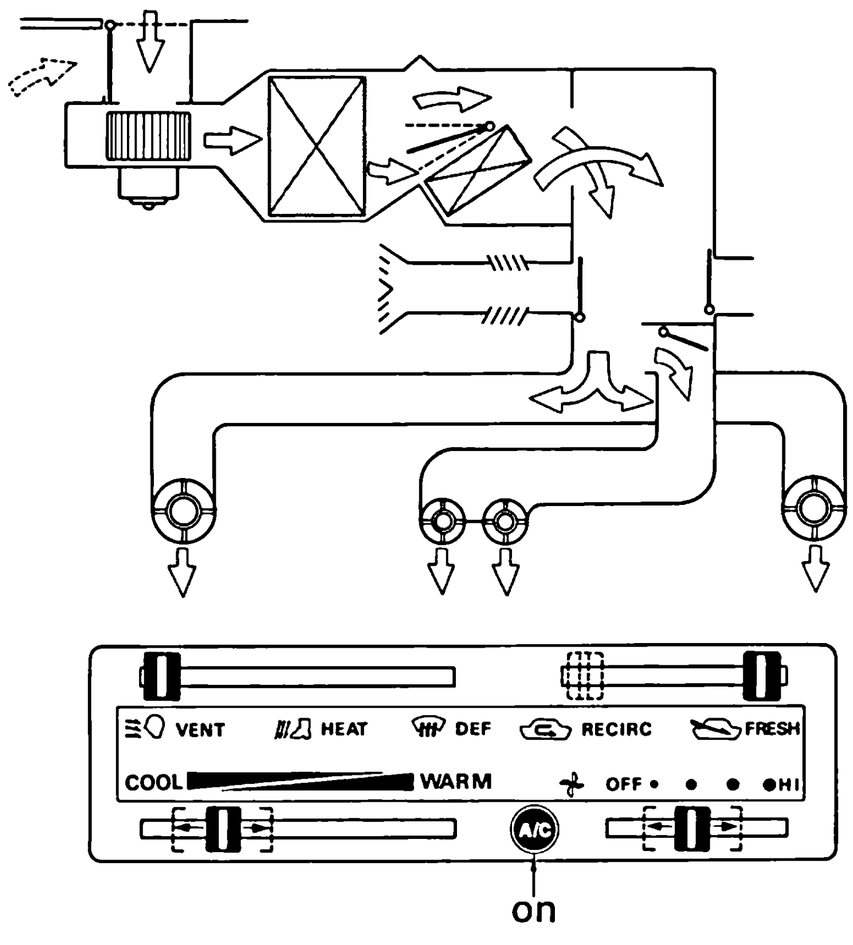
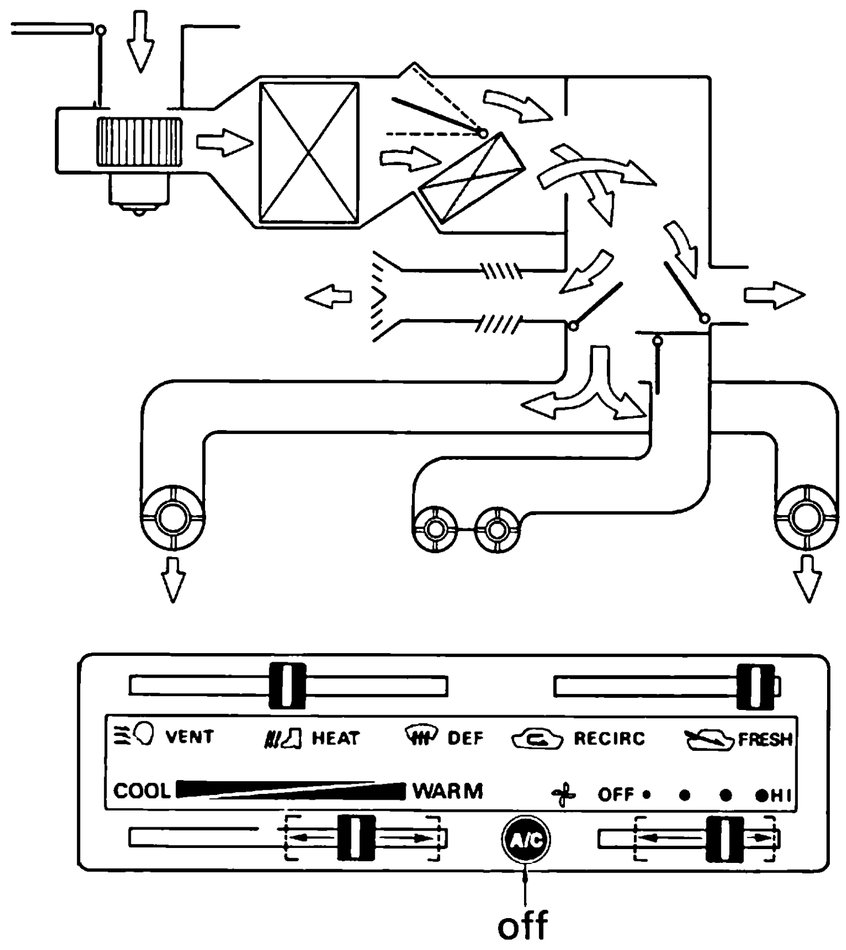
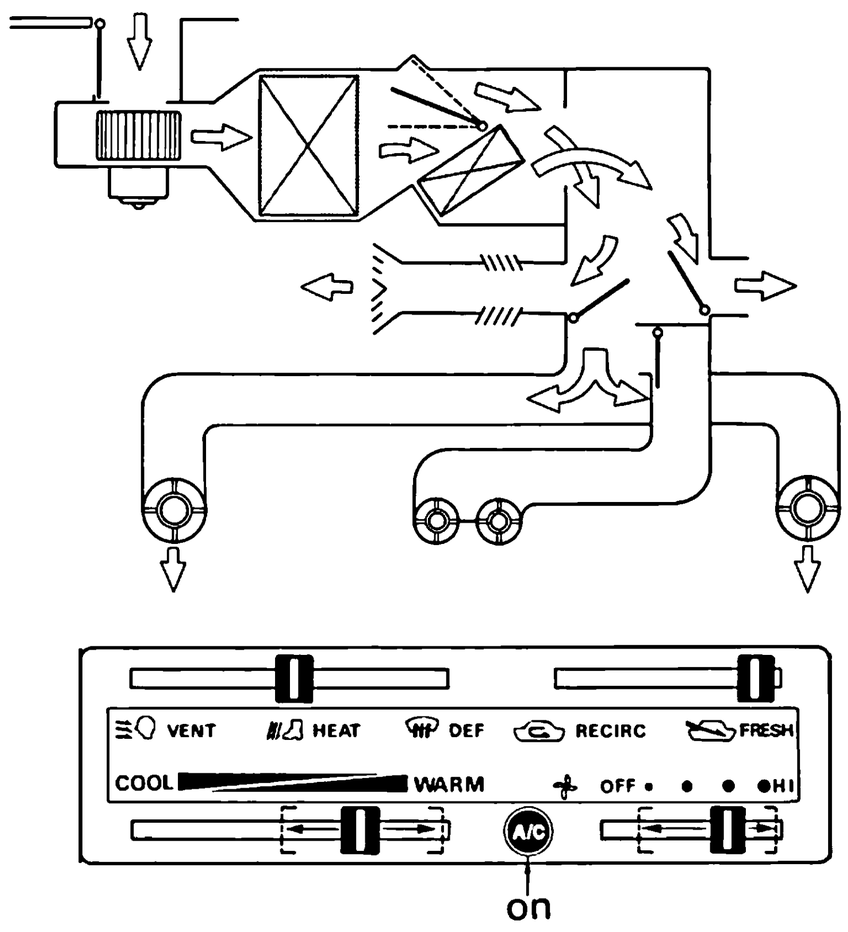
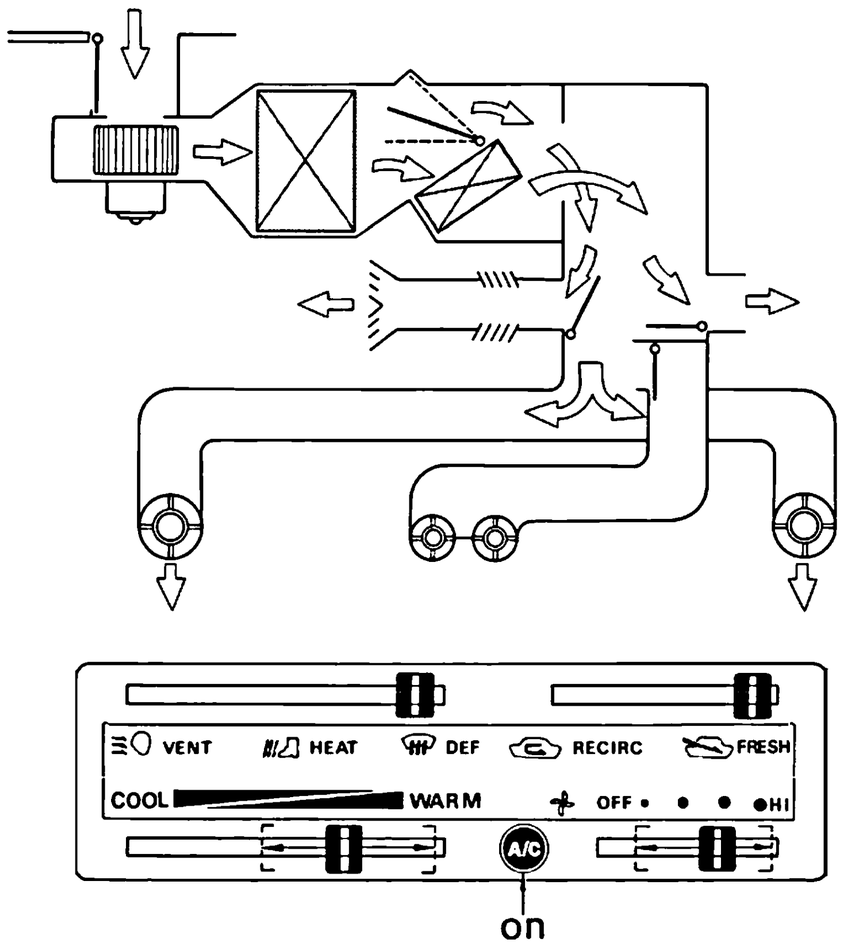

FRESH
OUTSIDE AIR
D1
RECIRCULATED
AIR
A
B
a
D2
EVAPORATOR
b
HEATER
CORE
W
D3
HEAT
D4
DEF
D5
SELECTOR LEVER (A)
SELECTOR LEVER (B)
VENT
VENT
HEAT
DEF
RECIRC
FRESH
COOL
WARM
OFF
HI
A/C
A/C SWITCH
TEMP. CONTROL LEVER
BLOWER SWITCH

Fig. III-1

LEVER POSITION	AIR DISTRIBUTION
VENTILATION	
Fig. III-2	
MAX COOLING	
Fig. III-3	
MILD COOLING	
Fig. III-4	

LEVER POSITION	AIR DISTRIBUTION
HEATING Fig. III-5	
DEHUMIDIFIED HEATING Fig. III-6	
DEFROSTING Fig. III-7	

2. VEHICLES WITH BOOST VENTILATOR

See the schematic diagram of the air distribution system.

A) Selection of recirculated air or fresh outside air is done with the door (D1) and the selector lever (B).

Moving the selector lever (B) to "RECIRC" will allow air inside the car to be recirculated.

Moving the selector lever (B) to "FRESH" will allow outside air to come in.

B) Outlet air flow is controlled with the doors (D2), (D3), (D4) and the selector lever (A).

Moving the selector lever (A) to "VENT" position will move the doors (D2), (D3), (D4) to position ①.

Moving the selector lever (A) to "DEF" position will move the doors (D2), (D3), (D4) to position ②.

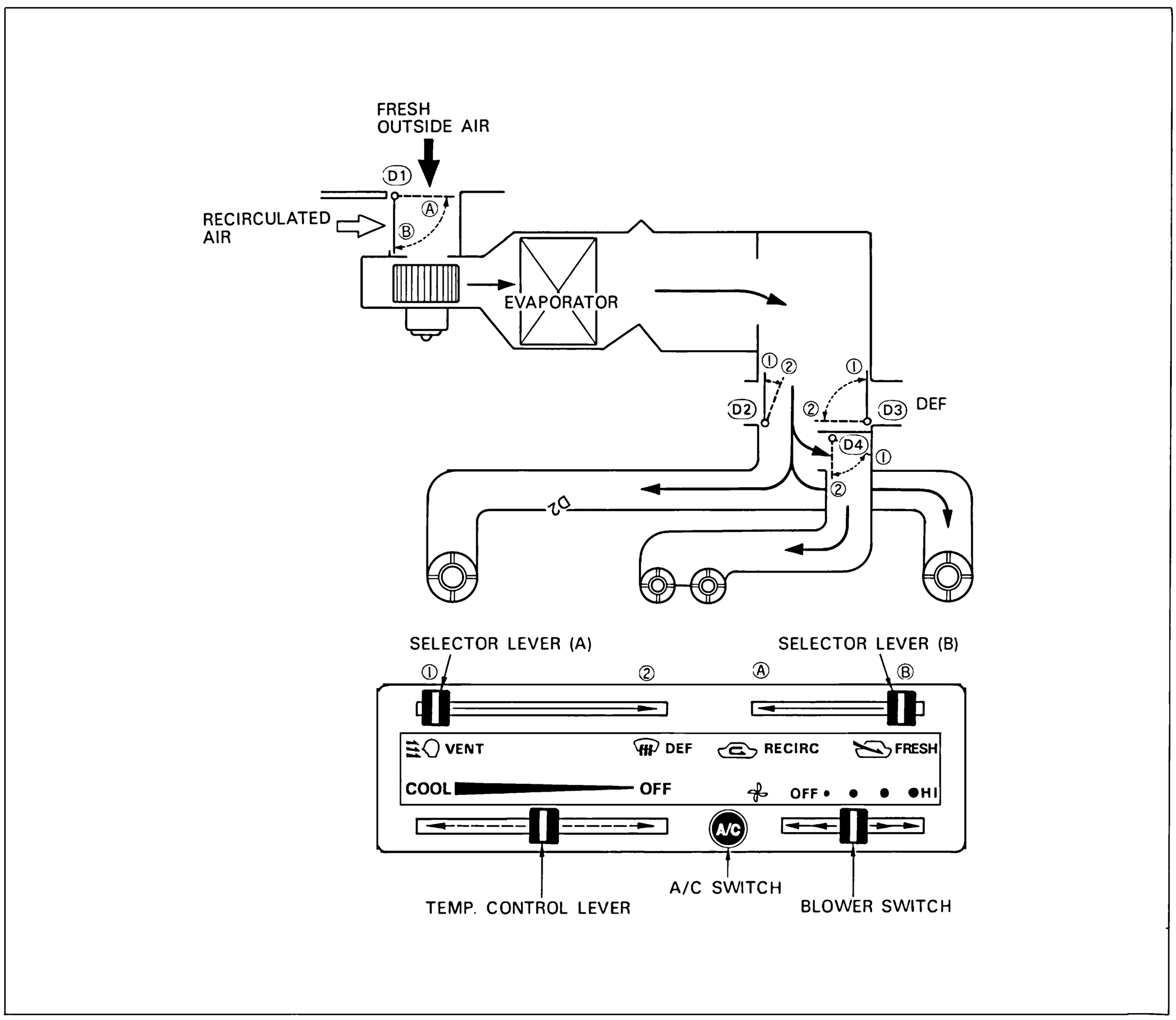
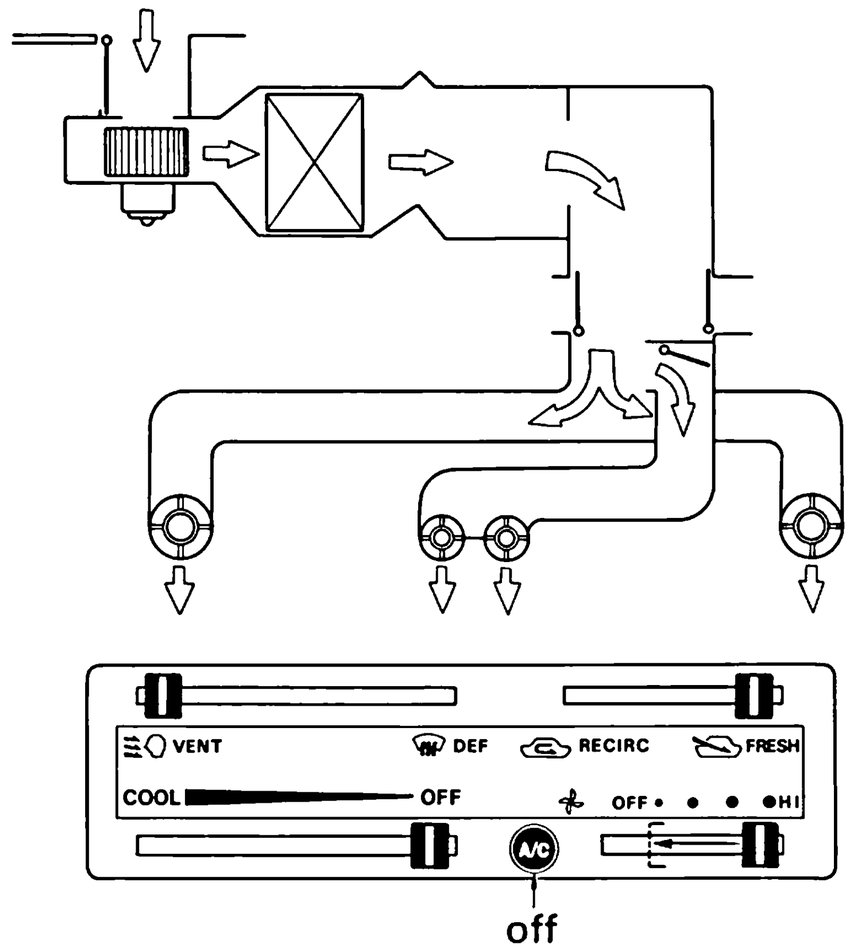
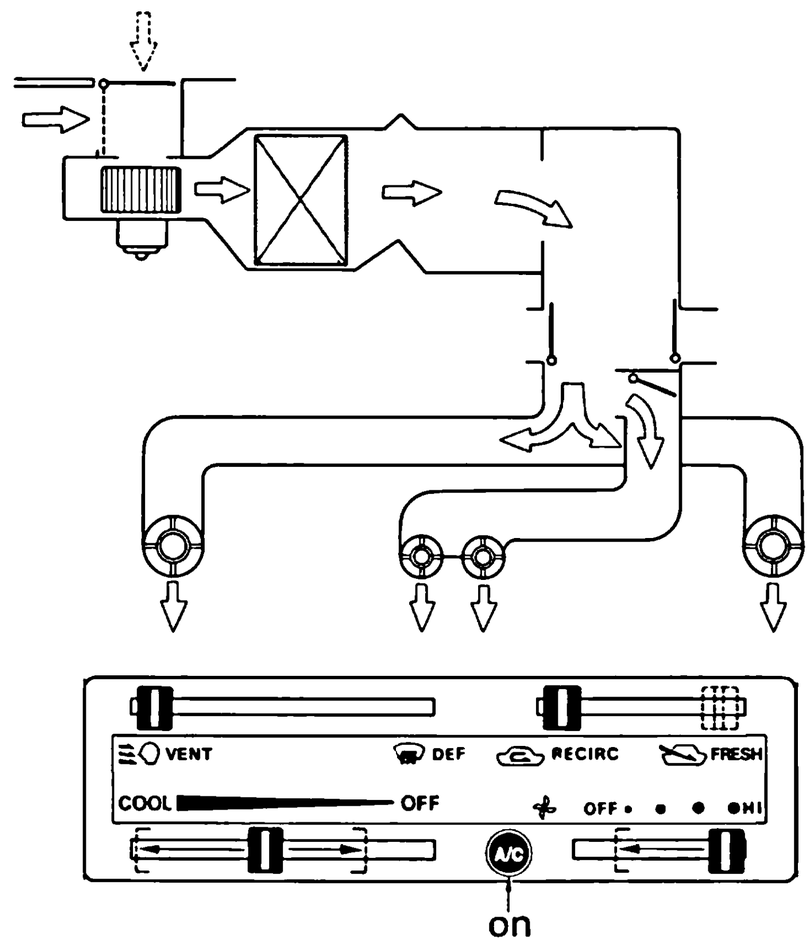
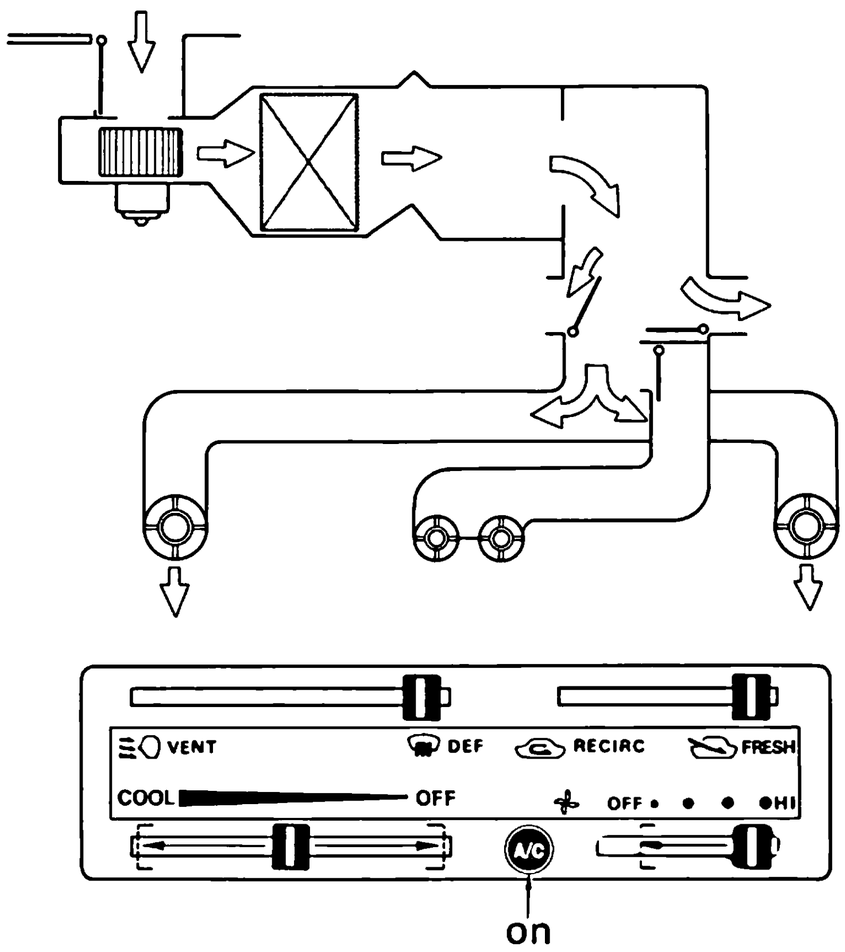


Fig. III-8

LEVER POSITION	AIR DISTRIBUTION
VENTILATION	
Fig. III-9	
COOLING	
Fig. III-10	
DEFROSTING	
Fig. III-11	

IV. TOOLS FOR REPAIRING

IV-1. SERVICE TOOL KIT

ILL. NO.	TOOL NAME	ILL. NO.	TOOL NAME
1	Gauge assy, refrigerant charging (Incl. A to C)	7	Holder, pipe
		8	Cutter, pipe
A	Gauge, low pressure	E	Reamer
B	Gauge, high pressure	F	Blade
C	Body, gauge	9	Tool, flaring
2	Hose, charging (red color)	10	Wrench, service valve
3	Hose, charging (green color)	11	Valve, refrigerant drum service
4	Hose, charging (blue color)	12	Packing, charging hose
5	Tester, gas leak (Incl. D)	13	Packing, service valve
D	Reactor	14	Case, tool
6	Container, spare		

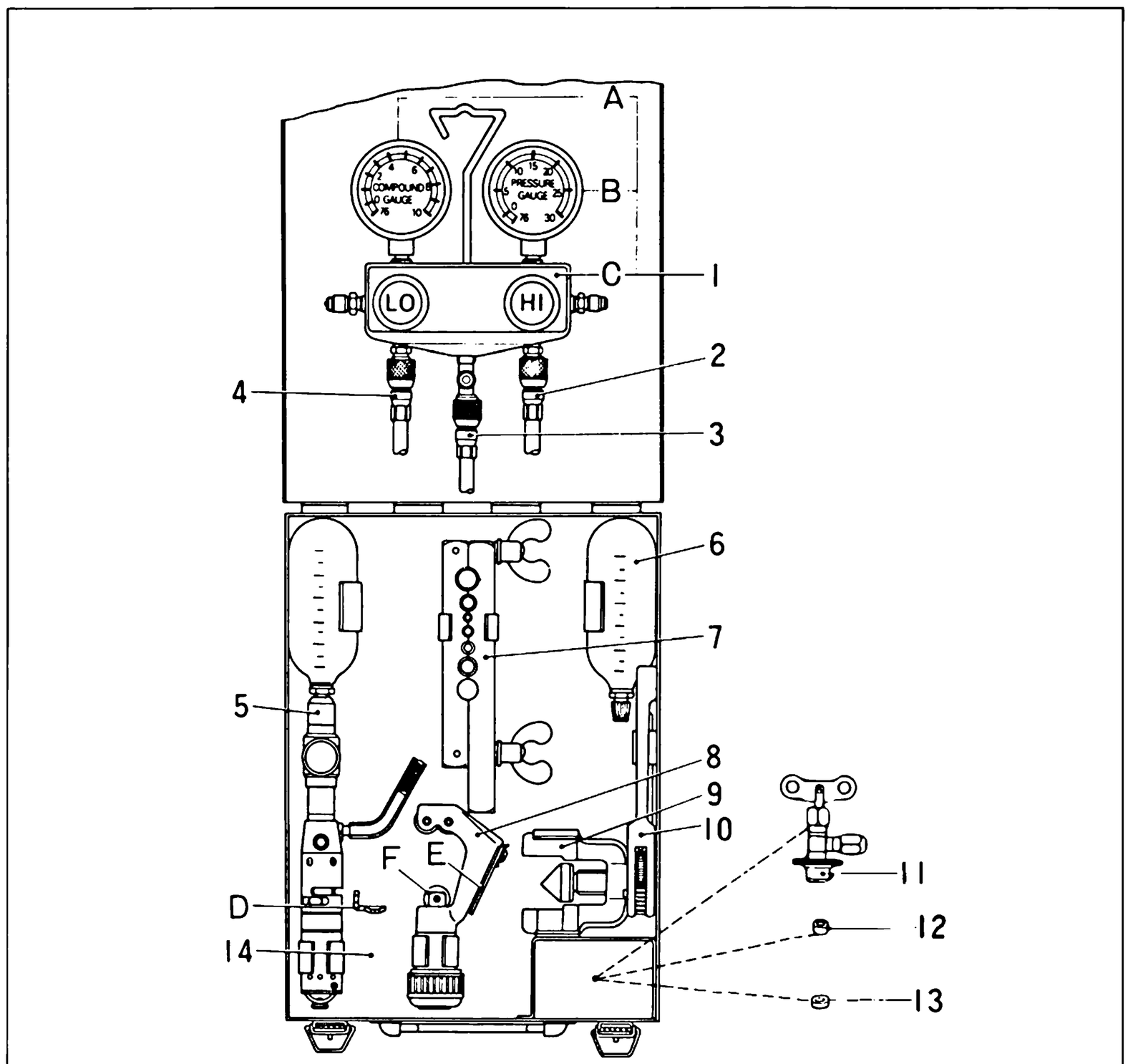


Fig. IV-1

IV-2. HANDLING OF SERVICE TOOLS

1. MANIFOLD GAUGE SET

The hand valves ("LO" and "HI") on the manifold gauge set are used to open and close the valve.

The hand valve inscribed "LO" is for the low pressure side valve and "HI" is for the high pressure side valve.

By opening or closing the high and low pressure hand valves, the following circuits are established. See Fig. IV-2.

A) When low pressure side valve ("LO") is opened and high pressure side valve ("HI") is closed.

Two circuits are established :

※ ③ → low pressure gauge
※ ③ → ②
※ ③ → ④ (schrader valve must be opend.)

※ ① → high pressure gauge

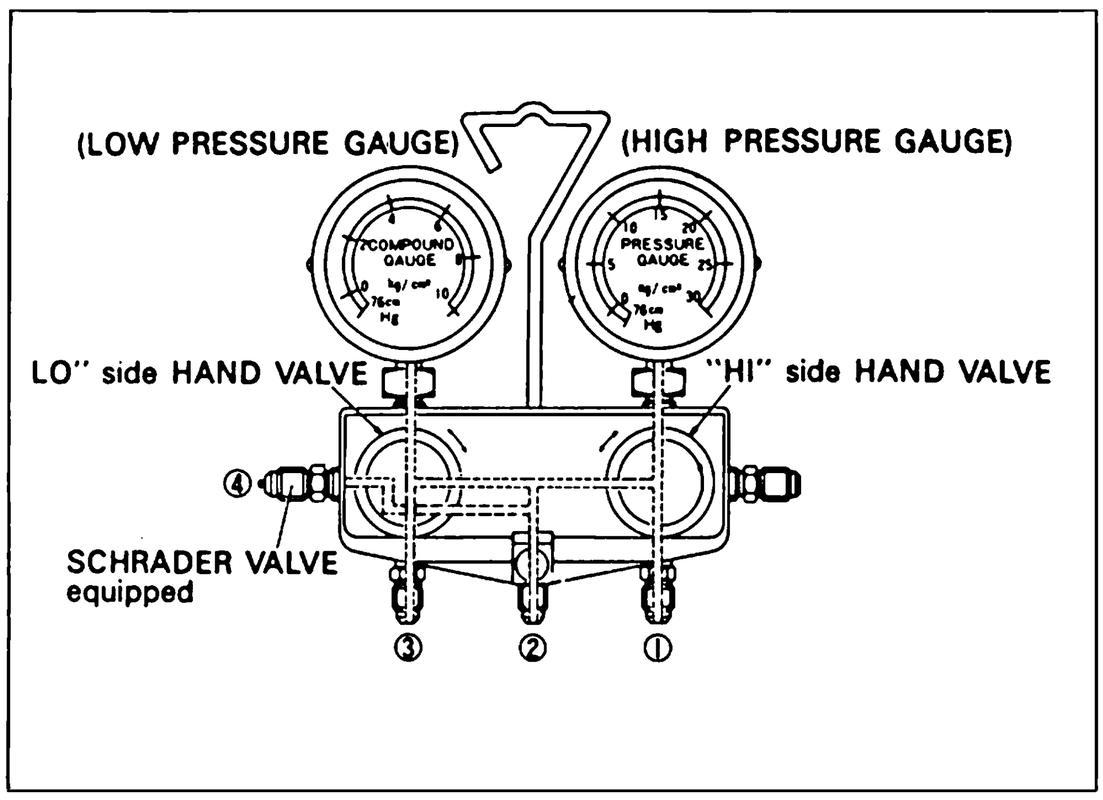


Fig. IV-2

B) When low pressure side valve ("LO") is closed and high pressure side valve ("HI") is opened.

