TOYOTA
CORONA
CELICA
CARINA

REPAIR MANUAL

AIR CONDITIONING SYSTEM

TOYOTA MOTOR SALES CO., LTD.
NIPPONDENSO CO., LTD.

FOREWORD

This manual has been published for the guidance of servicemen on repairing the automotive air conditioner and maintaining it in best performance.

It contains the general description and construction with all up-to-date information at the time of this publication. As for compressor repair, please refer to the booklet "AIR CONDITIONING COMPRESSOR REPAIR MANUAL : TYPE 2C—90" we issued.

It is recommended that this repair manual should be kept readily available for reference at all times. Also this may be used for the training of your servicemen in regards to the special features, function, operation and maintenance of the air conditioner for TOYOTA CORONA (RT85L), TOYOTA CELICA (RA21L) and TOYOTA CARINA (TA12L).

We reserve the right to change the specifications and data without further notice.

CONTENTS

I. THE PRINCIPLE OF THE AUTOMOTIVE AIR CONDITIONER

A. THE PURPOSE OF THE AUTOMOTIVE AIR CONDITIONER

The purpose of automotive air conditioning is to maintain the passenger compartment more comfortable for driver and passengers.

Well, what is comefortable circumstances for men?

The main factors that affect human body heat are temperature, humidity and air movement. The automotive air conditioner makes it possible to change the condition of the air in the car by controlling above factors.

B. EVAPORATION AND LIQUEFACTION

We know that liquid changes into gas when it is heated. Conversely, gas changes into liquid when it is cooled down. Therefore, we can change the phase of material by means of controlling the temperature. This evaporation or liquefaction is also affected by pressure.

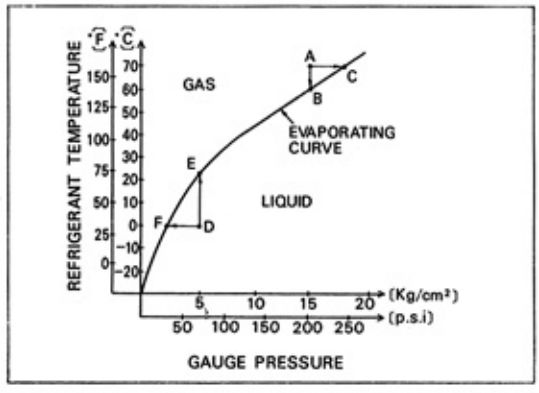


Fig. 1

Fig. 1 shows the saturating vapor pressure curve of R-12 which expresses the relation between temperature and pressure, when R-12 exists in both liquid and gaseous state in the air tight container. R-12 is the refrigerant which is used generally for automotive air conditioner.

The graph enable to determine the state of the refrigerant with temperature and pressure of R-12. In the graph, the upper part of the curve shows R-12 in gaseous state and the lower part in liquid state. The curve itself indicates the boiling point of R-12. Gaseous R-12 can be converted to liquid by increasing pressure without changing temperature, or by lowering temperature without changing pressure.
(In the graph, point "A" to "B", or "A" to "C".)

Conversely, liquid R-12 can be converted to gas by decreasing pressure without changing temperature, or by raising temperature without changing pressure.
(In the graph, point "D" to "E", or "D" to "F".)

C. LATENT HEAT

You feel cool when you wet your skin with alcohol. This is caused that alcohol absorbs body heat when it evaporates.

Generally, when material changes into gas from liquid, it absorbs heat from surrounding air. This heat is called latent heat.

Latent heat is the term applied to heat that is needed to cause a change of material state. Every materials have three states, solid, liquid and gas.

In change of state, large heat is absorbed from surroundings, or released to surroundings.

For example, water at an atmospheric pressure boils at 212°F (100°C).

In this case when 1 lb (1 kg) water changes into steam, 970 BTU (539 kcal) of heat is absorbed from surrounding air.

This is refered to as the latent heat of vaporization.

Conversely, steam at 212°F (100°C) will give up 970 BTU (539 kcal) of heat per 1 lb (1 kg) as it condenses into water. The heat released in this process is referred to as the latent heat of condensation. This principle is the basis for air conditioning.

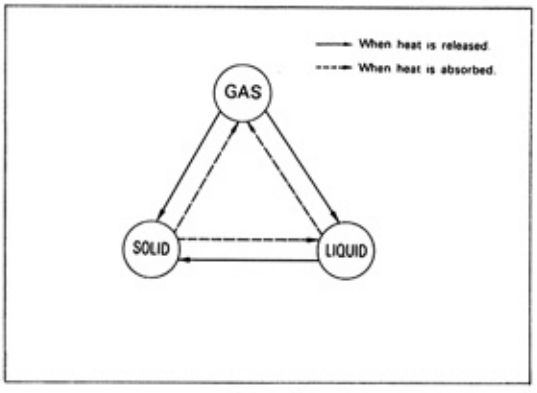


Fig. 2

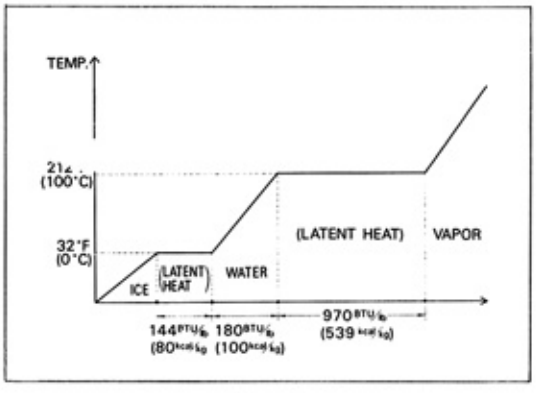


Fig. 3

It is by this process that we remove heat from the inside of the car and dissipate the heat in the outside air.

D. REFRIGERATION CYCLE

The basic chart of air conditioning system is shown in Fig. 4.

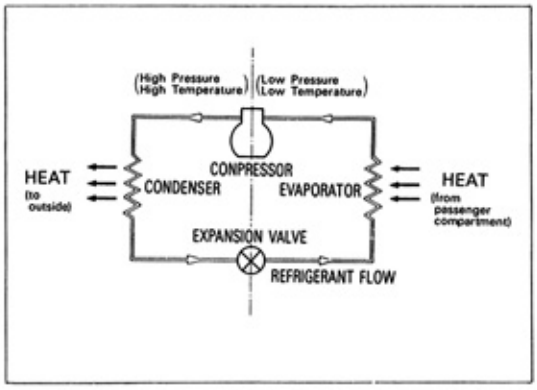


Fig. 4

The compressor makes gaseous refrigerant high pressure, high temperature, and compressed gaseous refrigerant changes into liquid by beeing cooled down till point of liquefaction in the condenser.

At this time, large heat is released to the outside.

Then high pressure liquefied refrigerant expands suddenly from the expansion valve into the evaporator. By this expansion, refrigerant evaporates and it absorbs large heat through the evaproter fins from outside.

Above description is the basic principle of general air conditioner.

Now, let's see the automotive air conditioner.

The schmatic chart of automotive refrigeration cycle is shown in Fig. 5. The compressor pumps heat-laden refrigerant from the evaporator. It compresses the refrigerant and send it under high pressure to the condenser.

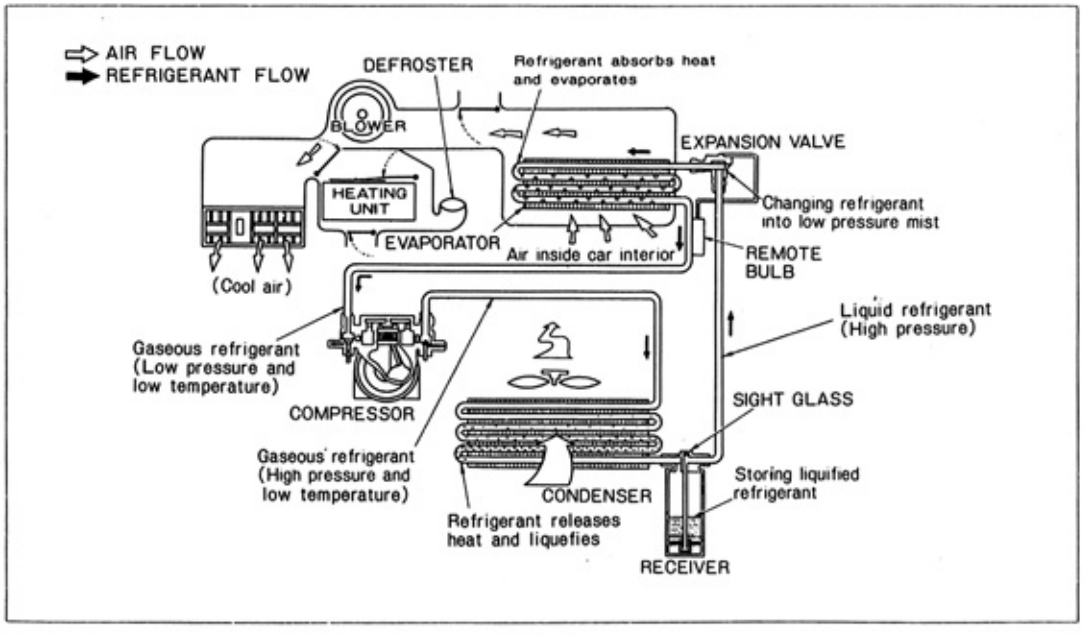


Fig. 5

Since the high pressure vapor delivered to the condenser is much hotter than the surrounding air, it gives up its heat to the outside through the condenser fins. As the refrigerant vapor dissipates its heat, it changes into liquid. The condensed liquid refrigerant is filtered, dried and temporarily stored under high pressure in the receiver until it is needed by the evaporator.

Liquid refrigerant is metered from receiver into the evaporator by the thermostatic expansion valve, which controls the flow of refrigerant in the system. The pressure of the refrigerant is lowered by the expansion valve and begins to boil, or change to a vapor. In so doing refrigerant absorbs heat from warm air in the passenger compartment passing through the evaporator fins. This heat will be transmitted, via compressor, to the condenser for dissipation.

E. REFRIGERANT (R-12)

In refrigeration system, the substance that absorbs and releases heat is called refrigerant. In automotive air conditioner, R-12 (CCl_2F_2) is used as refrigerant because of following merits.

(1) Large latent heat of evaporation and easy liquefaction.
(2) Chemical stability
(3) Non-corrosive
(4) Incombustible and non-explosive
(5) Non-poisonous
(6) Scentless
(7) Harmless to clothing and food

Now, let's see the saturating vapor pressure curve of R-12 again.
(See Fig. 6)

R-12 boils at −29.8°C (−21.6°F) in a atmosphere, and under a pressure of 2 kg/cm² (28.4 p.s.i.), it boils at 0°C (32°F) which is evaporation temperature in the air conditioner.

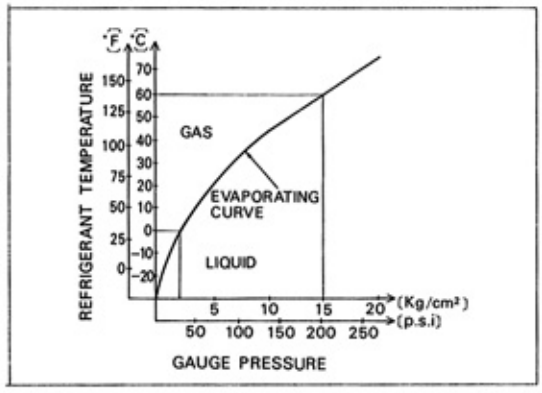


Fig. 6

Gageous R-12 can be converted to liquid by increasing pressure without changing temperature, or by lowering it to boiling point, in other words, dew point.

In case of automotive air conditioner, the liquefaction of the refrigerant is carried out by raising the pressure and also by lowering the temperature, which are performed within the compressor and condenser, respectively.

For example, 15 kg/cm² (213 p.s.i.), 70°C (158°F) gas refrigerant compressed by the compressor can be liquified by lowering the temperature about 10°C (18°F).

MEMO :

II. THE FUNCTION OF MAIN COMPONENTS FOR AIR CONDITIONER

A. COMPRESSOR

In short, the compressor is a pump designed to raise the pressure of the refrigerant. It is necessary that the compressor is of sufficient capacity to control the movement of refrigerant from the evaporator to the condenser. The compressor primarily circulates the refrigerant arround the system, but it must also increase the pressure of the refrigerant for a more efficient condensation process later in the cycle.

There are two types in compressor : reciprocating type and swash plate type compressor. We refer the reciprocating type compressor only. Application vehicle models of this manual mount reciprocating type compressor : 2C−90 type compressor.

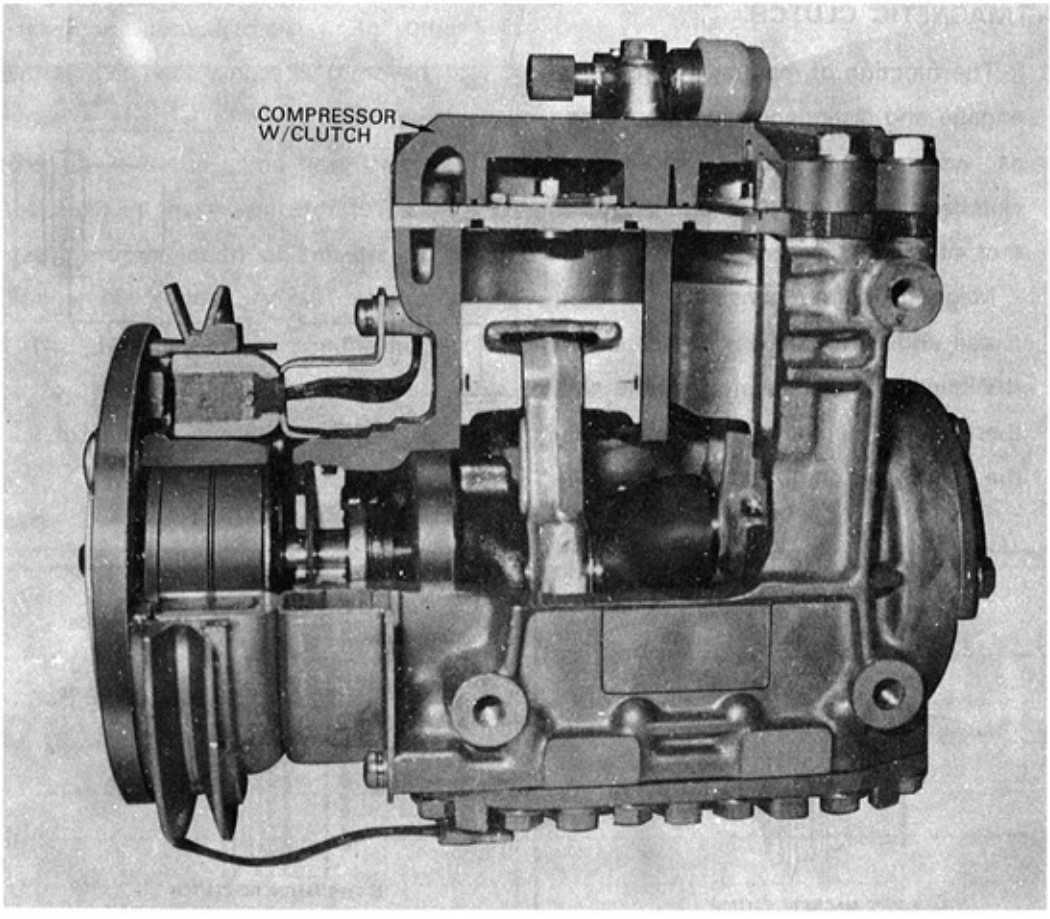


Fig. 7

2C–90 type compressor consists of two cylinders.

Each cylinder has two valves : a discharge valve to increase refrigerant pressure, and a suction valve that draws in refrigerant.

On the down stroke, vaporized refrigerant is drawn into the empty cylinder and on the upward stroke the vapor is pressurized and directed to the high pressure line.

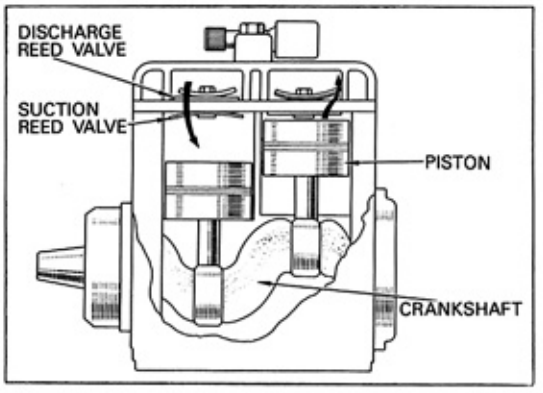


Fig. 8

B. MAGNETIC CLUTCH

The function of magnetic clutch is to engage and disengage the compressor as system demands. Basically, all clutches operate on the same principle, that of magnetic attraction.

Magnetic clutch consists of stator, coil and rotor.

When no current is fed to the coil, there is no magnetic force applied to the clutch and compressor disengages.

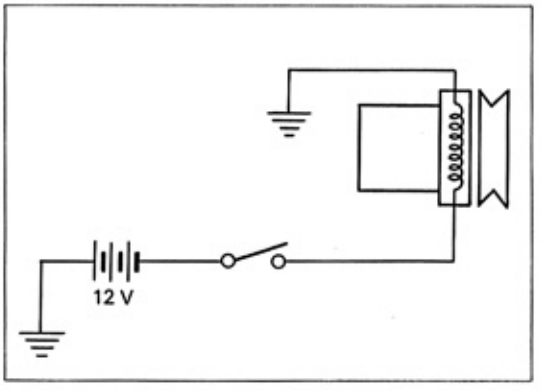


Fig. 9

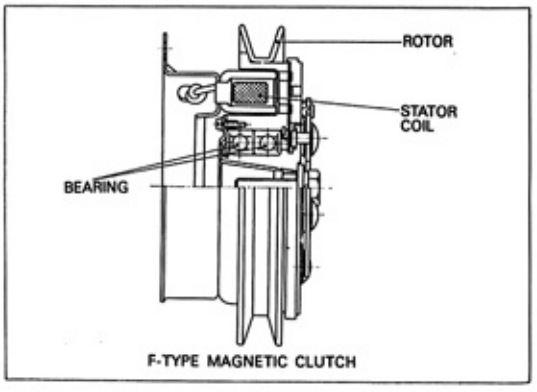


Fig. 10-a

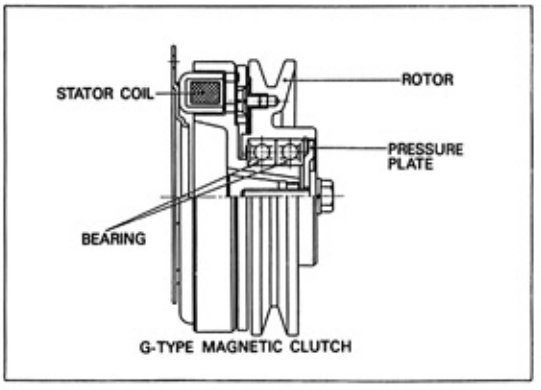


Fig. 10-b

When current is fed to the coil, magnetic force is set up between the field and armature. When the armature becomes engaged with the rotor, it becomes as one piece and complete unit turns while the field remains stationary. This causes the compressor crankshaft to turn, starting the refrigeration cycle.

C. CONDENSER

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

High pressure refrigerant, laden with heat, enters the condenser in the form of a gas and giving up its heat to the air, the gas changes to a liquid.

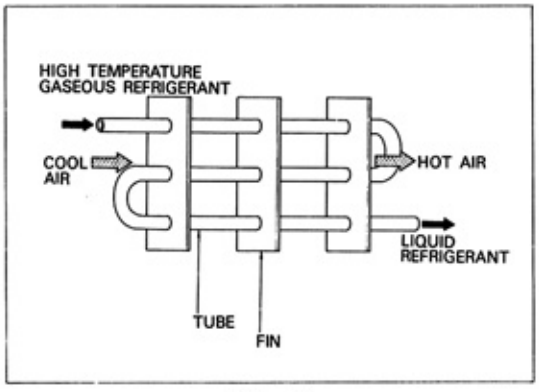


Fig. 11

This heat is transferred from the passenger compartment. In other words this heat which is removed to cause a change of state from a gas to a liquid is the same heat that was absorbed in the evaporator to cause a change of state from a liquid to a gas.

If the liquefaction of refrigerant is done insufficiently in the condenser, air conditioner will reduce its performance.

The efficiency of the condensing action is dependent on the motion of the vehicle to force air against the condenser fins combined with the cooling action of the belt driven cooling fan.

MEMO :

D. RECEIVER

The structure of receiver is shown in Fig. 12-a.

The receiver has important functions as follows.

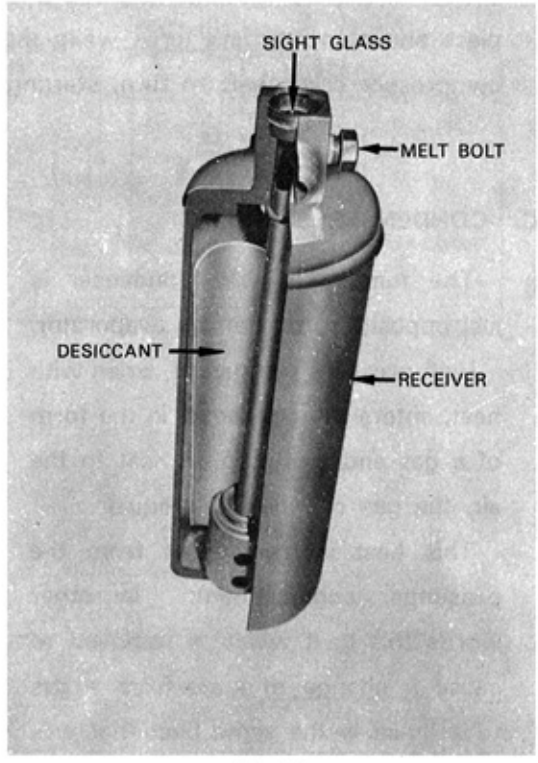


Fig. 12-a

(1) In case that the load on the evaporator varies because of refrigerant loss which occurs through small leaks and so on, receiver supplies the extra refrigerant which is stored until needed by the evaporator. As above description, one of receiver functions is a tank that is designed to supply or receive the refrigerant according to the load on evaporator.

(2) The receiver has drier and filter in the tank. A desiccant is a solid substance capable of removing moisture from gas or liquid. The drier desiccant is used usually silica gel. By this desiccant, moisture in the refrigerant cycle which causes corrosion of metal and deteriorate the refrigeration oil is removed.
The refrigerant must pass through the filter before it leaves the tank. The purpose of filter is to prevent the desiccant, dust and other solids carried with the refrigerant.

(3) The receiver is equipped with fusible plug as a safety device.
The structure is simple. A small hole is made through the center of a bolt, and where solder has been poured in.
When the temperature and the pressure inside the condenser or receiver go up abnormally due to poor liquefaction of the refrigerant and so on, the solder of fusible plug melts (at the temperature of about 95°C – 100°C (203°F – 212°F)) and springs out, thus, preventing the damage to other parts.

(4) The receiver is equipped with sight glass on the top.
Amount of refrigerant to be charged is very important for the efficiency of air conditioner. Sight glass is used to check the amount of refrigerant.
On checking the amount of refrigerant, refer to IX-III on page 70.

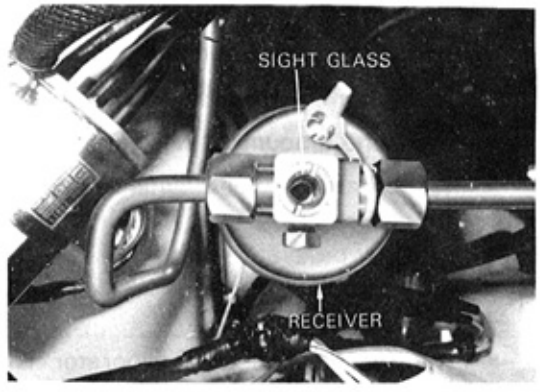


Fig. 12-b

E. EXPANSION VALVE

The main function of thermostatic expansion valve is to control the amount of refrigerant entering the evaporator core.

At the expansion valve, the high pressure liquid refrigerant from the receiver is changed into vapor by a sudden drop in pressure. The structure of the expansion valve is shown in Fig. 13. The remote bulb is fastened to the evaporator outlet.

