SERVICE MANUAL

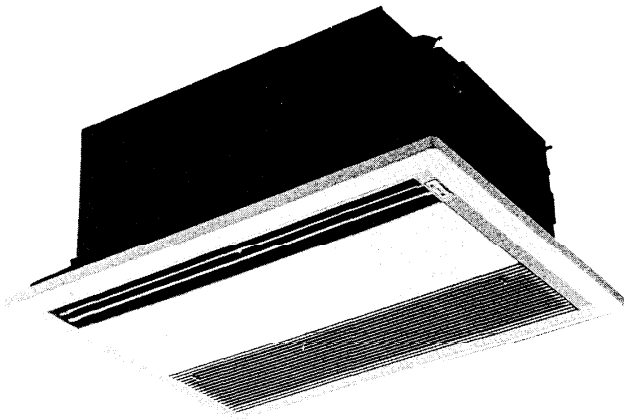
SANYO

SAP120RCH (USA)

SPLIT SYSTEM HEAT PUMP

Mar. 1988

MODEL NO.	PRODUCT CODE NO.	VOLT - PHASE - HERTZ
SAP 120RH	85264433	115 - 1 - 60
SAP 120CH	85274193	115 - 1 - 60



SAP120RH

Indoor Unit

SAP120CH

Outdoor Unit

Table of Contents

REFERENCE No. WM-22131

1. SPECIFICATIONS

(1) Unit Specifications

Model No.			SAP120RCH	
Unit Model No.	Indoor unit		SAP120RH	
	Outdoor unit		SAP120CH	
PERFORMANCE & ELECTRICAL RATINGS			Cooling	Heating
Capacity		BTU/hr.	11,200	12,000
Air circulation (High)		Cu.ft/min.	300	
Moisture removal (High)		Pints/hr	3.2	—
SEER		BTU/whr.	9.2	—
COP			—	2.75
Phase			Single	
Frequency		Hz	60	
Rated voltage		V	115	
Running amperes		A	11.7	11.5
Power input		W	1,280	1,275
Back-up heater		kW		
Fuse (or Circuit breaker) capacity		A	15	
FEATURES				
Controls			Microcomputer	
Fan speeds	Indoor fan		3	
	Outdoor fan		1	
Timer			ON/OFF 12 hours	
Ventilator			—	
Air deflection	Horizontal		Manual	
	Vertical		Manual	
Air filter			Washable, easy access	
Temperature control			IC thermostat (Microcomputer)	
Compressor			Rotary	
Refrigerant (R22)		lbs. (g)	3.04 (1,380)	
Compressor oil		cc	650	
Refrigerant tubing connections			Flare type	
Refrigerant control			Capillary tube	
Max. refrigerant line length		ft (m)	65 (20)	
Max. outdoor unit height		ft (m)	23 (7)	
Refrigerant tube o.d.	Narrow tube	In. (mm)	1/4 (6.35)	
	Wide tube	In. (mm)	1/2 (12.7)	
Drain pipe o.d.	(PVC pipe)	In. (mm)	3/4 (26.67)	
Refrigerant tube kit			Optional	
Accessories			Mounting bracket	
DIMENSIONS & WEIGHT			Indoor unit	Outdoor unit
Height		In. (mm)	12-5/8 (320)	20-7/8 (530)
Width		In. (mm)	31–29/32 (810)	29-17/32 (750)
Depth		In. (mm)	24–13/32 (620)	11-1/32 (280)
Net weight		lbs. (kg)	68.2 (30.9)	92.6 (42)
Shipping size		Cu.ft (Cu.m)	11.7 (0.33)	6.7 (0.18)
Shipping weight		lbs. (kg)	99 (44.9)	94.6 (42.9)

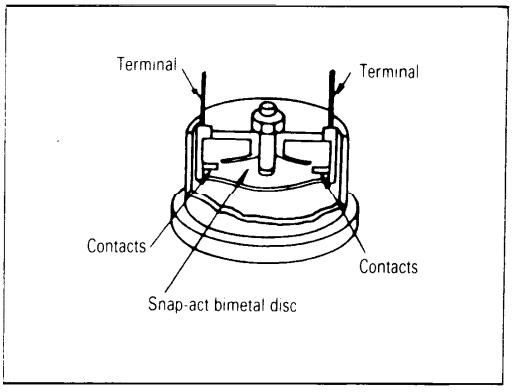
DATA SUBJECT TO CHANGE WITHOUT NOTICE.

(2) Major Component Specifications

Unit Model No.			SAP120CH	
COMPRESSOR			Hermetic rotary type	
Compressor Model No.			C-R90H2S	
Source			115 V, 60 Hz, single phase	
Pole			2	
Nominal output		W (H.P.)	900 (1-3/16)	
Displacement		cc/rev.	17.5	
Ampere	Full load	A	11.2	
	Locked rotor	A	60	
Type of oil			Special oil for rotary compressor	
Compressor oil amount		cc	650	
Coil resistance (Ambient temperature 77°F)		Ω	C-R : 0.58 C-S : 2.80	
Protective device			External line break overload relay	
Run capacitor	MFD		35	
	VAC		330	
Unit Model No.			SAP120RH	SAP120CH
FAN MOTOR			Capacitor run induction motor	
Fan Motor Model No.			KFH6Q-31A1P	FT6-21C1PE
Source			115 V, 60 Hz, single phase	
Pole			6	
Nominal output		W (H.P.)	30 (1/32)	20 (1/32)
Ampere	Full load	A	0.82	0.69
	Locked rotor	A	1.14	0.79
Protective device			Internal protector (9700K-01-215)	Internal protector (9700K211-215)
Run capacitor	MFD		8	8
	VAC		220	
Coil resistance (Ω) at 68 °F			BLU-BRN : 40.3 BLU-VLT : 15.3 VLT-GRY : 13.9 YEL-GRY : 175.4 BLU-PNK : 49.3	BLU-BRN : 62.5 BLU-PNK : 59.1

Unit Model No.		SAP120CH
OVERLOAD RELAY, COMPRESSOR		
Dome Mount No.		MRA98693-9200
Temperature	Operating	329 ± 9°F
	Reset	156 ± 20°F
Ampere at 77°F (Cold Start)		Operates within 6-16 sec. at 43.0A
Ampere at 176°F (Cold Start)		Should not operate for 30 min. at 29.8A
Reset		Automatic

External Line Break Overload Relay



Major Component Specifications

Unit Model No.	SAP120RH	
Indoor Coil Temperature Sensor	NTC-51H-S4	
Resistance (kΩ)	32°F: 186 ~ 177 50°F: 112 ~ 107 68°F: 70 ~ 67	86°F: 45 ~ 43 122°F: 20 ~ 19 140°F: 13.8 ~ 13.5

Figure

Unit Model No.	SAP120RH
Room Temperature Sensor	OCS5K – UL
Resistance (kΩ)	69°F: 6 – 6.5 77°F: 4.9 – 5.2 86°F: 3.9 – 4.2

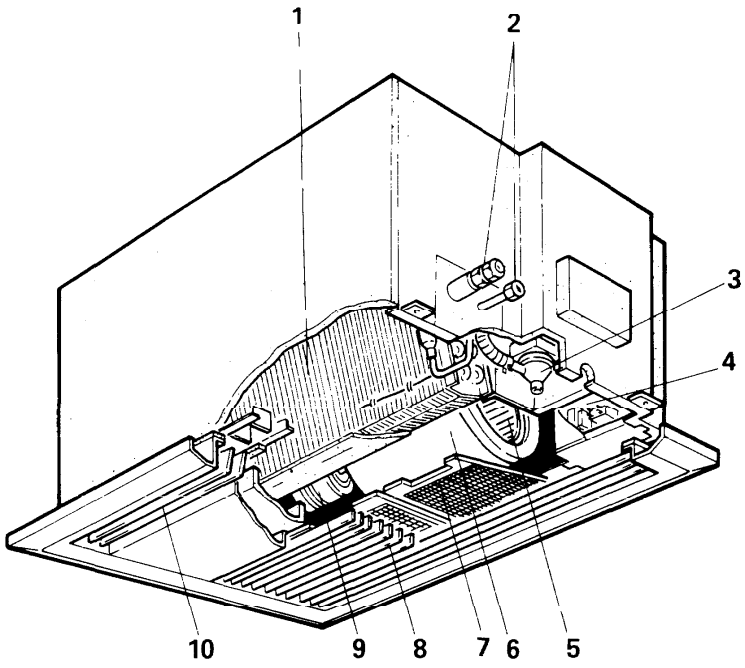
Incorporated in the remote control unit

Unit Model No.	SAP120CH
Outdoor Coil Temperature Sensor	TRS-12M160UL
Characteristics	OFF: 39°F ON: 54°F±4°F Difference: 14.4°F

Figure

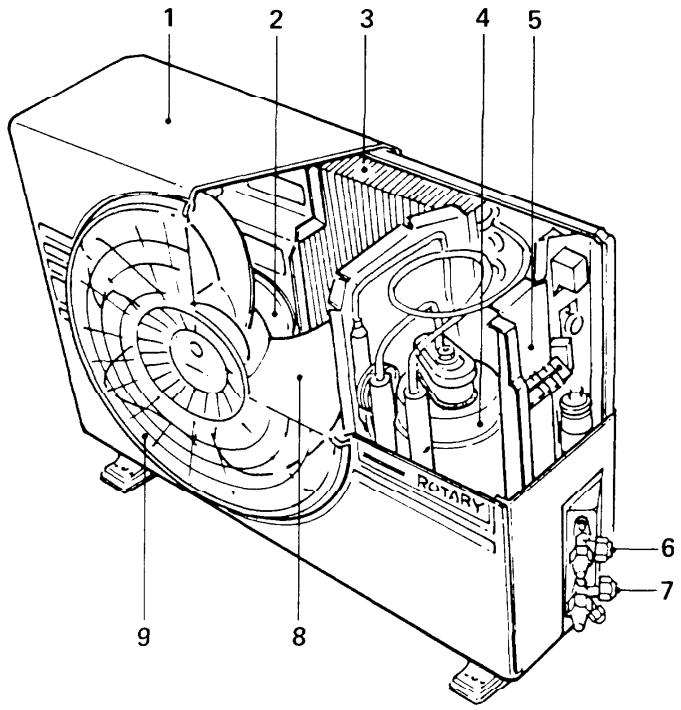
2. CONSTRUCTION OF THE UNIT

INDOOR UNIT SAP120RH



1. Indoor heat exchanger
2. Refrigerant tubing
3. Drain pump
4. Electrical component box
5. Centrifugal fan
6. Fan casing
7. Air filter
8. Air intake grille
9. Fan motor
10. Air discharge grille

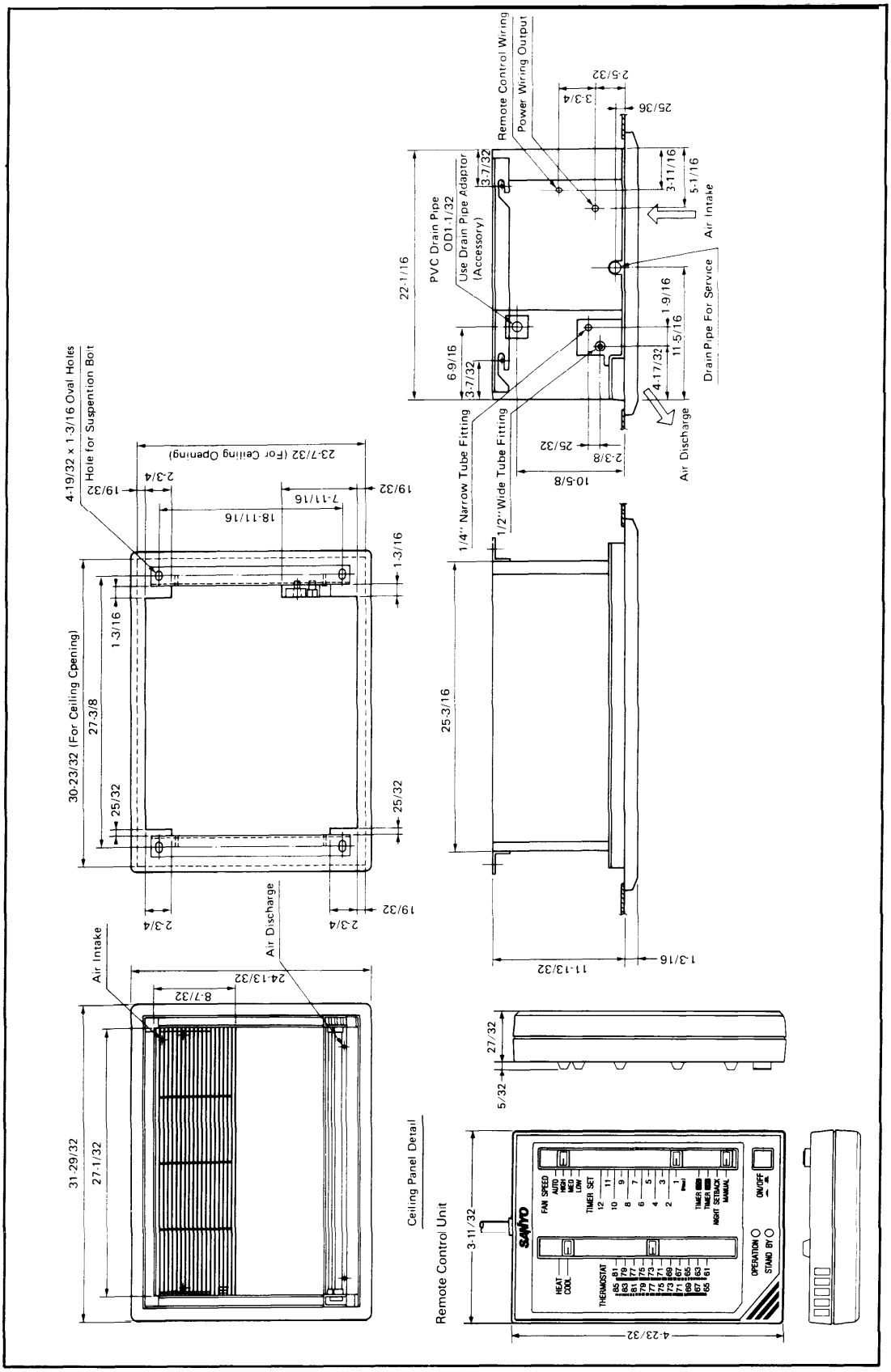
OUTDOOR UNIT SAP120CH



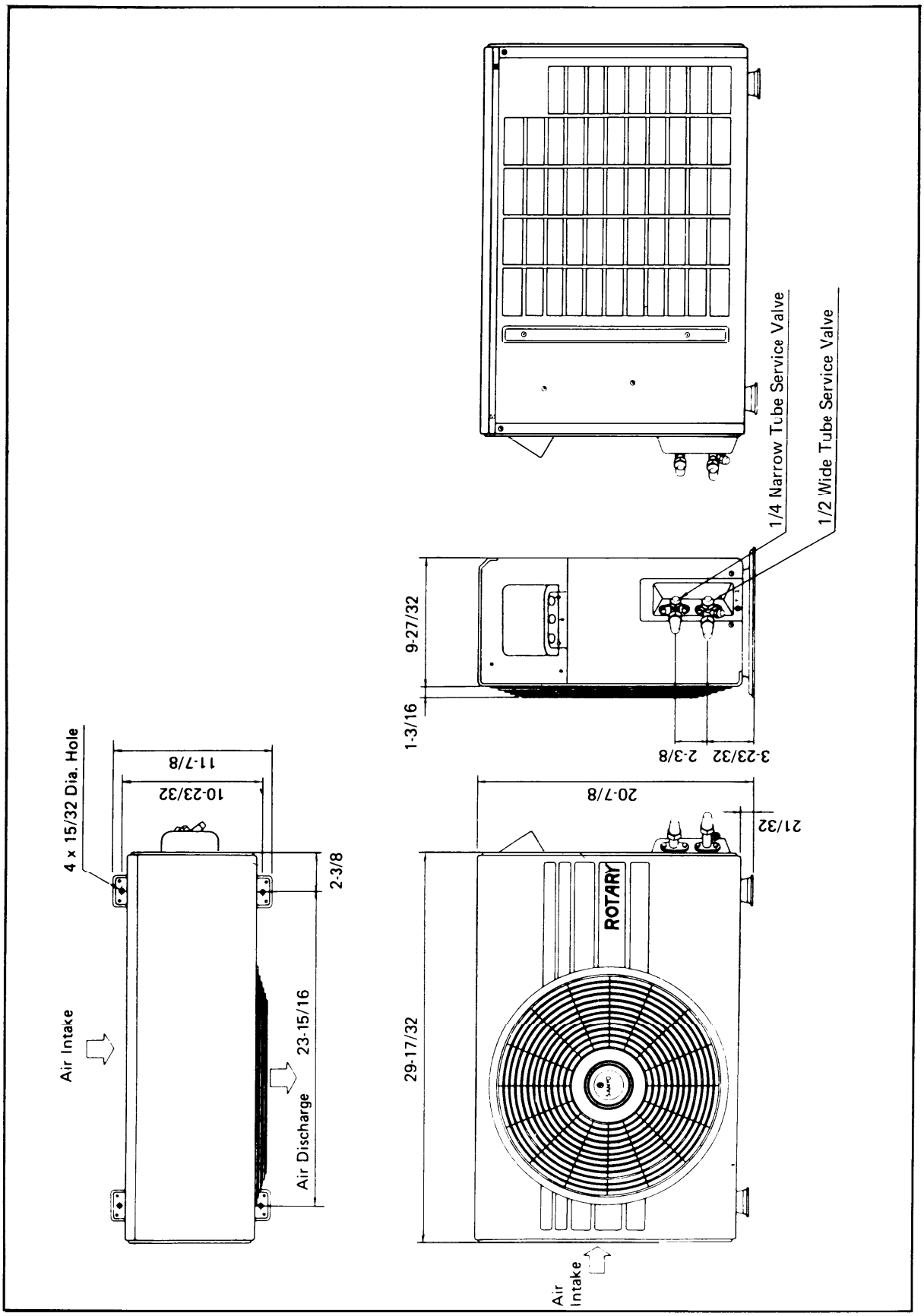
1. Cabinet
2. Fan motor
3. Outdoor heat exchanger
4. Compressor
5. Electrical component box
6. Service valve (Narrow tube)
7. Service valve (Wide tube)
8. Propeller fan
9. Fan guard

3. DIMENSIONAL DATA

Indoor Unit SAP120RH



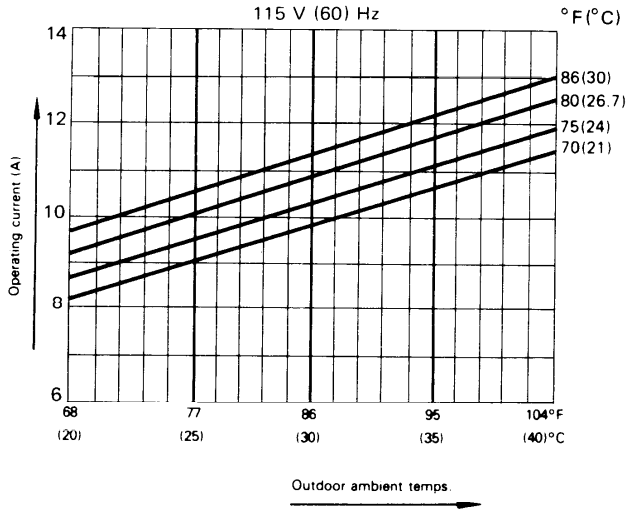
OUTDOOR UNIT SAP120CH



4. PERFORMANCE CHARTS

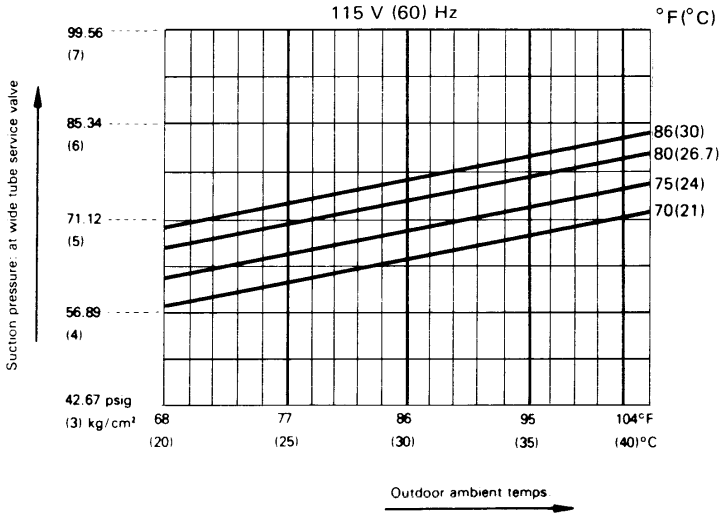
Cooling characteristics

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.)