Two circuits are established :

※ ① → high pressure gauge
※ ① → ②
※ ① → ④ (schrader valve must be opened.)

※ ③ → low pressure gauge

C) When low and high pressure gauges are closed.

Two circuits are established :

※ ③ → low pressure gauge
※ ① → high pressure gauge

2. REFRIGERANT CHARGING HOSE

The charging hoses are classified in three colors.

Each charging hoses must be handled as follows :

A) The air conditioner manufacturer recommends that the blue hose is used for the low pressure side (suction side), the green hose tor refrigeration side (center connecting port) and the red hose for high pressure side (discharge side).

B) The 45 degree swivel fitting of the charging hose is equipped with a special pin to depress the schrader valve on the compressor service valve. The straight fitting of charging hose must always be connected to the manifold gauge. See Fig. IV-3.

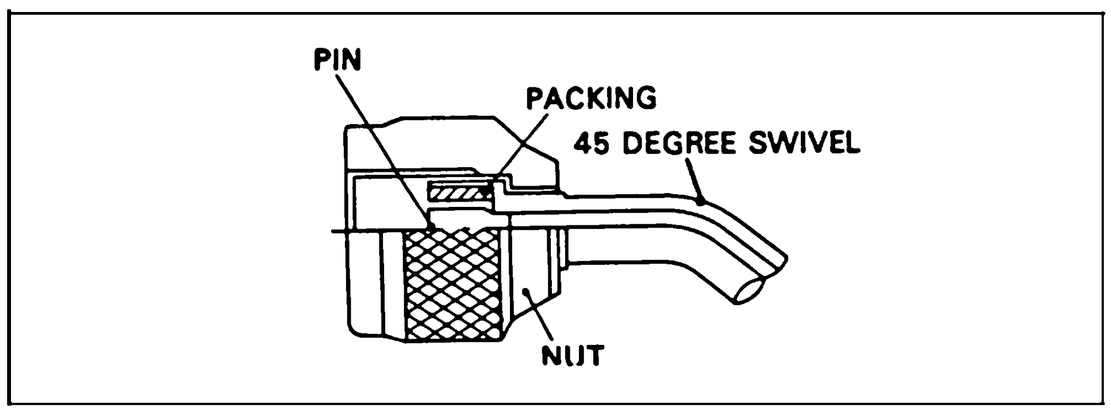


Fig. IV-3

C) The nut at the end of charging hose should only be tightened by hand.

D) When the manifold gauge set is not in use, connect the end of the hose to spare fitting of refrigerant charging hose.
See Fig. IV-4.

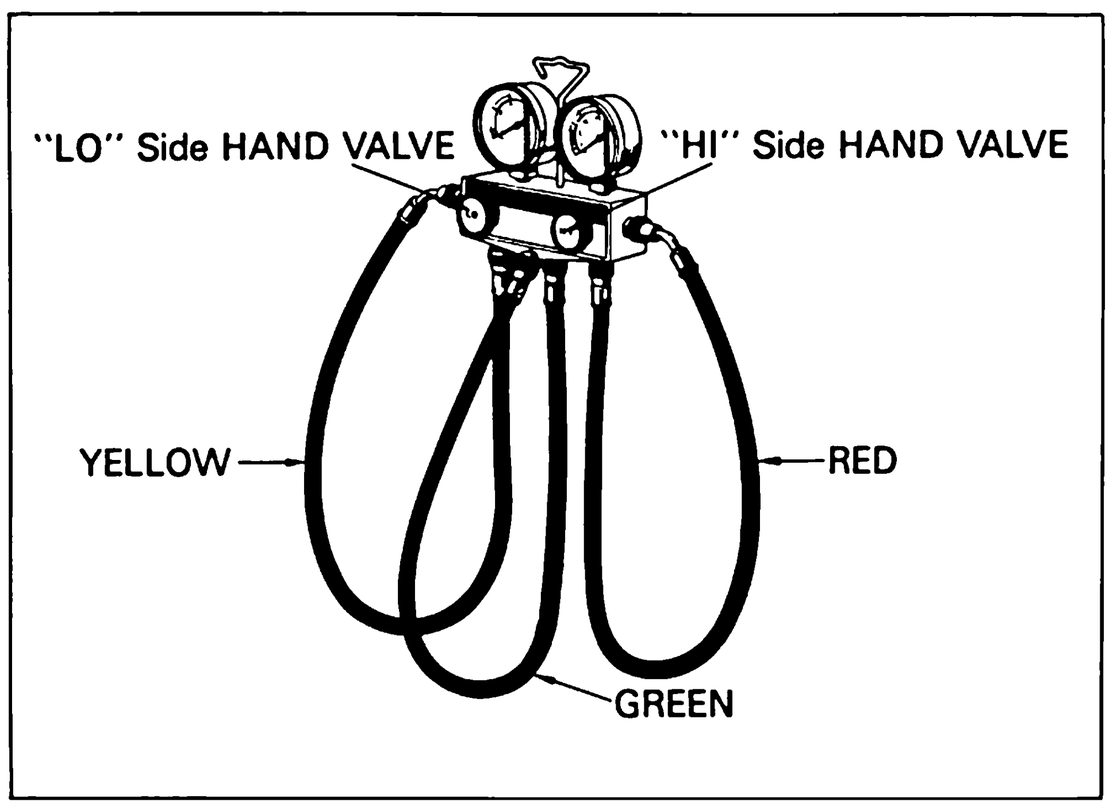


Fig. IV-4

3. REFRIGERANT CONTAINER SERVICE VALVE

Refrigerant container service valve that is used to charge the refrigerant into the air conditioning system, should be used as follows :

A) Before putting the refrigerant container service valve on the refrigerant container, turn the handle counterclockwise till the valve needle is fully retracted.

B) Turn the plate nut (disk) counterclockwise till it reaches its highest position, then screw down the refrigerant drum service valve into the sealed tap.

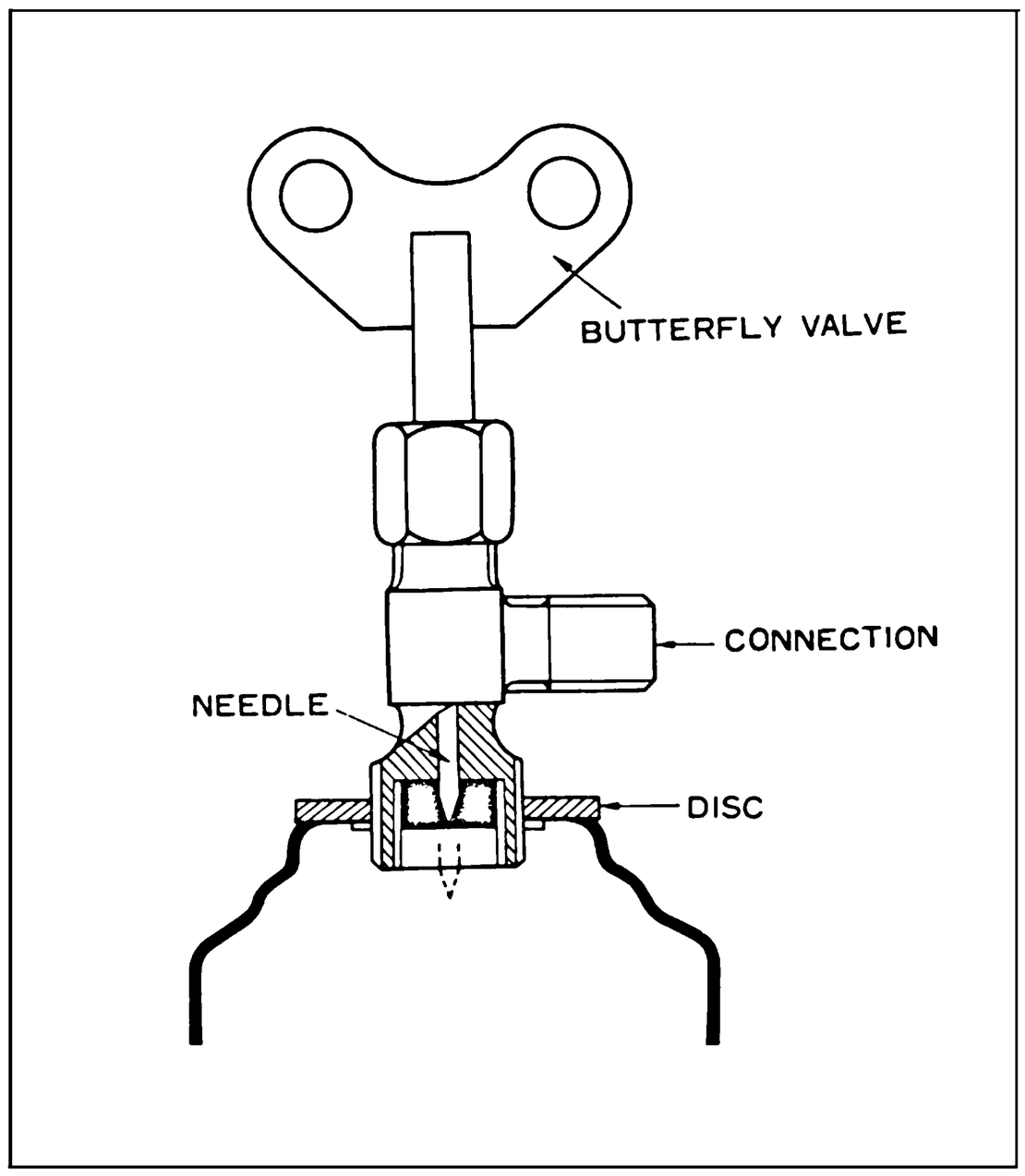


Fig. IV-5

C) Turn the plate nut (disk) clockwise fully, and fix the center charging hose to the valve.

D) The plate nut can be sufficiently tightened by hand.

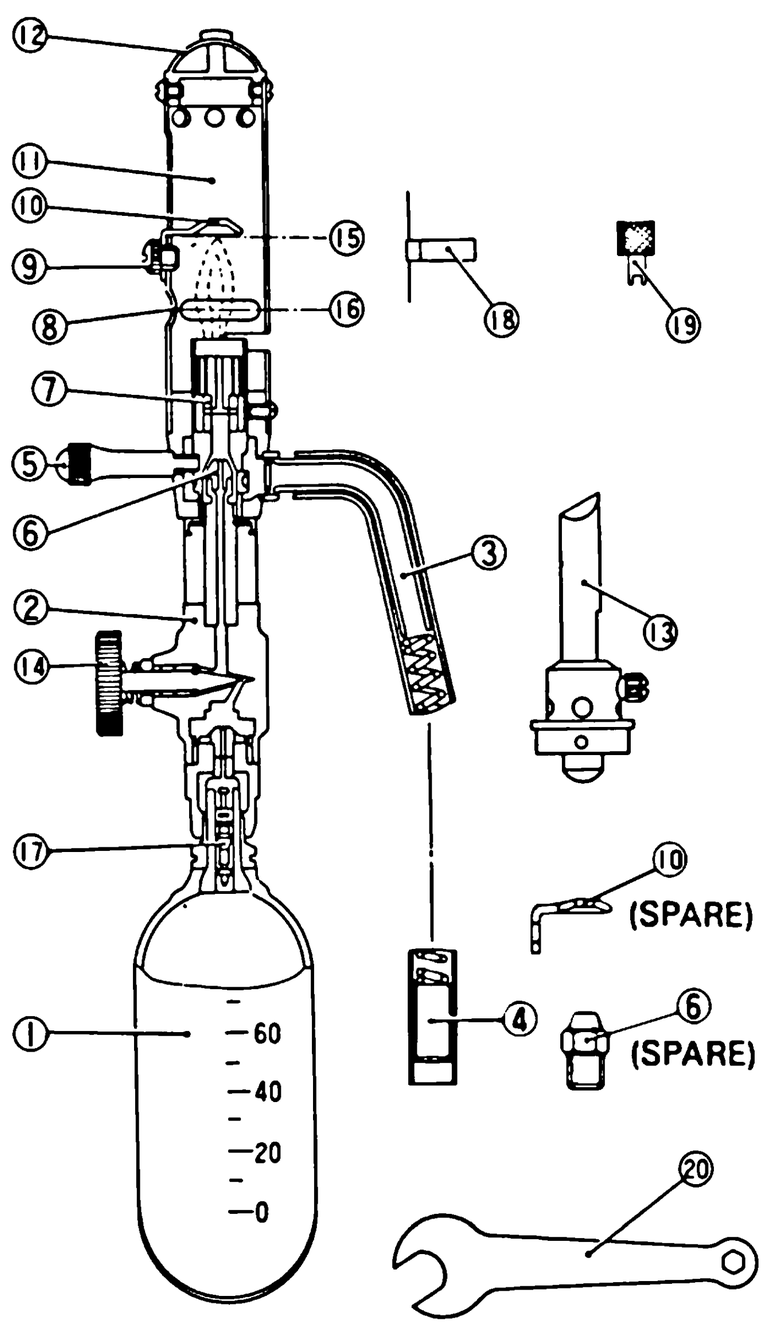
E) Turn the handle clockwise, thus making a hole in the sealed tap.

F) To charge the refrigerant into the system, turn the handle counterclockwise. To stop the charging, turn it clockwise.

4. GAS LEAK TESTER

Check all connection, and the compressor shaft seal for leaks carefully, whenever the air conditioning system is replaced or repaired.

Use the gas leak tester to inspect the system.



① GAS LEAK TESTER BOMB
② GAS LEAK TESTER BODY
③ INTAKE TUBE
④ FILTER
⑤ COMBUSTION CYLINDER HOLDER
⑥ NOZZLE
⑦ FLAME DIVIDER
⑧ IGNITING HOLE
⑨ REACTOR PLATE SCREW
⑩ REACTOR PLATE
⑪ COMBUSTION CYLINDER
⑫ COMBUSTION CYLINDER CAP
⑬ CAP (for using leak detector as soldering iron)
⑭ ADJUSTING HANDLE
⑮ FLAME LENGTH (UPPER LIMIT)
⑯ FLAME LENGTH (LOWER LIMIT)
⑰ PROPANE CONTAINER NOZZLE
⑱ NOZZLE CLEANER
⑲ WRENCH
⑳ WRENCH

Fig. IV-6

The gas leak tester is used as follows.

A) Install the gas container to the gas leak tester body by turning it clockwise fully.

B) When ignite the tester, insert the flame of match into the igniting hole of the tester and turn the adjusting handle slowly counterclockwise.
This will ignite the gas leak tester.

C) The reactor (copper ring) must be red hot, but the flame must be kept as small as possible.
The smaller the flame the more sensitive it is to leak.

D) Hold the tip of sensing tube at each suspected leak portion.

E) Watch for the change in the flame color.
If there is no leak, the flame will be almost colorless.
The slightest leak will be indicate by a bright color to the flame.

Color of flame :

When leak is very small ..... Color of flame is light green.
When leak is large ..... Color of flame is bright blue.
When leak is very large ..... Color of flame is purple.

Note :

a) Always hold the tester vertically when detecting a leak.

b) Use adequate ventilation, burned R-12 poisonus and should not be inhaled.

VI. REPAIRING

VI-1. TROUBLE SHOOTING

TROUBLE	SYMPTOM	POSSIBLE CAUSES	REFERENCE PAGE
SYSTEM PRODUCES NO COOLING OR WARM	I. Magnetic clutch does not engage	I. (Electrical)	
		1) Blown HEATER-A/C fuse	Page 54
		2) Defective magnetic clutch	Page 54
		3) Defective heater relay	*
		4) Defective A/C switch (w/heater only)	Page 54
		5) Defective temp. control resistor (w/boost ventilator only)	Page 58
		6) Defective blower switch	*
		7) Defective thermister	Page 56
		8) Defective wiring connection	Check and correct
		9) Defective idling stabilizer amplifier	
	II. Compressor does not rotate properly	II. (Mechanical)	
		1) Loose or broken compressor drive belt	Page 63
		2) Defective compressor	Page 64
	III. Blower does not rotate properly	III. (Electrical)	
		1) Blown HEATER-A/C fuse	Page 54
		2) Defective blower motor	*
		3) Defective blower switch	*
		4) Defective blower control resistor	*
		5) Defective wiring connection	Check and correct

* : *LAND CRUISER is originally equipped with the parts and devices with asterisks (*). When repairing or replacing these parts, refer to "Heater section in Toyota LAND CRUISER Repair Manual".*

TROUBLE	SYMPTOM	POSSIBLE CAUSES	REFERENCE PAGE
	IV. Item I, II and III are normal	IV. (Mechanical) 1) Defective expansion valve 2) Defective compressor (Refrigeration) 1) Broken refrigerant line 2) Leak in system 3) Blown fusible plug of receiver 4) Defective shaft seal of compressor 5) Clogged screen in receiver	 Page 52 Page 44 Page 53 Page 42 Page 47 Page 44 Page 57
SYSTEM PRODUCES INSUFFICIENT COOLING	I. Cool air comes out intermittently	I. (Mechanical) 1) Magnetic clutch slipping 2) Defective expansion valve (Electrical) 1) Defective wiring connection (Refrigeration) 1) Excessive moisture in system	 Page 54 Page 52 Check and correct Page 66
	II. Cool air comes out only when running at high speed	II. (Mechanical) 1) Condenser air passage clogged partially 2) Compressor drive belt slipping 3) Defective compressor (Refrigeration) 1) Insufficient or too much refrigerant in system 2) Air in system	 Page 45 Page 63 Page 44 Page 42 Page 66

* : *LAND CRUISER is originally equipped with the parts and devices with asterisks (*). When repairing or replacing these parts, refer to "Heater section in Toyota LAND CRUISER Repair Manual".*

TROUBLE	SYMPTOM	POSSIBLE CAUSES	REFERENCE PAGE
	III. Limited amount cool air when running at high speed	III. (Electrical) 1) Frosted evaporator by defective thermister 2) Frosted evaporator by defective idling stabilizer amplifier	 Page 56 Page 60
	IV. Insufficiently cooled air comes out	IV. (Mechanical) 1) Clogged condenser fins 2) Compressor drive belt slipping 3) Magnetic clutch slipping by leaking grease of clutch rotor bearing 4) Magnetic clutch slipping by oil leakage from compressor shaft seal 5) Defective compressor 6) Defective expansion valve 7) Misadjusted temperature control lever (Electrical) 1) Defective thermistor 2) Defective temp. control resistor (w/boost ventilator only) 3) Defective idling stabilizer amplifier (Refrigeration) 1) Insufficient or too much refrigerant in system 2) Air in system 3) Excessive refrigeration oil in system 4) Clogged screen in receiver	 Page 45 Page 63 Page 54 Page 44 Page 44 Page 52 * Page 56 Page 58 Page 60 Page 42 Page 66 Page 65

* : *LAND CRUISER is originally equipped with the parts and devices with asterisks (*). When repairing or replacing these parts, refer to "Heater section in Toyota LAND CRUISER Repair Manual".*

TROUBLE	SYMPTOM	POSSIBLE CAUSES	REFERENCE PAGE
	V. Insufficient velocity of cooled air	V. (Mechanical) 1) Blocked air inlet 2) Clogged evaporator fins 3) Frosted evaporator 4) Air leakage from unit or air duct (Electrical) 1) Defective blower motor 2) Defective wiring connection	 * Page 47 Page 47 Page 47 * Check and correct
SYSTEM PRODUCES NO OR INSUFFICIENT HEATING	I. Insufficiently warmed air comes out	I. (Mechanical) 1) Defective water valve 2) Misadjusted temperature control lever or disconnected control wire	 * *
	II. Insufficient velocity of warmed air	II. (Mechanical) 1) Blocked air inlet 2) Clogged evaporator fins 3) Clogged heater core 4) Air leakage from unit or air duct (Electrical) 1) Defective blower motor 2) Defective wiring connection	 * Page 47 * Page 47 * Check and correct
IMPROPER SHIFTING OF DOORS	I. When setting selector lever at each position, each door can not be moved properly	I. (Mechanical) 1) Misadjusted control lever or disconnected control wire	 *

* : *LAND CRUISER is originally equipped with the parts and devices with asterisks (*). When repairing or replacing these parts, refer to "Heater section in Toyota LAND CRUISER Repair Manual".*

TROUBLE	SYMPTOM	POSSIBLE CAUSES	REFERENCE PAGE
ABNORMAL NOISE IN SYSTEM	I. Noise from piping	I. (Mechanical)	
		1) Loosen clamp	Page 53
		2) Defective compressor	Page 44
		3) Defective expansion valve	Page 52
	II. Noise from blower assy	II. (Mechanical)	
		1) Blower touches case	*
		2) Defective bearing	
	III. Noise from compressor	III. (Mechanical)	
		1) Loosen or broken compressor mount	Page 64
		2) Defective compressor	Page 44
		(Refrigeration)	
		1) Compressor oil level low	Page 66
		2) Insufficient refrigerant in system	Page 42
	IV. Noise from magnetic clutch	IV. (Mechanical)	
		1) Rotor bearing are worn out	Page 54
		2) Insufficient clearance between pressure plate and rotor	Page 54
	V. Noise from belt	V. (Mechanical)	
		1) Loose or excessively worn drive belt	Page 63

* : *LAND CRUISER is originally equipped with the parts and devices with asterisks (*). When repairing or replacing these parts, refer to "Heater section in Toyota LAND CRUISER Repair Manual".*

TROUBLE	SYMPTOM	POSSIBLE CAUSES	REFERENCE PAGE
	VI. Noise from idle pulley	VI. (Mechanical) 1) Worn out bearing	 Page 64
POOR ENGINE PERFORMANCE	I. Engine tends to overheat	I. (Mechanical) 1) Loose or broken fan belt 2) Clogged condenser or radiator fins 3) Defective radiator cap 4) Defective water pump 5) Engine out of tune	 Page 63 Page 45 * * *

* : *LAND CRUISER is originally equipped with the parts and devices with asterisks (*). When repairing or replacing these parts, refer to "Heater section in Toyota LAND CRUISER Repair Manual".*

V-2. SAFETY PRECAUTIONS

When repairing the air conditioning system, the following precautions and rules must be observed.

WIRING	1. Disconnect the battery negative terminal to prevent a short circuit. 2. Connection of terminals or connectors should be done surely. 3. When wire harness is routed through the hole on panel, insert the rubber bushing into the hole for protection. 4. The air conditioner wire harness should be fastened to the main harness with the vinyl tape or original clamps. 5. If original harness was disconnected or moved while repairing, it should be returned to proper position. 6. Be careful not to pinch original and air conditioner wire harnesses during installation. 7. When the lead wire is added to the wire harness by soldering, use the same diameter lead wire, and tape the connection. 8. The wire harness should not come in contact with moving or high temperature parts. 9. Connecting portions of wire harness must be kept away from the fuel lines. 10. Be sure that the wire harness does not contact a sharp corner or edge.
TUBING	1. Never use heat when bending tubes When bending the tube, try to make the bend as wide as possible. 2. Internal parts of the air conditioner must be kept free from moisture and dust. When disconnecting any lines, install blind plugs or caps on the fittings immediately.

<table>
<tr><td>TUBING</td><td>
3. Before making any hose and tube connections, apply a few drops of refrigeration oil to the seat of coupling nut.
4. When tightening and loosening fittings, use two wrenches for support.
5. Pay special attention to the direction of receiver.
(inlet side is marked "IN")
Receiver inlet fitting must be connected to the tube from condenser outlet fitting.
6. Tighten coupling nuts according to following torque table.
<table>
<tr><th>Size of Couqling Nut</th><th>Fixing Torque</th></tr>
<tr><td>for 3/8 inch tube</td><td>1.2 – 1.5 kg-m (9 – 11 ft-lbs)</td></tr>
<tr><td>for 1/2 inch tube</td><td>2.0 – 2.5 kg-m (15 – 18 ft-lbs)</td></tr>
<tr><td>for 5/8 inch tube</td><td>3.0 – 3.5 kg-m (22 – 25 ft-lbs)</td></tr>
</table>
7. Drain hose should be routed and fastened so that drain water does not contact vehicle parts.
</td></tr>
<tr><td>REFRIGERANT</td><td>
1. The following rules must be followed when handling refrigerant.
A) Use suitable eye protection such as safety goggles or glasses when handling the refrigerant or servicing the refrigeration system.
B) Avoid direct contact with liquid refrigerant.
C) Do not heat the refrigerant container higher than 40°C (100°F).
D) Do not discharge the refrigerant into an enclosed area having an open flame.
E) Do not allow the liquid refrigerant to touch bright metal. Refrigerant in combination with moisture is corrosive and will tarnish bright metal and chrome surfaces.
F) Discharge the refrigerant very slowly when purging a refrigeration system.
Otherwise the refrigeration oil will discharge together with refrigerant.
</td></tr>
</table>

REFRIGERANT	G) When discharging refrigerant from system, cover end of charging hose with a rag or place end of hose in a container. 2. If liquid refrigerant strikes your eye or skin. A) Do not rub the eye or skin. B) Splash large quantities of cool water on the eye or skin to raise the temperature. C) Tape on a sterile eye patch to avoid the possibility of dirt entering the eye. D) Apply clean petroleum jelly to the skin. E) Rush to a physician or hospital for immediate professional treatment. F) Do not attempt to treat it yourself.
CLEARANCE	1. When installing the air conditioner parts, maintain clearance. Use insulators between sorrounding parts. A) Fan shroud — Radiator hose ·····5 mm (0.20 in) or more B) Cooling fan (steel) — Radiator ·····15 mm (0.59 in) or more Cooling fan (plastic) — Radiator ·····20 mm (0.79 in) or more C) Cooling fan — Fan shroud·····15 mm (0.59 in) or more D) Cooling fan — Crankshaft and Idle pulleys ····· 4 mm (0.16 in) or more E) Cooling fan — Radiator hose ·····15 mm (0.59 in) or more F) Brake and Fuel pipes — Surrounding parts ·····15 mm (0.59 in) or more G) Suction and discharge hoses — Surrounding parts ·····15 mm (0.59 in) or more (except the places with clamps or rubber cushions)
CLEARANCE	H) High tension cord — Surrounding parts ·····15 mm (0.59 in) or more

	1) loose side of —— Radiator hose ····· 20 mm (0.79 in) or more V-belt 2. After finishing repair work, be sure that the air conditioner parts are properly positioned.
MOUNTING PARTS	1. Always use lock washers. 2. The parts mounted on the engine must be tightened to specified torque.
OTHERS	1. When repairing the air conditioning system, use fender and seat covers to protect the vehicle. 2. When the air cleaner is removed from the engine, cover the carburetor inlet to keep dust and dirt out. 3. Never rotate the compressor without refrigerant in the system. 4. When storing a compressor for an extended period after use, evacuate and charge with refrigerant or dry nitrogen gas to prevent corrossion. (1—2 kg/cm², 14—28 psi) 5. After finishing repair work, check that the each component part of the car operates correctly.

V-3. INSPECTION & REPAIRING

V-3-1. REFRIGERATION SYSTEM

1. CHECKING OF REFRIGERANT CHARGE

The following procedure can be used to quickly determine whether or not the air conditioning system has a proper charge of refrigerant.

Run the engine at fast idle, and operate the air conditioner at maximum cooling for a few minutes. Then check the amount of refrigerant by observing the sight glass on the receiver.

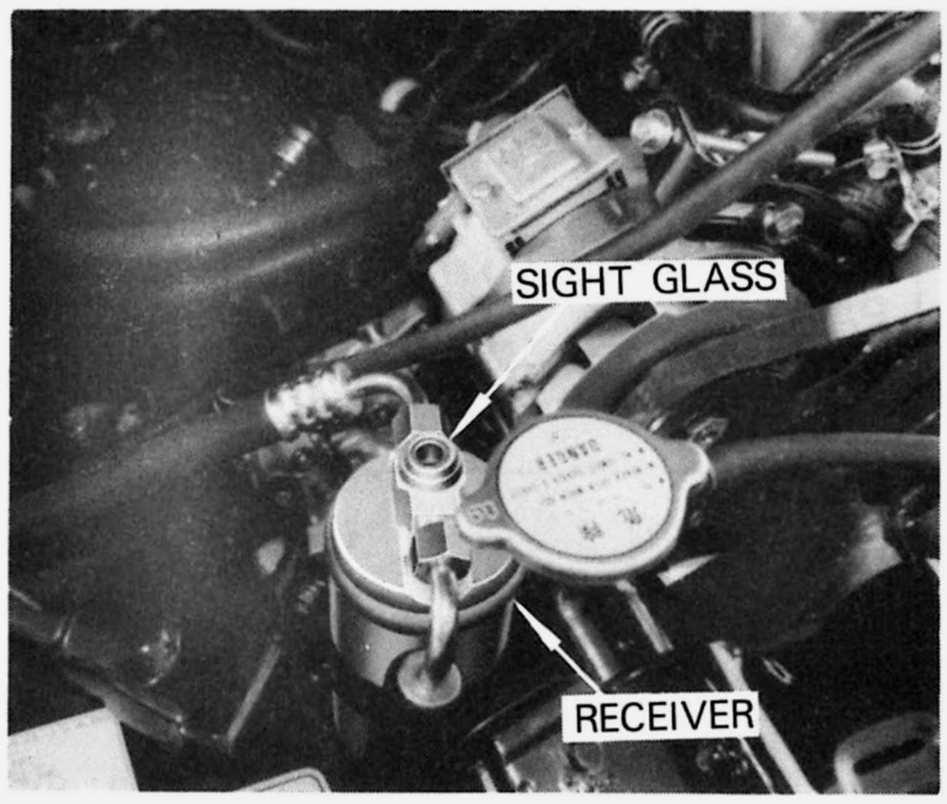


Fig. V-1

Procedure to Check Refrigerant Charge:

Item	Symptom	Amount of Refrigerant	Indication
1	Bubbles present in sight glass.	Insufficient refrigerant in the system.	Check for leak with gas leak tester.
2	No bubbles present in sight grass.	No or sufficient refrigerant in the system.	Refer to Item 3 and 4.
3	No temperature difference between compressor inlet and outlet.	System is empty or nearly empty.	Evacuate and charge system, then check for leak with gas leak tester.
4	Temperature between compressor inlet and outlet is noticeably different.	Proper or too much refrigerant in the system.	Refer to Item 5 and 6.
5	Immediately after the air conditioner is turned off, refrigerant in sight glass remains clear.	Too much refrigerant in the system.	Discharge the excess refrigerant to specified amount.

Item	Symptom	Amount of Refrigerant	Indication
6	When the air conditioner is turned off, refrigerant foams and then remains clear.	Proper amount of refrigerant in the system.	Refrigerant amount is normal.

Discharging of the Air Conditioning System

1. Disconnect center hose of the manifold gauge set from refrigerant container and place the free end in a shop towel.
2. Slowly open the high side manifold hand valve and adjust valve for refrigerant flow from center hose only. Do not open valve too wide. Check shop towel to make certain that no oil is being discharged with refrigerant. If oil is present in shop towel, partially close hand valve to lessen flow of refrigerant.