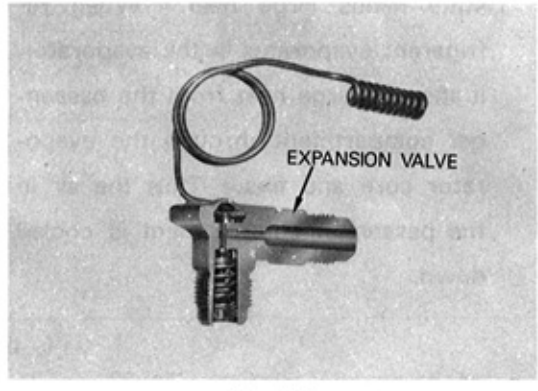


Fig. 13

The remote bulb senses the temperature of evaporator outlet, and activiates the diaphragm in the expansion valve through the capillary tube and causes the proper amount of refrigerant to flow into the evaporator.

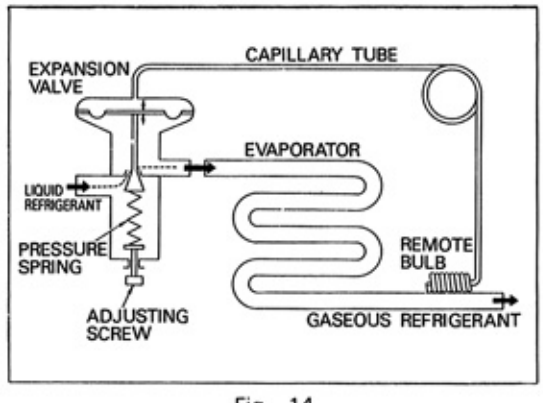


Fig. 14

When remote bulb senses high temperature, in other words, the evaporator is starved of refrigerant, this heat causes pressure to be increased on the diaphragm by the expanding gas in

the remote bulb through the capillary tube. And the valve is opened more widely.

Conversely, when remote bulb senses low temperature, in other words, the amount of refrigerant is excessive in the evaporator, the valve is opened more narrowly.

Thus, the amount of refrigerant in the evaporator is controlled by the expansion valve.

F. EVAPORATOR

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

In the evaporator, the refrigerant from expansion valve is vaporized completely. This change of refrigerant state needs large heat. When refrigerant evaporates in the evaporator, it absorbs large heat from the passenger compartment through the evaporator core and fins. Thus the air in the passenger compartment is cooled down.

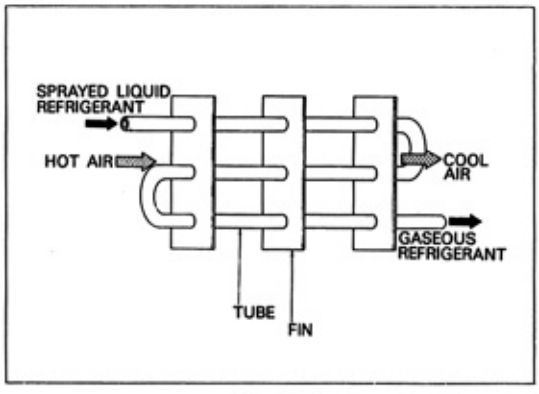


Fig. 15

G. ELECTRICAL SYSTEM

The function of electrical circuits in the air conditioner system is, in short, controlling the air cooling action.

The most important electrical circuit is the idling stabilizer circuit. Schmatic chart of idling stabilizer circuit is shown in Fig. 16. The idling stabilizer circuit comprises the outlet air temperature detecting circuit and engine revolution detecting circuit. They are thermistor, temperature control resistor (thermostat dial) and idling stabilizer amplifier with idling stabilizer relay.

The idling stabilizer amplifier amplifies and synthesizes both electric signals from the distributor and thermistor. When these signals are simulataneously satisfied for the specified condition, the amplifier actuates the relay and the magnetic clutch engages.

Then the compressor is driven by the engine.

The temperature control resistor (thermostat dial) varies in resistance as it is adjusted by the driver to suit his comfort requirement.

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.

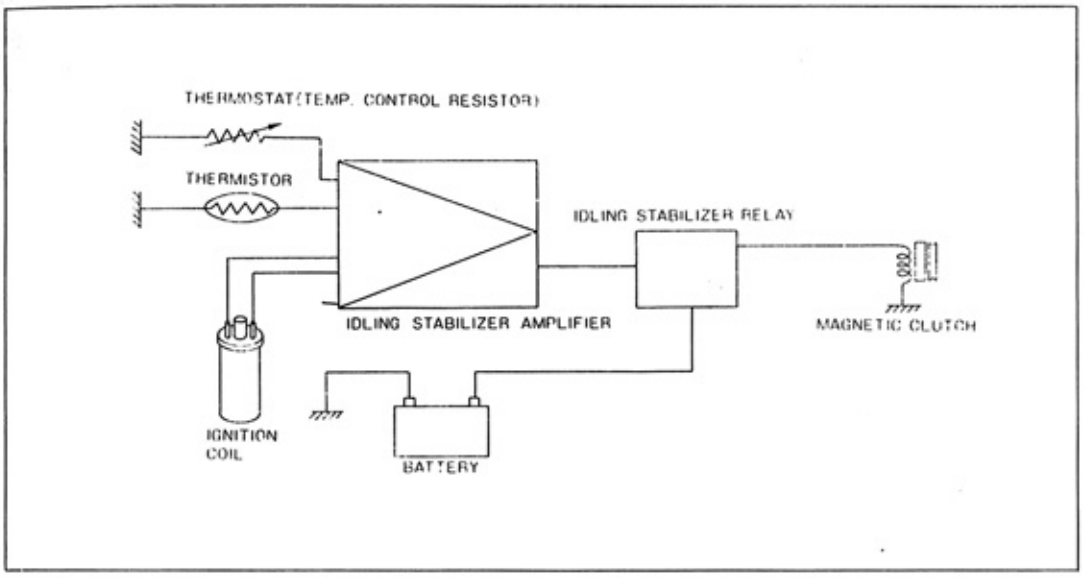


Fig. 16

MEMO :

III. AIR CONDITIONING CONTROLS

A. GENERAL DESCRIPTION

Cooling unit and heating unit are mounted on the dash panel of passenger compartment. Blower is equipped in heating unit originally and other compornent parts of air conditioner are installed in the engine compartment.

Air conditioning (both heating and cooling) functions are performed by this system.

The recirculated air is forced through the evaporator by blower, through and arround the heater core then mixed, and is delivered to the rectangular center outlet grille, heater and defroster outlet, according to the setting position of each control lever on the control panel.

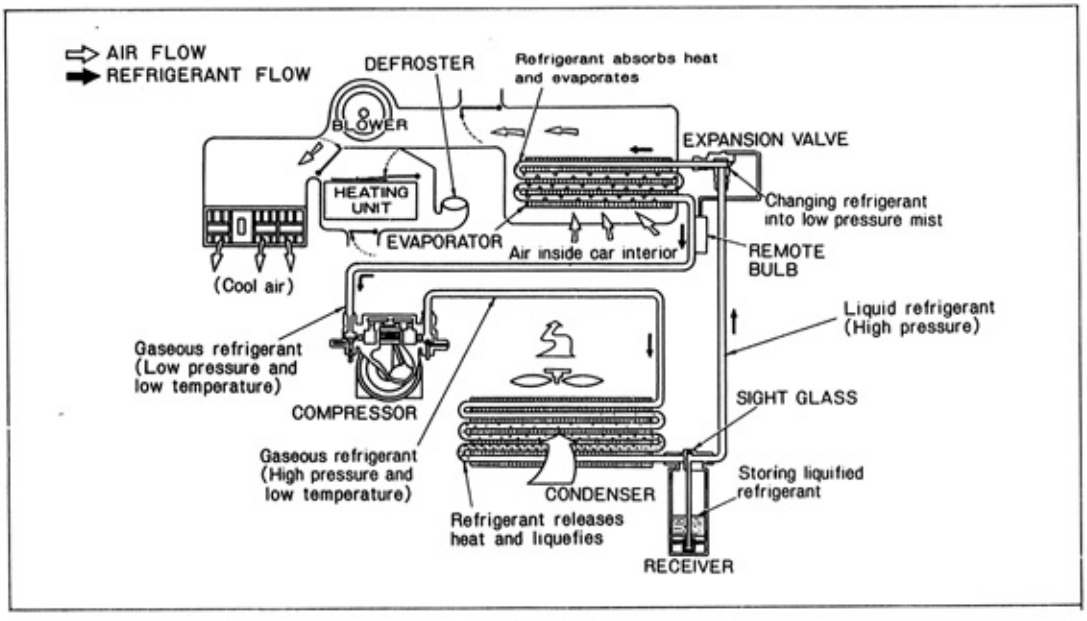


Fig. 17

The system operations are as follows. (See Fig. 17)

The temperature of conditioned air is determined by the setting of the thermostat dial on the rectangular center outlet and the temperature control lever on the control panel.

The blower speed and velocity of the air flow from the rectangular center outlet, heater outlet and defroster outlet is determined by the setting position of the blower control switch on the control panel.

Direction of conditioned air is controled by moving the grille of rectangular center outlet or by the Air Distribution Lever on the control panel.

B. AIR CONDITIONING CONTROLS

Air Conditioning system is maintained through the use of three levers, three-speed blower control switch and thermostat dial.

FRESH-RECIRC control lever controls the fresh air door with a control wire.

To operate the system as air conditioner (cooling), this lever should be set at RECIRC position.

HI-LO (HOT-COLD) control lever is used to adjust the amount of coolant flowing to heater core. To stop the coolant flow, set the lever at "LO" ("COLD") position. And also, this lever controls the position of temperature damper, therefore temperature of outlet air (conditioned air) can be changed by sliding the lever.

HEAT-DEF (DEFROST)-VENT control lever uses two control wires and linkage lever to operate three doors in the heating unit.

The thermostat installed on the rectangular center outlet has two functions. One of thermostat functions is to control the power source for the electrical devices of air conditioner.

To stop the power source, turn the dial downward to "OFF" position.

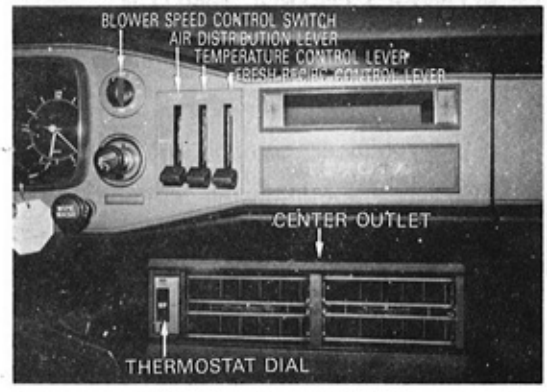


Fig. 18-a (For CORONA)

Fig. 18-b (For CELICA)

Fig. 18-c (For CARINA)

Other function is to control the temperature inside passenger compartment by turning dial from "1" to "10" position.

Maximum cooling is determined at "10" position.

1. BLOWER CONTROL SWITCH

Blower control switch is shown in Fig. 19.

When blower control switch is at "OFF" position, the air conditioning system is entirely inoperative. And also the blower control switch controls the operation of the blower motor speed and the velocity of air flowing from the air conditioning system.

Blower motor speed can be controlled at three-speed as below.

1 ..... low speed

2 ..... medium speed

3 ..... high speed

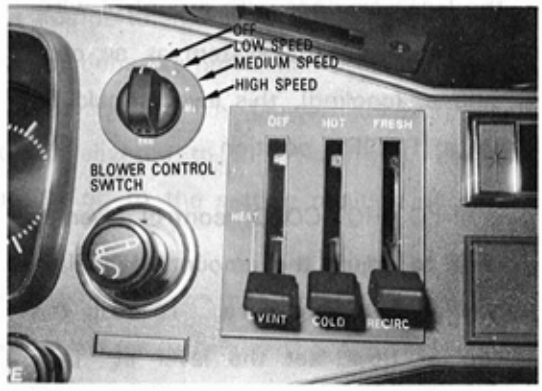


Fig. 19-a (For CORONA)

Fig. 19-b (For CELICA)

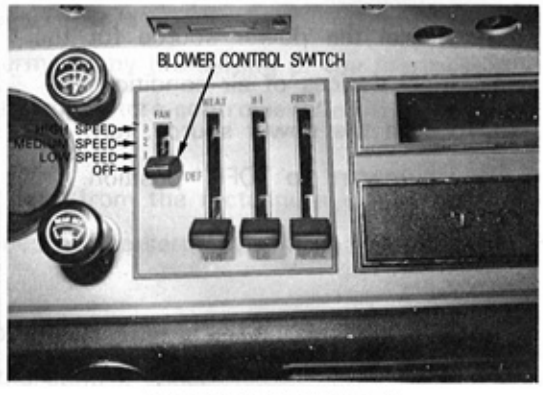


Fig. 19-c (For CARINA)

2. COOLING

Set the three control levers and blower control switch on the instrument panel shown in Fig. 20. In addition, when placing the thermostat dial at certain number, cool air will be delivered from the rectangular center outlet. At this mode, the system is always operating on inside air and the water valve is closed to preventing coolant flow through the heater core. (See Fig. 21)

Temperature of inside passenger compartment is determined by setting position of the blower control switch and thermostat dial.

Never operate the air conditioner with the thermostat dial at "10" position and the blower control switch at "LOW" position, for this combination may sometimes cause frost on the evaporator.

Fig. 20-a (For CORONA)

Fig. 20-b (For CELICA)

Fig. 20-c (For CARINA)

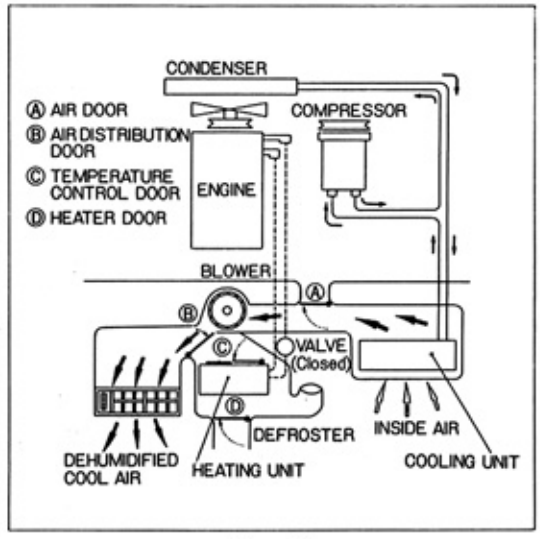


Fig. 21

3. VENT

On the above mode, slide the FRESH-RECIRC control lever from "RECIRC" to "FRESH" position shown in Fig. 22.

The system will operate as boost ventilator. (See Fig. 23.)

In this mode the air door is open and the compressor is turned off by the microswitch installed on the underside of heater inlet case.

The air velocity is changed by blower control switch.

If turning off the blower control switch, the outside air flows into the passenger compartment through the rectangular center outlet when car is running.

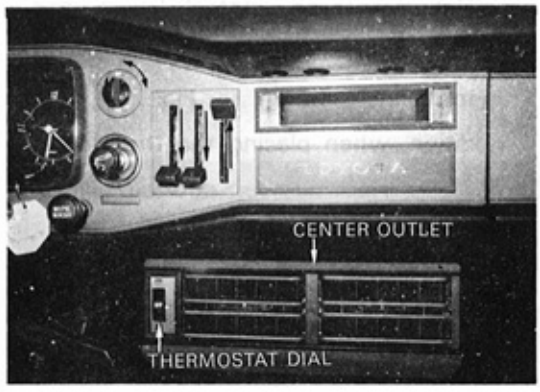


Fig. 22-a (For CORONA)

Fig. 22-b (For CELICA)

Fig. 22-c (For CARINA)

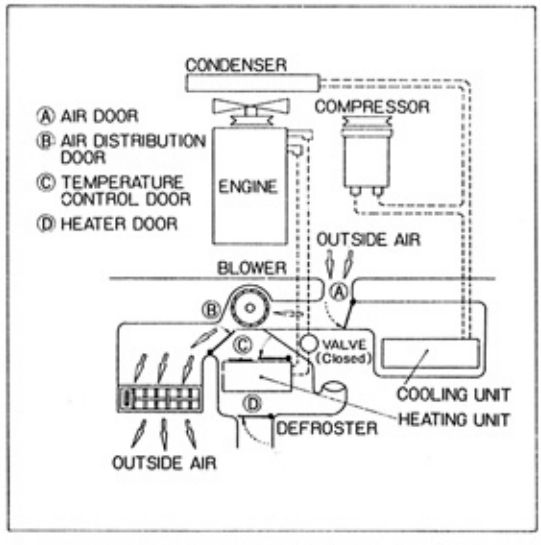


Fig. 23

4. HEATING

When setting three control levers at the positions shown in Fig. 24, each damper is placed as shown in Fig. 25, and water valve is open, directing almost all heated air flow out of the lower side outlet of heating unit (a small amount heated air is allowed to bleed to the defroster nozzle.).

Temperature of heated air is controlled by sliding the temperature control lever.

Note: *Always keep the thermostat dial in "OFF" position when using the system as a heater.*

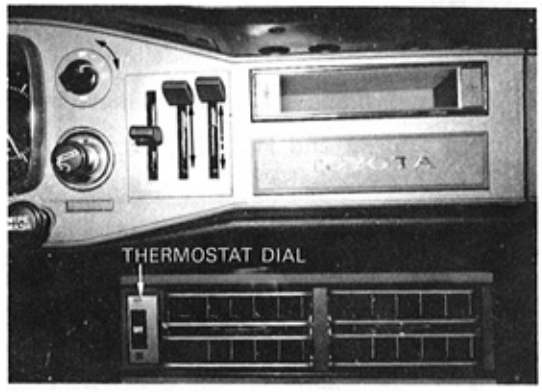


Fig. 24-a (For CORONA)

Fig. 24-b (For CELICA)

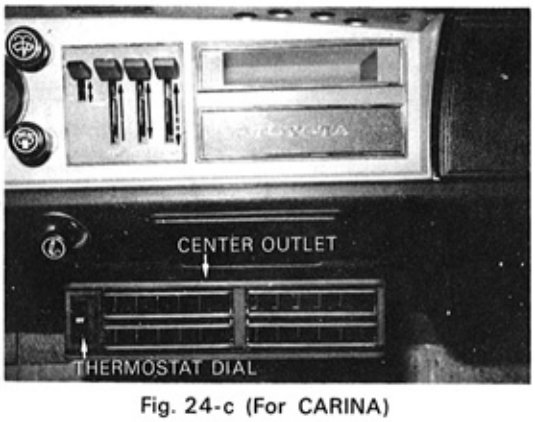


Fig. 24-c (For CARINA)

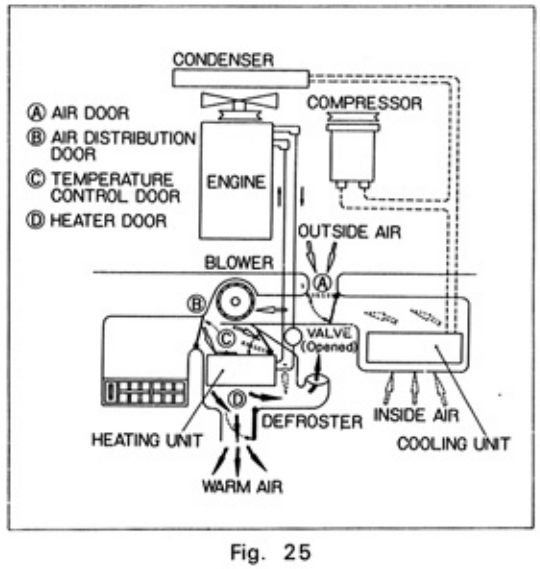


Fig. 25

5. DEFROSTING

When placing the air distribution lever only at the "DEF" ("DEFROST") position from the "HEATING" mode, the heater door moves to close position.

The air flow is allowed to flow out of the defroster nozzle.

(See Fig. 26 and Fig. 27)

Fig. 26-a (For CORONA)

Fig. 26-b (For CELICA)

Fig. 26-c (For CARINA)

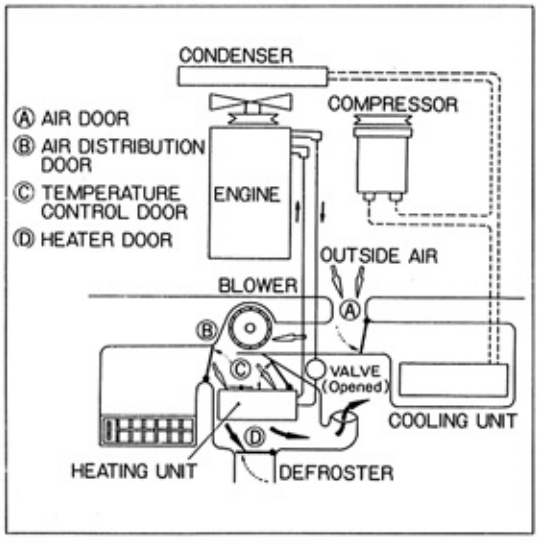


Fig. 27

MEMO :

6. DEHUMIDIFYING

Set the three control levers at the positions shown in Fig. 28.

With the "FRESH-RECIRC" control lever at the "RECIRC" position, the door is opened to the cooling unit.

At the same time, the microswitch is actuated. When dehumidifying the recirculating air by this air conditioner, the thermostat dial must be set with "7" to "9" in indicator.

In the above condition, the magnetic clutch will be engaged.

The conditioned air temperature is determined by setting position of temperature control lever and thermostat dial.

