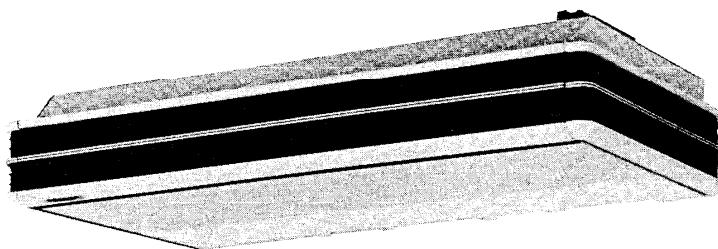


SERVICE MANUAL

SPLIT-TYPE
AIR CONDITIONER

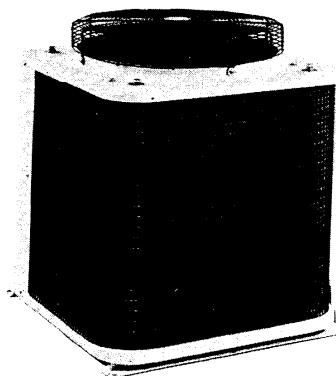


SAP241TC
(U.S.A.)



Indoor Unit

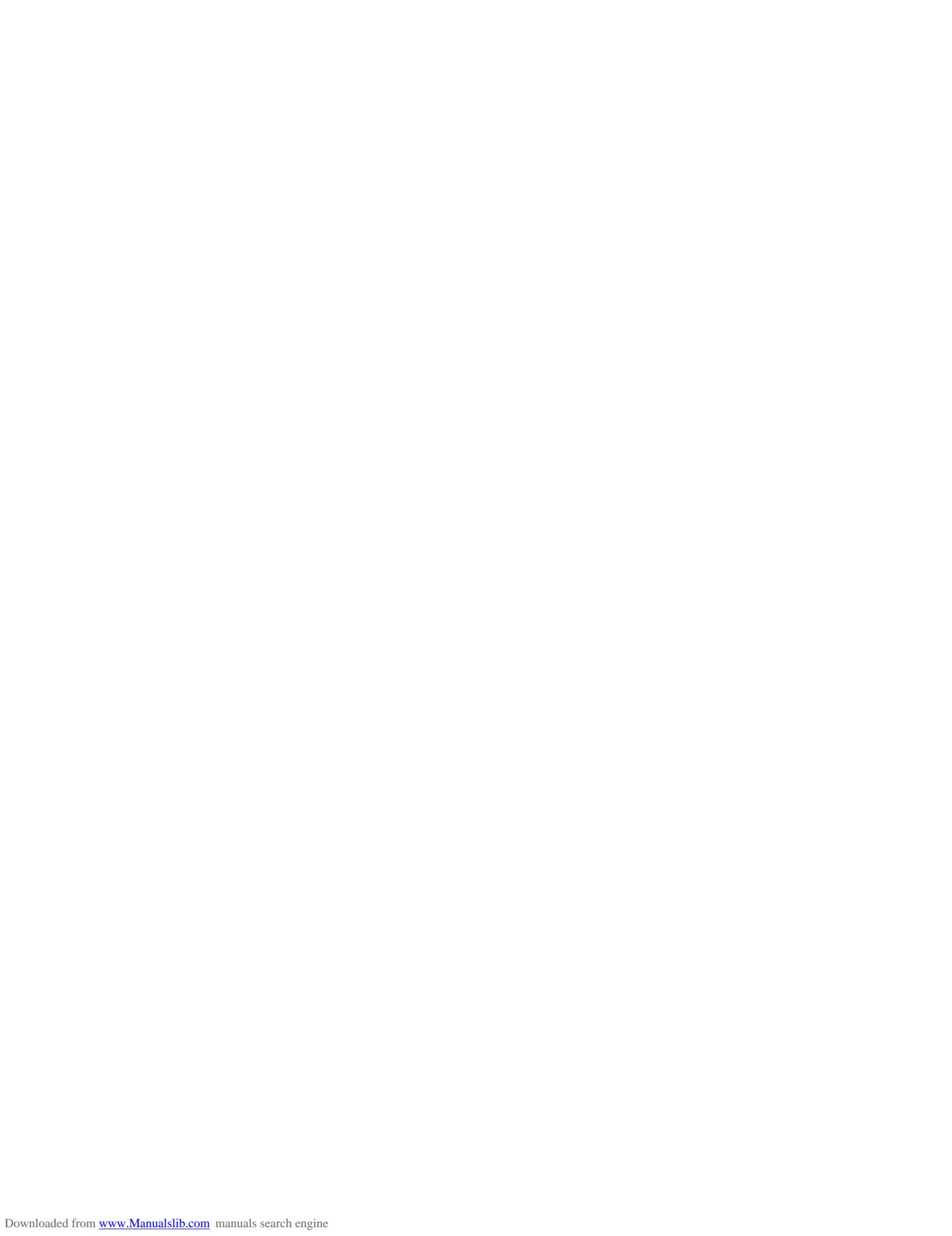
SAP241T



Outdoor Unit

SAP241C

WM-14966





HVAC

LIMITED WARRANTY OF ORIGINAL PURCHASER

Sanyo Electric Inc. takes pride in its products and believes they are manufactured to the highest possible standards. Consequently, Sanyo warrants to the original consumer its Air Conditioner for one (1) year for parts only. Sanyo will repair or replace (at its option) at no charge any part(s) found to be defective during the warranty period. In addition, Sanyo warrants the compressor for a total of five (5) years, and will cover labor charges on compressor replacement only for a period of thirty (30) days.

OBLIGATIONS OF THE ORIGINAL OWNERS

Warranty repair must be performed by a qualified HVAC contractor. The dealer's original dated bill of sale must be retained as proof of purchase and must be presented to the qualified HVAC contractor.

EXCLUSIONS OF THE WARRANTY

The warranty does not cover accident, misuse, fire, flood and other Acts of God, incorrect line voltage, damage caused by improper installation, labor cost of removing or reinstalling of product for repairs, improper or unauthorized repair, broken or marred cabinet, accessories, knobs, filters, customer adjustments which are not covered in instruction book.

Warranty is void and of no effect if serial numbers on the Sanyo product are missing or altered. This warranty is valid on products purchased and used in the United States of America only.

This is the entire Sanyo warranty and it may not be changed or amended by any person, agency, distributor, dealer, or company without prior written authority from Sanyo Electric Inc., and Sanyo does not authorize any party to assume for it any obligation or liability.

This warranty gives the consumer specific legal rights but he may have other legal rights which may vary from state to state. In no event shall Sanyo be liable and specifically denies responsibility for any consequential damages arising from the use of this product beyond the repair or replacement of the Air Conditioner, or for any delay in the performance of this warranty due to causes beyond our control.

Some states do not allow limitations on how long an implied warranty last and/or do not allow the exclusion or limitation of consequential damages, so the above limitations on implied warranty and consequential damages may not apply to you.

Should the consumer need repairs or assistance in locating his nearest qualified HVAC contractor, contact dealer of purchase or call/write to Sanyo Electric Inc. as follows:

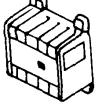
Sanyo Electric Inc.
200 Riser Road
Little Ferry, NJ 07643
(201) 641-2333

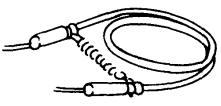


1.2 Major Component Specifications

| | | | |
|--|-----|---|-----------------------------------|
| Unit Model No. | | SAP241C | |
| Compressor | | Hermetic Rotary Type | |
| Compressor Model No. | | C-R190H6N | |
| Source | | 230/208 V, 60 Hz, Single Phase | |
| Pole | | 2 | |
| Nominal Output (W) | | 1,900 | |
| Displacement (cc/rev.) | | 41.6 | |
| Amps.-Full Load (A) | | 12.7/14.0 | |
| -Locked Rotor (A) | | 84 (240 V) | |
| Type of Oil | | Special oil for Rotary Compressor | |
| Compressor Oil Amount (cc) | | 1,350 | |
| Coil Resistance (Ω) (Ambient Temp. 77°F) | | C-R: 0.66 C-S: 1.968 | |
| Protective Device | | Internal Protector (15HM2505) | |
| Run Capacitor, | MFD | 35 | |
| | VAC | 370 or 400 | |
| Unit Model No. | | SAP241T | SAP241C |
| Fan Motor | | Capacitor Run Induction Motor | |
| Fan Motor Model No. | | KFG4S-61A6P | KFC8-101A6P |
| Source | | 230/208 V, 60 Hz, Single Phase | |
| Pole | | 4 | 8 |
| Nominal Output (W) | | 60 | 20 |
| Amps.-Full Load (A) | | 0.8/0.7 | 0.5/0.5 |
| -Locked Rotor (A) | | — | |
| Protective Device | | Internal Protector (17AM033 A5-4) | Internal Protector (17AM035 A5-4) |
| Run Capacitor, | MFD | 2 | 5 |
| | VAC | 440 | |
| Coil Resistance (Ω) (Ambient Temp. 68°F) | | WHT-BRN: 52.7 WHT-YEL: 38.8 YEL-PNK: 68.9 | WHT-BRN: 24.1 WHT-PNK: 53.8 |
| Auto Deflector Motor | | Synchronous Motor | |
| Motor Model No. | | M001-1 | |
| Source | | 230/208 V, 60 Hz, Single Phase | |
| Pole | | — | |
| Nominal Output (W) | | 3 | |
| Amps.-Full Load (A) | | 0.017 | |
| -Locked Rotor (A) | | — | |
| Protective Device | | Impedance Protector | |
| Run Capacitor, | MFD | — | |
| | VAC | — | |
| Coil Resistance (Ω) (Ambient Temp. 68°F) | | 10,629 | |

DATA SUBJECT TO CHANGE WITHOUT NOTICE.

| Unit Model No. | SAP241C | Figure |
|----------------|-------------|---|
| Magnet Relay | CLK-16E3-21 |  |

| Unit Model No. | SAP241C | Figure |
|------------------|-------------|---|
| Crankcase Heater | CH5700 | |
| Rating | 230 V, 30 W |  |

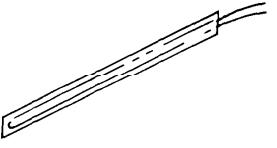
| Unit Model No. | SAP241C | Figure |
|-------------------------|---------------------|---|
| Outdoor Coil Thermostat | YTB-4U201 | |
| Operating Temperature | ON: 75°F, OFF: 78°F |  |

| Unit Model No. | SAP241C | Figure |
|----------------|--------------------------------------|---|
| Solenoid Valve | NEV-603DXFU (valve), NEVAC208 (coil) | |
| Rating | 230 V/208 V 5.5 W/5 W |  |

| Unit Model No. | SAP241T | Figure |
|--------------------|--|---|
| Room Temp. Sensor* | OCS5K-UL | Incorporated in the remote control unit |
| Resistance (kΩ) | 69°F: 6–6.5 86°F: 3.9–4.2 77°F: 49–5.2 | |

Note: * = thermistor

| Unit Model No. | SAP241T | Figure |
|--|--|---|
| Power Transformer (for Controller PCB) | ATR-J122U | |
| Resistance (Ω) | Primary: WHT-NHT 143.5 Secondary: BRN-BRN 1.2 |  |

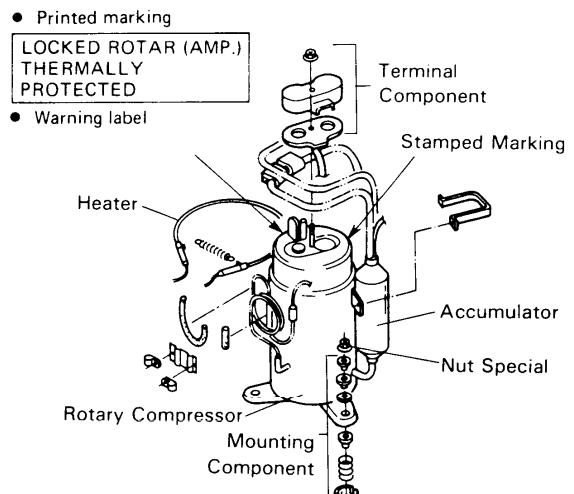
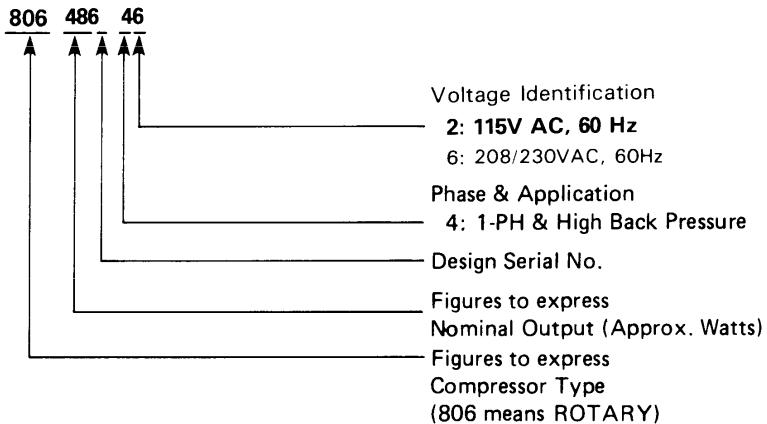
| Unit Model No. | SAP241T | Figure |
|------------------|-------------|---|
| Dew Proof Heater | | |
| Rating | 230 V, 13 W |  |

1.3. Compressor Identification

1. Marking (Stamped)

Compressor code No. → **806 486 46** Manufacturer:
 Model No. → **C - R190H6N TSE** T = Tokyo
 S = Sanyo
 E = Electric.
 Production Date → **30 01 5** (= 30 Jan., 1985)
 Ratings (V) → **V230/208**
 Frequency (Hz) and Phase → **HZ60 PH1**

2. Compressor Code No.



WARNING-SERVICEMAN

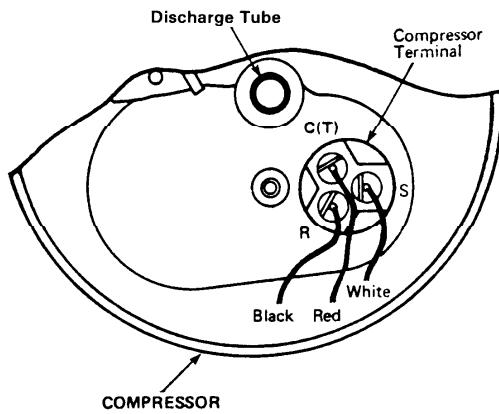
1. FIELD SERVICE LEAK TEST PRESSURE MUST NOT EXCEED 150 P.S.I.G.
2. THIS COMPRESSOR MUST BE GROUNDED.
3. DO NOT OPERATE WITHOUT PROTECTIVE COVER OVER TERMINALS: DISCONNECT ALL POWER BEFORE REMOVING THE PROTECTIVE COVER.

CAUTION

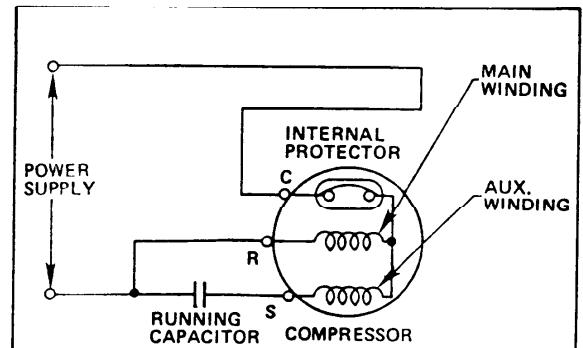
COMPRESSOR HOUSING MAY REACH 302°F (150°C) WITH TERMINAL PROTECTOR APPROVED BY TOKYO SANYO AND TESTED IN ACCORDANCE WITH UL984-1981.

TOKYO SANYO ELECTRIC CO.,LTD.

3. Compressor Wire Orientation

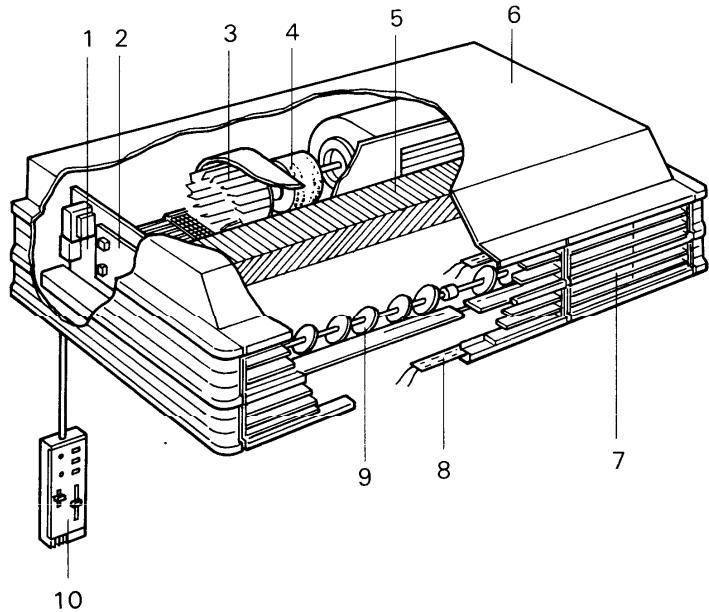


Wiring Diagram



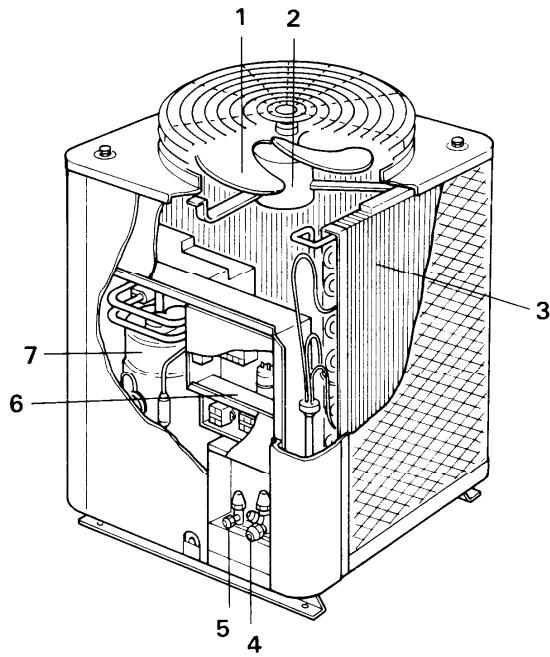
2. CONSTRUCTION OF THE UNIT

INDOOR UNIT SAP241T



1. Electrical component box
2. Controller P.C.B.
3. Centrifugal fan
4. Fan motor
5. Evaporator (= Indoor heat exchanger)
6. Cabinet
7. Air outlet
8. Defrost heater
9. Auto deflector
10. Remote control unit

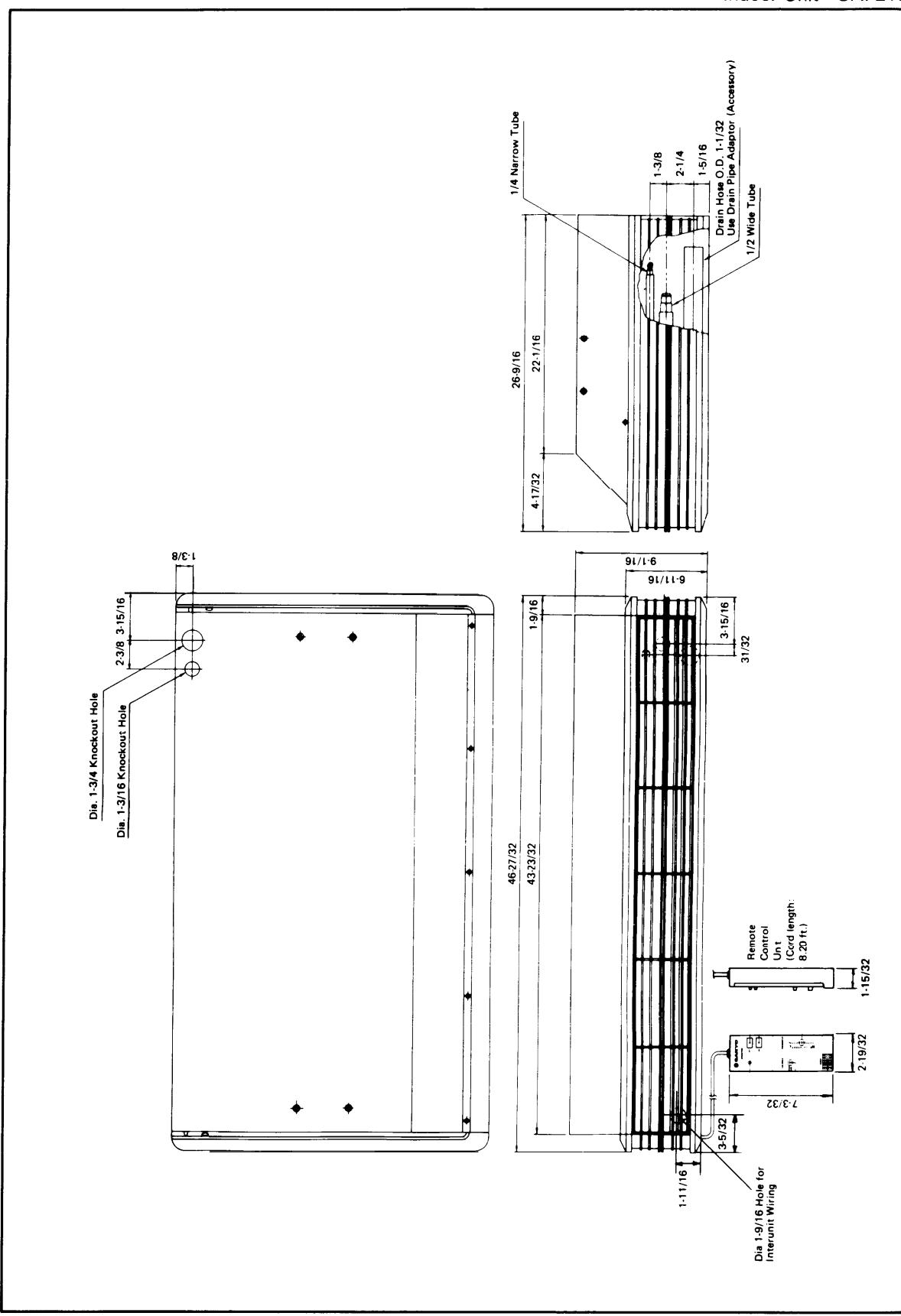
OUTDOOR UNIT SAP241C



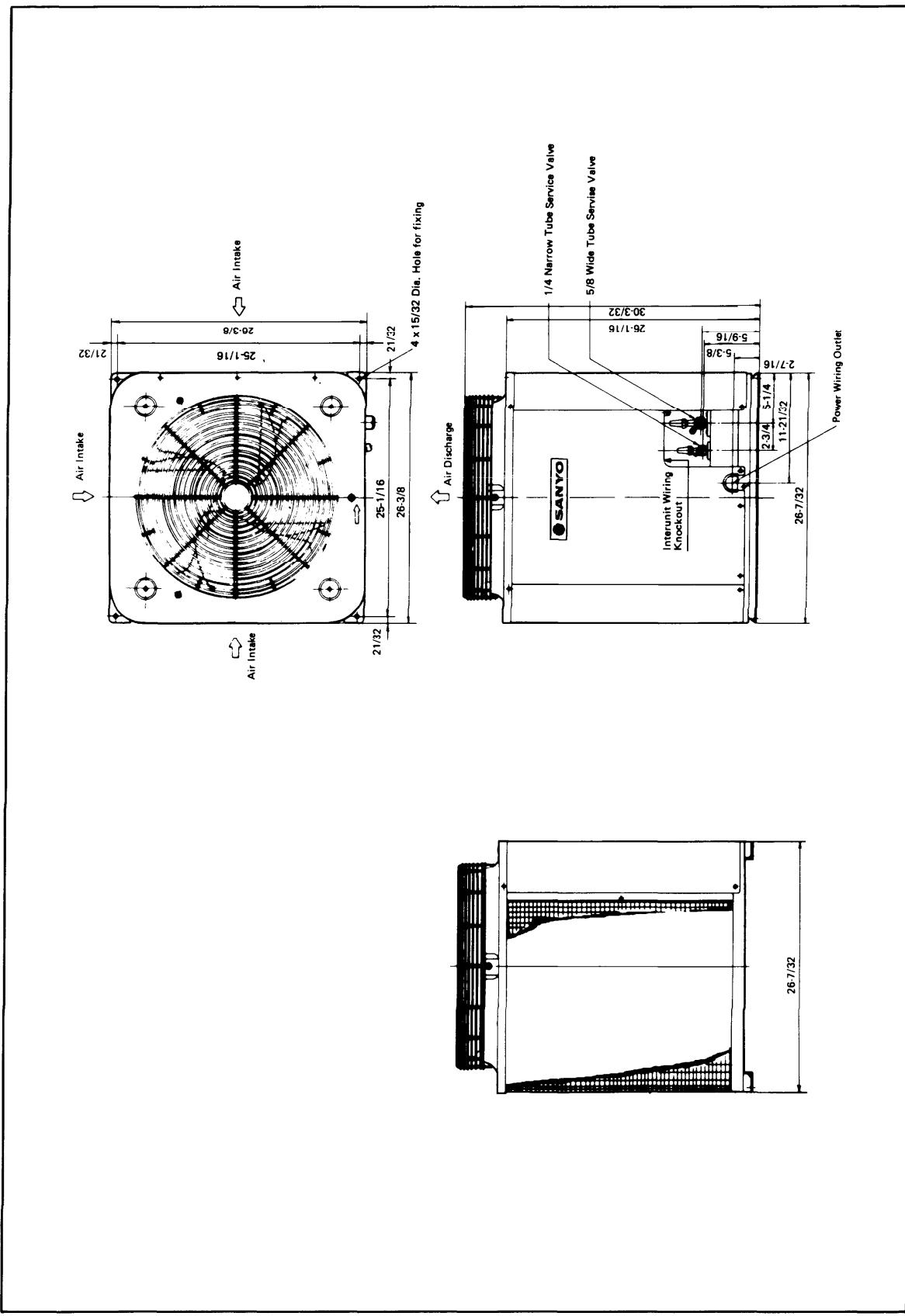
1. Propeller fan
2. Fan motor
3. Condenser (= Outdoor heat exchanger)
4. Service valve (Wide tube)
5. Service valve (Narrow tube)
6. Electrical component box
7. Compressor

3. DIMENSIONAL DATA

Indoor Unit SAP241T



Outdoor Unit SAP241C

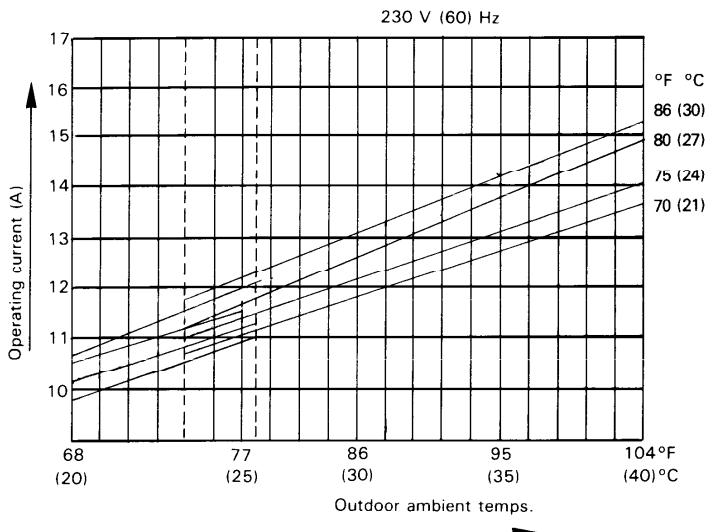


4. PERFORMANCE CHARTS

Cooling characteristics

Operating current characteristics versus outdoor ambient temperature and indoor temperature (Indoor relative humidity: 50%, indoor air velocity: High overall value for indoor and outdoor shown.)

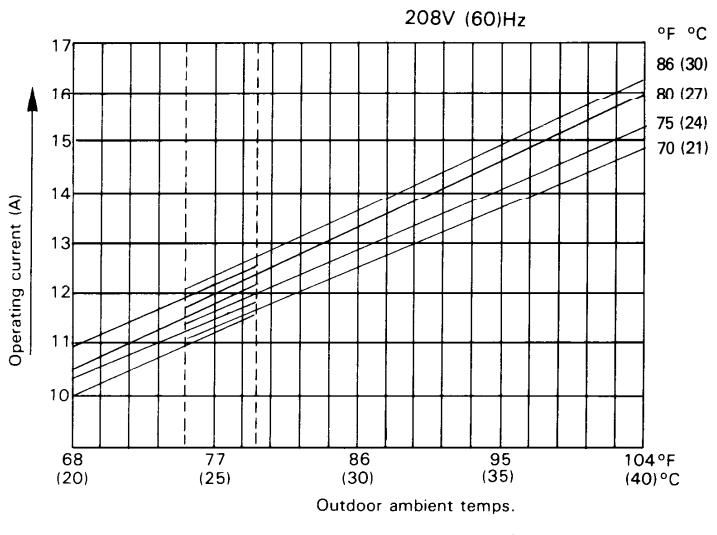
NOTE: The solenoid valve opens to by-pass refrigerant flow when the outdoor ambient temperature stays within the dotted-line range.



Cooling characteristics

Operating current characteristics versus outdoor ambient temperature and indoor temperature (Indoor relative humidity: 50%, indoor air velocity: High overall value for indoor and outdoor shown.)

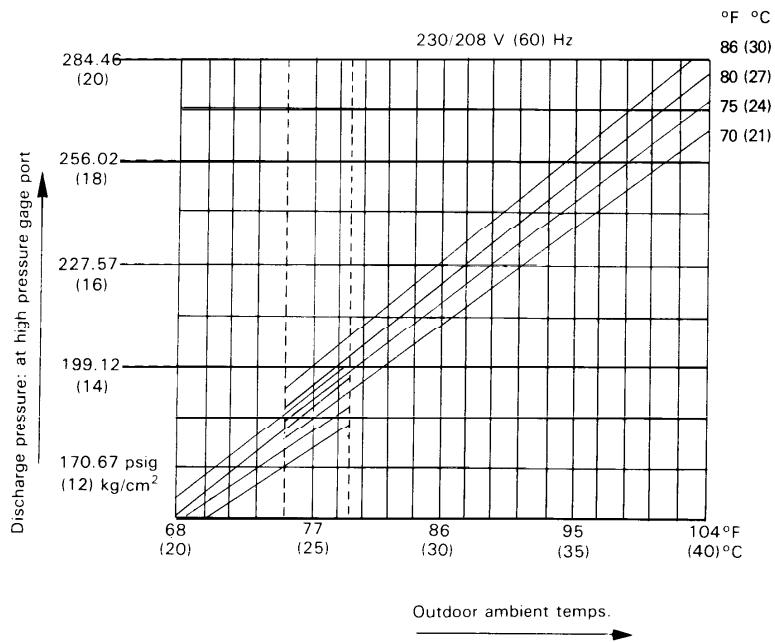
NOTE: The solenoid valve opens to by-pass refrigerant flow when the outdoor ambient temperature stays within the dotted-line range.