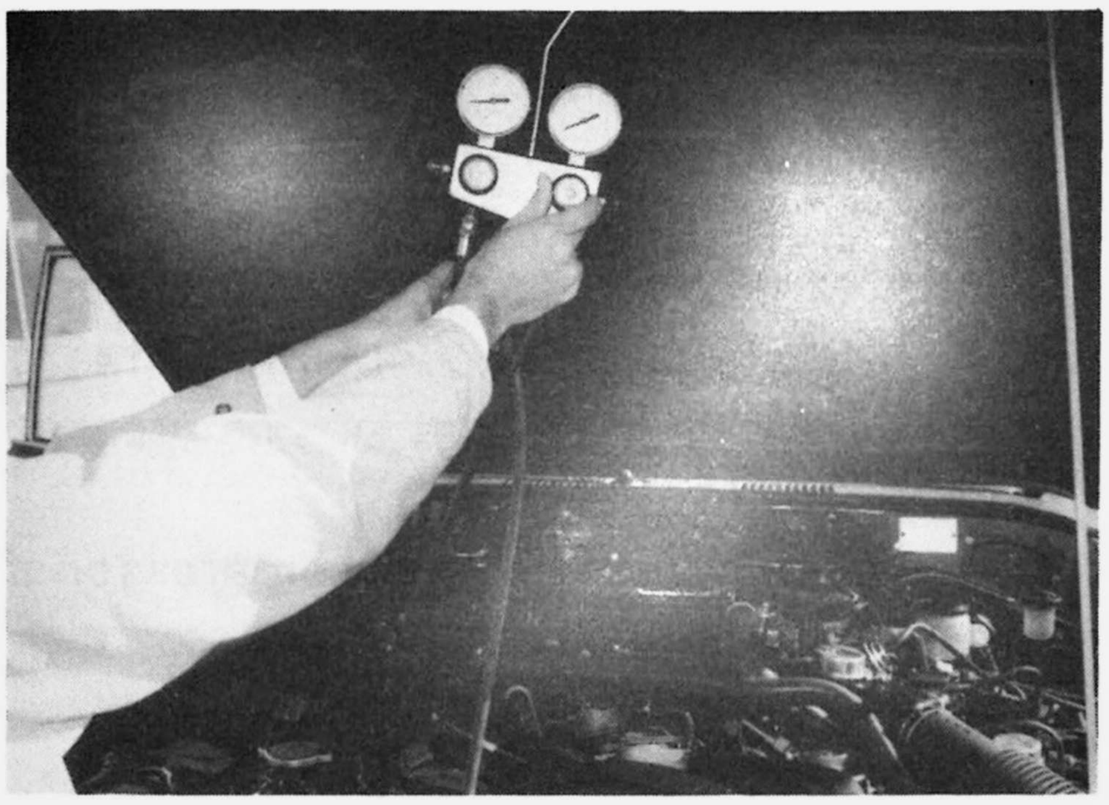


Fig. V-2

CAUTION: *If refrigerant is allowed to escape too fast, compressor oil will be drawn out of system.*

3. After manifold gauge reading has dropped below 50 psi, slowly open the low side hand valve to discharge both high and low sides of system.
4. Note gauge readings and, as system pressure drops, gradualy open both high and low side hand valves fully until both gauges indicate 0 psi.

2. COMPRESSOR

A) Inspection before removal

1) Close both hand valves (''LO'' and ''HI'') on the manifold gauge set, and connect red charging hose (discharge side) to the discharge service valve of the compressor and blue charging hose (suction side) to the suction service valve of the compressor. See Fig. V-3.

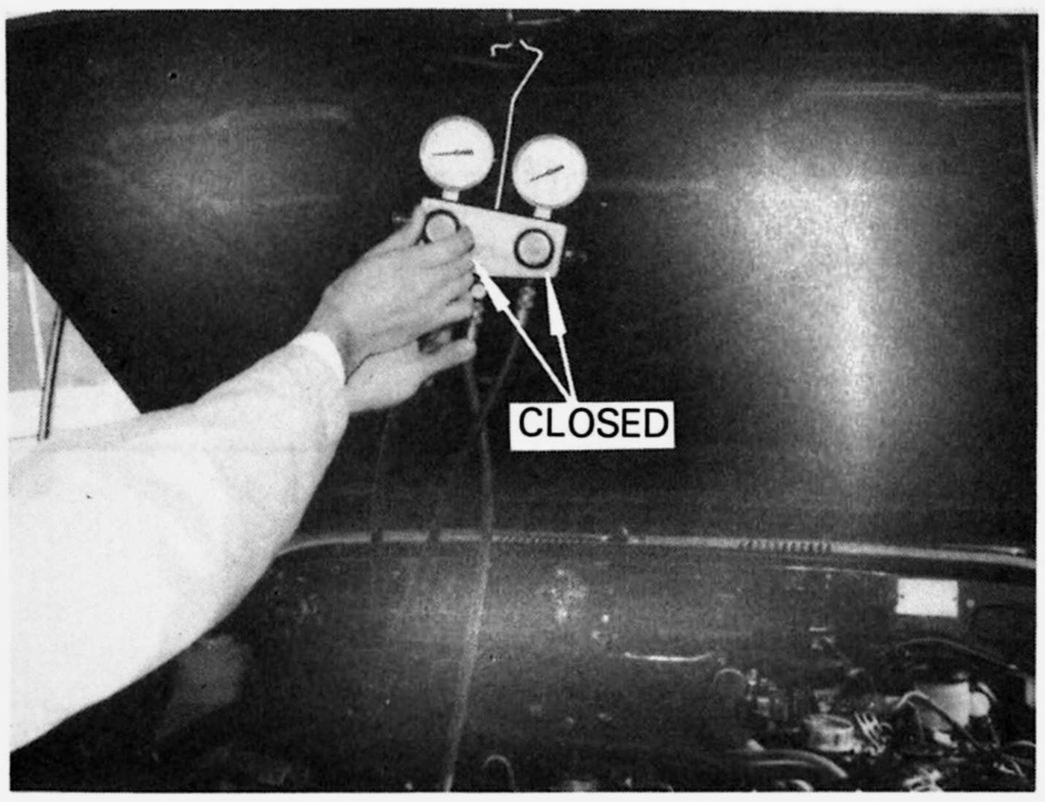


Fig. V-3

2. Run the compressor at fast idle, and check the following items.

Check if ;

a) high pressure gauge reading is low and low pressure gauge reading is higher than normal.
b) a metallic sound is heard from the compressor.
c) leakage is evident around the compressor shaft seal.
(A slight amount of compressor leakage from the front seal is considered normal.)

Repair or replace the compressor if necessary.

B) Removal

1) Run the engine at idling speed and operate the air conditioner for more than 10 minutes, before removing compressor.
2) Disconnect the battery nagative terminal.
3) Disconnect the clutch stator lead wire from the air conditioner wire harness.
4) Discharge the refrigerant very slowly from the refrigeration system.
(Refer to ''DISCHARGE PROCEDURE'' on page 43.)
5) Disconnect the suction and discharge flexible hoses from the compressor service valve.

Note: *Cap the open fittings immediately to keep the moisture out of the system.*

6) Loosen the compressor drive belt, then remove compressor mounting bolts.
7) Remove the compressor w/clutch assy from the mounts.
8) Remove the magnetic clutch from the compressor.
(Refer to ''AIR CONDITIONING COMPRESSOR REPAIR MANUAL''.)

C) Inspection and Repairing

(Refer to ''AIRCONDITIONING COMPRESSOR REPAIR MANUAL''.)

D) Installation

1) Follow the removal procedures in reverse order.

Note: *1) Adjust the compressor drive belt as specified.*
(Refer to ``1. DRIVE BELTS'' on page 63.)
2) Check the refrigeration oil before installing compressor.
(Refer to ``CHEKING THE REFRIGERATION OIL'' on page 65.)

3. CONDENSER

A) Inspection

Check ;

a) the condenser fins for blockage.

b) the condenser fittings for leakage.

c) the condenser fins for damage.

Clogged condenser fins should be washed with water and dryed with compressed air.

Note: *Be careful not to damage the condenser fins.*

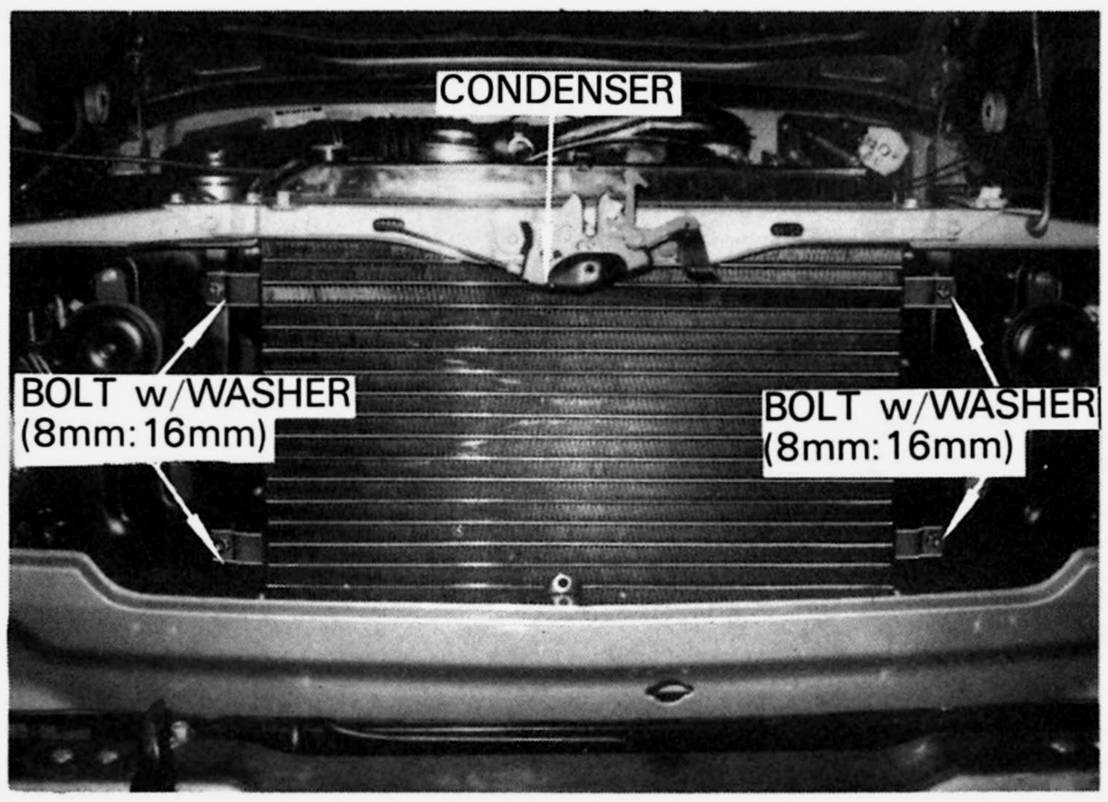


Fig. V-4

If the condenser fins are bent, straighten them using a screwdriver or plier.
If leakage from the fitting or the tube is found, repair or replace the condenser.

B) Removal

1) Discharge the refrigerant very slowly from system.
(Refer to "DISCHARGE PROCEDURE" on page 45.)
2) Remove the front grille.
3) Disconnect the discharge tube and the discharge flexible hose from the condenser inlet and outlet fittings.
See Fig. V-5, V-6.

Note: *Cap the open fittings immeditely to keep the moisture out of the system.*

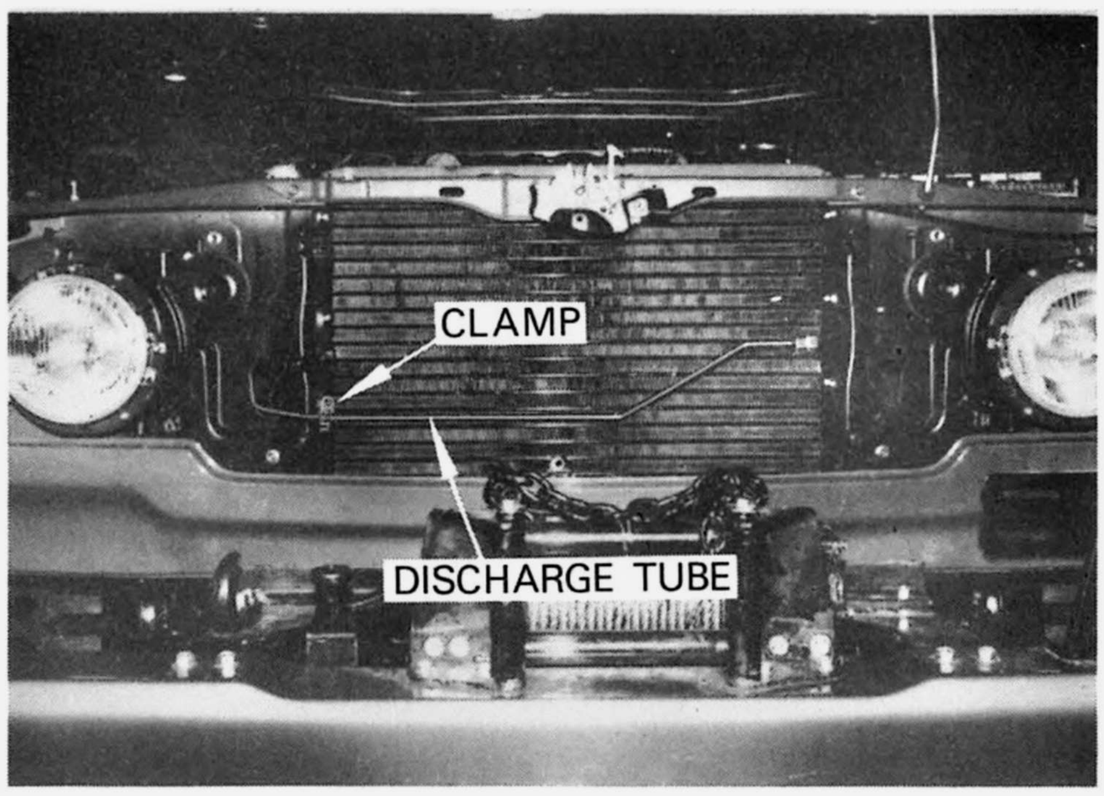


Fig. V-5

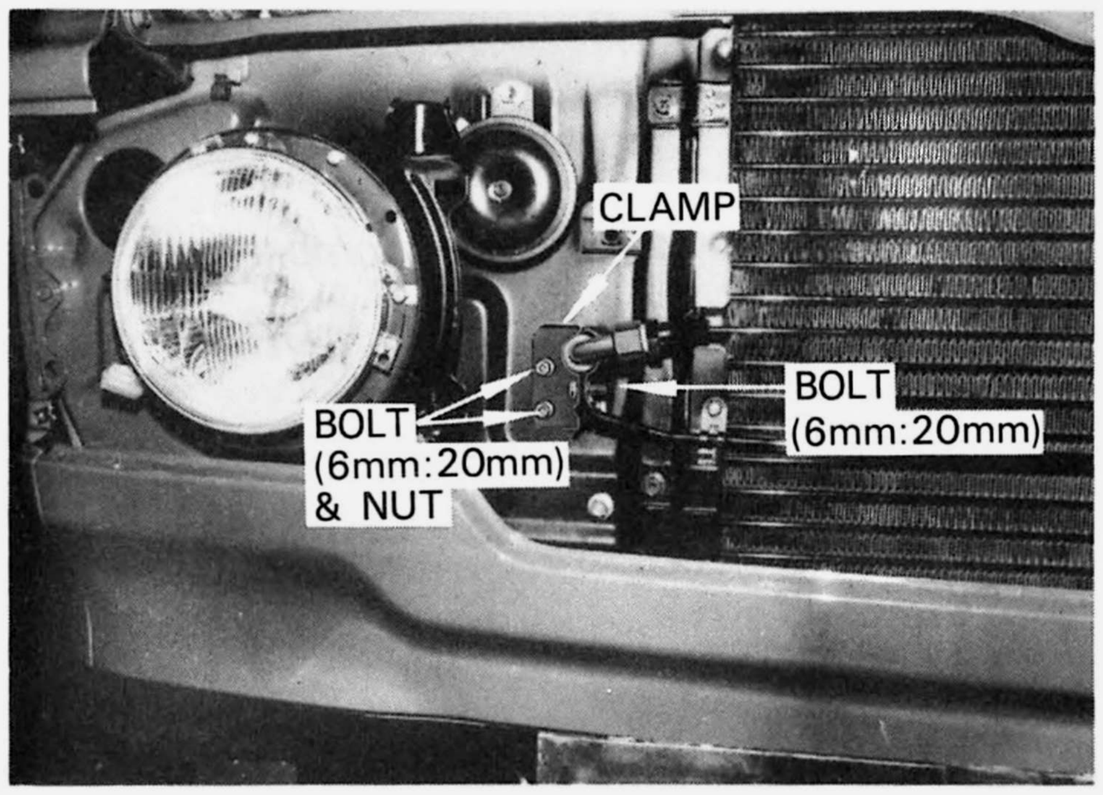


Fig. V-6

4) Unscrew four bolts, and remove the condenser.

C) Installation

1) Follow the removal procedure in reverse order.

Note: *Add refrigeration oil 40 — 50 cc (1.4 — 1.7 oz) into the compressor when the condenser is replaced with new one.*

2) Charge the system and carry out the performance test.
(Refer to "FINISH" on page 65.)

4. RECEIVER

A) Inspection

a) Check the sight-glass, fusible plug and fittings for gas leakage using the gas leak tester.

B) Removal

1) Discharge the refrigerant very slowly from the refrigeration system.
(Refer to "DISCHARGE PROCEDURE" on page 43.)

2) Disconnect the liquid line tubes from the receiver inlet and outlet fittings.

Note: *Cap the open fittings immediately to keep moisture out of the system.*

3) Remove the receiver from the receiver holder.

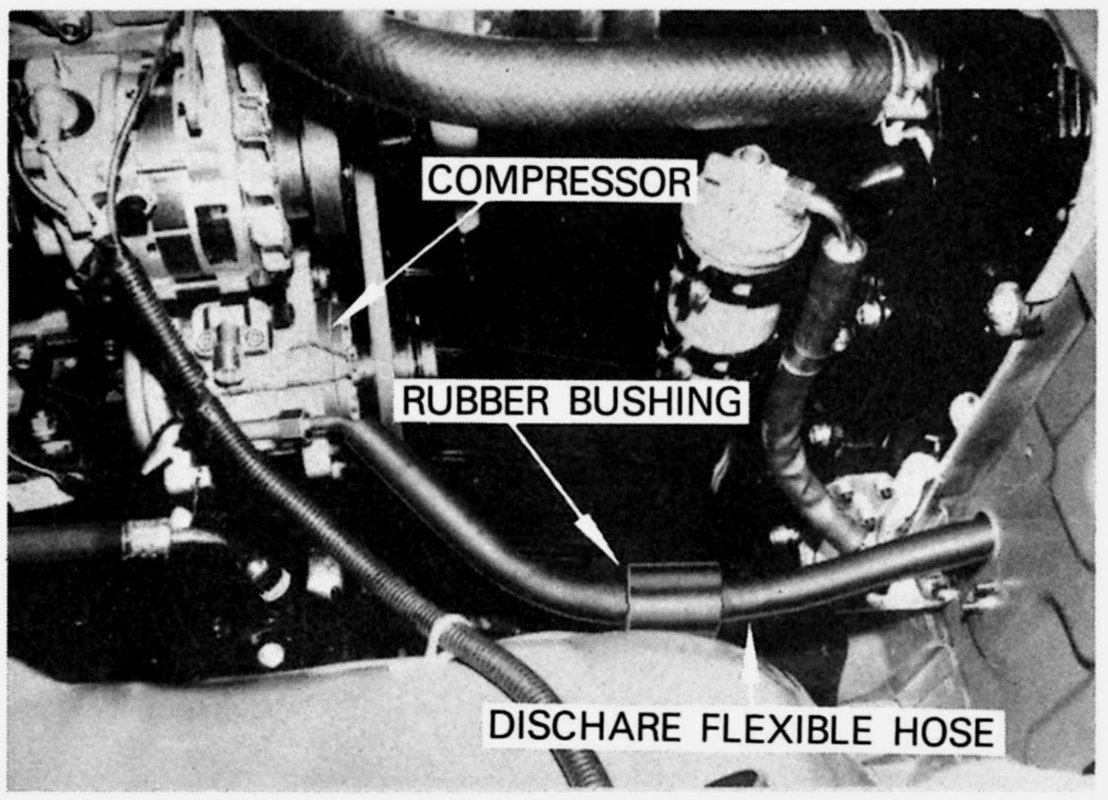


Fig. V-7

C) Installation

1) Follow the removal procedures in reverse order.

Note: *1) Ade refrigeration oil 10 cc (0.4 oz) into the compressor when the receiver is replaced with new one.*
2) Do not remove the blind plugs of the receiver until ready for connection.

2) Charge the system and carry out the performance test.
(Refer to "VII. FINISH" on page 65.)

5. EVAPORATOR (COOLING UNIT)

A) Removal of cooling unit

(1) Disconnect the battery negative terminal.

(2) Discharge the refrigerant very slowly from the system.
(Refer to "DISCHARGE PROCEDURE" on page 43.)

(3) Disconnect the suction flexible hose and the liquid line hose from the inlet and outlet fittings of the cooling unit. See Fig. VII-8.

Note: *Cap open fittings immediately to keep moisture out of the system.*

4) Remove the grommets from the inlet and outlet fittings of the cooling unit. See Fig. V-8.

5) Remove the under tray and the glove box assy and the assistant side air duct.

6) Unscrew two nuts and bolt, and remove the cooling unit. See Fig. V-10.

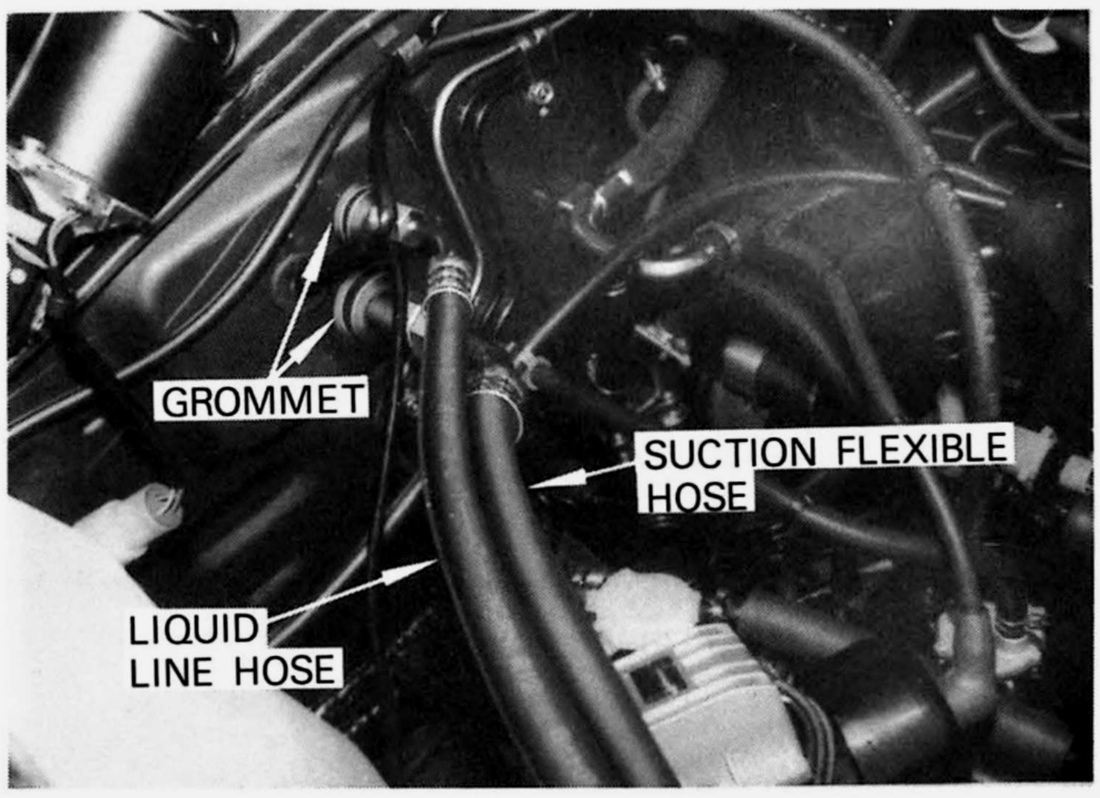


Fig. V-8

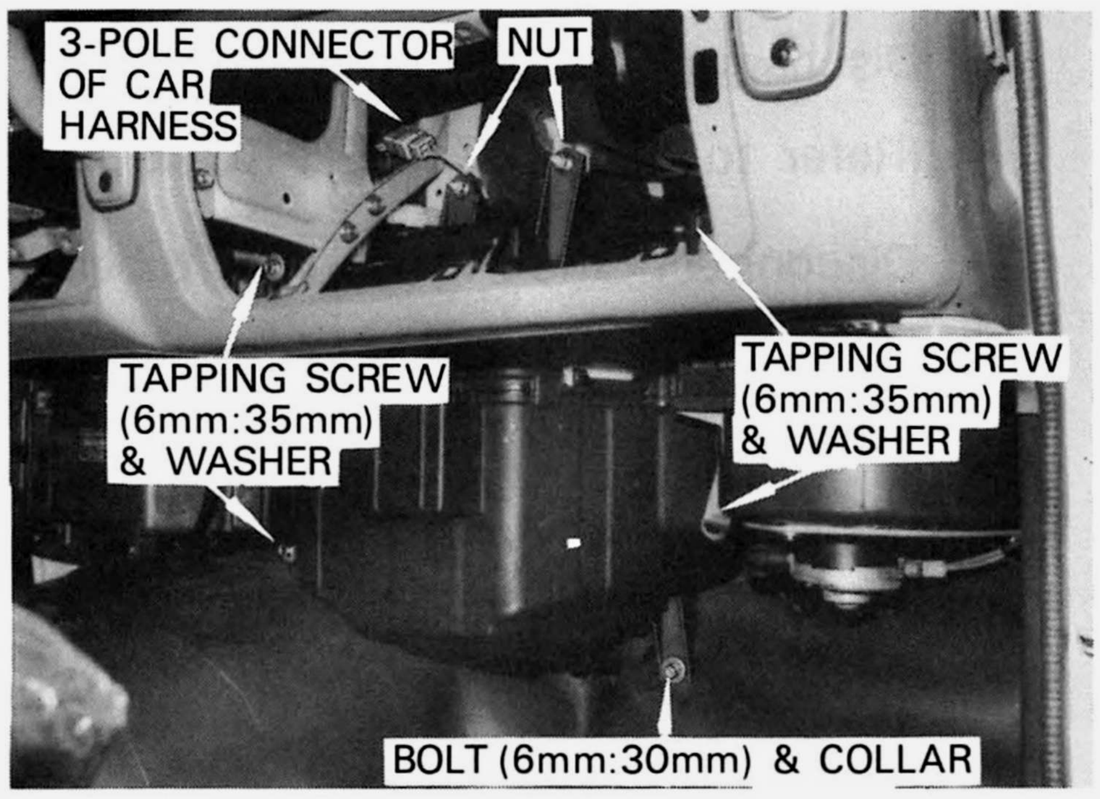


Fig. V-9

B) Disassembly of cooling unit

1) Remove the amplifier from the case. See Fig. V-10 and Fig. V-11.

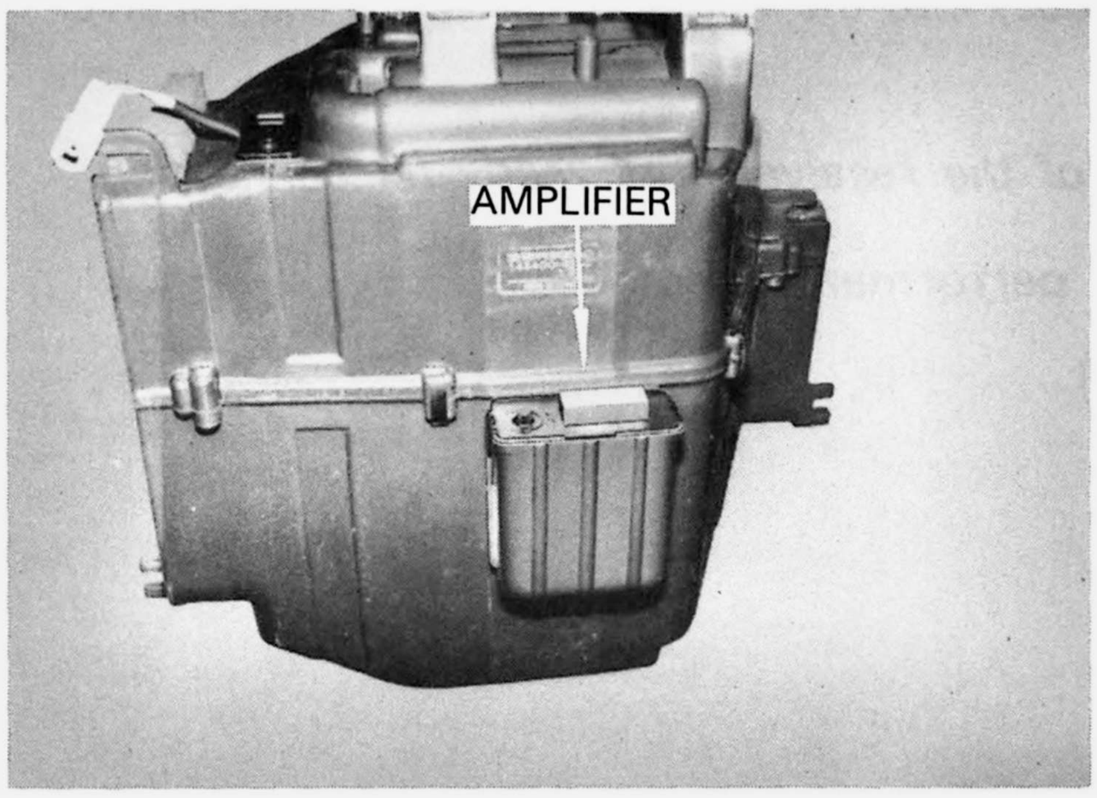


Fig. V-10

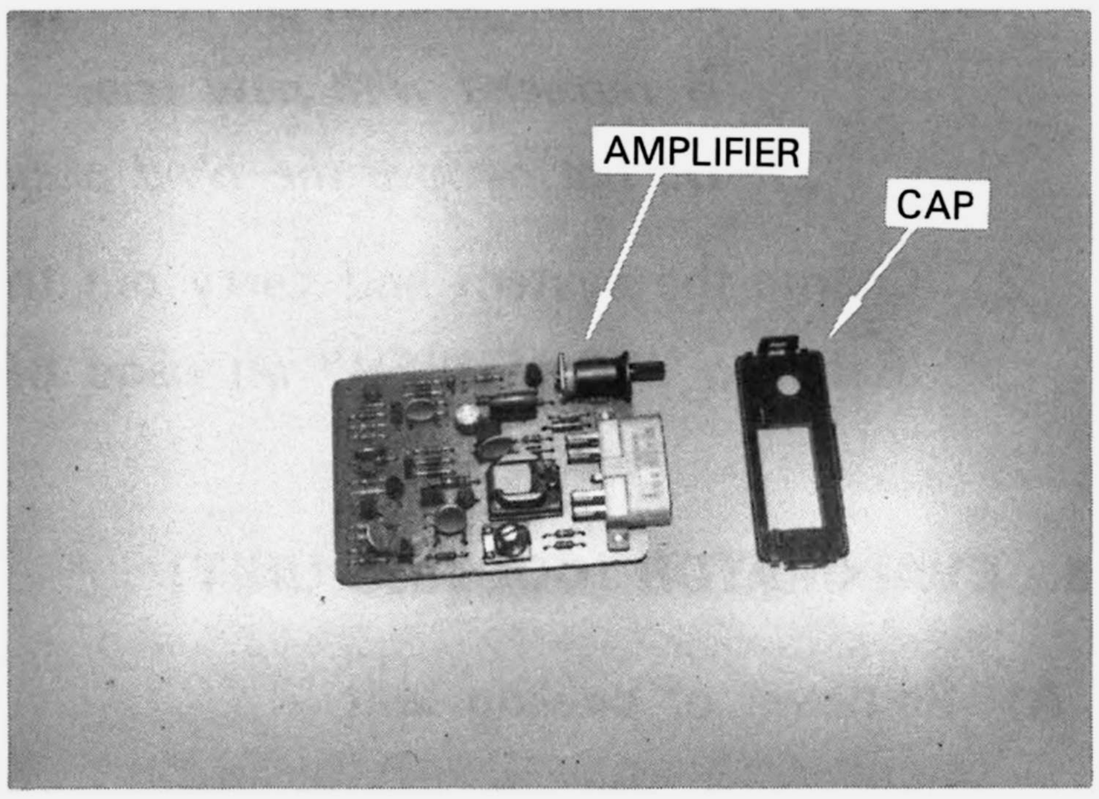


Fig. V-11

2) Unscrew the tapping screw, and remove the thermistor and the cover. See Fig. V-12.