All the air flow from the inlet of cooling unit (recirculating air) passes through the evaporator and into the blower. And cooled air is forced by blower, through and/or around heater core then mixed and is delivered to the lower side of heating unit and defroster nozzle. (See Fig. 29)

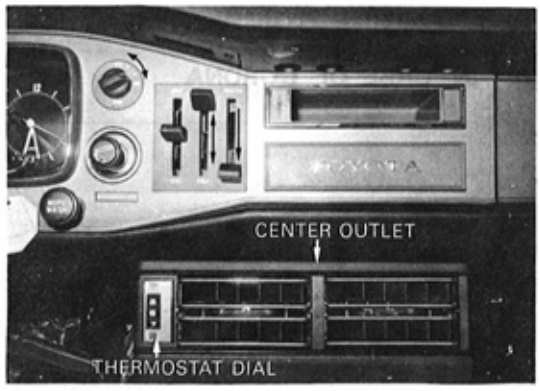


Fig. 28-a (For COORONA)

Fig. 28-b (For CELICA)

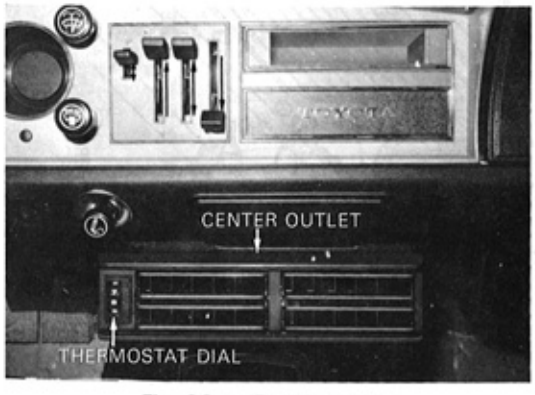


Fig. 28-c (For CARINA)

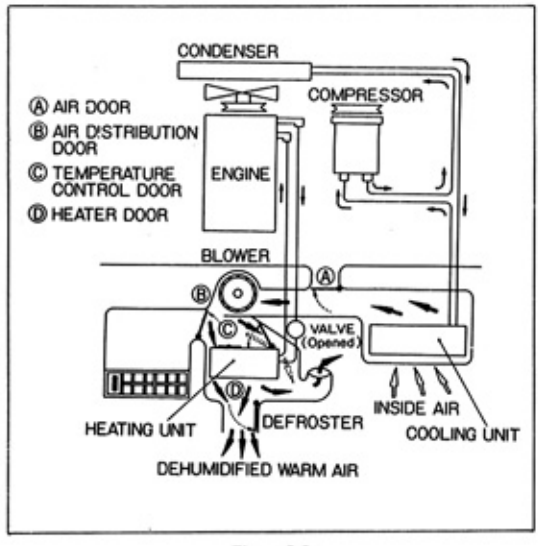


Fig. 29

IV EXPLODED VIEW

IV-1 ENGINE COMPARTMENT

A. IN CASE OF CORONA

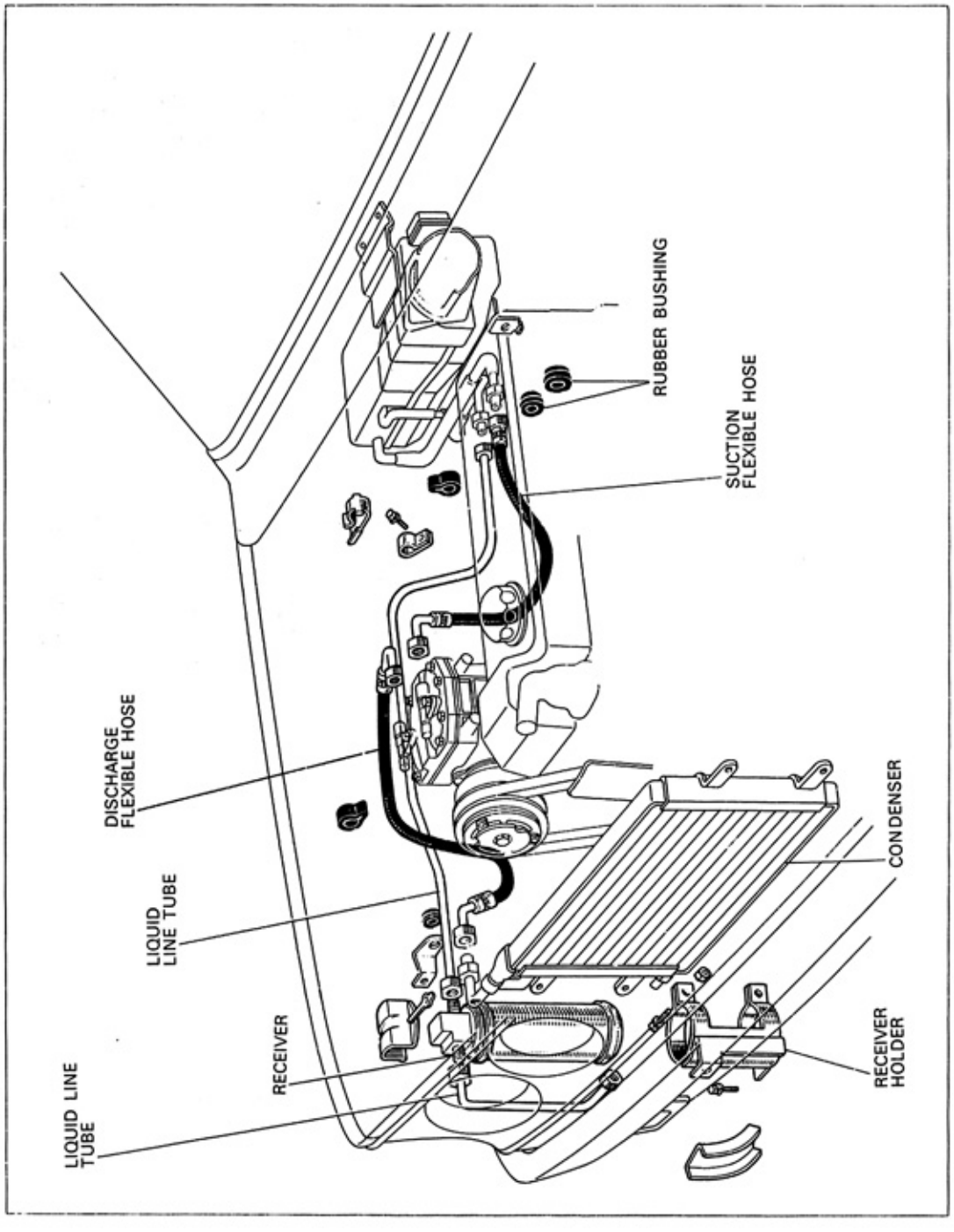


Fig. 30 (For CORONA)

IV-1 ENGINE COMPARTMENT

B. IN CASE OF CELICA

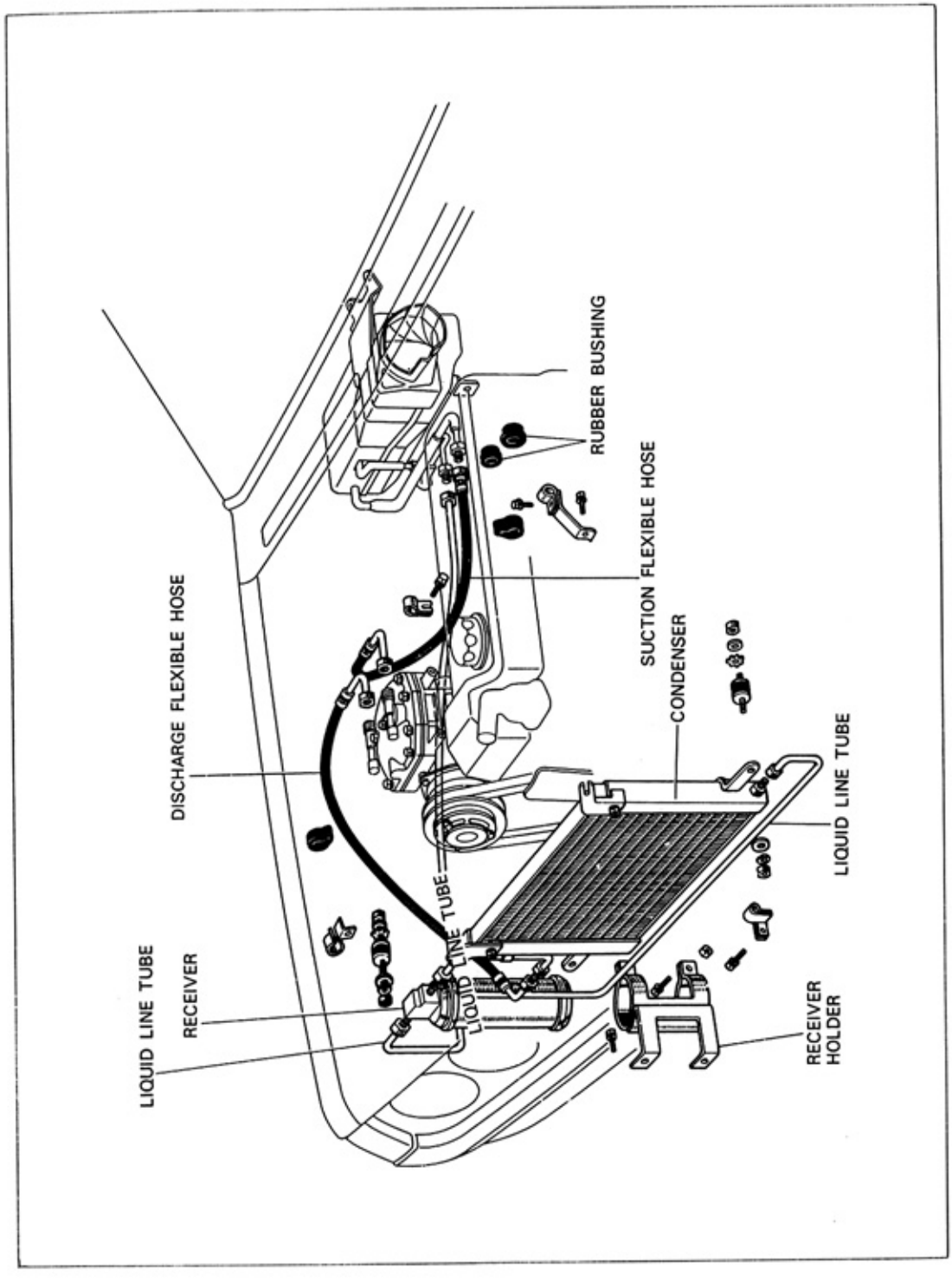


Fig. 31 (For CELICA)

IV-1 ENGINE COMPARTMENT

C. IN CASE OF CARINA

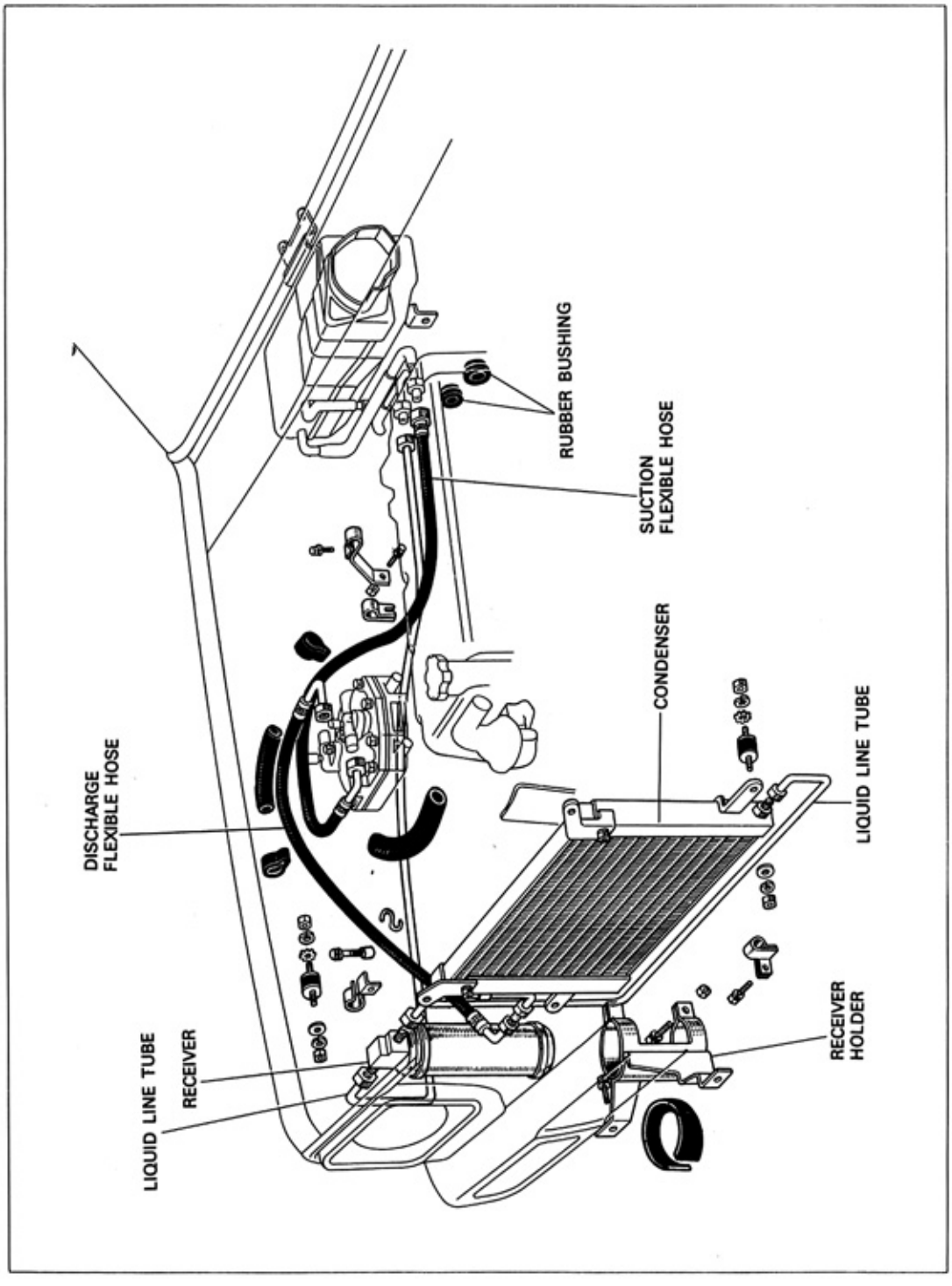


Fig. 32 (For CARINA)

IV-2 COMPRESSOR

A. IN CASE OF CORONA

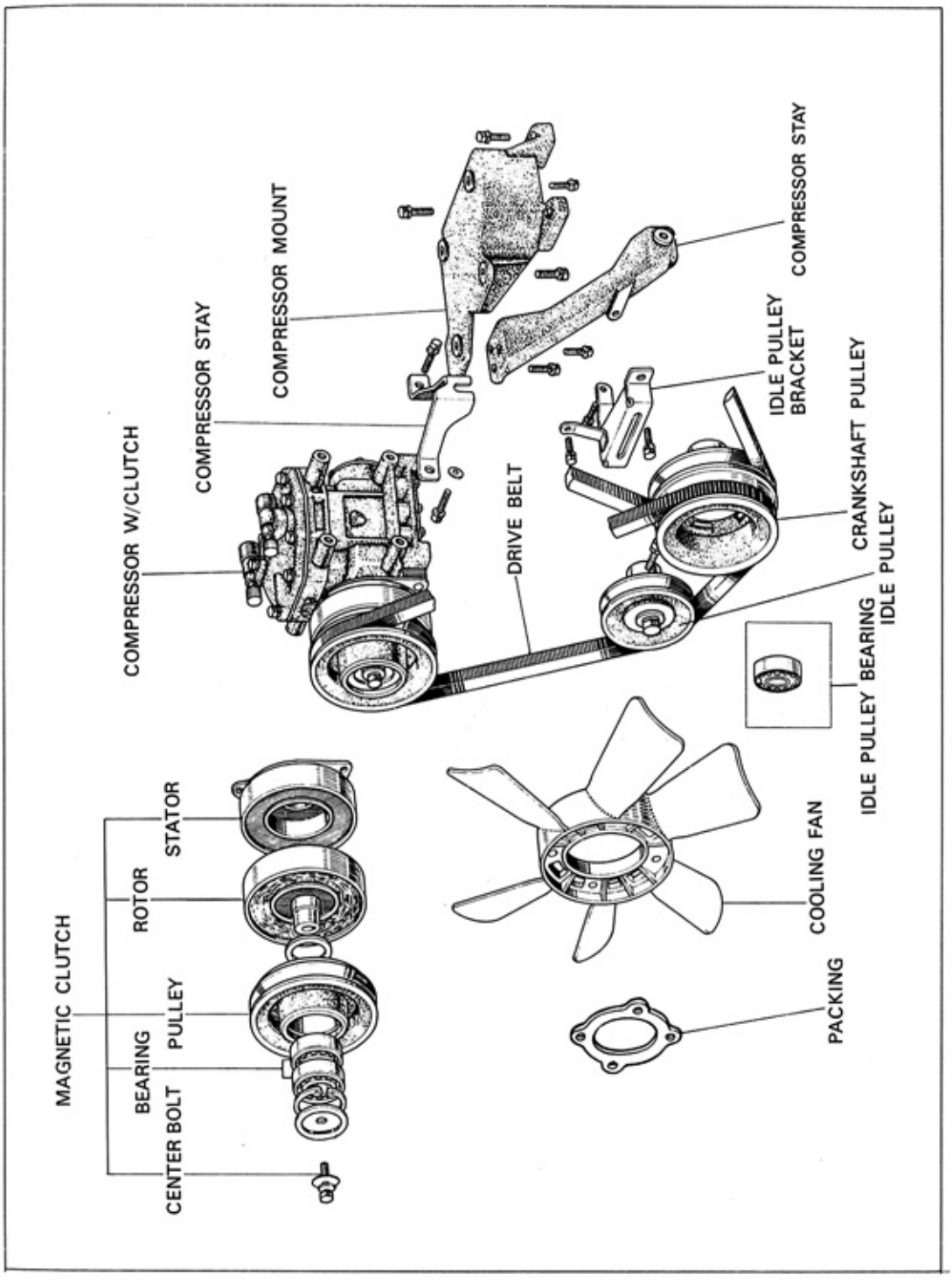


Fig. 33 (For CORONA)

IV-2 COMPRESSOR

B. IN CASE OF CELICA

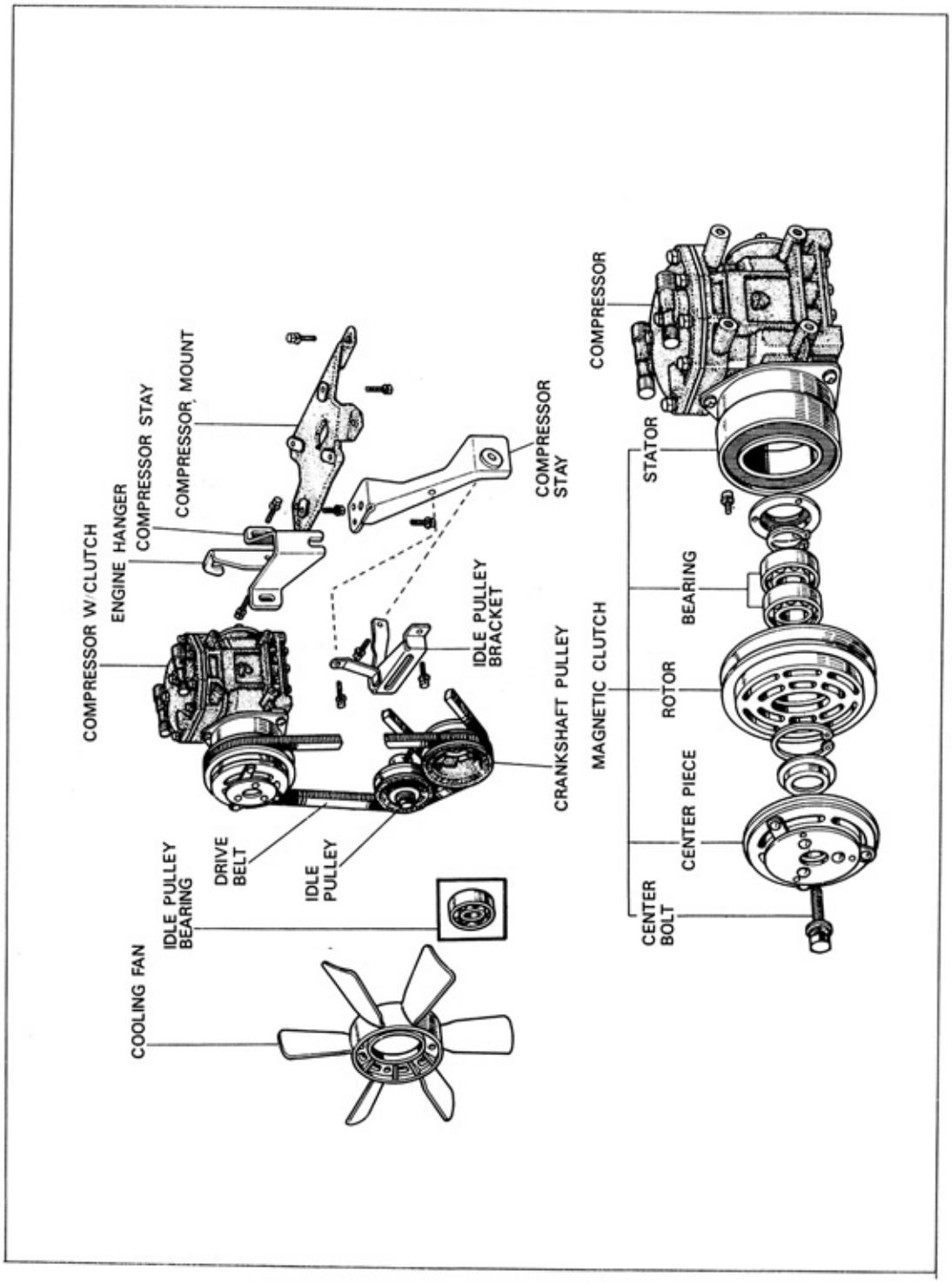


Fig. 34 (For CELICA)

IV-2 COMPRESSOR

C. IN CASE OF CARINA

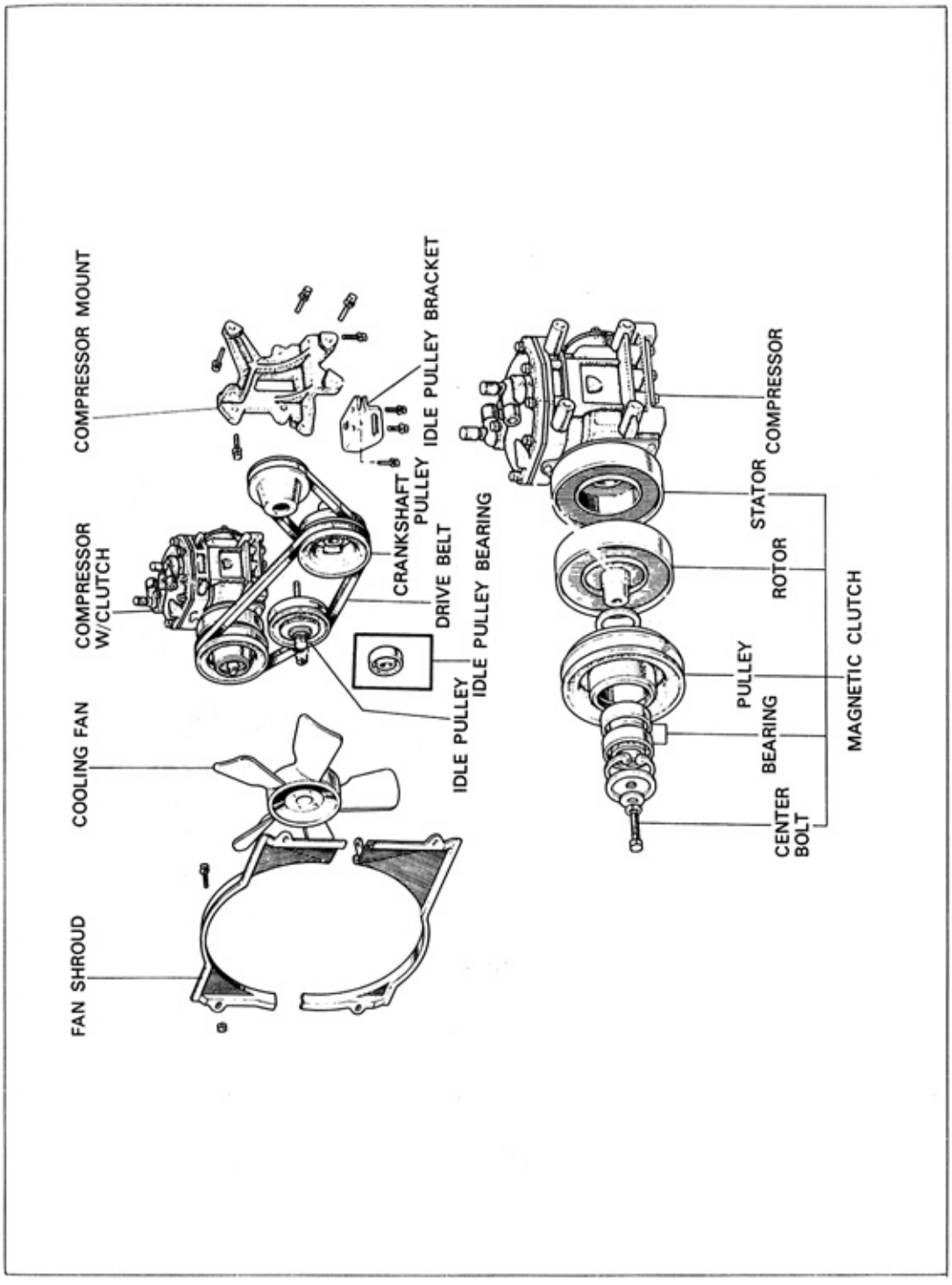


Fig. 35 (For CARINA)