Cooling characteristics

High pressure characteristics versus outdoor ambient temperature and indoor temperature (Indoor relative humidity: 50%, indoor air velocity: High.)

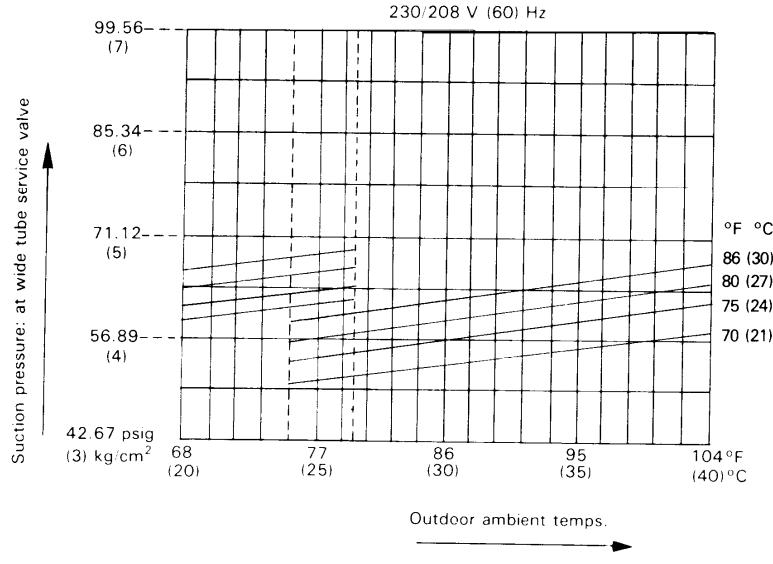
NOTE: The solenoid valve opens to by-pass refrigerant flow when the outdoor ambient temperature stays within the dotted-line range.



Cooling characteristics

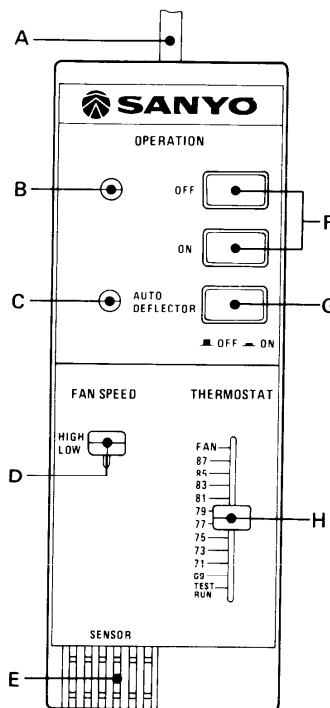
Low pressure characteristics versus outdoor ambient temperature and indoor temperature (Indoor relative humidity: 50%, indoor air velocity: High.)

NOTE: The solenoid valve opens to by-pass refrigerant flow when the outdoor ambient temperature stays within the dotted-line range.



5. OPERATING INSTRUCTIONS

1. REMOTE CONTROL UNIT



● OPERATION SWITCH

| SWITCH | KIND OF OPERATION | OPERATION INDICATOR LAMP |
|----------------|---|--------------------------------|
| OFF | Stops operation. | Operation lamp goes out. |
| ON | Starts operation. | Operation lamp lights up. |
| AUTO DEFLECTOR | Starts auto deflector to deliver cool air to every corner in the room over 80 deg. arc. | Auto deflector lamp lights up. |

Note: If the lamp goes out and the air conditioner stops operating, refer to the section entitled "REMEDIES"

● THERMOSTAT

The thermostat maintains the room temperature automatically at the desired level and ensures economical operation of the air conditioner. Just set thermostat lever for the temperature level you want.

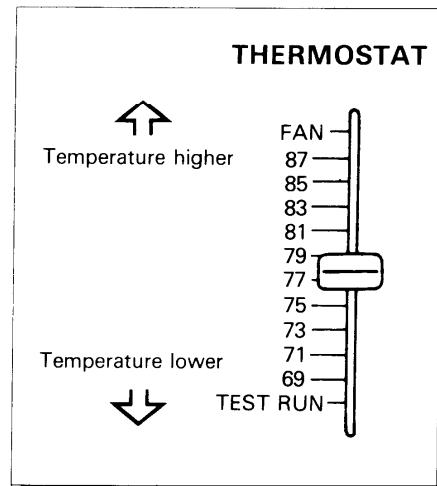
Note:

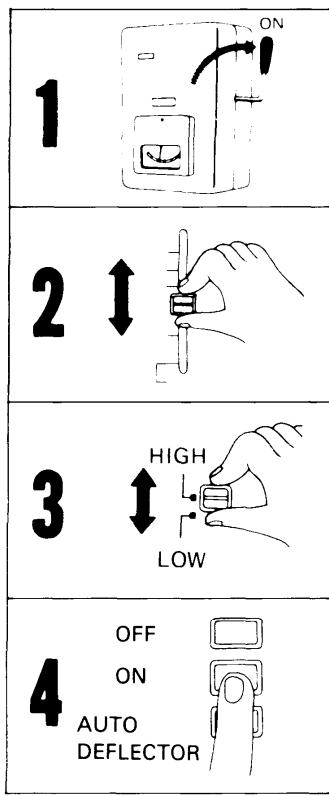
The numbers on the graduated scale are meant to serve as a guideline only. The actual room temperature may differ from the thermostat setting depending on room size and cooling load.

FAN: Set thermostat lever to this position when FAN operation only is needed.

CAUTION: TEST RUN;

This position is to be used only for test operation after completion of installation or during service operations. Normally it is locked.





2. HOW TO OPERATE

- 1) Turn on the power supply at least five hours before starting up the air conditioner.
- 2) Adjust the position of the thermostat lever.
- 3) Set the FAN SPEED selector to the desired speed
- 4) Press the ON pushbutton.

● HOW TO STOP

Press the OFF pushbutton to stop the air conditioner.

● EMERGENCY SHUTDOWN

If the air conditioner does not stop even when the OFF pushbutton is pressed, disconnect the power supply.

3. AIR FLOW DIRECTION

- Vertical adjustment (Manual). Move the horizontal blades of the air outlet by hand.
- Horizontal adjustment (Automatic)

Variable mode

Press the AUTO DEFLECTOR pushbutton to start automatic air sweep. AUTO DEFLECTOR lamp lights during operation.

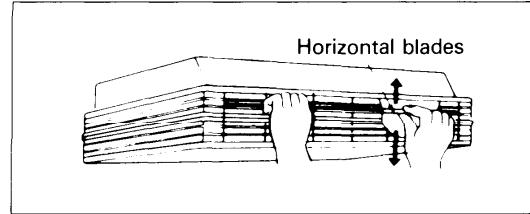
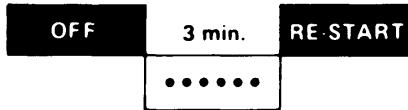
Fixed mode

To select a fixed air direction, press the pushbutton again when the air is flowing in the desired direction. The lamp will go out at this time.

4. CAUTION

● SAFETY INTERVAL RESTARTING

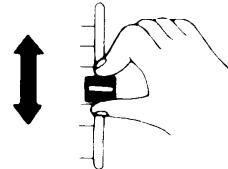
After pressing the OFF button, the air conditioner stops and it will not start for three minutes. To start the air conditioner again after three minutes, press the ON button.



● THERMOSTAT SETTING

Inadvertently moving the thermostat lever quickly up and down will cause the compressor to stop for three minutes.

Set the lever to the desired temperature and the unit will operate normally after three minutes.



Do not move this lever too quickly.

● POWER SUPPLY

Be sure to supply power at least five (5) hours before operating the air conditioner at the beginning of the season. During the period of service, leave the power supply ON and let the current flow in the crankcase heater to warm up the compressor.

6. INSTALLATION INSTRUCTIONS

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1. GENERAL

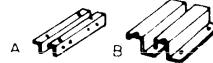
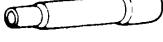
Here is a brief outline of where and how to install the unit. Please read over entire set of instructions for indoor and outdoor units and make sure all accessory parts listed are with the unit before beginning.

1-1. Tools Required for Installation (not supplied)

Drill, 3-5/32" dia. hole saw or key hole saw for normal walls. However, chisels or core bits will be required for brick, concrete, or similar walls.

- Regular Screwdriver
- Phillips Head Screwdriver
- Knife or Wire Stripper
- Level
- Tape Measure
- Tube Cutter
- Flaring Tool
- Torque Wrench
- Adjustable Wrench
- Reamer or Small File

1-2. Accessories Supplied with Unit for Installation

| Description | Shape | Q'ty | Remarks |
|------------------------------|---|----------------|-----------------------------------|
| Suspension fitting |  | A (2) B (2) | |
| Suspension bolt (M8x200) |  | 4 | |
| M8 hex. nut with flat washer |  | 8 | |
| M8 bolt |  | 4 | |
| M8 flat washer |  | 4 | |
| M8 spring washer |  | 4 | |
| Woodscrew (M3.1x13) |  | 2 | Used to mount remote control unit |
| Heat insulating material |  | 1 | Used for wide tube connection |
| | | 1 | Used for narrow tube connection |
| Drain hose |  | 1 | |
| Drain-hose clamp |  | 1 | Connect to drain outlet |

1-3. Optional Copper Tubing Kit

Copper tubing for connecting outdoor unit to indoor unit is available in kits which contain the narrow and wide tubing, fittings and insulation.

1-4. Type of Copper Tubes and Insulation Material

If you wish to purchase these materials separately from a local source, you will need:

- Deoxidized annealed copper tube 1/4" outside dia. with a 0.0314" wall thickness, and an equal length of 5/8" outside dia. with a 0.0394" wall thickness.

Cut to the appropriate lengths + 12" to 20" on each to dampen vibration between units.

- Foamed insulation 1/4" I.D., or 5/8" I.D. as required to precise length of copper tubing, wall thickness of insulation should be 5/16" to 1/2" thick. (Refer to page 21.)
- Copper Wire
Inter Unit: Min. AWG 14 in appropriate length.
Power Supply: Min. AWG 10
- 3" O.D. (I.D. 2-13/16", wall thickness 3/16") PVC pipe length to match thickness of wall.

1-5. Additional Materials Required to Give Installation a Professional Appearance

| | |
|---|--|
| • Refrigeration (armored) tape | • Refrigeration Oil |
| • Insulated staples or clamps for connecting wire (Refer to local codes) | • 3-1/2" clamp – use 1 every 4 ft. (To secure copper tubing). |
| • Putty (1/2 lbs) | |

2. INSTALLATION SITE SELECTION

Indoor Unit :

- AVOID:**
- areas where leakage of flammable gas may be expected.
 - places where large amounts of oil mist exist.
 - direct sunlight.
 - nearby heat sources that may affect performance of the unit.
 - locations where remote control will be splashed with water or affected by dampness or humidity.
 - installing remote control unit behind curtains or furniture that obstruct air circulation.

°F °C
86 (30)
80 (27)
75 (24)
70 (21)

- DO:**
- select an appropriate position from which every corner of the room can be uniformly cooled. (High on the wall is best.)
 - select a location that will hold the weight of the unit.
 - select a location where tubing and drain pipe have shortest run to the outside. Fig. 1
 - allow room for operation and maintenance as well as unrestricted air flow around the unit.
 - allow room for mounting control unit about 4' off the floor, in an area that is not in direct sunlight or in the flow of cool air from the unit.
 - install unit within 33' up or down of outdoor unit and within a total of 50' from outdoor unit. Fig. 2

°F °C
86 (30)
80 (27)
75 (24)
70 (21)

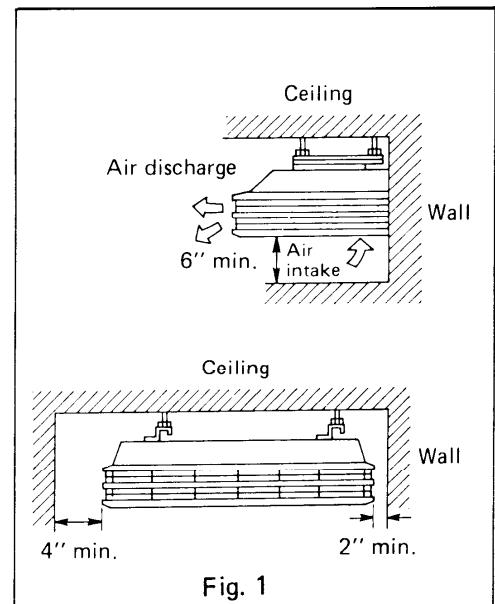


Fig. 1

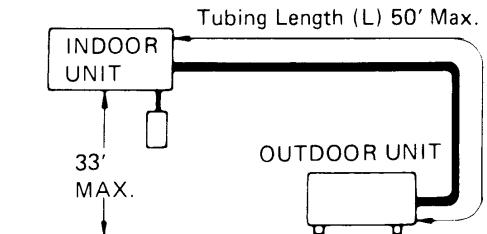


Fig. 2

Outdoor Unit :

AVOID: • heat sources, exhaust fans, etc., Fig. 3
 • damp, humid or uneven locations.

DO:

- choose a place as cool as possible.
- choose a place that is well ventilated and outside air temperature does not exceed 115°F constantly.
- allow enough room around unit for air intake/exhaust and possible maintenance. Fig. 4
- provide a solid base; about 4" above ground level to reduce humidity and possible water damage in unit and decrease service life. Fig. 5
- use lug bolts or equal to bolt down unit, reducing vibration and noise.

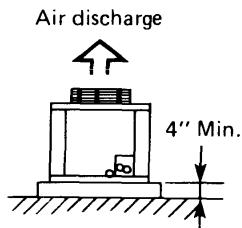


Fig. 5

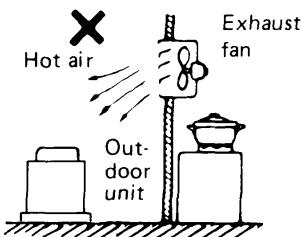


Fig. 3

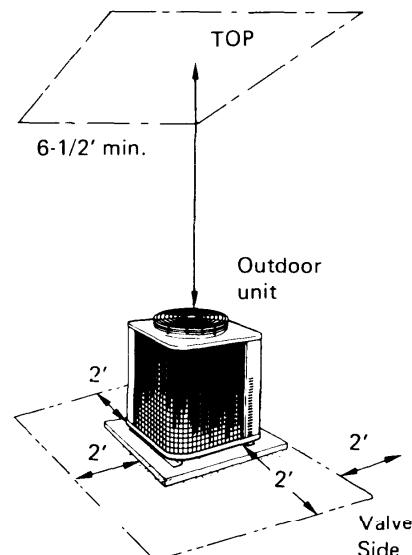


Fig. 4

3. HOW TO INSTALL INDOOR UNIT

3-1. Mount the Unit

a) Place the Full-Scale Diagram (accessory) onto the ceiling, as shown in the illustration at right. Then mark the positions of the bolt anchors where the suspension bolts are to be mounted. Fig. 6A

NOTE : The diagram made of paper may shrink/stretch due to temperature or humidity, causing slight distortions in the dimensions. Therefore, before drill the hole, maintain the dimensions between the markings.

b) In the holes for the bolts, insert securely bolt anchors (or bolt holding plugs). Then securely screw the bolts into the anchors, as shown in the illustration at right. Fig. 6B

c) Install suspension pieces. Fig. 7A

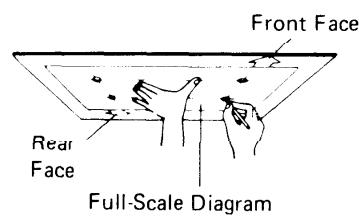


Fig. 6A

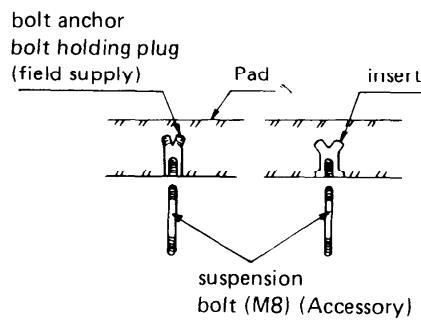
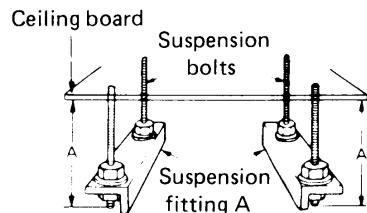


Fig. 6B

NOTE : If the ceiling pad is not strong enough to suspend the air conditioner or if it is difficult to use bolt anchors, secure the suspension bolts with the construction member. Refer to Fig. 7B



Four suspension bolts extruded from ceiling board shall be adjusted to equal in length (A) with one another.

Fig. 7A

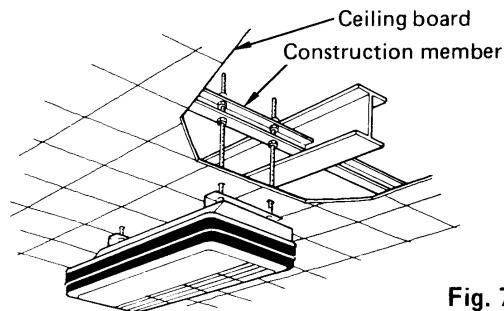


Fig. 7B

d) If tubing and wire are to go directly out back of unit, make holes on the wall. Fig. 8

e) Measure thickness of wall from inside edge to outside edge and cut PVC pipe at a slight angle. Insert PVC pipe in wall. Fig. 9

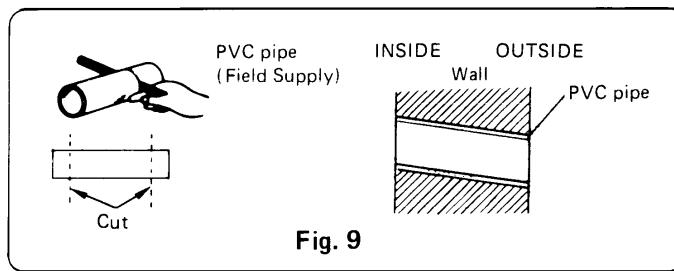


Fig. 9

CAUTION :

Hole should be made at a slight downward slant to the outdoor side.

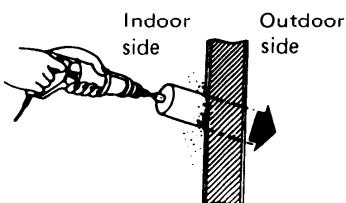


Fig. 8

f) Install suspension fitting (B) on the unit.

g) Hang the unit on the suspension fitting A. Fig. 10

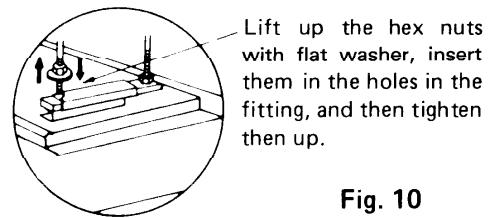


Fig. 10

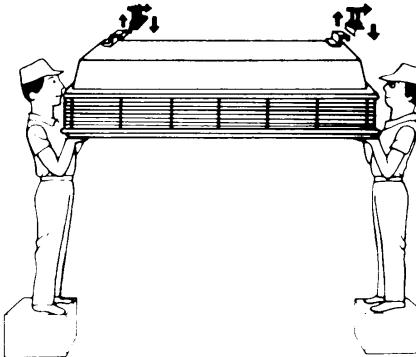
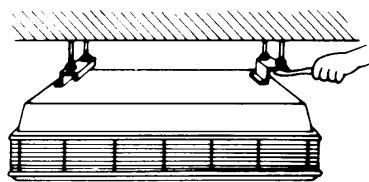


Fig. 11

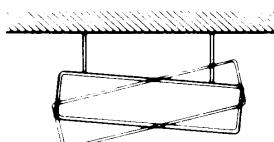
CAUTION : Avoid holding the plastic cover on both ends when lifting the unit. Fig. 11

h) Level the indoor unit by adjusting the M8 hex. nuts.

Fig. 12



Level



No good

3-2. Wiring Instruction for Interunit Connections

- a) Insert the interunit wiring (according to local codes) into through-the-wall PVC pipe. Run the wiring toward indoor side allowing approx. 7 in. from the wall face. Fig. 13

CAUTION : Never fix the wiring by any means before the indoor unit is fully seated on the rear panel.

- b) Remove the air intake grille and air filter. Fig. 14

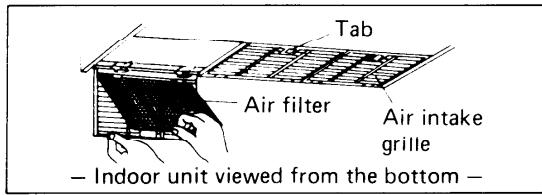


Fig. 14

- c) Unscrew the cover plate of the electrical component box. Fig. 15

- d) Temporarily set the wiring connector in the hole at the electrical component box.

- e) Secure the conduit connector to the electrical component box with a lock nut. Fig. 16

- f) Give some play to the interunit wiring from the outdoor unit to the corresponding terminals on the terminal base.

CAUTION :

- Be sure to refer the wiring system diagram labelled on the electrical component box and carry out correct field wiring. Wrong wiring causes malfunction of the unit.
- Check local electrical codes and also any specific wiring instructions or limitation.

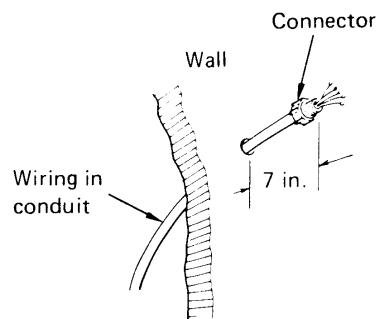


Fig. 13

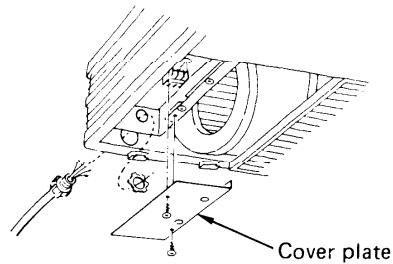


Fig. 15

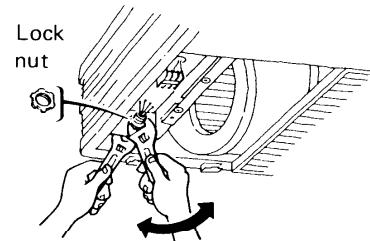


Fig. 16

3-3. Drain Piping

- Drain piping should be slanted downward to outdoor. Fig. 17
- Never form a trap in the course of piping.
- If the drain pipe will run in the room, insulate the pipe with an insulation material* so that chilled sweat should not damage furniture or floors. Fig. 18

* Formed polyurethane or polypropylene is recommended.

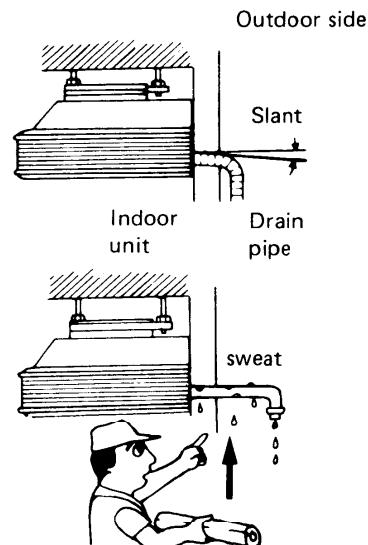


Fig. 17

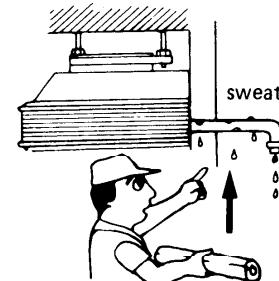


Fig. 18

3-4. Install the Control Unit

Mounting position of control unit should be located in an accessible place for control and enable the average room temperature to be detected. Never cover over the unit or recess it into the wall.

- Fix the mounting plate on the wall with 2 screws, align the rail on the rear of the control unit and slide the unit down as far as it will go. Fig. 19
- Fix the control cord to the wall.

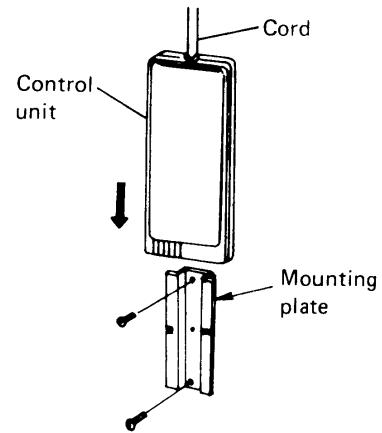


Fig. 19

CAUTION

- The remote control unit has a temperature sensing element. Do not install it where:
 - Direct stream of cold air can reach it.
 - Direct sunlight will fall on it.
 - There are obstacles such as counters and tables.
 - Water vapor or moisture is always present.
 - There is a door and outdoor air can reach it.
- Do not twist the cord of the remote control unit and other power cables together. Otherwise, the switch may malfunction.

WARNING

Do not supply power to the unit or operate until tubing and wiring to the outside unit is completed.

4. HOW TO INSTALL OUTDOOR UNIT

- Place unit on level pad, blocks or equal and anchor.

Refer to INSTALLATION SITE LOCATION given in page 14.

4-1. Wiring Instructions on Outdoor Unit

- Remove access panel "C" and punch knockout holes on the panel. Fig. 20
- Connect interunit control line and power line per drawing on inside of the panel "C". Fig. 21
- Be sure to size each wire allowing several inches longer than the required length for wiring.
- When connections are completed secure both connectors on the panel with lock nuts and then close the panel.
- Ground unit in accordance with local codes.

CAUTION :

- Be sure to comply with local codes on running the wire from the indoor unit to outdoor unit. (size of wire and wiring method etc.)
- Every wire must be connected firmly.
- No wire should touch refrigerant tubing, compressor or any moving part.

| CONNECTOR SIZE | | |
|----------------|---------------------------|-------------------------------|
| MODEL | POWER LINE CONNECTOR SIZE | INTERUNIT LINE CONNECTOR SIZE |
| SAP241C | 1/2" | 1/2" |

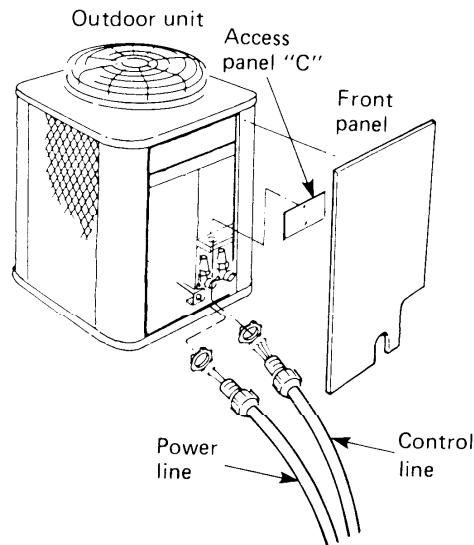


Fig. 20

WIRING SYSTEM DIAGRAM

SAP241TC

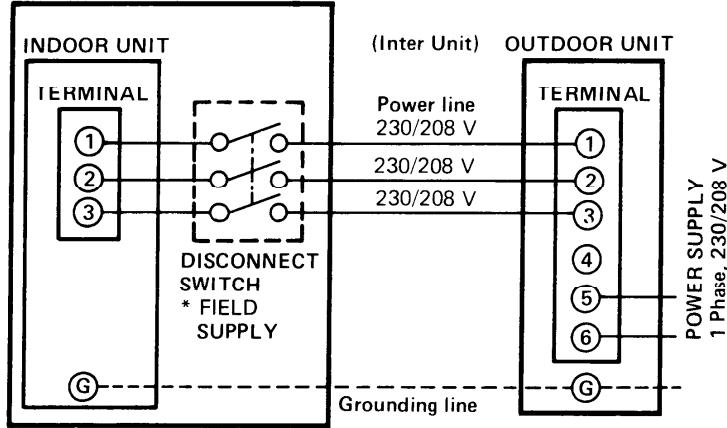


Fig. 21

5. REFRIGERANT TUBING

5-1. Use of the Flaring Method

The refrigerant tubing for every split type air conditioner must be connected by flaring. In this method, the copper tubes are flared at each end and connected with flare nuts.

5-2. Flaring procedure with a Flaring Tool

- a) Cut the copper tube to proper length with a tube cutter. It is recommended to cut approx. 12 ~ 20 in. longer than the estimated tubing length.
- b) Remove burrs at the end of the copper tube with a reamer or a file. This process is important and should be done carefully to make a good flare. Fig. 22

NOTE : When reaming, hold the copper tube end downward and be sure that no copper scraps fall into the tube. Fig. 23

- c) Remove the flare nut from the unit and be sure to mount it on the copper tube.
- d) Make a flare at the end of copper tube with a flaring tool* Fig. 24 (*Use "RIGID" or equivalent.)

NOTE : Good flare should have following conditions:

- Inside surface is glossy and smooth.
- Edge is smooth.
- Tapered sides are in uniform length.

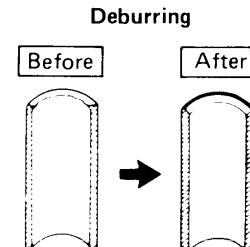


Fig. 22

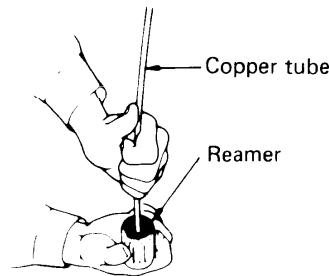


Fig. 23

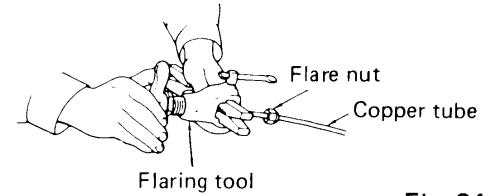


Fig. 24

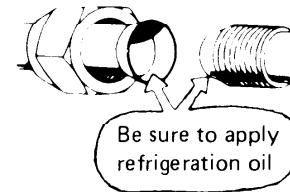


Fig. 25

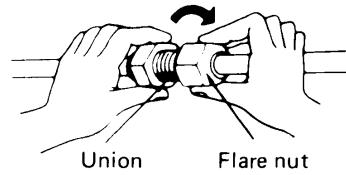


Fig. 26

5-4. Connecting Tubes between Indoor and Outdoor Units

1. Connect the indoor side refrigerant tubing extended from the wall with the outdoor side tubing tightly.
2. Flare nut on large dia. tube should be torqued to 510~550 lbs. in. Flare nut small dia. tube should be torqued to 130~170 lbs. in. Fig. 27
3. After performing a leak test on the connecting part, insulate it with INSUL. NIPPLE and finish with a vinyl masking tape over it. Fig. 28

NOTE : Never connect up tubes by brazing them. If it is inevitable, be sure to blow nitrogen gas while brazing to avoid oxidation of inside copper tube.