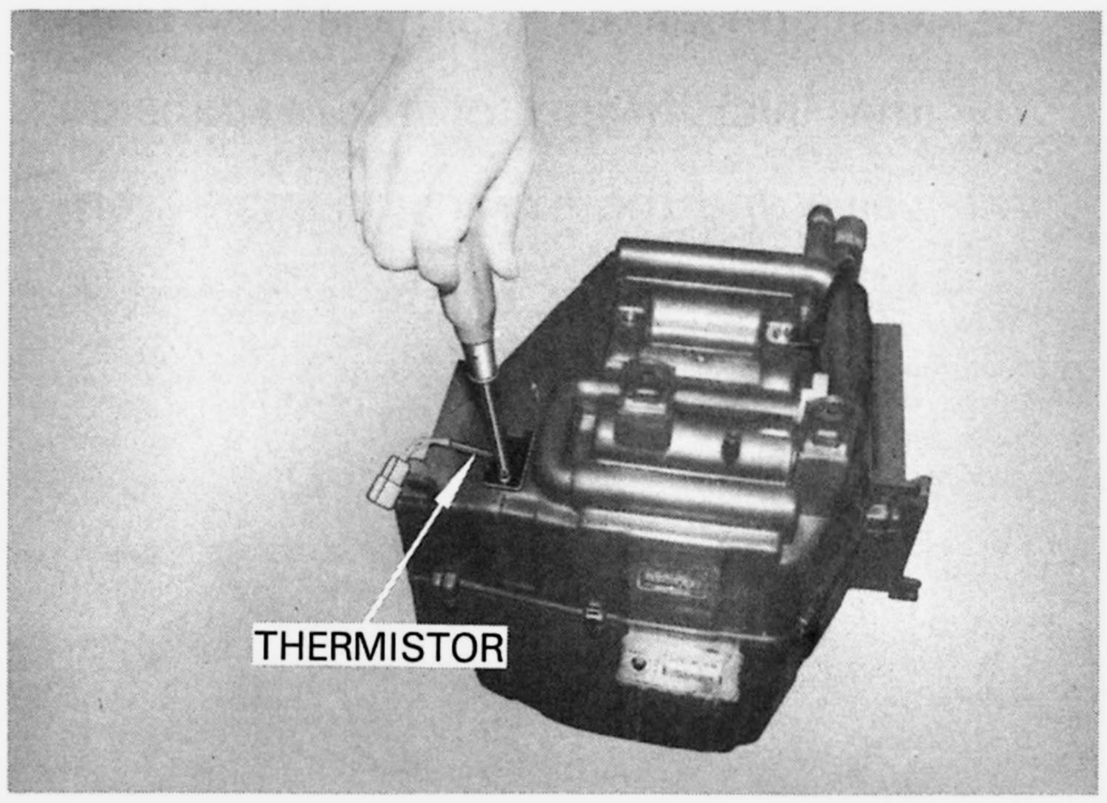


Fig. V-12

3) Remove clips using screw driver, and remove the lower case. See Fig. V-13.

4) Remove the upper case from the evaporator.

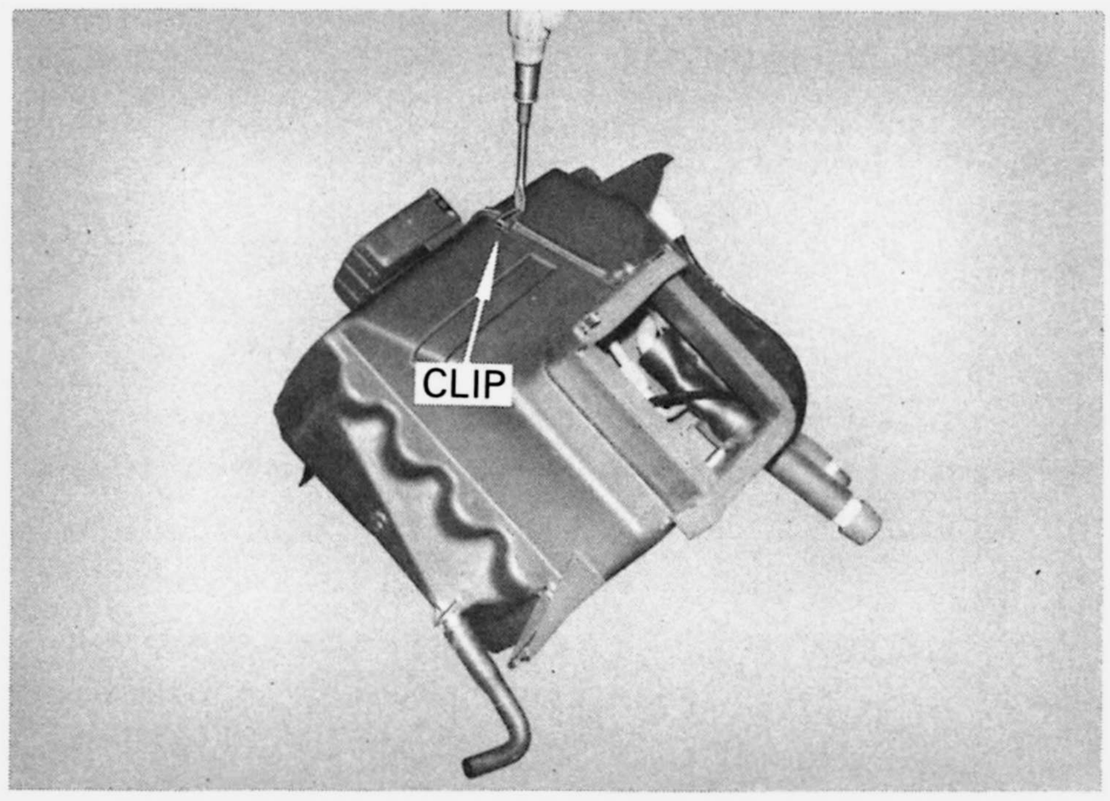


Fig. V-13

5) Remove the heat insulator and the clamp from the outlet tube of the evaporator.

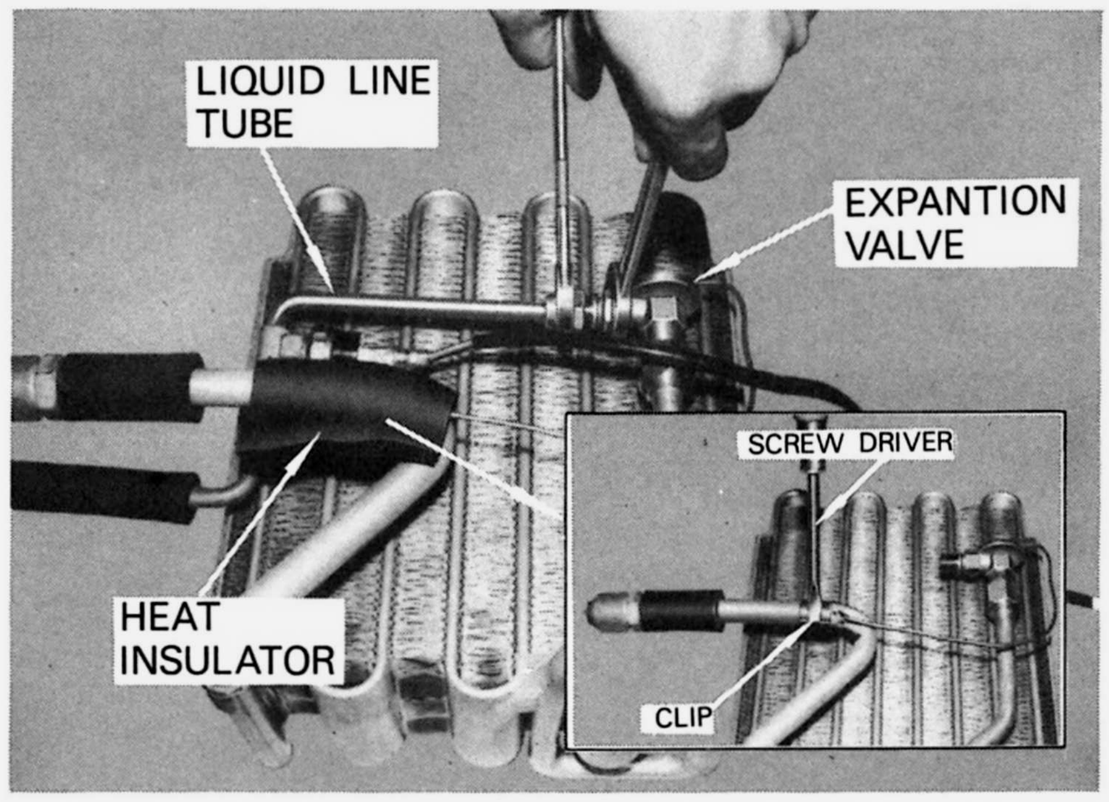


Fig. V-14

6) Disconnect the liquid line tube from the inlet fitting of the expansion valve and the expansion valve from the inlet fitting of the evaporator. See Fig. V-15.

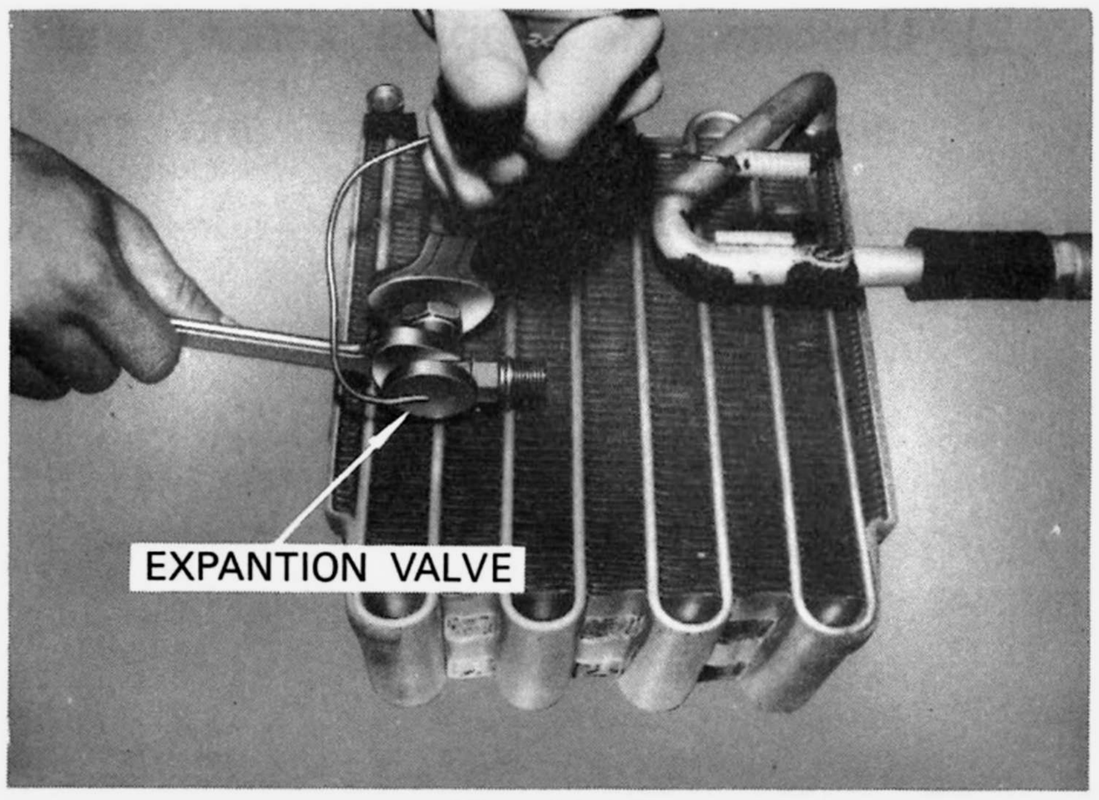


Fig. V-15

7) Remove the pressure switch from the liquid line tube using two wrenches for support. See Fig. V-16 and Fig. V-17.

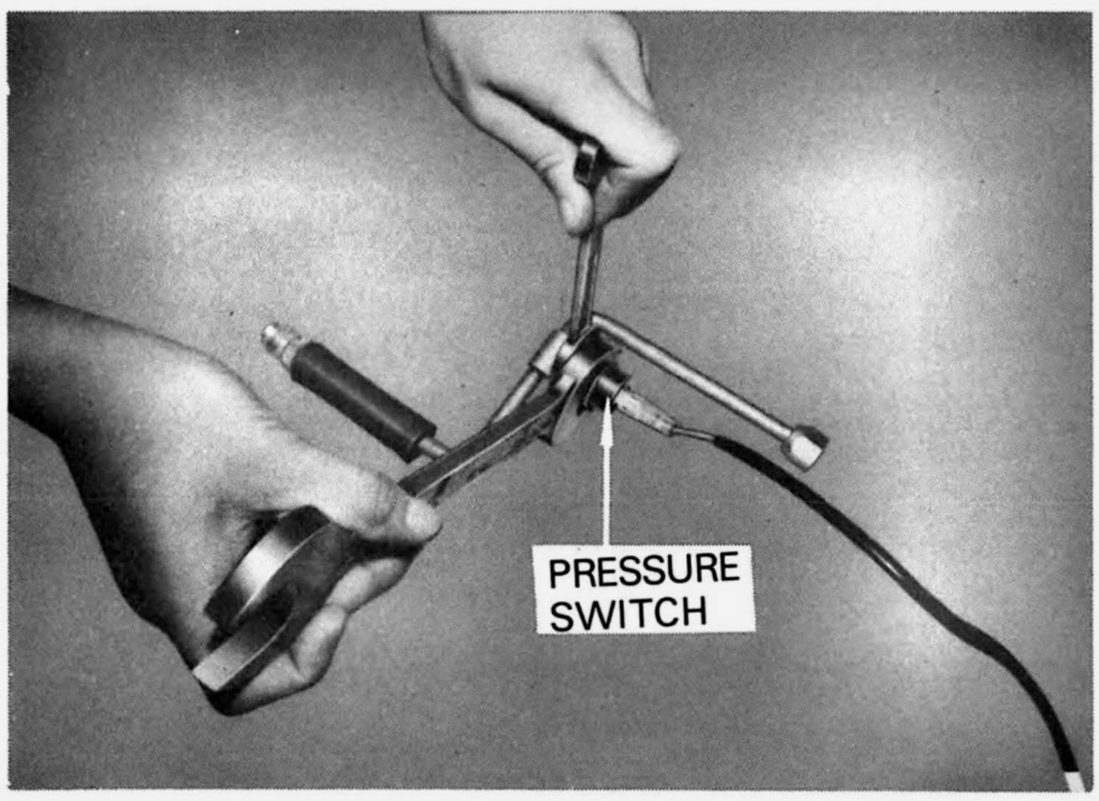


Fig. V-16

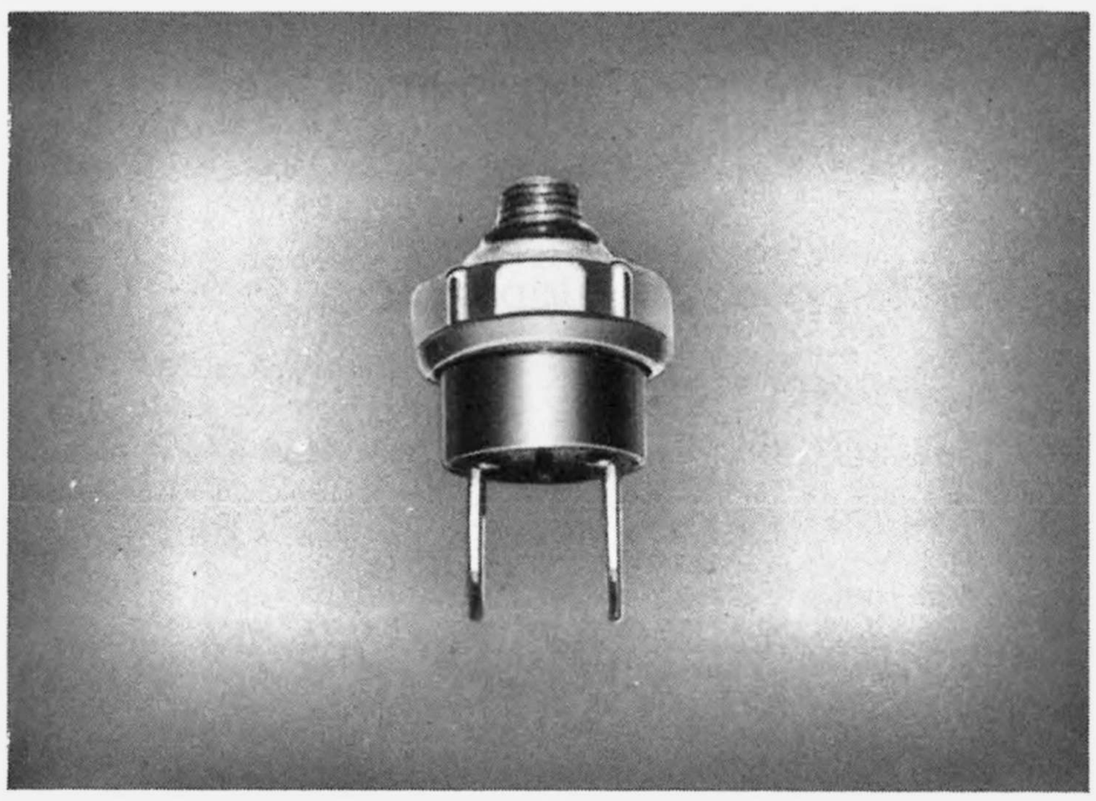


Fig. V-17

C) Inspection

a) Check if the evaporator fins are clogged.

b) Check fittings for cracks or scratches.

Clogged evaporator fins should be cleaned with compressed air.

Note: *Never use water.*

If the inlet or outlet fitting is damaged, repair or replace the evaporator.

D) Installation

1) Follow the removal procedures in reverse order.

Note: *1) When installing the evaporator unit, be careful not to pinch the wire harness.*

2) Add refrigeration oil 40 — 50 cc (1.4 — 1.7 oz) into the compressor when the eveporator is replaced with new one.

3) When installing the expansion valve and the liquid line tube, tighten the nut to the standard torque. ***See Fig. V-18 & Fig. V-19.***

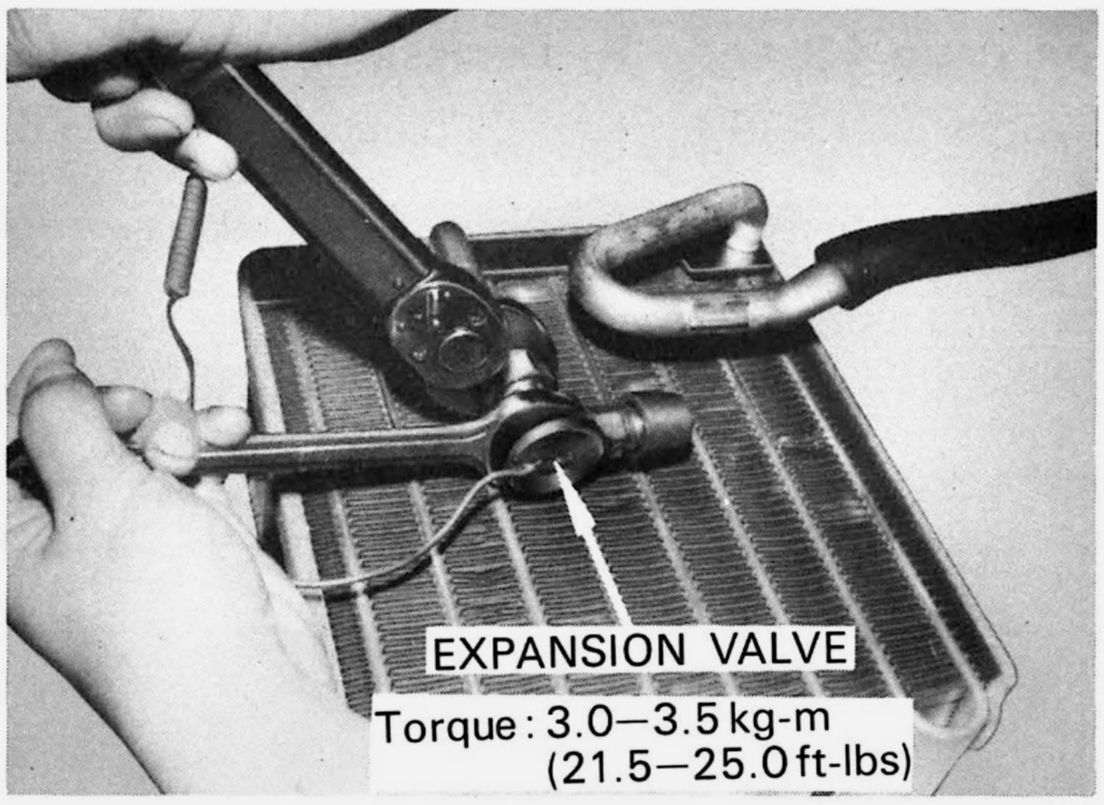


Fig. V-18

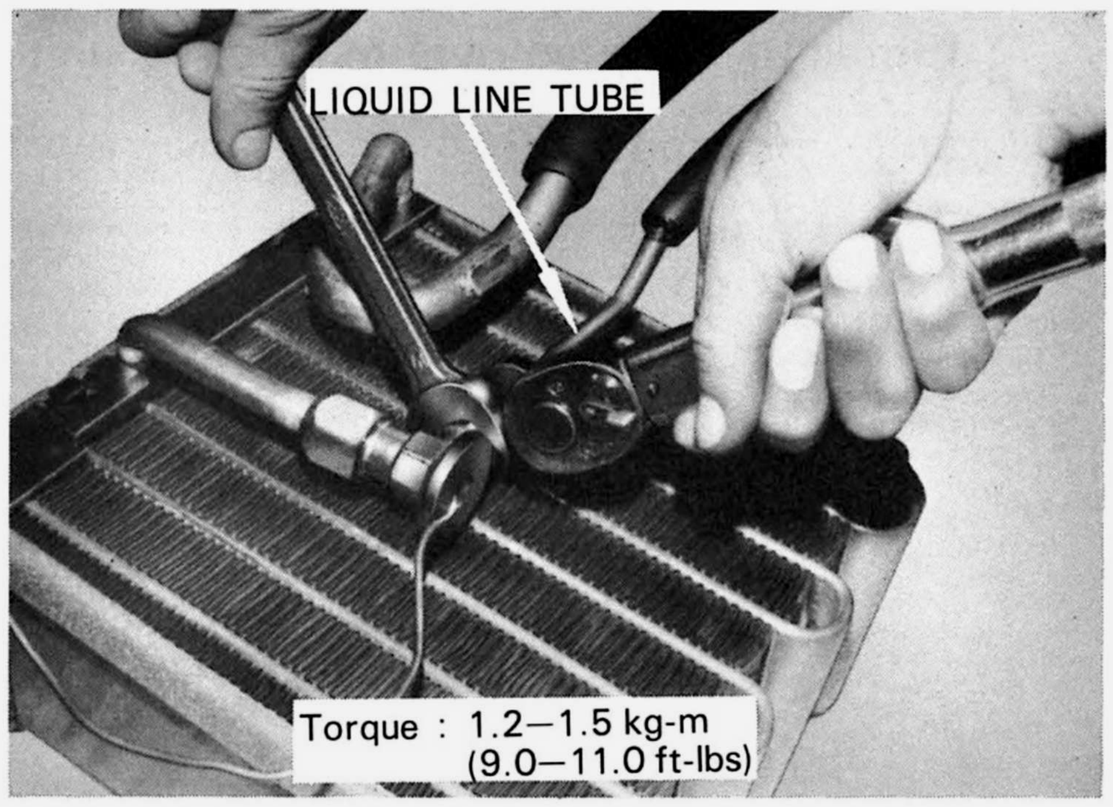


Fig. V-19

2) Charge the system and carry out the pefformance test.

(Refer to "VI. FINISH" on page 65.)

6. EXPANSION VALVE

A) Inspection before removal

1) Connect the manifold gauge set to the compressor.

2) Run the compressor at fast idle, and check the low pressure gauge reading.

a) When the low pressure gauge reads too low (below 0.5 kg/cm²), it is caused by moisture freezing on the spray hole of the expansion valve or by gas leakage from the remote bulb.
If so, check and replace the expansion valve and the receiver/dryer.

b) When the low pressure gauge reads too high (above 5.0 kg/cm²), it is caused by the spray hole of the expansion valve being opened too wide and is due to a loose remote bulb holders or a defective expansion valve.
If so, retighten or replace the remote bulb holders and/or expansion valve.

B) Removal

(Refer to "A) Removal of cooling unit" on page 43 and "B) Disassembly of cooling unit" on page 49.)

C) Inspection

1) Connect the manifold gauge set to the expansion valve and refrigerant container with the charging hoses as shown in Fig. V-20.

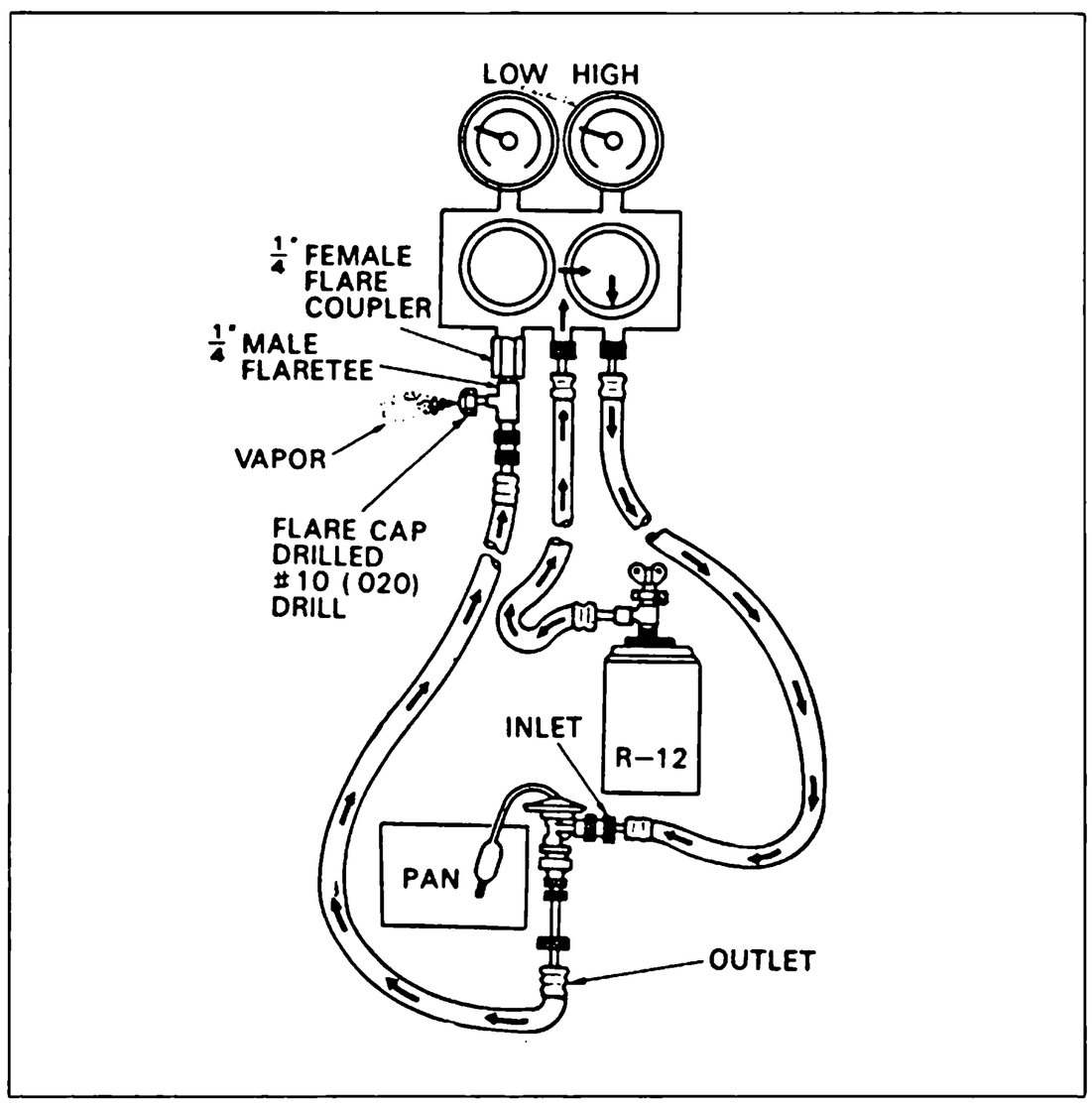


Fig. V-20

2) Dip the remote bulb of the expansion valve in a pan filled with various temperature water.