IV-3 COOLING UNIT

A. IN CASE OF CORONA

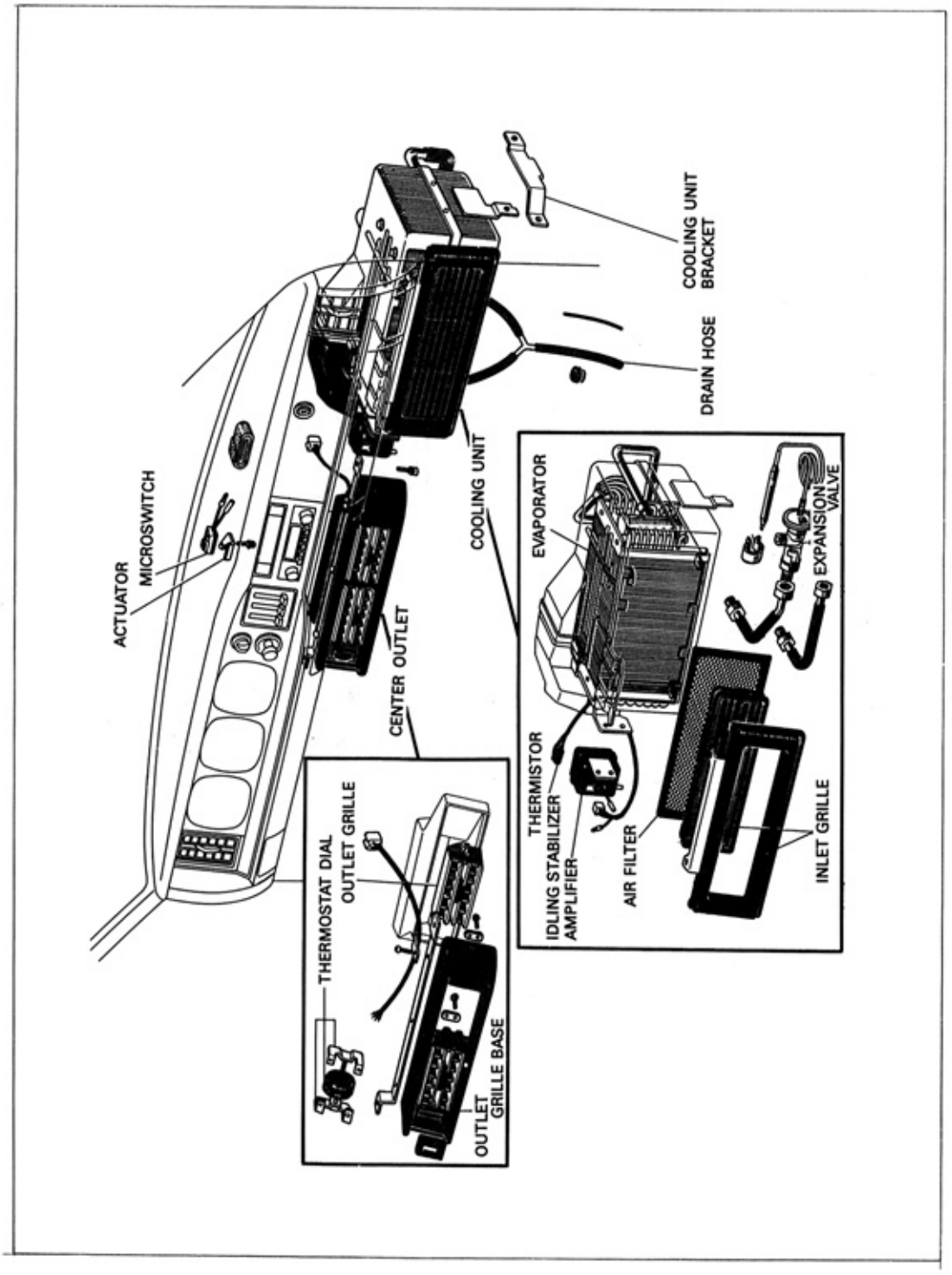


Fig. 36 (For CORONA)

IV-3 COOLING UNIT

B. IN CASE OF CELICA

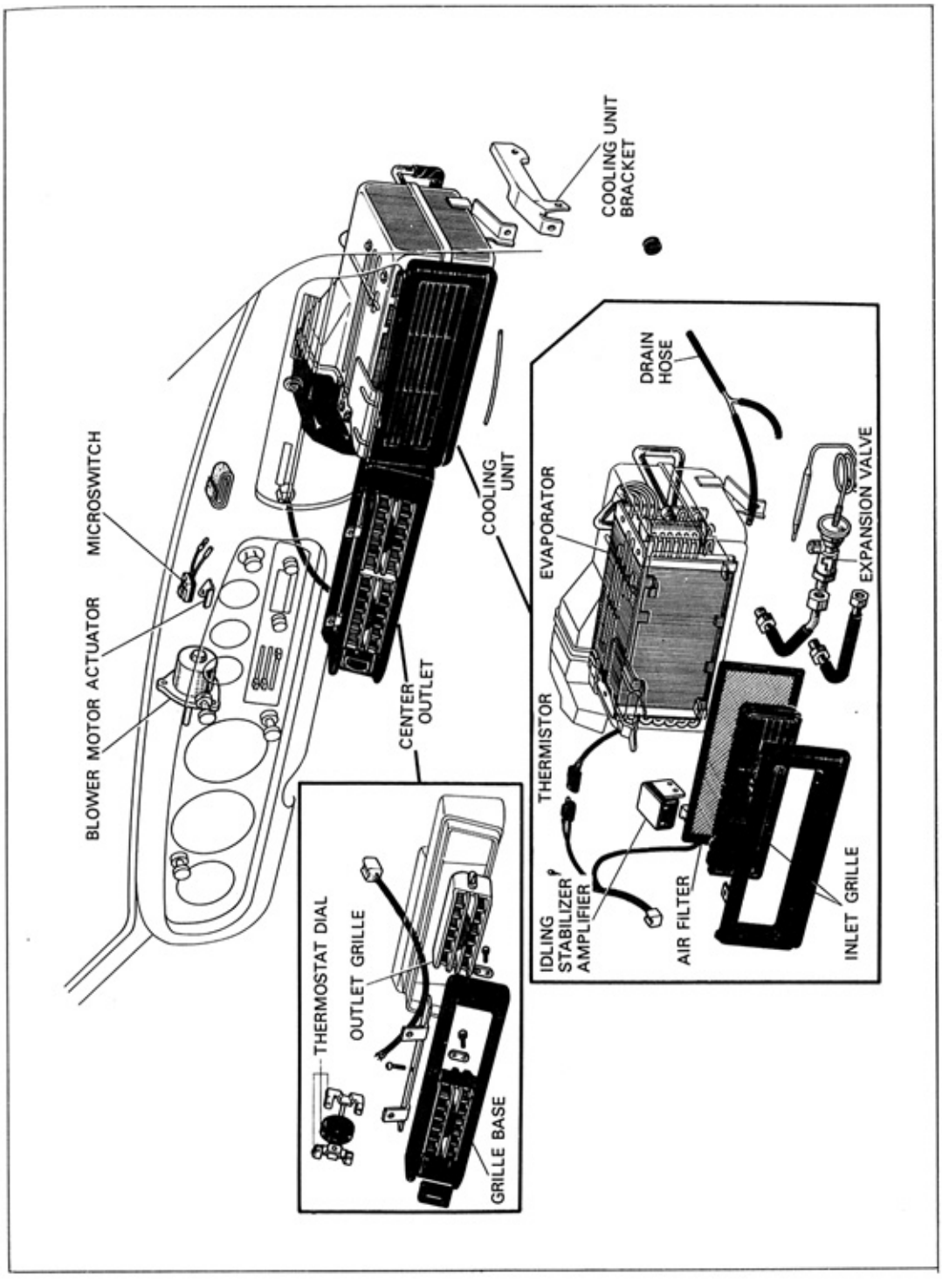


Fig. 37 (For CELICA)

IV-3 COOLING UNIT

C. IN CASE OF CARINA

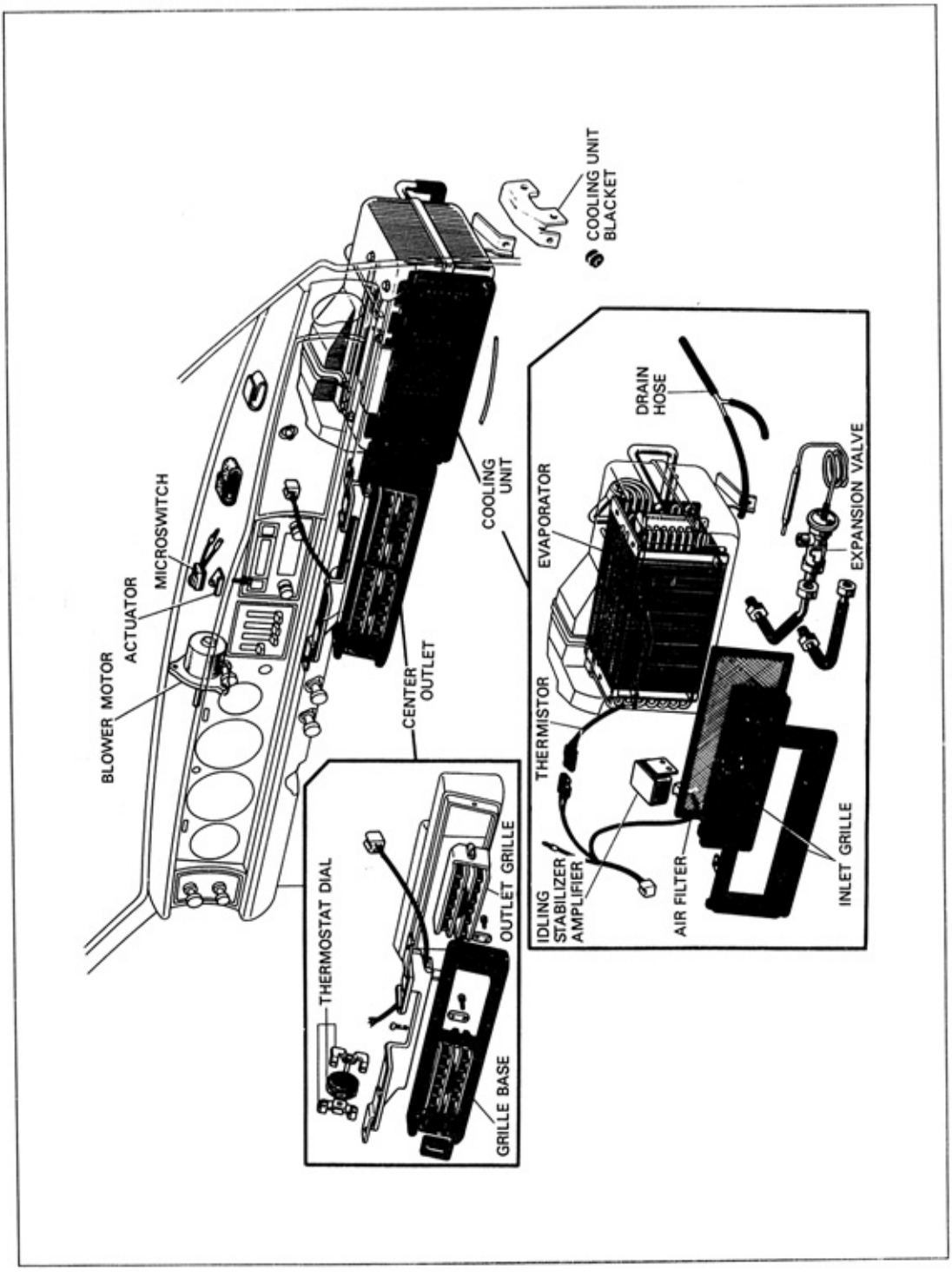


Fig. 38 (For CARINA)

V. CONNECTION AND WIRING

V-1 CONNECTION DIAGRAM

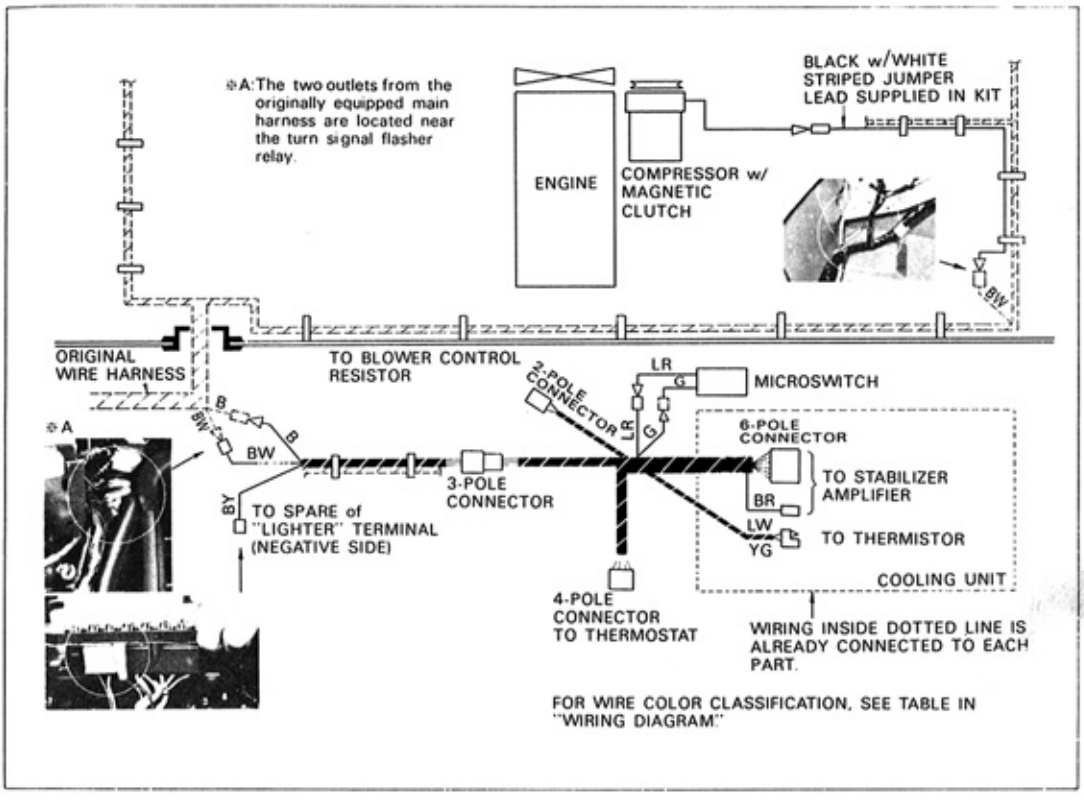


Fig. 39-a (For CORONA)

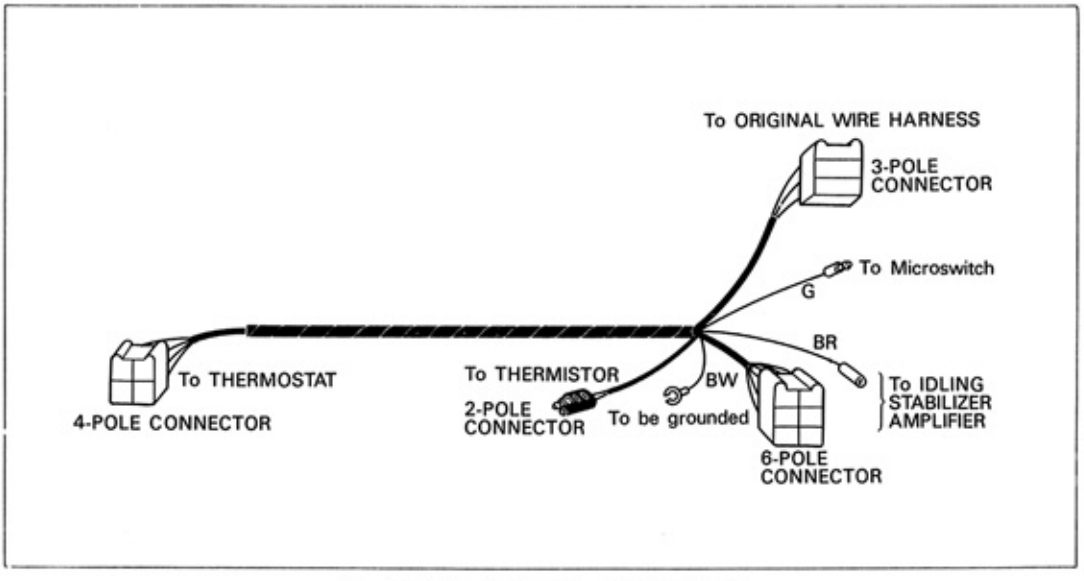
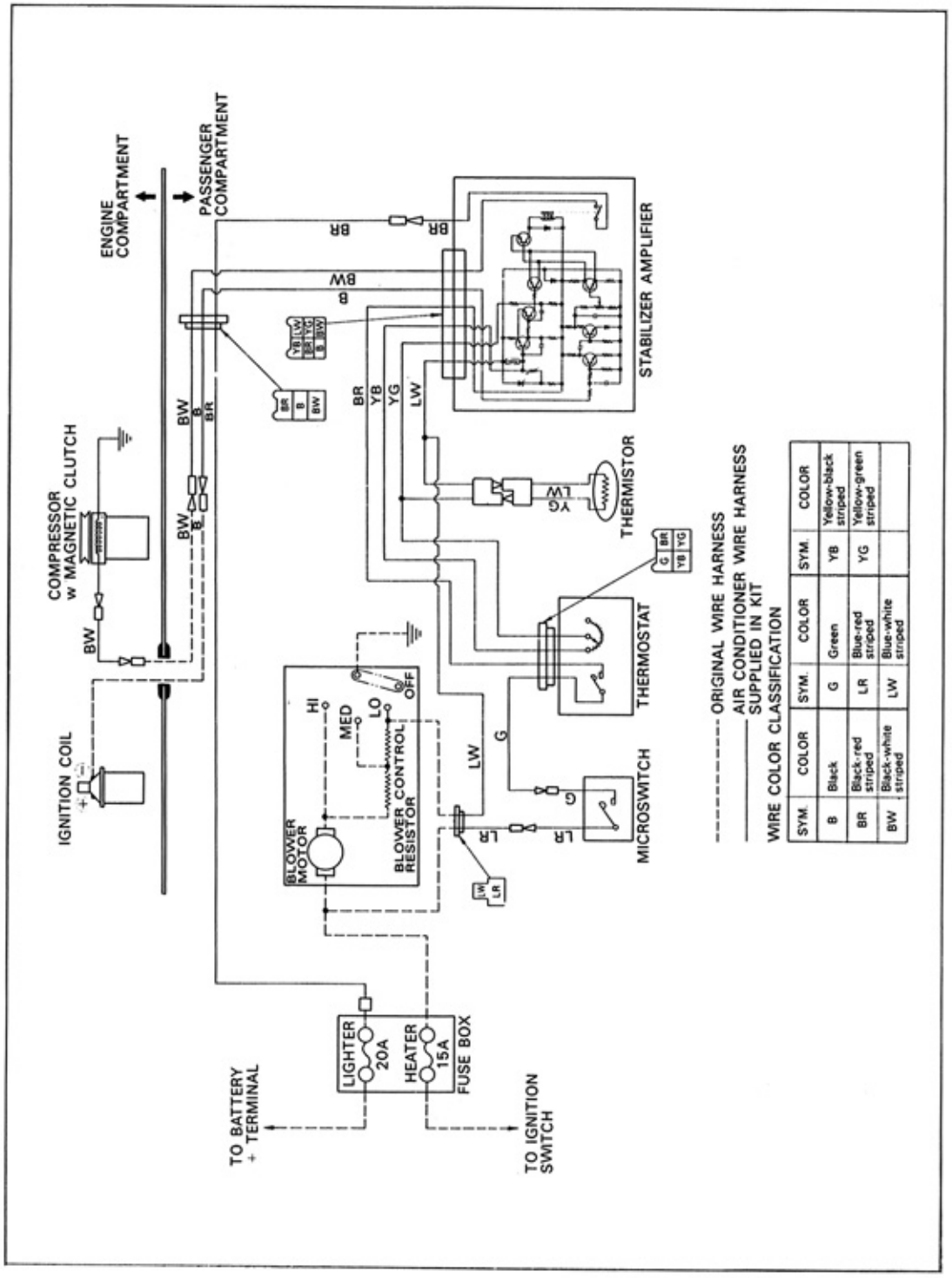


Fig. 39-b (For CELICA AND CARINA)

V-2 WIRING DIAGRAM

A. IN CASE OF CORONA



SYM.	COLOR	SYM.	COLOR	SYM.	COLOR
B	Black	G	Green	YB	Yellow-black striped
BR	Black-red striped	LR	Blue-red striped	YG	Yellow-green striped
BW	Black-white striped	LW	Blue-white striped		

Fig. 40-a (For CORONA)

V-2 WIRING DIAGRAM

B. IN CASE OF CELICA AND CARINA

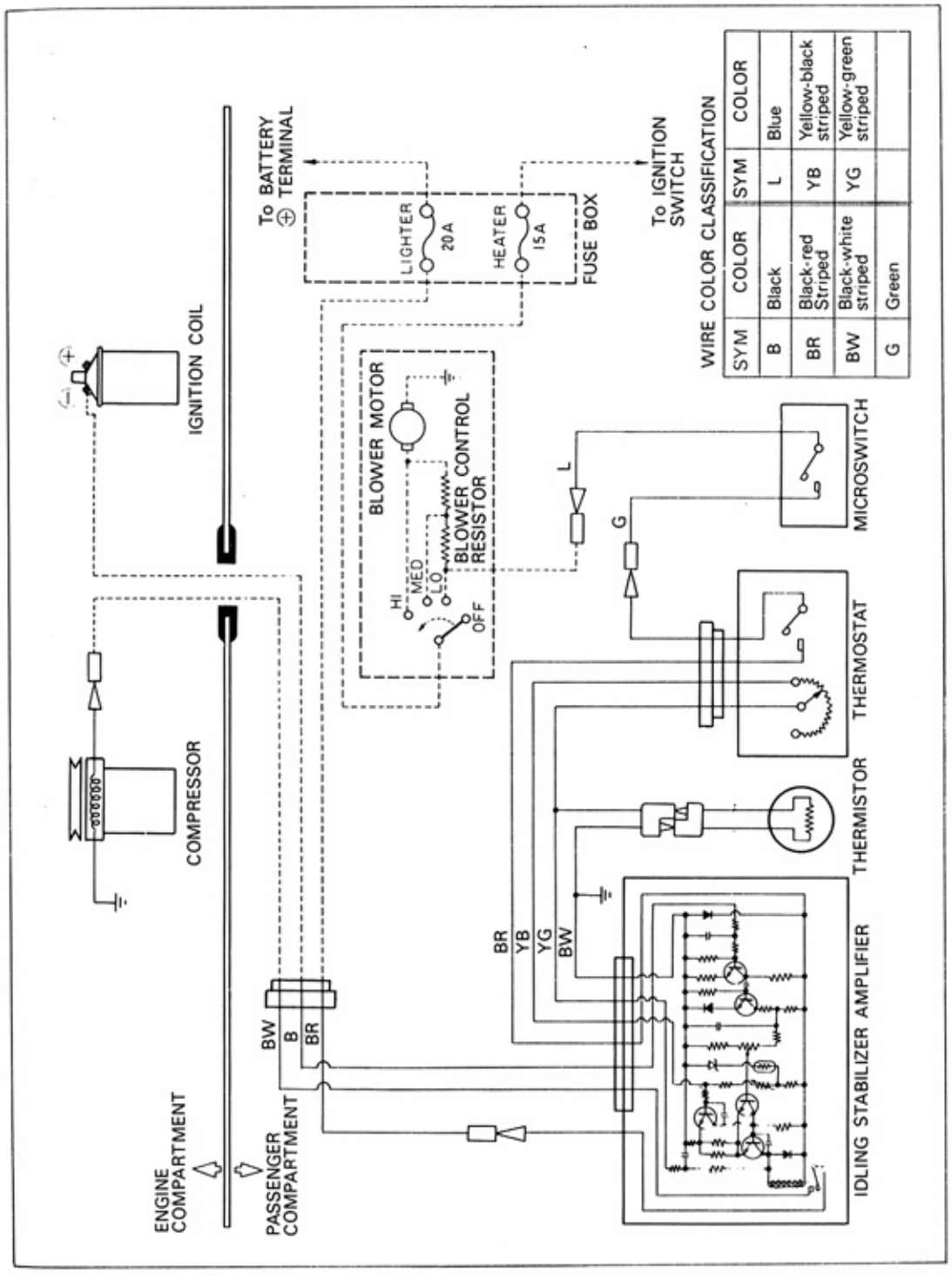


Fig. 40-b (For CELICA AND CARINA)

VI TOOLS FOR REPAIRING

(1) Automobile Service Tools
(2) Air Conditioner Service Tools
(3) Tachometer
(4) Circuit Tester
(5) Ammeter (full scale 10A)
(6) Thermometer
(7) Vacuum Pump

A. AIR CONDITIONER SERVICE TOOL KIT

ILL. NO.	TOOL NAME	ILL. NO.	TOOL NAME
1	Gauge, refrigerant charging	17	Holder, refrigerant pipe, No. 1 (for 1/2", 5/8", 3/4")
2	Hose, refrigerant charging, No. 3 (red color tube)	18	Holder, refrigerant pipe, No. 2 (for 1/8", 3/16", 5/16", 1/4", 3/8", 7/16")
3	Hose, refrigerant charging, No. 1 (green color tube)	19	Cutter, refrigerant pipe
4	Hose, refrigerant charging, No. 2 (yellow color tube)	20	Flare-tool, refrigerant pipe
5		21	Gauge, oil level
6	Tester, gas leak	22	Wrench, compressor service valve
7	Reactor, gas leak tester	23	Valve, refrigerant drum service
8	Nozzle, gas leak tester	24	Packing, refrigerant drum service valve
9	Cap, gas leak tester	25	Adapter, compressor service valve
10	Wrench, gas leak tester bomb valve	26	Remover, magnetic clutch (for removing clutch fixed with swash plate type compressor)
11	Wrench, gas leak tester valve		
12	Cleaner, gas leak tester nozzle		
13	Tube, gas leak tester inlet	27	Adapter, compressor service valve
14	Bomb, gas leak tester	28	Remover, magnetic clutch (for removing clutch fixed with reciprocating type compressor)
15	Hose, LPG inlet		
16	Thermometer, No. 1 (for high temp.)	29	Case, air conditioner service tool
	Thermometer, No. 2 (for low temp.)	30	Packing, refrigerant charging hose