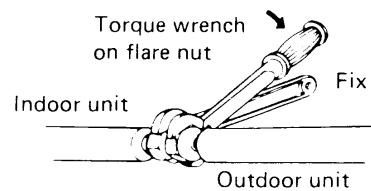


Fig. 27

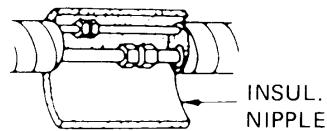


Fig. 28

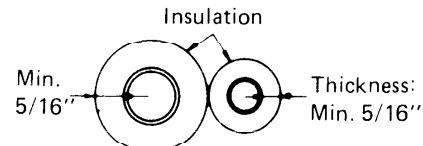


Fig. 29

5-5. Insulation of Refrigerant Tubing

Because the capillary tubing is installed in the outdoor unit, both wide and narrow tubes of this air conditioner become cold. Therefore, to prevent heat loss and wet floors due to dripping of chilled sweat, both tubes must be well insulated with proper insulation material. Thickness of insulation material should be min. 5/16". Fig. 29

- **Insulation material**

The material must of course have good insulation characteristics, be easy to use, age resistant, and must not easily absorb moisture. The following is recommended; foamed polyurethane or polypropylene.

5-6. Taping the Tubing

- a) At this time, the two refrigerant tubes (and electrical wire if code permits) should be taped together with armoring tape. The drain pipe may also be included and taped together as one bundle with the tubing.
- b) Wrap the armoring tape from the bottom of the outdoor unit to the top of the tubing, where it enters the wall. As you wrap the tubing cover half of each previous tape turn. Fig. 30
- c) Clamp tubing bundle to wall, one clamp every 4' approx.

NOTE : Do not wind the armoring tape around too tightly since this will impair the heat insulation effect. Also be sure condensation drain hose splits away from bundle and empties clear of unit and tubing.

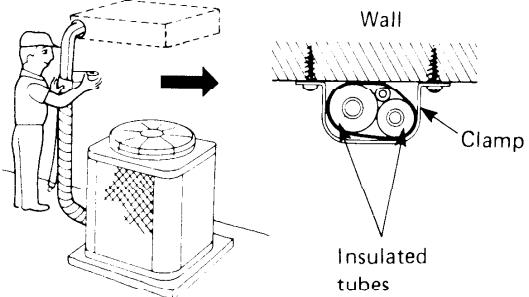


Fig. 30

5-7. Finishing the Installation

After finishing insulation and taping over tubing, fill the void space with putty to prevent rain and draft from entering. Fig. 31

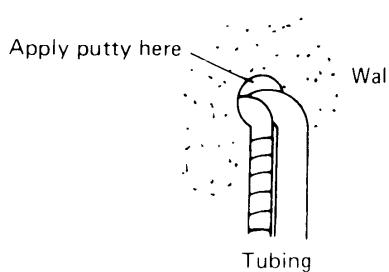


Fig. 31

6. AIR PURGING

Air does not function as a refrigerant, because it cannot be liquefied in the condenser. Air and moisture remaining in the refrigerant system have undesirable effects as indicated at right. Therefore, they must be purged completely.

- The pressure in the narrow tube rises.
- The operating current rises.
- Cooling and heating efficiency drops.
- Water contained in the air may freeze and block the capillary tubing.
- Water may lead to corrosion of parts in the refrigerant circuit.

■ TUBING DIAGRAM FOR AIR PURGING

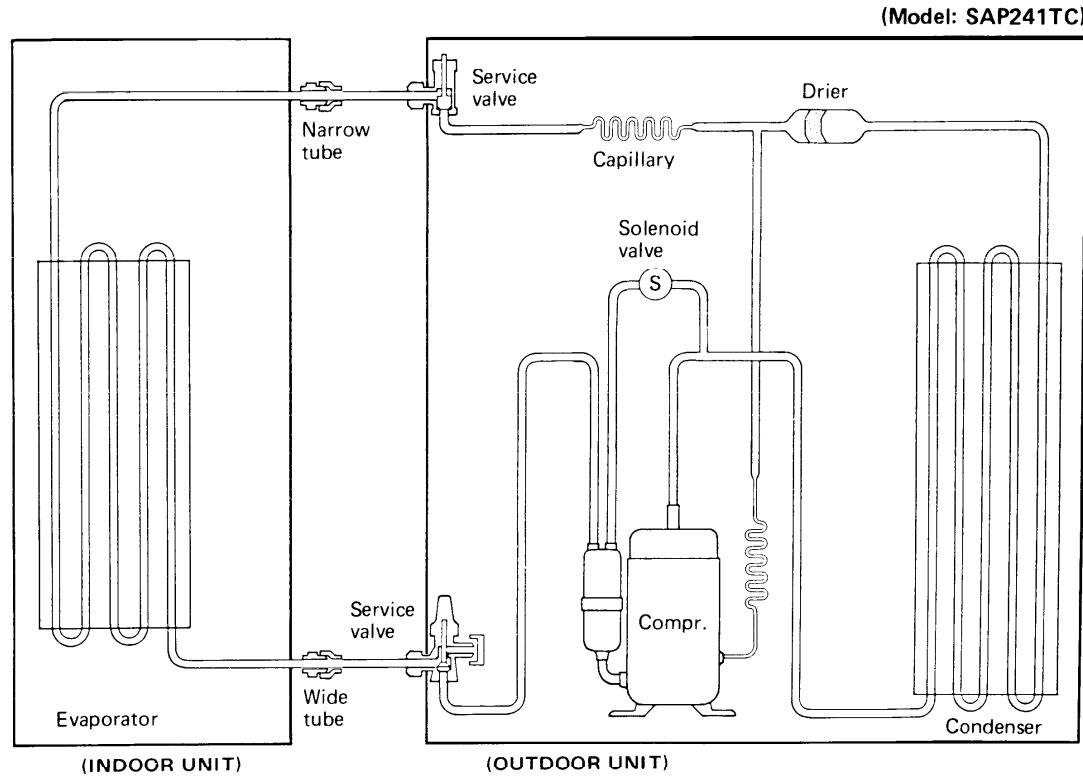


Fig. 32

6-1. Quick Air Purge System

New quick air purge system represents purging the air in the indoor unit and connection tubes with the aid of refrigerant gas pre-charged in the outdoor unit.

By this system, air purging has become much simpler and installation time has become shorter than conventional methods.

NOTE : Outdoor unit is pre-charged at the factory. Don't open valves until tubing is hooked up and you are ready to proceed with purging procedure.

6-2. Air Purging Procedure

- a) Remove the valve caps from the service valves on the narrow tubes.
- b) Loosen the flare nut (A) of wide tube by 180 degrees (1/2 turn). Fig. 33
- c) Open the spindle of the narrow tube by 90 degrees (1/4 turn) for 15 seconds and close it to the original position.
- d) After 45 seconds, fasten the flare nut (A) of wide tube tightly as it was. Fig. 34
- e) Open the wide tube service valve by a quarter turn and close it as soon as hissing stops. This indicates that tubings are filled with the refrigerant gas of the outdoor unit.
- f) Leak test the joints with liquid soap. If no leakage, wipe off the soap. Fig. 35
- g) Turn the valve stems all the way out to Back Seat on both service valves, then, tighten the valve seal caps with the copper gaskets.
- h) The all air purge procedure has been completed and the unit is ready for trial operation.

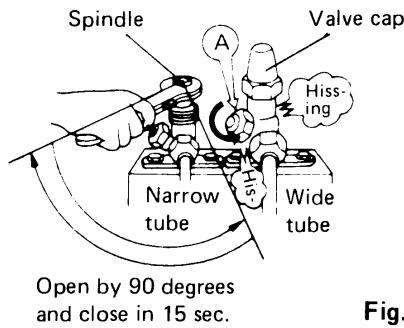


Fig. 33

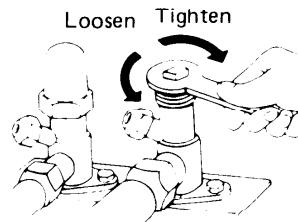


Fig. 34

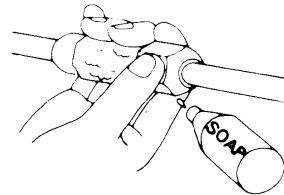


Fig. 35

■ SERVICE VALVE CONSTRUCTION

- **Valve Position -a-**

The valve stems of both wide & narrow tubes are turned all the way in. The unit is shipped from the factory in this position and it is also used for PUMP DOWN. (Fig. 36-a)

- **Valve Position -b-**

The valve stems of both wide & narrow tubes are turned all the way out ("BACK SEAT" position). This is the normal operating position. (Fig. 36-b)

- **Valve Position -c-**

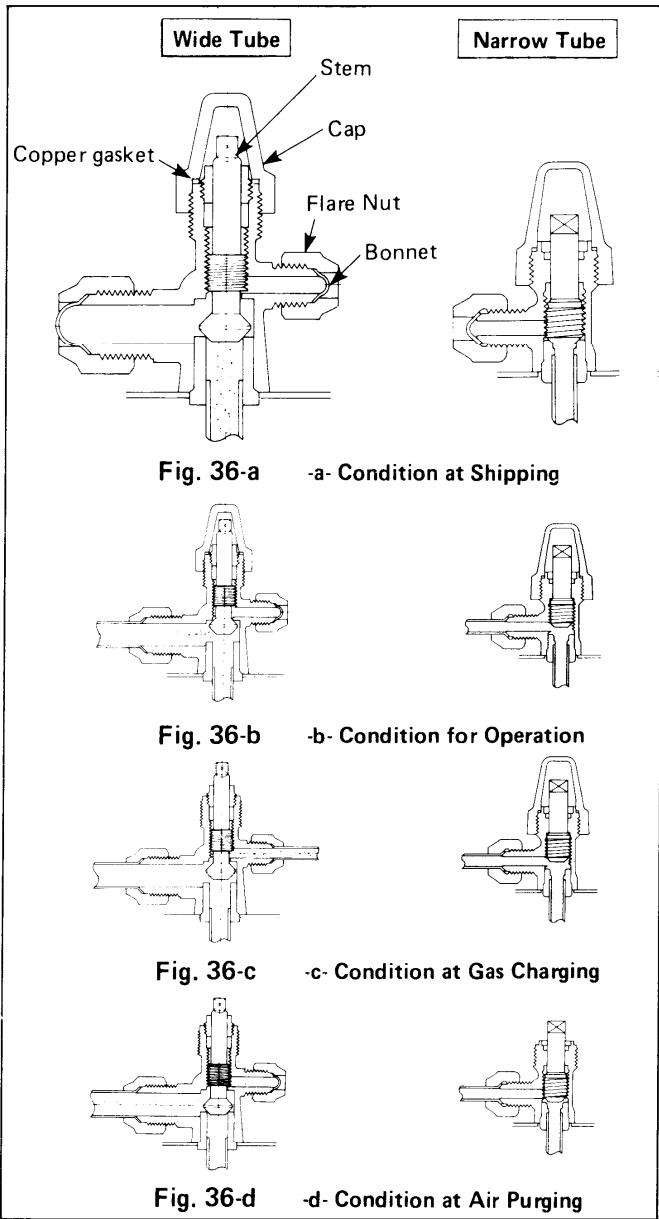
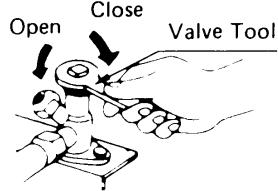
With the narrow tube valve kept at BACK SEAT, only the wide tube valve stem is turned halfway-down position. This position is used for pressure measurement and gas charging. (Fig. 36-c)

- **Valve Position -d-**

Like position -a-, but with the flare nut of wide tube open. This position is used for air purging. (Fig. 36-d)

CAUTION :

Be sure to use the valve tool or ratchet wrench when opening or closing the shut-off valve spindle.



■ PUMP DOWN

Pump down means collecting all refrigerant in the system back into the outdoor unit without losing refrigerant gas. Pump down is used when unit is moved or for servicing the refrigerant circuit.

CAUTION :

- 1) Close valve on wide tube halfway (2 turns).
- 2) Close valve on narrow tube all the way (4 turns).
- 3) Turn unit on (cooling) for approximately 3 minutes then shut off.
- 4) Close valve on wide tube all the way (2 additional turns).
- 5) Disconnect tubes slowly allowing pressure to equalize inside and out.
- 6) When tubing is disconnected provide dust covers for both valves and tubes until unit is reconnected.

7. PRECAUTIONS BEFORE STARTING

After insulation, be sure to bind up insulation material and refrigerant tubings with a water-proof tape so as rain should not creep into the insulation material and wiring.

Before attempting to start the air conditioner, check the following:

- a) All loose matter is removed from the cabinet especially steel fillings and chips.
- b) Control wirings are correctly connected and all electrical connections tight.
- c) All temporary jumper wires removed. (Refer to unit wiring diagram.)
- d) Check to see if compressor mounting bracket or board, which secures compressor during transportation, is removed. If not, remove them.
- e) Be sure to confirm that all shut-off valves are open.
- f) Power connected to unit for at least five hours before starting the compressor. The bottom of compressor should be warm to the touch and crankcase heater around the feet of the compressor should be hot to the touch.

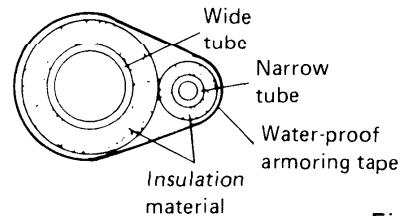


Fig. 37

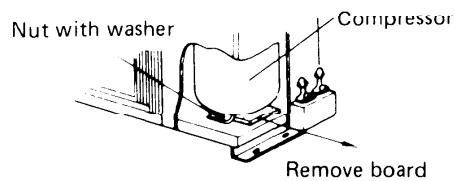


Fig. 38

8. TRIAL RUN

Check that all tubing and wiring have been completed correctly. Check again that wide and narrow tube service valves are fully opened. Turn on power and run the unit.

NOTE :

If the room temperature is too low, cooling operation may not be possible even if the thermostat knob is set at the lowest position.

In this event, perform test run as follows:

- a) Pull off the thermostat knob. Fig. 39.
- b) Set the thermostat lever to the lowest position. (The central position of the lever becomes the TEST RUN position.) Fig. 40
- c) Press OPERATION "ON" button to start the air conditioner.
- d) After completion of test run, press "OFF" button to stop the unit.
- e) Reinstall the thermostat knob. (The stopper position facing down.)

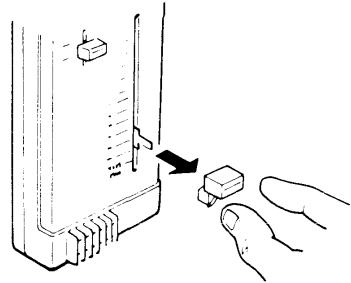


Fig. 39

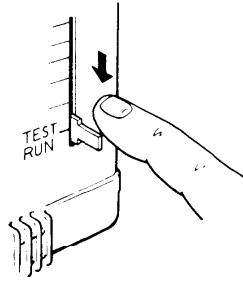


Fig. 40

7. TROUBLESHOOTING

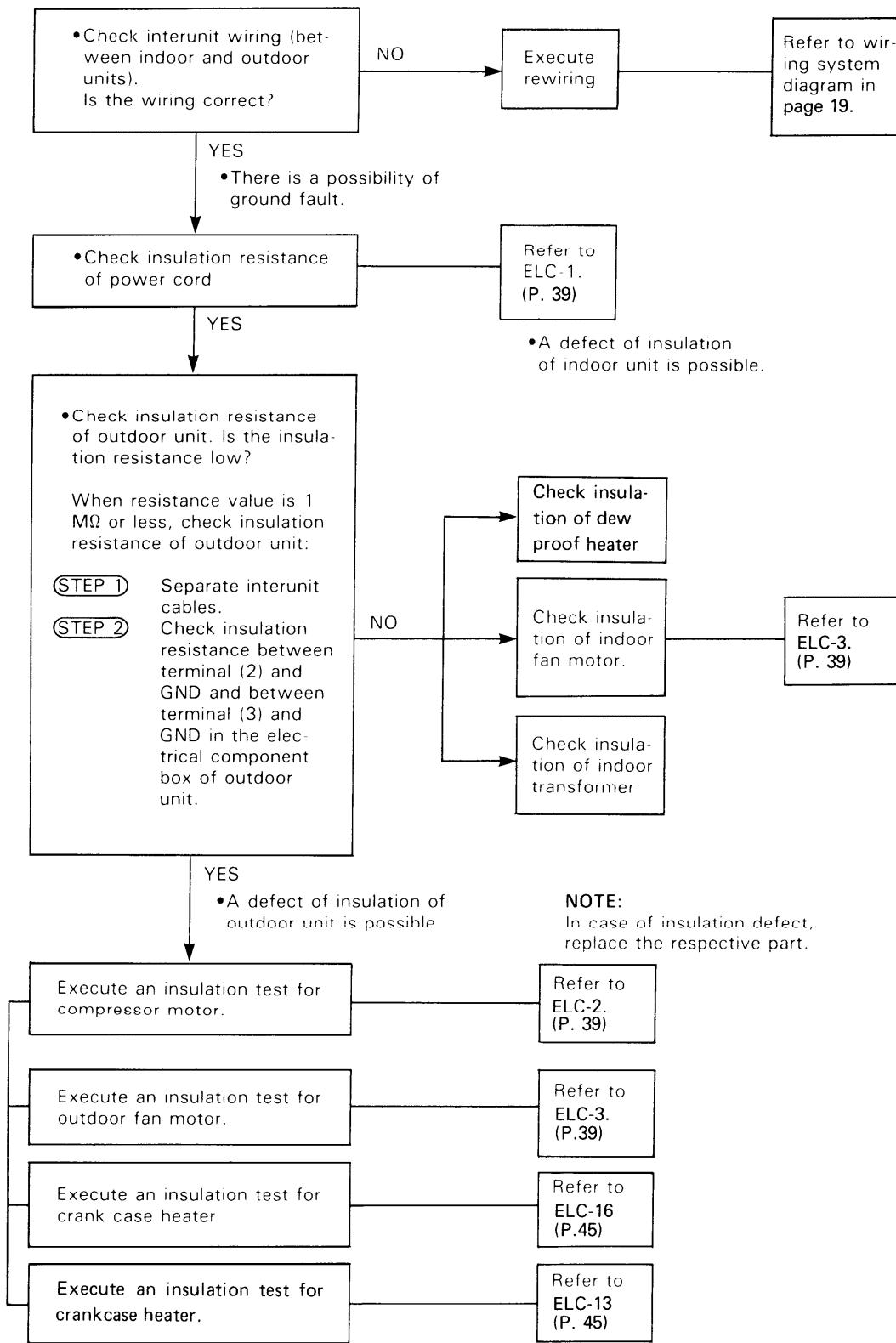
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| 3.2. Excessive cooling | |

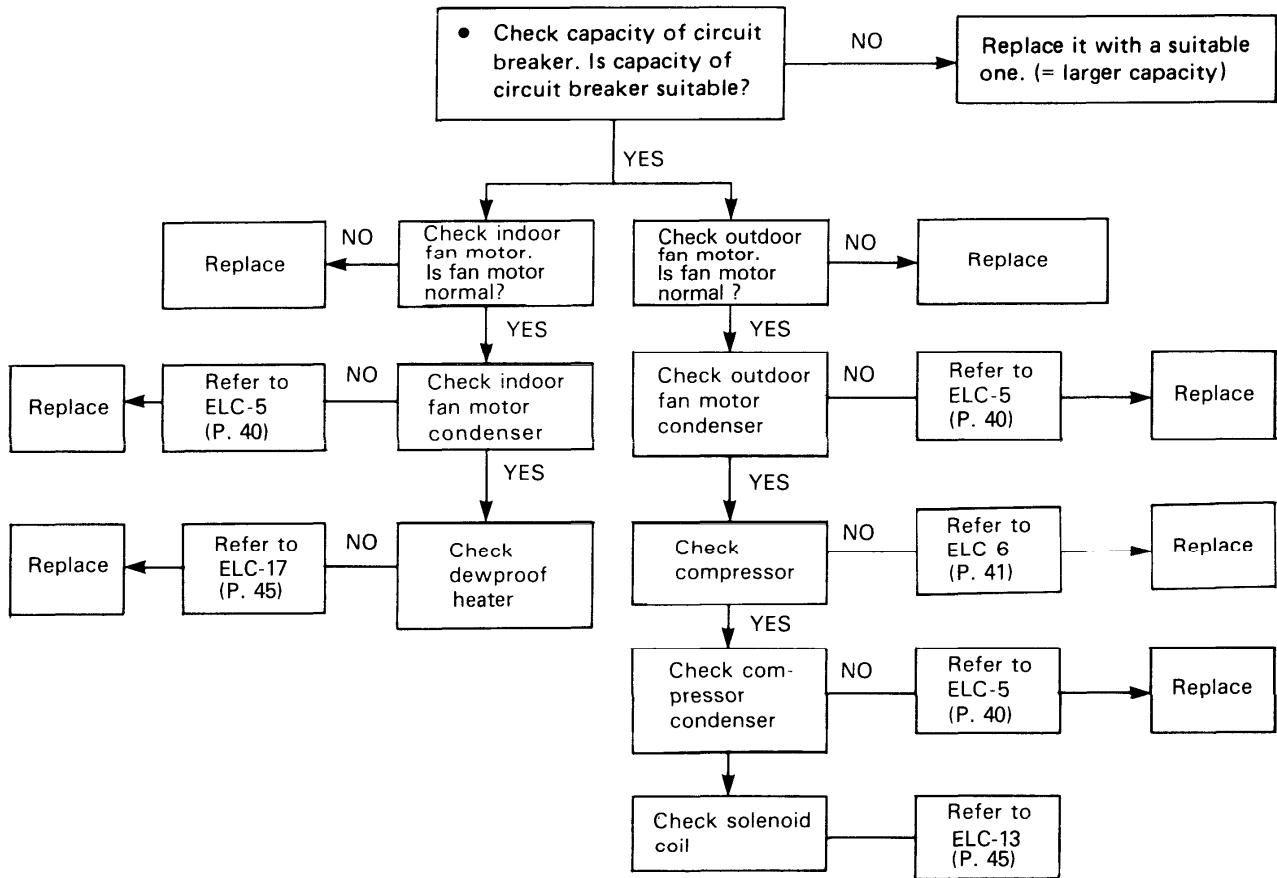
1. Air conditioner does not operate

1.1 Circuit breaker trips (or fuse blows)

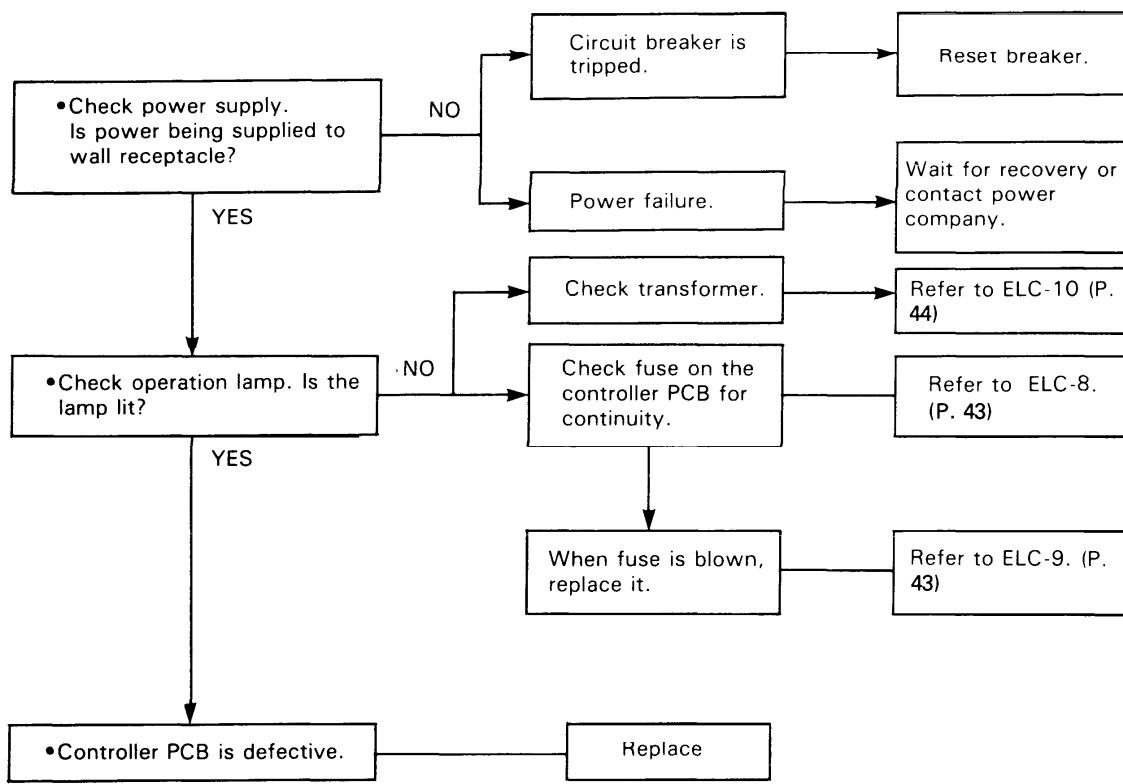
1.1.1 When circuit breaker is set to ON, it trips soon
(resetting is not possible)



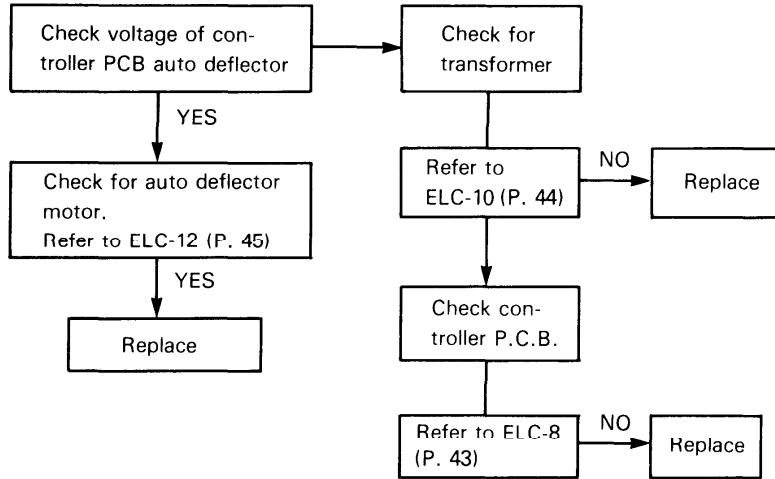
1.1.2 Circuit breaker trips when the operation switch is depressed.