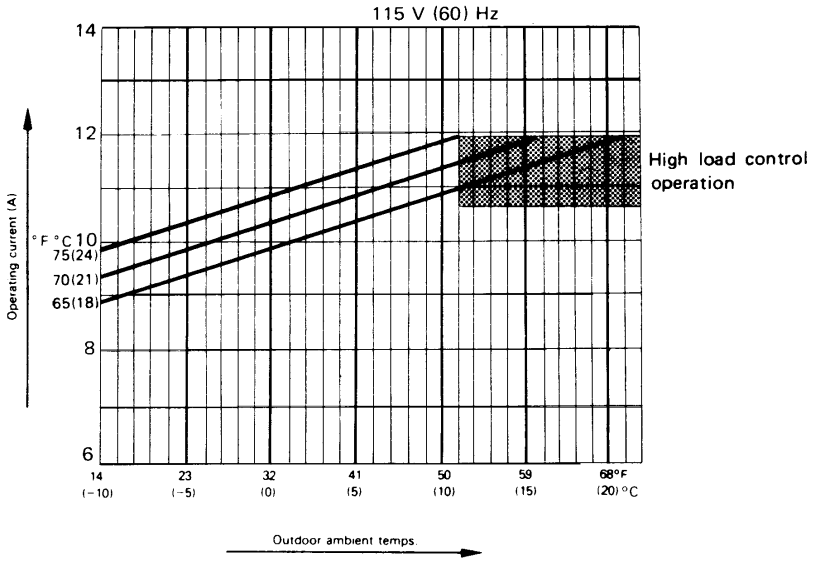
Cooling characteristics

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



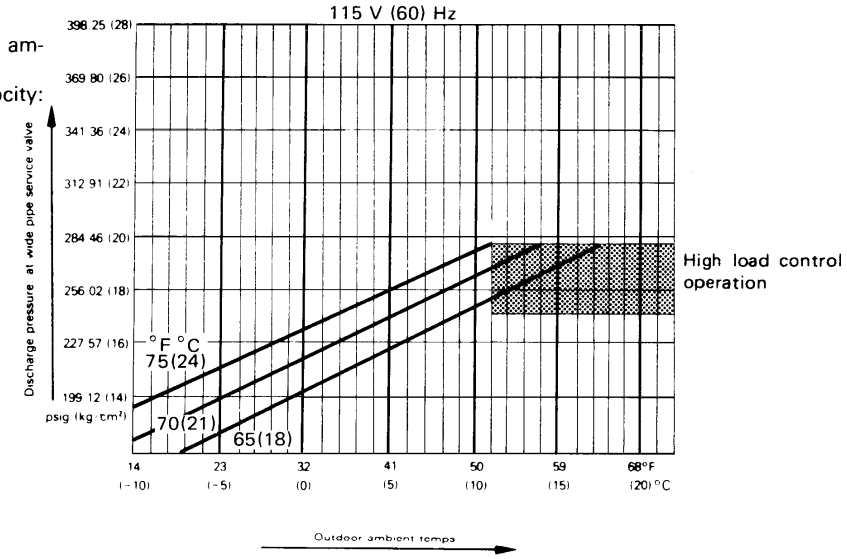
Heating characteristics

Operating current characteristics versus outdoor ambient temperature and indoor temperature
(Indoor relative humidity: 75%, indoor air velocity: High, overall value for indoor and outdoor shown.)
(However, the heater shall be excluded.)



Heating characteristics

Low pressure characteristics versus outdoor ambient temperature and indoor temperature
(Indoor relative humidity: 75%, indoor air velocity: High.)



NOTE

High load prevention

1. The shaded part indicates ON/OFF operation status for the outdoor fan by operation of the high load prevention function, and current and pressure vary over this width.
2. Please note that the characteristics of the shaded part may vary somewhat.

5. OPERATING INSTRUCTIONS

Controls and Indicators

A. OPERATION ON/OFF

To start the heat pump, press this button so that it locks. To stop the heat pump, press the button again so that it releases.

B. OPERATION LAMP

This lamp lights when the system is in operation.

C. STANDBY LAMP

This lamp lights in the following cases:

1. When the heat pump is in HEAT mode (when the indoor coil is not warm enough).
2. While the defrosting system is working.

D. THERMOSTAT

This automatically turns the heat pump on and off to keep the room at a comfortable temperature. The lower the number you select, the cooler the room will be.

E. HEAT/COOL SELECTOR

Use this control to select the desired operating mode.

F. FAN SPEED

Use this control to select the desired fan speed.

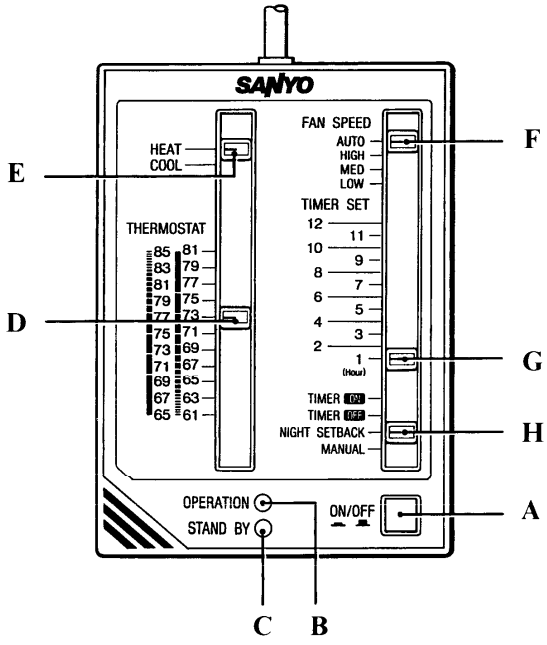
Programmed operation	Non-programmed operation
AUTO	HIGH: High Speed MED: Medium Speed LOW: Low Speed

G. TIMER SET

This control is used to set the time at which you wish the air conditioner to go on or off. Each number on the scale shows setting hour.

H. SELECTOR ("SELECTOR" is not shown)

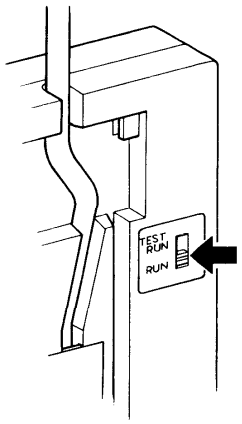
TIMER ON	Used to start the system at the set time. Refer to page 12.
TIMER OFF	Used to stop the system at the set time. Refer to page 12.
NIGHT SETBACK	Used for programmed energy saving operation.
MANUAL	Used for conventional temperature control operation using the thermostat.



Service TEST RUN switch *

This switch is a service switch for the heat pump. Do not touch it, therefore.

During normal operation, this switch must be set in the RUN position. If the heat pump is used with the switch in the TEST RUN position, it will not operate normally.



* The Service TEST RUN switch is located at the back of the control unit.

Operation

COOLING

1. Manual Cooling

The Manual mode is used for normal cooling operation.

STEP 1: Set the HEAT/COOL selector to COOL.

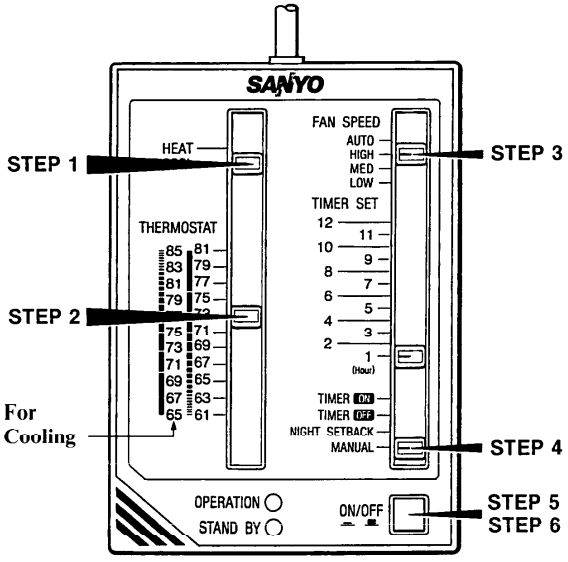
STEP 2: Set the THERMOSTAT to the desired temperature.

STEP 3: Set the FAN SPEED as desired.

STEP 4: Set the SELECTOR to MANUAL.

STEP 5: Press the ON/OFF button to start the heat pump.

STEP 6: *To stop*, press the button again.

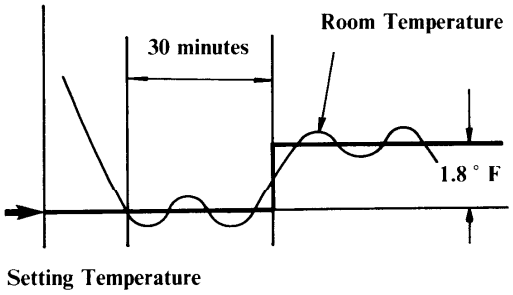


NOTE

To protect the compressor from overloading, a 3-minute time delay circuit is built into the heat pump. The compressor starts running after 3 minutes when the operation ON button is pressed.

2. Night Setback Mode in Cooling

By selecting this mode then pressing the OPERATION ON/OFF button, the heat pump will perform cooling operation until the temperature in the room reaches the set value, then the thermostat will cause the unit to stop. After about half an hour, the heat pump will automatically raise the set temperature 1.8 °F as shown in the diagram on the right. This enables you to save energy without sacrificing comfort. This function is convenient for when leaving the system on all night.



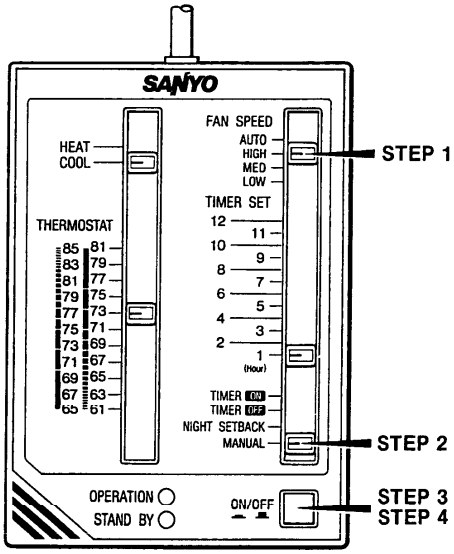
STEP 1: Set the SELECTOR to NIGHT SETBACK before turning the system on.

STEP 2: Press the OPERATION ON/OFF button to start the heat pump.

To cancel the Night Setback mode, move the selector to MANUAL. The heat pump will first stop, then after 3 minutes normal cooling operation will automatically start.

Operation

ADJUSTING THE FAN SPEED



1. Manual

STEP 1: Set the FAN SPEED control as desired. (HIGH, MED., or LOW).

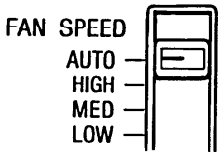
STEP 2: Set the SELECTOR to "MANUAL".

STEP 3: Press the OPERATION ON/OFF button so that it locks.

STEP 4: *To stop*, press the button again.

2. Automatic

Simply set the FAN SPEED selector to the "AUTO" position.



A microcomputer in the heat pump automatically controls the fan speed when the AUTO mode is selected. When the heat pump starts operating, the difference between the room temperature and the set temperature is detected by the microcomputer which then automatically switches the fan speed to the most suitable level.

Cooling

When difference between room temperature and set temperature is	FAN SPEED
3.6 °F and over	HIGH
Between 3.6 °F and 1.8 °F	MED.
Below 1.8 °F	LOW

Heating

When difference between room temperature and set temperature is	FAN SPEED
1.8 °F and over	HIGH
Below 1.8 °F	MED.

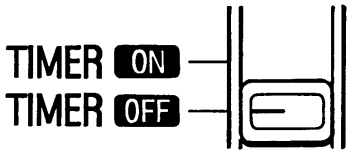
Operation

USING THE TIMER

1. Timer Off Mode

The system stops at the set time.

STEP 1: Set the SELECTOR to TIMER OFF.



STEP 2: Set the TIMER SET control to the desired time.

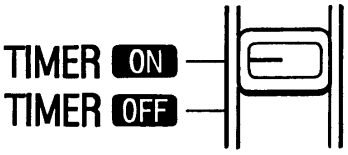
When the timer is set to 6, for instance, the system stops after six hours.

STEP 3: Press the OPERATION ON/OFF button so that it locks.

2. Timer On Mode

The system starts at the set time.

STEP 1: Set the SELECTOR to TIMER ON.



STEP 2: Set the TIMER SET control to the desired time.

When the timer is set to 6, for instance, the system starts after six hours.

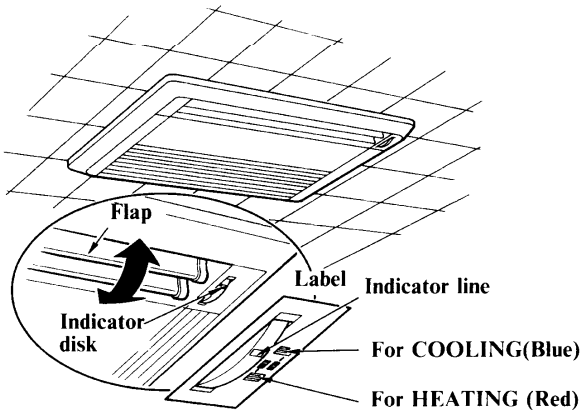
STEP 3: Press the OPERATION ON/OFF button so that it locks.

ADJUSTING THE AIR FLOW DIRECTION

Hold the flap and move it up and down to adjust the orientation of the air flow.
By moving the flap, the line engraved on the rim of the disk will move up and down.

When performing cooling operation, manually adjust the angle of the flap so that the indicator is in line with the blue rectangular mark on the label.

When performing heating operation, adjust the flap so that the indicator is line with the red rectangular mark.



Operation

HEATING

1. Manual Heating

The Manual mode is used for normal heating operation.

STEP 1: Set the HEAT/COOL selector to HEAT.

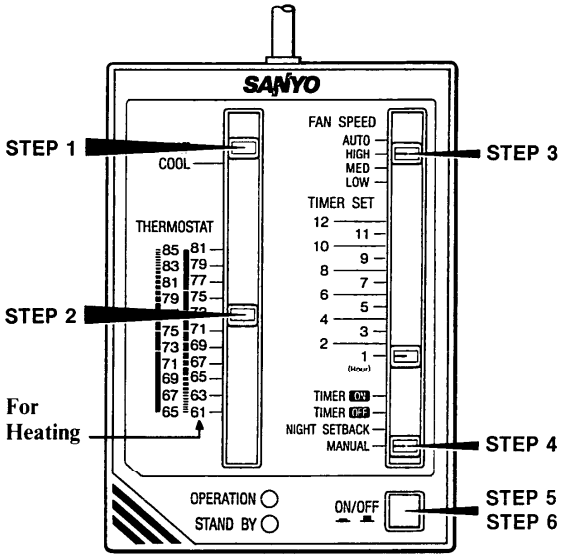
STEP 2: Set the THERMOSTAT to the desired temperature.

STEP 3: Set the FAN SPEED as desired.

STEP 4: Set the SELECTOR to MANUAL

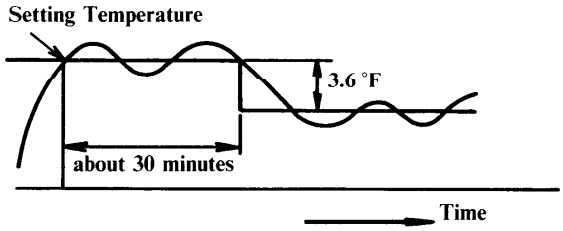
STEP 5: Press the ON/OFF button to start the heat pump.

STEP 6: *To stop*, press the button again.



2. Night Setback Mode in Heating

By selecting this mode then pressing the OPERATION ON/OFF button, the heat pump will perform heating operation until the temperature in the room reaches the set value, then the thermostat will cause the unit to stop. After about half an hour, the heat pump will automatically go down the set temperature 3.6 °F as shown in the diagram below. This enables you to save energy without sacrificing comfort.
This function is convenient for when leaving the heat pump on all night.



STEP 1: Set the SELECTOR to NIGHT SETBACK before turning the system on.

STEP 2: Press the OPERATION ON/OFF button.

SPECIAL REMARKS ON HEATING

Heating Performance

If the outdoor temperature is very low, the heat pump will not work so well, as it absorbs its heat from the outside air.

Defrosting

If the outdoor temperature is low and frost forms on the heat exchanger coil, a built-in defrosting system operates. At the same time, the fan speed on the indoor unit rotates at very low speed and the STANDBY lamp remains lit until defrosting is completed. Heating operation restarts after several minutes, depending on the outdoor temperature and the amount and type of frost.

Warming up

When the heat pump is switched on, in heating mode, the indoor fan will start running at very low speed until the indoor heat exchanger coil has warmed up. This takes several minutes. During which time the STANDBY lamp remains lit.

6. INSTALLATION INSTRUCTIONS

1. 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.

DO:
- select an appropriate position from which every corner of the room can be uniformly cooled.
- 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.
- allow room for operation and maintenance as well as unrestricted air flow around the unit. Fig. 1
- 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.