3) Keep both hand valves of refrigerant charging gauge closed.

4) Pierce the refrigerant container to release the pressure.

5) Open the high pressure hand valve and adjust the high side pressure to approximately 70 psi (5 Kg/cm²).

6) Read the low pressure gauge and at the same time measure the water temperature using a thermometer.

7) Compare the two readings on the following chart.
See Fig. V-21.
If the crossing point is between the two lines, the expansion valve is normal.
If not, replace.

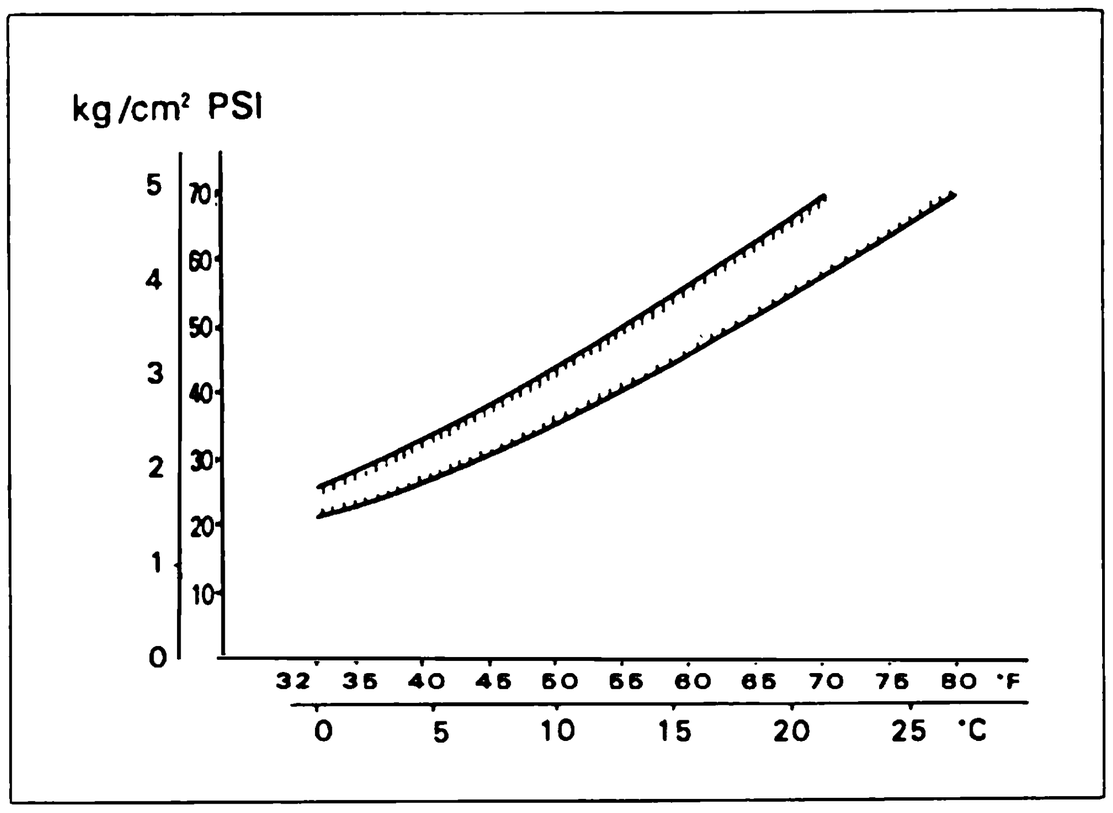


Fig. V-21

D) Installation

1) Follow the removal procedures in reverse order.

2) Charge the system and carry out the performance test.
(Refer to "VI. FINISH" on page 65.)

7. REFRIGERANT LINE

A) Inspection

a) Inspect the hoses and tubes for gas leakage using the gas leak tester.

b) Check the hose and tube clamps for looseness.
If defective, retighten or replace.

B) Removal

1) Discharge the refrigerant very slowly from the system.
(Refer to "DISCHARGE PROCEDURE" on page 43.)

2) Replace the defective tube or hose.

Note: *Cap the open fittings immediately to keep moisture out of the system.*

C) Installation

1) Follow the removal procedures in reverse order.

2) Charge the air conditioning system.
(Refer to "VI FINISH" on page 66.)

V-3-2. ELECTRICAL CIRCUIT

1. FUSE

A) Inspection

a) Check the "HEATER-A/C" fuse in the fuse box.

If the fuses are blown, check and repair the air conditioner wire harness or the faulty electrical part, then replace the blown fuse.

2. MAGNETIC CLUTCH

A) Inspection before removal

a) Inspect the pressure plate surface and the rotor for wear and oil soaked condition.

b) Check the clutch bearings for wear, noise and leakage of the grease.

c) Measure the resistance of the stator coil using a circuit tester. See Fig. V-22.

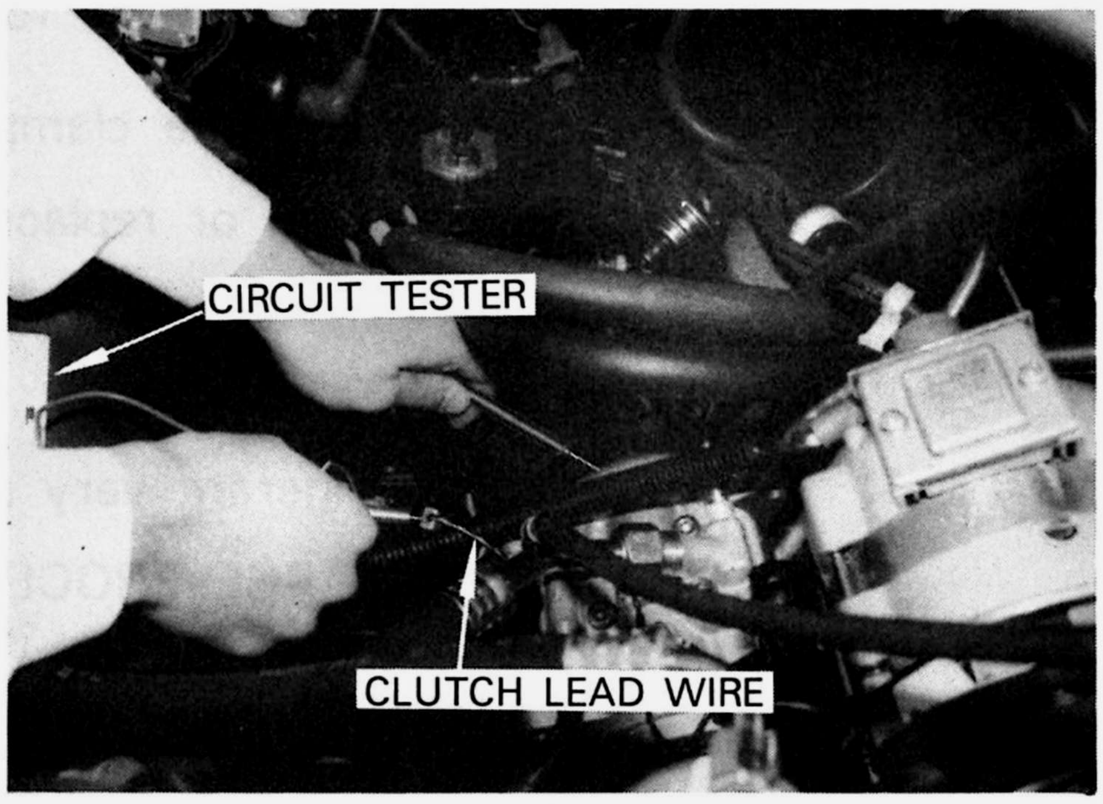


Fig. V-22

Standard resistance at 20°C (68°F): CLUTCH of 6P80 ·····2.9 ± 0.2Ω

Reading of less than specified range indicates shorted field coil.

Reading of infinity (∞) indicates open field coil.

If not within limits, replace.

B) Removal, Repairing and Installation

(Refer to "AIRCONDITIONING COMPRESSOR REPAIR MANUAL.)

3. A/C SWITCH

A) Inspection before removal

1) Disconnect the 3-pole connector of A/C switch.

2) Check the continuity between following terminals of the A/C switch.

TERMINAL / SWITCH POSITION	YL	WB	LO
OFF	○—○		
ON	○—○	○—○	

If defective, replace it.

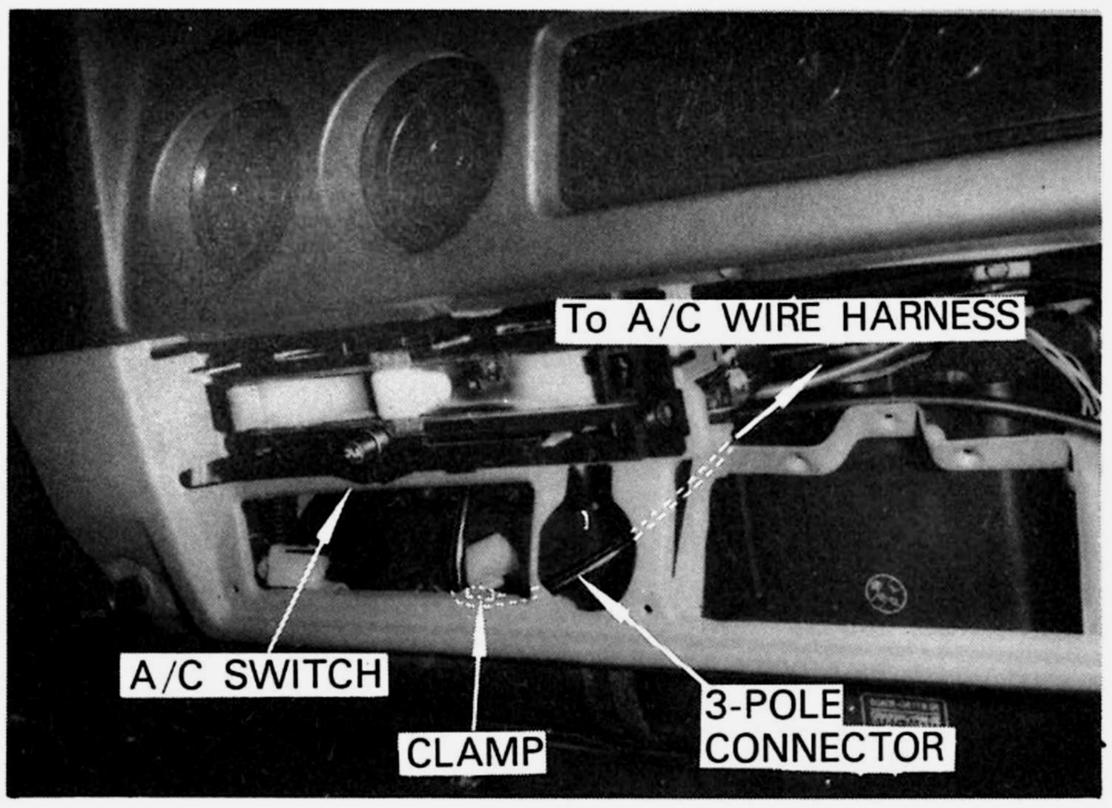


Fig. V-23

B) Removal

1) Disconnect the battery negative terminal.
2) Remove the indicator panel and plastic cover.
3) Disconnect the 3-pole connector of A/C switch.
4) Remove screw and the A/C switch.

C) Installation

1) Follow the removal procedures in reverse order.

4. THERMISTOR

A) Removal

1) Disconnect the battery negative terminal.

2) Remove the glove box and disconnect the 2-pole connector.

3) Unscrew the screw, and remove the thermistor from the cooling unit. See Fig. V-24.

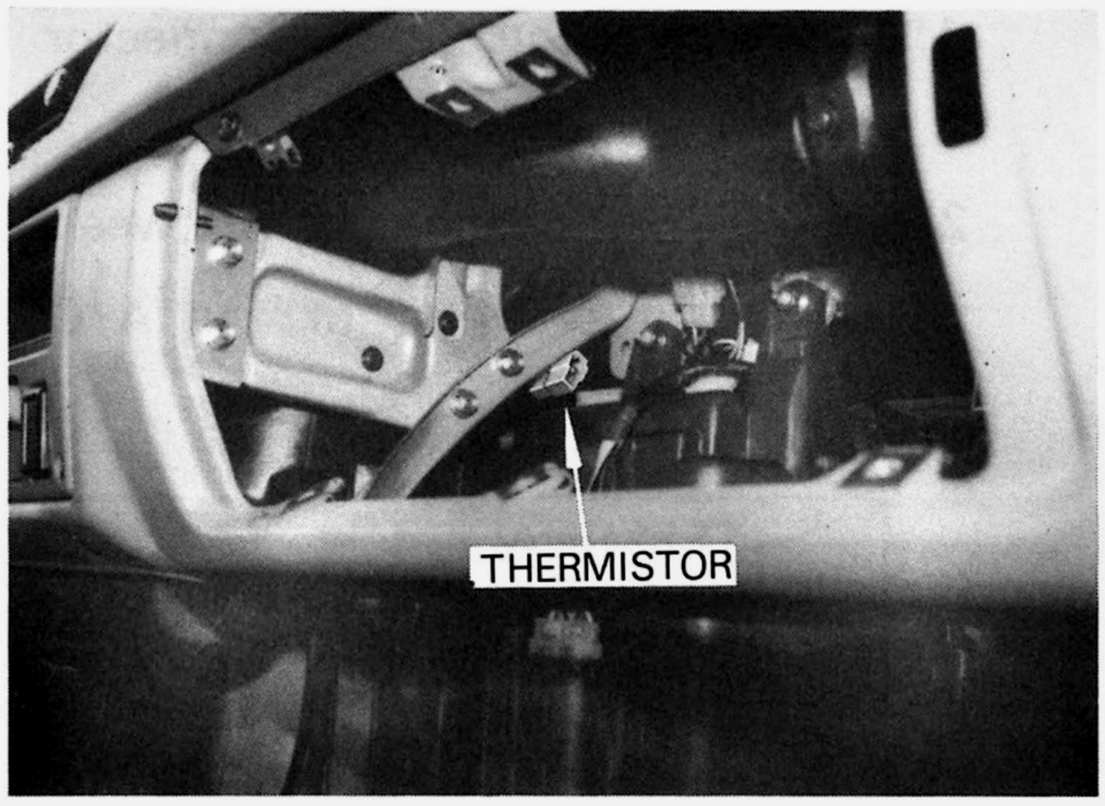


Fig. V-24

B) Inspection

1) Put the thermistor into the cold water and measure the resistance of thermistor using the circuit tester and the water temperature using thermometer. See Fig. V-25.

2) Relate two readings (resistance and temperature) on the chart in Fig. V-26. If the crossing point is out of area outlined by diagonal lines, replace it.

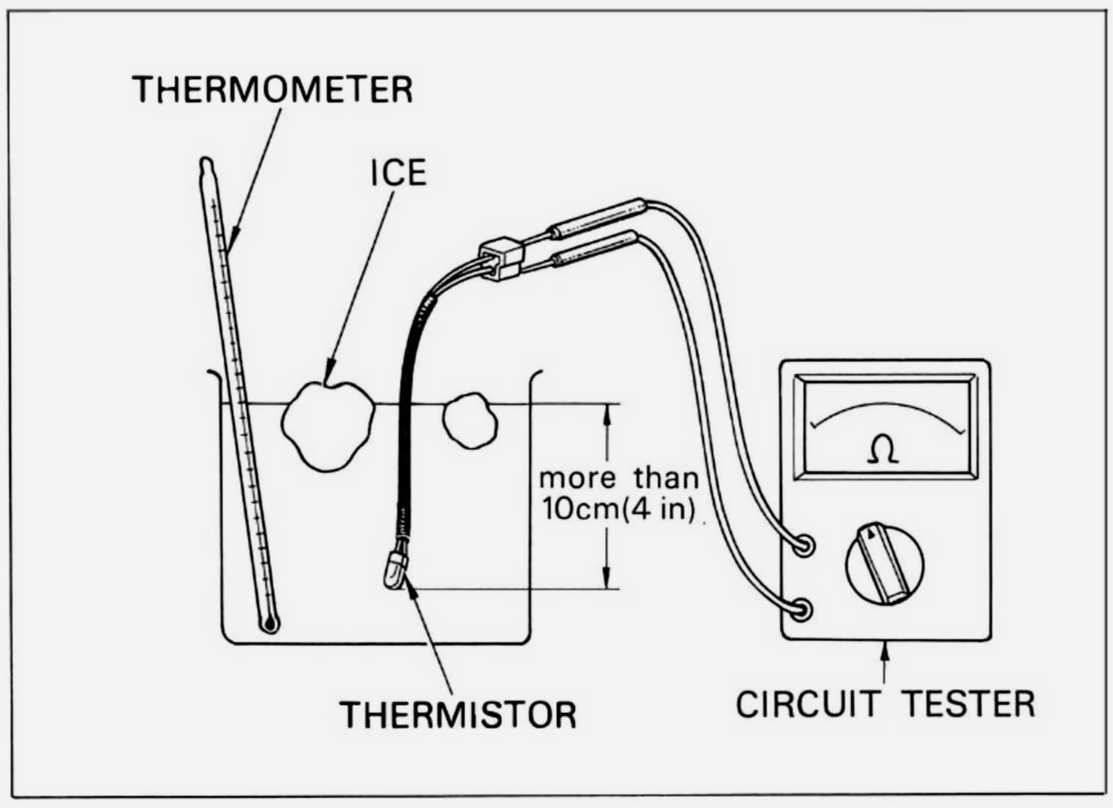


Fig. V-25

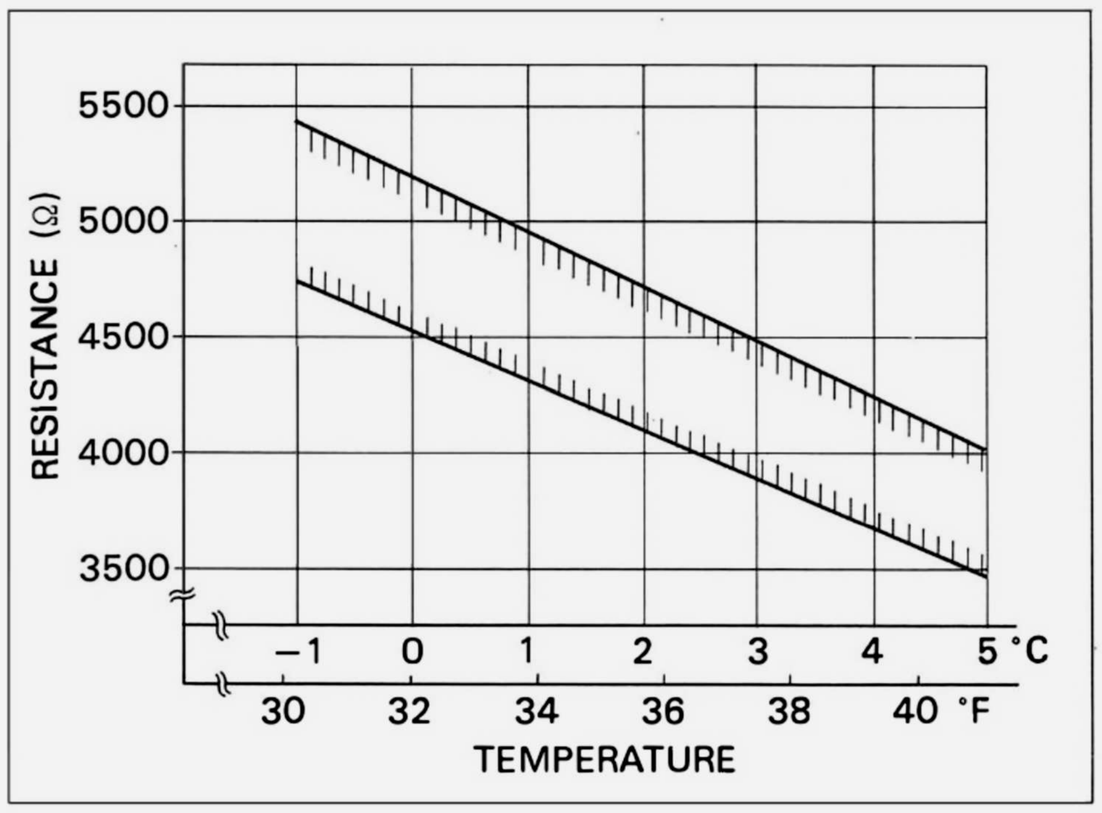


Fig. V-26

C) Installation

1) Follow the removal procedures in reverse order.

5. PRESSURE SWITCH

A) Inspection

1) Connect the hoses of the manifold gauge set to the compressor service valves as described in Section IV and observe the gauge reading.
   The gauge reading must be more than 2.11 kg/cm (30 psi) when the ambient temperature is higher than 0°C (32°F).

2) Remove the glove box.

3) Disconnect the pressure switch lead wires.

4) Check the continuity between the lead wires of pressure switch.
   See Fig. V-27.
   The circuit tester must indicate zero (0) ohm.
   If defective, replace it.

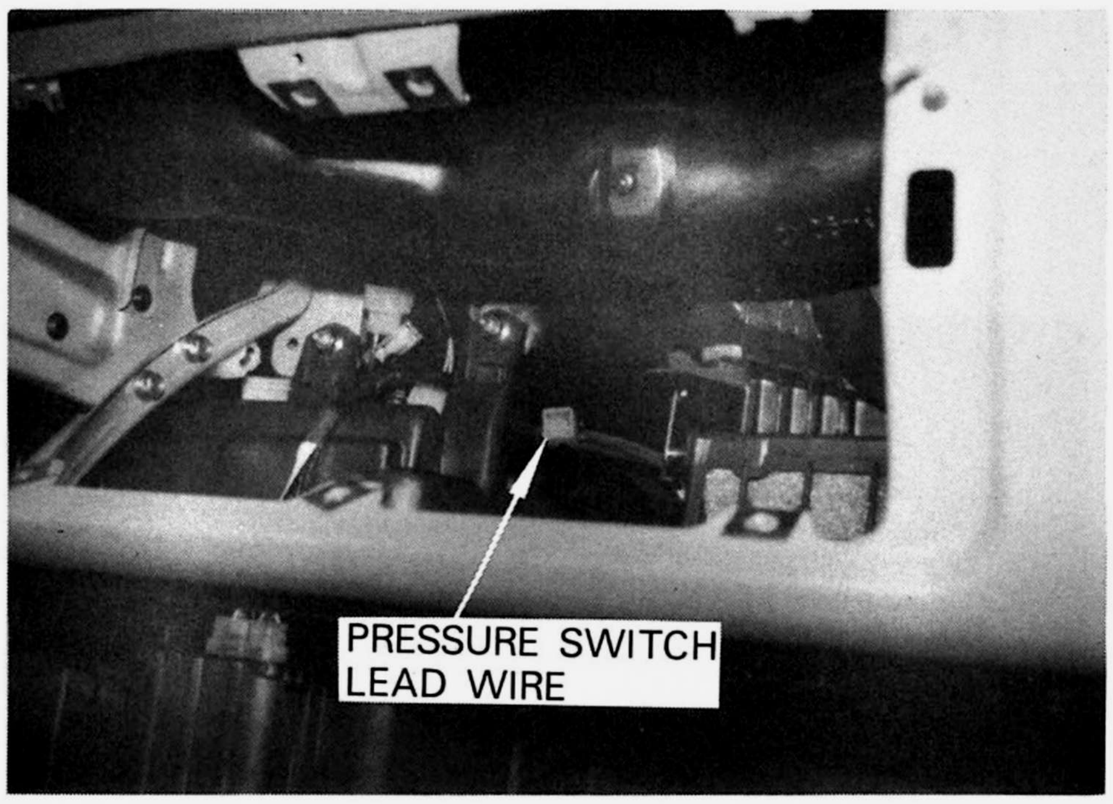


Fig. V-27

B) Removal

1) Disconnect the battery negative terminal.

2) Discharge the refrigerant very slowly from the system.
   (Refer to "DISCHARGE PROCEDURE" on page 43.)

3) Follow the cooling unit removal procedure on page 47.

C) Installation

1) Follow the removal procedure in reverse order.
   Fixing torque of pressure switch; 1.2 — 1.5 kg-m (9 — 11 ft-lbs)

2) Charge the system according to the "VI. FINISH" on page 65.

6. TEMP. CONTROL RESISTOR

(for TA, RA Series w/boost ventilator)

A) Inspection

1) Disconnect the battery negative terminal.
2) Remove the under tray and the glove box.
3) Disconnect the 2-pole connector of the temp. control resistor.
4) Measure the resistance of temp. control resistor.
   Standard resistance is shown in Fig. V-29.
   If defective, replace it.

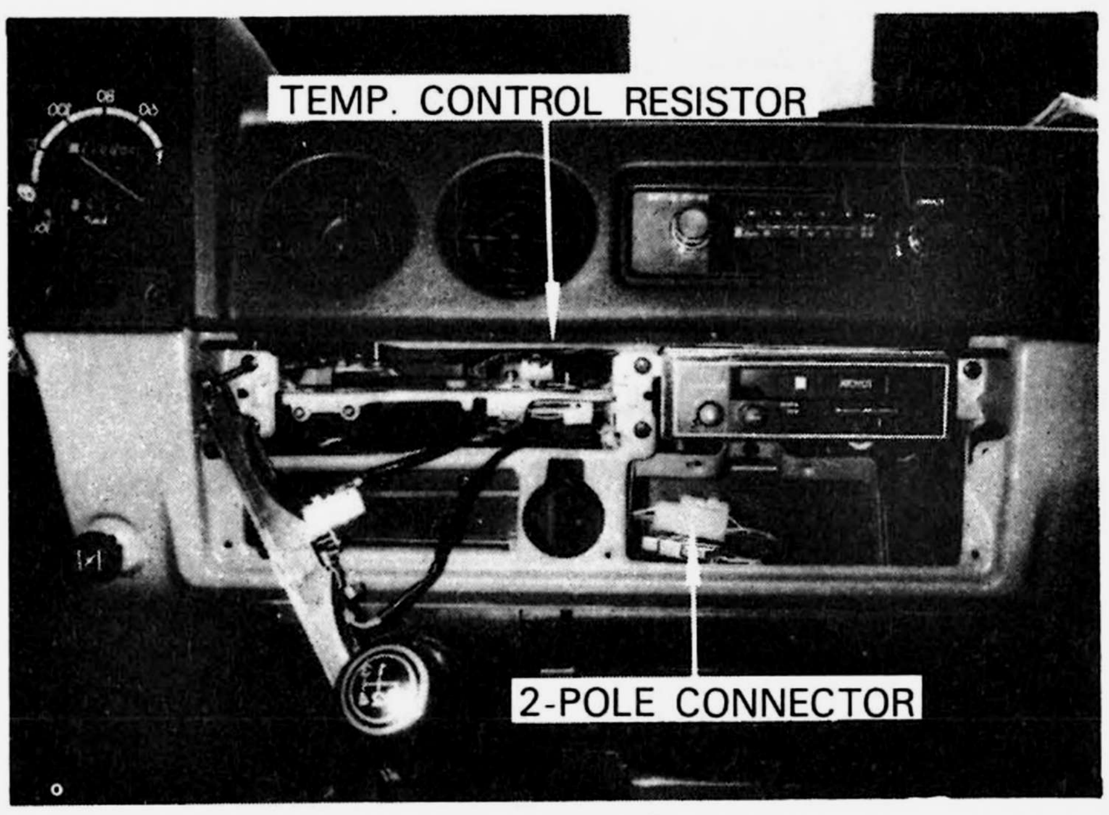


Fig. V-28

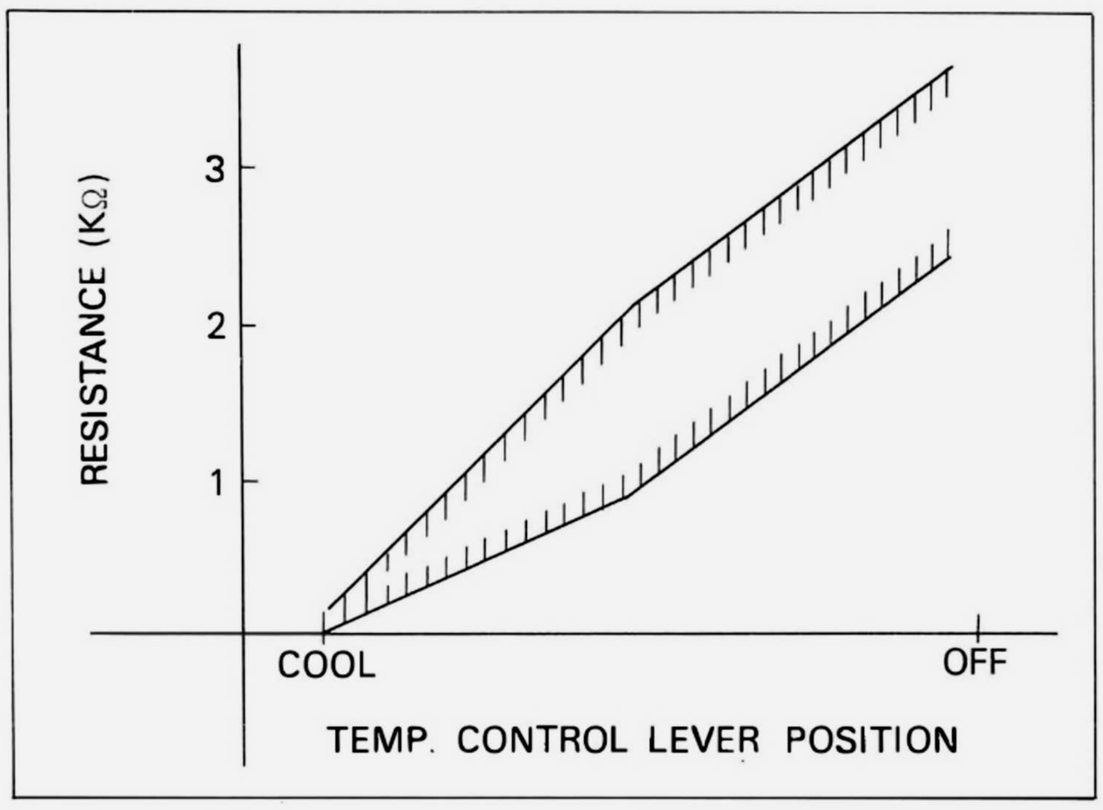


Fig. V-29

B) Removal

1) Remove the instrument panel.
2) Disconnect control cables from VENT-DEF damper and FRESH-RECIRC damper.
3) Pull off the control lever assy.
4) Remove two screws and the temp. control resistor.
   See Fig. V-30.