1.2 Neither indoor unit nor outdoor unit runs

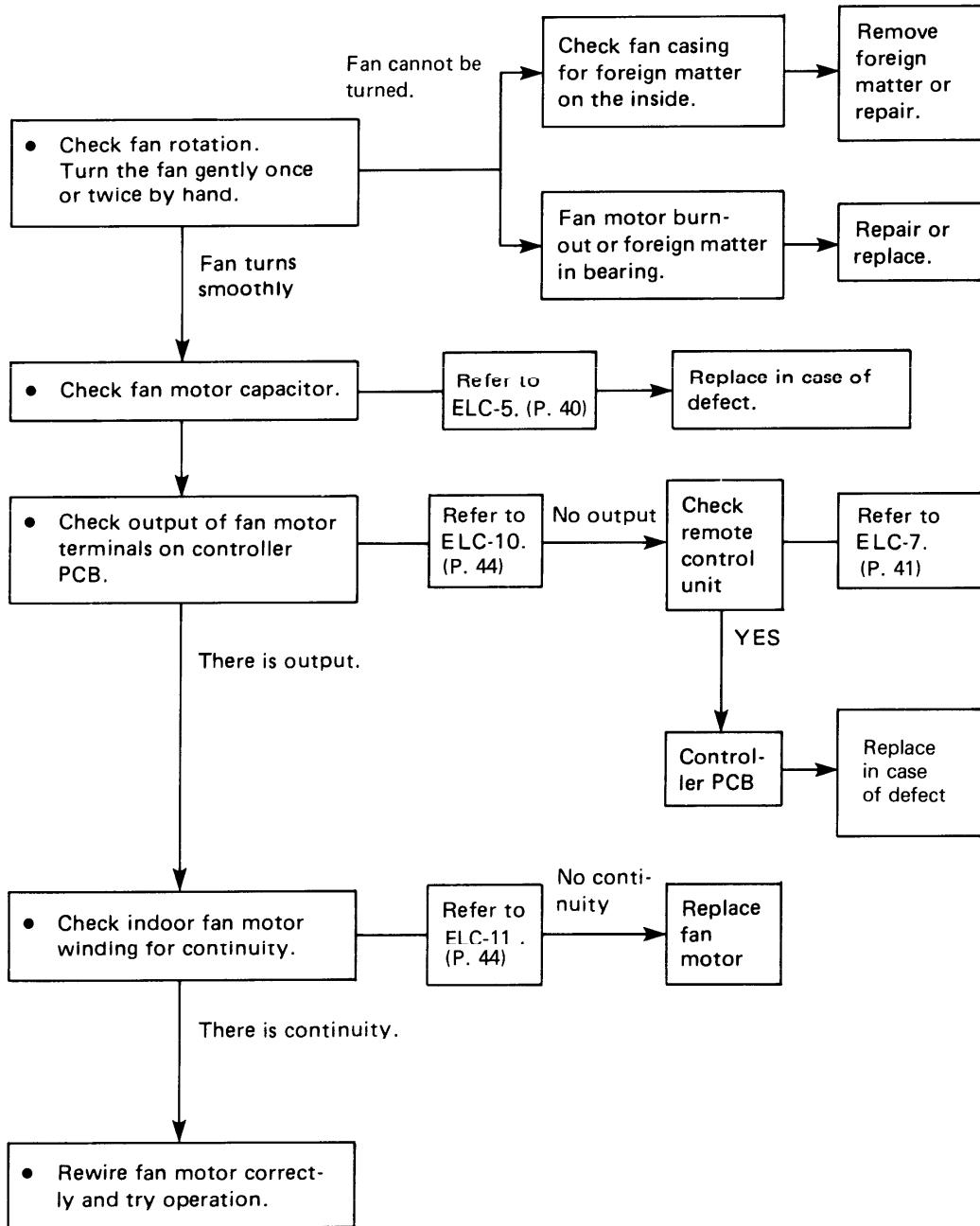


1.3 Auto deflector motor does not run.



2. Some part of air conditioner does not operate

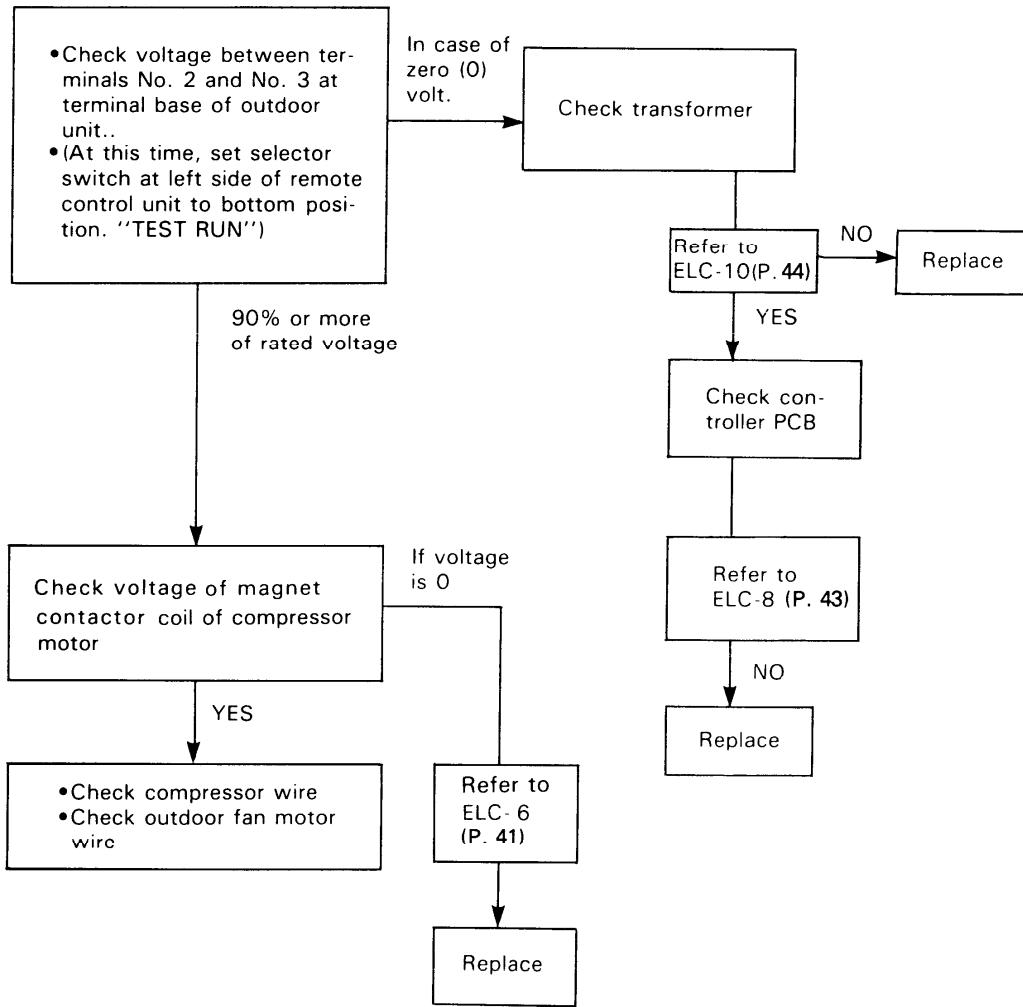
2.1 Indoor fan does not run



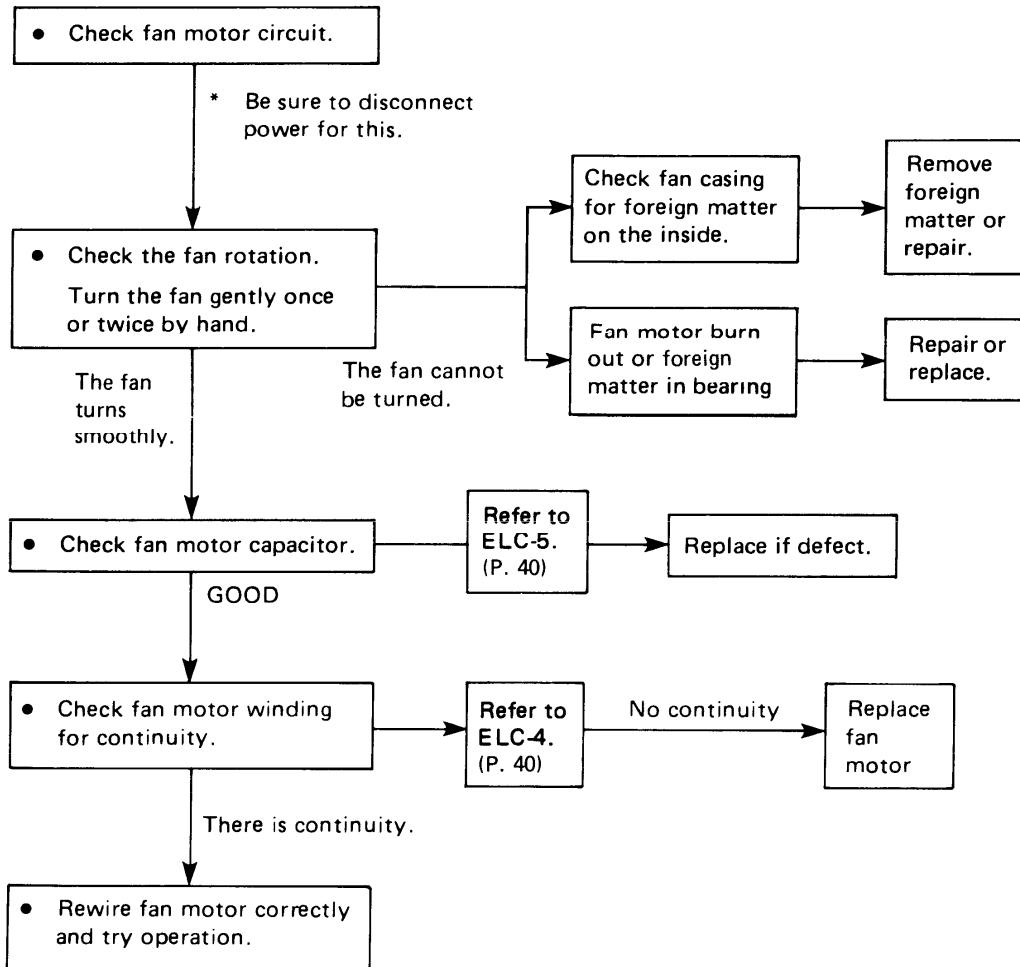
2.2 Neither outdoor fan nor compressor runs

Note: Check following points at first;

1. Is thermostat setting suitable?
2. Has 3 minute timer operated?
(No operation for 3 minutes after power ON.)

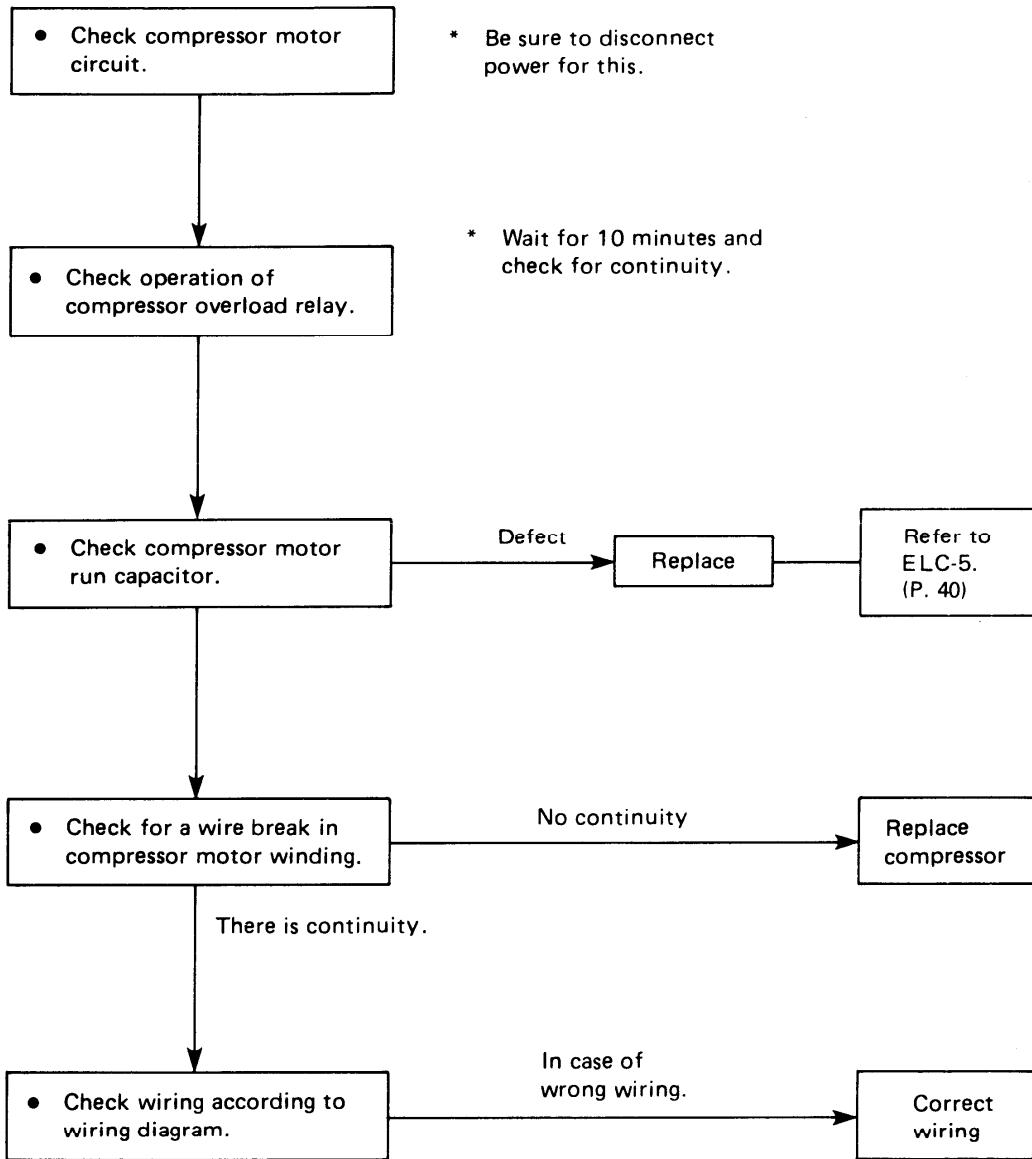


2.3 Only outdoor fan does not run



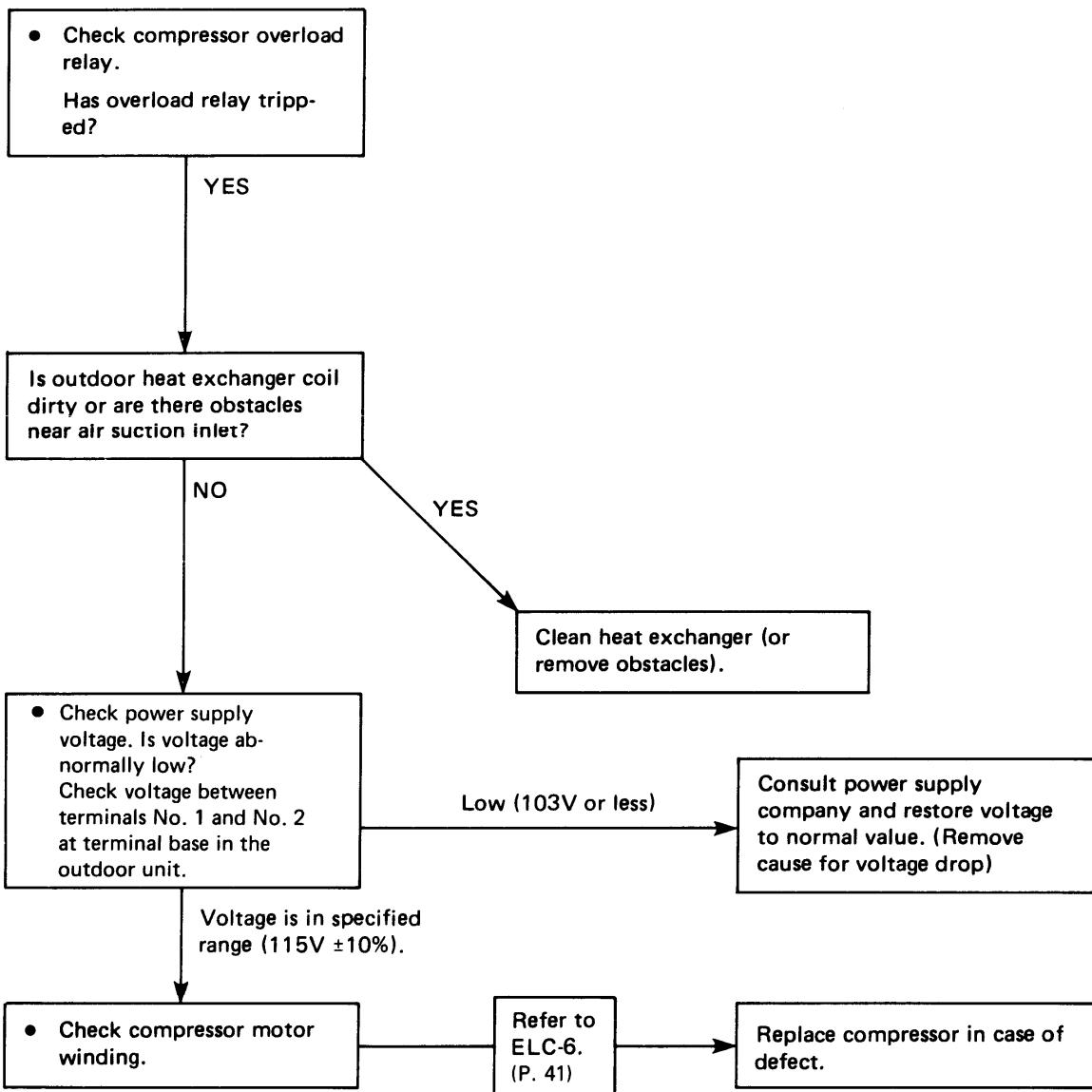
NOTE: The fan motor does not run until the winding temperature lowers and automatic resetting works if the internal thermostat operates.

2.4 Only compressor does not run



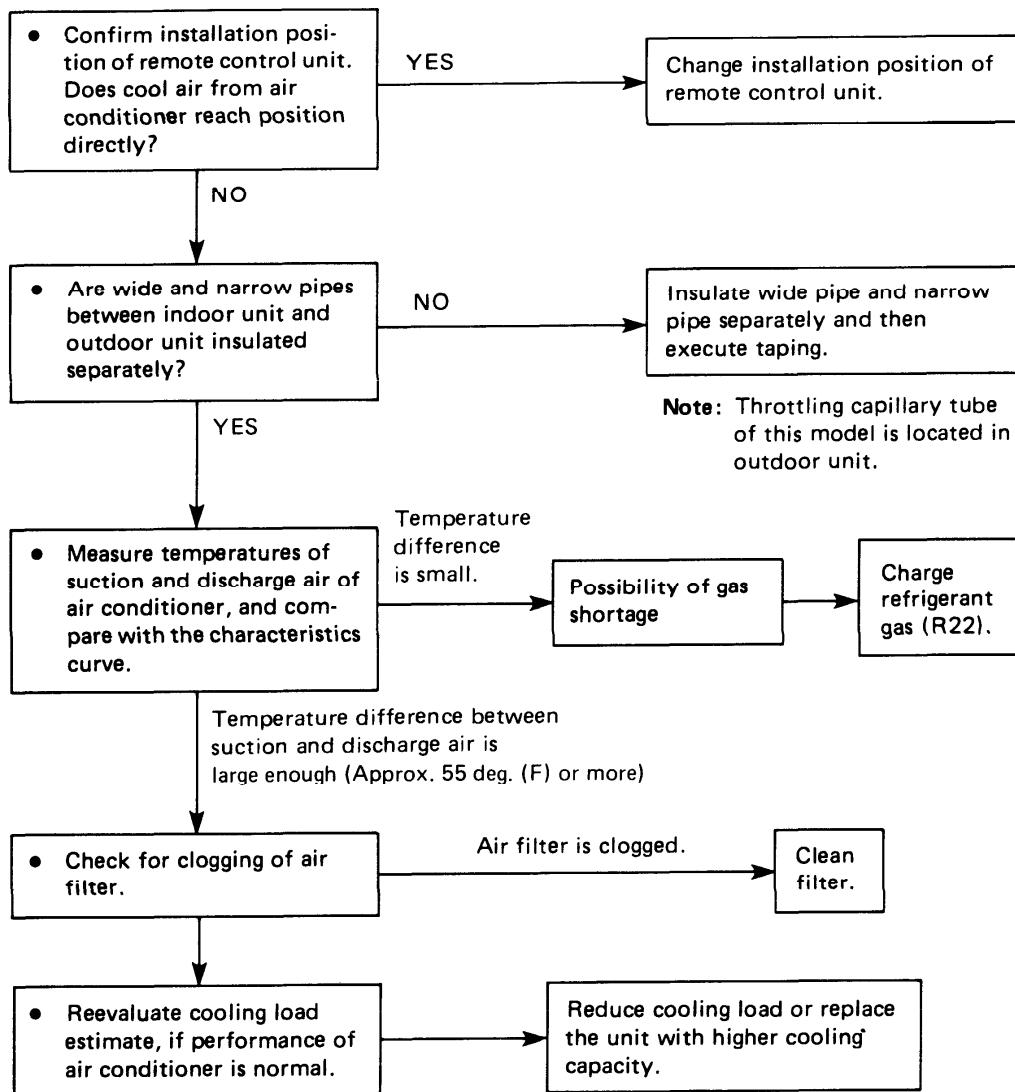
2.5 Compressor frequently repeats ON and OFF

(Only compressor repeats ON and OFF, while indoor unit and outdoor fan run without fail.)

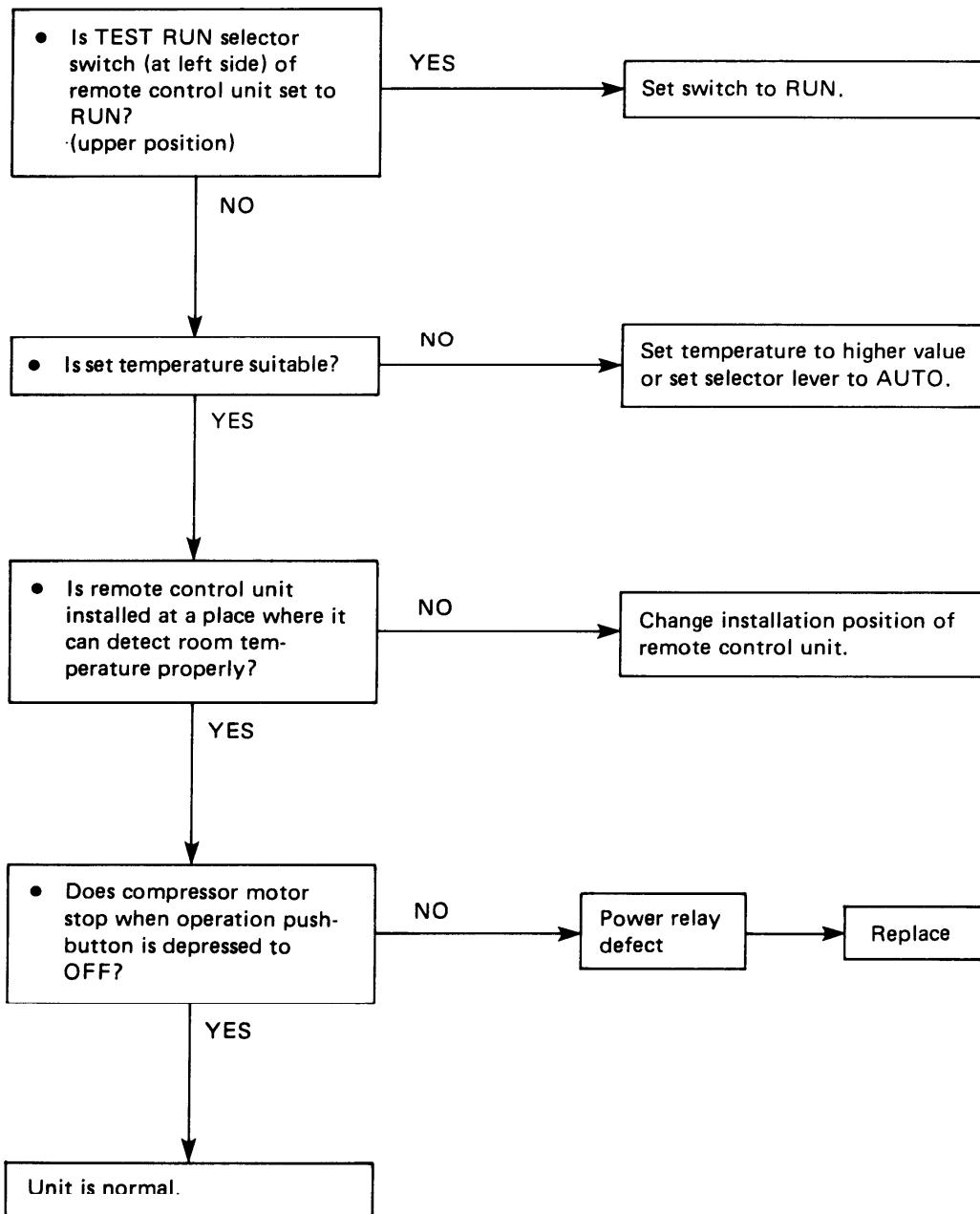


3. Air conditioner operates, but abnormalities are observed

3.1 Poor cooling



3.2 Excessive cooling

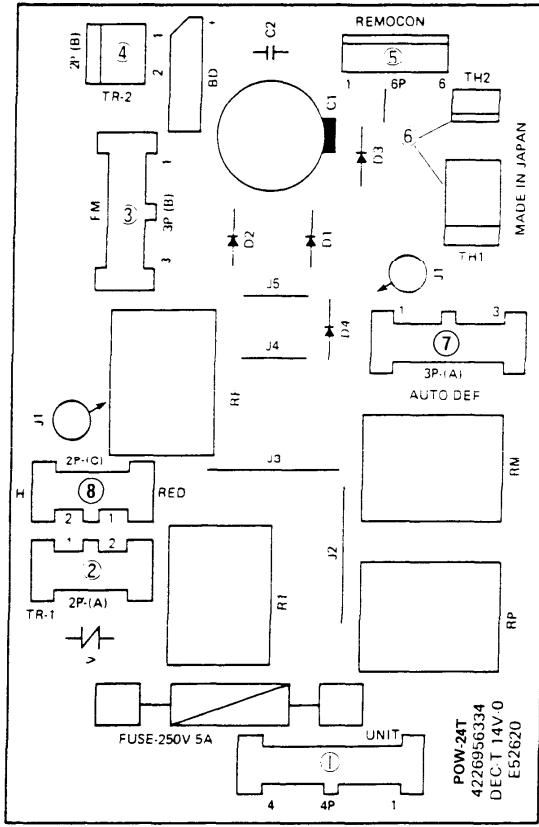


8. CHECKING AND REPLACING ELECTRICAL COMPONENTS

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E-A. Connector Identification on Controller PCB

POW-24T (For SAP241TC)


Fig. E-A

1. Connector, Power Supply to PCB *
2. Connector, Transformer (Primary: *)
3. Connector, Fan Motor *
4. Connector, Transformer (Secondary: 19V)
5. Connector, Remote Control Unit 24V
6. Connector, Thermistor Sensor 24V
7. Connector, Auto Deflector *
8. Connector, Dew Proof Heater *

* Line Voltage

ELC-1. Measurement of Insulation Resistance of the Power Cord

Clamp the ground (GND) line of the Power Cord with a lead clip of the insulation resistance tester and measure the resistance by placing a probe on either of the two power lines.

Then also measure the resistance between the GND line and the other power line. The insulation is in good condition if the resistance exceeds $1\text{ M}\Omega$.

Then also measure the resistance between the ground and the other power line. The insulation is in good condition if the resistance exceeds $1\text{ M}\Omega$ (Fig. E-1).

ELC-2. Measurement of Insulation Resistance of the compressor

Remove the red lead wire connected to the compressor motor from (4) on the terminal base. Clamp the removed black lead wire with a lead clip of the insulation resistance tester and measure the resistance by placing a probe of the tester to the terminal GND, to which green lead wire is connected.

The insulation is in good condition if the resistance exceeds $1\text{ M}\Omega$ (Fig. E-2).

ELC-3. Measurement of Insulation Resistance of the Fan Motor

3.1. In case of indoor fan motor

Remove the fan motor connector from controller PCB (P38, Fig. E-A). Clamp the green lead wire (at the bear section) extended from the terminal GND in the electrical component box and measure insulation resistance by placing a probe of the insulation tester to either pole of this connector.

The insulation is in good condition if the resistance exceeds $1\text{ M}\Omega$. Fig. E-3.

Note:

If the probe does not enter the pole because the hole is too narrow then use a probe with a thinner pin.

3.2. In case of outdoor fan motor

Disconnect the white lead wire connected to Terminal (6) of the electric magnetic contactor. Clamp this lead wire with a lead clip of the insulation resistance tester and measure the resistance by placing a probe of the tester to the terminal GND.

The insulation is in good condition if the resistance exceeds $1\text{ M}\Omega$. Fig. E-4.

3.3. Crankcase heater

Disjoin and check both ends of the crankcase heater

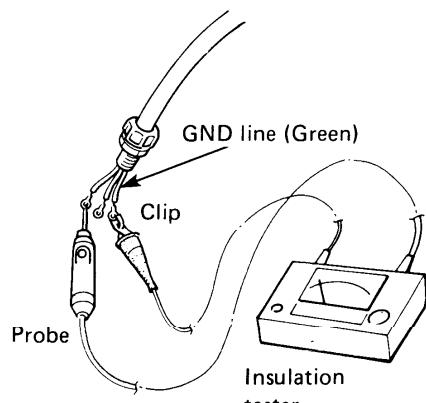


Fig. E-1

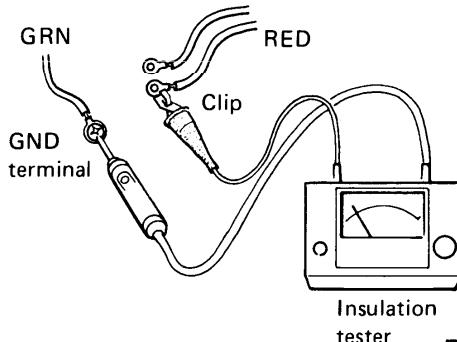


Fig. E-2

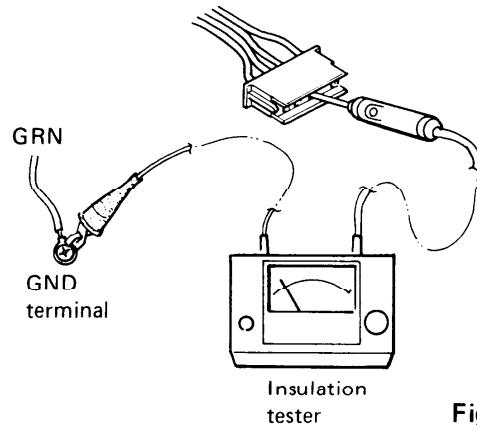


Fig. E-3

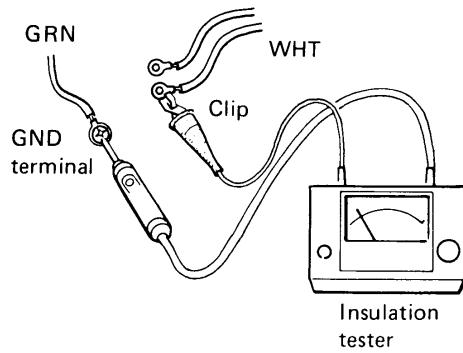


Fig. E-4

ELC-4. Checking of the outdoor fan motor

Remove the fan motor lead wires (WHT, BRN, PNK) and check as shown in the wiring diagram (Fig. E-5).

Set the resistance measuring range of the multimeter to "X1Ω" and measure the resistance between the fan motor lead wires.

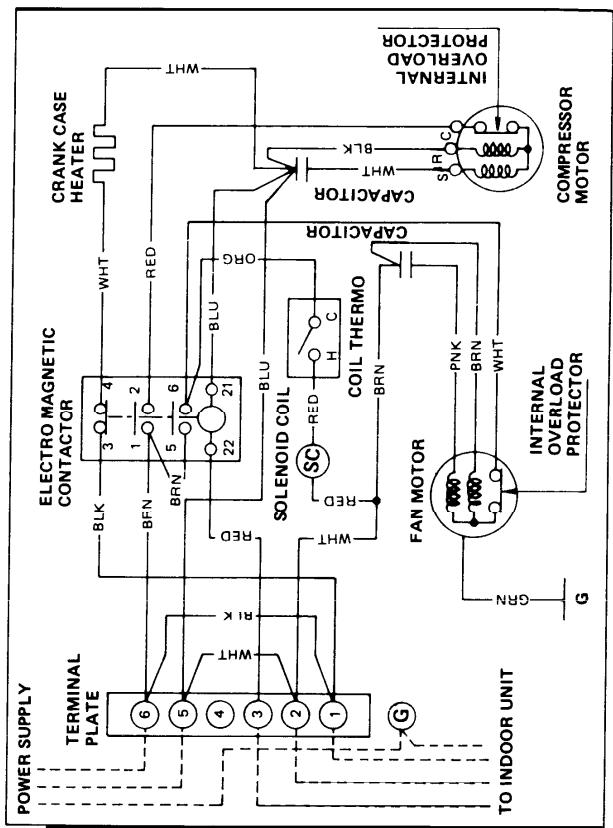
SAP241C

| Lead wire color | Coil resistance |
|-----------------|----------------------|
| WHT — BRN | $24 \Omega \pm 10\%$ |
| WHT — PNK | $54 \Omega \pm 10\%$ |

(Table-1)

Note: When ambient temp is 70°F.