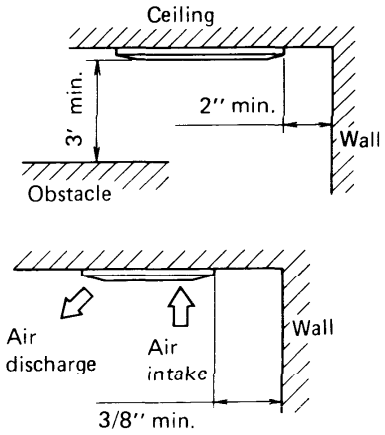


Fig. 1

Outdoor Unit :

AVOID:
- heat sources, exhaust fans, etc., Fig. 2
- 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. 3
- provide a solid base; about 4" above ground level to reduce humidity and possible water damage in unit and decrease service life. Fig. 4
- use lug bolts or equal to bolt down unit, reducing vibration and noise.

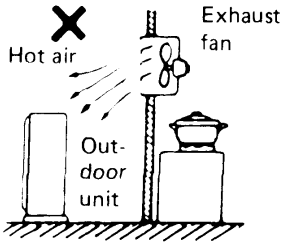


Fig. 2

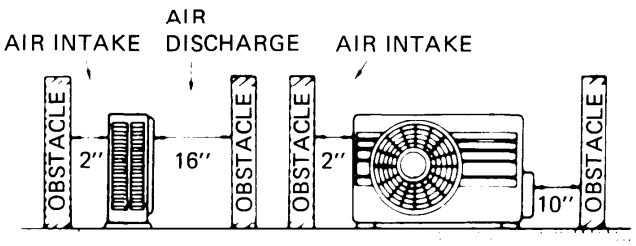


Fig. 3

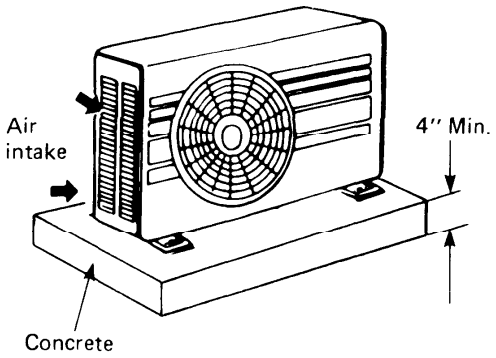


Fig. 4

2. Connecting tube 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 430 ~ 470 lb.

   Flare nut small dia. tube should be torqued to 130 ~ 170 lb. in. Fig. 5.
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. 6 (Accessories parts (1) ~ (3))

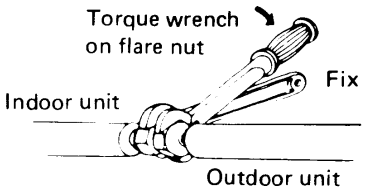


Fig. 5

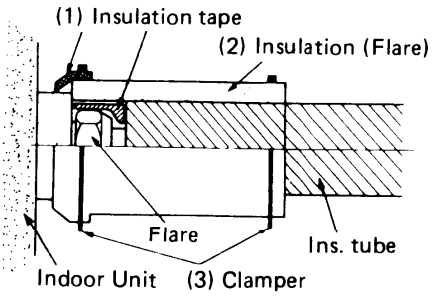


Fig. 6

3. Insulation of Refrigerant Tubes

Because the capillary tubes are 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 condensation both tubes must be well insulated with proper insulation material. Thickness of insulation material should be min. 5/16". Fig. 7.

- **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.

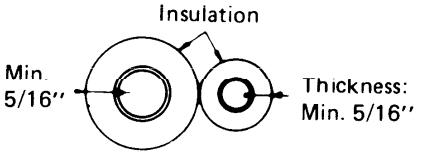


Fig. 7

4. Wiring Instructions on Outdoor Unit

a) To remove the access panel, remove 4 screws.
b) Dismount plugs on the conduit plate.
c) Temporarily mount conduit tubes on the conduit plate.
d) Properly connect power supply mains and interunit lines to corresponding terminals on the terminal block.
Refer to the wiring diagram in Fig. 8, which is labelled on the access panel.

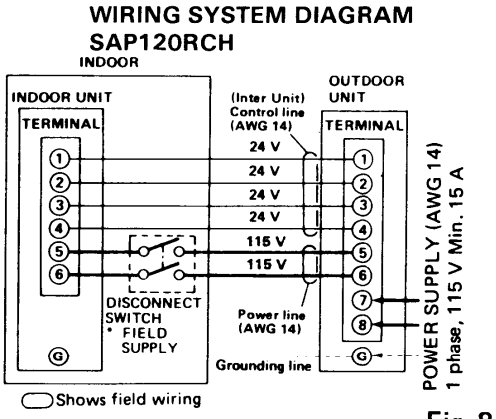


Fig. 8

e) When connections are completed secure both connectors on the panel with lock nuts and then close the panel. Fig. 9.

NOTE: Connector trade size for this unit is 1/2", which is available in a hardware store.

f) 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 piping, compressor or any moving part.

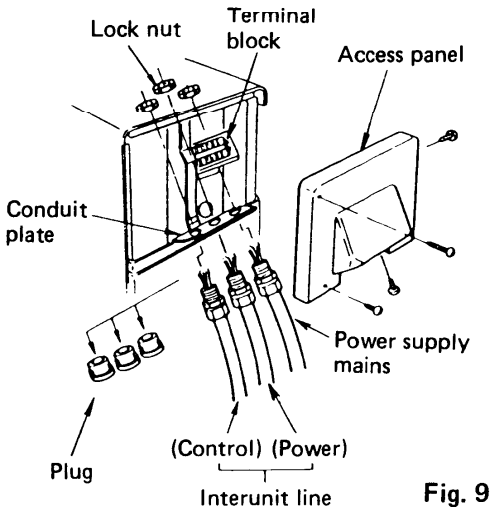


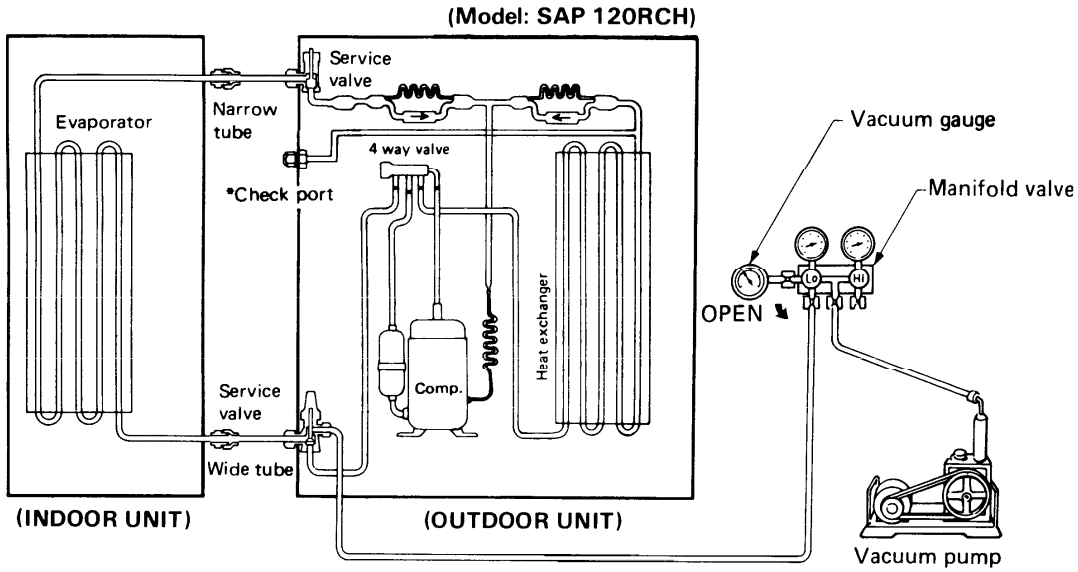
Fig. 9

5. 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 mentioned below. Therefore, they must be purged completely.

- The pressure on the narrow pipe 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



Air Purging Procedure (conventional evacuation system) **Fig. 10**

a) Check gas leakage of all joints with liquid soap. Fig. 11.

b) If no gas leakage is confirmed, connect both vacuum pump and vacuum gauge to service valve through 1/4" port with a flare nut. Fig. 10.

c) Next, run the vacuum pump until the pressure reaches to 1.5 mmHg abs. or less valve than that.

d) Close the low pressure side knob on the gauge manifold valve and stop evacuation.

e) Remove the cap from the gas line service valve and turn the spindle gradually until it is back seated. Fig. 12.

f) Disconnect vacuum pump and gauge manifold valve from the service valve. Then replace bonnet and flare nut to 1/4" ports of service valve.

g) The stem of liquid line service valve shall be fully back seated. Then, tighten the valve seal cap with the copper gasket.

h) The all air purge procedure has been completed and the unit is ready for trial operation.

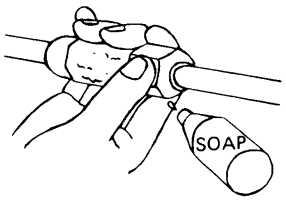


Fig. 11

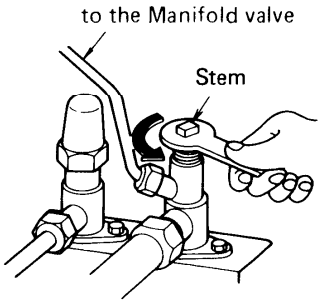


Fig. 12

■ 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. (Fig. 13-a)

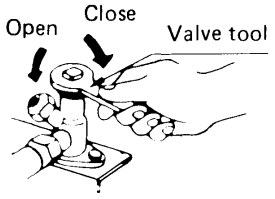
- **Valve Position -b-**
  The valve stems of both wide & narrow tubes are turned all the way out ("BACK SEAT" position). This is the normal operating position. (Fig. 13-b)

- **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. 13-c)

- **Valve Position -d-**
  Like position -a-, but with the flare nut of wide tube open. This position is used for air purging. (Fig. 13-d)

CAUTION :

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



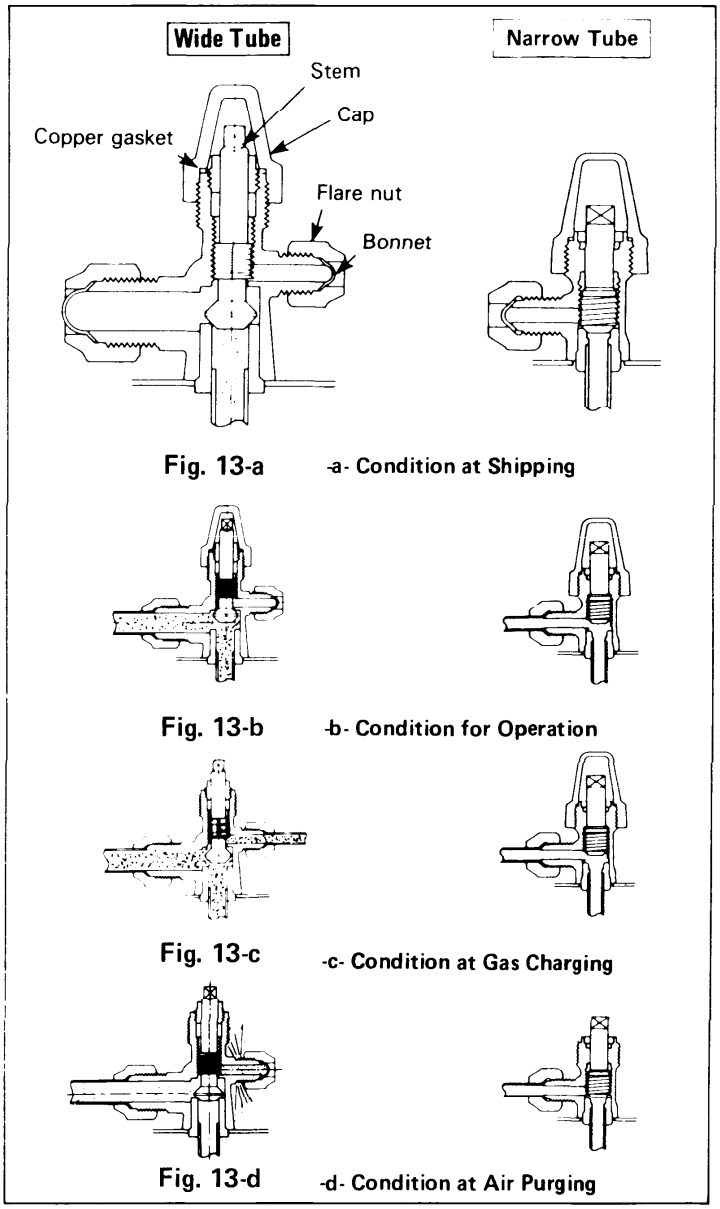


Fig. 13-a -a- Condition at Shipping

Fig. 13-b -b- Condition for Operation

Fig. 13-c -c- Condition at Gas Charging

Fig. 13-d -d- Condition at Air Purging

■ 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.

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.

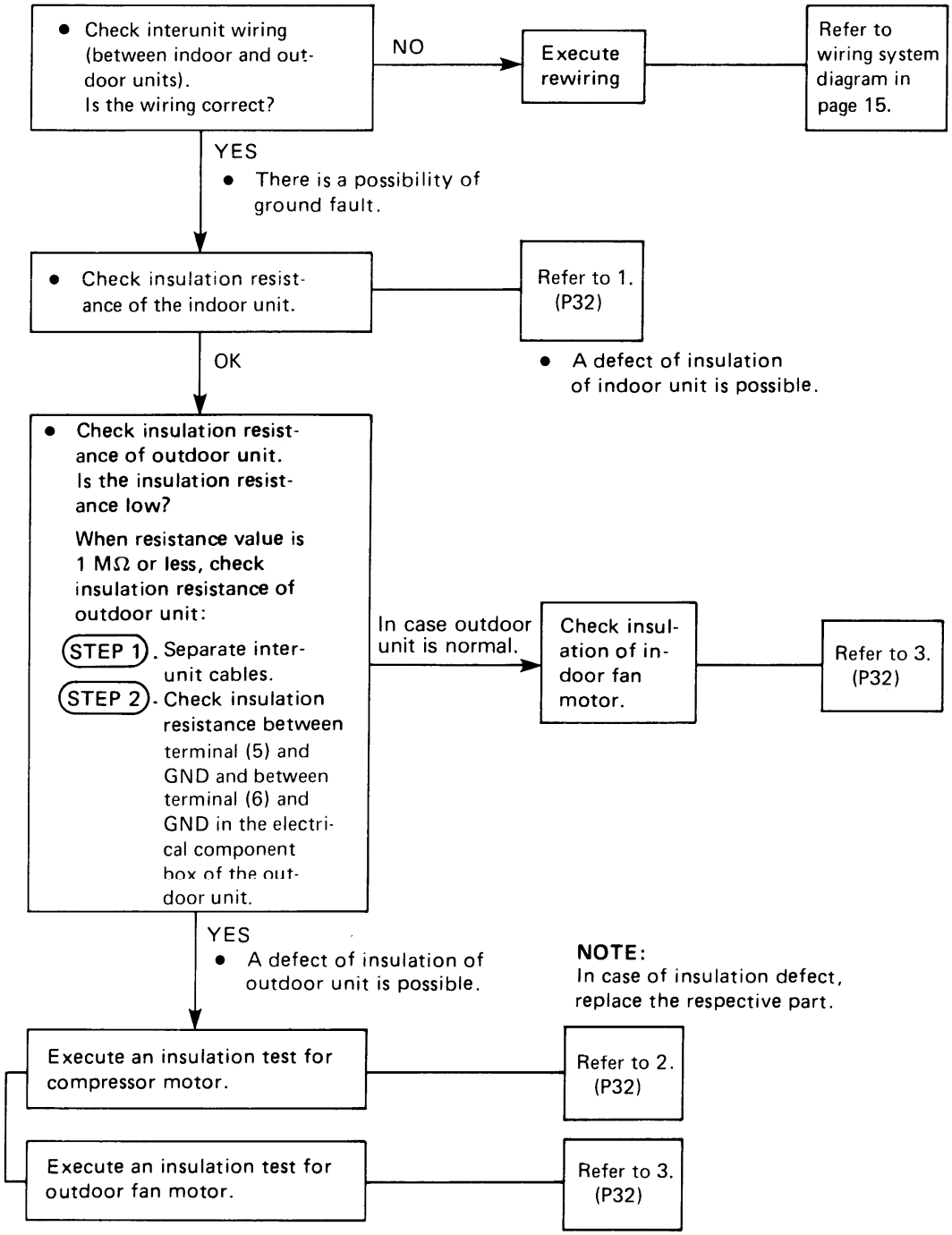
7. TROUBLESHOOTING

— Quick Access Index —

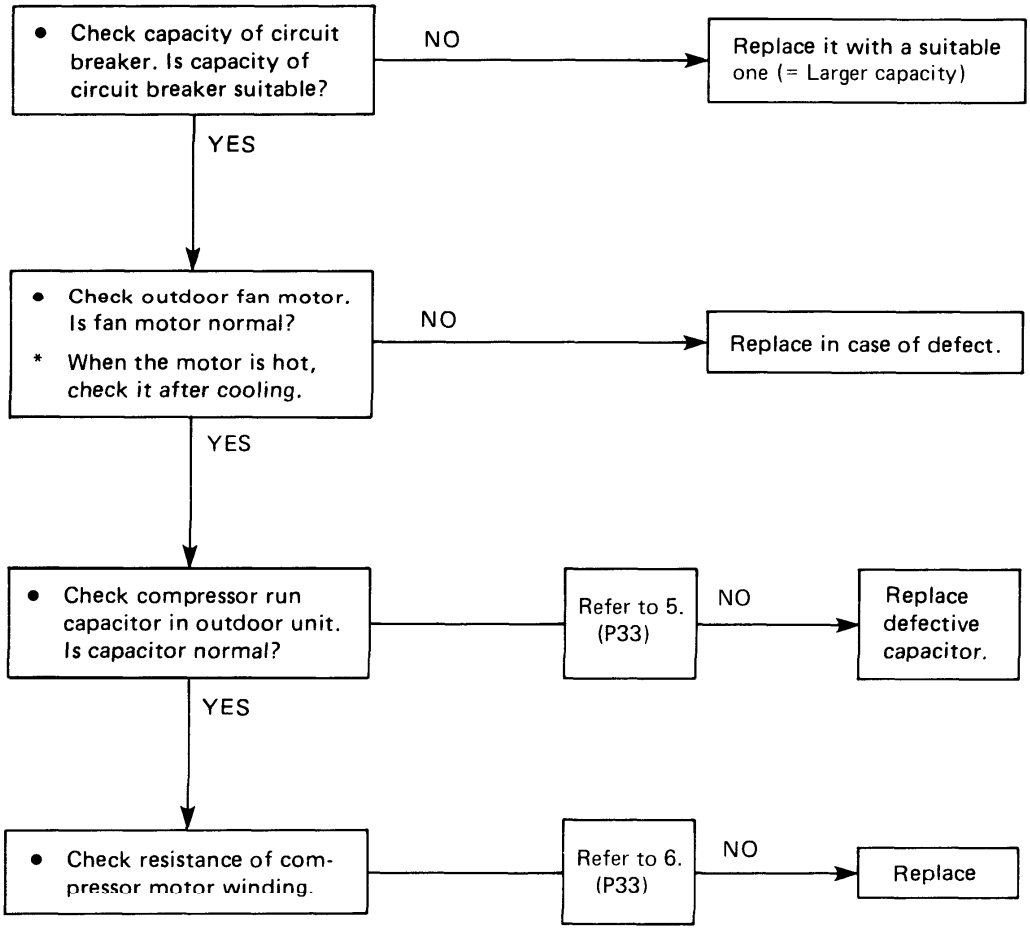
1. Air conditioner does not operate

1) Circuit Breaker trips (or fuse blows)