B. SPECIAL SERVICE TOOLS FOR "F" TYPE MAGNETIC CLUTCH

ILL. NO.	TOOL NAME
1	Remover, magnetic clutch center piece
2	Remover, magnetic clutch bearing, No. 1
3	Remover, magnetic clutch bearing, No. 2
4	Replacer, magnetic clutch bearing
5	Replacer, magnetic clutch center piece, No. 1
6	Replacer, magnetic clutch center piece, No. 2

AIR CONDITIONER SERVICE TOOL KIT

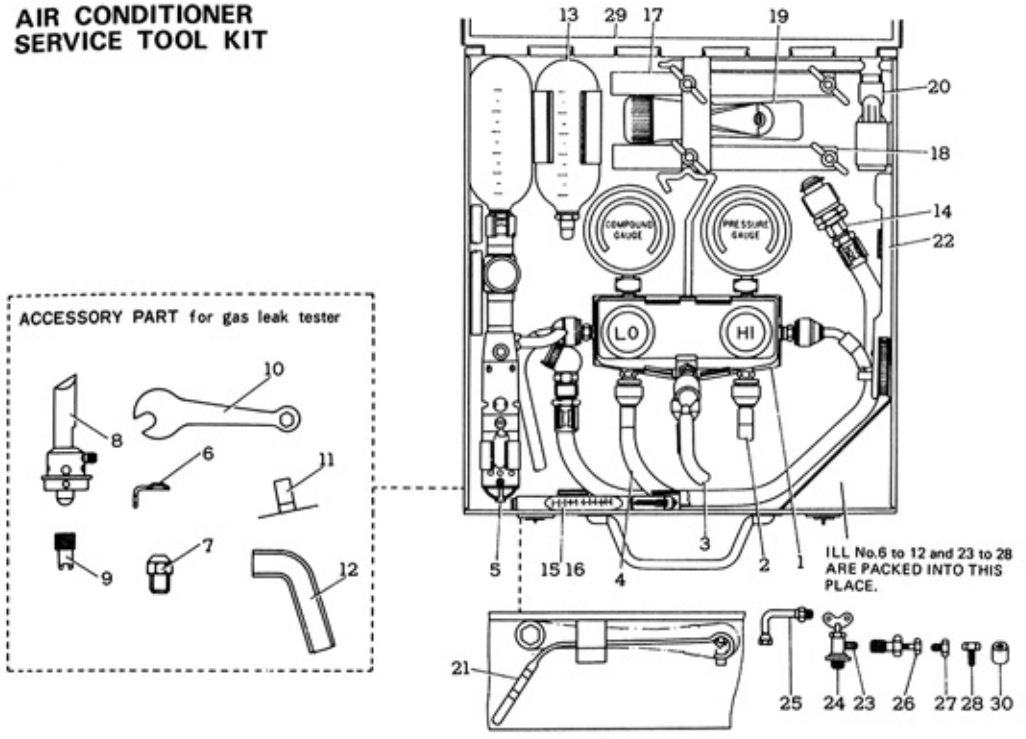


Fig. 41

SPECIAL SERVICE TOOLS FOR "F" TYPE MAGNETIC CLUTCH

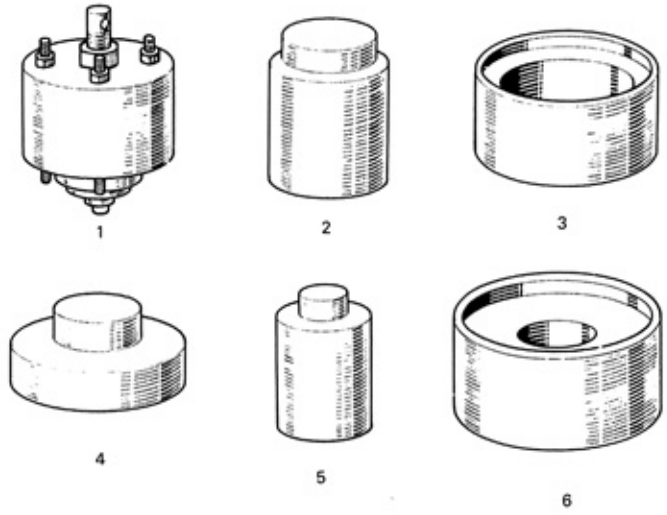


Fig. 42

VII. PIPING TECHNIQUES

A. When tightening and loosening the various fittings, use two spanners or monkey wrenches, to avoid exerting too much pressure on the pipe. Especially, as the inlet and outlet fittings of the condenser and the receiver is made of aluminum, be careful not to damage the screw thread on them. See Fig. 43.

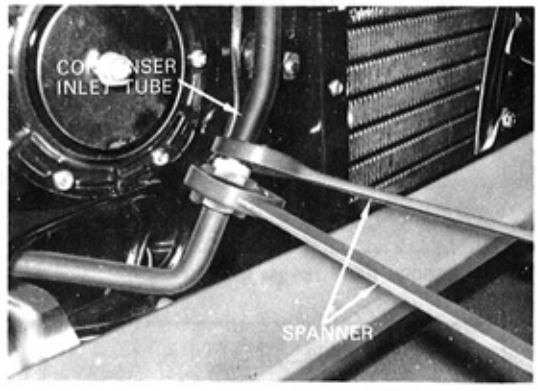


Fig. 43

B. When bending the copper tubes to connect the component parts of the air conditioner should be followed as below.

1. As a basic rule, the pipes are bend by a pipe bender.
2. The bending radious should be over five times of pipe diameter. Try to make the curve as wide as possible.

C. When cutting the copper tubes to suitable length, follow the procedures as below.

1. When cutting the tubes, the refrigerant pipe cutter should be used.
   Handling of the pipe cutter is shown in Fig. 44.

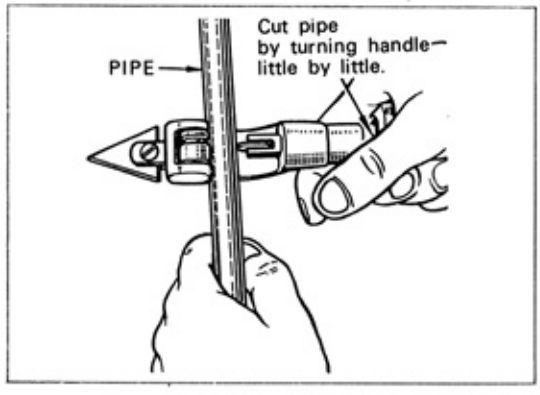


Fig. 44

2. Every time the tube is cut, finish the cut end using the refrigerant pipe cutter knife as shown in Fig. 45. Especially, the internal surface of the flared portion should be finished sufficiently.

3. Take care not to let dust and chips get inside the tube while cutting and finishing.

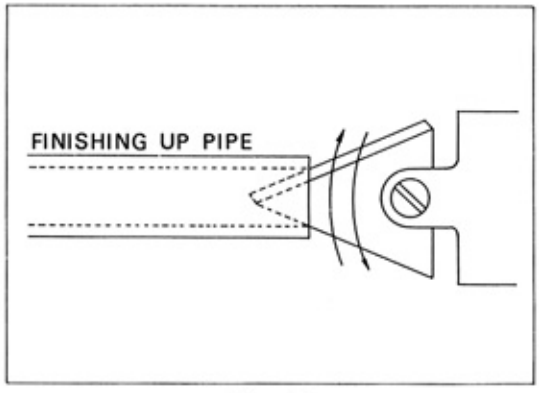


Fig. 45

D. When flaring the copper tubes, the refrigerant pipe flare tool and the refrigerant pipe holder should be used.

1. Hold the tube with a pipe holder at a specified position, and clamp evenly.

2. The top of the tube should stick out of the pipe holder by the dimension shown in Fig. 46.

3. Flare the tube with the flare tool as shown in Fig. 47.

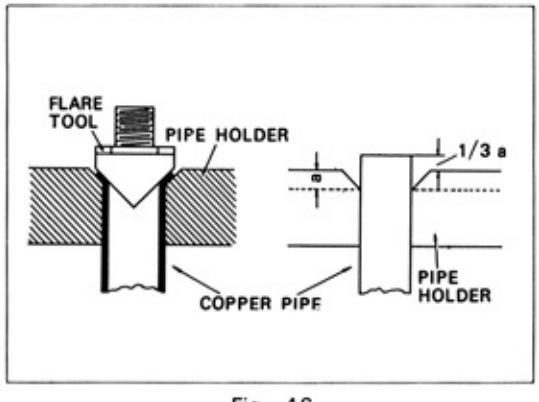


Fig. 46

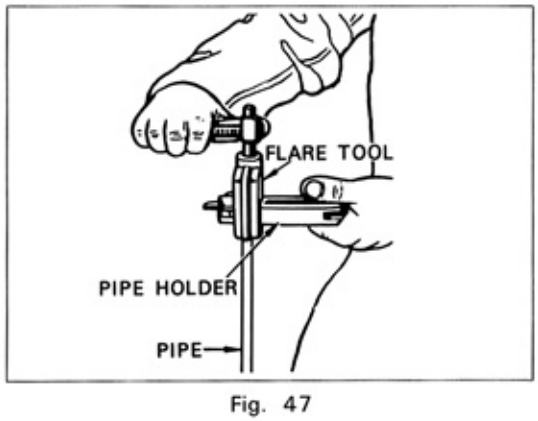


Fig. 47

VIII TROUBLESHOOTING

TROUBLE	SYMPTOM
SYSTEM PRODUCES NO/HARDLY COOLING	I. Magnetic clutch does not engage. II. Compressor does not rotate properly. III. Compressor and blower rotate normally.

POSSIBLE CAUSE	REFERENCE
1. Fuse is blown.	IX-1. A on page 45.
2. Power source for magnetic clutch stator coil is interrupted.	IX-1. B on page 45.
3. Blower control switch or resistor is defective.	IX-1. C on page 46.
4. Microswitch is defective.	IX-1. E. on page 48.
5. Thermostat dial (temperature control resistor) is defective.	IX-1. F. on page 48.
6. Thermistor is defective.	IX-1. G. on page 49.
7. Idling stabilizer amplifier is defective.	IX-1. H. on page 50.
8. Magnetic clutch is defective.	IX-2. A. on page 53.
1. Loose or broken compressor drive belt.	IX-2. H. on page 69.
2. Compressor is defective.	IX-2. B. on page 59.
1. No or insufficient refrigerant in system.	IX-3. on page 70.
2. Expansion valve is defective.	IX-2. F. on page 63.
3. Receiver is choked.	IX-2. D. on page 62.
4. Compressor is defective.	IX-2. B. on page 59.
5. Air conditioner control dampers do not move properly.	III. on page 13.
6. Air filter is clogged.	IX-2. F. 3. on page 66.

VIII. TROUBLESHOOTING

TROUBLE	SYMPTOM
SYSTEM PRODUCES INSUFFICIENT COOLING	I. Cool air from air conditioner outlet is warmed.
	II. Cool air comes out intermittently.
	III. Running at only high speed, cool air comes out.
	IV. Running at high speed, cool air is not enough.
	V. When guessing trouble in the refrigeration system.

POSSIBLE CAUSE	REFERENCE
1. Ventilator is defective.	III. on page 13.
2. Heating system is operating.	III. on page 13.
3. Electrical parts in temperature control system are defective.	IX-1. F, G, H on page 48 to 52.
1. Refrigerant is insufficient or too much.	IX-3. on page 70.
2. Compressor is defective.	IX-2. B on page 59.
3. Magnetic clutch is defective.	IX-2. A on page 53.
1. Condenser fins are clogged partially with dust or dirt.	IX-2. C on page 60.
2. Compressor drive belt is slipping.	IX-2. I on page 69.
3. Magnetic clutch is slipping.	IX-2. on page 53.
1. Evaporator is frosted because that temperature control parts are defective.	IX-1. F, G, H on page 48 to 52.
1. Refrigerant amount is improper.	IX-3. on page 70.
2. Receiver is clogged.	IX-2. D on page 62.
3. Expansion valve is clogged.	IX-2. E on page 63.
4. Expansion valve is opened widely.	IX-2. E on page 63.
5. Compressor is defective.	IX-2. B on page 59.
6. Air in system.	XII. on page 72.
7. Excessive moisture in system.	IX-2. D on page 62.

VIII. TROUBLESHOOTING

TROUBLE	SYMPTOM
SYSTEM PRODUCES INSUFFICIENT COOLING (Continued)	VI. Magnetic clutch does not disengage.
NO OR INSUFFICIENT COOL AIR COMES OUT	I. Blower does not rotate.
	II. Blower does not rotates properly.
	I. Noise from pipe clamp.
	II. Noise from blower or blower motor.
	III. Noise from compressor.

POSSIBLE CAUSE	REFERENCE
1. Thermostat dial (temperature control resistor) is defective.	IX-1. F on page 48.
2. Thermistor is defective.	IX-1. G on page 49.
3. Idling stabilizer amplifier is defective.	IX-1. H on page 50.
4. Magnetic clutch is defective.	IX-2. A on page 53.
1. Fuse is blown.	IX-1. A on page 45.
2. Blower control switch or resistor is defective.	IX-1. C on page 47.
3. Blower motor is defective.	IX-1. D on page 47.
1. Blower control switch or resistor is defective.	IX-1. C on page 46.
2. Blower motor is defective.	IX-1. D on page 47.
1. Pipe clamp is loosen.	IV-1. on page 21 to 23.
1. Blower touches case.	IX-1. D on page 47.
2. Blower motor shaft bearing lacks oil.	IX-1. D on page 47.
1. Compressor mount fixing bolt is loosen.	IV-2. on page 24 to 26.
2. Compressor is defective.	IX-2. B on page 59.
3. Amount of compressor lubricant is not proper.	XI. on page 73.

VIII. TROUBLESHOOTING

TROUBLE	SYMPTOM
ABNORMAL NOISE IN SYSTEM (Continued)	IV. Noise from magnetic clutch.
	V. Noise from compressor drive belt or fan belt.
	VI. Noise from idle pulley.
CAR PERFORMANCE SHOWS A FALL	I. Engine tends to overheat.

POSSIBLE CAUSE	REFERENCE
1. Bearings are worn out.	IX-2. A on page 53.
1. Compressor drive belt or fan belt is loosen.	IX-2. I. on page 69.
1. Idle pulley bracket fixing bolts are loosen.	IV-2. on page 24 to 26.
2. Idle pulley bearing is defective.	IV-2. on page 24 to 26.
1. Fan belt is slipping.	IX-2. I on page 69.
2. Condenser fins are clogged.	IX-2. C on page 60.
3. Radiator fins are clogged.	
4. Radiator cap is defective.	
5. Water pump is defective.	

IX. INSPECTION AND REPAIRING

In this chapter, you will clear the cause of trouble described on chapter XIII (TROUBLESHOOTING). After clearing the cause of trouble, repair or replace the defective parts according to descriptions in this chapter.

IX-1. ELECTRICAL SYSTEM

A. FUSE

A. Inspect "LIGHTER" or "HEATER" fuse in the fuse box. See Fig. 48.

B. If fuse is blown, replace it.

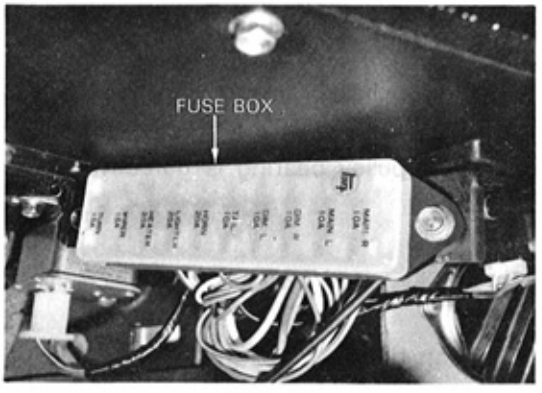


Fig. 48

B. AIR CONDITIONER WIRE HARNESS AS POWER SOURCE TO MAGNETIC CLUTCH STATOR COIL

1. Refer to wiring diagram. And measure the terminal voltage of black-white striped lead wire to magnetic clutch rotor with circuit tester under following conditions :
   a) Run engine at 1,000 rpm or more.
   b) Set thermostat dial at "10" position.
   c) Turn on blower switch.

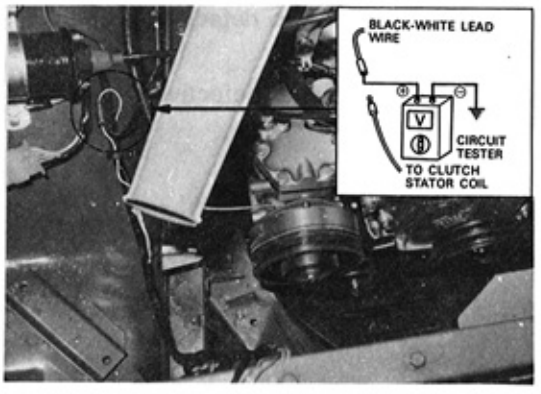


Fig. 49

2. If the circuit tester does not indicate battery voltage, check for loose connection or open circuit of wire harness and examine other electrical compornent parts.

3. If the circuit tester indicates battery voltage, electrical circuit is normal.

C. BLOWER CONTROL SWITCH AND RESISTOR

C-1 In case of CORONA

1. Disconnect 2-pole connector of blower control switch from air conditioner wire harness.
   Connect one lead wire of circuit tester to #1 terminal of 2-pole connector and another lead wire of circuit tester to ground. (See Fig. 50.) Then check for open circuit of blower control switch and resistor as below. Set blower control switch at "LO", "MED" and "HI" position to measure each terminal.

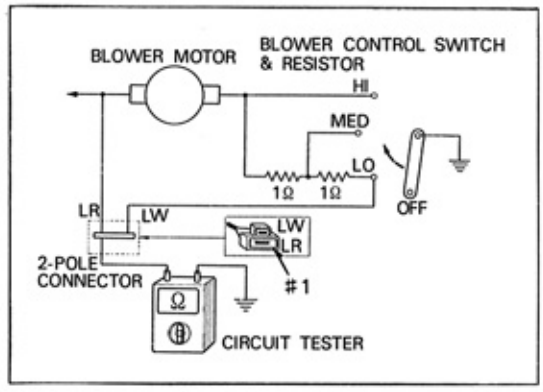


Fig. 50

2. If the circuit tester indicates infinity (∞) ohm, blower control switch, resistor or blower motor is open circuit. Check and replace the defective part.

C-2 In case of CELICA and CARINA.

1. Disconnect blue-white lead wire connected to blower control resistor from microswitch. And connect the positive lead wire of circuit tester to blue-white lead wire from blower control resistor and negative lead wire of circuit tester to ground.
   Then, turn on ignition switch, and set blower control switch at "LO", "MED" and "HI" position to measure each terminal. See Fig. 51.

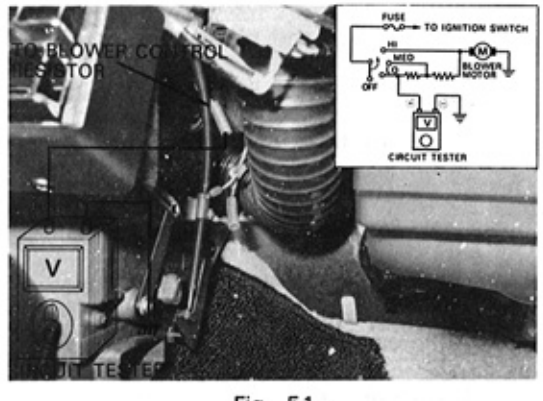


Fig. 51.

2. If the circuit tester indicates zero (0) volt, check for blown fuse, defective ignition switch or defective blower control switch. Replace the defective part.

3. If the circuit tester indicates battery boltage, blower control switch and resistor are normal.

D. BLOWER AND BLOWER MOTOR

1. INSPECTION BEFORE REMOVAL

(a) Disconnect two lead wire of blower motor.

(b) Connect an ammeter (0 — 10 ampere scale) in series with 12 volts battery and the blower motor lead wire using the jumper wires.

(c) Ground the another lead wire of blower motor.

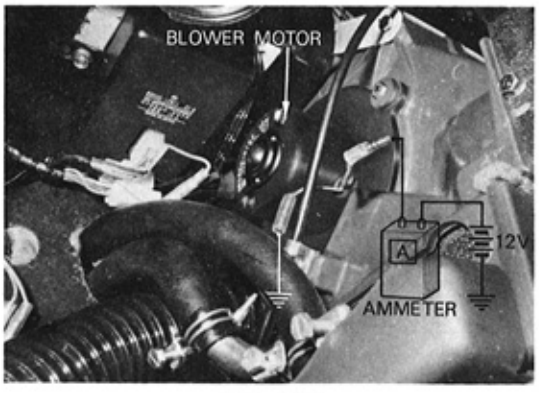


Fig. 52

(e) If current is between 6.4 and 7.8 amperes and the motor runs smoothly, blower motor is normal.

(e) If blower motor is defective, replace it.

2. REMOVAL

(a) Unscrew three fixing bolts for the blower motor.

(b) Remove the blower motor with blower.

(c) Remove a blower fixing nut from the blower motor shaft and isolate the blower from the motor.

3. INSTALLATION

(a) Attach the blower to the blower motor using a fixing nut.

(b) Reinstall the blower motor with blower to the original place using three bolt.

(c) Connect two lead wires of blower motor as before.

E. MICROSWITCH

1. Disconnect two lead wires of microswitch installed to underside of heater inlet duct. Connect two circuit tester lead wires to both terminal of microswitch, and measure resistance of switch by setting FRESH-RECIRC control lever at both "RECIRC" and "FRESH" position.

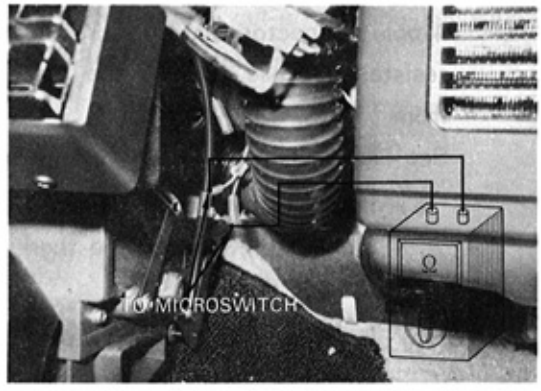


Fig. 53

2. If the ciricuit tester indicates infinity (∞) or any ohms at "RECIRC" position or the circuit tester indicates zero (0) ohm at "FRESH" position, replace the microswitch.

3. If the circuit tester indicates zero (0) ohm at "RECIRC" position and the circuit tester indicates infinity (∞) at "FRESH" position, microswitch is normal.

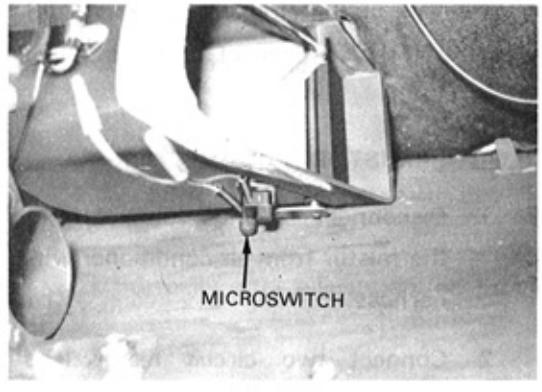


Fig. 54

F. THERMOSTAT DIAL (TEMPERATURE CONTROL RESISTOR)

1. Disconnect 4-pole connector of thermostat dial from air conditioner wire harness.

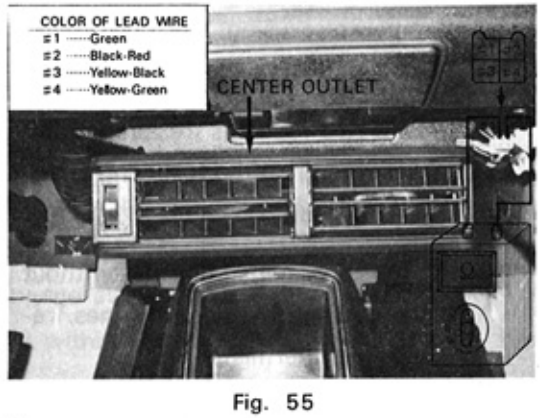


Fig. 55

2. Connect two circuit tester lead wires to #1 and #2 terminal of 4-pole connector and measure the resistance when the switch of thermostat dial is turned on. See Fig. 55.
   (a) If the circuit tester indicates infinity (∞) or any ohms, replace the thermostat dial assy.
   (b) If the circuit tester indicates ZERO (0) ohm, the changeover switch of thermostat dial is normal.