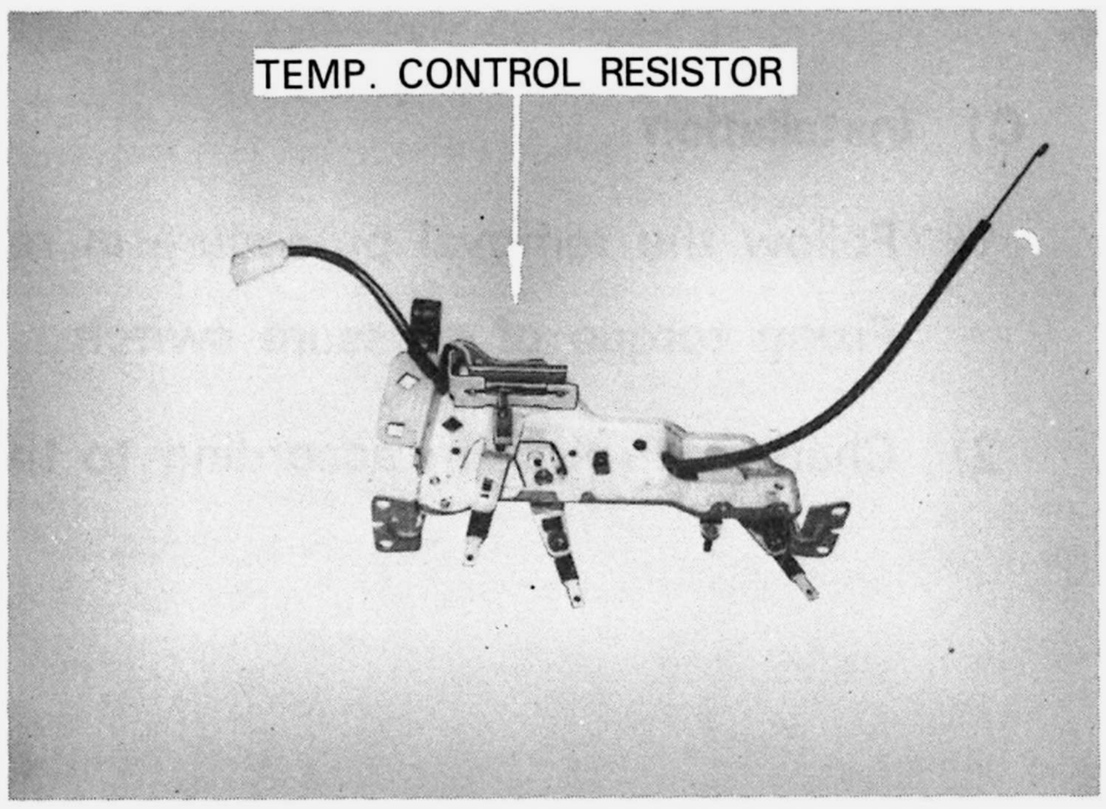


Fig. V-30

C) Installation

1) Follow the removal procedures in reverse order.

7. VACUUM SWITCHING VALVE (for FJ60 Series only)

A) Inspection

(1) Disconnect the vacuum hoses and 2-pole connector from the VSV.

(2) Check the vacuum circuit continuity between pipe Ⓐ — pipe Ⓑ and pipe Ⓐ — Atmosphere by blowing air or smoke into pipe Ⓐ.

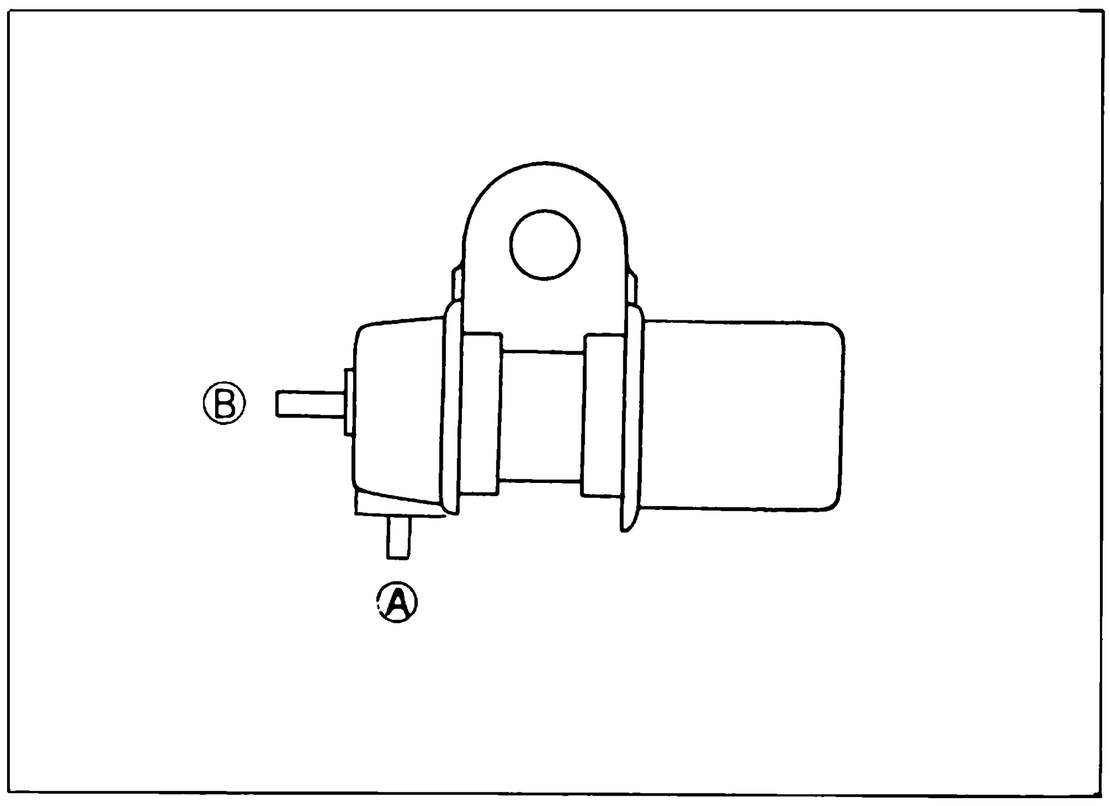


Fig. V-31

a) "Off" atate test ;

Between pipes Ⓐ and Ⓑ should be discontinued.

Pipe Ⓐ should be continued to Ⓒ (atmosphere).

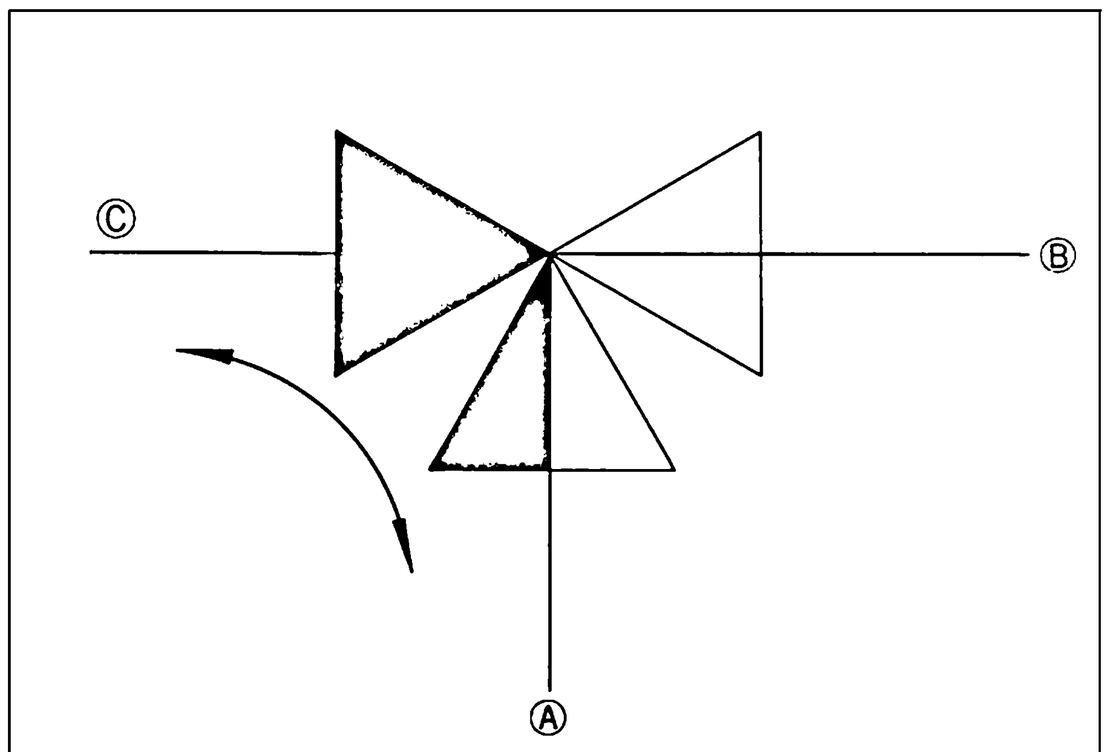


Fig. V-32

b) "On" state test ;

Connect an ammeter in series with 12 volts battery and the VSV lead wires using the jumper wires as shown in Fig. V-33.

Check the continuity between the pipes under this condition.

Between pipes Ⓐ and Ⓑ should be continued.

Pipe Ⓐ should not be continued to Ⓒ (atmosphere).

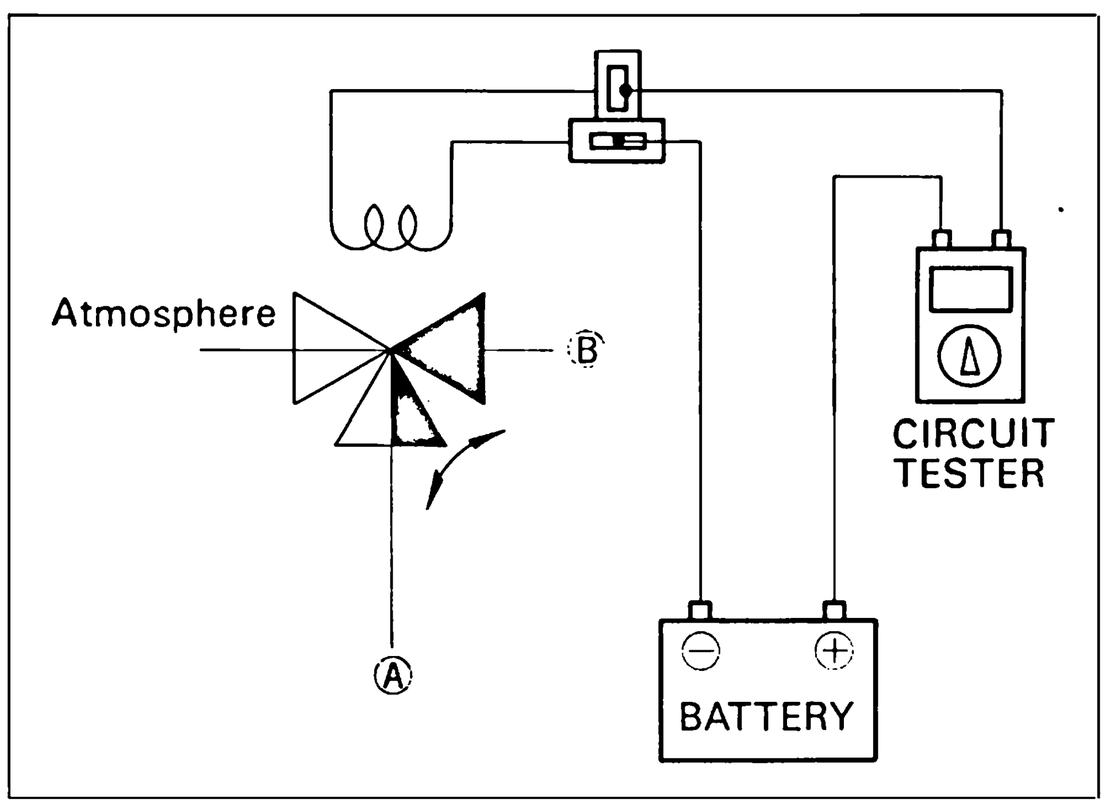


Fig. V-33

At thia time, current flow should be less than 0.25 ampere : If defective, replace it.

8. IDLING STABILIZER AMPLIFIER

8-1. ENGINE SPEED DETECTING CIRCUIT

A) Inspection

a) Run the engine and operate the air conditioner, then measure cut-off and cut-in engine revolution.
Standard cut-off rpm :
700 — 800 rpm.
Standard cut-in rpm :
See Fig. V-34.

b) If the cut-off engine revolution is too high or low, adjust or replace the control box to get specified cut-off and cut-in engine revolution.

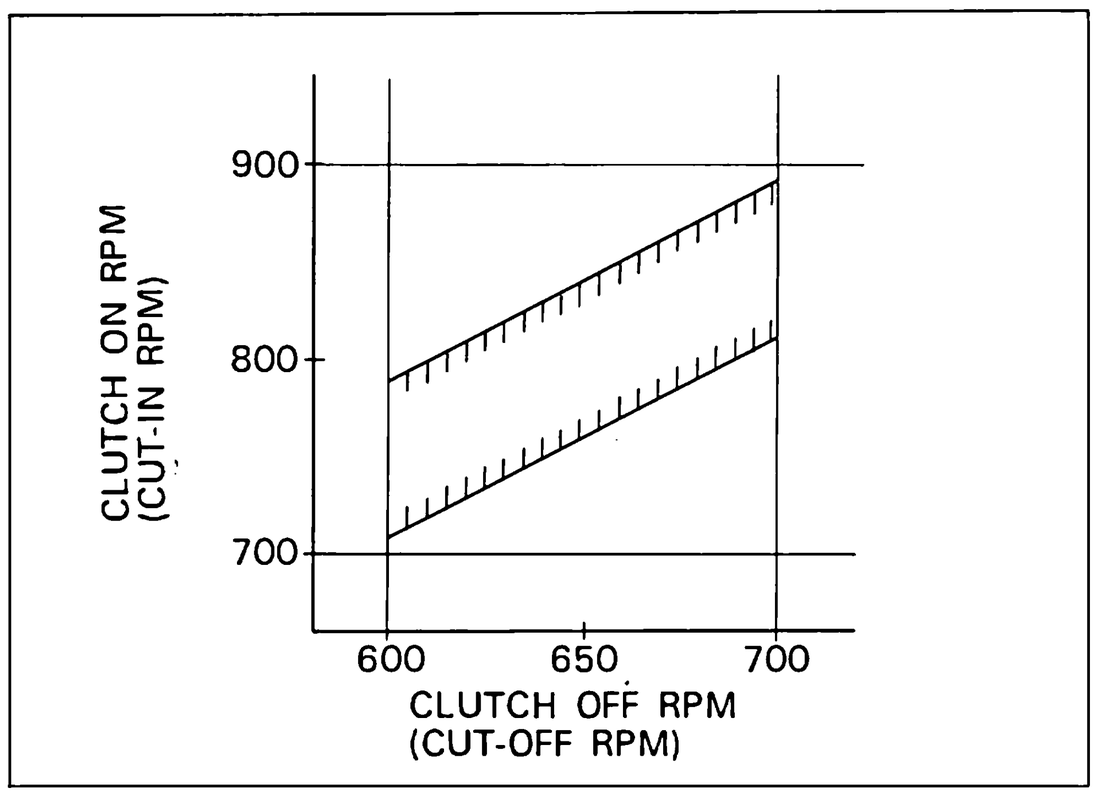


Fig. V-34

B) Adjustment

a) If operating point is too high ;
Turn the knob of cut-off rpm setting resistor counterclockwise.
See Fig. V-35.

b) If operating point is too low ;
Turn the knob clockwise.

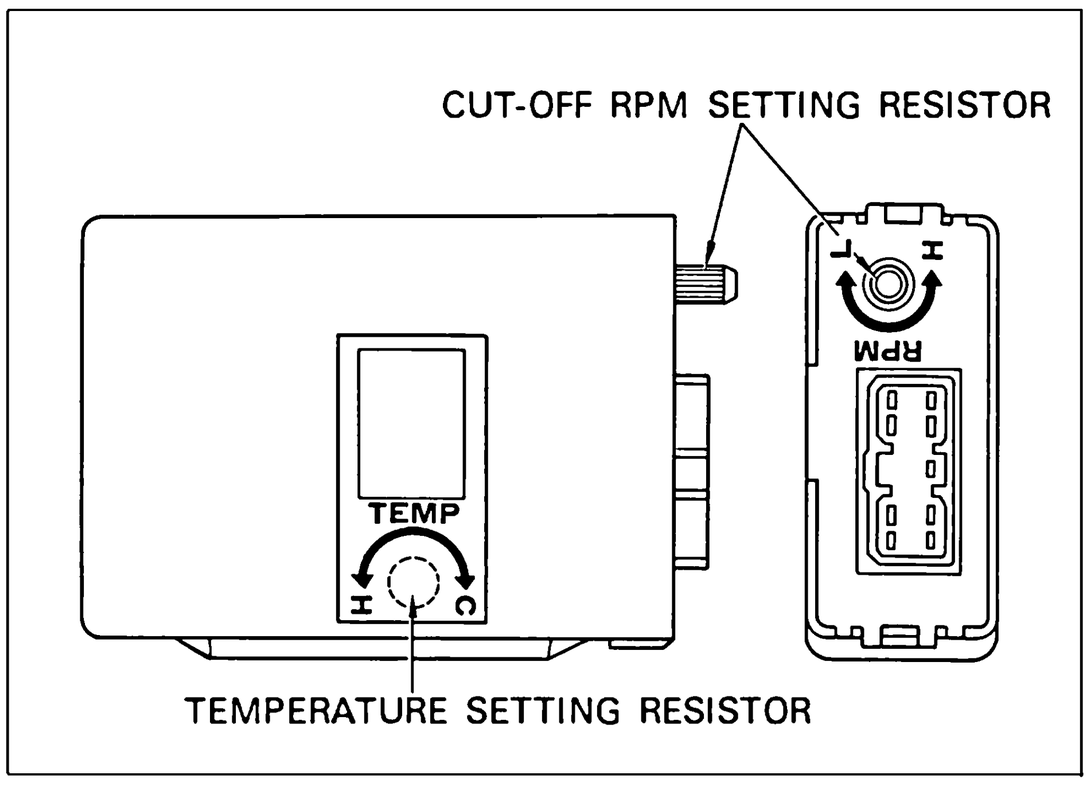


Fig. V-35

8-2. TEMPERATURE DETECTING DIRCUIT

The outlet cool air temperature is detected by a thermistor which is installed just in front of the evaporator. The temperature of the outlet cool air is varied by sliding the temp. control lever.
When the control lever is set at maximum cooling position, the magnetic clutch will be disengaged at about 0°C (32°F). On the other hand, when the control lever is set at minimum cooling position, the magnetic clutch will be disengaged at about 15°C (59°F).

For w/heater ;

The outlet cool air temperature passed through evaporator is detected by a thermistor which is installed just in front of the evaporator to prevent the evaporator frosting. The temperature setting resistor of the amplifier is set to cut off the magnetic clutch at about 3°C (37°F).

A) Inspection

a) Remove the glove box and the under tray.

b) Disconnect the 2-pole connector of thermistor and connect the variable resistor.

c) Run the engine and operate the air conditioner to get max. cooling.

Air Intake Control : RECIRC
Air Flow Control : VENT
Temperature Control : COOL
Blower Control : HI

d) Measure the resistance of the variable resistor at the magnetic clutch cut-off and cut-in.

e) If the resistance is out of standard, adjust the amplifier.

Standard cut-off resistance :

4000 — 4300 Ω

Standard cut-in resistance :

See Fig. V-37.

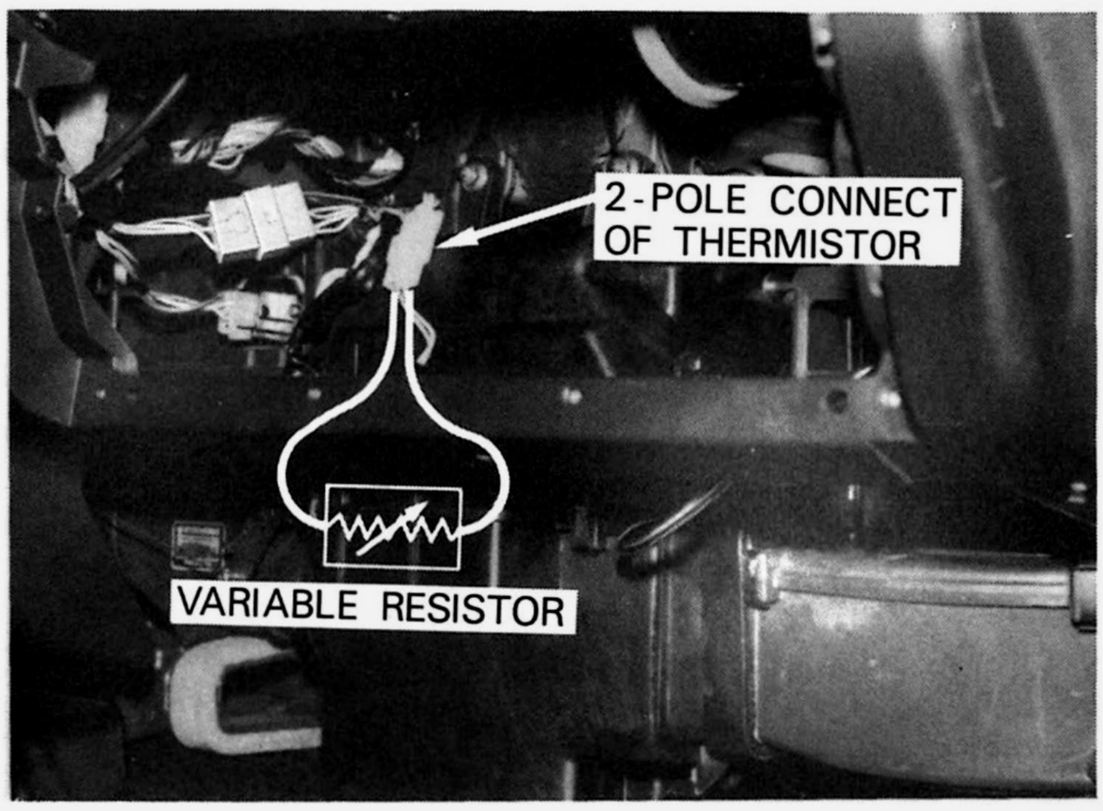


Fig. V-36

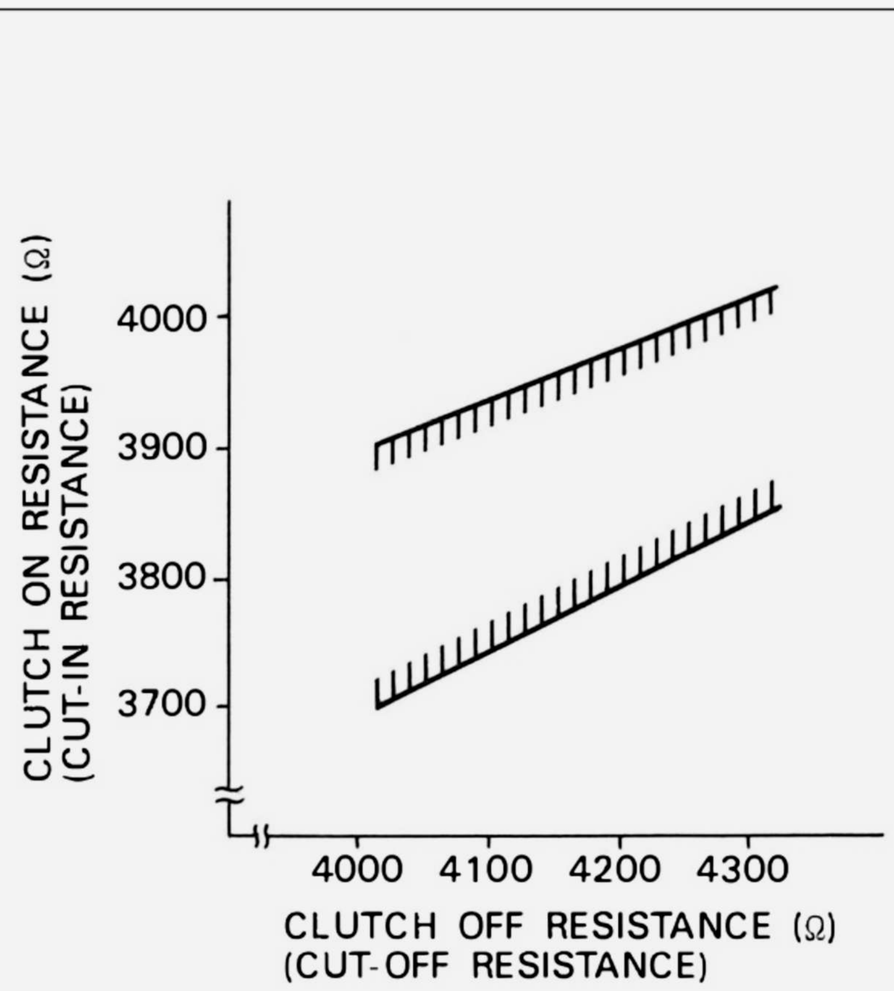


Fig. V-37

B) Adjustment

The air conditioner does not become cool enough or the evaporator core will be frosted when the system operates in maximum cooling. In this case, the outlet cool air temperature should be adjusted by turning the temperature setting resistor. See Fig. V-35.

a) If off or in resistance is higher than standard;

Turn the shaft of resistor clockwise.

b) If the resistance is lower than standard or the evaporator is frosted;

Turn the shaft counterclockwise so that the magnetic clutch engages at standard resistance.

Note: *Prior to adjustment of temperature control range, check the resistance of thermistor and temp. control resistor.*

V-3-3. MISCELLANEOUS

1. DRIVE BELTS

A) Inspection

a) Check the belt tension.

b) Check if the belt is worn.

Adjust or replace it as necessary.

Specified belt tension:

Belt deflection when pushed with 10 kg (22 lbs) force;

FJ60 Series

Fan Belt .....

7 – 10 mm (0.28 – 0.40 in.)

Compressor Drive Belt .....

15 – 18 mm (0.56 – 0.69 in.)

Power Steering Belt .....

11 – 14 mm (0.44 – 0.56 in.)

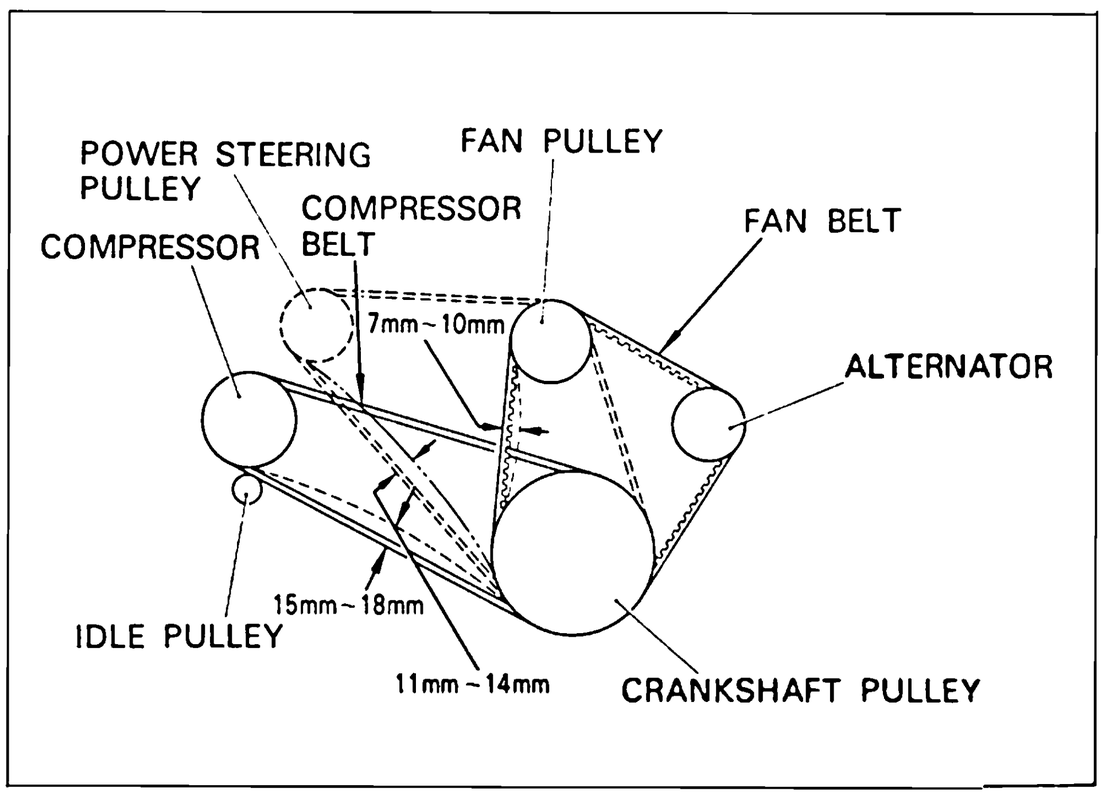


Fig. V-38

BJ60 Series

Fan Belt .....

11 – 14 mm (0.44 – 0.56 in.)

Compressor Drive Belt .....

10 – 12 mm (0.40 – 0.50 in.)

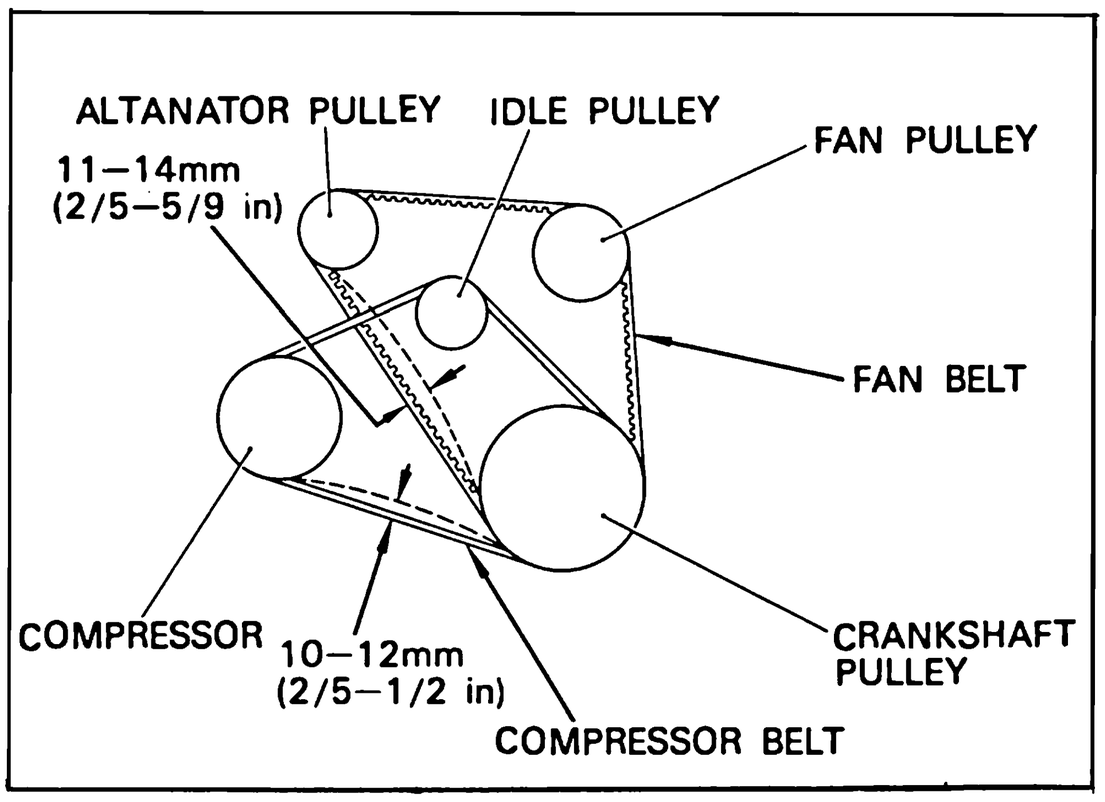


Fig. V-39

HJ60 Series

Compressor Drive Belt .....