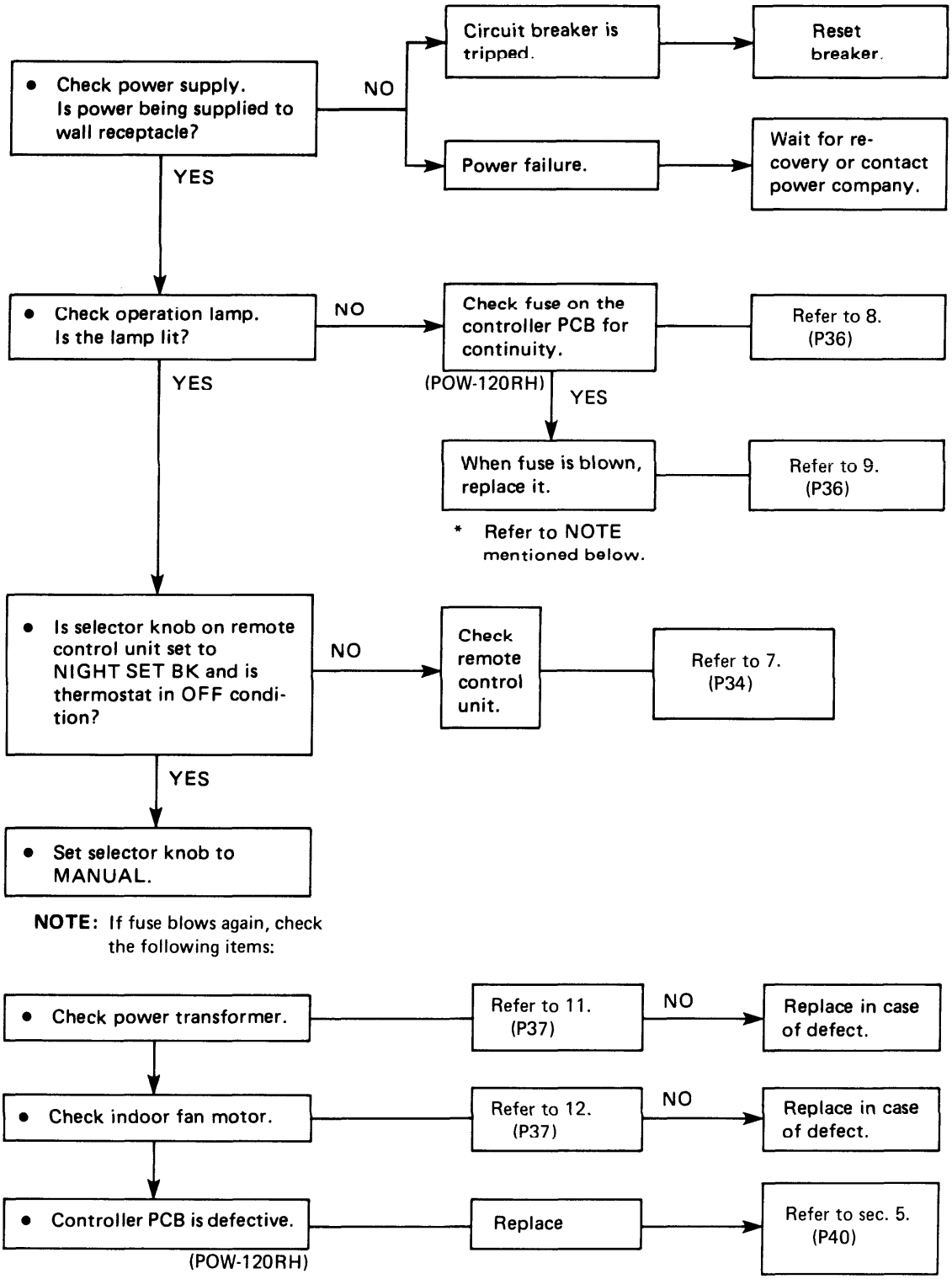
① When circuit breaker is set to ON, it is tripped soon (Resetting is not possible)



② Circuit breaker trips when the operation switch is depressed.

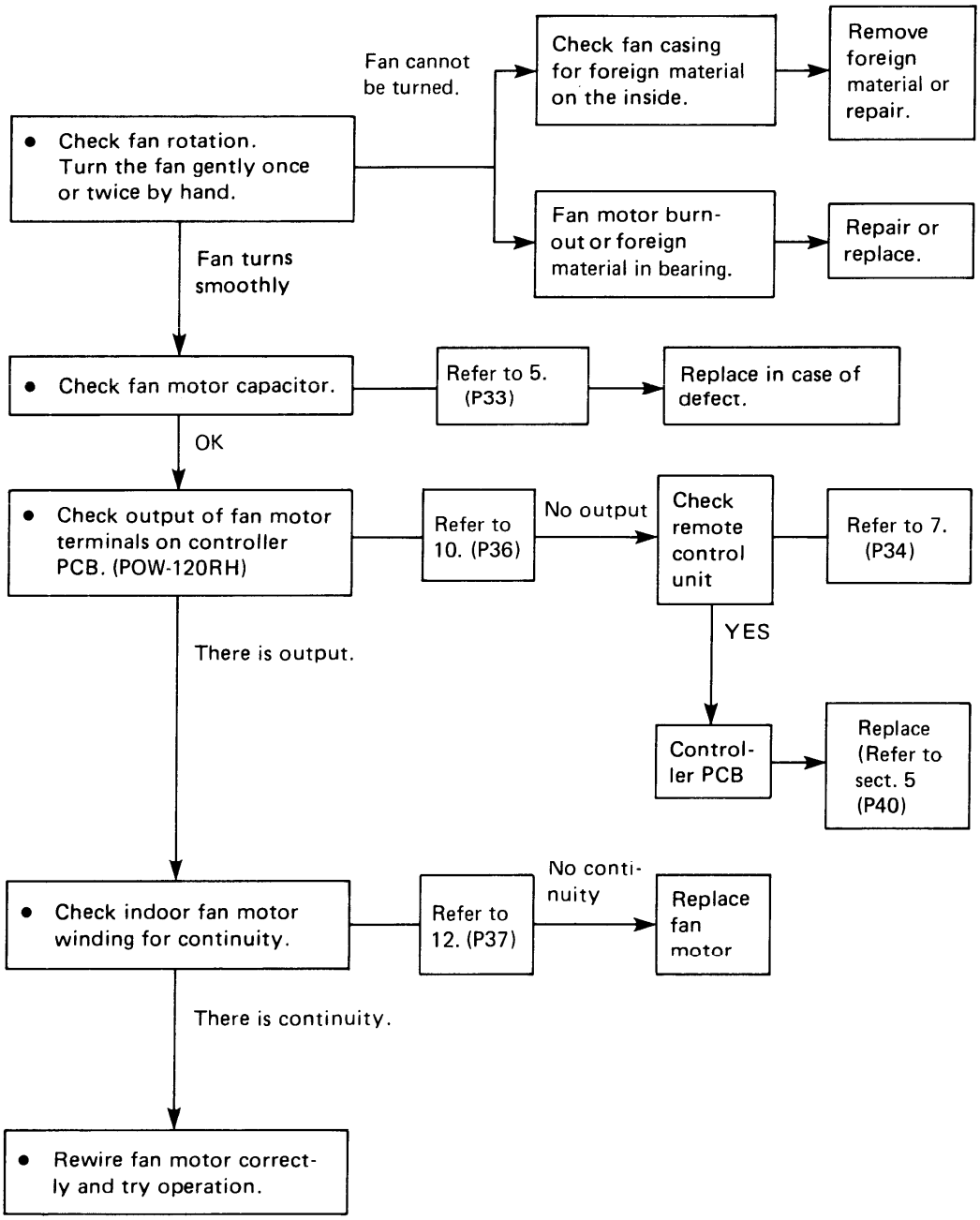


2) Neither indoor unit nor outdoor unit runs



2. Some part of air conditioner does not operate

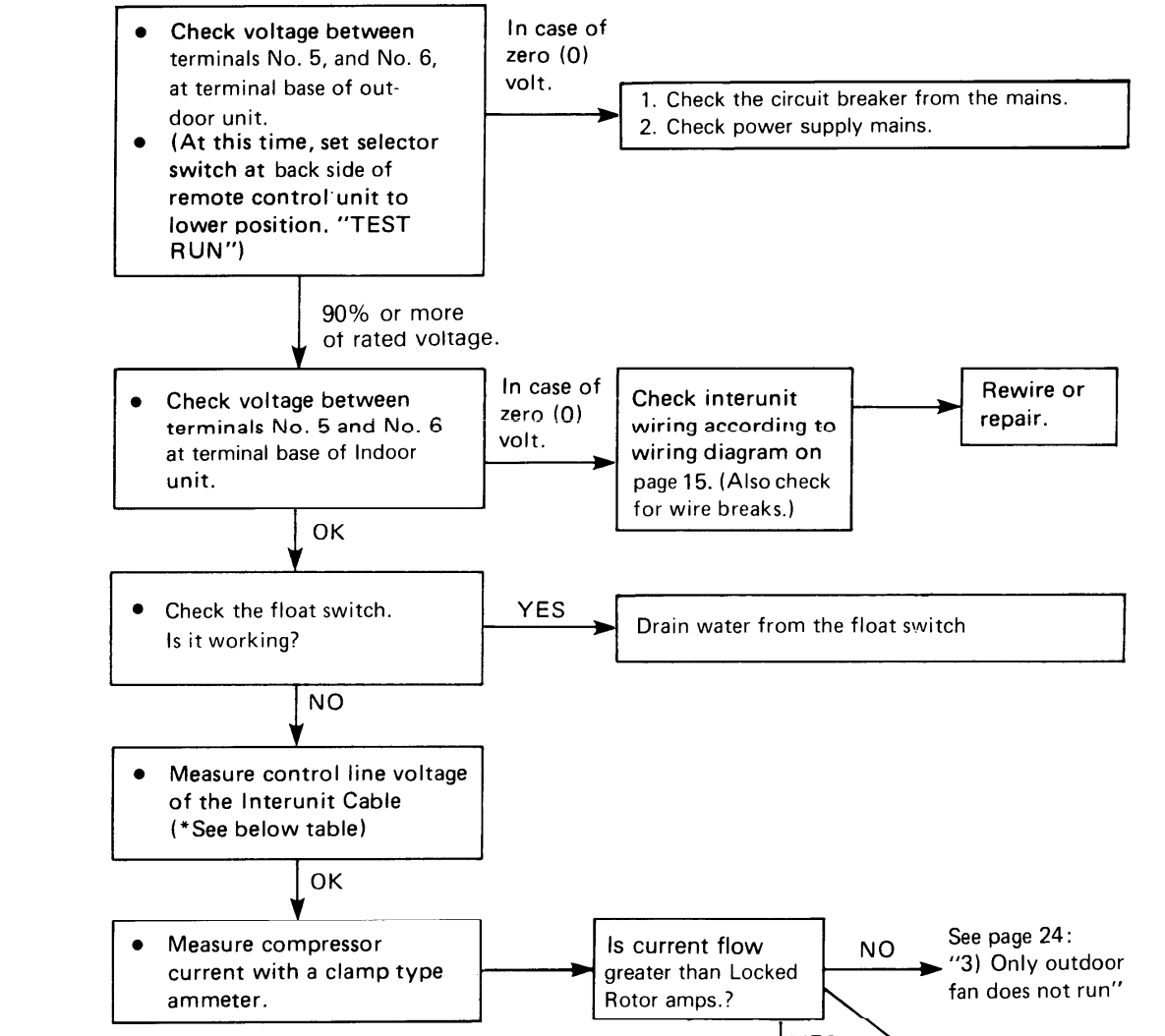
1) Indoor fan does not run



2) Neither outdoor fan nor compressor runs

Note: Check following points at first;

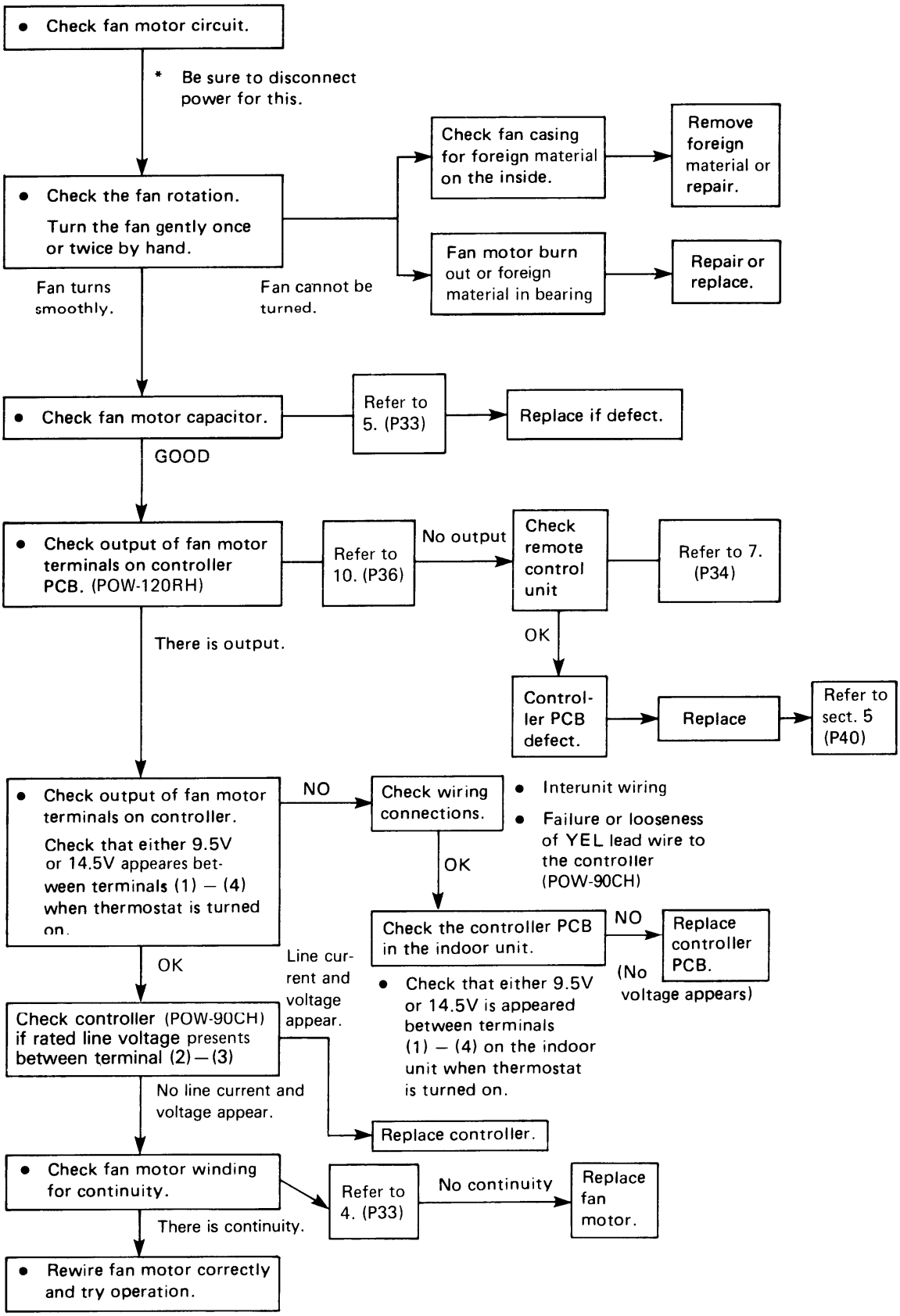
1. Is thermostat setting suitable?
2. Has 3 minute timer operated?
   (No operation for 3 minutes after power ON.)