3. Connect two circuit tester lead wires to #3 and #4 terminal of 4-pole connector, and measure the resistance while turning the dial from "1" to "10" position.
See Fig. 56.

Fig. 56

   (a) If the circuit tester indicates infinity (∞), replace the thermostat dial assy.

   (b) If the circuit tester reading does not decrease smoothly reading, replace the thermostat dial assy.

   (c) If the circuit tester reading decreases smoothly from 500 to 0 ohms, the resistance of thermostat dial is normal.

G. THERMISTOR

1. Disconnect 2-pole connector of thermistor from air conditioner wire harness.

2. Connect two circuit tester lead wires to 2-pole connector of thermistor and then measure the resistance of thermistor, at the same time, measure the surrounding air temperature using thermometer.
(See Fig. 57)

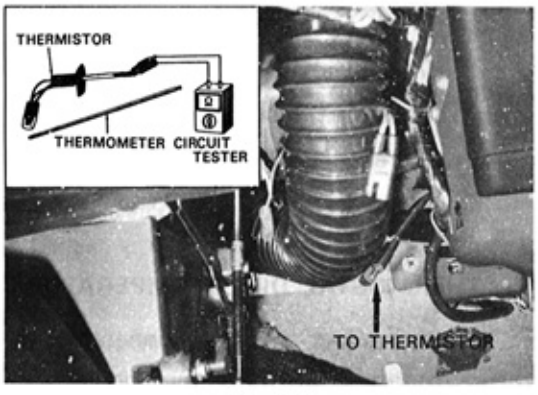


Fig. 57

3. Relate two readings (resistance and temperature) on the following chart.
(See Fig. 58)

4. If the crossing point is without area outlined by diagonal lines, replace the thermistor.

5. If the crossing point is within area outlined by diagonal lines, thermistor is normal.

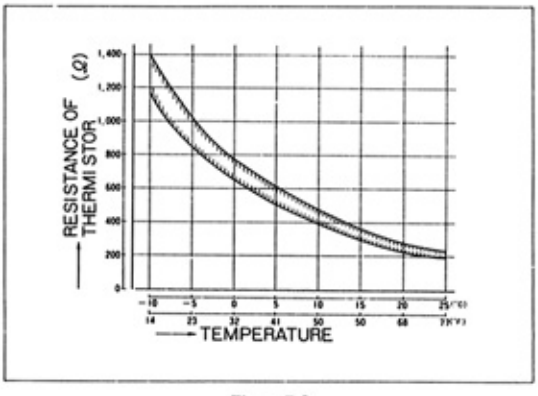


Fig. 58

H. IDLING STABILIZER AMPLIFIER

1. Operate the air conditioner and measure cut-in and cut-off engine revolution which magnetic clutch engages or disengages with tachometer.
   If magnetic clutch engages or disengages at out of standard idling revolution, adjust the idling stabilizer amplifier according to H-1. 1 on page 50.

   Standard cut-in rpm : 850—950 rpm
   cut-off rpm : 700—800 rpm

2. Operate the air conditioner at following conditions, and then measure cool air temperature at thermistor position.

   Testing condition :

   a) Keep all windows and doors of vehicle close.
   b) Rotate blower at low speed and set thermostat dial at "10" position.
   c) Run the engine approx. at 1,500 rpm.

   If minimum cool air temperature is more than 32°F (0°C), adjust the idling stabilizer amplifier according to H-1. 2 on page 51.

3. If the idling stabilizer amplifier does not work normally after adjustment according to H-1 on page 50 to 53, replace it.

H-1. ADJUSTMENT OF IDLING STABILIZER AMPLIFIER

1. ***Adjusting the amplifier according to outlet cool air temperature.***
   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 turning the dial built in the rectangular center outlet, which means that the resistance of the temperature control resistor for thermostat is changed.
   When thermostat dial is set "10" position, the magnetic clutch will disengage about 32°F (0°C). On the other hand, when thermostat dial is set at "1" position, the magnetic clutch will disengage at about 59°F (15°C).
   When the magnetic clutch is controlled within the above temperature range, the outlet cool air temperature detecting circuit of idling stabilizer amplifier is working normally.
   If temperature control range is out of standard range, you must adjust the idling stabilizer temperature.

Standard temperature control range :

23°F – 32°F (–5°C – 0°C) at "10" position

55°F – 64°F (13°C–18°C) at "1" position

How to adjust the idling stabilizer amplifier

The air conditioner does not become of cool enough or the evaporator core is frosted when the system operates in maximum cooling. In this case, the outlet cool air temperature should be adjusted by turning the variable resistor shaft. (See Fig. 59 or Fig. 60)

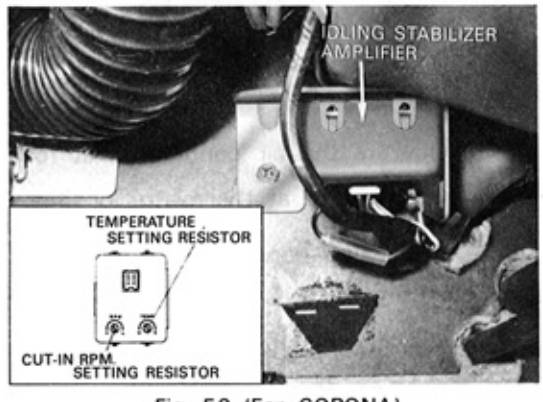


Fig. 59 (For CORONA)

a) If temperature is higher than specified :
turn the variable resistor shaft (lettered "TEMP" on the cover) clockwise.

b) If temperature is lower than specified or the evaporator is frosted :
turn the variable resistor shaft (lettered "TEMP" on the cover) counterclockwise so that magnetic clutch disengages above 32°F (0°C).

Note : *(1) Prior to adjustment of temperature control range, check the resistance of thermistor and temperature control resistor for thermostat.*

(2) When measuring cool air temperature, insert the thermometer just in front of evaporator (near thermistor position) through rubber packing for thermistor lead wire.

2. ***Adjusting the amplifier according to engine revolution.***

If the magnetic clutch fails to engage at specified engine revolution, adjust the idling stabilizer amplifier as follows. (See Fig. 59 or Fig. 60.)

Standard Operating Engine Revolution :

cut-in engine rpm ..... 850—950 rpm

cut-off engine rpm ..... 700—800 rpm

—— How to adjust the idling stabilizer amplifier ——

a) If cut-in engine revolution is too high :

turn the variable resistor shaft (lettered "RPM" on the cover) clockwise.

b) If cut-in engine revolution is too low.

turn the variable resistor shaft (lettered "RPM" on the cover) counterclockwise so that magnetic clutch disengages at idling revolution.

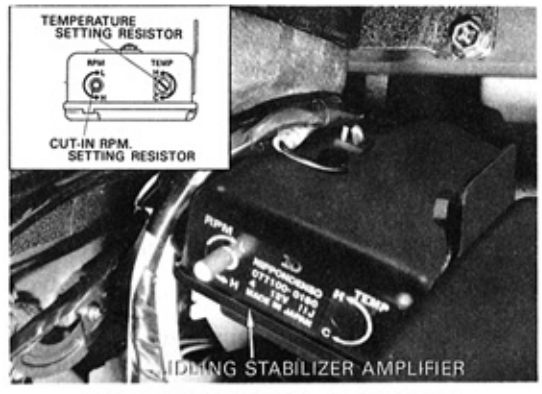


Fig. 60 (For CELICA & CARINA)

Note: *1) The amplifier should be adjusted at actuating point.*

2) After having adjusted the amplifier, apply locking paint on the variable resistor shaft.

IX-II COMPONENT OF AIR CONDITIONING SYSTEM

A. MAGNETIC CLUTCH

1) When magnetic clutch does not engage, check whether magnetic clutch is defective or not as follows.
   a) Connect jumper wire from battery positive terminal to clutch stator coil lead wire.
   b) If magnetic clutch does not engage, magnetic clutch is defective. Replace the clutch stator.

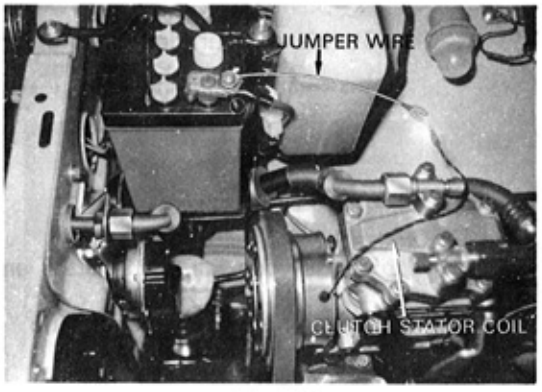


Fig. 61

2. When magnetic clutch occurs abnormal noise, it is probably due to worn out bearings. If so, check and replace the bearings.
3. In case that magnetic clutch surfaces are fouled with oil, magnetic clutch slips. Clean up clutch surfaces.

A-1 "F" Type Magnetic Clutch (For CELICA)

1. REMOVAL

a) Disconnect the battery negative cord from the battery terminal.
b) Remove the compressor drive belt from the pulleys.
c) Disconnect the clutch stator lead wire from air conditioner wire harness.
d) Unscrew the center bolt from the compressor crankshaft.
e) Remove the clutch rotor assembly from the compressor crankshaft by means of clutch remover (SST No.07112-71010).
   See Fig. 62 and Fig. 63.

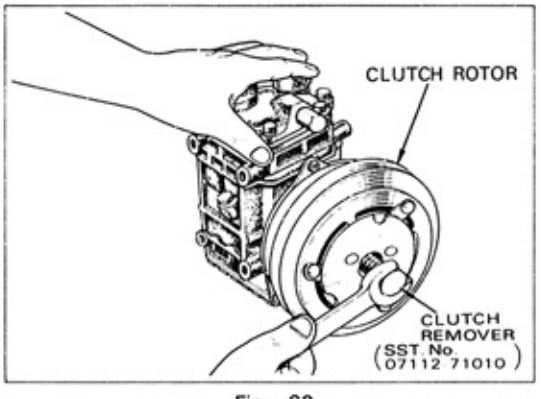


Fig. 62

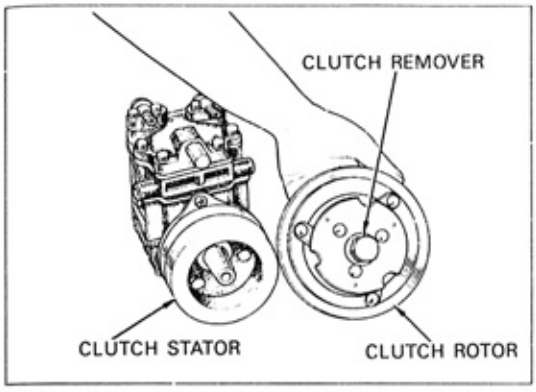
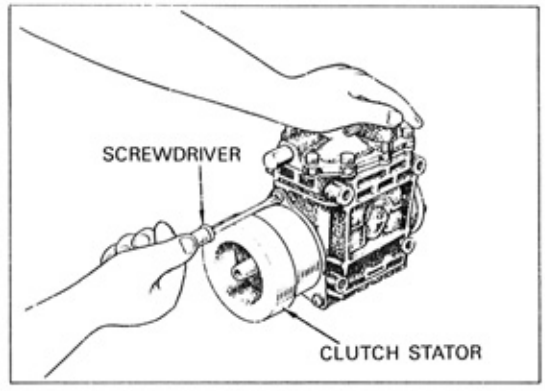


Fig. 63



64

f) Unscrew three small screws attaching clutch stator on the compressor crankcase, and take off the stator assembly from the compressor. See Fig. 64.

2. INSPECTION

a) Clean and check the both contact surfaces of clutch rotor and pulley for wear, score and oil soaked condition. If necessary, replace the clutch rotor assembly.

b) Inspect the clutch bearings, If necessary, replace the clutch bearings.

c) Connect an ammeter (0—10 ampere scale) in series with 12 volts battery and the stator coil lead wire to check the stator coil for open or short circuit.

Note: *Current should be flowed 2.9 to 3.1 amperes at 68° F (20° C).*

MEMO :

3. DISASSEMBLY

a) Remove the dustproof cover and small snap ring from the clutch rotor assembly. See Fig. 65 and Fig. 66.

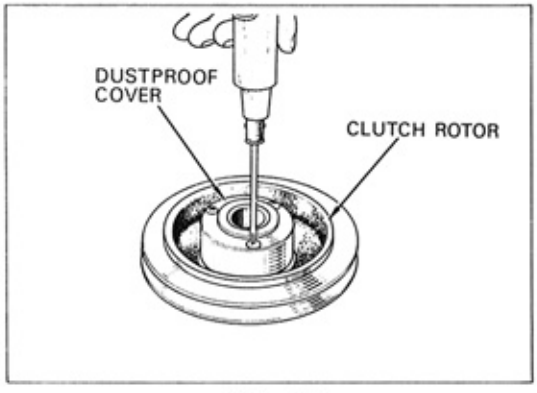


Fig. 65

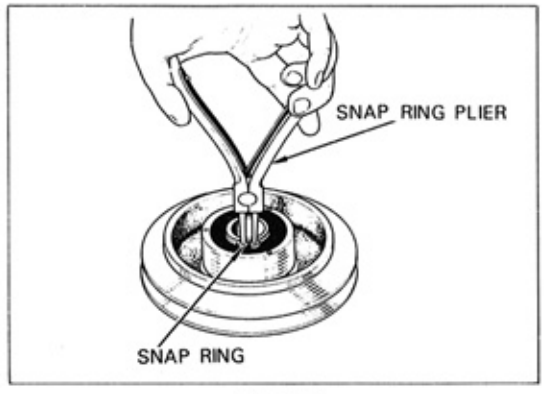


Fig. 66

b) Set the center piece remover (SST No. 07112—66010) to the pulley boss as shown in Fig. 67. Then turning the bolt of center piece remover, and separate the clutch center piece from the pulley. (See Fig. 68.).

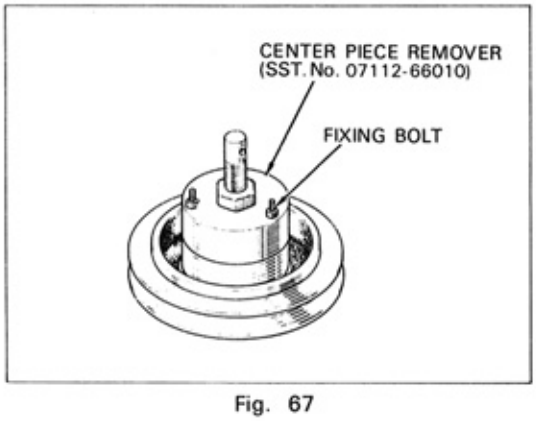


Fig. 67

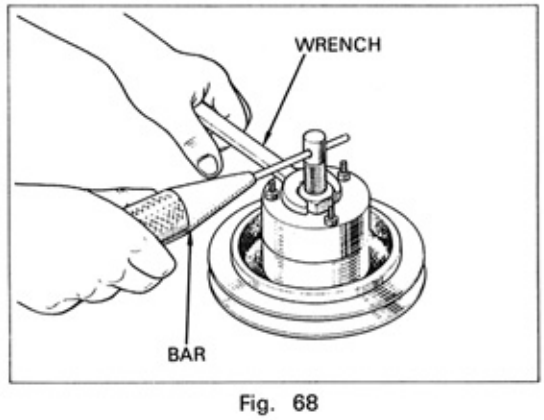


Fig. 68

c) Place the clutch pulley on the rotor supporter (SST No.07112-56020) with contact surface side up, and press two bearings using bearing remover (SST No.07112-56010) from the clutch pulley. See Fig. 69.

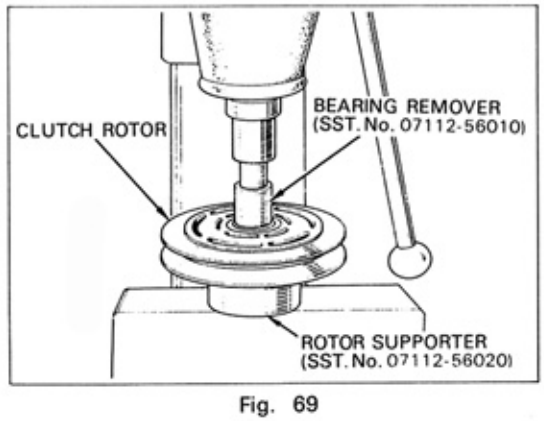


Fig. 69

d) Remove the splash ring from the clutch pulley.

Note: *New bearings should be installed, every time the magnetic clutch is disassembled.*

4. ASSEMBLY

a) Install the splash ring to inside boss of clutch rotor.

Note: *Never place splash ring reverse direction.*

b) Set the clutch pulley on the press as shown in Fig. 70, and insert two new bearings into the clutch pulley bore by means of rotor supporter (SST No.07114—66020) and bearing installer (SST No. 07114—66010) till fully seated.

Note: *When installing new bearing to clutch pulley bore, seal ring which is installed to bearing must view from outside as shown in Fig. 71.*

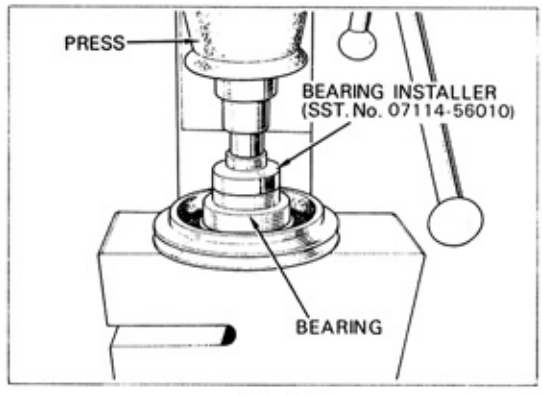


Fig. 70

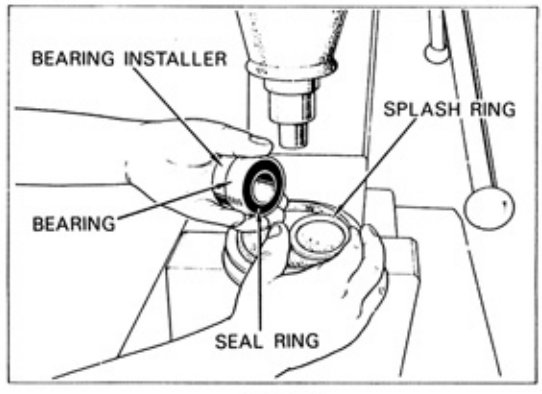


Fig. 71

c) Set the clutch pulley on the press using rotor supporter (SST No. 07114—66020) and center piece installer (SST No.07114—66010) as shown in Fig. 72 and Fig. 73.

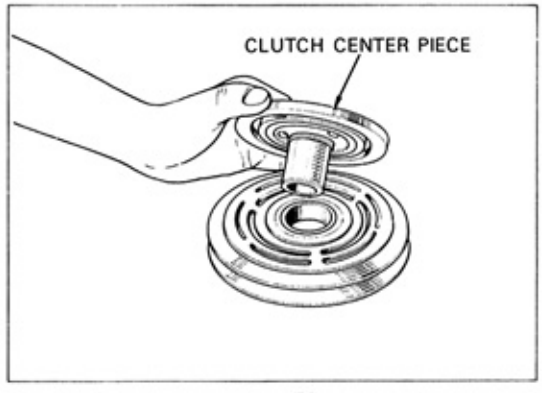


Fig. 72

d) Insert the boss of clutch center piece into the inner race of bearing as shown in Fig. 73.

e) Fix the bearing with small snap ring, and install the dustproof cover to clutch pulley boss using three small screws.

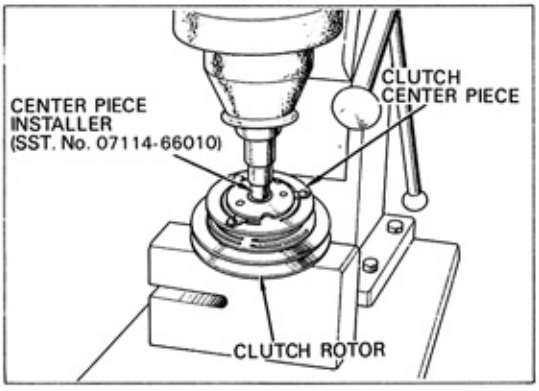


Fig. 73

. INSTALLATION

a) Install the clutch stator to the compressor crankcase with three screws.

b) Install the clutch rotor assembly onto the compressor crankshaft.

c) Torque the center bolt to 12—17 ft-lb (1.7—2.4 kg-m).

d) Install the compressor drive belt onto the pulleys and stretch it to specified tension by moving the idle pulley.

e) Connect the clutch stator coil lead wire to air conditioner wire harness, and install the battery negative cord to the battery terminal.

-2 "G" Type Magnetic Clutch (For CORONA and CARINA)

. REMOVAL

a) Disconnect the battery negative cord from the battery.

b) Disconnect the clutch stator coil lead wire from the air conditioner lead wire.

c) Remove a center bolt for fixing the magnetic clutch and then pull out the pulley assy.

d) To remove the clutch pulley from the crankshaft of compressor, tap the clutch stator gently with plastic hammer or use clutch remover (SST No.07112—71010).

e) Remove three small screws and washers for attaching the clutch stator to the compressor, and take off the stator from the compressor.

2. INSPECTION

a) Inspect the both surfaces of rotor and pulley for wear, score and oil soaked condition.

b) Check the clutch bearing for wear.

c) Connect the ammeter (0—10 ampere scale) in series with 12 volts battery and the stator coil lead wire to test the stator coil for open or short circuit.

Note: *Current should be flowed 2.4 to 2.6 amperers at 68° F (20° C).*

3. DISASSEMBLY

a) Remove the snap ring from the groove of the clutch pulley.

b) Place the clutch pulley on the support stand with pulley side down, and press two bearings from the clutch pulley. See Fig. 74.

Note: *New bearing must be installed, every time the magnetic clutch is disassembled.*

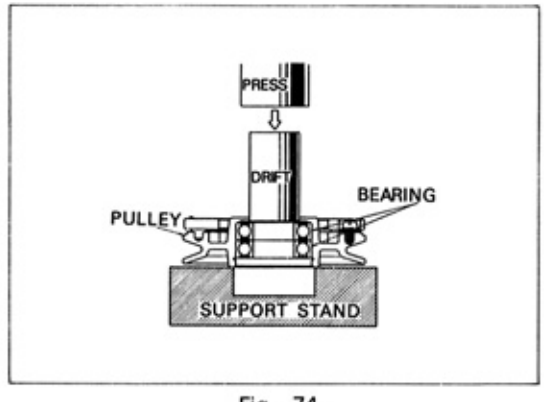


Fig. 74

4. ASSEMBLY

a) Place the clutch pulley with pulley side up on the press as shown in Fig. 75 and insert two new bearings into the bore till fully seated.

b) Install a snap ring to the groove.

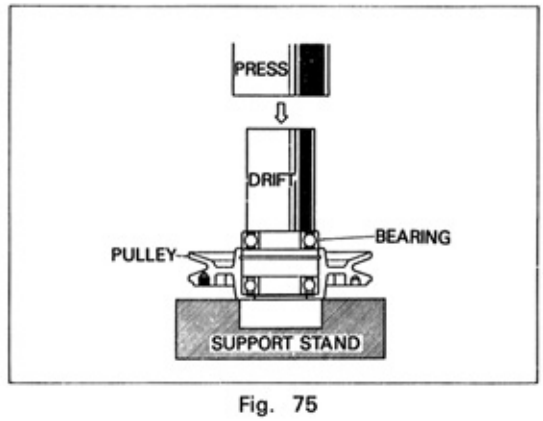


Fig. 75

5. INSTALLATION

a) Install the clutch stator to the compressor with three screws.

b) Insert the woodruff key in the crankshaft groove.

c) Install the clutch rotor on the crankshaft.

d) Insert the clutch pulley into the clutch rotor boss, and then fix the magnetic clutch with a center bolt to specified torque.

Standard Torque : 12—17 ft-lb (1.7—2.4 kg-m)

Note: *When assembling the clutch pulley to the clutch rotor, adjust the gap between rotor and pressure plate of clutch pulley by putting the thrust washer on the clutch rotor boss.*

e) Connect the clutch stator coil lead wire to air conditioner wire harness and battery negative cord to the battery terminal.

B. COMPRESSOR

1. REMOVAL

a) Disconnect the battery negative code from the battery.

b) Discharge the refrigerant from the refrigeration.
(Refer to "SAFETY PRECAUTIONS IN HANDLING REFRRIGERANT (R—12)" on page 72.)

c) Measure and record the refrigeration oil level inside compressor removed from the engine so that the same oil level can be established when new or repaired compressor is installed on the engine.

d) Disconnect the suction and discharge flexible hoses from the compressor service valves.