SAP241C ELECTRIC WIRING DIAGRAM



ELC-5. Checking of the Motor Capacitor

Checking of any of the indoor fan motor capacitor, outdoor fan motor capacitor and compressor motor capacitor can be done by the same method.

Remove both the lead wire terminals connected to the capacitor, place the probe on the capacitor terminals as shown in the Fig. E-6 and observe the deflection of the pointer, setting the resistance measuring range of the multimeter to the maximum value.

For good condition of the capacitor the pointer bounces to a great extent and then gradually returns to its original position.

The range of deflection and deflection time differ according to the capacity of the capacitor.

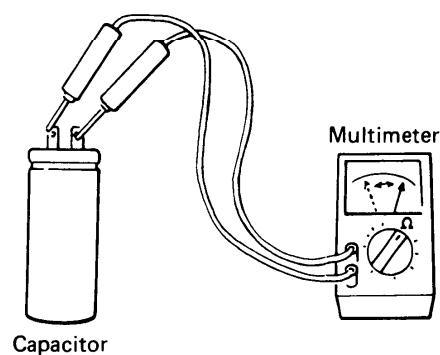


Fig. E-6

ELC-6. Checking of the Compressor Motor Winding

Remove the terminal cover of the compressor motor, set the resistance measuring range of the multimeter to "X1Ω" and check the continuity between each pair out of the 3 terminals as indicated in Fig. E-7.

It is in good working condition if there is continuity among each pair of terminals.

SAP241C

| Leadwire color | Coil resistance |
|----------------|-----------------|
| C-R | 0.66Ω ± 10% |
| C-S | 1.97Ω ± 10% |

(Table-2)

Note: When ambient temp is 77°F.

ELC-7. Checking of the Remote Control Unit Proper

A. Caution: Use of the Test Switch (TEST RUN)

The position of the switch which is used to operate the air conditioner for a room temperature below 69°F(21°C) is the position of the switch for this TEST RUN.

If this operation is continued for a long time, there would be a bad effect on the air conditioner because of over-cooling. Therefore, use this switch only for checking, and in any case, DO NOT KEEP ON COOLING FOR MORE THAN 15 MIN. UNDER TEST RUN MODE.

When the checking is over, TURN THE SWITCH BACK TO ITS ORIGINAL POSITION (= RUN) WITHOUT FAIL.

REFERENCE TEST RUN

Check that all tubing and wiring have been completed correctly. Check again that wide and narrow tube service valves are fully opened. Turn on power and run the unit.

NOTE :

If the room temperature is too low, cooling operation may not be possible even if the thermostat knob is set at the lowest position.

In this event, perform test run as follows:

- Pull off the thermostat knob. Fig. E-8.
- Set the thermostat lever to the lowest position. (The central position of the lever becomes the TEST RUN position.) Fig. E-9.
- Press OPERATION "ON" button to start the air conditioner.
- After completion of test run, press "OFF" button to stop the unit.
- Reinstall the thermostat knob. (The stopper position facing down.)

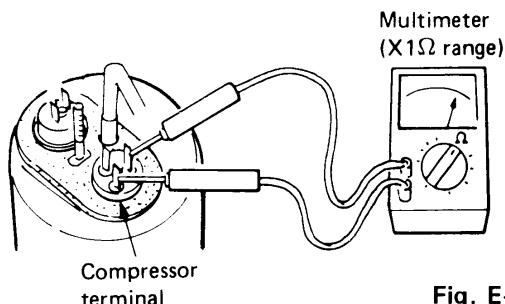


Fig. E-7

1. REMOTE CONTROL UNIT

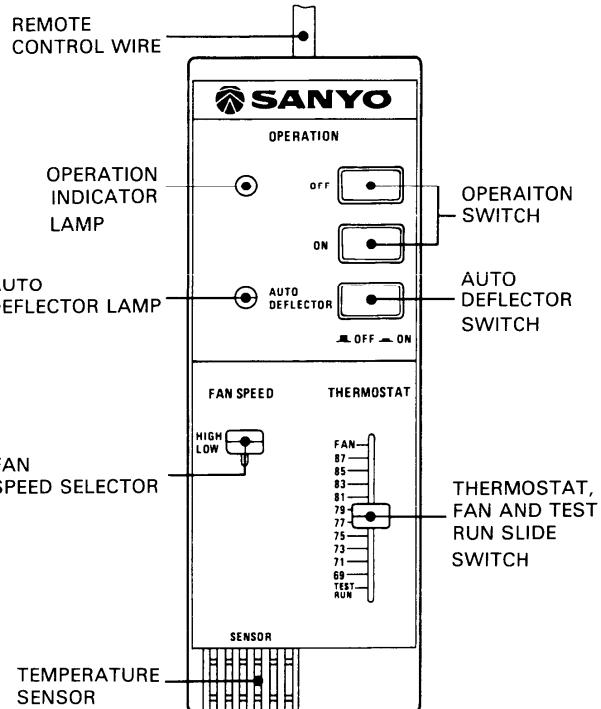


Fig. E-7A

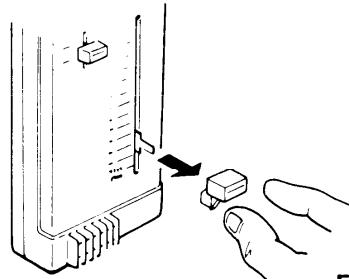


Fig. E-8

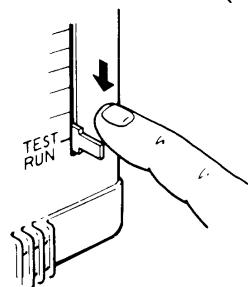


Fig. E-9

B. Checking of the items of the Remote Control Unit

At first, pull out the connector (7P) of the remote control unit from the controller PCB of the unit (refer to Fig. E-10).

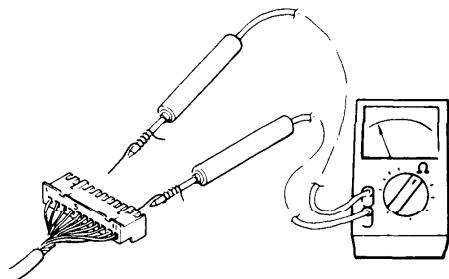


Fig. E-10

(1) Fan Speed Selector

Check the continuity of the connector No. 3 against No. 4 (place the negative (-) probe on No. 4 and positive (+) probe on No. 3).

| Checking points | Position of the selector | |
|-----------------|--------------------------|-----|
| | High | Low |
| 3-4 | NO | YES |

(Table-3)

NOTE: YES Continuity
 NO Discontinuity

(2) Auto Deflector Motor

| Checking points | ON | OFF |
|-----------------|-----|-----|
| 3-6 | YES | NO |

(3) Checking of the Operation Pushbutton

The operating switch is in good working condition if there is continuity between No. 2 (placing the negative (-) probe and No. 3 (placing positive (+) probe) while the pushbutton is pressed.

CAUTION:

Do not disassemble the Remote Control Unit.

It is supplied as a complete assembly and is carefully adjusted in the factory by skillful workmanship. Inexperienced disassembly will cause trouble and malfunction in the unit.

ELC-8. Checking of the Continuity of Fuse on the Controller PCB

Check the continuity by the multimeter as shown in Fig. E-11.

If it is difficult to check in this way, remove the lamp board ass'y connector and then check it.

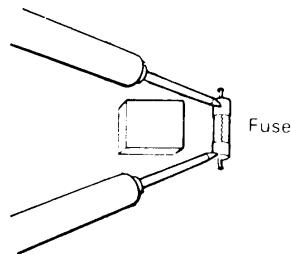


Fig. E-11

ELC-9. Method to Replace Fuse on the Controller PCB

1. Remove the controller PCB
2. Pull out the fuse at the metal clasp by a pair of pliers while heating the soldered leads on the back side of the controller PCB with a soldering iron (30W or 60W). Fig. E-12.
3. Remove the fuse ends one by one. For replacement, insert a fuse of the same rating and solder it.
(Allow time to radiate heat during soldering so that the fuse does not melt).

CAUTION : Be sure to replace the varistor adjacent to the fuse either when the fuse is blown.

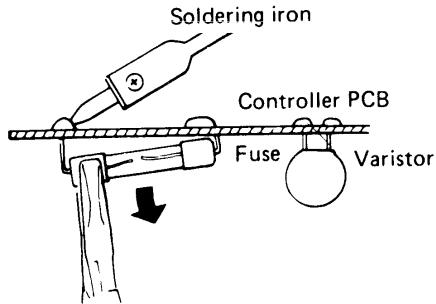


Fig. E-12

ELC-10. Checking of the Power Transformer

1. Remove connectors TRANS-1 and TRANS-2 from the controller PCB.
2. Set the resistance measuring range of multimeter to "X1Ω" and measure the resistance of the lead wires between WHT-WHT and BRN-BRN as shown in Fig. E-13.

It will be completely satisfactory if all measured values agree with those indicated in Table-5.

| Lead wires | Value of resistance |
|------------|---------------------|
| WHT - WHT | About 143.5Ω |
| BRN - BRN | About 1.2Ω |

(Table-5)

NOTE: Ambient room temp 70°F

SAP241T ELECTRIC WIRING DIAGRAM

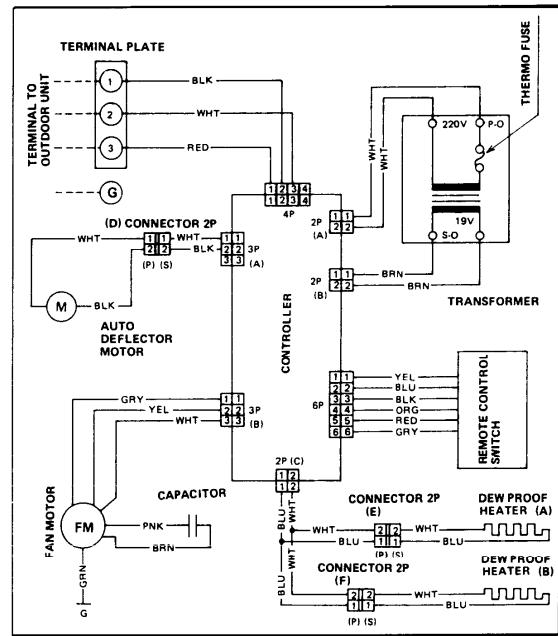


Fig. E-13

ELC-11. Checking of the Indoor Fan Motor

Remove the fan motor connector FM from controller PCB and measure the resistance between each lead wires of the fan motor connector setting the resistance measuring range to "X1Ω".

The motor is in very good working condition if all the values agree with those indicated in Table-6.

| Lead wires | Value of resistance |
|------------|---------------------|
| WHT-BRN | About 53Ω |
| WHT-YEL | About 39Ω |
| YEL-PNK | About 69Ω |

(Table-6)

Note: Ambient room temp. 68°F

ELC-12. Checking of the Auto Deflector Motor

Disconnect Connector 2P on the auto deflector motor and measure the winding resistance value between Lead Wires (1) and (2) on both ends of the motor. Satisfactory if the resistance value is as shown below. (Table 7)

| | |
|--|-----------------|
| Coil Resistance (Ω) Ambient Temp. 68°F | About 10,629 |
|--|-----------------|

(Table-7)

ELC-13. Checking of the Solenoid Coil

- 1 . From the terminal plate (No. 2, terminal), disconnect RED lead wire for the Solenoid Coil.
- 2 . From the Coil Thermo (Terminal "H"), disconnect RED lead wire.
- 3 . Check Solenoid Coil for continuity between the moved RED lead wires with a multimeter. No continuity means broken wire. If so, replace the wire.

ELC-14. Checking of the Coil Thermostat

Disconnect the lead wire connected to the coil thermostat. Check the coil thermostat itself. Satisfactory if the value is as follows. (Table 8)

| | |
|----------|-----------|
| ON: 75°F | OFF: 79°F |
|----------|-----------|

(Table-8)

ELC-15. Checking of the Electro-Magnetic Contactor

Disconnect BLU lead wire from terminal (21) and RED lead wire from terminal (22) on the contactor and check continuity using a multimeter. Satisfactory if continuity is assured. If continuity cannot be verified, the coil must be broken. Check and replace the coil.

ELC-16. Checking of the Crankcase Heater

Disjoin both ends and check continuity. Satisfactory if continuity is assured. If continuity cannot be verified, the heater must have broken wire. Check and replace broken wire.

ELC-17. Checking of the Dewproof Heater

Disconnect Connector 2P for the dewproof heater located by the power transformer and check continuity. Satisfactory if continuity is assured. If continuity cannot be verified, replace the connector.

9. DISASSEMBLY AND SERVICE PROCEDURES



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OUTDOOR UNIT

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INDOOR UNIT

9-1. Side Panel Removal

- 1) Remove the four screws (a) of the cover plate on the under-side.
- 2) Slide the side panels on both sides towards the front (b) of the unit in order to remove them. Fig. 1

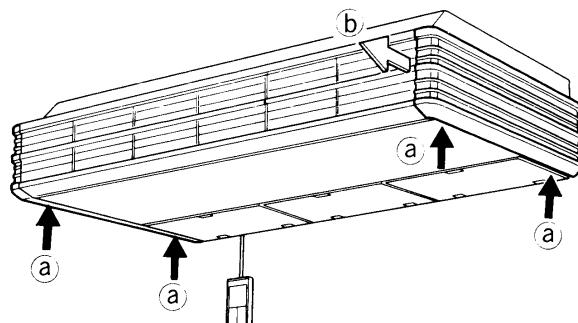


Fig. 1

9-2. Suction Grille Removal

- 1) The suction grille opens when the tab (a) of the suction grille is pulled.
- 2) Raise the suction grille lightly and shift it in the direction of the arrows (b) to remove it from the hooks. Fig. 2

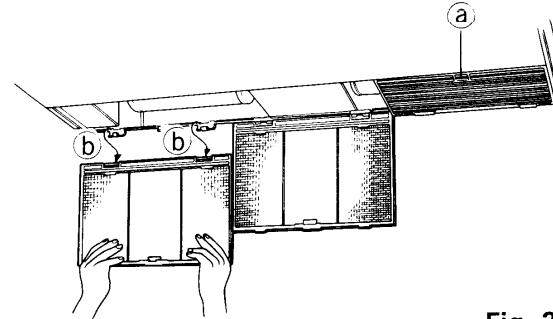


Fig. 2

9-3. Electrical Component Box Removal

- 1) Remove the two screws (a) of the electrical component box, and remove the cover plate.
- 2) When the three screws (b) are removed, the electrical component box can be pulled out to the lower side of the unit. (The one other screw (b) is at the rear between box and casing.) Fig. 3

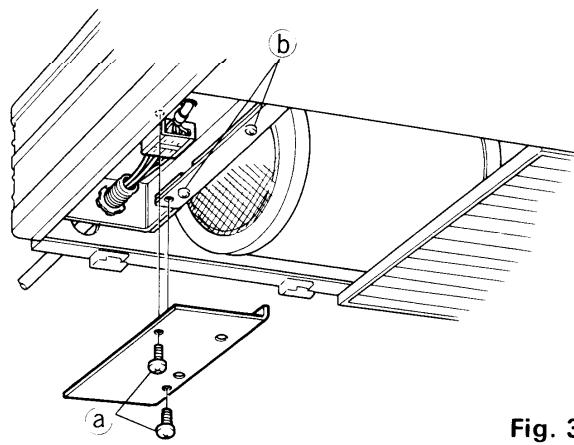


Fig. 3

- 3) Remove the four screws (a) holding the wiring.
 4) Cut the wire bundling plastic tie (b) without damaging the wires.

Note:

After the disassembly, use vinyl tape instead of the plastic to bundle the wires at the same place.

- 5) When the two fixing screws (c) are removed, the electric protection cover can be removed.

Fig.4

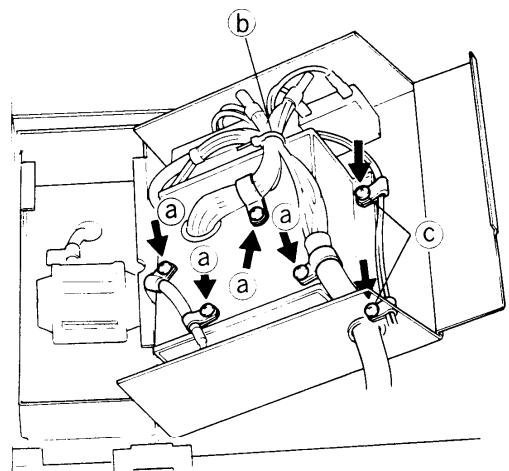


Fig. 4

- 6) The electrical components in the electrical component box all can be checked in this condition. Fig. 5

Note:

For checking of the electrical components, refer to "CHECKING AND REPLACING ELECTRICAL COMPONENTS, page 37."

- (1) Terminal base
- (2) Fixed capacitor
- (3) Transformer assembly
- (4) Controller

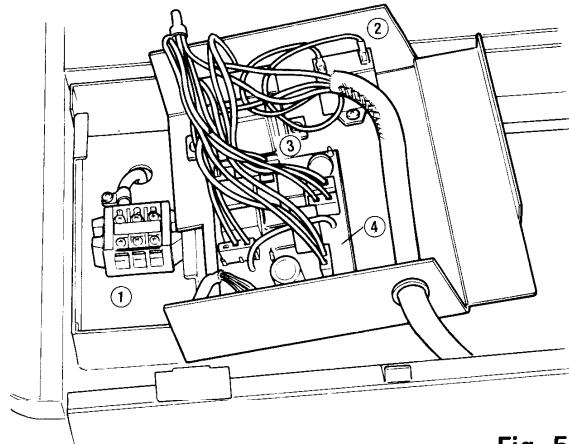


Fig. 5

9-4. Drain Pan Removal

- 1) Remove the drain pipe.
- 2) Remove the suction grille from the unit body.
- 3) Remove the four screws (a) fixing the fan motor cover. Fig. 6

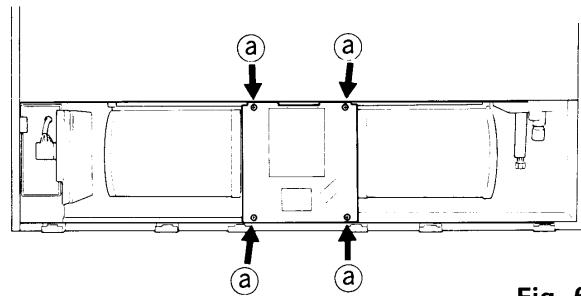


Fig. 6

- 4) Slide the discharge grille at the unit front about 0.38" to the side, remove it, and remove the screw (black color) at the center on the inside.

- 5) Remove the four screws (a) at the lower part on both sides.
Fig. 7

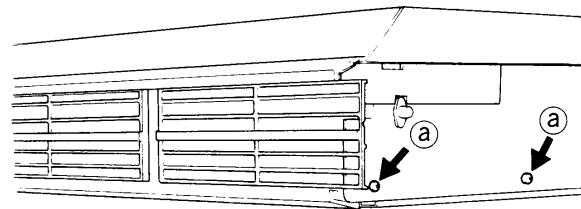


Fig. 7

- 6) Remove the five screws (a) fixing the bottom plate and the partition plate.

- 7) Remove the drain pan in this condition.

- 8) Remove the two screws (b) to remove the rear panel (A).
Fig. 8

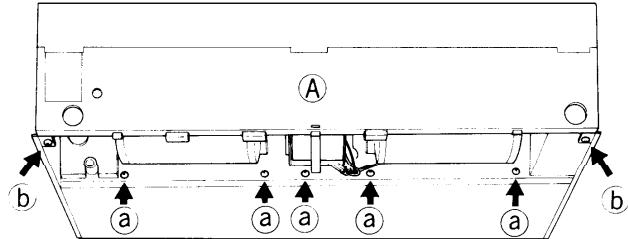


Fig. 8

9) As the drain pan is made of foamed styrene, take care not to damage the inside.

Damage becomes the cause for water leakage.

Fig. 9

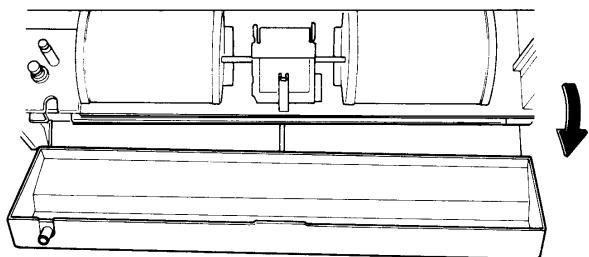


Fig. 9

9-5. Fan Removal

1) Remove the four screws (a) fixing the fan casing.

2) Rotate the fan casing for 90° in the direction of the arrows (b).

Fig. 10

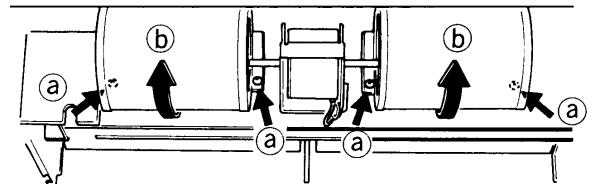


Fig. 10

3) Loosen the screw (a) fixing the fan boss on the motor shaft with a screwdriver.

4) In this condition, slide the fan and the fan casing together to the side for removal from the motor shaft.

Fig. 11

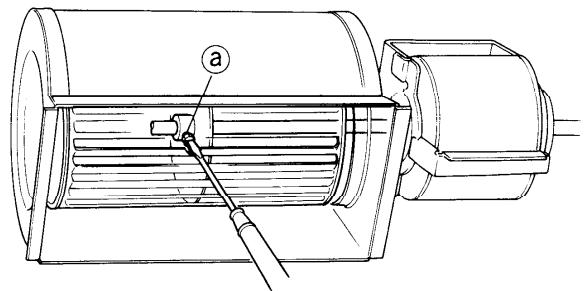


Fig. 11

- 5) The fan can be removed as shown in the figure when the four screws (a) fixing the back plate of the fan casing are removed.
Fig. 12

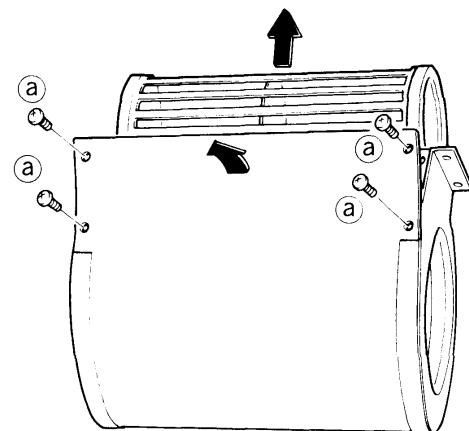


Fig. 12

9-6. Fan Motor Removal

- 1) Remove the four nuts (a) fixing the fan motor stand.
Fig. 13

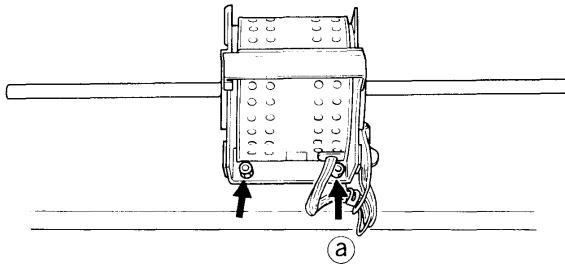


Fig. 13

- 2) The fan motor stand is taken out as shown in the figure. Fig.

14

Note:

Take care not to apply a strong force onto the motor wiring.

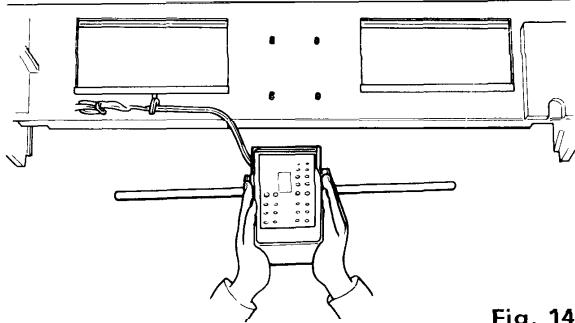


Fig. 14

3) Remove the four screws (a) fixing the motor. Fig. 15

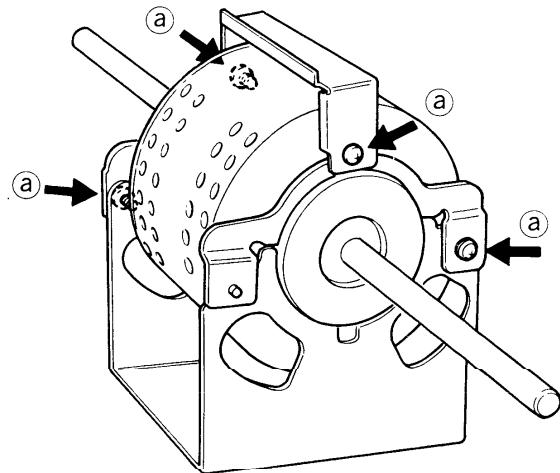


Fig. 15

4) Open the fixing arms as shown in the figure.
Then the fan motor can be removed from the fan motor stand.
Fig. 16

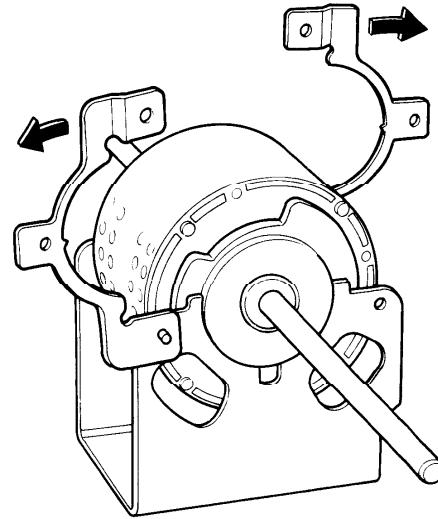


Fig. 16

OUTDOOR UNIT

9-7. Cabinet Removal

- 1) Remove the outer panels in the order of front panel (A), side panel (B), and side panel (C).
- 2) Remove the cover plates (D) and (E).
- 3) Remove the mounting plate (F).

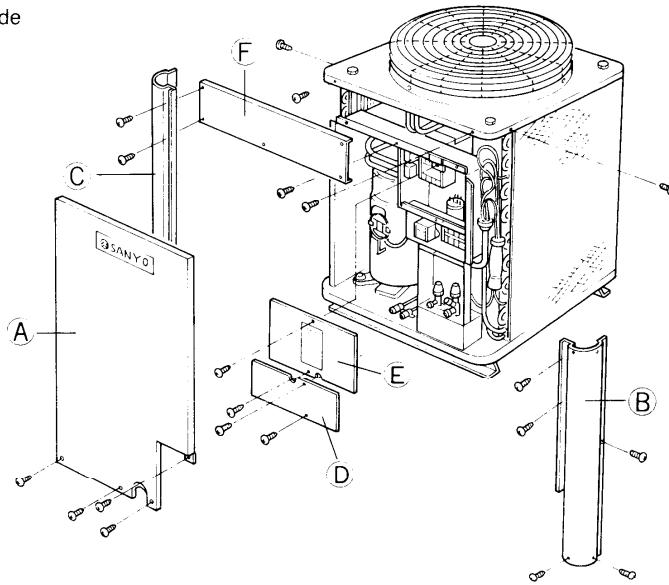


Fig. 17

9-8. Fan and Motor Removal

- 1) After removal of the guard (A), loosen the bolt (a) of the propeller fan (B), and remove the fan to the top.
- 2) Remove the fan motor wires from the electrical component box, and remove the top cover (C) with the fan motor fixed to the top cover.

Fig. 18

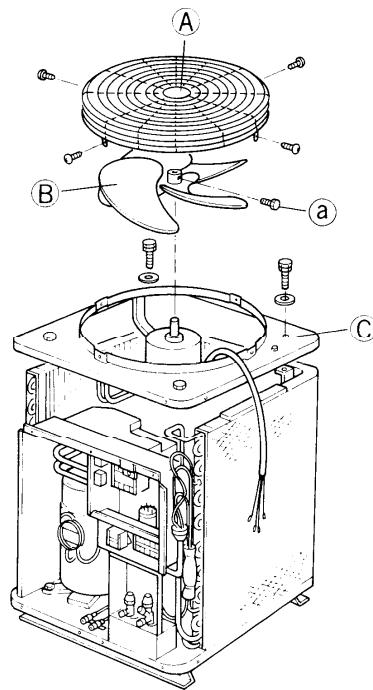


Fig. 18

9-9. Electrical Component Box Removal

- 1) Remove the following wires from the electrical component box.
 - (1) Compressor wire
 - (2) Crankcase heating wire
 - Solenoid valve wire

- 2) (1) Remove the cover plate (A) and remove the fixed sensor (B).
 - (2) Remove the insulation (C), loosen the fitting fixing the sensor (D), and remove the sensor.

- 3) After completion of the above work, remove the screw (E) and then remove the electrical component box.