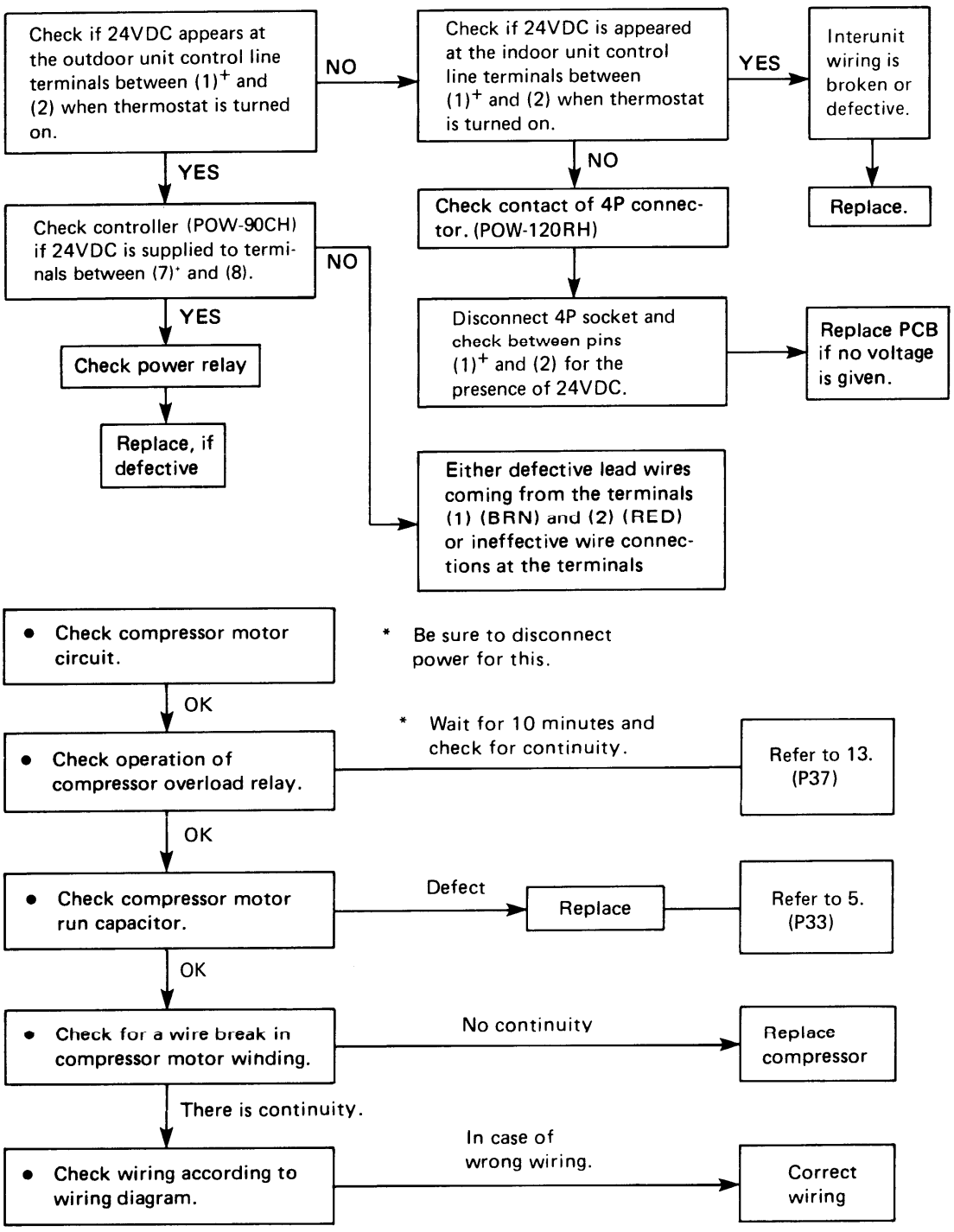
* CONTROL LINE VOLTAGE AT THE INDOOR UNIT'S TERMINAL BASE

Signal	Terminal No. (to be checked)	Thermo. Cycle	Cooling Operation	Heating Operation
Compressor ON – OFF	1 – 2	ON	24VDC	
		OFF	0 V	
Heating	1 – 3	–	0 V	24VDC
				* 0 V when defrosting
Fan motor ON – OFF	1 – 4	ON	Approx. 9.5 V or 14.5 V	
		OFF	0 V (Defrosting and Overload Condition are included)	

3) Only outdoor fan does not run

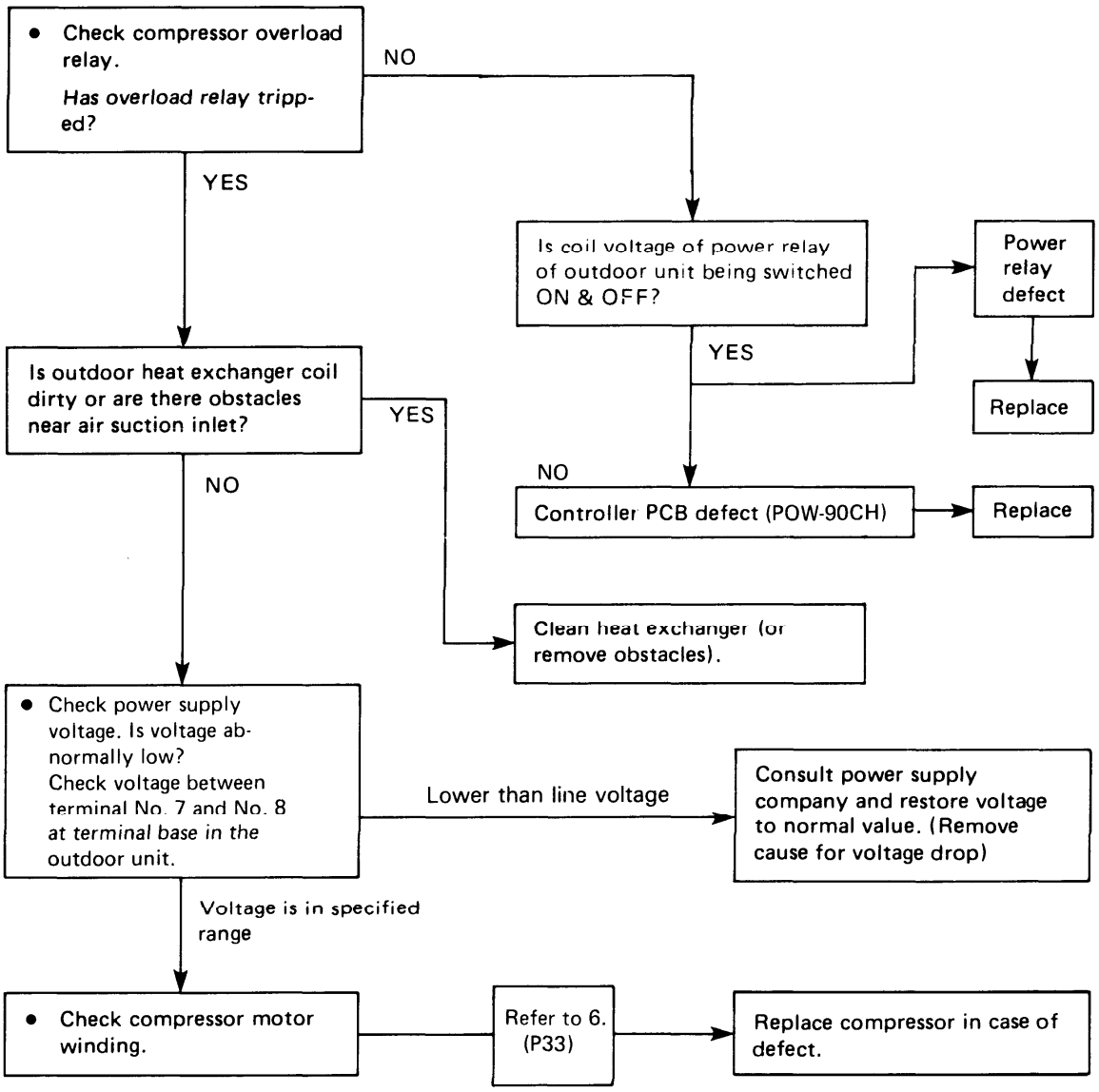


4) Only compressor does not run

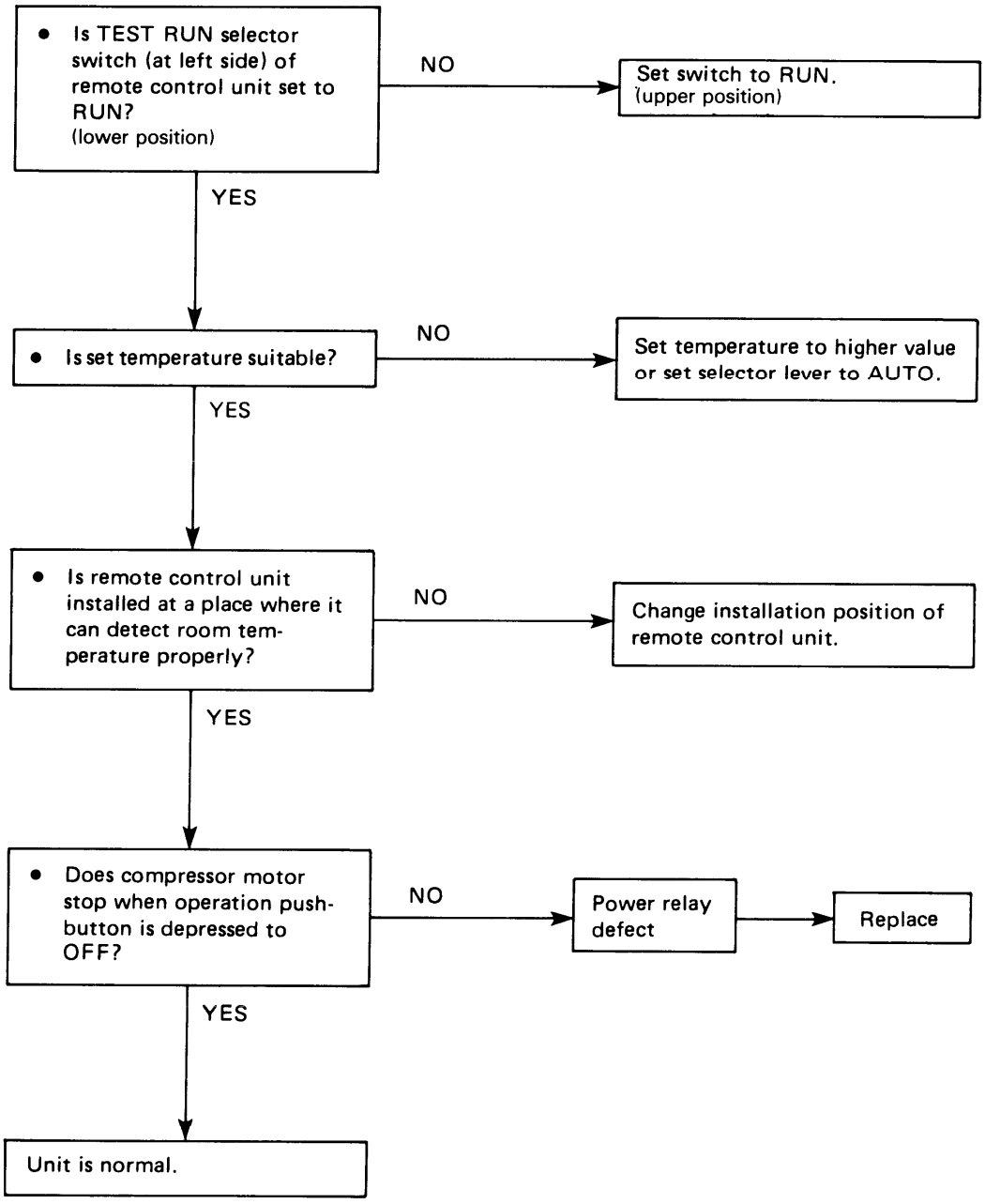


5) Compressor frequently repeats ON and OFF

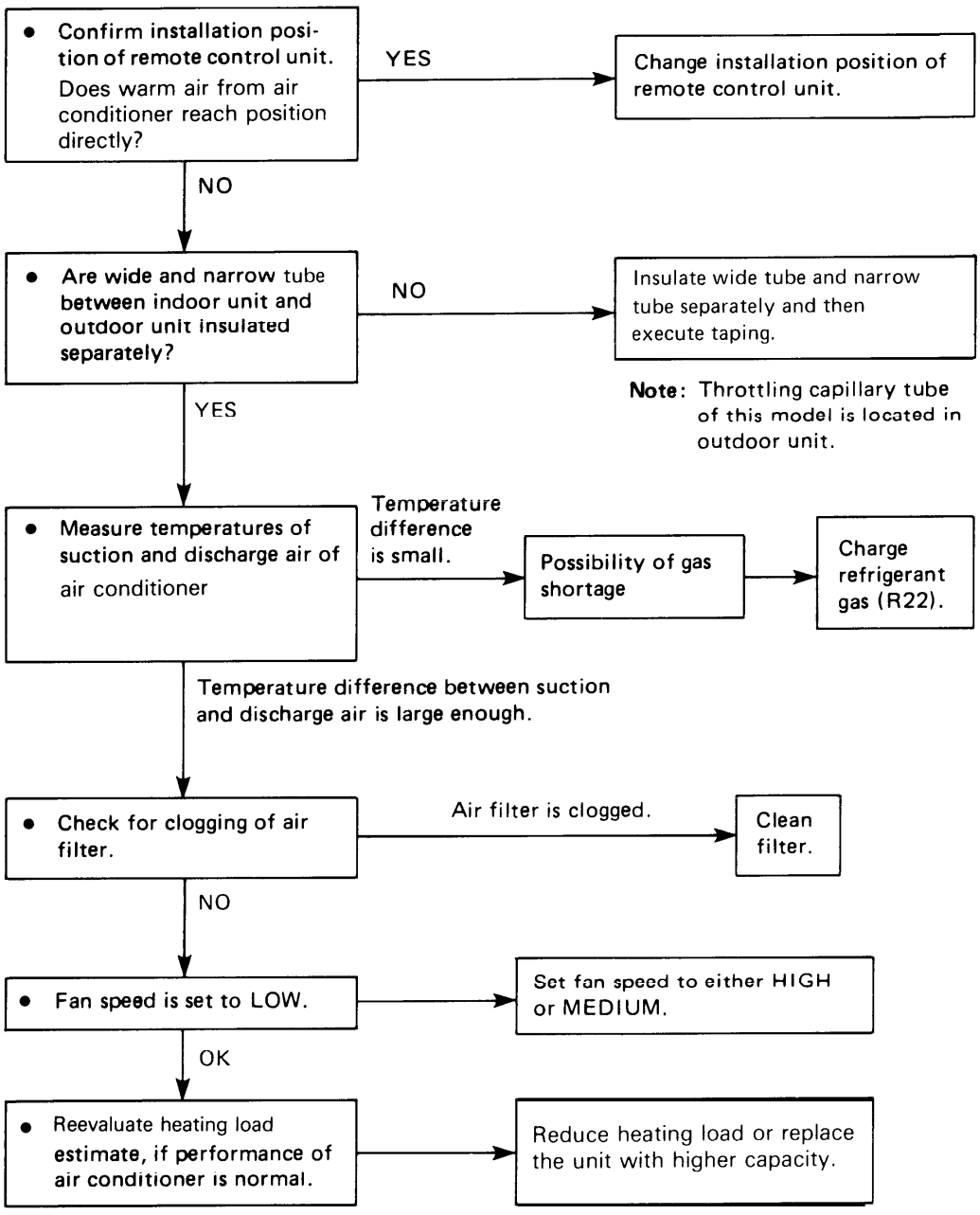
(Only compressor repeats ON and OFF, while indoor unit and outdoor fan runs without fail.)



2) Excessive cooling



3) Poor heating



8. CHECKING AND REPLACING ELECTRICAL COMPONENTS

— Quick Access Index —

1. Measurement of Insulation Resistance of the Unit

Turn off Power supply (terminal ⑦ and ⑧ on the outdoor terminal plate)

Clamp the gound (GND) line of the Power Line with a lead clip of the insulation resistance tester and measure the resistance by placing a probe on either of the two power lines. (terminal ⑦ and ⑧.)

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 MΩ. Fig. 1.

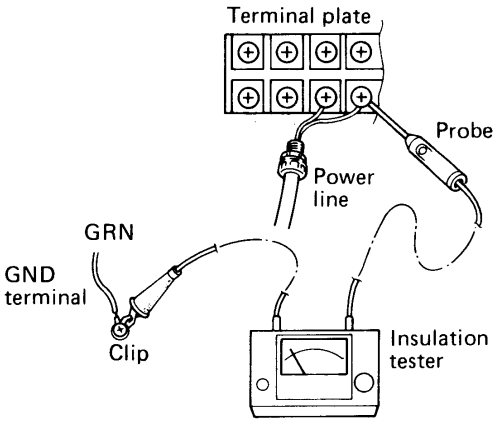


Fig. 1

2. Measurement of Insulation Resistance of the Compressor

Remove the red lead wire connected to the compressor motor from power relay (terminal). Clamp the removed red 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 MΩ. Fig. 2.

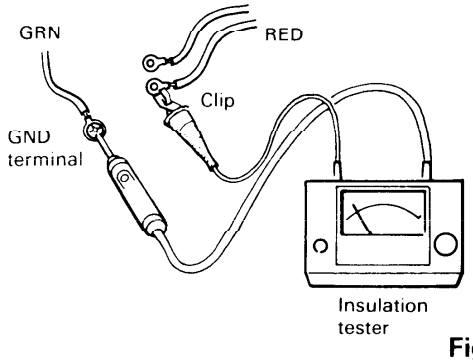


Fig. 2

3. Measurement of Insulation Resistance of the Fan Motor

1) In case of indoor fan motor

Remove the fan motor connector (5P-FM) from controller PCB (P.51) 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 MΩ. Fig. 3.

NOTE

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

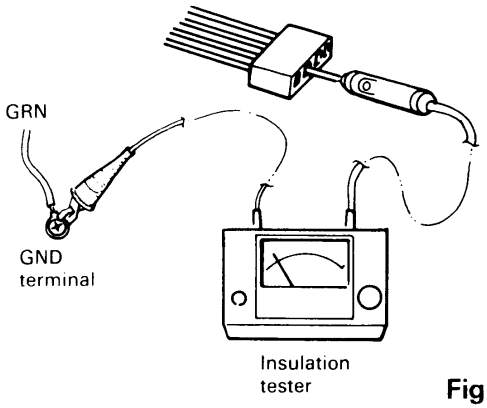


Fig. 3

2) In case of outdoor fan motor

Remove the black lead wire of the fan motor capacitor connected to CM Capacitor. 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 tester to the terminal GND.

The insulation is in good condition if the resistance exceeds 1 MΩ. Fig. 4.

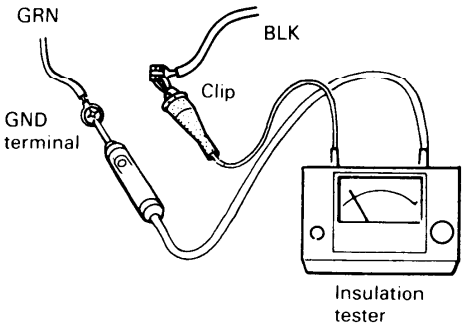


Fig. 4

4. Checking of the Outdoor Fan Motor

Remove the blue (BLU) lead wire from the defrost controller 3 , then brown (BRN) and pink (PNK) lead wires from the fan motor capacitor respectively as indicated in the wiring diagram. (Refer to P.50)

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

Lead wire color	Coil resistance
BLU—BRN	63Ω ± 10%
BLU—PNK	59Ω ± 10%

Table-1

NOTE When ambient temp. is 68°F.

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 Fig. 5 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.

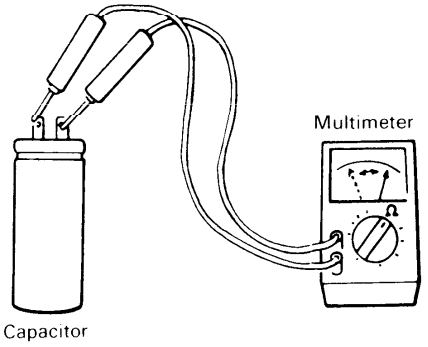


Fig. 5

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. 6 and 7.

It is in good working condition if there is continuity among each pair of terminals. Fig. 7.

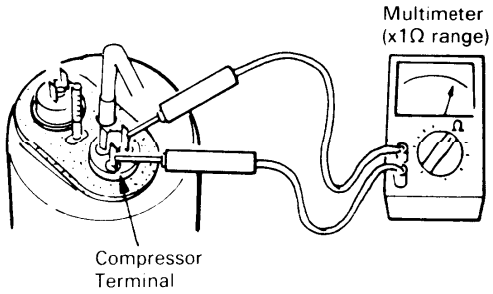


Fig. 6

Compressor Coil Resistance

Lead wire color	Coil resistance
C — R	0.58 Ω
C — S	2.80 Ω

Table-2

NOTE : ambient temp. is 77°F.