Note: *Cap all the lines and compressor service valves as soon as they are disconnected.*

e) Disconnect the clutch stator coil lead wire from the air conditioner wire harness.

f) Remove the compressor drive belt.

g) Remove the idle pulley with bracket and compressor with mount by unscrewing the fixing bolts.
See Fig. 76.

h) Remove the compressor mounts from the compressor by unscrewing the fixing bolts.

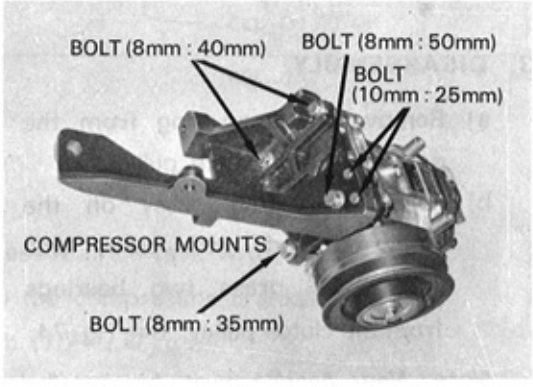


Fig. 76-a (For CORONA)

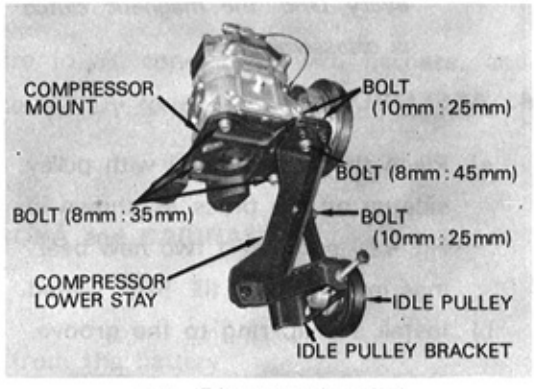


Fig. 76-b (For CELICA)

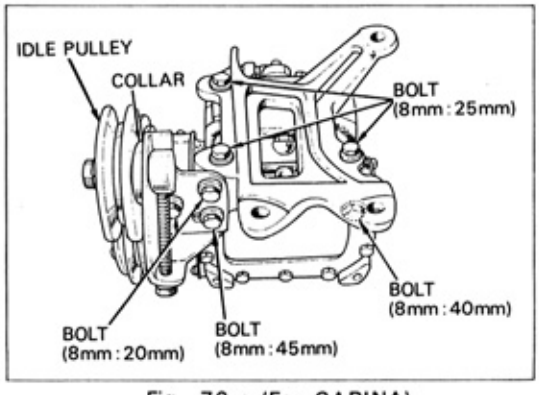


Fig. 76-c (For CARINA)

2. DISASSEMBLY, ASSEMBLY, INSPECTION AND PERFORMANCE TEST

Refer to the booklet of "AIR CONDITIONING COMPRESSOR REPAIR MANUAL, Type : 2C-90" in serial number MAC-031.

3. INSTALLATION

a) Attach the compressor mounts and idle pulley with bracket to the compressr using fixing bolts. See Fig. 77.

b) Install the compressor with mounts to the original place on the engine using the fixing bolts.

c) Install the compressor drive belt onto crankshaft, magnetic clutch and idle pulleys, and then stretch the belt to specified tension by moving the idle pulley. Refer to IX-II. 9 on page 69.

d) Connect the clutch stator coil to the black-white lead wire of air conditioner wire harness.

e) Remove the blind plugs from the hose fittings, and connect the suction and discharge flexible hoses to the compressor service valves, respectively.

f) Charge the refrigerant to the air conditioning system completely.
(Refer to "EVACUATING AND CHARGING METHOD" on page 74).

g) Inspect the connected portions of the system for gas leak using the gas leak tester.

C. CONDENSER

If condenser fins are clogged with dust or dirt, wash it with water.

***Note**: Be careful not to sprincle the water on other components in the engine compartment.*

If the refrigerant leaks from the condenser, replace it according to following methods.

1. REMOVAL

a) Disconnect the battery negative cord from the battery terminal.

a-1) In case of CORONA

Remove the radiator grille, radiator and fan shroud from the vehicle.

a-2) In case of CELICA and CARINA

Remove the front bumper, radiator and fan shroud.

(In case of CARINA, the vehicle with manual transmission is not equipped with fan shroud.).

b) Purge the air conditioner system of refrigerant.
(Refer to "SAFETY PRECAUTIONS IN HANDLING REFRIGERANT (R-12) on page 72).

c) Disconnect the condenser outlet fitting from receiver inlet and the discharge flexible hose from the condenser inlet fitting.

Note: *Cap the open fittings with the blind plugs or vinyl tape at once.*

d) Unscrew four condenser fixing bolts from the radiator side baffle, and remove the condenser from the vehicle.

2. INSPECTION

a) Check the inlet and outlet fittings of the condenser for cracks and scratches.
b) Inspect the condenser fittings and tubes for gas leak using the gas leak tester.

3. INSTALLATION

a) Install the condenser onto the four rubber cushions using nuts and washers.
b) Remove the blind plugs from the condenser and lines, and connect the discharge flexible hose and liquid line tube to the condenser inlet and outlet of condenser.

Note: *When installing the new condenser, add 1 fluid ounce (30cc) of refrigeration oil into the system.*

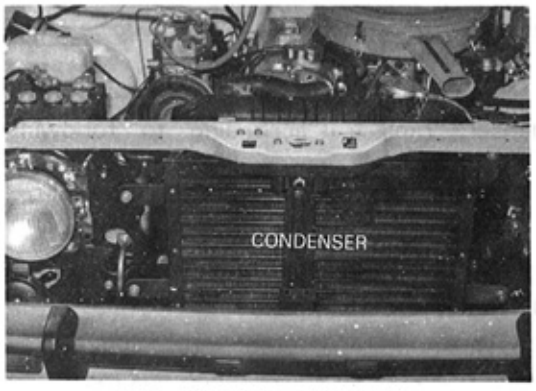


Fig. 77-a (For CORONA)

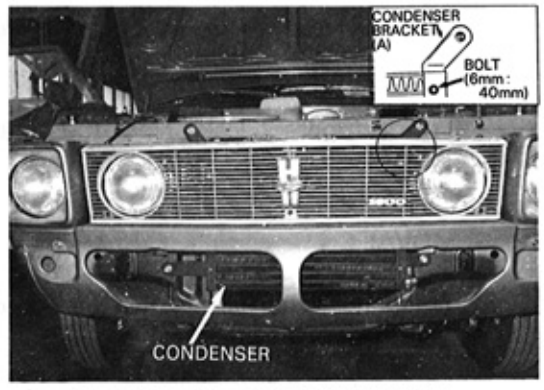


Fig. 77-b (For CELICA & CARINA)

c) Connect the battery negative code to the battery.

d) Evacuate and charge the refrigerant into the system and check for gas leak. (Refer to "EVACUATING AND CHARGING METHOD" on page 74.)

e-1) In case of CORONA

Reinstall the radiator grille, radiator and fan shroud to the original place.

e-2) In case of CELICA AND CARINA

Reinstall the radiator, fan shroud and front bumper to the original place. (In case of CARINA, the vehicle with manual transmission is not equipped with fan shroud.)

D. RECEIVER

1. INSPECTION

a) When rotating compressor for a while, low pressure gauge indicates too low and pipe near the receiver outlet is cooled down compaired with the tube connected to receiver inlet by partial clog or becomes white with frost. In this case, check and replace the receiver.

b) Check the inlet and outlet fittings of receiver for cracks and scratches.

c) Check the sight glass, fusible plug and welding portion for gas leak using the gas leak tester.

2. REMOVAL

a) Disconnect the battery negative cord from the battery terminal.

b) Discharge the refrigerant from the air conditioning system. (Refer to "SAFETY PRECAUTIONS IN HANDLING REFRIGERANT (R-12) on page 72)

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

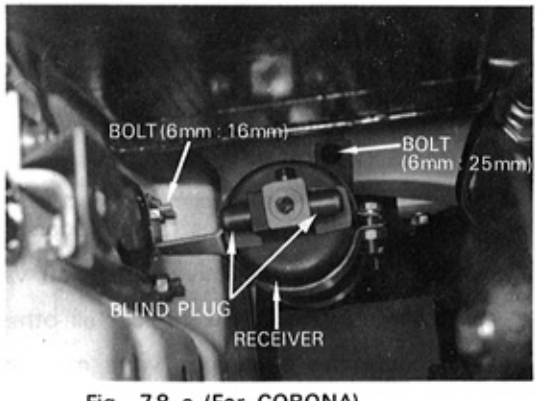


Fig. 78-a (For CORONA)

Note: *Cap or tape the open fittings of the receiver and lines immediately.*

d) Unscrew two receiver fixing bolts and nuts and remove the receiver assembly from its holder.

3. INSTALLATION

a) Install the receiver to the holder and tighten two fixing screws.

Note: *If the new receiver is installed, add 3 fluid ounce (90cc) refrigeration oil into the system.*

b) Connect the liquid line tubes to the receiver inlet and outlet fittings respectively after blind plugs or tapes are removed from the tube fittings.

Note: *Do not remove the blind plugs till ready for connection.*

c) Evacuate and charge the refrigerant into the system, and check the air conditioner system for gas leak using gas leak tester.

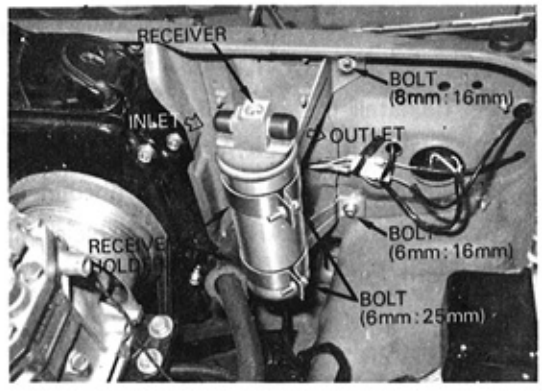


Fig. 78-b (For CELICA)

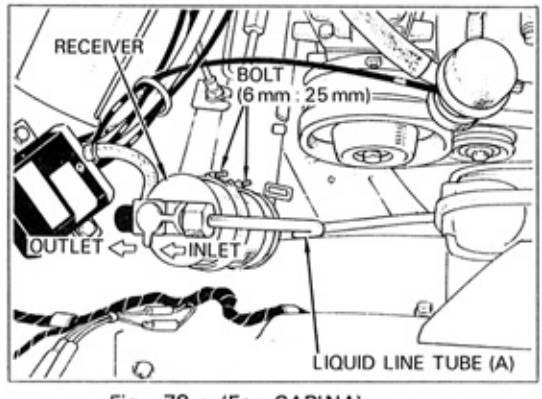


Fig. 78-c (For CARINA)

E. EXPANSION VALVE

The expansion valve is factory adjusted and pre-set, and cannot be adjusted after installation. The defective expansion valve should be replaced. However, before replacement, check and inspect all other possible causes of system trouble.

The defective expansion valve may result from a stick.

If low pressure gauge indicates too low or negative at approx. 2000 rpm of engine revolution or expansion valve outlet is covered with frost, expansion valve is clogged. Check and replace the expansion valve.

If low pressure gauge indicates too high and discharge flexible hose vibrates strongly, check the remote bulb holder for loose and fasten it.

1. REMOVAL

a) Disconnect the battery negative cord from the battery terminal.

b) Purge the air conditioning system of refrigerant.
(Refer to "SAFETY PRECAUTIONS IN HANDLING REFRIGERANT (R-12) on page 72).

c) Slit the heat insulator which covers the expansion valve body and the remote bulb, then remove the expansion valve assembly from the evaporator.

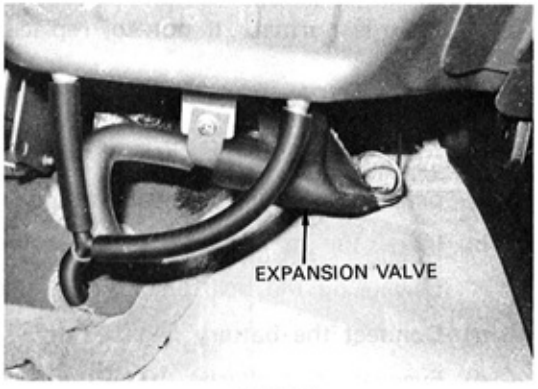


Fig. 79

Note: *Gap or tape the open fitting at once.*

2. INSPECTION

a) Connect the gauge manifold set, expansion valve and service drum with the charging hoses as shown in Fig. 80.

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

c) Keep the both hand valves of gauge manifold set closed.

d) Pierce the service drum to release the pressure.

e) Open the high pressure hand valve and adjust the high side pressure to approximate 70 psi. (50 kg/cm²) by turning the high pressure hand valve.

f) Read the indication of low pressure gauge, at the same time measure temperature using the thermometer.

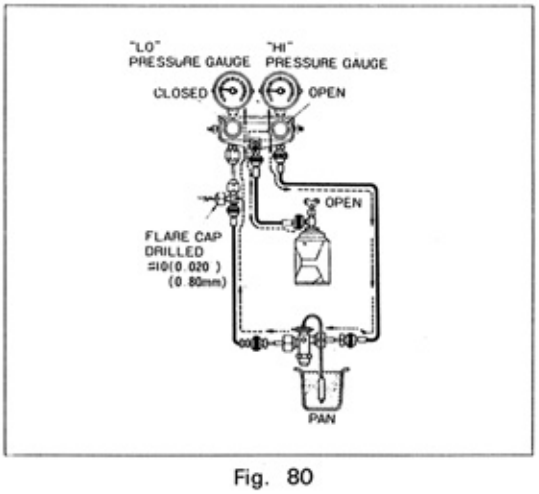


Fig. 80

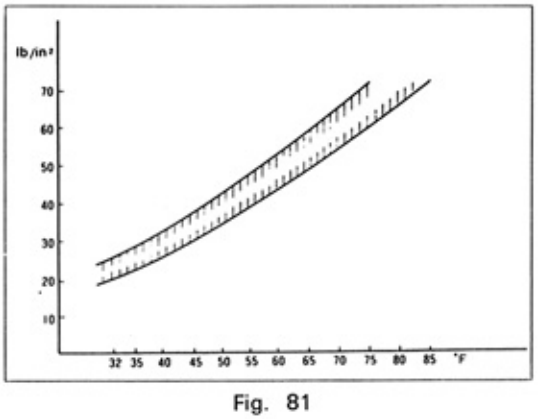


Fig. 81

g) Relate two readings on the following chart. (See Fig. 81.)
If the crossing point is within the area outlined by diagonal lines, the expansion valve is normal. If not so, replace it.

3. INSTALLATION

a) After removing the caps or tapes from the fittings and a line, install the expansion valve to the evaporator inlet fitting and to the liquid line tube.
b) Install the remote bulb of expansion valve on the bulb seat of evaporator outlet tube using the bulb holder. Be sure to seat tightly.
c) Connect the battery negative cord to the battery terminal.
d) Evacuate and charge the system, and check for gas leak using leak tester
(Refer to "EVACUATING AND CHARGING METHOD" on page 74.)
e) If no leak evidence, wrap the expansion valve body, remote bulb, evaporator inlet tube and outlet tubes using heat insulator.
f) Perform the performance test to check the air conditioning system for proper operation.
(Refer to "PERFORMANCE TEST" on page 79.)

F. COOLING UNIT (EVAPORATOR)

1. REMOVAL

a) Disconnect the battery negative code from the battery.
b) Purge the air conditioning system of refrigerant.
(Refer to "SAFETY PRECAUTIONS IN HANDLING REFRIGERANT (R-12) on page 72.)
c) Disconnect the suction flexible hose at the cooling unit outlet tube and the liquid line tube at the cooling unit inlet tube.

Note: *Cap or tape all open fittings at once.*

d) Disconnect all lead wires attached to the cooling unit.
e) Remove four fixing bolts for cooling unit from the instrument panel, cooling unit bracket and dash panel, and remove the cooling unit. See Fig. 82.

2. DISASSEMBLY

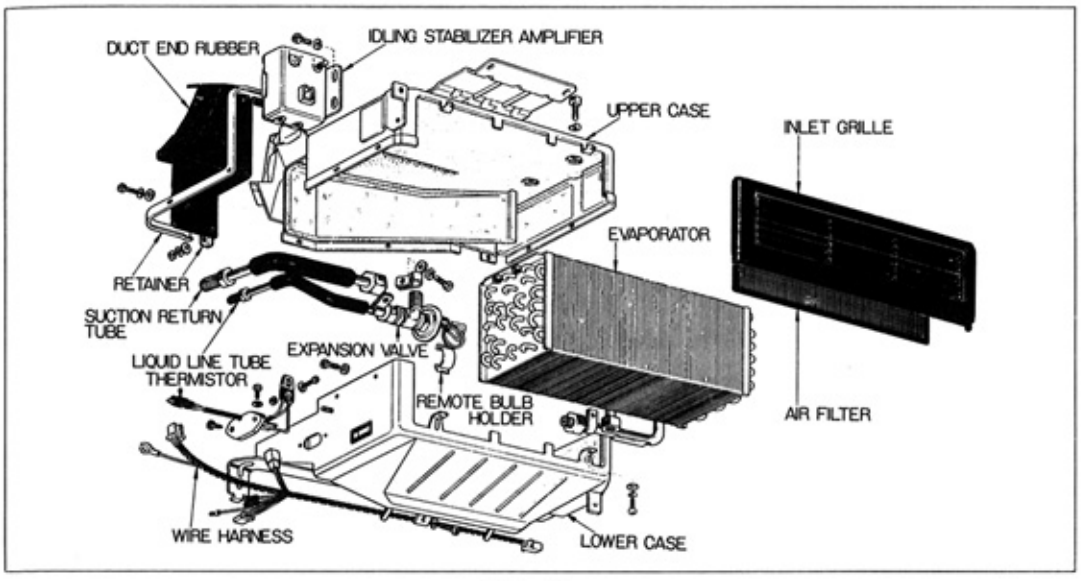


Fig. 82

a) Remove the inlet grille and the air filter by unscrewing two small screws.

b) Remove two retainers and duct end rubber by unscrewing three fixing nuts and two tapping screws.

c) Remove four evaporator fixing bolts and six small screws which fix the upper and lower case of cooling unit.

d) Separate both cases of cooling unit by pulling the upper case upward, and remove the upper case.

e) Remove three tube clips from the lower case, and sparate the evaporator core and lower case each other.

f) If necessary, remove the liquid line tube, suction return tube and expansion valve from the evaporator core, and remove the thermistor from the lower case.

3. INSPECTION

a) Check both evaporator fittings for cracks or scratches and the evaporator core for gas leak with gas leak tester.

b) Check the thermistor.
Refer to IX-I. 7 on page 49.

c) Inspect the air filter. If the air filter is clogged with dust, wash the filter with water.

4. ASSEMBLY

a) To assemble, reverce step(a) to (f) on disassembling procedures.

Note: *Afrer assembling the cooling unit, wrap up the heat insulator around the expansion valve body and the evaporator outlet tube.*

5. INSTALLATION

a) Joint the cooling unit to the heater inlet duct, and install the cooling unit assy to the vehicle.

b) Stick the dust end rubber of cooling unit to the inlet duct of heater.

c) After removing the blind plugs or tapes from the liquid line tube and suction flexible hose, connect the tube and hose to the inlet and outlet fittings of evaporator.

d) Connect all lead wires and connectors of cooling unit to the air conditioner wire harness.

e) Connect the battery negative cord to the battery.

f) Evacuate and charge the system of refrigerant to specified amount, and check the system for gas leak with gas leak tester.

Note: *When installing the new evaporator core, add 1 fluid ounce (30 cc) of refrigerantion oil into the system.*

G. RECTANGULAR CENTER OUTLET

1. REMOVAL

a) Disconnect the battery negative cord from the battery.

b) Remove the rectangular center outlet fixing bolts and screws, then pull out the center outlet from the upper outlet of heating unit.

c) Disconnect the four pole connector for temperature control resistor from air conditioner wire harness.

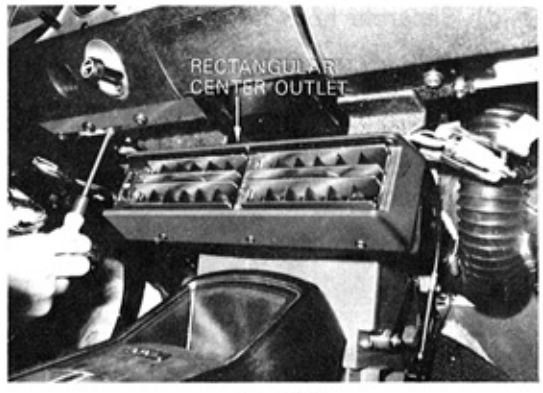


Fig. 83

2. DISASSEMBLY

a) Remove six screws from the rectangular center outlet and disassemble the rectangular center outlet into outlet grille, grille base, thermostat and bracket as below.

b) To remove the thermostat (temperature control resistor), remove two tapping screw from the grille base.

c) To remove the outlet grille, remove four taping screws for one piece of grille.

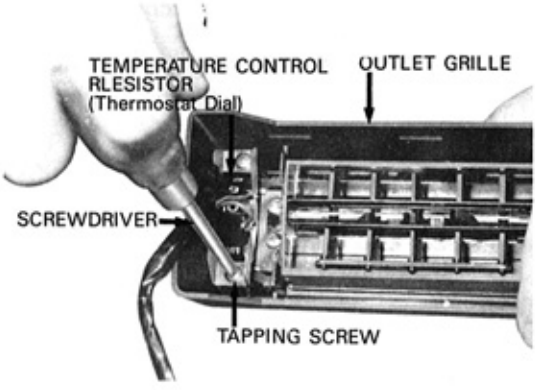


Fig. 84

3. INSPECTION

a) Inspect the outlet grille, grille base and bracket for crack.

b) Check the thermostat dial. Refer to IX-II. 6. on page 48.

4. ASSEMBLY

a) Assemble the center outlet in reverse step of disassembly.

5. INSTALLATION

a) Connect the four pole connector for temperature control resistor to the air conditioner wire harness.

b) Install the center outlet to the heating unit and instrument panel.

c) Connect the battery negative cord to the battery.

H. AIR CONDITIONER LINES

When guessing the air conditioner lines leak, check the fittings or flare portions for crack, and inspect the hose or tube for gas leak using gas leak tester.

If the refrigerant leaks from the air conditioner lines, replace the hose or tube as below.

1. REMOVAL

a) Disconnect the battery negative code from the battery.

b) Purge the air conditioning system of refrigerant.
(Refer to "SAFETY PRECAUTIONS IN HANDLING REFRIGERANT (R-12) on page 72.)

c) Remove the defective hose or tube from the system.

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

2. INSTALLATION

a) Remove the blind plugs or tapes from the fittings, and install the new refrigerant hose or tube to the system.

b) Connect the battery negative cord to the battery negative terminal.

c) Evacuate and charge the system, and inspect the system for gas leak using gas leak tester.

Note: *After installing the refrigerant hose or tube, clamp it using hose holder or tube clip.*

I. COMPRESSOR DRIVE BELT AND FAN BELT

1. The tension of compressor drive belt and fan belt should be adjusted as specified.
2. If compressor drive belt is slipping because of loosen or worn belt, compressor does not rotate properly.
3. Retighten or replace the belt.

If fan belt is slipping because of loosen or worn belt, fan does not rotate properly and vehicle may overheat.

Retighten or replace the belt.

4. Adjustment of Belt Tension

a) If the tension of fan belt i is out of standard, adjust the belt tension by moving the alternator.

b) If the tension of compressor drive belt is out of standard, adjust the belt tension by moving the idle pulley.

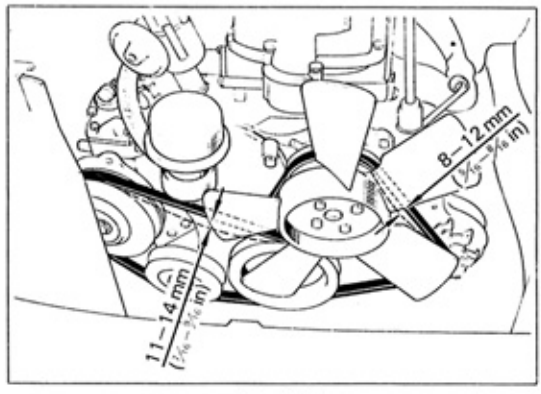


Fig. 85

※ Standard deflection when pushed with 22 lbs. (10kg) force on the center of belt.

Fan belt ..... 5/16–8/16 inch (8–13 mm)

Compressor drive belt ..... 5/8–6/8 inch (15–18 mm)

IX-2. CHECK FOR AMOUNT OF REFRIGERANT BY SIGHT GLASS

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

This check is started by observing the refrigerant state through the sight grass on the receiver.