- 4) Loosen the screw of the mounting plate (F) fixing the solenoid valve and remove the cover (G). Fig. 19

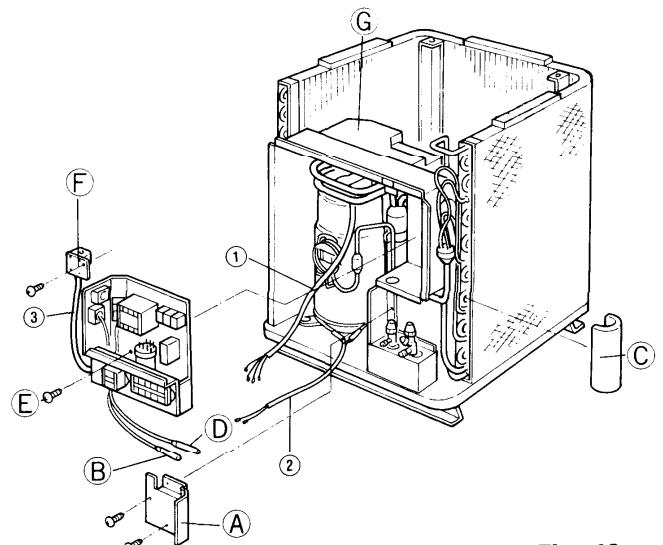


Fig. 19

9-10. Compressor Cover Removal

- 1) Remove the four screws (1) fixing the cover (B), and raise the cover (B) to remove it. Fig. 20

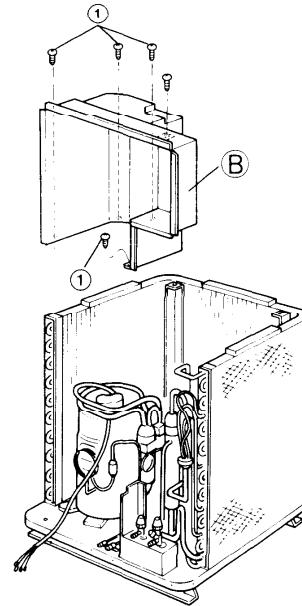


Fig. 20

9-11. Compressor Removal

- 1) Use an oxyacetylene torch to separate the four places (A), (B), (C), and (D) where tubing is welded to the compressor.
- 2) Remove the three nuts (E) fixing the compressor, and raise the compressor to remove it. Fig. 21

CAUTION

- 1) As wires are to be removed at many places, refer to the electric diagram on the rear of the cover plate (E) (Fig. 17) for the removal, and at the time of reconnection after exchange of the compressor, refer to this diagram to prevent wrong connections.
- 2) For the new service compressor, blind tubes have been applied at the three places (A), (B), and (C) to prevent entry of dirt and moisture. At the time of exchange, remove these tubes, and then connect the unit tubing. Fig. 22

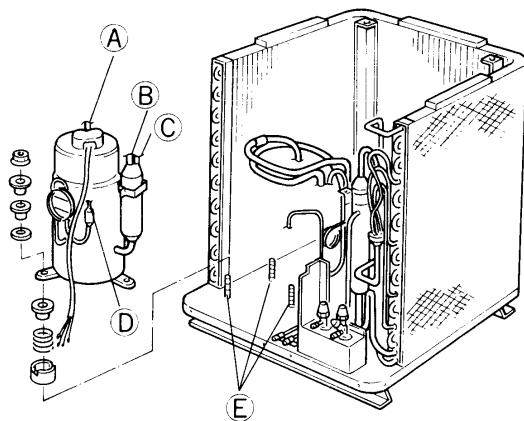


Fig. 21

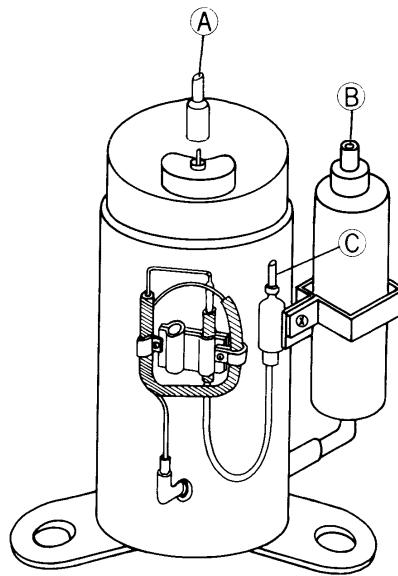


Fig. 22

9-12. Compressor Replacement

9-12-1. Tool List for Compressor Replacement

| No. | Item | Q'ty | Remarks |
|-----|--|------|---|
| 1 | Portable fire extinguisher | 1 | |
| 2 | Oxy-acetylene torch set | 1 | Prest-O-Lite Portable Outfit or equivalent |
| 3 | Torch lighter | 1 | |
| 4 | Oxweld goggles | 1 | |
| 5 | Brazing flux | 1 | |
| 6 | Soldering rod | 1 | |
| 7 | Vacuum pump (Capacity: 2 ~ 3 Cu-ft./min.) | 1 | Robinair or equivalent |
| 8 | Nitrogen gas (in 10 lbs. container) | 1 | |
| 9 | Refrigerant R22 (in 10 lbs. container) | 1 | |
| 10 | Refrigerant charging cylinder (5 lbs. or more) | 1 | |
| 11 | System analyzer valve set | 1 | Robinair, Imperial or equivalent "Robbi" thermistor vacuum gauge or equivalent |
| 12 | Vacuum gauge (Range 0 – 1000 microns) | 1 | |
| 13 | Charging hose W/ 1/4" fittings | 5 | |
| 14 | Charge fitting 1/4" | 1 | |
| 15 | Tube adapter 1/4" | 1 | |
| 16 | Pinch-off tool | 1 | |
| 17 | Diagonal cutting plier | 1 | |
| 18 | Long-nose side cutting plier | 1 | |
| 19 | Slip-joint plier | 1 | |
| 20 | Torque wrench (340 lbs.) | 1 | |
| 21 | Pipe cutter | 1 | Imperial or Rigid |
| 22 | Flaring tool | 1 | Rigid or equivalent |
| 23 | Swaging tool | 1 | |
| 24 | Combination file set | 1 | |
| 25 | Regular screwdriver 8" | 1 | |
| 26 | Phillips screwdriver 6" | 1 | |
| 27 | Adjustable wrench 10" | 1 | |
| 28 | Adjustable wrench 12 " | 1 | |
| 29 | Hex. nut driver (6mm) | 1 | (For compressor bolt) |
| 30 | Oil pan | 1 | |
| 31 | Liquid soap with a brush | 1 | |
| 32 | Clean moist cloth | 1 | |

9-12-2. Safety Precautions

1. Make sure unit is disconnected from the power source while it is being assembled or disassembled for servicing.
2. Wear protective goggles at any time when brazing or unbrazing.
3. Be sure to confirm system is at atmospheric pressure before using torch.
4. When brazing or unbrazing tubes, never locate face or any other parts of the human body in direct line with the tubing opening.
5. Before commencing the trial run, be sure the unit is correctly wired and is grounded adequately when it is connected to the power.

9-12-3. Compressor Replacement Procedures

A. Separating the Outdoor Unit

In case the compressor malfunctions with a split type air conditioner under normal conditions, release the refrigerant gas at the location first and remove the tubing, then separate the outdoor unit. Pay special attention to ventilation if the place of installation is small.

- 1) Make sure that the power is definitely turned OFF and remove the Access Panel "C" of the outdoor unit with power line and inter-unit line connectors. Remove wires from terminals within the electrical component box and wrap the ends of the wires separately with the insulating tape.
- 2) Place an oil pan at the under side of the service valves. Then remove the caps of the wide tube service valve and narrow tube service valve with an adjustable wrench.
- 3) Leave the wide tube service valve fully close by turning the spindle of the valve clockwise with a valve key or ratchet wrench. Close the narrow tube service valve in the same manner.
- 4) Apply two pairs of adjustable wrenches to the union of the wide tube service valve, then disconnect tubing from the outdoor unit.
- 5) Use an adjustable wrench and a torque wrench (130 ~ 170 lbs. in.), and disconnect narrow tube from the outdoor unit.

The refrigerant gas will seep out from the indoor unit as well as the tubing.

- 6) Seal the ends of the tubing so that no moisture or dust to enter.
- 7) Gradually open the narrow tube service valve and release the remaining refrigerant.
- 8) Open the wide tube service valve and release the remaining refrigerant.
- 9) Finally leave the wide tube service valve and narrow tube service valve fully open.
- 10) Clean the oil that has spread around the periphery.
- 11) Keep the separated outdoor unit in an upright position and carry it to the service station.

B. Removing the Old Compressor

CAUTION :

Always wear welder's goggles when heating the tubing with a torch and make sure not to get too close to the opening of the tubing. Furthermore, pay special attention to the position of the torch flame so as not to burn the compressor terminals.

- 1) The outdoor unit carried into the service shop may have some refrigerant gas remaining within it. Therefore, make sure that both wide tube service valve and narrow tube service valve are fully open.
- 2) Remove the cabinet according to the disassembly procedure of the outdoor unit. Refer to Page 53. Furthermore remove the terminal cover at the top of the compressor and remove the wiring of the overload relay and the compressor terminal. Fig. 24.
- 3) Set aside an Oxy-Acetylene torch which is needed for removing the piping of the compressor.
- 4) Confirm that system has reached atmospheric pressure.
- 5) With an Oxy-Acetyline torch apply heat uniformly and unbraze the joints of upper section of the Liquid Injection Capillary tube to the compressor, the upper section of the accumulator and the upper section of the compressor discharge tube respectively, and pull them free with pliers. Fig. 23 shows unbrazing points with arrows.

* Be sure to save all mounting components with the replacement compressor for future use.

- 6) To remove the compressor, raise it straight and disengage from the base unit.

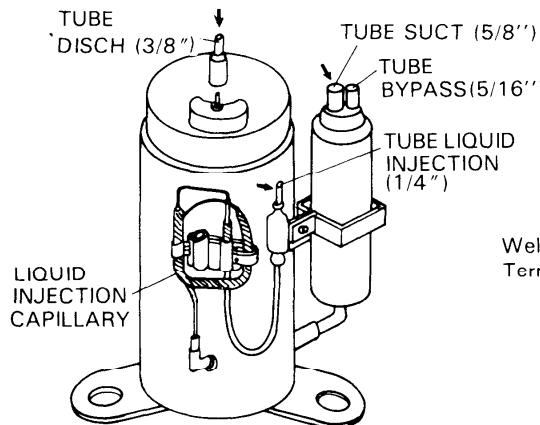


Fig. 23

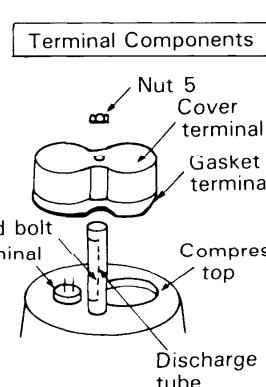


Fig. 24

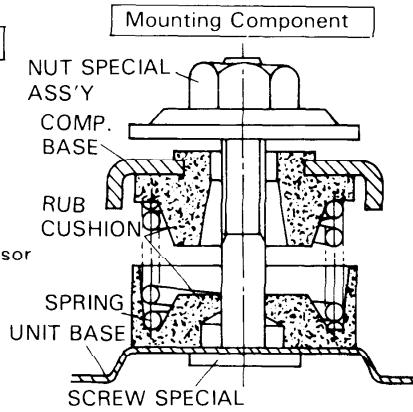


Fig. 25

IMPORTANT NOTICE

Before installing the new compressor, check for possible system contamination by the following procedure:

- Place about 10 cc of the oil from the old compressor into a transparent container and visually check the degree of oil contamination. If the oil has a slight burnt odor but no color change or residue, and ordinary compressor replacement according to the instructions below may be carried out.
- If the oil has a burnt pungent odor and shows contamination (dark color with tiny particles of metal) the system must be cleaned sufficiently with a suction filter or a drier-strainer and then replace the oil drier with a new one.
- However, if just the compressor is replaced without sufficient system cleaning, contaminated oil may cause the burning of the compressor again.
- If the oil compressor is to be scrapped, by pinching the terminal section with a pair of pliers, there should not be any chance of it being mistakenly used.

C. Installing a New Compressor

1. Make sure that the defective old compressor has been removed and the new compressor to be installed is of the same specification by checking the 8 digit code number on stamped marking on the upper section of the compressor helmet case. (e.g. : **80648646**) For the detail of the compressor identification refer to page. 4.
2. Transfer the mounting parts to the new compressor.
3. Nick the end of the pinched suction tube of the new compressor with a pincher and release the holding charge (Nitrogen: 29 psig).
4. With an Oxy-acetylene torch and pliers, unbraze compressor seals at both discharge port and suction port (upper part of the accumulator).

CAUTION

Be careful of the position of the torch so as not to burn the terminals of the compressor when brazing or unbrazing.

5. Install the new compressor in exactly the same manner as the original compressor.
(* See CAUTION bottom of this page)
6. Shape both the suction and discharge lines to the approx. area of the compressor fittings and engage each tube end to the mating compressor fitting.
7. Hold tubing securely with pliers and braze all connections carefully with the torch.
8. Perform leak test, evacuation, and charging refrigerant according to procedures described in section 9-13. page. 60

CAUTION

* If the old compressor was heavily contaminated, be sure to replace strainer (or drier) when replacing the new compressor.

9-13. Leak Test, Evacuation and Charging

9-13-1. Required tools and system set up

| No. | Item | Q'ty |
|-----|--|------|
| 1) | Vacuum pump | 1 |
| 2) | Vacuum gauge | 1 |
| 3) | System analyzer valve set | 1 |
| 4) | Charging hose (With 1/4" connector) | 6 |
| 5) | 1/4" Flared tube cross fitting | 1 |
| 6) | Charging Cylinder | 1 |
| 7) | 1/4" Flared Packless valve (To be used for V3, V4 and V5) | 3 |

* One of conventional system set up and procedure for leak test, evacuation and charging is described in section 9-13 for the reference.

** Robinair or Imperial Portable Charging Station may be used as a convenient packaged tool for the purpose of servicing the refrigerant system.

9-13-2. System Leak Test at the Service Site

After replacement of the new compressor, the system must be checked for leaks according to the below mentioned procedure:

- * If cylinder has not yet been filled, move at least one pound of refrigerant (R22) to the charging cylinder. Fig. 26
- 1) Prepare the system analyzer valve set and connect charging hoses as in Fig. 27. Be sure to close all valves before connection. (Refer to page 24, Fig. 36-c)
 - 2) Confirm that both Narrow Tube and Wide Tube service valves on the outdoor unit **V6** and **V7** are fully opened, and other valves are still closed. (Refer to Fig. 28)
 - 3) Open valves **V8**, **V4** and **V2** respectively to allow refrigerant gas entering into the system. Charge about 1/2 pound of gas to the system and close **V2**, **V4** and **V8** in sequence.
 - 4) Apply liquid soap at charge hose connectors, discharge and suction tubes, and brazed liquid injection capillary section of the replaced compressor or other connection parts, and check to see change of bubbles. An electronic halogen gas leak detector, of course, may be used for this purpose.
 - 5) When leaks are located, depressurize system and repair leaks.
 - 6) If there are no leaks, open **V1**, purge the 1/2 pound of refrigerant from the system and proceed for evacuation in section 9-13-3. Refer to page 61.
- * Refer to page 24 in regard to the operation method for the service valve **V7**.

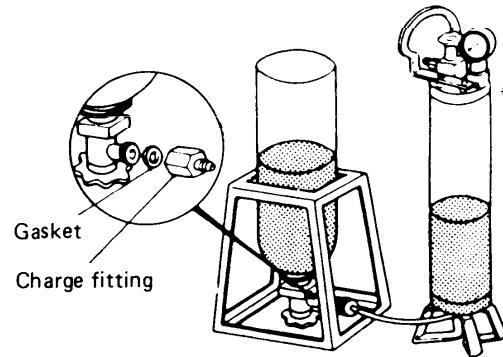


Fig. 26

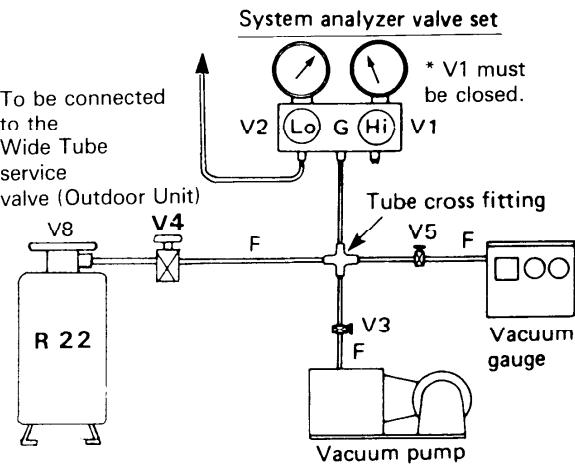


Fig. 27

9-13-3. Evacuation

- 1) Connect instrument as in Fig. 28
 - 2) Confirm that all connections are made correctly and check all valves are closed. * **V6** and **V7** should be fully opened. (Refer to page 24, Fig. 36-C.)
 - 3) Open **V2** only.
 - 4) Open **V3** and **V5**. Never fail to open the shut off valve on the vacuum pump if there is.
 - 5) Run the vacuum pump for evacuation. Required time for complete evacuation differs with capacity of the pump. (Consult shop manual for specifications.)
- * While system is evacuating, utilize this time to fill the charging cylinder, if it is not ready.
- 6) If vacuum gauge reading has reached 500 microns or less, stop the vacuum pump and close **V3**.
 - 7) Keep this condition at least 5 minutes and observe the vacuum gauge for change. (Fig. 29)
If pointer on the gauge moves to larger numbers, check system for leaks again according to the procedure in section 9-13-2. Page 60.
 - 8) If the indication of the vacuum gauge will not change, system is now prepared for charging refrigerant. Close **V5**.
 - 9) Proceed to charging refrigerant in section 9-13-4. Page 62.

NOTE:

This model uses low pressure on the narrow tube side as well as on the wide tube side. Accordingly, the tubing on both sides must be insulated at the time of installation.

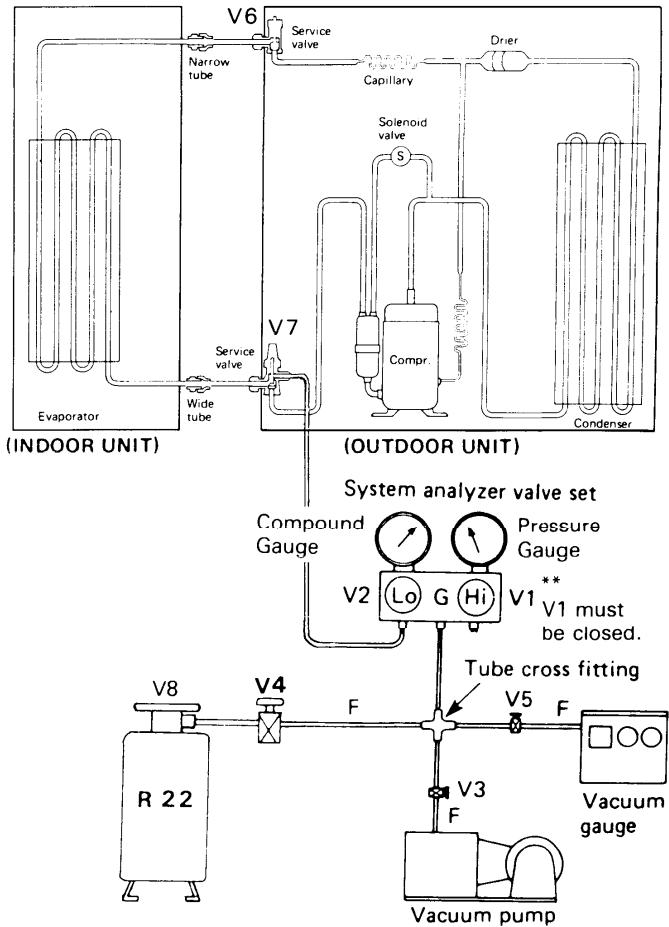


Fig. 28

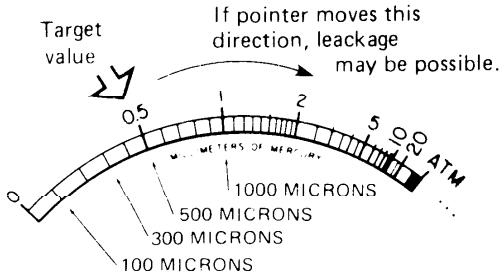


Fig. 29

9-13-4. Charging Refrigerant (R22)

● Preparation of Refrigerant

- a) Measure the net weight of the charging cylinder before charging refrigerant and memorize it.
- b) Refill required amount of refrigerant from the container to the charging cylinder. Be sure to measure the cylinder contents by weighing it. Fig. 30.

NOTE : Do not confuse the refrigerant gas level graduations on the charging cylinder with the weight. Vapor refrigerant on the upper cylinder part must be taken into consideration.

● Charging Procedure

- 1) Evacuate system according to the procedure in section 9-13-3
- 2) Confirm that valves **V1**, **V2**, **V3**, **V4**, **V5**, and **V8** are closed when evacuation is completed.
- 3) Open charging cylinder valve **V8** slightly.
- 4) Loosen hose connection at **V4** a little to let air escape from the hose. Then tighten connection again.
- 5) Measure and memorize charging cylinder weight to charge exact amount of refrigerant.
- 6) Open **V4**, fully to supply refrigerant gas to **V2**.
- 7) Close **V7** halfway (2 turns) for charging refrigerant. (Refer to page 24, Fig. 36-b.)
- 8) Open **V2** gradually and let refrigerant gas entering into the system.
- 9) When full charge has entered system (do not permit liquid level to drop blow "0" (zero) on the graduation of the charging cylinder), close **V2** tightly.
- 10) Open **V7** fully until it reaches to the back-seat position. (Refer to page 24, Fig. 36-b)
- 11) Close **V4** and **V8**.
- 12) Loosen hose connections and let refrigerant escape from hoses.
- 13) Remove hoses, charging cylinder and system analyzer valve set. Now, system charging has completed.

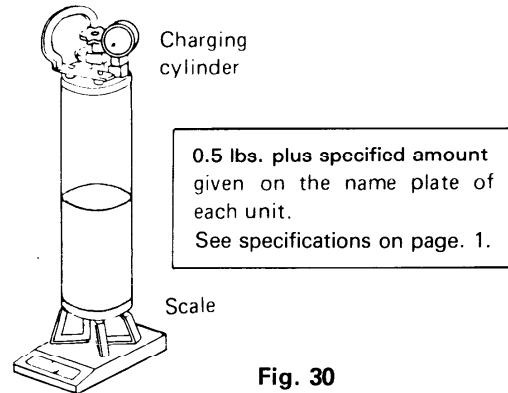
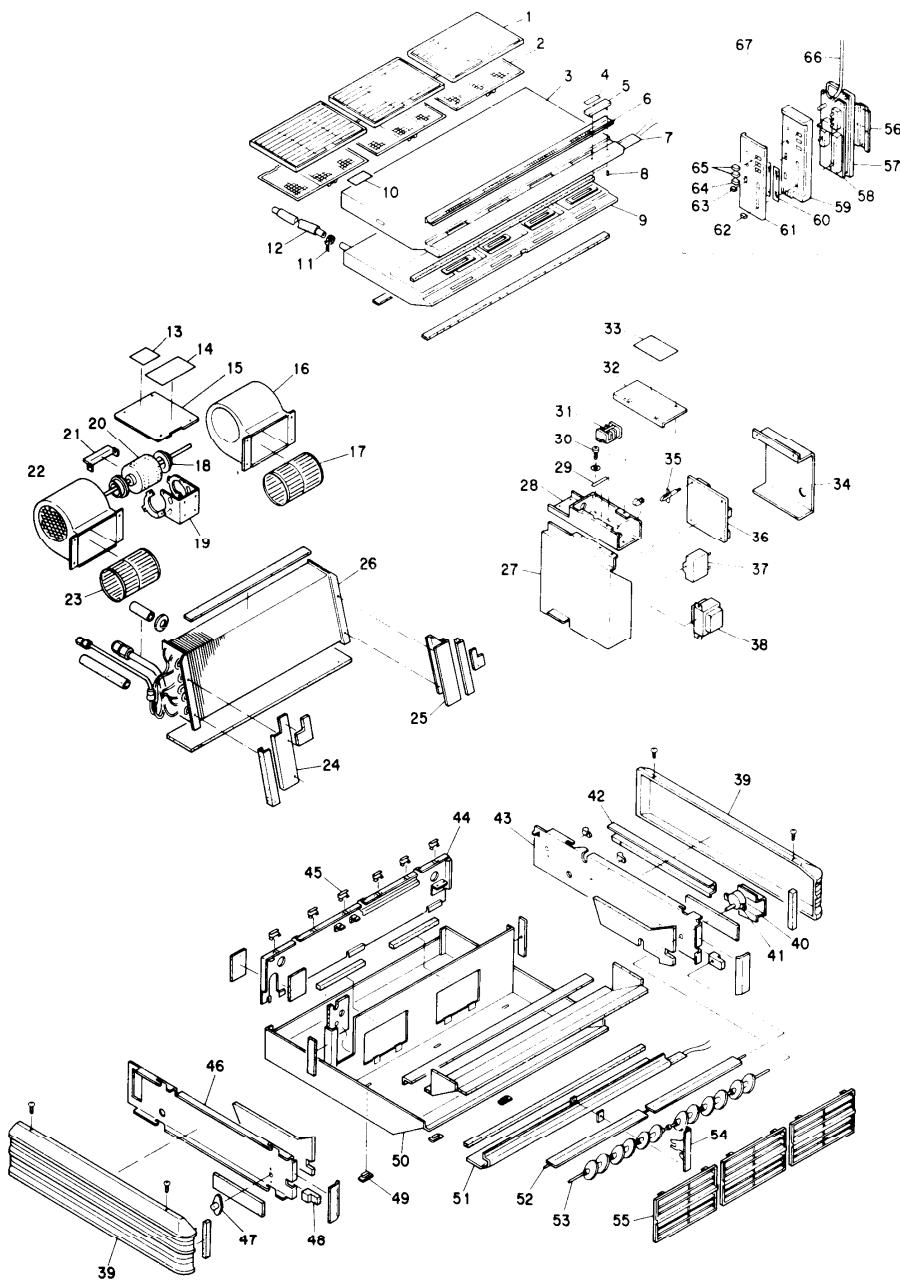


Fig. 30

10. PARTS LIST



■ Accessory Parts List LIST OF PACKAGED PARTS

| Parts Name | Figure | Q'ty | Code |
|--------------------------------|--------|------|---------------|
| Suspension fittings | | 2 | 8542112713701 |
| Suspension fittings | | 2 | 8542112713901 |
| Suspension bolts (M8x200) | | 4 | 8542135611901 |
| M8 round washers | | 4 | 3928008011 |
| M8 hex. nuts with flat washers | | 8 | 8510239510201 |

| Parts Name | Figure | Q'ty | Code |
|--------------------------|--------|------|---------------|
| M8 bolt | | 4 | 3924081601 |
| M8 spring washer | | 4 | 3928208001 |
| Woodscrew (M3.1x13) | | 2 | 3926121301 |
| Drain socket | | 1 | 8540429711300 |
| Heat insulating material | | 1 | 8542241032600 |
| Heat insulating material | | 1 | 8522241411300 |
| Drain-hose clamp | | 1 | 8512535400200 |

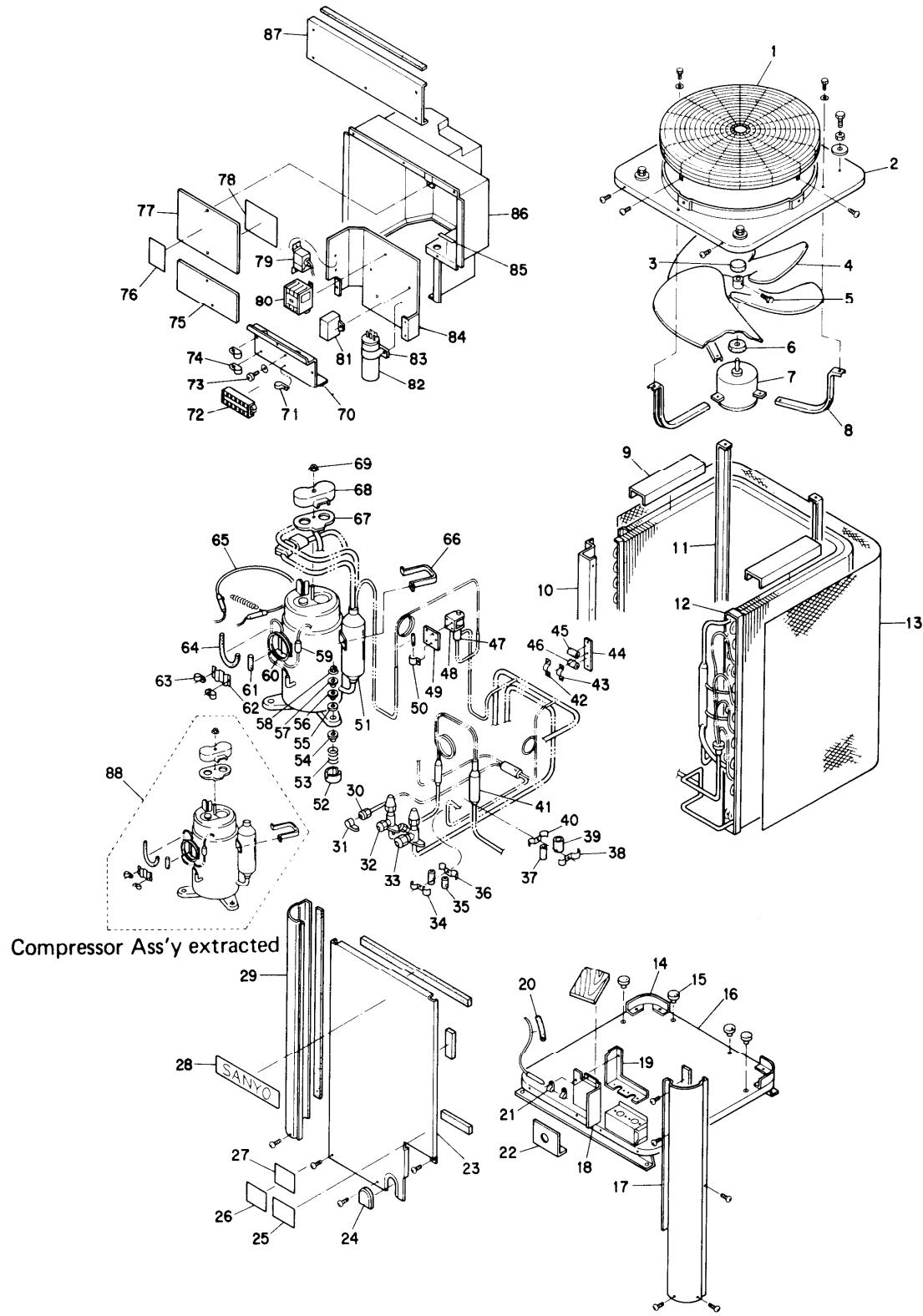
ATTENTION !