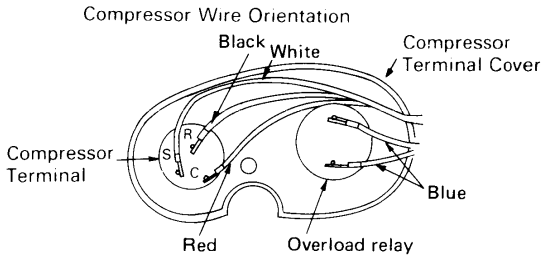


Fig. 7

7. Checking of the Control Unit Proper
(Refer to P. 52)

1) **CAUTION** : Use of the Test Switch (RUN/TEST RUN)

The position of the switch which is used to operate the air conditioner for a room temperature below 65°F (19°) 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 overcooling. 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.**

2) Checking of the Items of the Control Unit

At first, pull out the connectors (12P and 3P) of the control unit from the controller PCB of the unit. (Fig. 8).

① Checking of the Room Temperature Sensor (12P-ROOM SENSOR)
Measure the resistance between No. 5 and No. 6 connectors. (For an ambient temperature of 80°F, the resistance is about 5KΩ)

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

② Checking of the Fan Speed Selector (12P-FAN SPEED)
Check the continuity of connectors (No. 3 and No. 4 against No. 10 (Place the negative (–) probe on No. 10 and positive (+) probe on No. 3 and then No. 4).

Checking points	Position of the selector			
	High	Med.	Low	Auto
10 – 3	NO	YES	YES	NO
10 – 4	YES	YES	NO	NO

Table-3

Note: YES ..... Continuity
NO ..... Discontinuity

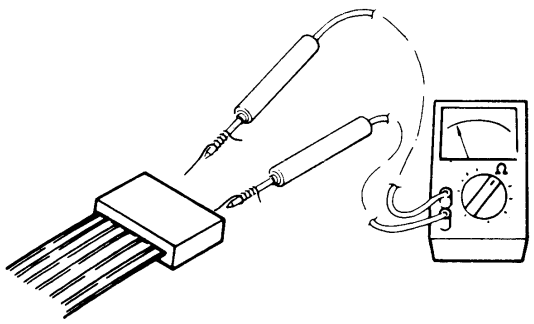


Fig. 8

③ Checking of the Selector (12P-SELECTOR)
Check the continuity of connectors No. 3, 1 and 2 against connector No. 9.

Connector No.	Position of the Selector			
	MANUAL	NIGHT SET BACK	TIMER	
			ON	OFF
9 – 3	NO	NO	YES	NO
9 – 1	NO	NO	YES	YES
9 – 2	NO	YES	NO	NO

Table-4

④ Checking of the Operation Pushbutton (12P-OPERATION)

The operating switch is in good working condition if there is continuity between No.9 (placing negative (–) probe) and No. 4 (placing positive (+) probe) while the pushbutton is pressed.

⑤ Checking of the Timer (12P-TIMER)

Measure the continuity between No. 4, 3, 1, 2 and No. 8 (placing the negative (–) probe).

Connector No.	Position of the Selector											
	1	2	3	4	5	6	7	8	9	10	11	12
8 – 4	—	—	—	—	—	—	—	—	Y	Y	Y	Y
8 – 3	—	—	—	—	Y	Y	Y	Y	Y	Y	Y	Y
8 – 1	—	—	Y	Y	Y	Y	—	—	—	—	Y	Y
8 – 2	—	Y	Y	—	—	Y	Y	—	—	Y	Y	—

Y for YES = There is continuity. Table-5

⑥ Checking of the Thermostat (12P-THERMOSTAT)

Measure the cointinuity between No. 4, 3, 1, 2 and No. 7 (placing the negative (–) probe).

Connector No.	Position of the Selector										
	61 65	63 67	65 69	67 71	69 73	71 75	73 77	75 79	77 81	75 83	81 85
7 – 4	—	—	—	—	—	Y	Y	Y	Y	Y	Y
7 – 3	—	Y	Y	Y	Y	Y	Y	Y	Y	—	—
7 – 1	Y	Y	Y	—	—	—	—	Y	Y	Y	Y
7 – 2	—	—	Y	Y	—	—	Y	Y	—	—	Y

Y for YES = There is continuity. Table-6

⑦ Checking of the Operation Switch (12P-OPERATION)
Check the continuity of connectors No. 11 and No. 12 against No. 9 (placing the negative (–) probe). Table-6A

⑧ Checking of the Operation/Stand-by Lamps (3P-OPERATION/STAND-BY)
The operation and stand-by lamps are in good working condition if there is continuity between connectors No. 1 and No. 2 against connector No. 3.

If there is abnormality during checking at any of the above steps from ① to ⑧, replace the control switch unit as it is.

CAUTION :

Do not disassemble the 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.

Connector No.	Position of the Selector	
	COOL	HEAT
9 – 11	NO	YES
9 – 12	YES	YES

Table-6A

8. Checking of the continuity of Fuse on the Controller PCB

Check the cointinuity by the multimeter as shown in Fig. 9.

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

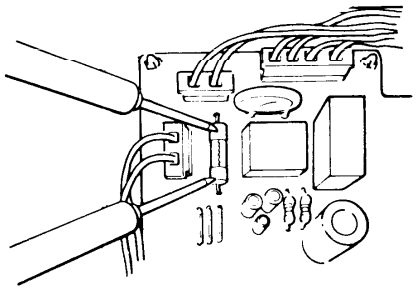


Fig. 9

9. Method of Replace Fuse on the Controller PCB

1. Remove the controller PCB according to Disassembly Procedure sect. 5 (P.40)
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. 10.
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.

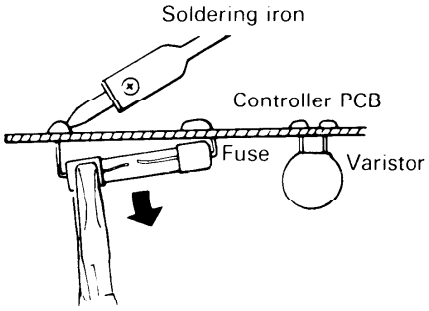


Fig. 10

10. Checking of the Output of the Controller PCB for Fan Motor Terminals

Remove the 5P connector coming from the PCB and be sure that there is no danger of short circuit to other parts before supplying electricity to the unit. Then put the operation switch to ON and set the selector to MANUAL.

Now measure the voltage between these pins by the multimeter. The controller PCB is in good working condition if the voltage output becomes same as those shown in the right table.

Pair of Pins	FAN		
	Low	Med.	High
1 – 4	*	0	0
1 – 3	0	*	0
1 – 2	0	0	*

* Line voltage

Table-7

11. Checking of the Power Transformer

① Remove connectors 2P-PRY and 2P-SEC from 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. (Refer to P.50).

It will be completely satisfactory if all the measured values agree with those indicated in Table-8.

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

Table-8

NOTE Ambient room temp : 70°F

12. Checking of the Indoor Fan Motor

Remove the fan motor connector (5P-FM) from controller PCB and measure the resistance between each lead wire 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-9.

Lead wires	Value of resistance
BLU—BRN	About 40 Ω
BLU—VLT	15 Ω
VLT—GRY	14 Ω
YEL—GRY	175 Ω
BLU—PNK	49 Ω

Table-9

13. Checking of the Compressor Overload Relay (Protector)

Remove both lead wire terminals connected to the compressor overload relay. Set the resistance measuring range of the multimeter to "X1Ω" and check the continuity between terminals of the overload relay. The overload relay is normal if there is a continuity.

14. Checking of the Drain Pump

Remove the drain pump connector (3P-DP) from controller PCB and measure the resistance across the connector No. 1 and No. 3 setting the resistance measuring range "X1Ω". The drain pump is in good working condition if the resistance is about 35Ω.

9. DISASSEMBLY PROCEDURES

-Quick Access Index-

INDOOR UNIT SAP120RH

1. **Top Panel-Removal**
   Loosen the four screws (a) and remove the top panel by sliding it in arrow direction. Fig. 1

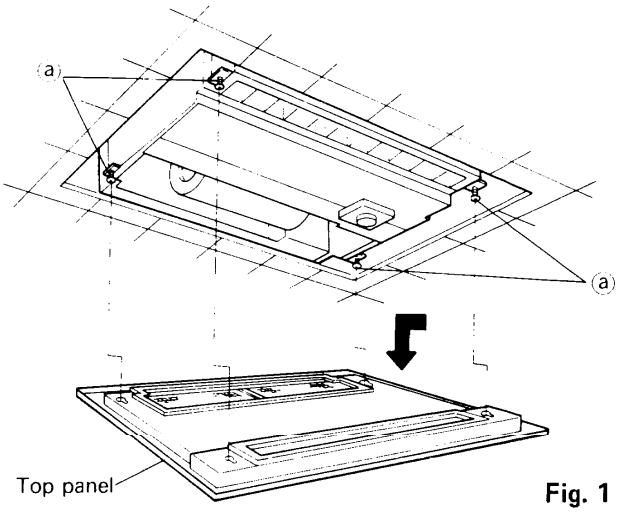


Fig. 1

2. **Air Filter-Removal**
   (1) Slide the two mounting plates (a) of the air intake grille and lower the air intake grille.
   (2) Remove the two air filters by pulling them in arrow direction. Fig. 2

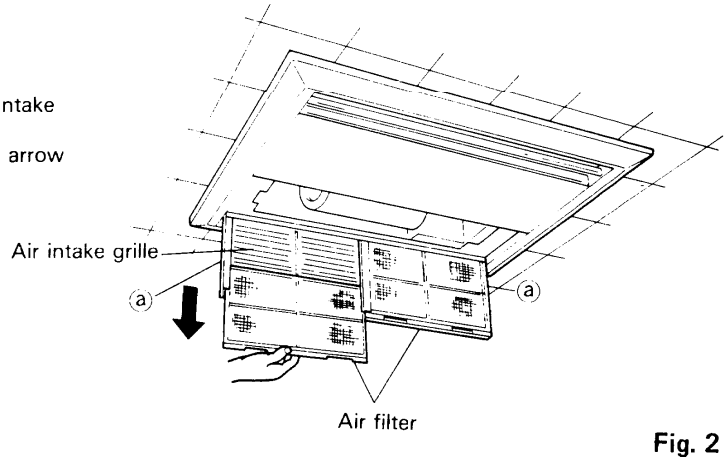


Fig. 2

3. **Float Switch-Removal**
   (1) Separate the lead wire (2P connector).
   (2) Turn the float switch to the left and remove it by pulling downward.
   At this time, take care not to spill the drain water remaining in the float switch.
   (3) Discharge the drain water and then confirm vertical movement of the float switch. Fig. 3

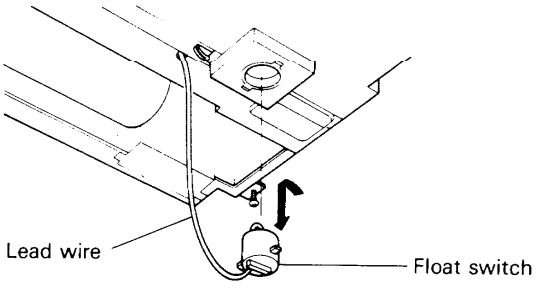


Fig. 3

4. Fan Motor-Removal

(1) Remove the two screws ⓐ fixing the rear panel.
(2) Remove the four screws ⓑ (2 each left and right) fixing the fan casing.
(3) Loosen the bolt ⓒ fixing the centrifugal fan and the fan motor shaft with a monkey wrench as shown in the figure. Fig. 4

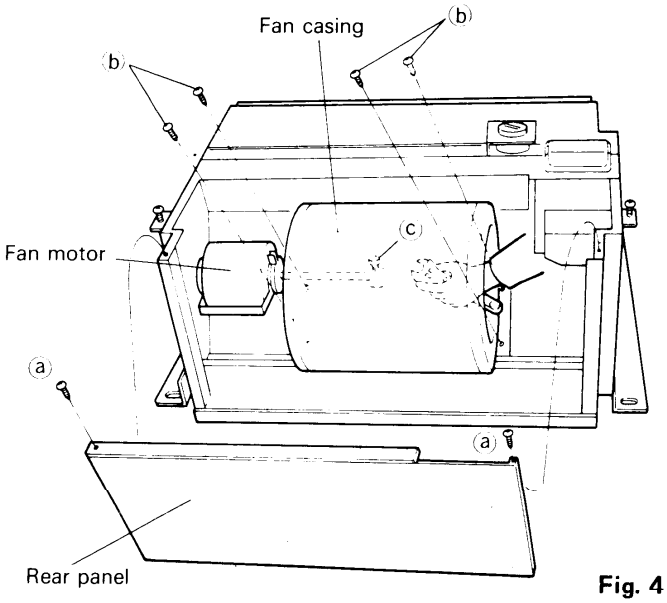


Fig. 4

(4) The motor can be removed after the two screws fixing the support have been removed. Fig. 5

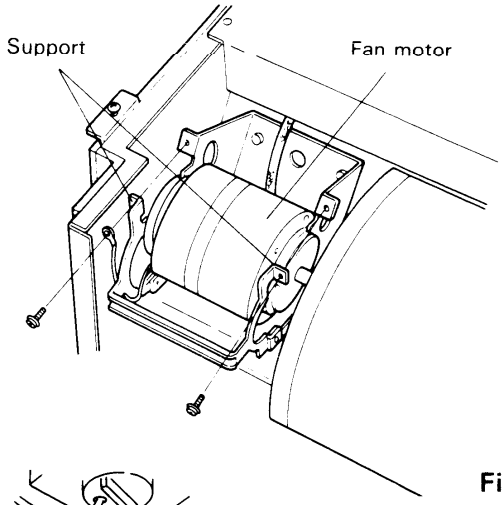


Fig. 5

5. Electrical Component Box-Removal

(1) Remove the two screws ⓐ of the electrical component box.
(2) Remove the clamp ⓑ on the cover plate.
(3) Remove the electrical component box by pulling it in arrow direction.
(4) When the thermostat and the thermistor are to be removed from the clamp ⓑ, this must be done in installed condition. Fig. 6

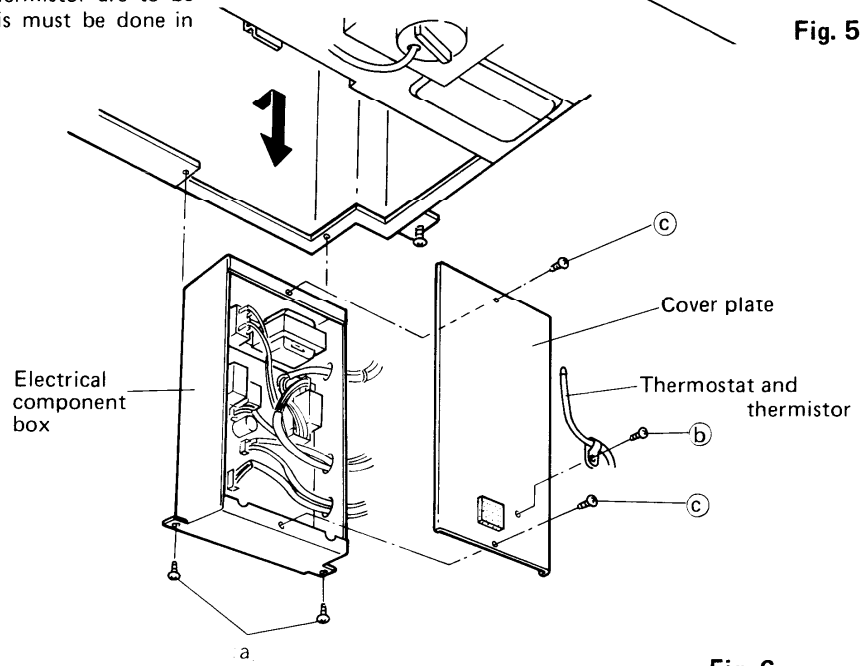


Fig. 6

6) When the two screws ⓒ of the electrical component box are removed, the inside can be checked. Fig. 6, 7

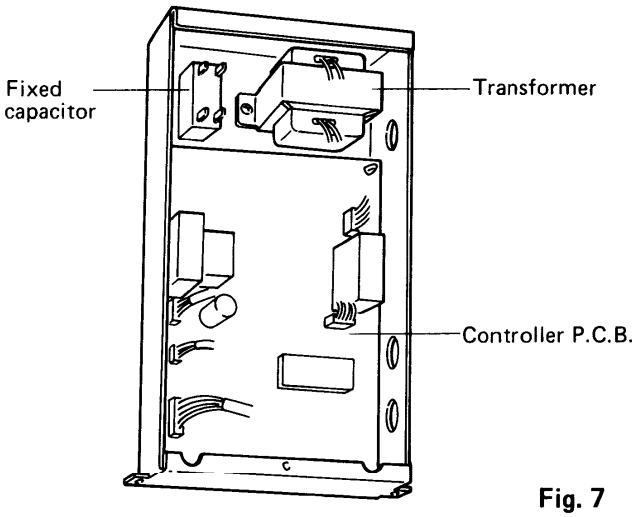


Fig. 7

6. Drain Pump-Removal

(1) Remove the two screws ⓐ of the cover plate Ⓐ and the five screws ⓑ of the cover Ⓑ.
In this case, remove the lead wires of the float switch.

(2) Pull the drain pan from the unit. Fig. 8

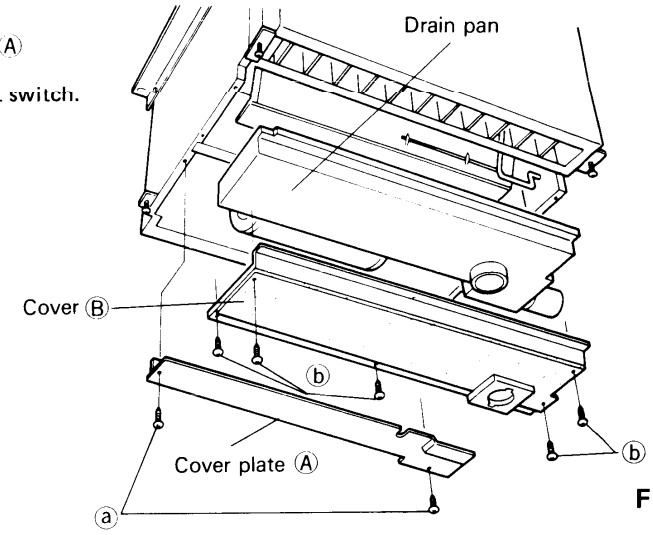


Fig. 8

(3) Remove the three screws ⓒ and pull out the cover plate and the drain pump in arrow direction.

(4) Remove the clip ⓓ connecting the drain pipe.

(5) Remove the earth ⓔ and the lead wire ⓕ.