8 – 11 mm (0.31 – 0.44 in.)

Fan Belt .....

7 – 10 mm (0.28 – 0.40 in.)

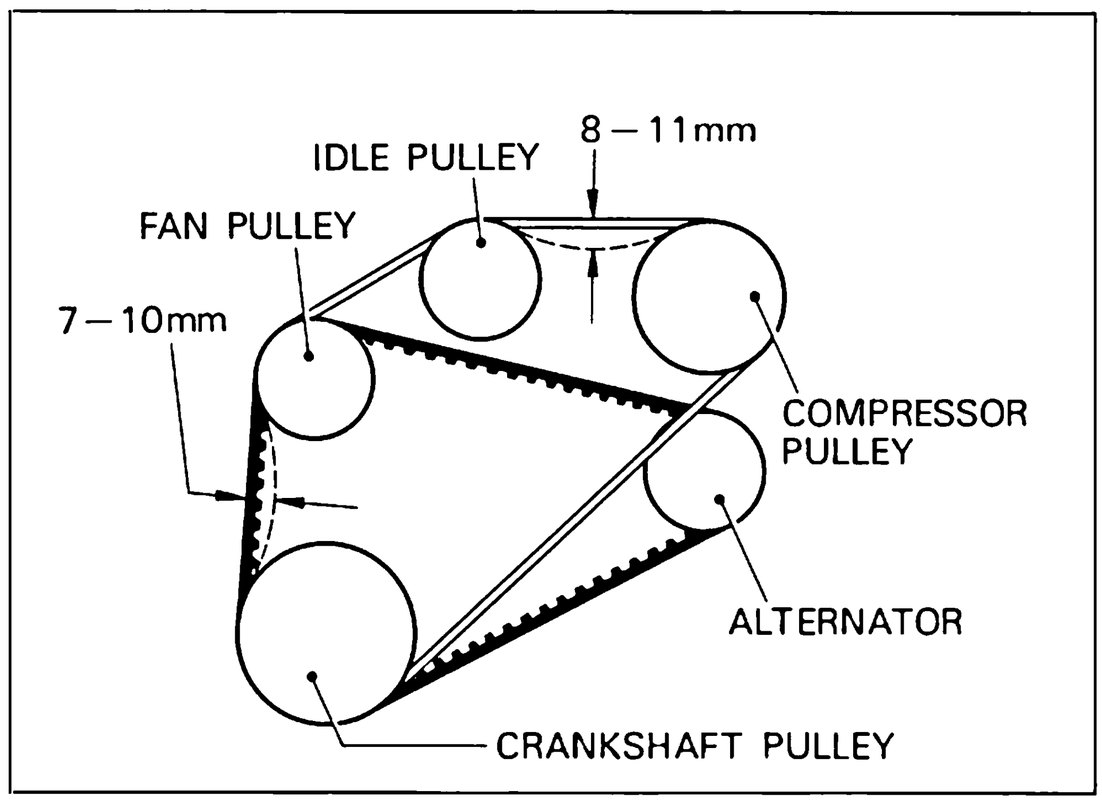


Fig. V-40

2. COMPRESSOR MOUNTS

A) Inspection

Check if ;

a) the mounting bolts are loose.

b) the mounts are broken or cracked.

If the bolts are loose, retighten the bolts with specified torque.

If the mount is defective, replace it.

Note: *After reinstalling the mounts, adjust the belt to specified tension. (Refer to "DRIVE BELTS".)*

B) Removal

FJ60 Series

1) Remove a nut, collar and idle pulley from the mount.

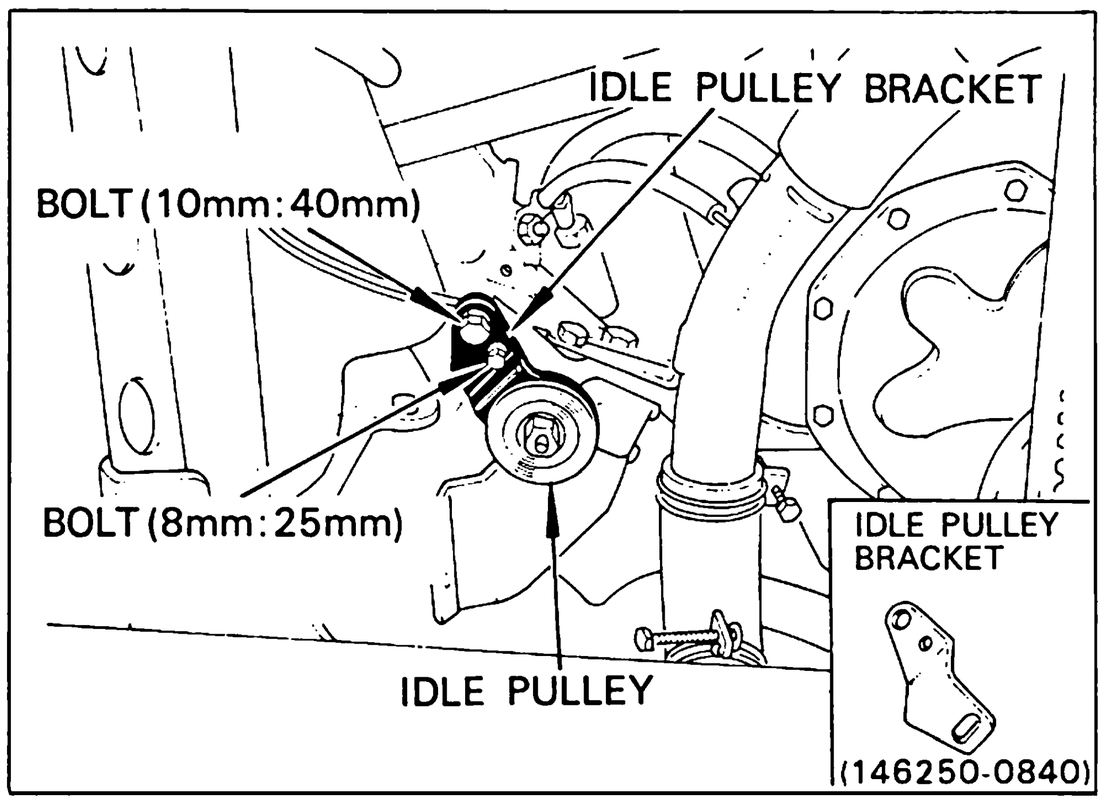


Fig. V-41

BJ60 Series

1) Loose the idle pulley adjusting bolt.

2) Remove a nut, collar and idle pulley from the mount.

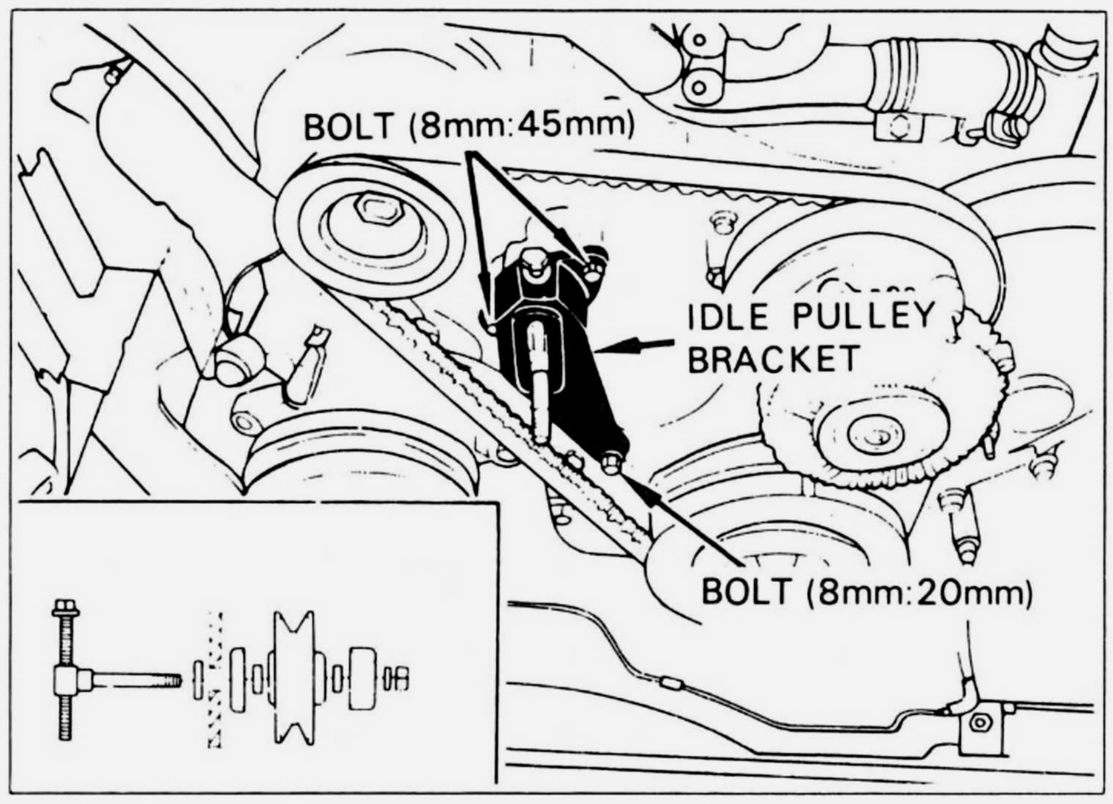


Fig. V-42

HJ60 Series

1) Loose the idle pulley adjusting bolt.

2) Remove a nut, collar and idle pulley from the mount.

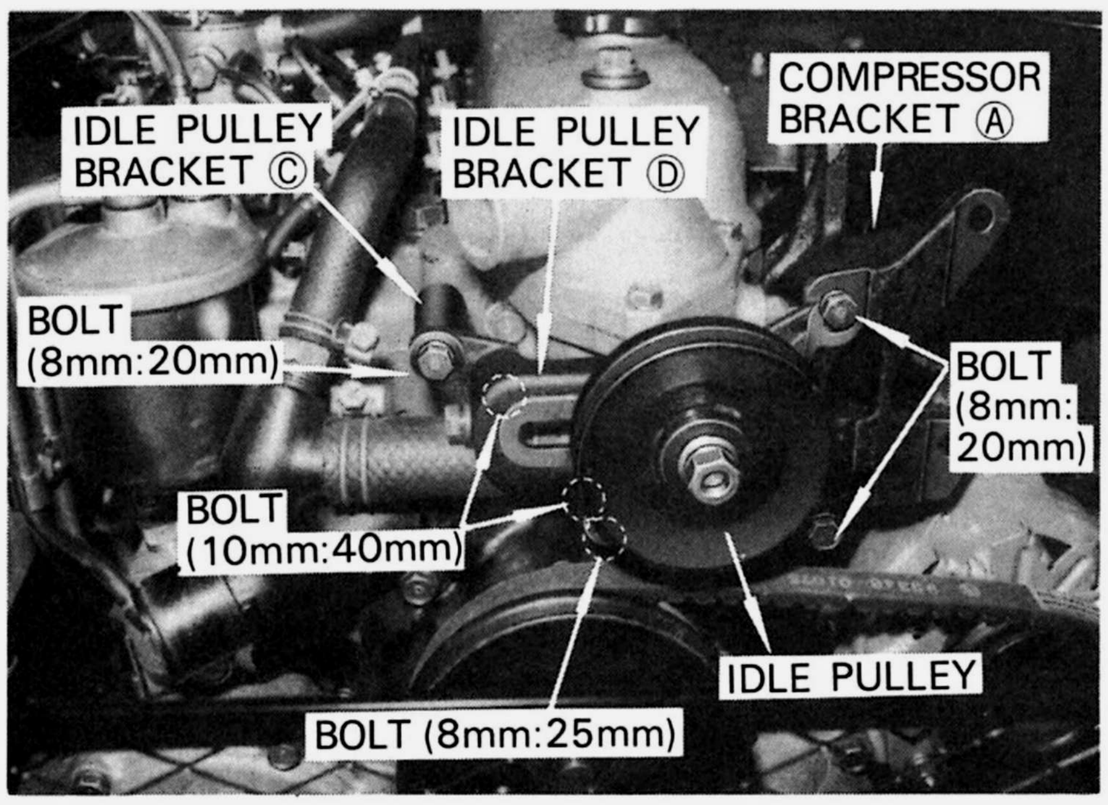


Fig. V-43

C) Installation

1) Follow the removal procedure in reverse order.

Note: *Stretch the drive belt with specified tension.*
(Refer to "1. DRIVE BELTS" on page 63.)

VI. FINISH

1. CHECKING THE REFRIGERATION OIL

Generally, when the air conditioning system is operating normally, the compressor oil level does not need checking.

Standard oil capacity 170 ±15 cc (10.4 ±0.9 cu. in.)

But compressor oil level should be checked whenever there is evidence of a major loss of refrigerant such as :

a) an excessive leakage from hose or tube fitting.

b) a broken flexible hose.

c) collision damage to the air conditioner component parts.

d) an excessive leakage from the compressor shaft seal.
(A slight amount of compressor oil leakage at the compressor front shaft seal is considered normal.)

A) Add refrigeration oil to compressor whenever system component is replaced.

Evaporator ..... 40 — 50 cc (2.4 — 3.1 cu. in.)

Condenser ..... 40 — 50 cc (2.4 — 3.1 cu. in.)

Receiver ..... 20 cc (1.2 cu. in.)

Note: *Refrigeration oil will absorb moisture quickly. When adding refrigeration oil, the oil container should not be opened until ready for use, and it should be capped immediately after using.*

2. EVACUATING AND CHARGING PROCEDURE

2A. INSTALLING THE MANIFOLD GAUGE SET

A) The fittings for attaching the gauge manifold set are located on the compressor service valves. Each service valve has a schrader type valve as shown in Fig. VI-1.

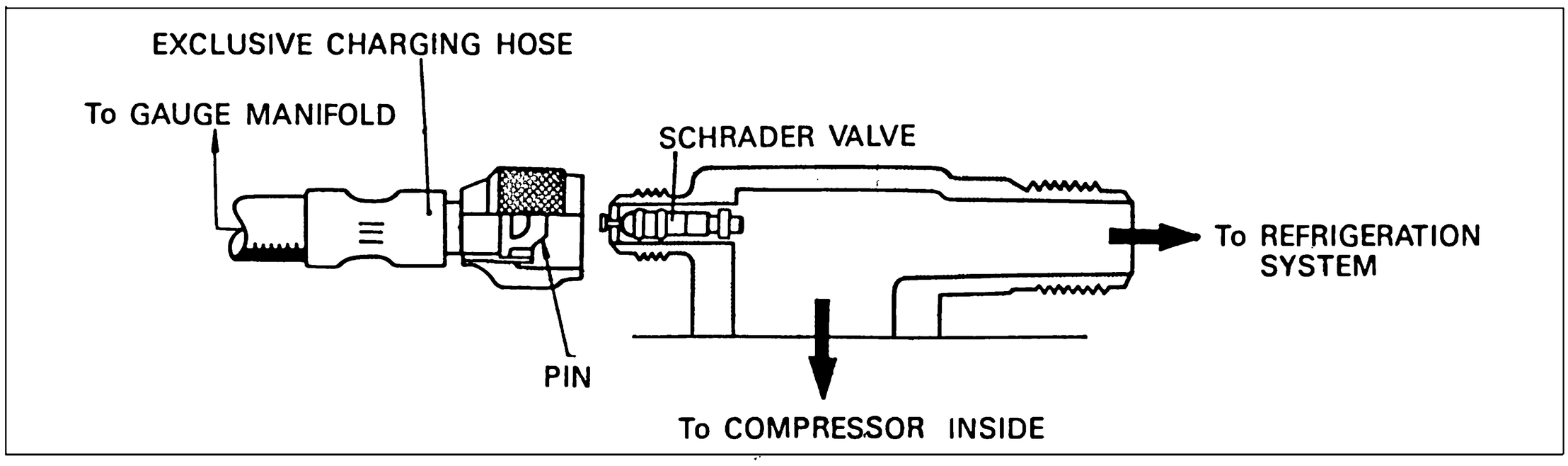


Fig. VI-1

B) Be certain that both hand valves of gauge manifold set are closed.

C) Install the charging hoses of gauge manifold set onto the suction and discharge service valves respectively.

Note: *When connecting charging hoses*

1) Do not apply any drops of refrigeration oil to the seat of connection.

B) Tighten hose nuts by hand.

2B. EVACUATING THE SYSTEM

A) Whenever an air conditioning system has been opened (exposed to atmosphere) it must be evacuated by use of a vacuum pump. After installation, it is recommended that the system be evacuated for approximately 15 minutes (a unit in service that has been opened for repair should be evacuated for 30 minutes).

B) Connect the high and low charging hoses of gauge manifold set to the hose fittings of the compressor service valves.

Note: *High charging hose should be connected to the discharge service valve fitting (compressor to condenser).*

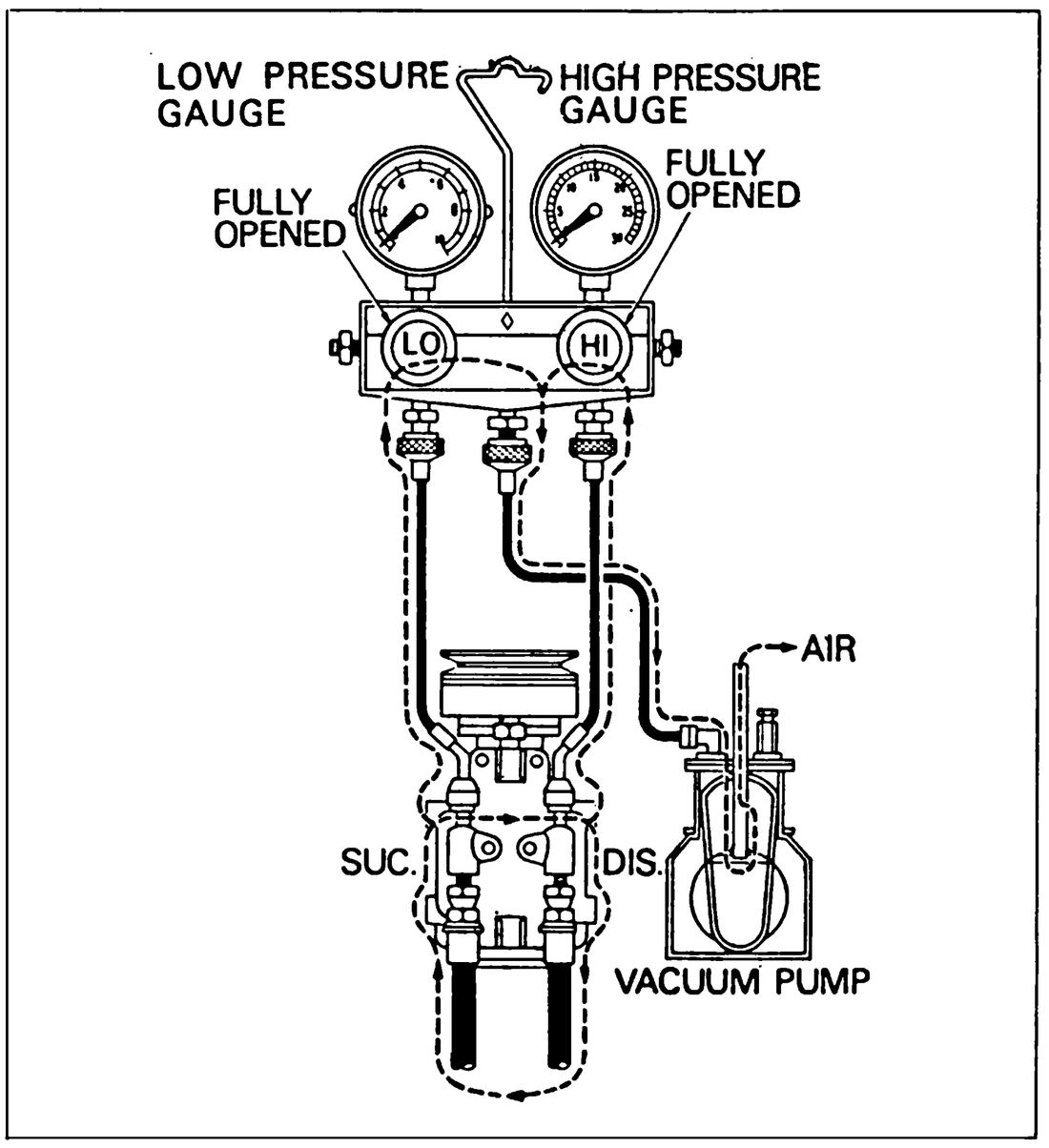


Fig. VI-2

C) Install the center charging hose of manifold gauge set to the vacuum pump inlet. See Fig. VI-2.

D) Run the vacuum pump, then open both hand valves.

E) After about 10 minutes, the low pressure gauge should be more than 60 — 70 cm-Hg (24 — 27 in-Hg) vacuum, if there is no leak.

Note: *1) If the system is not up to 60 — 70 cm-Hg (24 — 27 in-Hg) vacuum, close the high and low hand valves and stop the vacuum pump.*

2) If the low pressure gauge indicates loss of vacuum, there is a leak which must be repaired before continuing with evacuation.

3) If no leak is evident, continue pumping down.

F) After evacuating the system until low pressure gauge indicates above 70 cm-Hg (27 in-Hg) vacuum.

Continue evacuating for at least 15 minutes, then close the both hand valves.

G) Stop the vacuum pump, then disconnect the center charging hose from the vacuum pump inlet.

The system is now ready for charging after it is evacuated as above.

2C. REFRIGERANT CONTAINER SERVICE VALVE

A) Before putting the can tap valve on the refrigerant container, turn the handle counterclockwise until the valve needle is fully retracted.

B) Turn the plate nut (disc) counter-clockwise till it reaches its highest position, and then screw down the can tap valve onto the refrigerant container. See Fig. VI-3.

C) Install the center charging hose to the valve fitting and turn the plate nut (disc) fully clockwise.

D) The plate nut can be sufficiently tightened by hand.

E) Turn the handle clockwise, thus making a hole in the sealed tap.

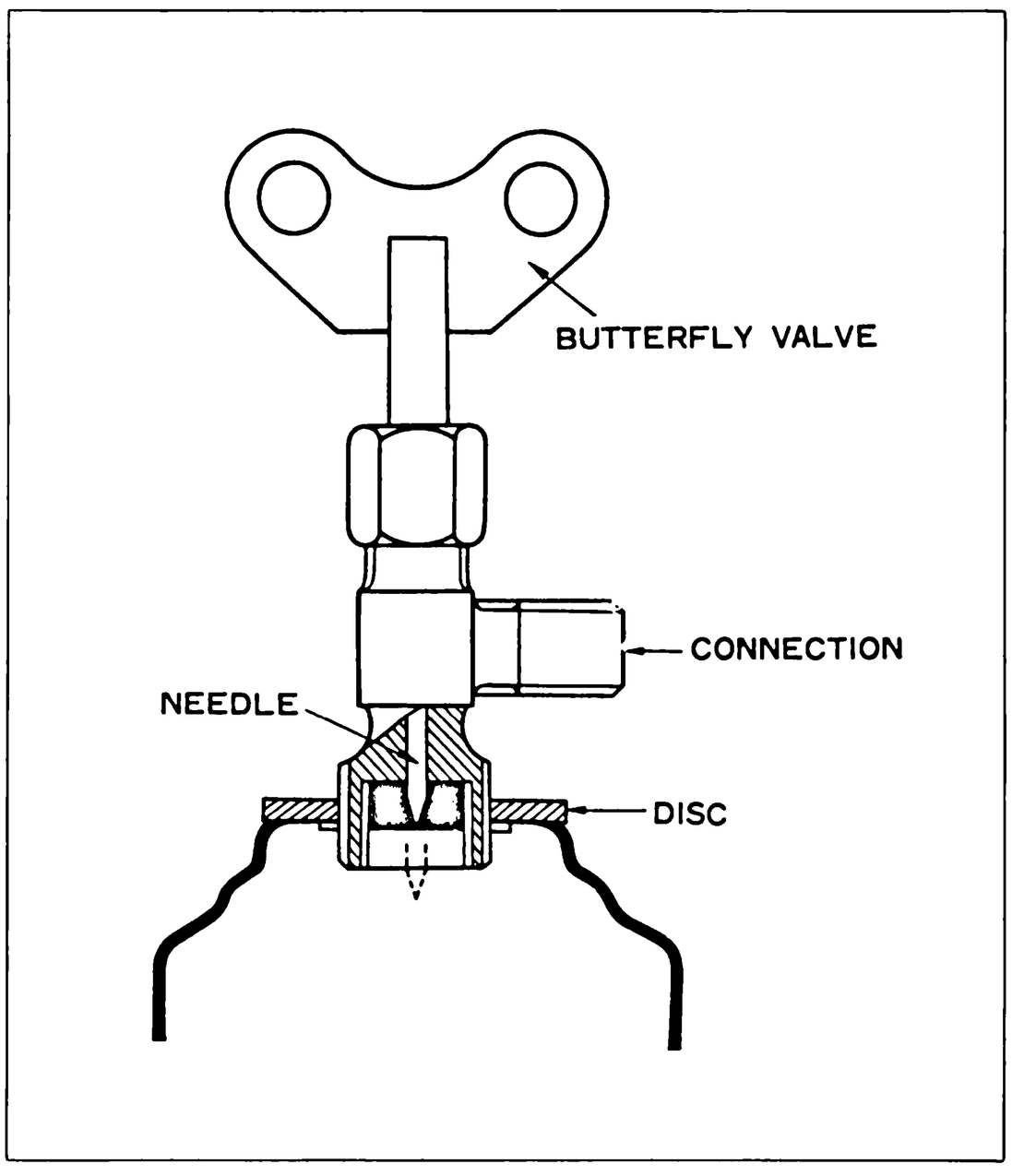


Fig. VI-3

F) To charge the refrigerant in to the system, turn the handle of the gauge manifold set counterclockwise.
To stop the charge, turn it clockwise.

CAUTION

1) When handling refrigerant (R-12), the following precautions should be observed.
A) Always wear eye protection while handling refrigerant.
B) Keep the refrigerant container (service-drum) below 40° C (100° F).
C) Do not handle refrigerant in an enclosed area having an open flame.
D) Discharge refrigerant slowly, when purging a system.
E) Be careful the liquid refrigerant does not contact skin.

2) If liquid refrigerant strikes eye or skin.
A) Do not rub the eye or skin.
B) Splash large quantities of cool water on the eye or skin.
C) Apply clean petroleum jelly to the skin.
D) Rush to a physician or hospital for immediate professional treatment.
E) Do not attempt to treat it yourself.

2D. LEAK TESTING THE SYSTEM

After finishing the evacuation of the system, check the system for gas leak using gas leak detector as described below.

A) Attach the can tap valve to the refrigerant container.

B) Install the center charging hose of the gauge manifold set to the can tap valve, then pierce the service drum by screwing the can tap valve handle in clockwise.

C) Unscrew the can tap .valve handle counterclockwise fully. Now the center charging hose is filled with air. Do not open the high and low hand valves at this time.

D) Loosen the center charging hose nut connected to the center fitting of gauge manifold set until a hiss can be heard.

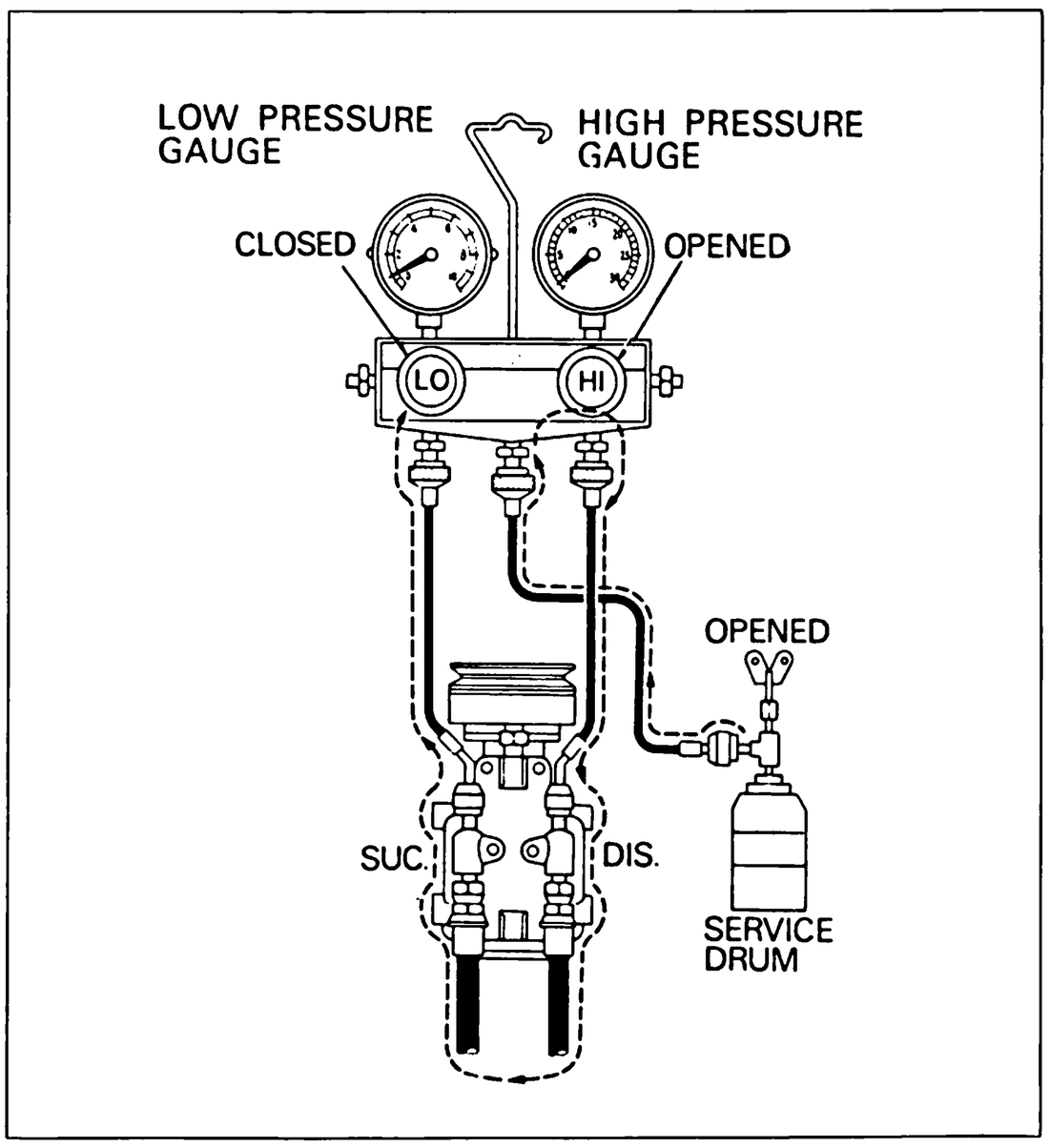


Fig. VI-4

Allow the air to escape for a few seconds, and tighten nut.