To ensure correct parts supply, please let us know followings, when you make service parts order:

1. Part No. 2. Description 3. Q'ty 4. Volts - Hz - Ph 5. PRODUCT MODEL NO.

| Key No. | Part No. | Description | Q'ty | Key No. | Part No. | Description | Q'ty |
|---------|------------------|----------------------------------|------|---------|------------------|---------------------------------|------|
| 1 | 854-2-1104-12613 | Suction Grille | 3 | 61 | 851-2-5365-03401 | Indicator Plate | 1 |
| 2 | 854-0-1302-13800 | Filter Ass'y | 3 | 62 | 854-2-1311-12401 | Knob | 1 |
| 3 | 854-0-1101-266H9 | Front Panel Ass'y | 1 | 63 | 854-2-1311-12002 | Knob | 1 |
| 4 | 854-2-1301-25001 | Ornament | 1 | 64 | 851-2-5375-00601 | Knob | 1 |
| 5 | 852-2-1504-16414 | Badge | 1 | 65 | 800-2-5328-12602 | Knob | 2 |
| 6 | 854-2-1330-15911 | Ornamental Sash | 1 | 66 | 851-0-5292-13400 | Remote Control Cable | 1 |
| 7 | 851-0-5290-638H0 | Heater Ass'y 230V 13W | 2 | 67 | 859-2-1445 | Remote Control Switch Ass'y | 1 |
| 8 | 852-2-1314-11901 | Stopper | 2 | 7 | 859-2-1445 | RCS-24T | |
| 9 | 854-0-2301-342H0 | Drain Pan Ass'y | 1 | ■ | 854-6-4119-36800 | Operation Manual | 1 |
| 10 | 854-2-1367-31600 | Name Plate | 1 | ■ | 854-6-4139-30300 | Installation Instructions | 1 |
| 11 | 851-2-5354-00200 | Clamper, Drain Pipe | 1 | ■ | 854-6-4139-25500 | Full-scall Installation Diagram | 1 |
| 12 | 854-0-4297-11300 | Drain Pipe Ass'y | 1 | | | | |
| 13 | 851-6-4729-14600 | Label | 1 | | | | |
| 14 | 851-2-5250-77000 | Wiring Diagram | 1 | | | | |
| 15 | 854-2-2307-11801 | Cover, Fan Motor | 1 | | | | |
| 16 | 854-0-2502-20701 | Blower Casing Ass'y | 1 | | | | |
| 17 | 854-0-2501-15900 | Blower Ass'y | 1 | | | | |
| 18 | 854-2-2534-13500 | Cushion Rubber, Fan Motor | 2 | | | | |
| 19 | 854-0-2511-14601 | Mounting Plate Ass'y, Fan Motor | 1 | | | | |
| 20 | 851-0-5290-638M2 | Fan Motor Ass'y KFG4S-61A6P | 1 | | | | |
| 21 | 854-2-2518-26100 | Mounting Plate | 1 | | | | |
| 22 | 854-0-2502-20601 | Blower Casing Ass'y | 1 | | | | |
| 23 | 854-0-2501-15800 | Blower Ass'y | 1 | | | | |
| 24 | 854-2-2303-202H2 | Mounting Plate Ass'y, Evaporator | 1 | | | | |
| 25 | 854-0-2317-155H0 | Cover Ass'y, Evaporator | 1 | | | | |
| 26 | 854-0-4118-34701 | Evaporator Ass'y | 1 | | | | |
| 27 | 854-2-5301-48801 | Electrical Component Box | 1 | | | | |
| 28 | 854-0-5301-33301 | Electrical Component Box Ass'y | 1 | | | | |
| 29 | 852-6-4729-17300 | Label | 1 | | | | |
| 30 | 852-2-2396-10111 | Screw Special | 1 | | | | |
| 31 | 4-2379-56168 | Terminal Base 3P 20A | 1 | | | | |
| 32 | 854-2-5304-26401 | Cover Plate | 1 | | | | |
| 33 | 854-2-1358-46700 | Label | 1 | | | | |
| 34 | 854-2-5312-49601 | Mounting Plate | 1 | | | | |
| 35 | 851-2-5366-01400 | Spacer | 4 | | | | |
| 36 | 859-4-7292 | Controller POW-24T | 1 | | | | |
| 37 | 4-2239-56218 | Fixed Capacitor 440V 2MF | 1 | | | | |
| 38 | 851-0-5290-638PO | Transformer Ass'y ATR-J122U | 1 | | | | |
| 39 | 854-2-1102-240H1 | Side Panel Ass'y | 2 | | | | |
| 40 | 854-2-2342-26701 | Cover Plate, Synchro Motor | 1 | | | | |
| 41 | 851-0-5290-638MO | Synchro Motor Ass'y M001-1 | 1 | | | | |
| 42 | 854-2-2342-26601 | Cover Plate | 1 | | | | |
| 43 | 854-0-1114-108H1 | Side Cover Ass'y, Left | 1 | | | | |
| 44 | 854-0-1109-198H0 | Rear Panel Ass'y | 1 | | | | |
| 45 | 854-2-1130-12513 | Cap, Top Panel | 6 | | | | |
| 46 | 854-0-1114-104H2 | Side Cover Ass'y, Right | 1 | | | | |
| 47 | 854-2-1111-17810 | Support Louver | 1 | | | | |
| 48 | 854-2-1111-18000 | Support Flap | 2 | | | | |
| 49 | 854-2-1114-10800 | Cap, Top Panel | 3 | | | | |
| 50 | 854-0-1105-234H1 | Top Panel Ass'y | 1 | | | | |
| 51 | 854-0-1101-268H9 | Front Panel Ass'y | 1 | | | | |
| 52 | 854-0-1505-17401 | Flap Ass'y | 1 | | | | |
| 53 | 854-0-1505-21000 | Deflector Louver Ass'y | 1 | | | | |
| 54 | 854-2-1111-17901 | Support Louver | 1 | | | | |
| 55 | 854-2-1101-45114 | Discharge Grille | 3 | | | | |
| 56 | 800-2-5352-14801 | Mounting Plate | 1 | | | | |
| 57 | 851-2-5358-00610 | Bottom Plate | 1 | | | | |
| 58 | 851-0-5158-07100 | Control Switch PCB Ass'y | 1 | | | | |
| 59 | 800-2-5318-14911 | Lid, Remote Control Switch | 1 | | | | |
| 60 | 800-2-5367-11300 | Filter | 1 | | | | |

NOTE. Metal and plastic parts will be supplied basically with necessary heat insulating pads or packing.
 Some key numbers are intentionally omitted or left blank for the editor's convenience.



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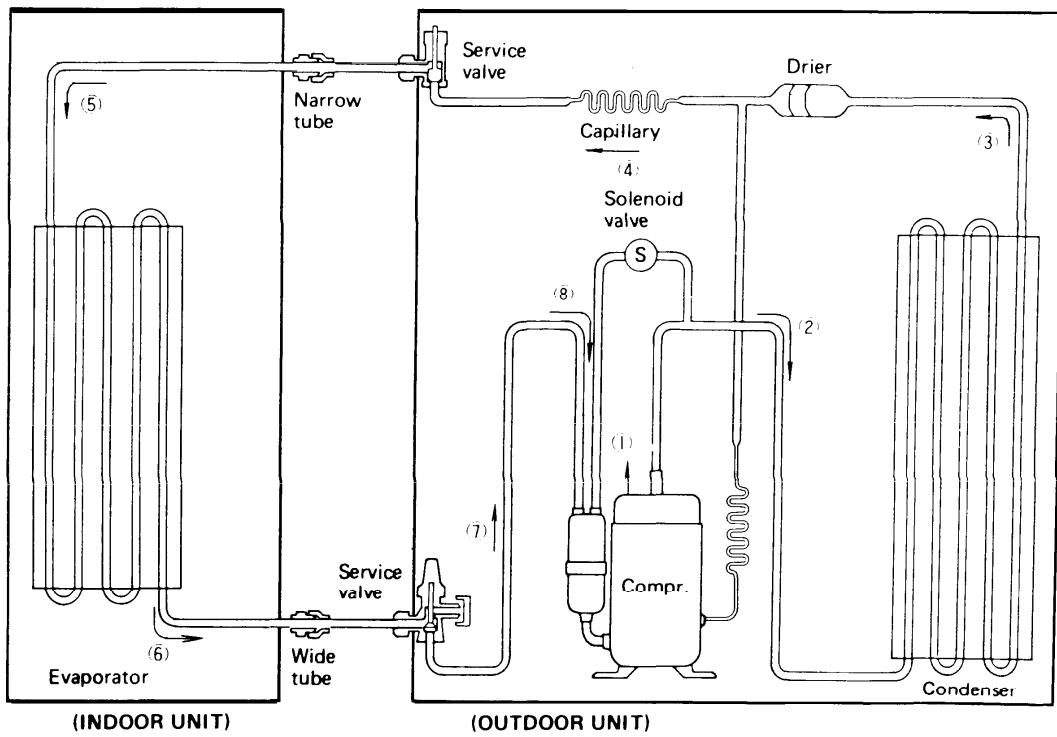
To ensure correct parts supply, please let us know followings, when you make service parts order:

1. Part No. 2. Description 3. Q'ty 4. Volts - Hz - Ph 5. PRODUCT MODEL NO.

| Key No. | Part No. | Description | Q'ty | Key No. | Part No. | Description | Q'ty |
|---------|------------------|-----------------------------|------|---------|------------------|--|------|
| 1 | 854-0-1113-13801 | Guard Ass'y | 1 | 59 | 852-0-4506-14000 | Strainer Ass'y | 1 |
| 2 | 854-0-1106-20201 | Top Cover Ass'y | 1 | 60 | 854-2-4219-58100 | Capillary Tube | 1 |
| 3 | 854-2-2346-11400 | Cap | 1 | 61 | 852-2-2353-19500 | Packing | 1 |
| 4 | 854-0-2501-18100 | Propeller Fan Ass'y | 1 | 62 | 852-2-2309-34101 | Mounting Plate | 1 |
| 5 | 854-2-2529-10101 | Bolt Special, Propeller Fan | 1 | 63 | 3-9030-00508 | Clamper F-6 | 2 |
| 6 | 852-2-2514-10700 | Cap Rubber | 1 | 64 | 853-2-4310-10300 | Packing | 1 |
| 7 | 851-0-5290-636M1 | Fan Motor Ass'y KFC8-101A6P | 1 | 65 | 851-0-5290-636H1 | Heater Ass'y CH5700 230V30W | 1 |
| 8 | 854-0-2511-14400 | Support Motor Ass'y | 3 | 66 | 851-2-2356-16901 | Mounting Plate, Accumulator | 1 |
| 9 | 854-2-2360-18900 | Mounting Plate | 2 | 67 | 801-2-5303-13100 | Gasket Terminal | 1 |
| 10 | 854-2-4134-32100 | Mounting Plate | 1 | 68 | 801-2-6194-12100 | Cover Terminal | 1 |
| 11 | 854-0-2206-18100 | Frame Ass'y | 2 | 69 | 801-2-8305-10100 | Nut 5mm | 1 |
| 12 | 854-0-4106-18500 | Condenser Ass'y | 1 | 70 | 854-2-5301-48401 | Electrical Component Box | 1 |
| 13 | 854-2-1113-12400 | Guard | 1 | 71 | 3-9030-00508 | Clamper F-6 | 1 |
| 14 | 854-2-2360-19100 | Mounting Plate | 2 | 72 | 4-2379-56175 | Terminal Base 6P 30A | 1 |
| 15 | 854-2-1353-11000 | Cushion Rubber | 4 | 73 | 852-2-2396-10103 | Screw Special | 1 |
| 16 | 854-0-2204-35801 | Bottom Plate Ass'y | 1 | 74 | 3-9030-00512 | Clamper F-10 | 1 |
| 17 | 854-0-1102-234H0 | Side Panel Ass'y, Right | 1 | 75 | 854-2-5304-26100 | Cover Plate | 1 |
| 18 | 854-2-1133-20101 | Cover Plate | 1 | 76 | 854-2-1358-46700 | Label | 1 |
| 19 | 854-2-1133-17501 | Cover Plate | 1 | 77 | 854-2-5304-26000 | Cover Plate | 1 |
| 20 | 854-2-4310-10100 | Mounting Rubber, Capillary | 1 | 78 | 851-2-5250-76800 | Wiring Diagram | 1 |
| 21 | 3-9030-00506 | Clamper F-4 | 2 | 79 | 4-2339-56195 | Thermostat YTB-4U201 | 1 |
| 22 | 854-2-2360-26801 | Mounting Plate | 1 | 80 | 4-2329-56284 | Relay CLK-16E3-21 | 1 |
| 23 | 854-0-1101-301H0 | Front Panel Ass'y | 1 | 81 | 4-2239-56224 | Fixed Capacitor 440VAC 5MFD | 1 |
| 24 | 852-2-1320-10500 | Eyelet Rubber | 1 | 82 | 4-2239-56339 | Fixed Capacitor 400VAC 35MFD | 1 |
| 25 | 854-2-1367-31500 | Name Plate | 1 | 83 | 852-2-5301-20600 | Clip, Capacitor | 1 |
| 26 | 854-6-4729-68600 | Label | 1 | 84 | 854-0-5301-33001 | Electrical Component Box Ass'y | 1 |
| 27 | 854-6-4729-71600 | Label | 1 | 85 | 852-6-4729-17300 | Label | 1 |
| 28 | 854-2-1354-14300 | Badge | 1 | 86 | 854-0-2325-16900 | Cover Ass'y | 1 |
| 29 | 854-0-1102-233H0 | Side Panel Ass'y, Left | 1 | 87 | 854-2-2208-195H0 | Mounting Plate Ass'y | 1 |
| 30 | 854-0-4514-10200 | Charge Port Ass'y | 1 | 88 | 852-0-4516-15700 | Compressor Ass'y C-R190H6N (806-4-8646) | 1 |
| 31 | 3-9030-00512 | Clamper F-10 | 1 | | | | |
| 32 | 854-0-4521-11100 | Valve Ass'y 1/4" | 1 | | | | |
| 33 | 854-0-4506-16200 | Valve Ass'y 5/8" | 1 | | | | |
| 34 | 852-2-2356-13301 | Mounting Plate, Tube | 1 | | | | |
| 35 | 854-2-2336-48200 | Packing | 2 | | | | |
| 36 | 852-2-2356-13201 | Mounting Plate, Tube | 1 | | | | |
| 37 | 854-2-4315-13900 | Packing | 1 | | | | |
| 38 | 854-2-4316-12100 | Mounting Plate, Tube | 1 | | | | |
| 39 | 854-2-2336-49200 | Packing | 1 | | | | |
| 40 | 854-2-4316-12200 | Mounting Plate, Tube | 1 | | | | |
| 41 | 852-0-4505-13600 | Dehydrater Ass'y | 1 | | | | |
| 42 | 853-2-2340-21901 | Mounting Plate, Tube | 1 | | | | |
| 43 | 854-2-4134-16501 | Mounting Plate, Tube | 1 | | | | |
| 44 | 854-2-2360-28700 | Mounting Plate | 1 | | | | |
| 45 | 854-2-4315-13500 | Packing | 1 | | | | |
| 46 | 853-2-4319-11200 | Packing | 1 | | | | |
| 47 | 854-2-4549-10100 | Solenoid Valve NEV603DXFU | 1 | | | | |
| 48 | 851-0-5290-636C1 | Solenoid Ass'y NEVAC208V | 1 | | | | |
| 49 | 854-2-2360-38000 | Mounting Plate | 1 | | | | |
| 50 | 854-2-4316-13101 | Mounting Plate, Tube | 1 | | | | |
| 51 | 854-0-4517-17800 | Accumulator Ass'y | 1 | | | | |
| 52 | 851-2-2390-14000 | Cushion Rubber | 3 | | | | |
| 53 | 851-2-2330-13201 | Spring | 3 | | | | |
| 54 | 854-2-2356-10500 | Rubber Protection | 3 | | | | |
| 55 | 854-2-2356-10600 | Rubber Protection | 3 | | | | |
| 56 | 854-2-2349-12201 | Spacer | 3 | | | | |
| 57 | 854-2-2356-10400 | Rubber Protection | 2 | | | | |
| 58 | 854-2-2356-10700 | Rubber Protection | 1 | | | | |
| 58 | 854-0-2321-10201 | Nut Special Ass'y | 2 | | | | |
| 58 | 851-0-2395-10702 | Nut Special Ass'y | 1 | | | | |

NOTE: Metal and plastic parts will be supplied basically with necessary heat insulating pads or packing.
 Some key numbers are intentionally omitted or left blank for the editor's convenience.

11. REFRIGERANT FLOW DIAGRAM

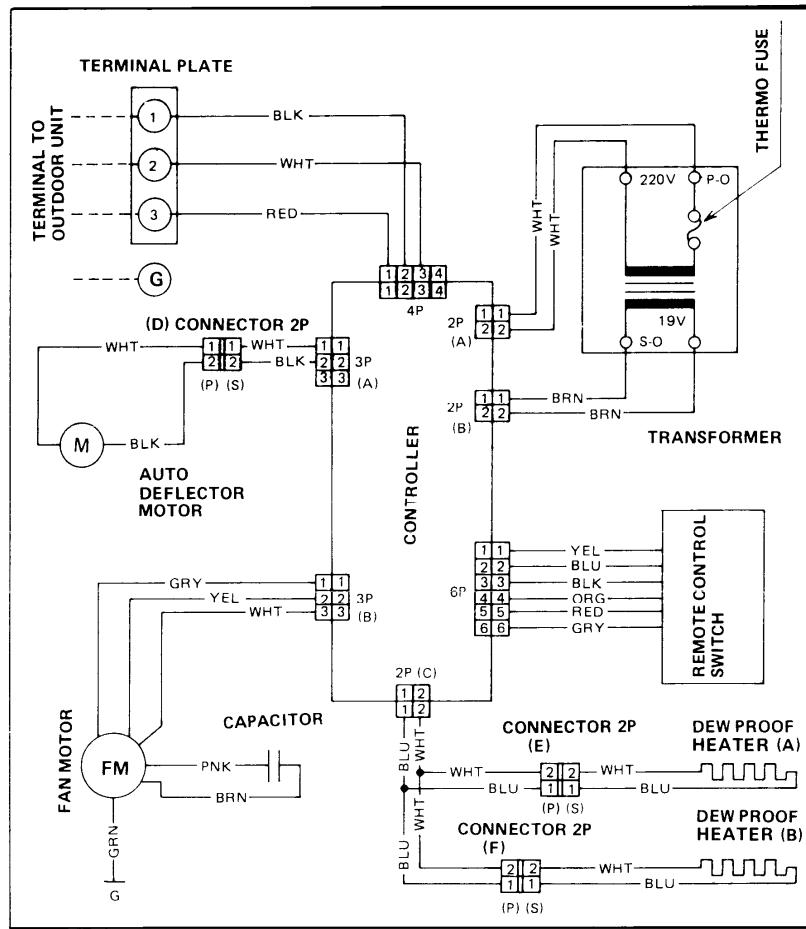


NOTE:

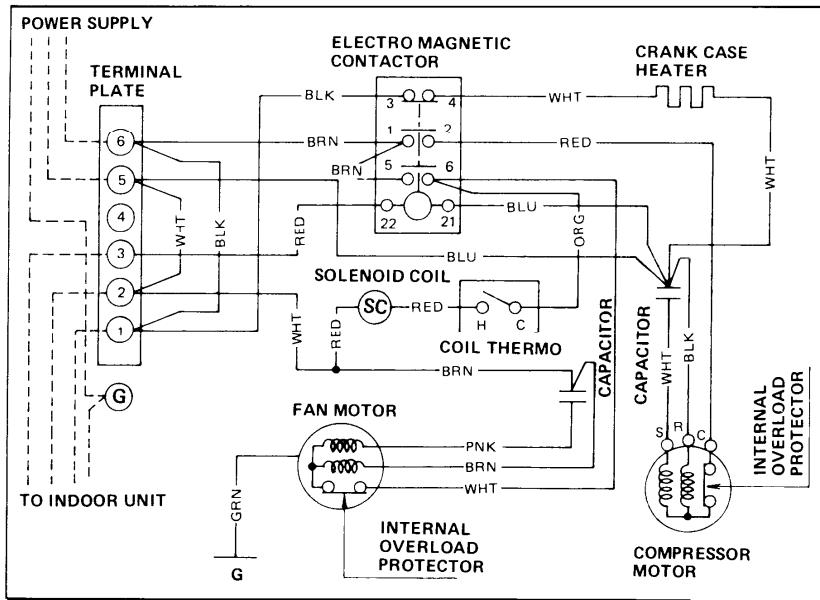
→ with sequential number shows flow
of refrigerant in COOLING CYCLE.

12. ELECTRIC WIRING DIAGRAM

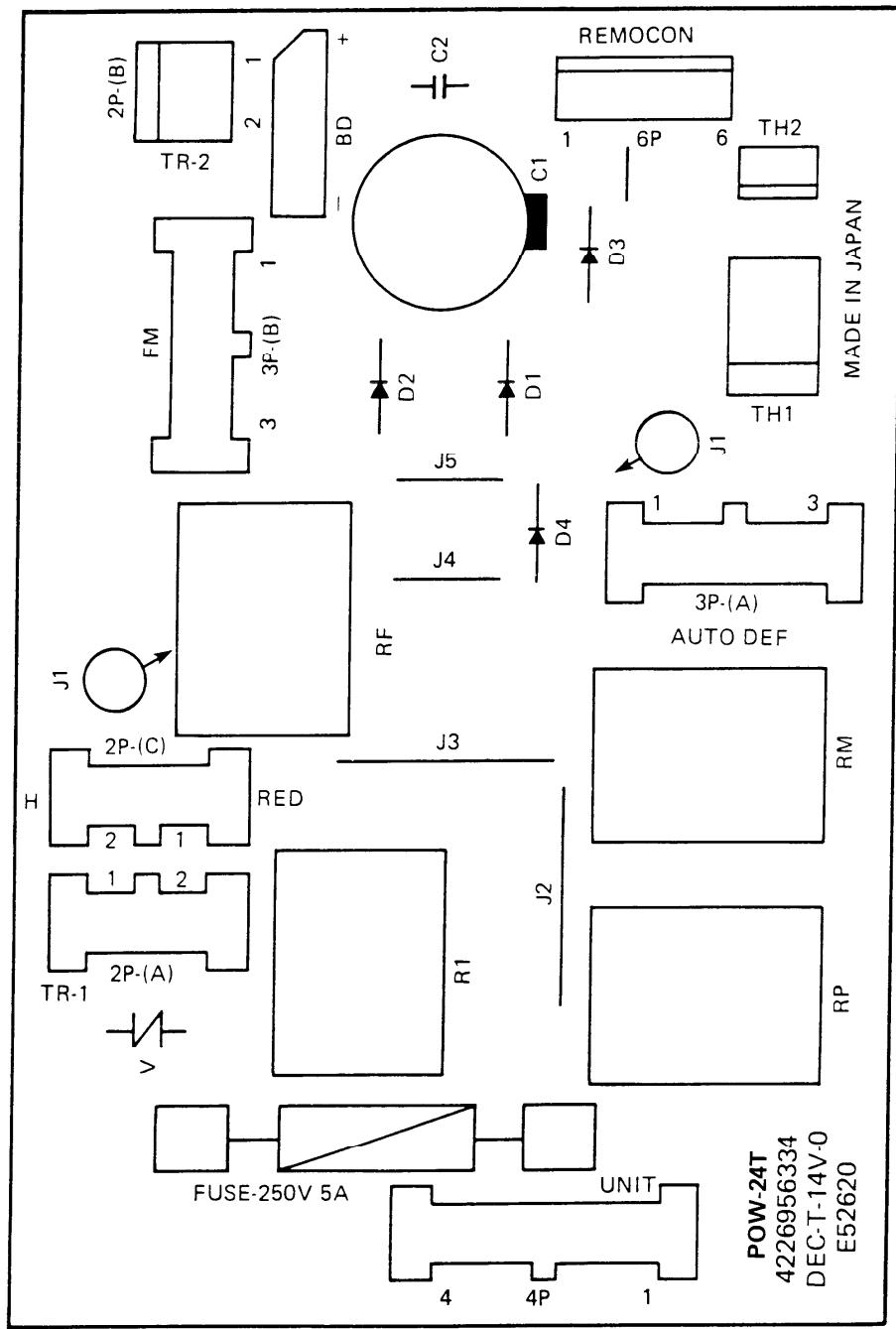
SAP241T ELECTRIC WIRING DIAGRAM



SAP241C ELECTRIC WIRING DIAGRAM



CONTROLLER P.C.B. POW-24T (PRINTED PATTERN)



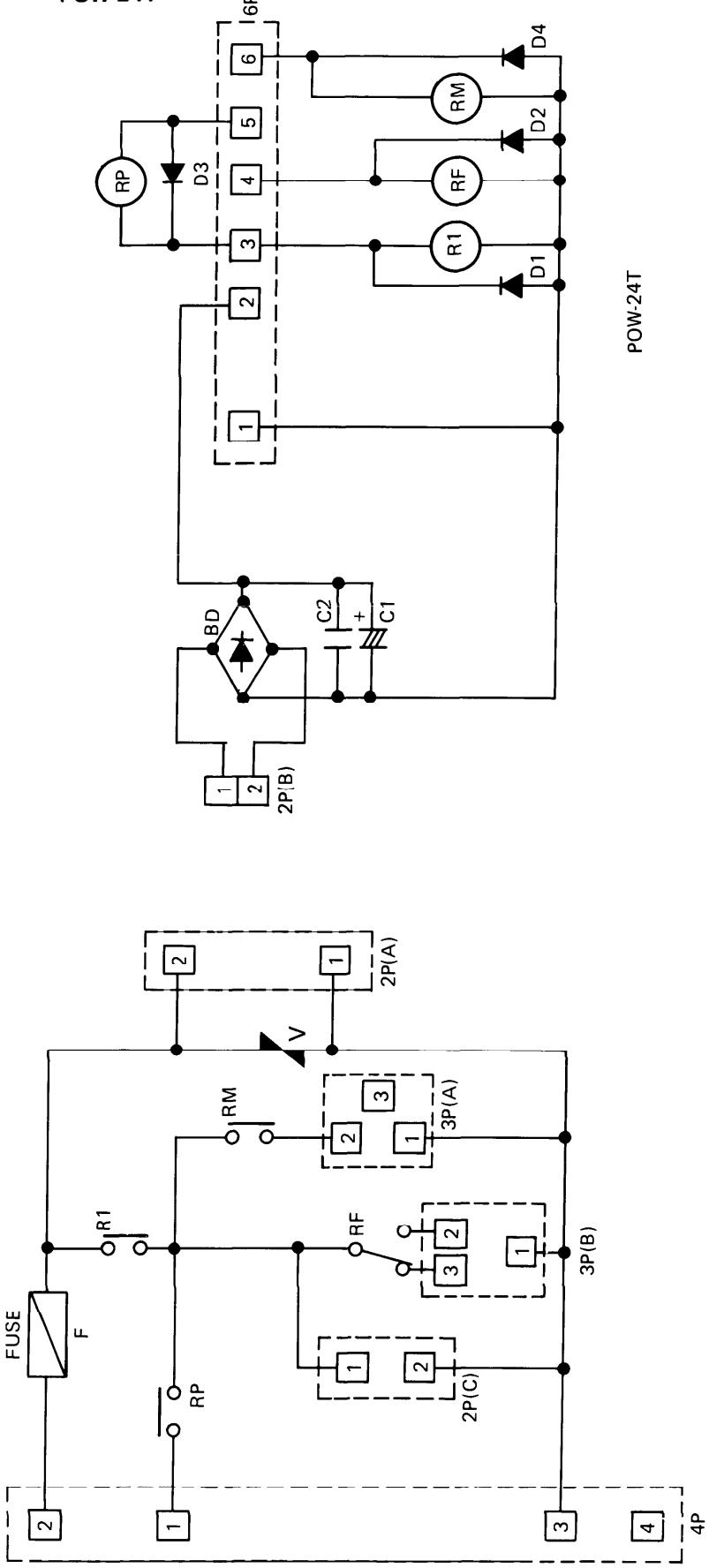
ELECTRIC WIRING DIAGRAM (CONTROLLER P.C.B.)
POW-24T

| Description | |
|-------------|--------------|
| Key No. | Description |
| 3P(A) | Connector 3P |
| 3P(B) | Connector 3P |
| 2P(A) | Connector 2P |
| 2P(B) | Connector 2P |
| 2P(C) | Connector 2P |
| F | Connector |

| Description | |
|-------------|--------------|
| Key No. | Description |
| R1 | Relay |
| RF | Relay |
| RM | Relay |
| RP | Relay |
| V | Varistor |
| 6P | Connector 6P |
| 4P | Connector 4P |

| Description | |
|-------------|--------------|
| Key No. | Description |
| BD | Bridge Diode |
| D1 | Diode |
| D2 | Diode |
| D3 | Diode |
| D4 | Diode |
| C1 | Capacitor |
| C2 | Capacitor |