(6) For exchange of the drain pump, remove the two screws ⓖ.
Installation is executed in reverse order of the removal. Fig. 9

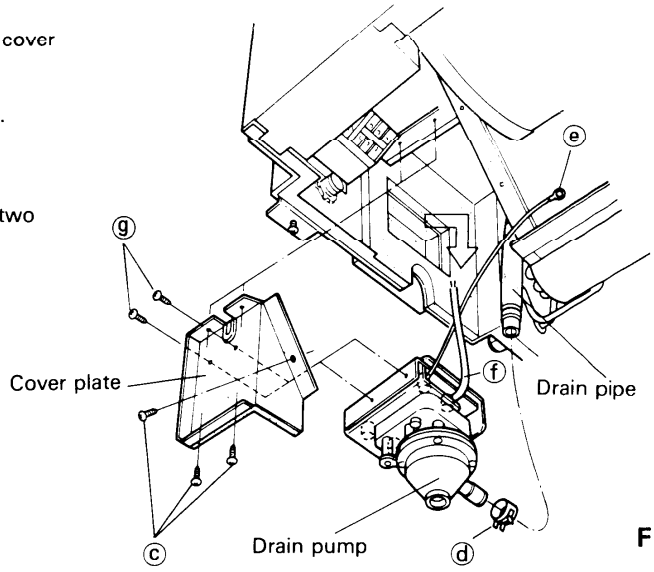


Fig. 9

7. Cabinet – Removal

Remove the cabinet by removing fixing screws using a Phillips screwdriver. Fig. 10

NOTE : When working only on the wiring, it is possible to gain access to the wiring terminals by simply removing the side panel (A). Fig. 11

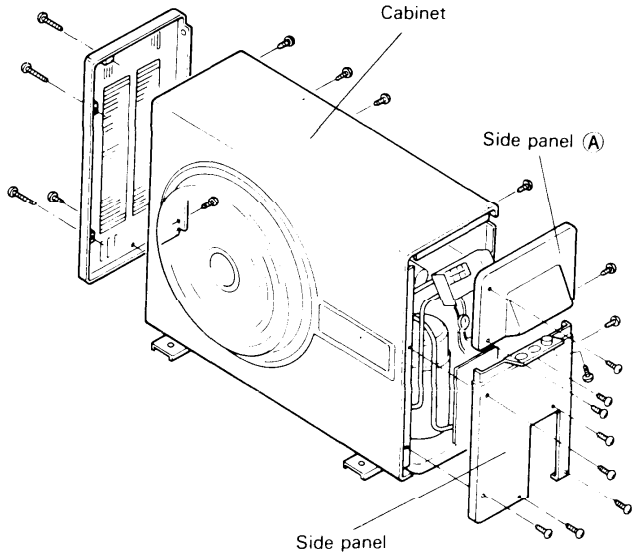


Fig. 10

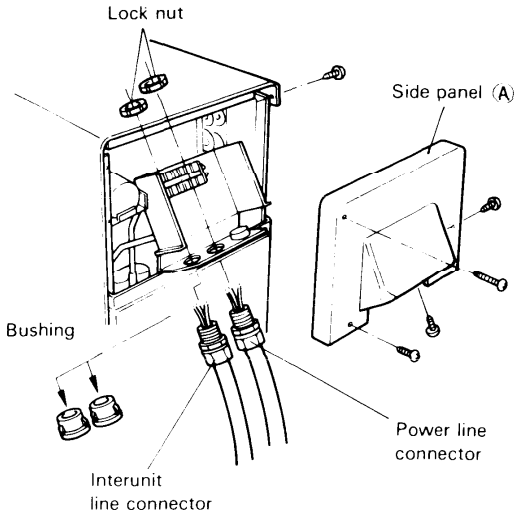


Fig. 11

8. Fan and Fan Motor – Removal

(1) Remove the fan by removing the propeller fan fixing screw (A) using a straight blade screwdriver. Refer to Fig. 12

(2) Using a pincher, cut the plastic wire ties fixing the fan motor lead wires connected to fan motor capacitor or other terminals.

(3) Using a Phillips screwdriver, remove the three fixing screws of the fan motor, then withdraw the fan motor.

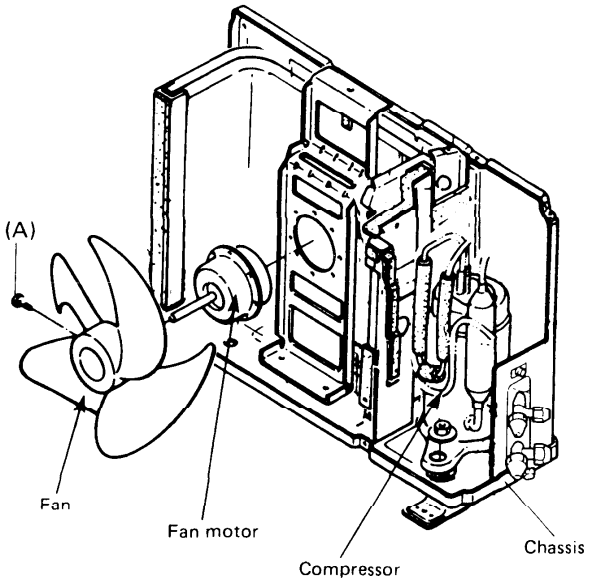
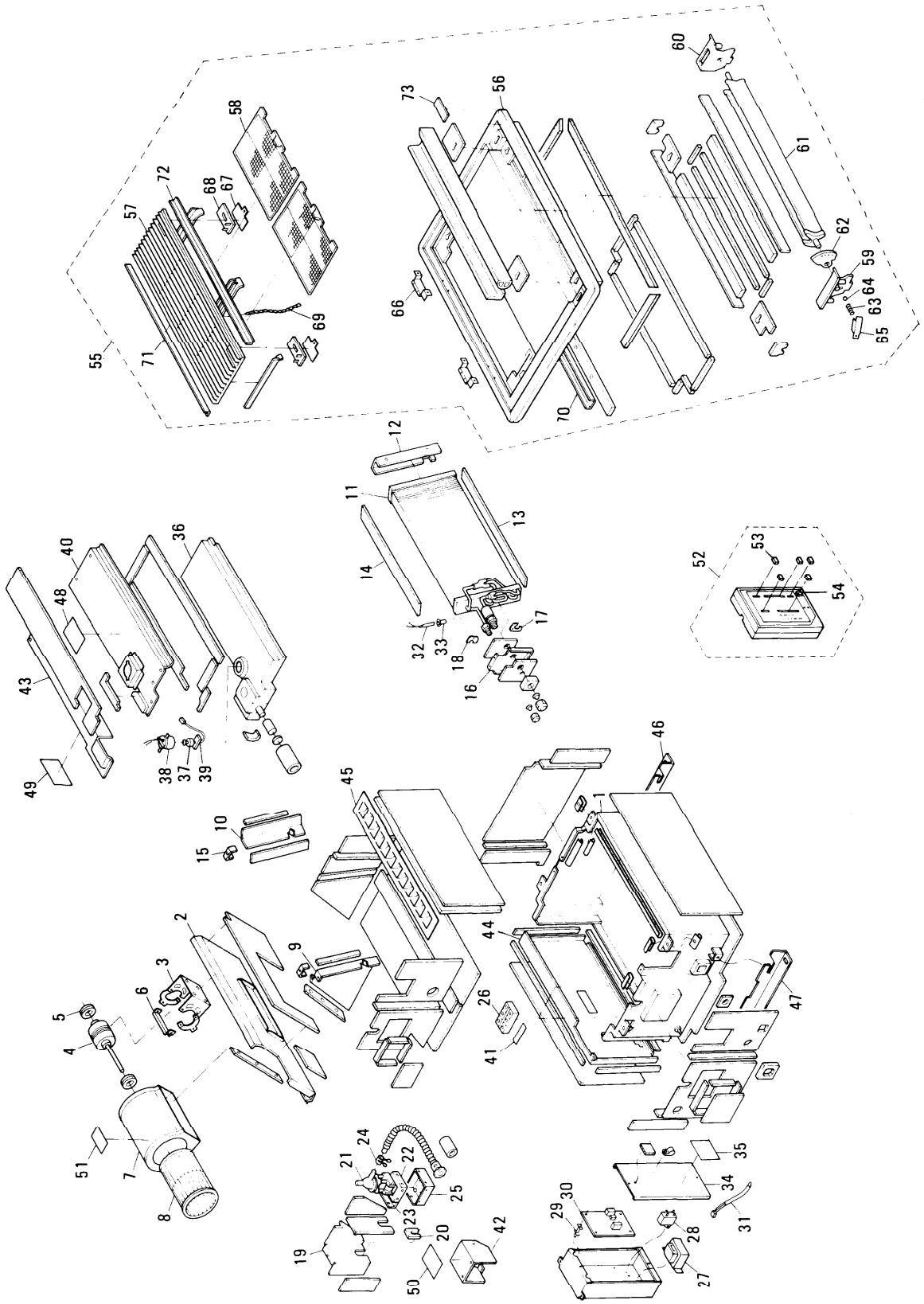


Fig. 12

10. PARTS LIST



A T T E N T I O N !
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
1	854-0-1104-142H1	Cabinet Ass'y	1
2	854-0-2516-130H1	Partition Plate Ass'y	1
3	854-0-2511-17401	Support Motor Ass'y	1
4	851-0-5291-265M1	Fan Motor Ass'y KFH6Q-31A1P	1
5	852-2-2511-12020	Cushion Rubber, Fan Motor	2
6	854-2-2518-31201	Mounting Plate	1
7	854-0-2502-20801	Fan Casing Ass'y	1
8	854-0-2501-14700	Centrifugal Fan Ass'y	1
9	854-2-2303-219H2	Mounting Plate Ass'y, Evaporator	1
10	854-2-2303-224H1	Mounting Plate Ass'y, Evaporator	1
11	854-0-4118-50901	Evaporator Ass'y (incl. No. 12)	1
12	854-2-2303-22301	Mounting Plate, Evaporator	1
13	854-2-2404-19501	Insulation, Evaporator	1
14	854-2-2404-19601	Insulation, Evaporator	1
15	854-2-2303-21800	Mounting Plate, Evaporator	2
16	854-2-1133-214H2	Cover Plate Ass'y	1
17	854-2-2360-15300	Mounting Plate	1
18	854-2-2360-45100	Mounting Plate	1
19	854-2-2307-125H1	Cover Plate Ass'y, Fan Motor	1
20	854-2-2338-15300	Eyelet Rubber	1
21	851-0-5291-265P1	Pump Ass'y WP20SL-4	1
22	854-2-2360-44400	Mounting Plate	1
23	854-2-2360-44300	Mounting Plate	1
24	854-2-2315-10301	Clip	1
25	854-2-5312-57601	Mounting Plate	1
26	4-2379-56170	Terminal Base JTU20-6	1
27	851-0-5291-265P2	Transformer Ass'y ATR-J121U1	1
28	4-2239-51171	Fixed Capacitor 220V 8MFD	1
29	851-2-5366-01400	Spacer	6
30	851-0-5158-40700	Controller Ass'y POW-120RH	1
31	851-0-5291-265T1	Thermistor Ass'y	1
32	851-0-5291-265T2	Thermistor Ass'y NTC-51H-S4	1
33	852-2-5304-13700	Clip, Thermistor	1
34	854-2-5304-31001	Cover Plate	1
35	851-2-5251-35701	Elec. Wiring Diagram	1
36	854-0-2301-349H1	Drain Pan Ass'y	1
37	851-0-5291-265S1	Switch Ass'y FS-3502U-201	1
38	854-2-2346-12010	Cap	1
39	854-2-2360-49301	Mounting Plate	1
40	854-0-2325-171H2	Cover Ass'y	1
41	852-6-4729-17300	Label	1
42	854-2-5305-12101	Cover Terminal	1
43	854-2-5304-278H2	Cover Plate Ass'y	1
44	854-0-1109-213H1	Rear Panel Ass'y	1
45	854-2-1110-16101	Blade Louver	1
46	854-2-1130-14401	Hook Plate	1
47	854-2-1130-14501	Hook Plate	1
48	854-6-4729-75700	Label	1
49	854-6-4729-71600	Label	1
50	852-6-4419-22000	Label	1

NOTE: Metal and plastic parts will be supplied basically with necessary heat insulation pads or packing.

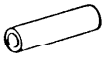
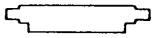
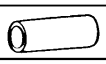
PARTS LIST

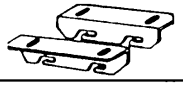
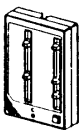
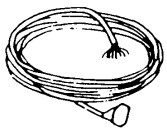
ATTENTION !
To ensure correct parts supply, please let us know followings, when you make service parts order:
1. Part No. 2. Description 3. Q'ty 4. Volts-Hz-Ph 5. Product Model No.

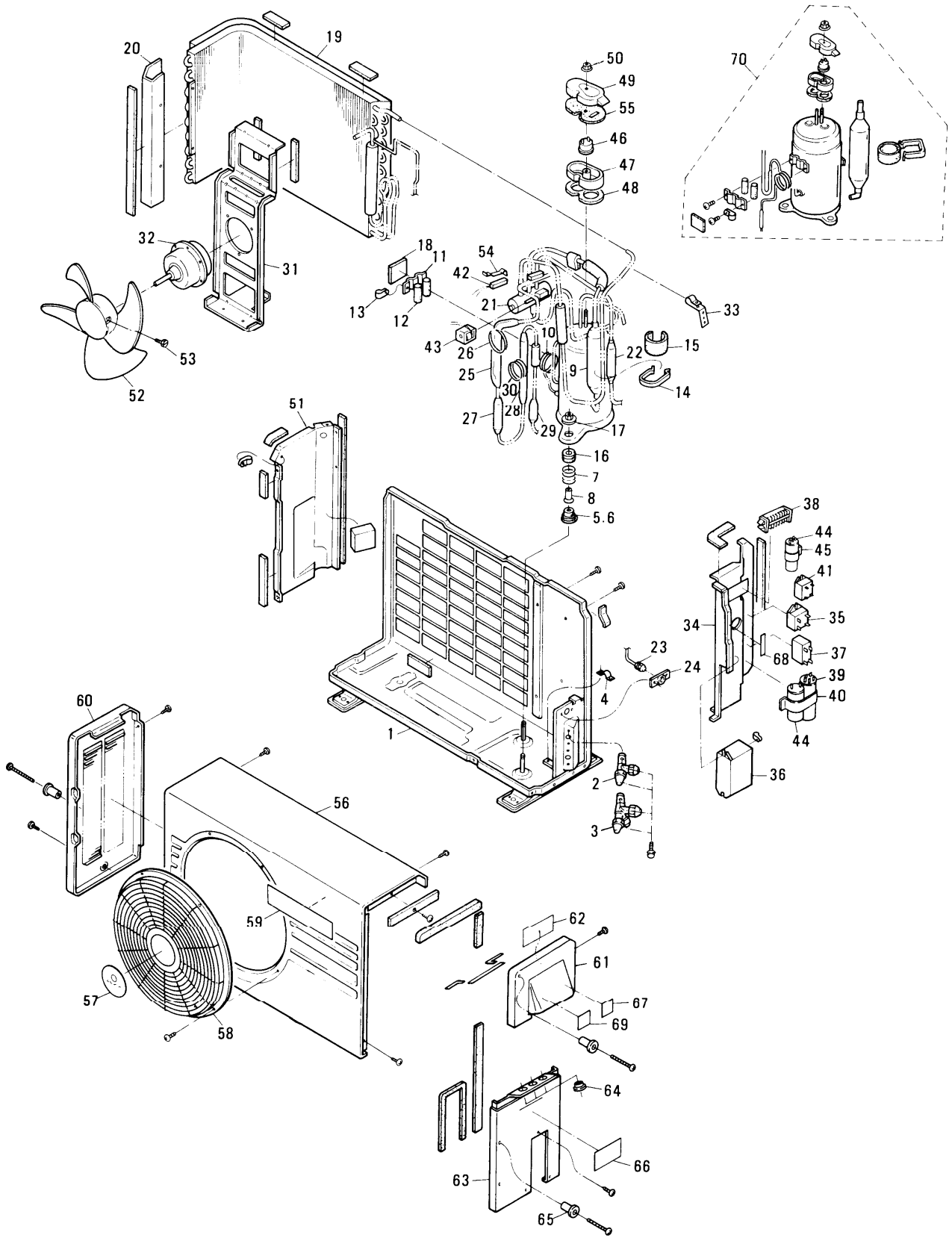
Key No.	Part No.	Description	Q'ty
51	854-2-1367-70800	Name Plate	1
52	851-0-0051-25200	Remote Control Unit Ass'y RCS-120RH	1
53	851-2-5375-01603	Knob	6
54	851-2-5375-05001	Knob	1
55	859-341-57	Panel Ass'y SAP-120RW	1
56	854-2-1112-21520	Top Panel	1
57	854-0-1110-13701	Air Intake Grille Ass'y	1
58	854-0-1302-14220	Air Filter Ass'y	2
59	854-2-1114-10910	Cap, Top Panel	1
60	854-2-1323-11310	Lamp Cover	1
61	854-0-1505-23501	Blade Louver Ass'y	1
62	854-2-1111-19810	Support Louver	1
63	854-2-1341-10700	Coil Spring	1
64	854-2-4541-10201	Ball Steel	1
65	854-2-1129-47701	Mounting Plate	1
66	854-0-2312-10201	Hinge Ass'y	2
67	854-2-1129-47101	Mounting Plate	2
68	854-2-1130-14310	Hook Plate	2
69	854-0-1111-15100	Mounting Parts Ass'y	1
70	854-2-1309-12901	Mounting Plate	1
71	854-2-1123-13101	Mounting Plate, Grille	1
72	854-2-1123-13201	Mounting Plate, Grille	1
73	854-2-1354-17601	Badge	1
●	854-6-4139-50500	Installation Instructions	1
●	854-6-4119-47400	Operation Manual	1

NOTE: Metal and plastic parts will be supplied basically with necessary heat insulation pads or packing.