E) Open the high pressure hand valve to charge the refrigerant vapor into the system. See Fig. VI-4.

F) After indicating 1 kg/cm² (14 psi) on low pressure gauge, close the high side hand valve. Under this condition, check the system for gas leak using a halide gas leak detector, propane torch or electric leak detector.

G) When gas leak is found, the defective components or connections should be repaired.

H) After checking and repairing the system for gas leak, evacuate the system again as outlined below.

a) Turn the can tap valve handle in clockwise fully to close the valve.

b) Disconnect the center charging hose from the can tap valve fitting.

c) Connect the center charging hose to the vacuum pump inlet, and then continue pumping down as described in Section 2B.

Note: *Evacuating time should be at least 15 minutes.*

2E. CHARGING THE SYSTEM

2E-1. Charging an empty system (liquid)

A) This procedure is for charging an empty system through the high side with refrigerant in liquid state.

When refrigerant container is held upside down R-12 will enter the system as liquid.

CAUTION

Never run engine when charging system through high side. *Do not open low side valve when R-12 is being charged in a liquid state (refrigerant container upside down).*

B) Close the high and low hand valves of manifold gauge set after the system is evacuated completely.

C) Connect the center charging hose to the can tap valve fitting, and then loosen the center charging hose at the center fitting of manifold gauge set until a hiss can be heard.

Allow the air to escape for a few seconds and tighten nut.

D) Open the high pressure hand valve fully, and keep the container upside down to charge the refrigerant in liquid state from the high pressure line. See Fig. VI-5.

E) Charge the system with refrigerant in liquid state to the amount more than one can (400g, 0.8 lb) or specified amount from high side.

Note: *If low side gauge does not show a reading, system blockage is indicated and must be corrected.*

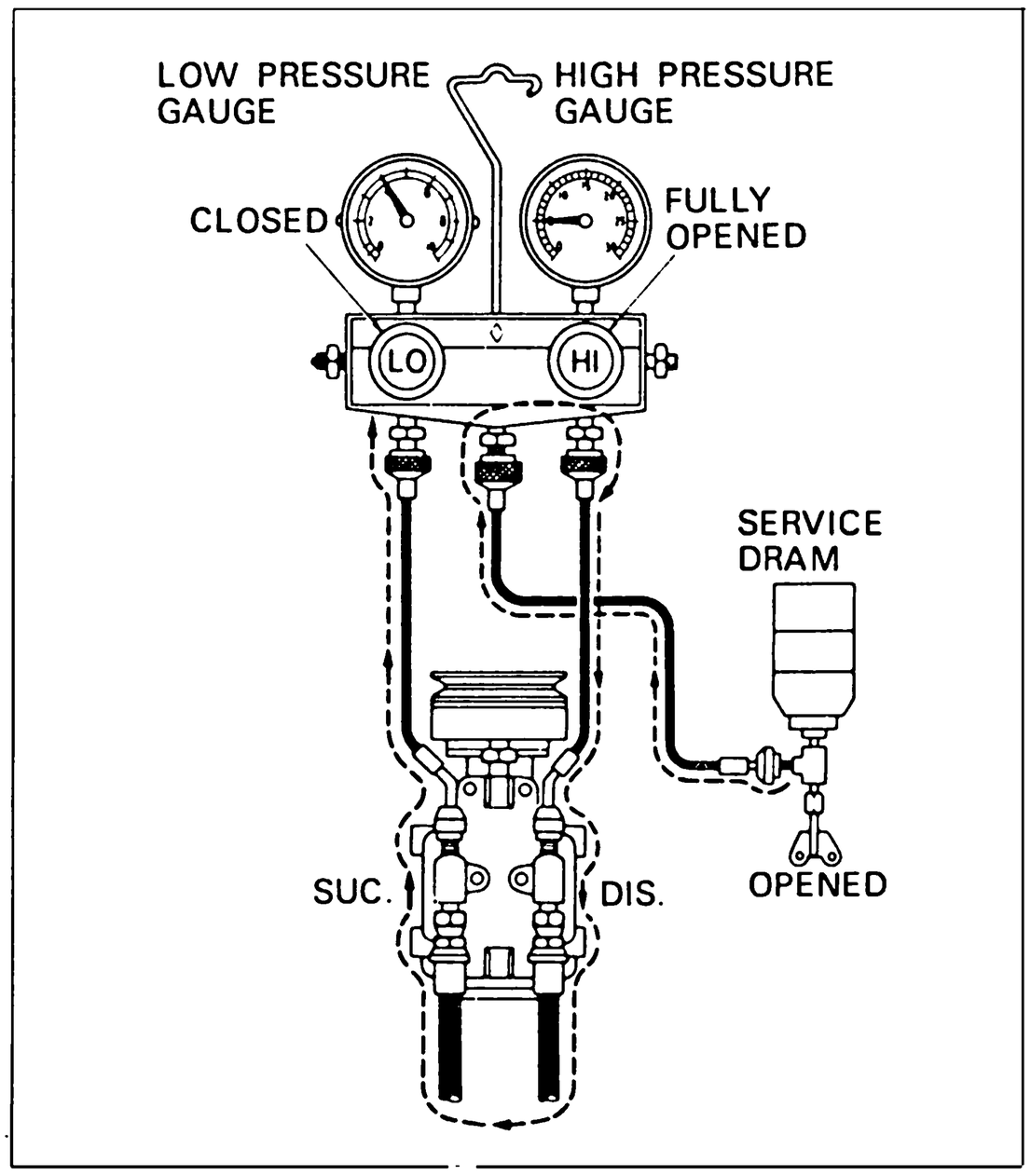


Fig. VI-5

2E-2. Charging an empty or partially charged system (vapor)

A) This procedure is used to charge a system through the low side with refrigerant in vapor state.

When refrigerant container is placed upright R-12 will enter the system as vapor.

Note: *Put refrigerant container into a pan of warm water (maximum temperature 40°C (100°F) to keep vapor pressure in container slightly higher than vapor pressure in system.*

B) With gauge manifold set connected and charging line purged, open low side valve.
Low side gauge should not read over 60 psi.
Adjust valve as needed.

C) Start engine and run it at fast idle, and operate the air conditioner.

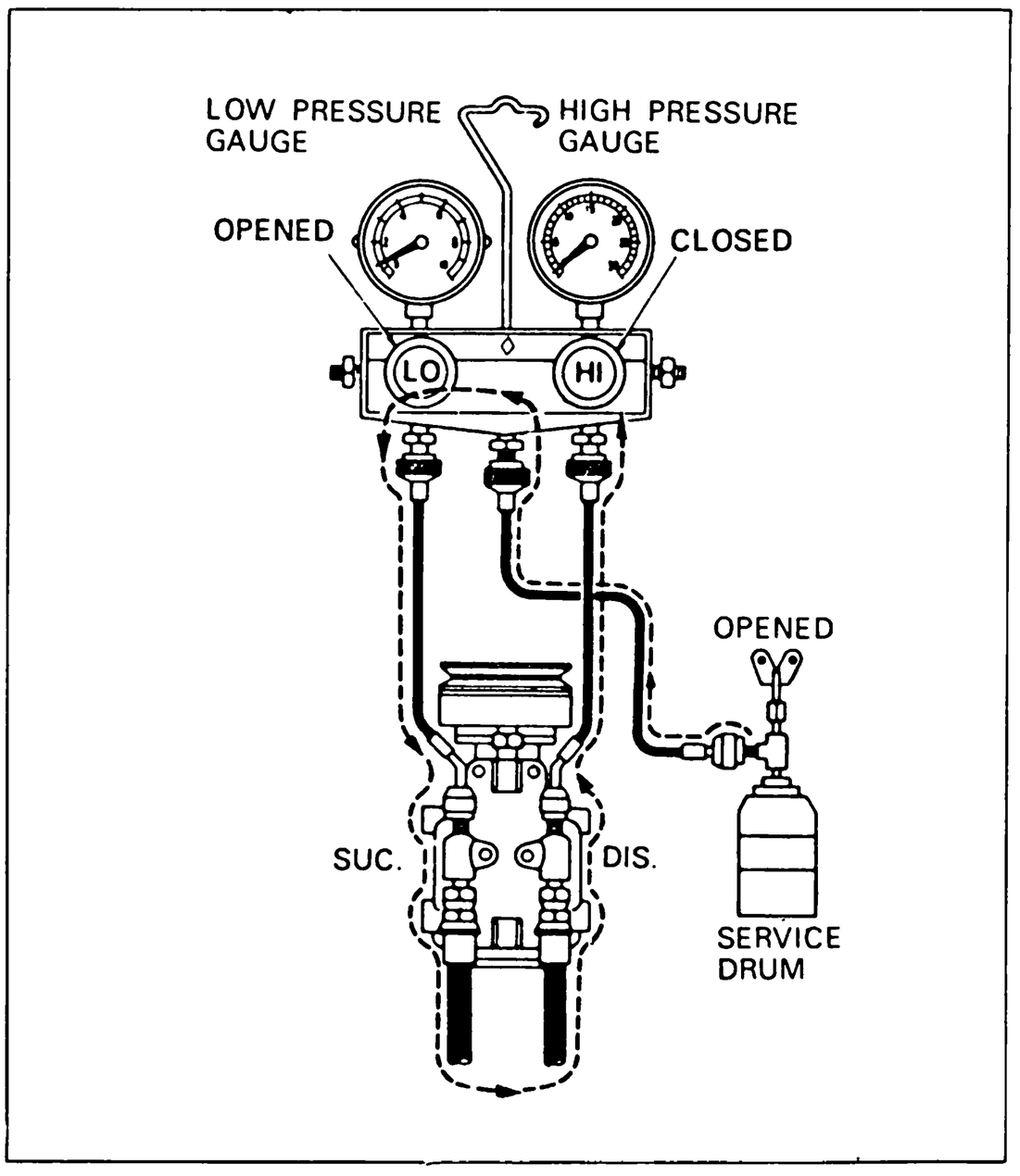


Fig. VI-6

D) Charge the refrigerant in vapor into the air conditioning system. Be sure to keep the container in upright position in this charging method. This is to prevent the liquid refrigerant from being charged into the system through the suction service port of compressor.

Liquid refrigerant entering suction chamber of the compressor may cause serious damage to internal component parts. See Fig. VI-6

E) After charging the specified amount of refrigerant into the system, close the low side hand valve.

Sight glass should be free of any bubbles, which indicates a fully charged system.

Specified amount of refrigerant ····· 650 – 750g (1.45 – 1.65 lbs)

F) When system is fully charged to specified amount, the manifold gauge set should be removed as follows :

1) Close both high and low side valves of manifold gauge set.
2) Close the valve at refrigerant container (if using 1 lb cans of R-12, remaining R-12 should be allowed to escape by slowly removing charge line).
3) Turn off engine.
4) Using a shop rag, remove high and low side lines from compressor service valves.

Remove quickly to allow schrader valves to close.

CAUTION

High side line is under high pressure and care must be used to protect eyes and skin.

2E-3.

A) When the refrigerant container is empty, close the low side hand valve of gauge manifold set, and remove the can tap valve from the container.

   Attach the can tap valve to a new refrigerant container and purge the air in the center charging hose. See Fig. VI-7.

B) Pierce the sealed tap of the refrigerant container, and charge the refrigerant into the system.

C) Put the cap nuts on the service valve fittings of compressor.

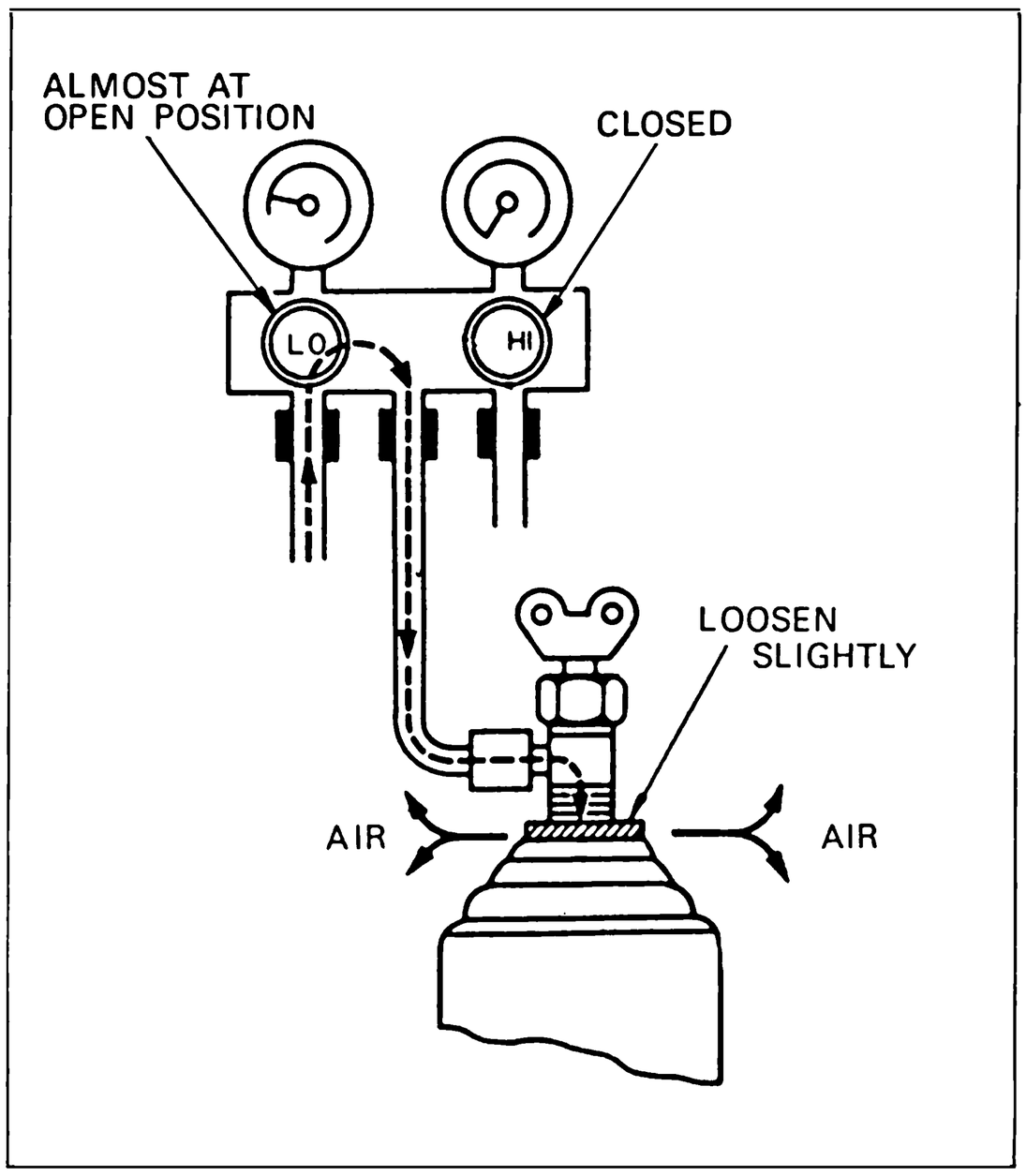


Fig. VI-7

3. PERFORMANCE TEST

After finishing all repairs, make sure to carry out the performance test of the air conditioning system as follows.

A) Procedure

1) Connect the high and low side charging hose of manifold gauge set to the hose fittings of compressor.

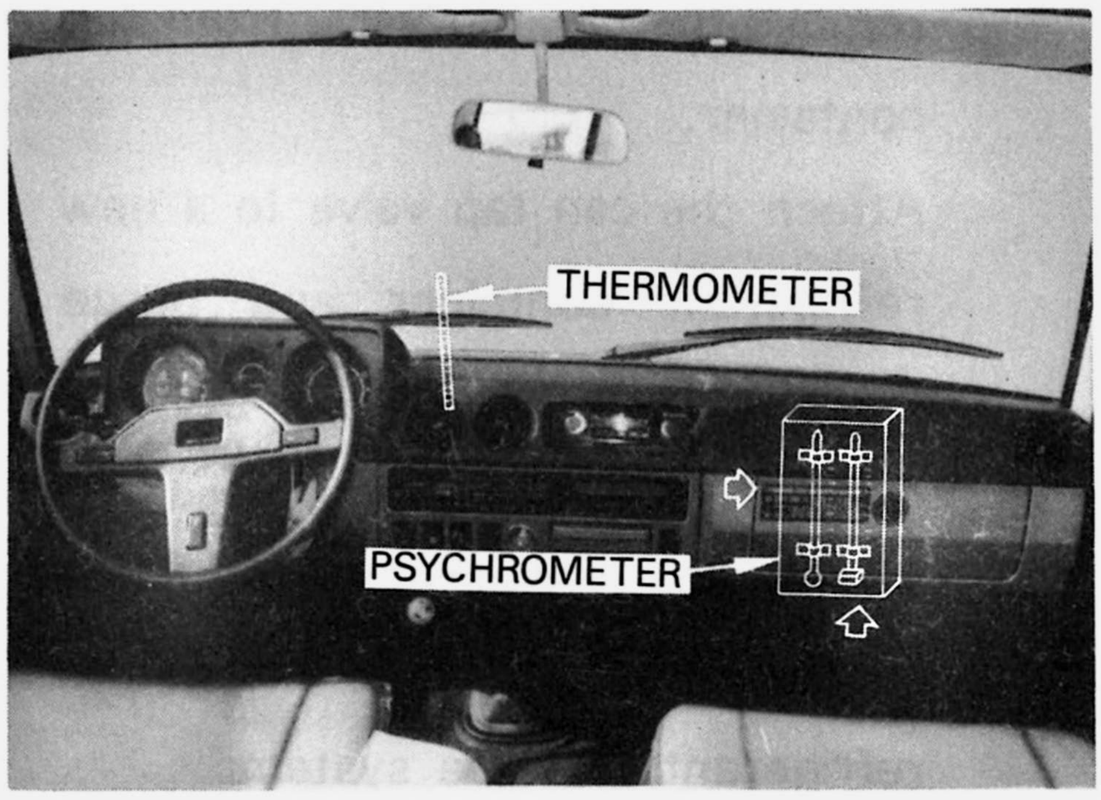


Fig. VI-8

2) Run the engine, and keep the compressor speed at 2,000 rpm.
3) Operate the air conditioner, and set the blower switch at "HI", the temperature lever at "COOL".
4) Keep the all windows and doors open.
5) Insert a dry bulb thermometer in the cool air outlet, and place the psychrometer (dry and wet bulb thermometer) close to the inlet of cooling unit. See Fig. VI-8.
6) The high pressure gauge reading should be within the specified pressure range, 14.0—15.5 kg/cm² (200—220 psi).

Note: *If the gauge indicates too high, pour the water on the condenser or if it is too low, cover the front surface of condenser.*

7) The dry bulb thermometer at the air inlet should be within 25—35°C (77—95°F).

On the above conditions, operate the air conditioning system until a stabilized condition on high and low pressure gauges and the thermometers have been established.

B) How to Read the Standard Performance Curve

1) Read the psychrometer reading at the inlet, and get the relative humidity from psychrometric chart.
   See Fig. VI-10, VI-11.
2) Measure the dry bulb temperature at the cool air outlet, then find out the difference between the inlet and outlet temperatures.

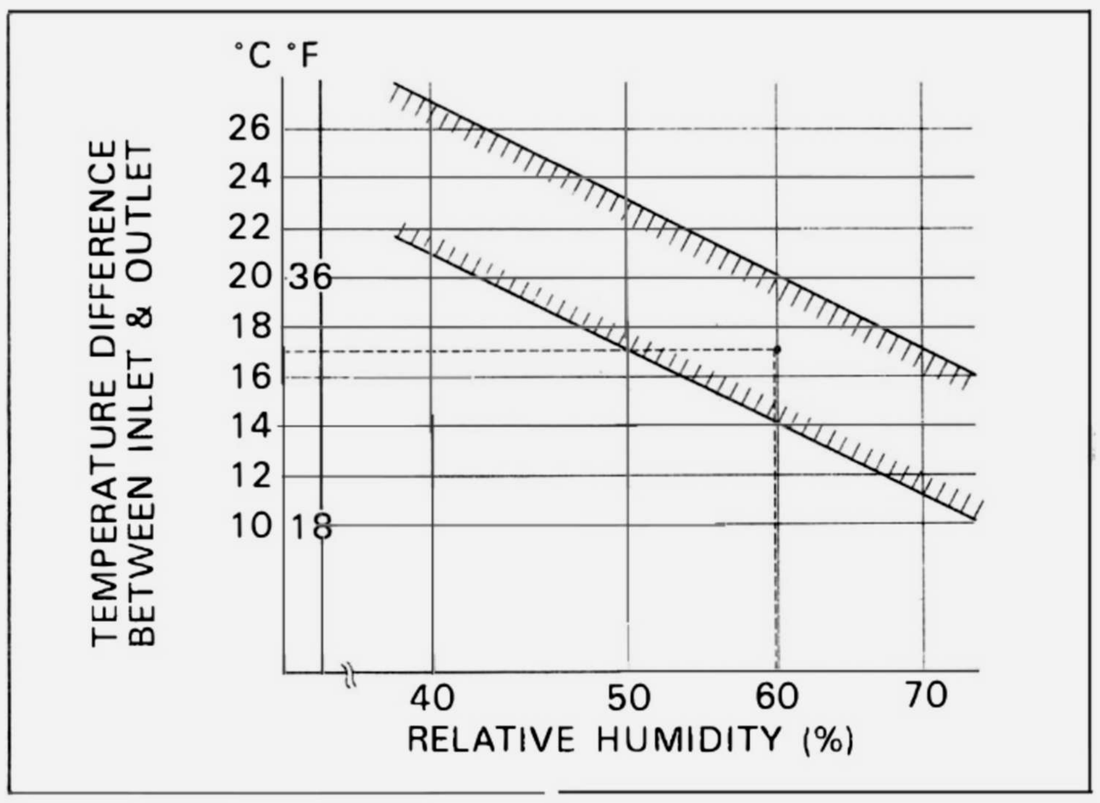


Fig. VI-9

3) For example, the difference is 17°C (30.6°F) and the relative humidity is 60%. If the crossing point is within two lines, the cooling performance is satisfactory and proper.

HOW TO GET RELATIVE HUMIDITY:
Measure temperatures of dry-and wet-bulb thermometers at air inlet (evaporator inlet), then bring them into mutual relation on the chart and find out the intersection wihch is relative humidity.
For example, if dry-bulb temperature is 90°F, and wet-bulb temperature is 78°F, the relative humidity is 60%.

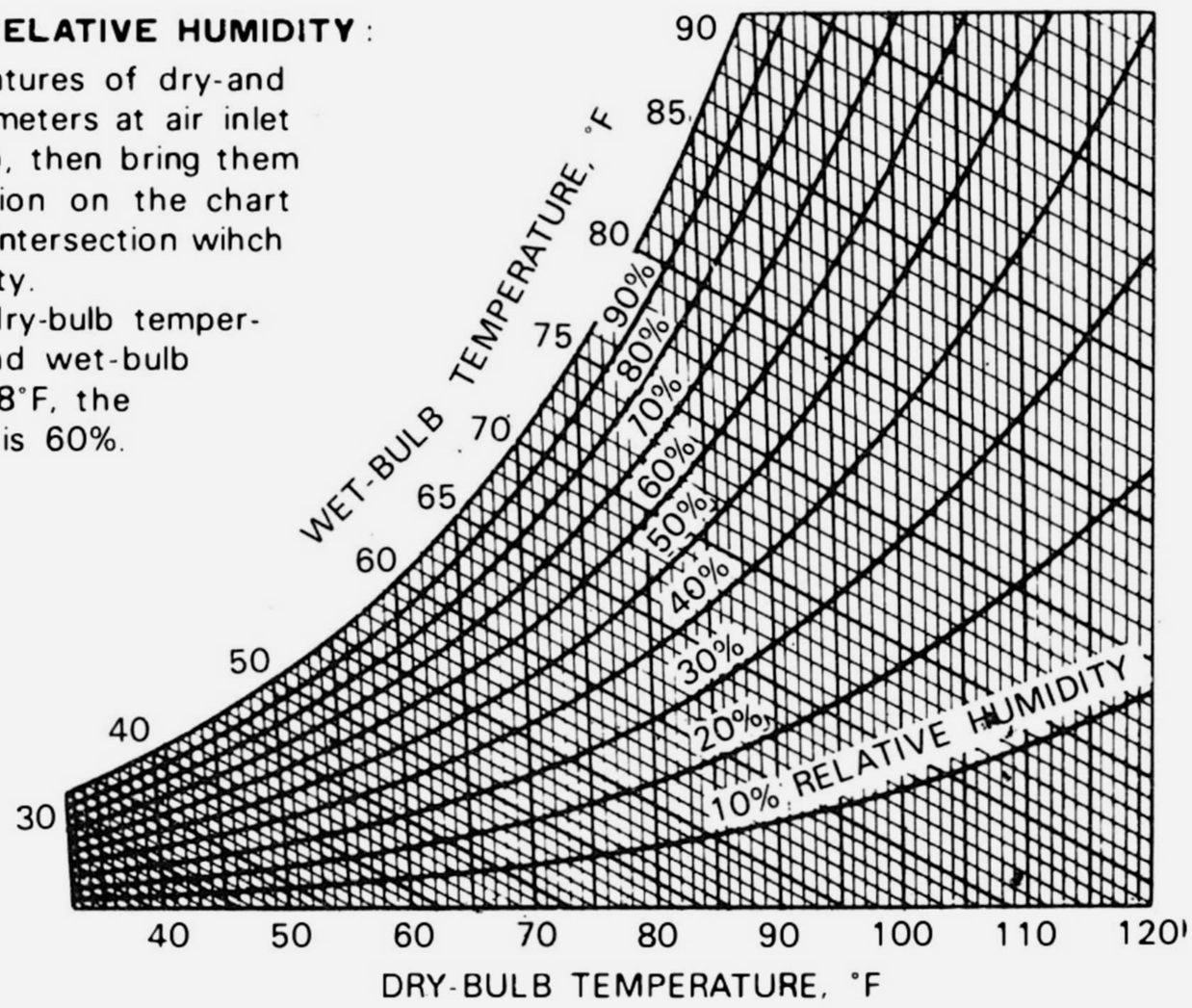


Fig. VI-10

HOW TO READ THE GRAPH:
After measuring the temperatures of wet-and dry-bulb thermometers at the evaporator air inlet, relative humidity (%) can be obtained.
Example: Supposing dry-and wet-blub temperatures at evaporator air inlet are 25°C and 19.5°C respectively, the point of intersection of the dotted lines in the graph, and is 60%

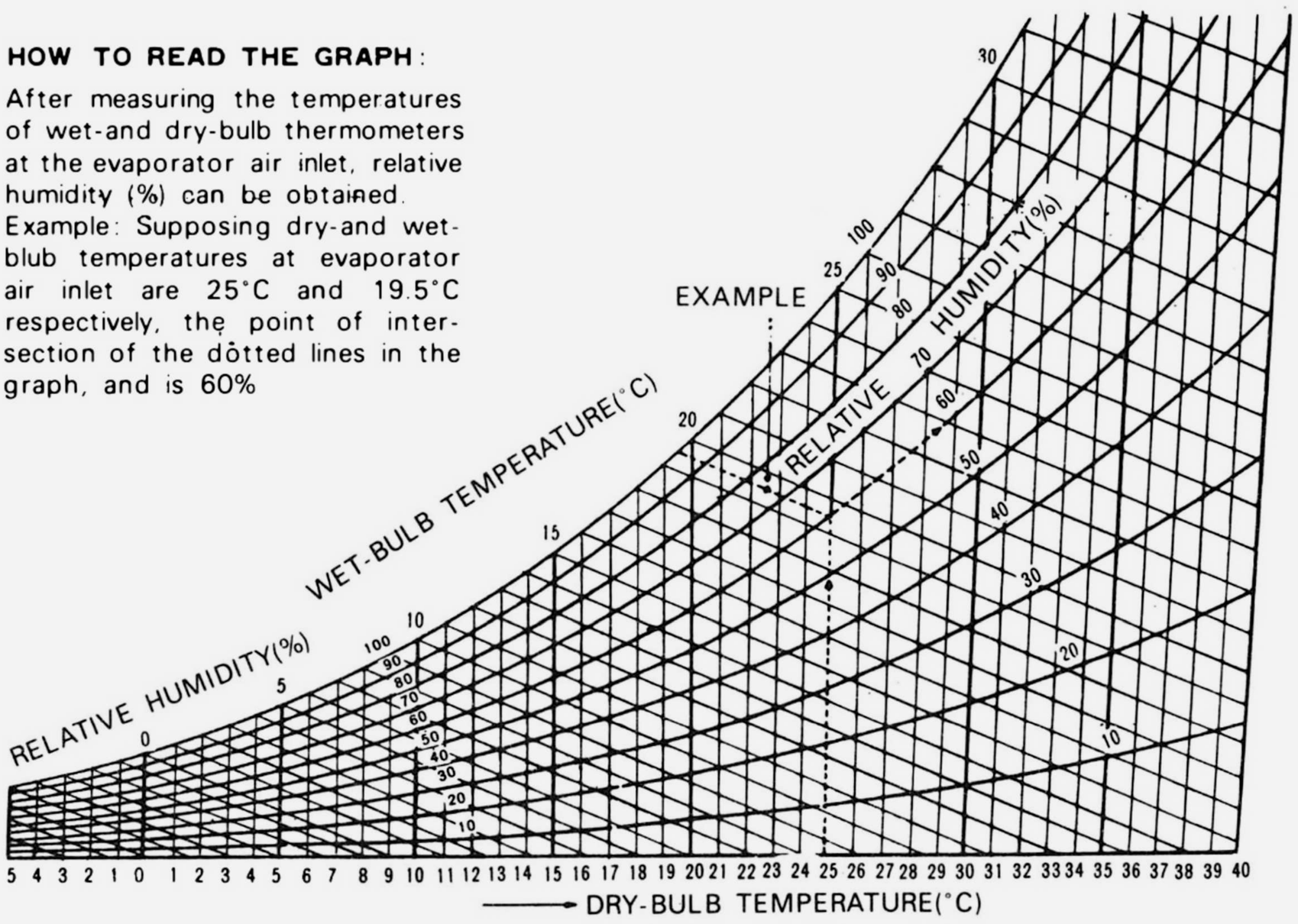


Fig. VI-11