DBA-10C
DS-442X
DS-442X
DS-442X
DS-442X
DS-442X
470μF/50V TW
0.047μF/50V



13. APPENDIX (Conversion Tables)

Centigrade \longleftrightarrow Fahrenheit

Numbers in the center column (between those marked C and F) refer to temperature, Centigrade or Fahrenheit, which it is desired to convert into the other scale. To convert from Fahrenheit to Centigrade find equivalent temperature in left hand column

| $^{\circ}\text{C}.$ | $^{\circ}\text{F}.$ | $^{\circ}\text{C}.$ | $^{\circ}\text{F}.$ | $^{\circ}\text{C}.$ | $^{\circ}\text{F}.$ | $^{\circ}\text{C}$ | $^{\circ}\text{F}$ | $^{\circ}\text{C}$ | $^{\circ}\text{F}$ | $^{\circ}\text{C}$ | $^{\circ}\text{F}$ |
|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| -40.0 | -40 | -40.0 | -6.7 | 20 | 68.0 | 15.6 | 60 | 140.0 | 37.8 | 100 | 212.0 |
| -38.9 | -38 | -36.4 | -6.1 | 21 | 69.8 | 16.1 | 61 | 141.8 | 38.9 | 102 | 215.6 |
| -37.8 | -36 | -32.8 | -5.6 | 22 | 71.6 | 16.7 | 62 | 143.6 | 40.0 | 104 | 219.2 |
| -36.7 | -34 | -29.2 | -5.0 | 23 | 73.4 | 17.2 | 63 | 145.4 | 41.1 | 106 | 222.8 |
| -35.6 | -32 | -25.6 | -4.4 | 24 | 75.2 | 17.8 | 64 | 147.2 | 42.2 | 108 | 226.4 |
| -34.4 | -30 | -22.0 | -3.9 | 25 | 77.0 | 18.3 | 65 | 149.0 | 43.3 | 110 | 230.0 |
| -33.3 | -28 | -18.4 | -3.3 | 26 | 78.8 | 18.9 | 66 | 150.8 | 44.4 | 112 | 233.6 |
| -32.2 | -26 | -14.8 | -2.8 | 27 | 80.6 | 19.4 | 67 | 152.6 | 45.6 | 114 | 237.2 |
| -31.1 | -24 | -11.2 | -2.2 | 28 | 82.4 | 20.0 | 68 | 154.4 | 46.7 | 116 | 240.8 |
| -30.0 | -22 | -7.6 | -1.7 | 29 | 84.2 | 20.6 | 69 | 156.2 | 47.8 | 118 | 244.4 |
| -28.9 | -20 | -4.0 | -1.1 | 30 | 86.0 | 21.1 | 70 | 158.0 | 48.9 | 120 | 248.0 |
| -27.8 | -18 | -0.4 | -0.6 | 31 | 87.8 | 21.7 | 71 | 159.8 | 50.0 | 122 | 251.6 |
| -26.7 | -16 | 3.2 | 0.0 | 32 | 89.6 | 22.2 | 72 | 161.6 | 51.1 | 124 | 255.2 |
| -25.6 | -14 | 6.8 | + 0.6 | 33 | 91.4 | 22.8 | 73 | 163.4 | 52.2 | 126 | 258.8 |
| -24.4 | -12 | 10.4 | 1.1 | 34 | 93.2 | 23.3 | 74 | 165.2 | 53.3 | 128 | 262.4 |
| -23.3 | -10 | 14.0 | 1.7 | 35 | 95.0 | 23.9 | 75 | 167.0 | 54.4 | 130 | 266.0 |
| -22.2 | -8 | 17.6 | 2.2 | 36 | 96.8 | 24.4 | 76 | 168.8 | 55.6 | 132 | 269.6 |
| -21.1 | -6 | 21.2 | 2.8 | 37 | 98.6 | 25.0 | 77 | 170.6 | 56.7 | 134 | 273.2 |
| -20.0 | -4 | 24.8 | 3.3 | 38 | 100.4 | 25.6 | 78 | 172.4 | 57.8 | 136 | 276.8 |
| -18.9 | -2 | 28.4 | 3.9 | 39 | 102.2 | 26.1 | 79 | 174.2 | 58.9 | 138 | 280.4 |
| -17.8 | 0 | 32.0 | 4.4 | 40 | 104.0 | 26.7 | 80 | 176.0 | 60.0 | 140 | 284.0 |
| -17.2 | 1 | 33.8 | 5.0 | 41 | 105.8 | 27.2 | 81 | 177.8 | 61.1 | 142 | 287.6 |
| -16.7 | 2 | 35.6 | 5.6 | 42 | 107.6 | 27.8 | 82 | 179.6 | 62.2 | 144 | 291.2 |
| -16.1 | 3 | 37.4 | 6.1 | 43 | 109.4 | 28.3 | 83 | 181.4 | 63.3 | 146 | 294.8 |
| -15.6 | 4 | 39.2 | 6.7 | 44 | 111.2 | 28.9 | 84 | 183.2 | 64.4 | 148 | 298.4 |
| -15.0 | 5 | 41.0 | 7.2 | 45 | 113.0 | 29.4 | 85 | 185.0 | 65.6 | 150 | 302.0 |
| -14.4 | 6 | 42.8 | 7.8 | 46 | 114.8 | 30.0 | 86 | 186.8 | 66.7 | 152 | 305.6 |
| -13.9 | 7 | 44.6 | 8.3 | 47 | 116.6 | 30.6 | 87 | 188.6 | 67.8 | 154 | 309.2 |
| -13.3 | 8 | 46.4 | 8.9 | 48 | 118.4 | 31.1 | 88 | 190.4 | 68.9 | 156 | 312.8 |
| -12.8 | 9 | 48.2 | 9.4 | 49 | 120.2 | 31.7 | 89 | 192.2 | 70.0 | 158 | 316.4 |
| -12.2 | 10 | 50.0 | 10.0 | 50 | 122.0 | 32.2 | 90 | 194.0 | 71.1 | 160 | 320.0 |
| -11.7 | 11 | 51.8 | 10.6 | 51 | 123.8 | 32.8 | 91 | 195.8 | 72.2 | 162 | 323.6 |
| -11.1 | 12 | 53.6 | 11.1 | 52 | 125.6 | 33.3 | 92 | 197.6 | 73.3 | 164 | 327.2 |
| -10.6 | 13 | 55.4 | 11.7 | 53 | 127.4 | 33.9 | 93 | 199.4 | 74.4 | 166 | 330.8 |
| -10.0 | 14 | 57.2 | 12.2 | 54 | 129.2 | 34.4 | 94 | 201.2 | 75.6 | 168 | 334.4 |
| -9.4 | 15 | 59.0 | 12.8 | 55 | 131.0 | 35.0 | 95 | 203.0 | 76.7 | 170 | 338.0 |
| -8.9 | 16 | 60.8 | 13.3 | 56 | 132.8 | 35.6 | 96 | 204.8 | 77.8 | 172 | 341.6 |
| -8.3 | 17 | 62.6 | 13.9 | 57 | 134.6 | 36.1 | 97 | 206.6 | 78.9 | 174 | 345.2 |
| -7.8 | 18 | 64.4 | 14.4 | 58 | 136.4 | 36.7 | 98 | 208.4 | 80.0 | 176 | 348.8 |
| -7.2 | 19 | 66.2 | 15.0 | 59 | 138.2 | 37.2 | 99 | 210.2 | 81.1 | 178 | 352.4 |
| | | | | | | | | | | | |

Square Centimeters → Square Inches (1cm² = 0.155 In.²)

| Square Cm. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| | Sq. In. |
| 0 | | 0.155 | 0.310 | 0.465 | 0.620 | 0.775 | 0.930 | 1.085 | 1.240 | 1.395 |
| 10 | 1.550 | 1.705 | 1.860 | 2.015 | 2.170 | 2.325 | 2.480 | 2.635 | 2.790 | 2.945 |
| 20 | 3.100 | 3.255 | 3.410 | 3.565 | 3.720 | 3.875 | 4.030 | 4.185 | 4.340 | 4.495 |
| 30 | 4.650 | 4.805 | 4.960 | 5.115 | 5.270 | 5.425 | 5.580 | 5.735 | 5.890 | 6.045 |
| 40 | 6.200 | 6.355 | 6.510 | 6.665 | 6.820 | 6.975 | 7.130 | 7.285 | 7.440 | 7.595 |
| 50 | 7.750 | 7.905 | 8.060 | 8.215 | 8.370 | 8.525 | 8.680 | 8.835 | 8.990 | 9.145 |
| 60 | 9.300 | 9.455 | 9.610 | 9.765 | 9.920 | 10.075 | 10.230 | 10.385 | 10.540 | 10.695 |
| 70 | 10.850 | 11.005 | 11.160 | 11.315 | 11.470 | 11.625 | 11.780 | 11.935 | 12.090 | 12.245 |
| 80 | 12.400 | 12.555 | 12.710 | 12.865 | 13.020 | 13.175 | 13.330 | 13.485 | 13.640 | 13.795 |
| 90 | 13.950 | 14.105 | 14.260 | 14.415 | 14.570 | 14.725 | 14.880 | 15.035 | 15.190 | 15.345 |
| 100 | 15.500 | 15.655 | 15.810 | 15.965 | 16.120 | 16.275 | 16.430 | 16.585 | 16.740 | 16.895 |

Square Meters → Square Feet (1m² = 10.76 Ft.²)

| Square Meters | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| | Sq. Ft. |
| 0 | | 10.76 | 21.53 | 32.29 | 43.06 | 53.82 | 64.58 | 75.35 | 86.11 | 96.88 |
| 10 | 107.64 | 118.40 | 129.17 | 139.93 | 150.69 | 161.46 | 172.22 | 182.99 | 193.75 | 204.51 |
| 20 | 215.28 | 226.04 | 236.81 | 247.57 | 258.33 | 269.10 | 279.86 | 290.62 | 301.39 | 312.15 |
| 30 | 322.92 | 333.68 | 344.44 | 355.21 | 365.97 | 376.74 | 387.50 | 398.26 | 409.03 | 419.79 |
| 40 | 430.55 | 441.32 | 452.08 | 462.85 | 473.61 | 484.37 | 495.14 | 505.90 | 516.67 | 527.43 |
| 50 | 538.19 | 548.96 | 559.72 | 570.48 | 581.25 | 592.01 | 602.78 | 613.54 | 624.30 | 635.07 |
| 60 | 645.83 | 656.60 | 667.36 | 678.12 | 688.89 | 699.65 | 710.42 | 721.18 | 731.94 | 742.71 |
| 70 | 753.47 | 764.23 | 775.00 | 785.76 | 796.53 | 807.29 | 818.05 | 828.82 | 839.58 | 850.35 |
| 80 | 861.11 | 871.87 | 882.64 | 893.40 | 904.16 | 914.93 | 925.69 | 936.46 | 947.22 | 957.98 |
| 90 | 968.75 | 979.51 | 990.28 | 1001.04 | 1011.80 | 1022.57 | 1033.33 | 1044.10 | 1054.86 | 1065.62 |
| 100 | 1076.39 | 1087.15 | 1097.92 | 1108.68 | 1119.44 | 1130.21 | 1140.97 | 1151.74 | 1162.50 | 1173.26 |

Cubic Centimeters → Cubic Inches (1cm³ = 0.061 In.³)

| Cubic Cm. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|-----------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| | Cubic Inches |
| 0 | | 0.0610 | 0.1221 | 0.1831 | 0.2441 | 0.3051 | 0.3661 | 0.4272 | 0.4882 | 0.5492 |
| 10 | 0.6102 | 0.6712 | 0.7323 | 0.7933 | 0.8543 | 0.9153 | 0.9763 | 1.0374 | 1.0984 | 1.1594 |
| 20 | 1.2205 | 1.2815 | 1.3426 | 1.4063 | 1.4646 | 1.5256 | 1.5866 | 1.6477 | 1.7087 | 1.7697 |
| 30 | 1.8308 | 1.8918 | 1.9529 | 2.0139 | 2.0749 | 2.1359 | 2.1969 | 2.2580 | 2.3190 | 2.3800 |
| 40 | 2.4410 | 2.5020 | 2.5631 | 2.6241 | 2.6851 | 2.7461 | 2.8071 | 2.8682 | 2.9292 | 2.9902 |
| 50 | 3.0513 | 3.1123 | 3.1734 | 3.2344 | 3.2954 | 3.3564 | 3.4174 | 3.4785 | 3.5395 | 3.6005 |
| 60 | 3.6615 | 3.7225 | 3.7836 | 3.8446 | 3.9056 | 3.9666 | 4.0276 | 4.0887 | 4.1497 | 4.2107 |
| 70 | 4.2718 | 4.3328 | 4.3939 | 4.4549 | 4.5159 | 4.5769 | 4.6379 | 4.6990 | 4.7600 | 4.8210 |
| 80 | 4.8820 | 4.9430 | 5.0041 | 5.0651 | 5.1261 | 5.1871 | 5.2481 | 5.3092 | 5.3702 | 5.4312 |
| 90 | 5.4923 | 5.5533 | 5.6144 | 5.6754 | 5.7364 | 5.7974 | 5.8584 | 5.9195 | 5.9805 | 6.0415 |
| 100 | 6.1025 | 6.1635 | 6.2246 | 6.2856 | 6.3466 | 6.4076 | 6.4686 | 6.5297 | 6.5907 | 6.6517 |

Cubic Metres → Cubic Feet (1m³ = 35.3 Ft.³)

| Cubic Meters | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|--------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | Cubic Feet |
| 0 | | 35.3 | 70.6 | 105.9 | 141.3 | 176.6 | 211.9 | 247.2 | 282.5 | 317.8 |
| 10 | 353.1 | 388.5 | 423.8 | 459.1 | 494.4 | 529.7 | 565.0 | 600.3 | 635.7 | 671.0 |
| 20 | 706.3 | 741.6 | 776.9 | 812.2 | 847.5 | 882.9 | 918.2 | 953.5 | 988.8 | 1024.1 |
| 30 | 1059.4 | 1094.7 | 1130.1 | 1165.4 | 1200.7 | 1236.0 | 1271.3 | 1306.6 | 1341.9 | 1377.3 |
| 40 | 1412.6 | 1447.9 | 1483.2 | 1518.5 | 1553.8 | 1589.2 | 1624.5 | 1659.8 | 1695.1 | 1730.4 |
| 50 | 1765.7 | 1801.0 | 1836.4 | 1871.7 | 1907.0 | 1942.3 | 1977.6 | 2012.9 | 2048.2 | 2083.6 |
| 60 | 2118.9 | 2154.2 | 2189.5 | 2224.8 | 2260.1 | 2295.4 | 2330.8 | 2366.1 | 2401.4 | 2436.7 |
| 70 | 2472.0 | 2507.3 | 2542.6 | 2578.0 | 2613.3 | 2648.6 | 2683.9 | 2719.2 | 2754.5 | 2789.8 |
| 80 | 2825.2 | 2860.5 | 2895.8 | 2931.1 | 2966.4 | 3001.7 | 3037.0 | 3072.4 | 3107.7 | 3143.0 |
| 90 | 3178.3 | 3213.6 | 3248.9 | 3284.2 | 3319.6 | 3354.9 | 3390.2 | 3425.5 | 3460.8 | 3496.1 |
| 100 | 3531.4 | 3566.7 | 3602.0 | 3637.3 | 3672.7 | 3708.0 | 3743.3 | 3778.6 | 3813.9 | 3849.2 |

Kilocalorie → British Thermal Units (1kcal = 3.9683 B. T. U.)

| Kilocalories | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|--------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| | B.T.U. |
| 0 | | 3.968 | 7.937 | 11.905 | 15.873 | 19.841 | 23.810 | 27.778 | 31.746 | 35.714 |
| 10 | 39.683 | 43.651 | 47.619 | 51.587 | 55.556 | 59.524 | 63.497 | 67.460 | 71.429 | 75.391 |
| 20 | 79.365 | 83.333 | 87.302 | 91.270 | 95.238 | 99.206 | 103.175 | 107.143 | 111.111 | 115.079 |
| 30 | 119.048 | 123.016 | 126.984 | 130.952 | 134.921 | 138.889 | 142.857 | 146.825 | 150.794 | 154.762 |
| 40 | 158.730 | 162.698 | 166.667 | 170.635 | 174.603 | 178.571 | 182.540 | 186.508 | 190.476 | 194.444 |
| 50 | 198.413 | 202.381 | 206.349 | 210.317 | 214.286 | 218.254 | 222.222 | 226.190 | 230.159 | 234.127 |
| 60 | 238.095 | 242.063 | 246.032 | 250.000 | 253.968 | 257.936 | 261.905 | 265.873 | 269.841 | 273.809 |
| 70 | 277.778 | 281.746 | 285.714 | 289.682 | 293.651 | 297.619 | 301.587 | 305.555 | 309.524 | 313.492 |
| 80 | 317.460 | 321.428 | 325.397 | 329.365 | 333.333 | 337.301 | 341.270 | 345.238 | 349.206 | 353.174 |
| 90 | 357.143 | 361.111 | 365.079 | 369.047 | 373.016 | 376.984 | 380.952 | 384.920 | 388.889 | 392.857 |
| 100 | 386.250 | 400.793 | 404.762 | 408.730 | 412.698 | 416.666 | 420.635 | 424.603 | 428.571 | 432.539 |

Kilograms → Pounds (1kg = 2.205 lbs.)

| Kilograms | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|-----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | Lbs. |
| 0 | | 2.205 | 4.409 | 6.614 | 8.818 | 11.023 | 13.228 | 15.432 | 17.637 | 19.842 |
| 10 | 22.046 | 24.251 | 26.455 | 28.660 | 30.865 | 33.069 | 35.274 | 37.479 | 39.683 | 41.888 |
| 20 | 44.092 | 46.297 | 48.502 | 50.706 | 52.911 | 55.116 | 57.320 | 59.535 | 61.729 | 63.934 |
| 30 | 66.139 | 68.343 | 70.548 | 72.752 | 74.957 | 77.162 | 79.366 | 81.571 | 83.766 | 85.980 |
| 40 | 88.185 | 90.390 | 92.594 | 94.799 | 97.003 | 99.208 | 101.41 | 103.62 | 105.82 | 108.03 |
| 50 | 110.23 | 112.44 | 114.64 | 116.84 | 119.05 | 121.25 | 123.46 | 125.66 | 127.87 | 130.07 |
| 60 | 132.28 | 134.48 | 136.69 | 138.89 | 141.10 | 143.30 | 145.51 | 147.71 | 149.91 | 152.12 |
| 70 | 154.32 | 156.53 | 158.73 | 160.94 | 163.14 | 165.35 | 167.55 | 169.76 | 171.96 | 174.17 |
| 80 | 176.37 | 178.57 | 180.78 | 182.98 | 185.19 | 187.39 | 189.60 | 191.80 | 194.01 | 196.21 |
| 90 | 198.42 | 200.62 | 202.83 | 205.03 | 207.23 | 209.44 | 211.64 | 213.85 | 216.05 | 218.26 |
| 100 | 220.46 | 222.67 | 224.87 | 227.08 | 229.28 | 231.49 | 233.69 | 235.89 | 238.10 | 240.30 |

Liters → U. S. Gallons (1Lit. = 0.264Gallons)

| Liters | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|--------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| | Gallons |
| 0 | | 0.264 | 0.528 | 0.739 | 1.057 | 1.321 | 1.585 | 1.849 | 2.113 | 2.378 |
| 10 | 2.642 | 2.906 | 3.170 | 3.434 | 3.698 | 3.963 | 4.277 | 4.491 | 4.755 | 5.019 |
| 20 | 5.283 | 5.548 | 5.812 | 6.076 | 6.340 | 6.604 | 6.868 | 7.133 | 7.397 | 7.611 |
| 30 | 7.925 | 8.189 | 8.453 | 8.718 | 8.982 | 9.246 | 9.510 | 9.774 | 10.038 | 10.303 |
| 40 | 10.567 | 10.831 | 11.095 | 11.359 | 11.623 | 11.888 | 12.152 | 12.416 | 12.680 | 12.944 |
| 50 | 13.209 | 13.473 | 13.737 | 14.001 | 14.265 | 14.529 | 14.794 | 15.058 | 15.322 | 15.586 |
| 60 | 15.850 | 16.114 | 16.379 | 16.643 | 16.907 | 17.171 | 17.435 | 17.699 | 17.964 | 18.288 |
| 70 | 18.492 | 18.756 | 19.020 | 19.284 | 19.549 | 19.813 | 20.077 | 20.341 | 20.605 | 20.869 |
| 80 | 21.134 | 21.398 | 21.662 | 21.926 | 22.190 | 22.454 | 22.719 | 22.983 | 23.247 | 23.511 |
| 90 | 23.775 | 24.040 | 24.304 | 24.568 | 24.832 | 25.096 | 25.360 | 25.625 | 25.889 | 26.153 |
| 100 | 26.417 | 26.681 | 26.945 | 27.210 | 27.474 | 27.738 | 28.002 | 28.266 | 28.530 | 28.795 |

Kilograms per Square Centimeter → Pounds per Square Inch (1kg/cm² = 14.22 lbs/in.²)

| Kilograms per Sq. Cm. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|-----------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| | Lbs. Per Sq. In. |
| 0 | | 14.22 | 28.45 | 42.67 | 56.89 | 71.12 | 85.34 | 99.56 | 113.78 | 128.01 |
| 10 | 142.23 | 156.45 | 170.68 | 184.90 | 199.12 | 213.35 | 227.57 | 241.79 | 256.02 | 270.24 |
| 20 | 284.46 | 298.69 | 312.91 | 327.13 | 341.36 | 355.58 | 369.80 | 384.03 | 398.25 | 412.47 |
| 30 | 426.70 | 440.92 | 455.14 | 469.36 | 483.59 | 497.81 | 512.03 | 526.26 | 540.48 | 554.70 |
| 40 | 568.93 | 583.15 | 597.37 | 611.60 | 625.82 | 640.04 | 654.27 | 668.49 | 682.71 | 696.94 |
| 50 | 711.16 | 725.38 | 739.61 | 753.83 | 768.05 | 782.28 | 796.50 | 810.72 | 824.94 | 839.17 |
| 60 | 853.39 | 867.61 | 881.84 | 896.06 | 910.28 | 924.51 | 938.73 | 952.95 | 967.18 | 981.40 |
| 70 | 995.62 | 1009.8 | 1024.1 | 1038.3 | 1052.5 | 1066.7 | 1081.0 | 1095.2 | 1109.4 | 1123.6 |
| 80 | 1137.8 | 1152.1 | 1166.3 | 1180.5 | 1194.7 | 1209.0 | 1223.2 | 1237.4 | 1251.6 | 1265.9 |
| 90 | 1280.1 | 1294.3 | 1308.5 | 1322.7 | 1337.0 | 1351.2 | 1365.4 | 1379.6 | 1393.9 | 1408.1 |
| 100 | 1422.3 | 1436.5 | 1450.8 | 1465.0 | 1479.2 | 1493.4 | 1507.7 | 1521.9 | 1536.1 | 1550.3 |

Millimeters → Inches

| Millimeters | Inches | Millimeters | Inches | Millimeters | Inches |
|-------------|--------|-------------|--------|-------------|--------|
| 0.01 | 0.0004 | 0.35 | 0.0138 | 0.68 | 0.0268 |
| 0.02 | 0.0008 | 0.36 | 0.0142 | 0.69 | 0.0272 |
| 0.03 | 0.0012 | 0.37 | 0.0146 | 0.70 | 0.0276 |
| 0.04 | 0.0016 | 0.38 | 0.0150 | 0.71 | 0.0280 |
| 0.05 | 0.0020 | 0.39 | 0.0154 | 0.72 | 0.0283 |
| 0.06 | 0.0024 | 0.40 | 0.0157 | 0.73 | 0.0287 |
| 0.07 | 0.0028 | 0.41 | 0.0161 | 0.74 | 0.0291 |
| 0.08 | 0.0031 | 0.42 | 0.0165 | 0.75 | 0.0295 |
| 0.09 | 0.0035 | 0.43 | 0.0169 | 0.76 | 0.0299 |
| 0.10 | 0.0039 | 0.44 | 0.0173 | 0.77 | 0.0303 |
| 0.11 | 0.0043 | 0.45 | 0.0177 | 0.78 | 0.0307 |
| 0.12 | 0.0047 | 0.46 | 0.0181 | 0.79 | 0.0311 |
| 0.13 | 0.0051 | 0.47 | 0.0185 | 0.80 | 0.0315 |
| 0.14 | 0.0055 | 0.48 | 0.0189 | 0.81 | 0.0319 |
| 0.15 | 0.0059 | 0.49 | 0.0193 | 0.82 | 0.0323 |
| 0.16 | 0.0063 | 0.50 | 0.0197 | 0.83 | 0.0327 |
| 0.17 | 0.0067 | 0.51 | 0.0201 | 0.84 | 0.0331 |
| 0.18 | 0.0071 | 0.52 | 0.0205 | 0.85 | 0.0335 |
| 0.19 | 0.0075 | 0.53 | 0.0209 | 0.86 | 0.0339 |
| 0.20 | 0.0079 | 0.54 | 0.0213 | 0.87 | 0.0343 |
| 0.21 | 0.0083 | 0.55 | 0.0217 | 0.88 | 0.0346 |
| 0.22 | 0.0087 | 0.56 | 0.0220 | 0.89 | 0.0350 |
| 0.23 | 0.0091 | 0.57 | 0.0224 | 0.90 | 0.0354 |
| 0.24 | 0.0094 | 0.58 | 0.0228 | 0.91 | 0.0358 |
| 0.25 | 0.0098 | 0.59 | 0.0232 | 0.92 | 0.0362 |
| 0.26 | 0.0102 | 0.60 | 0.0236 | 0.93 | 0.0366 |
| 0.27 | 0.0106 | 0.61 | 0.0240 | 0.94 | 0.0370 |
| 0.28 | 0.0110 | 0.62 | 0.0244 | 0.95 | 0.0374 |
| 0.29 | 0.0114 | 0.63 | 0.0248 | 0.96 | 0.0378 |
| 0.30 | 0.0118 | 0.64 | 0.0252 | 0.97 | 0.0382 |
| 0.31 | 0.0122 | 0.65 | 0.0256 | 0.98 | 0.0386 |
| 0.32 | 0.0126 | 0.66 | 0.0260 | 0.99 | 0.0390 |
| 0.33 | 0.0130 | 0.67 | 0.0264 | 1.00 | 0.0394 |
| 0.34 | 0.0134 | | | | |

Inches → Millimeters

| Inches | Millimeters | Inches | Millimeters | Inches | Millimeters |
|--------|-------------|--------|-------------|--------|-------------|
| 0.001 | 0.025 | 0.290 | 7.37 | 0.860 | 16.76 |
| 0.002 | 0.051 | 0.300 | 7.62 | 0.670 | 17.02 |
| 0.003 | 0.076 | 0.310 | 7.87 | 0.680 | 17.27 |
| 0.004 | 0.102 | 0.320 | 8.13 | 0.690 | 17.53 |
| 0.005 | 0.127 | 0.330 | 8.38 | 0.700 | 17.78 |
| 0.006 | 0.152 | 0.340 | 8.64 | 0.710 | 18.03 |
| 0.007 | 0.178 | 0.350 | 8.89 | 0.720 | 18.29 |
| 0.008 | 0.203 | 0.360 | 9.14 | 0.730 | 18.54 |
| 0.009 | 0.229 | 0.370 | 9.40 | 0.740 | 18.80 |
| 0.010 | 0.254 | 0.380 | 9.65 | 0.750 | 19.05 |
| 0.020 | 0.508 | 0.390 | 9.91 | 0.760 | 19.30 |
| 0.030 | 0.762 | 0.400 | 10.16 | 0.770 | 19.56 |
| 0.040 | 1.016 | 0.410 | 10.41 | 0.780 | 19.81 |
| 0.050 | 1.270 | 0.420 | 10.67 | 0.790 | 20.07 |
| 0.060 | 1.524 | 0.430 | 10.92 | 0.800 | 20.32 |
| 0.070 | 1.778 | 0.440 | 11.18 | 0.810 | 20.57 |
| 0.080 | 2.032 | 0.450 | 11.43 | 0.820 | 20.83 |
| 0.090 | 2.286 | 0.460 | 11.68 | 0.830 | 21.08 |
| 0.100 | 2.540 | 0.470 | 11.94 | 0.840 | 21.34 |
| 0.110 | 2.794 | 0.480 | 12.19 | 0.850 | 21.59 |
| 0.120 | 3.048 | 0.490 | 12.45 | 0.860 | 21.84 |
| 0.130 | 3.302 | 0.500 | 12.70 | 0.870 | 22.10 |
| 0.140 | 3.56 | 0.510 | 12.95 | 0.880 | 22.35 |
| 0.150 | 3.81 | 0.520 | 13.21 | 0.890 | 22.61 |
| 0.160 | 4.06 | 0.530 | 13.46 | 0.900 | 22.86 |
| 0.170 | 4.32 | 0.540 | 13.72 | 0.910 | 23.11 |
| 0.180 | 4.57 | 0.550 | 13.97 | 0.920 | 23.37 |
| 0.190 | 4.83 | 0.560 | 14.22 | 0.930 | 23.62 |
| 0.200 | 5.08 | 0.570 | 14.48 | 0.940 | 23.88 |
| 0.210 | 5.33 | 0.580 | 14.73 | 0.950 | 24.13 |
| 0.220 | 5.59 | 0.590 | 14.99 | 0.960 | 24.38 |
| 0.230 | 5.84 | 0.600 | 15.24 | 0.970 | 24.64 |
| 0.240 | 6.10 | 0.610 | 15.49 | 0.980 | 24.89 |
| 0.250 | 6.35 | 0.620 | 15.75 | 0.990 | 25.15 |
| 0.260 | 6.60 | 0.630 | 16.00 | 1.000 | 25.40 |
| 0.270 | 6.86 | 0.640 | 16.26 | | |
| 0.280 | 7.11 | 0.650 | 16.51 | | |

Fractional Inches → Decimals and Millimeters

| Inch | Decimal Inch | Millimeter |
|-------|--------------|------------|-------|--------------|------------|-------|--------------|------------|-------|--------------|------------|
| 1/64 | 0.015525 | 0.396785 | 17/64 | 0.205823 | 5.746375 | 33/64 | 0.515625 | 13.096875 | 49/64 | 0.765625 | 19.446875 |
| 1/32 | 0.03125 | 0.79375 | 9/32 | 0.28125 | 7.14375 | 17/32 | 0.53125 | 13.49375 | 25/32 | 0.78125 | 19.84375 |
| 3/64 | 0.046875 | 1.190625 | 19/64 | 0.296875 | 7.540625 | 35/64 | 0.546875 | 13.890625 | 51/64 | 0.796875 | 20.240625 |
| 1/16 | 0.0625 | 1.5875 | 5/16 | 0.3125 | 7.9375 | 9/16 | 0.5625 | 14.2875 | 13/16 | 0.8125 | 20.6375 |
| 5/64 | 0.078125 | 1.984375 | 21/64 | 0.328125 | 8.334375 | 37/64 | 0.578125 | 14.684375 | 53/64 | 0.828125 | 21.034375 |
| 3/32 | 0.09375 | 2.38125 | 11/32 | 0.34375 | 8.73125 | 19/32 | 0.59375 | 15.08125 | 27/32 | 0.84375 | 21.43125 |
| 7/64 | 0.109375 | 2.778125 | 23/64 | 0.359375 | 9.128125 | 39/64 | 0.609375 | 15.478125 | 55/64 | 0.859375 | 21.828125 |
| 1/8 | 0.125 | 3.175 | 3/8 | 0.375 | 9.525 | 5/8 | 0.625 | 15.875 | 7/8 | 0.875 | 22.225 |
| 9/64 | 0.140625 | 3.571875 | 25/64 | 0.390625 | 9.921875 | 41/64 | 0.640625 | 16.271875 | 57/64 | 0.890625 | 22.621875 |
| 5/32 | 0.15625 | 3.96875 | 13/32 | 0.40625 | 10.31875 | 21/32 | 0.65625 | 16.66875 | 29/32 | 0.90625 | 23.01875 |
| 11/64 | 0.171875 | 4.365625 | 27/64 | 0.421875 | 10.715625 | 43/64 | 0.671875 | 17.065625 | 59/64 | 0.921875 | 23.415625 |
| 3/16 | 0.1875 | 4.7625 | 7/16 | 0.4375 | 11.1125 | 11/16 | 0.6875 | 17.4625 | 15/16 | 0.9375 | 23.8125 |
| 13/64 | 0.203125 | 5.159375 | 29/64 | 0.453125 | 11.509375 | 45/64 | 0.703125 | 17.859375 | 61/64 | 0.953125 | 24.209375 |
| 7/32 | 0.21875 | 5.55624 | 15/32 | 0.46875 | 11.90625 | 23/32 | 0.71875 | 18.25625 | 31/32 | 0.96875 | 24.60625 |
| 15/64 | 0.234375 | 5.953125 | 31/64 | 0.484375 | 12.303125 | 47/64 | 0.734375 | 18.653125 | 63/64 | 0.984375 | 25.003125 |
| 1/4 | 0.25 | 6.35001 | 1/2 | 0.50 | 12.7 | 3/4 | 0.75 | 19.05 | 1 | 1.00000 | 25.4 |





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