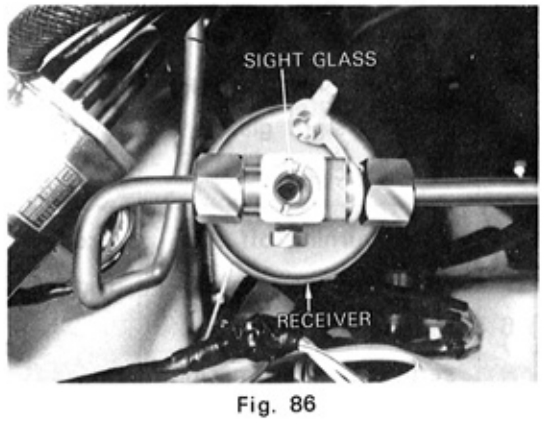


Fig. 86

Run the engine at fast idle, and operate the air conditioner at maximum cooling ("HI" blower speed and "10" position of thermostst dial) for a few minutes. Then check for amount of refrigerant by seeing sight glass as below.

Procedure of Check for Refrigerant Amount :

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 bubble presents in sight glass	No or suffient refrigerant in the system.	Refer to Item 3 and 4.
3	Temperature difference between compressor inlet and outlet is not appreciable.	System is empty or nearly empty.	Evacuate and charge the refrigerant in the system, then check for leak with gas leak tester.
4	Temperature difference between compressor inlet and outlet is appreciable clearly.	Proper or too much amount of refrigerant in the system.	Refer to Item 5 and 6.
5	When turning off the air conditioner, refrigerant in sight glass remains clear.	Too much amount of refrigerant in the system.	Discharge the refrigerant till specified amount.
6	When turning off the air conditioner, refrigrant foams and then settles away from sight glass in a short time.	Proper amount of refrigerant in the system.	Refrigerant amount is normal.

X SAFETY PRECAUTIONS IN HANDLING REFRIGERANT (R-12)

When handling the refrigerant R-12, the following precautions should be observed to protect the body injury at all the times.

A. Safety Precautions

1. Use suitable eye protection such as safety goggles or glasses when handling the refrigerant or servicing the refrigerant system.
2. Be careful the liquid refrigerant does not strike skin.
   If liquid R-12 strikes the skin, frostbite may occur.
3. Do not heat refrigerant container (service drum) above 100°F (38°C). For example, refrigerant should not be exposed to the radiant heat from the sun since the resulting increase in pressure may cause the container to burst.
4. Do not discharge the refrigerant into an enclosed area having an open flame.
5. Discharge the refrigerant very slowly, when purging a refrigeration system. Otherwise, refrigeration oil will discharge together with refrigerant.
6. Do not allow the liquid refrigerant to touch bright metal.
   Refrigerant in combination with moisture will corrode bright metal very gradually.

B. If liquid refrigerant strikes your eye or skin

1. Do not rub the eye or skin.
2. Splash large quantities of cool water to the eye or skin.
3. Rush to physician or hospital for immediate professional aid.
4. Do not attempt to treat it yourself.

XI CHECKING THE REFRIGERATION OIL

Generally when the air conditioning system is operating normally, the compressor oil level does not need checking. But compressor oil level should be checked only where there is evidence of a major loss of refrigeration oil such as caused by :

a) An excessive hose and tube fitting leak.
b) A broken flexible hose.
c) Collision damage to the air conditioner component parts.
d) An excessive leaking from compressor shaft seal. (A slight amount of compressor oil leakage at the compressor front shaft seal is considered normal.)

A. Filling or Drawing the Refrigeration Oil

When checking the refrigeration oil level with the oil level gauge (SST No.07115-81010), the refrigerant should be discharged from the air conditioning system according to following procedures.

1. Run the system for 10 minutes at idling engine revolution with controls set for maximum cooling and high blower speed.
2. Turn off engine and discharge the refrigerant from the system.
   (Refer to "SAFETY PRECAUTIONS IN HANDLING REFRIGERANT (R-12)" on page 72.)
3. Check the refrigeration oil level with oil level gauge as below.
   a) Remove the oil filler plug from the compressor cylinder block.
   b) Insert the gauge into the oil filler hole, and measure the oil level.
4. If additional oil is required, add clean SUNISO No.4 G oil or equivalent.
5. If the refrigeration oil is more excessive than specified, draw out the oil until proper quantity is indicated.
6. If new compressor is installed on the system which has been operated, draw out the oil until proper quantity is indicated.
7. After checking the refrigeration oil level, tighten the drain plug to 10—12 ft-lb (1.4—1.7 kg-m).
8. Evacuate and charge the system and check the drain plug for gas leak.

B. Add the additional refrigeration oil to inside compressor when system component is replaced or repaired.

Evaporator ..... 1 fluid ounce (30 cc)

Condenser ..... 1 fluid ounce (30 cc)

Receiver ..... 3 fluid ounce (90 cc)

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

XII EVACUATING AND CHARGING METHOD

A. INSTALLING THE REFRIGERANT CHARGING GAUGE

1. The fittings for attaching the refrigerant charging gauge are located on the compressor service valves. These service valves have schrader type valve shown in Fig. 87 so charging hose which is connected to the service valve fittings should be a pin at the end of charging hose.

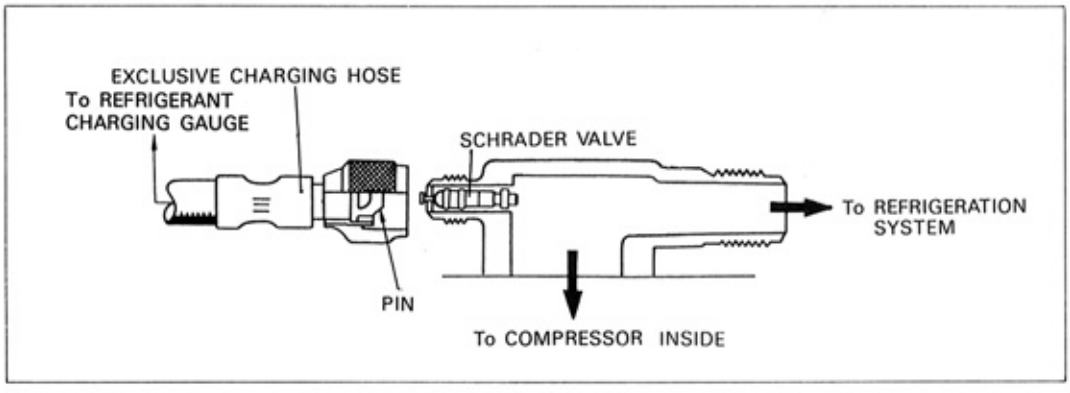


Fig. 87

2. After stopping the engine, remove the cap nuts from the service valve fittings.
3. Be certain that the both hand valves of gauge manifold set are closed.
4. Install the charging hoses of gauge manifold set onto the suction and discharge service valves respectively.

B. HANDLING OF THE REFRIGERANT DRUM SERVICE VALVE

1. Before putting the refrigerant durm service valve on the service drum turn the handle in counterclockwise till the valve needle is fully retracted.
2. Turn the plate nut (disc) counterclockwise till it reaches its highest position and then screw down the refrigerant drum service valve onto the sealed tap of service drum.
3. Turn the plate nut (disc) clockwise fully, and install the center charging hose to the valve fitting.
4. The plate nut can be sufficiently tightened by hand.
5. Turn the handle clockwise, thus making a hole in the sealed tap.

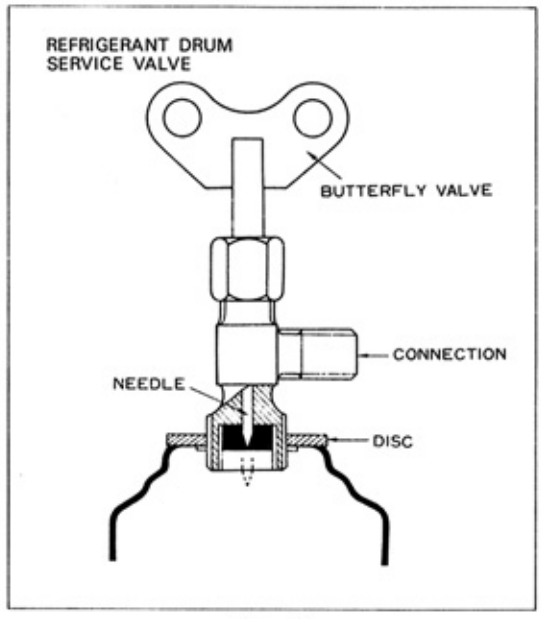


Fig. 88

6. To charge the refrigerant into the system, turn the handle counterclockwise. To stop the charge, turn it clockwise.

C. EVACUATING THE SYSTEM

1. Connect the high and low charging hoses of refrigerant charging gauge to the hose fittings of the compressor service valve.
2. Install the center charging hose of the refrigerant charging gauge to the vaccum pump inlet.
   See Fig. 89.
3. Close the both hand valves of the refrigerant charging gauge tightly.
4. Run the vacuum pump, then open the both hand valves.

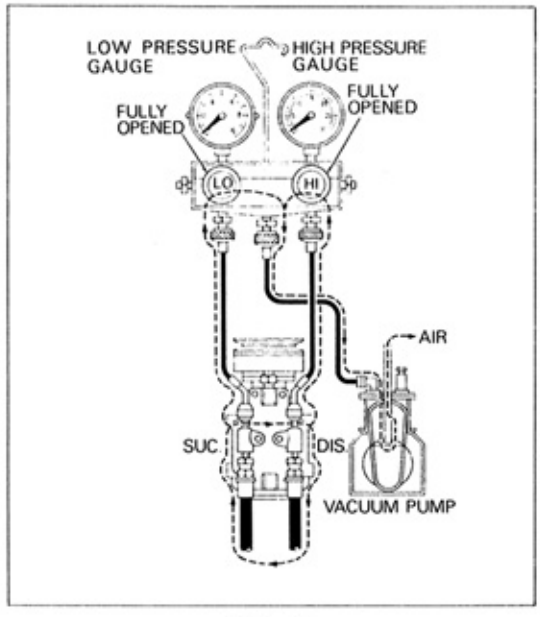


Fig. 89

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

Note: *a) If the system is not down to 24—27 in. Hg (60—70 cmHg) vacuum, close the high and low hand valves, and stop the vacuum pump.*
Observe the low pressure gauge of refrigerant charging gauge.
b) If the low pressure gauge indication increases, there is a leak which should be repaired before continuing on evacuating.
c) If no leak is evident, continue pumping down.

6. After evacuating the system until low pressure gauge indicates below 27 in. Hg (70 cmHg) vacuum, close the both hand valves.
7. Stop the vacuum pump, then disconnect the center charging hose from the vacuum pump inlet.

D. LEAK TESTING THE SYSTEM

After finishing the evacuation of the system for gas leak using gas leak tester as below.

1. Attach the refrigerant drum service valve to the service drum.
2. Install the center charging hose of the refrigerant charging gauge to the refrigerant drum service valve, then pierece the service drum by screwing the handle of refrigerant drnm service valve in clockwise.
3. Unscrew the handle of refrigerant drum service valve counterclock-wise fully.
   Now the center charging hose is filled with vapor.
   Do not open the high and low hand valves.

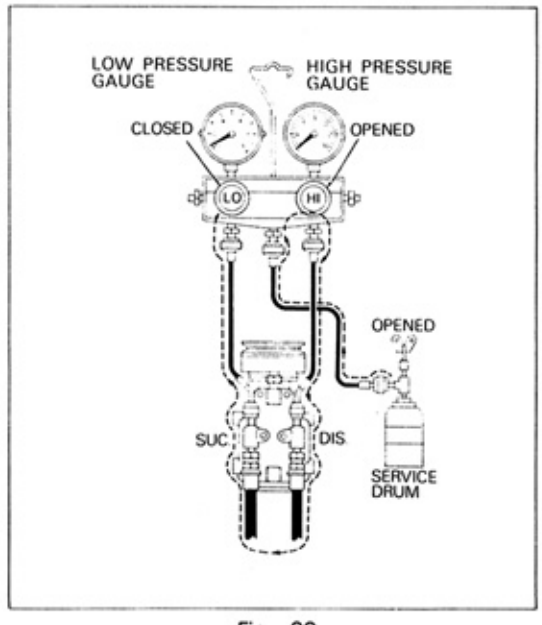


Fig. 90

4. Loosen the center charging hose nut connected to the center fitting of refrigerant charging gauge until a hiss can be heard.
   Allow the vapor to escape for a few seconds, and then tighten nut.

5. Open the high pressure hand valve to charge the refrigerant vapor into the system. See Fig. 90.
6. After indicating 14 psi (1 kg/cm²) of low pressure gauge, close the high side hand valve. Under this condition, check the system for gas leak using a gas leak tester.
7. If gas leak is found, the defective components or connected portions should be repaired.
8. After checking and repairing the system for gas leak, evacuate the system again as below.
   a) Turn the handle of refrigerant drum service valve in clockwise fully to close the valve.
   b) Disconnect the center charging hose from the refrigerant drum service valve fitting.
   c) Connect the center charging hose to the vacuum pump inlet and then continue pumping down as described in section C on page 75.

If possible, continue to run the vacuum pump for 30 minutes after the system reaches 24—27 in. Hg (60—70 cmHg) vacuum.

E. CHARGING THE SYSTEM

1. Close the high and low hand valves of the refrigerant charging gauge after the system is evacuated completely.
2. Connect the center charging hose to the refrigerant drum service valve fitting, and loosen the center charging hose nut connected to the center fitting of refrigerant charging gauge until a hiss can be heard.
   Allow the vapor to escape for a few seconds, and then tighten nut.
3. Open the high pressure hand valve fully, and keeping the service drum upside down to charge the refrigerant in liquid state from the high pressure line. (Never open the low hand valve of refrigerant charging gauge.)
   See Fig. 91.

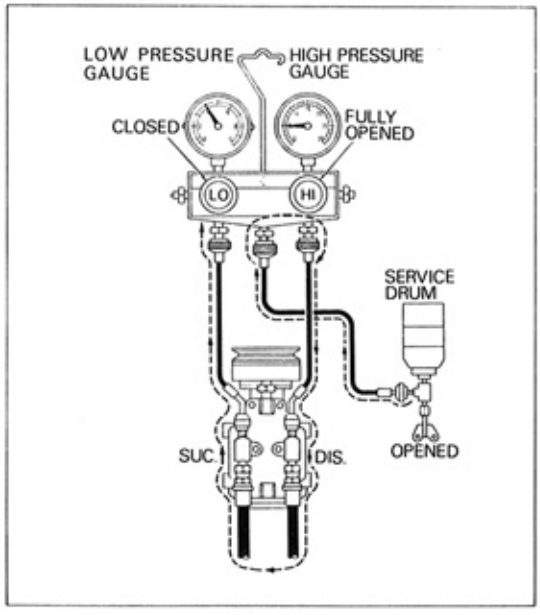


Fig. 91

4. Under the above state, charge the refrigerant completely to specified amount.
   Standard Amount of Refrigerant : 1.6 lbs (800g)

Note: *If liquid refrigerant does not flow into the system smoothly.*

a) Put the service drum in hot water of less than 100° F (38° C).

b) Charge the refrigerant in vapor from the low pressure line as described below.

1) Charge the refrigerant in liquid state at least more than one can (0.8 lb, 400g) from the high pressure line.

2) Close the high pressure hand valve of refrigerant charging gauge. Tightly, and then open low pressure hand valve.

3) Run the engine at fast idle, and operate the air conditioner at maximum cooling ("HI" blower speed and "10" position of thermostat dial).

4) Charge the refrigerant in vapor into the air conditioning system. Be sure to keep the service drum in upright position in this charging method. This is to prevent the liquid from 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.

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

5. When the service drum becomes empty, close the high pressure hand valve of the refrigerant charging gauge, and remove the refrigerant drum service valve from the service drum.
   Attach the refrigerant drum service valve to a new service drum and purge the air in the center charging hose shown in Fig. 92.
6. Pierce the sealed tap of the service drum, and charge the refrigerant into the system continuously.

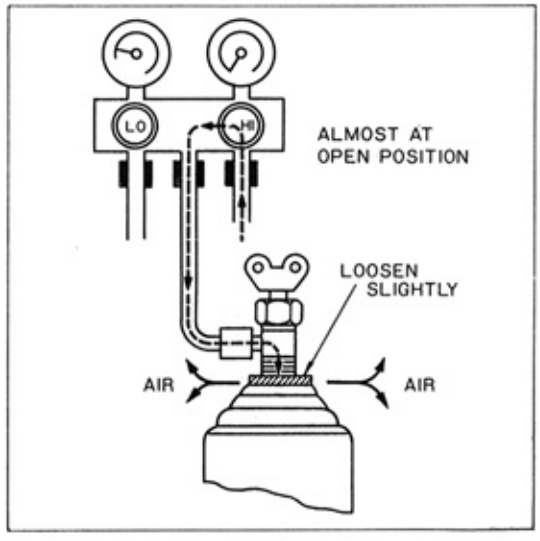


Fig. 92

7. Close the high pressure hand valve of the refrigerant charging gauge after the specified amount of refrigerant is charged into the system.
8. Remove the high and low pressure hand valves of the refrigerant charging gauge quickly from the discharge and suction service valves of compressor.
   Put the cap nuts on the both service valve fittings of compressor.

XIII PERFORMANCE TEST

After finishing all repairing works, make sure to carry out the performance test of the air conditioning system as below.

A. PROCEDURE

1. Conncet the high and low pressure side charging hoses of gauge manifold set to the service valves on the compressor.
2. Run the engine, and keep the compressor revolution at 2000 rpm.
3. Operate the air conditioner, and set the blower speed control switch at "HI" and the thermostat dial at "10" (Max. cooling).
4. Keep all windows and doors open.

Fig. 93

5. Insert the dry bulb thermometer in the rectangular center outlet and place the psychrometer (dry and wet bulb thermometer) close to the inlet of cooling unit.
6. The high pressure indication of refrigerant charging gauge should be within the specified pressure range, 200—220 psi (14.0—15.5 kg/cm²).

Note: *1) If the gauge indicates too high, pour the water on the condenser.*
2) If the gauge indicates too low, cover the front surface of condenser.

7. The dry bulb thermometer at the air inlet should be within 77—95°F (25—35° C).
   If not so postpone the performance test.

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 indications of psychrometer at the inlet, and get the relative humidity from psychrometric chart. (See Fig. 94 or Fig. 96).
2. Measure the dry bulb temperature at the rectangular center outlet, then find out the difference between the inlet and outlet temperatures.
3. For example, the difference is 64.5°F (18°C) and the relative humidity is 60%.

Relate two points on Fig. 95.

If the crossing point is within the diagonal lines, area, the cooling performance. is satisfactory and proper.

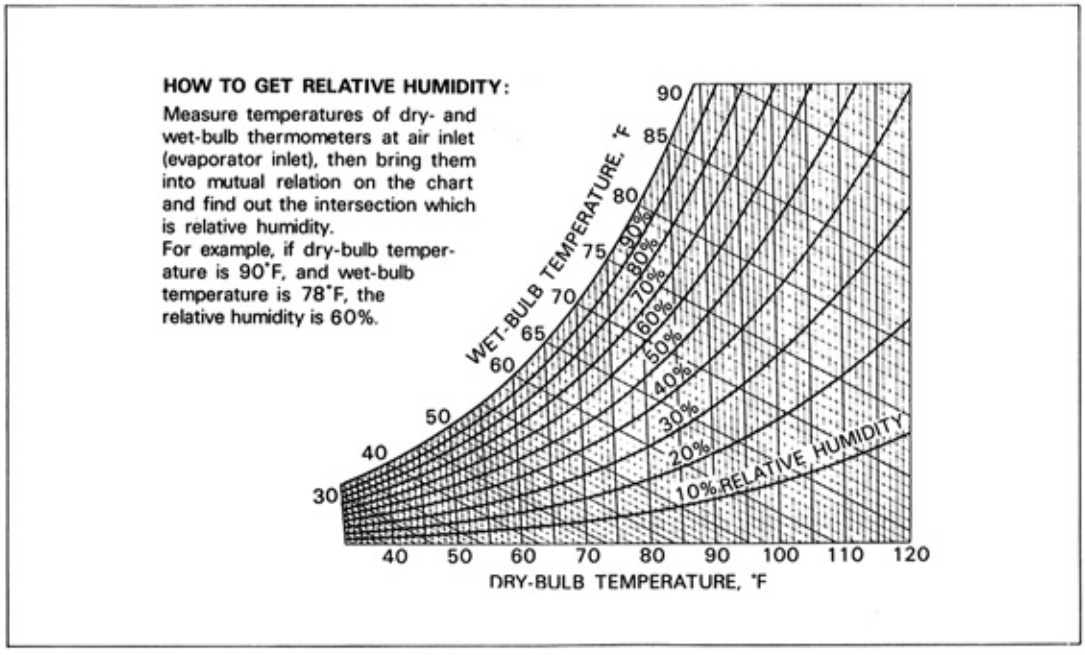


Fig. 94 Psychrometric Chart

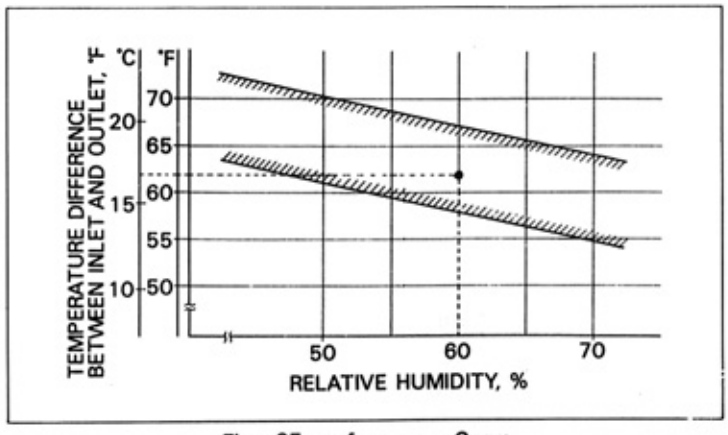


Fig. 95 performance Curve

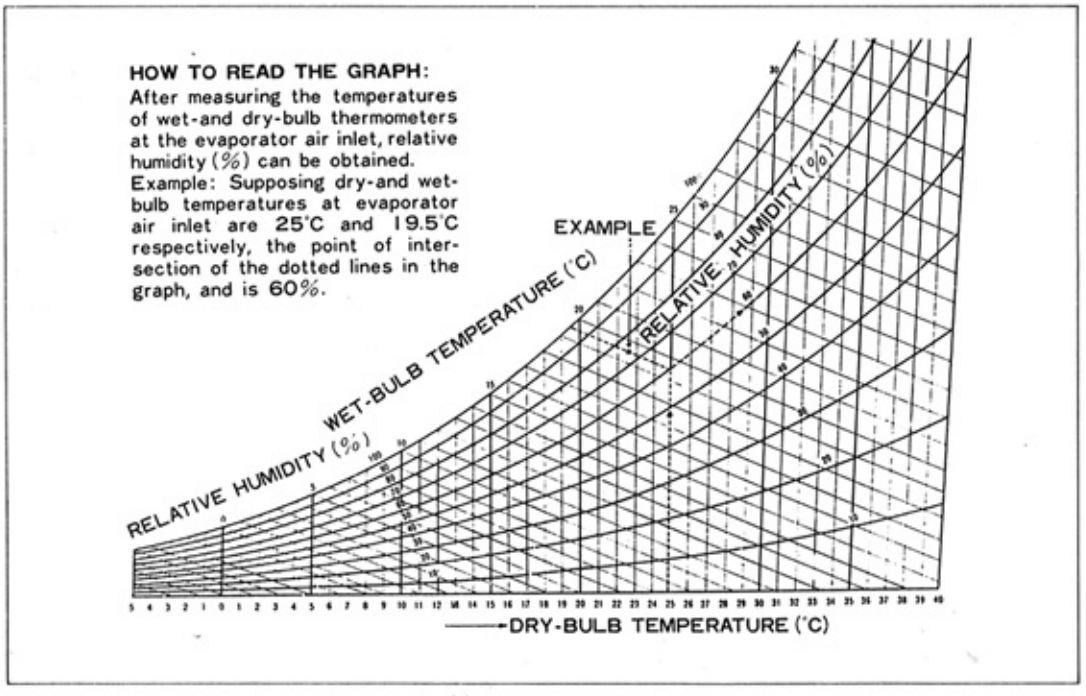


Fig. 96 Psychrometric Chart

December, 1971

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Prepared by

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