■ Accessory Parts List

Description	Shape	Q'ty	Remarks
PVC pipe		1	854-2-2334-13600
Gauge		1	854-6-4139-40900
Insulation material		1	854-2-2410-41710
Clamper		2	800-2-5308-11200
Insulation tape		3	854-2-1351-75710x1 854-2-2336-65910x2
Pan-head screw	 M5	4	3-9231-54003
Countersunk-head wood screw		2	3-9261-21301
Drain Hose adaptor		1	854-2-2334-14100

Description	Shape	Q'ty	Remarks
Flanged hex nut		4	851-0-2395-10201
Suspension lugs		1 Each	854-2-1130-14401 854-2-1130-14501
Remote control unit		1	851-0-0051-25200
Mounting plate			851-2-5378-01001
Lead wire for remote control unit		1	851-0-5290-30700



PARTS LIST

A T T E N T I O N !
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
1	852-0-2202-26001	Bottom Plate Ass'y	1
2	852-0-4501-26600	Valve Ass'y 1/4 in.	1
3	852-0-4501-21800	Valve Ass'y 1/2 in.	1
4	852-2-2362-15701	Mounting, Tube	1
5	851-2-2390-13700	Cushion Rubber	1
6	851-2-2390-13100	Cushion Rubber	2
7	851-2-2330-13001	Spring	3
8	851-2-1314-17301	Stopper	3
9	852-0-4511-14500	Accumulator Ass'y	1
10	852-0-4202-57000	Tube Ass'y, Capillary	1
11	852-2-2309-34101	Mounting Plate	1
12	852-2-2353-19500	Packing	2
13	3-9030-00506	Clamper F-4	1
14	852-2-2356-14601	Band Mounting	1
15	852-2-2353-38310	Packing	1
16	851-2-2390-13600	Cushion Rubber	3
17	851-0-2395-10501	Nut Special Ass'y	3
18	852-2-2353-19810	Packing	1
19	852-0-4102-33300	Condenser Ass'y (incl. No. 20)	1
20	852-2-2351-141H1	Cover Plate Ass'y	1
21	4-2649-56162	Reversing Valve V26-9000	1
22	852-2-4501-11600	Muffler	1
23	852-0-4507-33800	Nipple Ass'y	1
24	852-2-2309-19909	Mounting Plate	1
25	852-0-4204-12500	Check Valve Ass'y	1
26	852-2-4219-56300	Capillary Tube	1
27	852-0-4505-14600	Dehydrater Ass'y	1
28	854-0-4518-13800	Check Valve Ass'y	1
29	852-0-4506-15900	Strainer Ass'y	1
30	852-2-4219-56400	Capillary Tube	1
31	852-2-2354-140H2	Mounting Plate Ass'y, Fan Motor	1
32	851-0-5291-436M1	Fan Motor Ass'y FT6-21C1PE	1
33	852-2-2362-15601	Mounting, Tube	1
34	852-2-5307-304H1	Elec. Component Box Ass'y	1
35	4-2329-56282	Relay DFU24D1-F(M)	1
36	859-472-58	Controller POW-90CH	1
37	4-2239-51171	Fixed Capacitor 220V 8MFD	1
38	4-2379-56171	Terminal Base JTU20-8	1
39	4-2239-56281	Fixed Capacitor 330V 35MFD	1
40	852-2-5301-22801	Clip, Capacitor	1
41	4-2329-69210	Relay AMVL-180A	1
42	4-2339-56186	Thermostat TRS-12M160UL	1
43	4-2649-56161	Solenoid L27-9069	1
44	4-2239-60210	Fixed Capacitor 160V 100MFD	2
45	852-2-5301-17100	Clip, Capacitor	1
46	4-2329-69092	Relay MRA98693-9200	1
47	801-2-6194-12200	Cover Terminal	1
48	801-2-5303-12100	Gasket Terminal	1
49	801-2-6195-10500	Cap Terminal Cover	1
50	819-2-6919-10100	Nut, Compressor	1

NOTE: Metal and plastic parts will be supplied basically
with necessary heat insulation pads or packing.

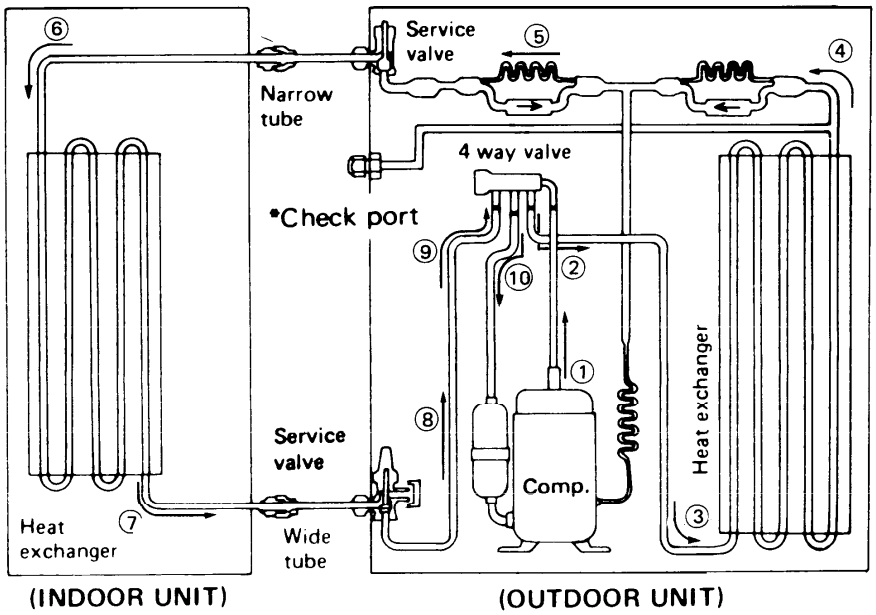
A T T E N T I O N !
To ensure correct parts supply, please let us know followings,
when you make service parts order:
1. Part No. 2. Description 3. Q'ty 4. Volts-Hz-Ph 5. Product Model No.

Key No.	Part No.	Description	Q'ty
51	852-2-2202-173H7	Partition Plate Ass'y	1
52	852-0-2502-12611	Propeller Fan Ass'y (incl. No. 53)	1
53	852-2-2510-10202	Bolt Special	1
54	852-2-5303-12100	Mounting Thermostat	1
55	801-2-5321-10600	Cover Gasket	1
56	852-2-1112-150D3	Cabinet Ass'y	1
57	852-2-1316-26201	Mark	1
58	852-0-1111-13001	Guard Ass'y	1
59	852-2-1316-26102	Mark	1
60	852-0-1104-14912	Side Panel Ass'y	1
61	852-0-1104-159H2	Side Panel Ass'y	1
62	851-2-5251-53001	Elec. Wiring Diagram	1
63	852-0-1104-160H1	Side Panel Ass'y	1
64	851-2-5370-01400	Bushing	3
65	852-2-2326-14302	Spacer	3
66	852-2-1335-85900	Name Plate	1
67	854-6-4729-71600	Label	1
68	852-6-4729-17300	Label	1
69	852-6-4419-22000	Label	1
70	852-0-4516-13100	Compressor Ass'y C-R90H2S	1

NOTE: Metal and plastic parts will be supplied basically
with necessary heat insulation pads or packing.

11. REFRIGERANT FLOW DIAGRAMS

COOLING CYCLE

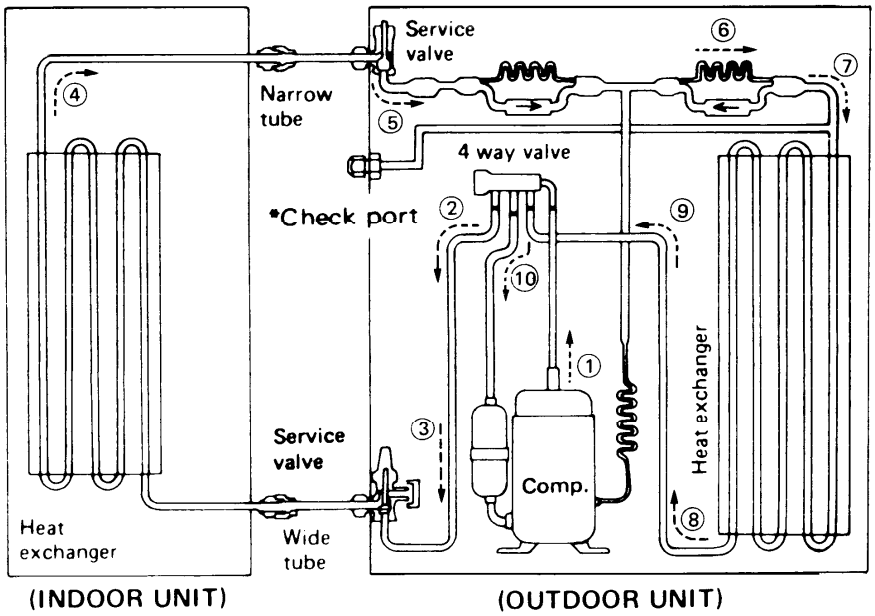


NOTE:

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

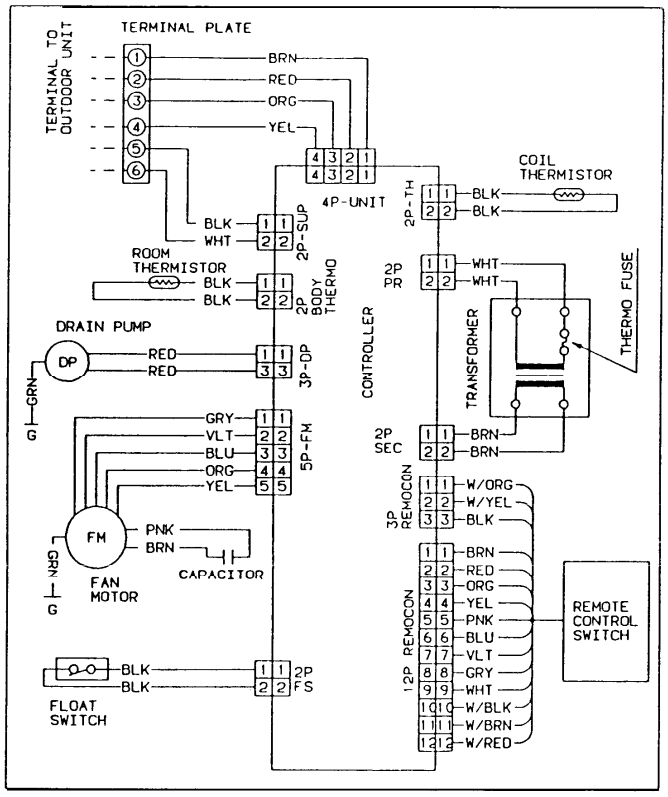
----→ with sequential number in circle shows flow of refrigerant in HEATING (= Reverse) CYCLE.

HEATING CYCLE

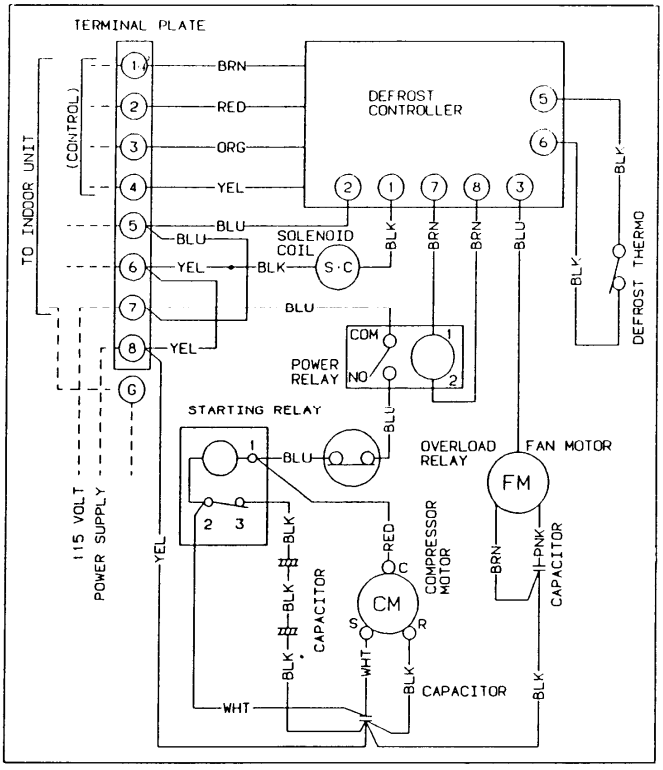


12. ELECTRIC WIRING DIAGRAMS

SAP120RH ELECTRIC WIRING DIAGRAM

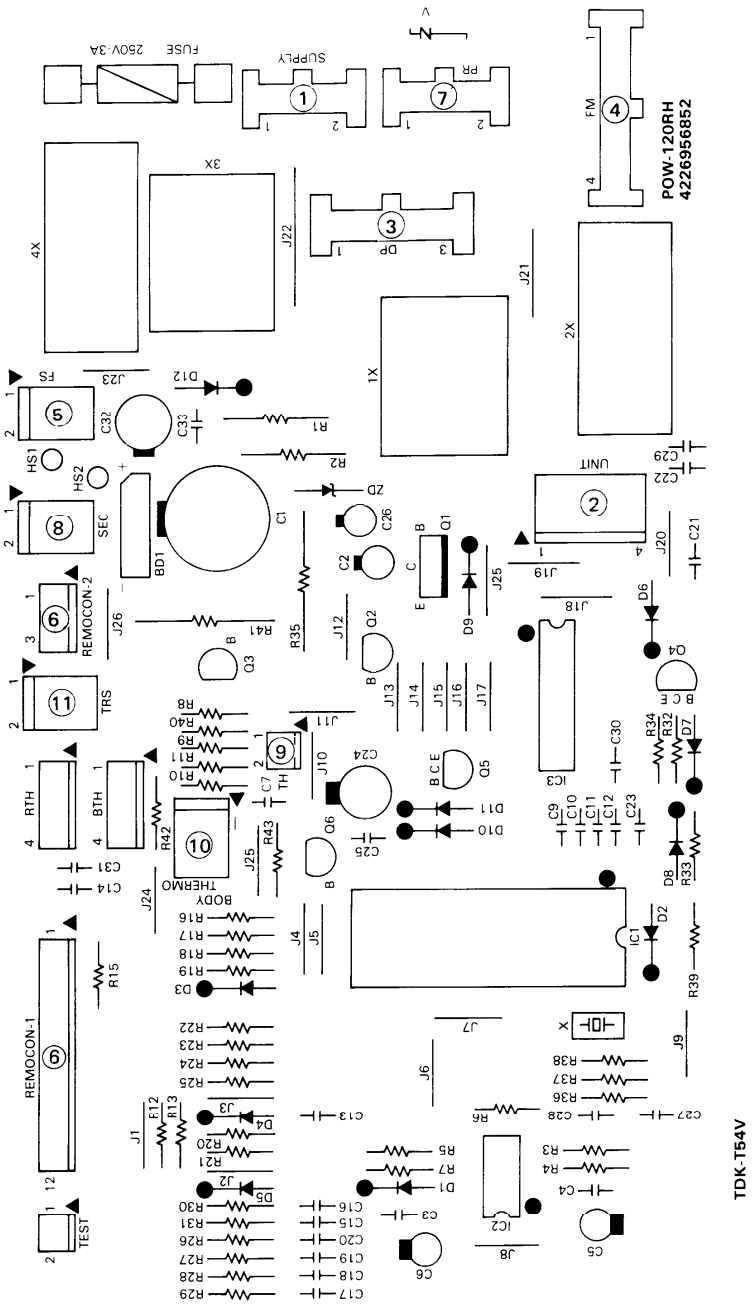


SAP120CH ELECTRIC WIRING DIAGRAM



CONTROLLER P.C.B. (PRINTED PATTERN)

POW-120RH (for SAP120RH)



(1) Connector, Power Supply to PCB: *
(2) Connector, Inter Unit Power Line: 24V.D.C.
(3) Connector, Drain Pump: *
(4) Connector, Fan Motor: *
(5) Connector, Float Switch: 24V.D.C.
(6) Connector, Remote Control Unit: 9V.D.C.
(7) Connector, Transformer (Primary: *)
(8) Connector, Transformer (Secondary: 19V.A.C.)
(9) Connector, Coil Thermistor: 9V.D.C.
(10) Connector, Room Thermistor: 9V.D.C.
(11) Connector, Freeze Protection Thermostat: 9V.D.C.

The asterisk "*" indicates that line voltage is applied

ELECTRIC WIRING DIAGRAM (CONTROLLER P.C.B.)

POW-120RH (for SAP120RH)

Symbol	Name	Description
R1	Resister	100Ω 1W
R2	Resister	1kΩ 1W
R3	Resister	30k 1/4W
R4	Resister	56k 1/4W
R5	Resister	1.5k 1/4W
R6	Resister	1.3k 1/4W
R7	Resister	56k 1/4W
R8	Resister	150k 1/4W
R9	Resister	18k 1/4W
R10	Resister	300K 1/4W
R11	Resister	390K 1/4W
R12	Resister	10K 1/4W
R13	Resister	100K 1/4W
R14	—	—
R15	Resister	8.2K 1/4W
R16	Resister	100Ω 1/4W
R17	Resister	100Ω 1/4W
R18	Resister	100Ω 1/4W
R19	Resister	100Ω 1/4W
R20	Resister	470Ω 1/4W

Symbol	Name	Description
R21	Resister	470Ω 1/4W
R22	Resister	470Ω 1/4W
R23	Resister	470Ω 1/4W
R24	Resister	470Ω 1/4W
R25	Resister	470Ω 1/4W
R26	Resister	56k 1/4W
R27	Resister	56k 1/4W
R28	Resister	56k 1/4W
R29	Resister	56k 1/4W
R30	Resister	56k 1/4W
R31	Resister	56k 1/4W
R32	Resister	3.3k 1/4W
R33	Resister	3k 1/4W
R34	Resister	2k 1/4W
R35	Resister	1k 1W
R36	Resister	56k 1/4W
R37	Resister	5.6k 1/4W
R38	Resister	100Ω 1/4W
R39	Resister	6.8k 1/4W
R40	Resister	100Ω 1/4W

Symbol	Name	Description
R41	Resister	3K 1W
R42	Resister	8.2K 1/4W
R43	Resister	300K 1/4W
D1	Diode	DS442X
	Diode	DS442X
D18	Diode	DS442
R44	Resister	20K 1/4W
R45	Resister	10K 1/4W
R46	Resister	10K 1/4W
R47	Resister	10K 1/4W
ZD2	Zener Diode	GZA5.6Z
ZD1	Zener Diode	GZA9.1Z
BD1	Bridge Diode	DBA10C

Symbol	Name	Description
C1	Capacitor	470μ 50V
C2	Capacitor	1μ 50V
C3	Capacitor	473
C4	Capacitor	223
C5	Capacitor	1μ 50V
C6	Capacitor	0.22μ 50V
C7	Capacitor	473
C8	—	—
C9	Capacitor	472
C10	Capacitor	472
C11	Capacitor	472
C12	Capacitor	472
C13	Capacitor	103K
C14	Capacitor	223
C15	Capacitor	472
C16	Capacitor	472
C17	Capacitor	472
C18	Capacitor	472
C19	Capacitor	472
C20	Capacitor	472

Symbol	Name	Description
C21	Capacitor	473
C22	Capacitor	223
C23	Capacitor	223
C24	Capacitor	223
C25	Capacitor	10μ 16V
C26	Capacitor	473
C27	Capacitor	10μ 25V
C28	Capacitor	151K 50V
C29	Capacitor	271K 50V
C30	Capacitor	223
C31	Capacitor	223
C32	Capacitor	103μ 50V
C33	Capacitor	103
1X	Relay	LZ6-24HE
2X	Relay	VB24TBU
3X	Relay	LZ6-24HE
4X	Relay	VB24TBU
5X	Relay	LZ6-24HE

Symbol	Name	Description
Q1	Transistor	2SD313EF
Q2	Transistor	3402
Q3	Transistor	3402
Q4	Transistor	2SA608EF
Q5	Transistor	3402
IC1	IC	TMS2600 MP9492
IC2	IC	LA6458
IC3	IC	LB1234
X	Cristal	SNR-14A420K
V	Varistor	260V 3A UL
F	Fuse