SERVICE MANUAL

SANYO

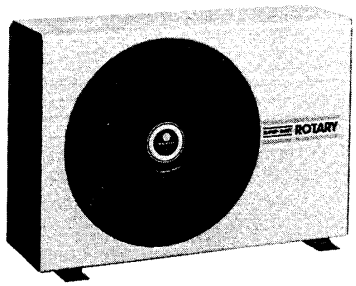
SAP120FCH (USA)

SPLIT SYSTEM HEAT PUMP

April 1987

MODEL NO.	PRODUCT CODE NO.	VOLT - PHASE - HERTZ
SAP 120FH	85264364	115 - 1 - 60
SAP 120CH	85274193	115 - 1 - 60

SAP120FH
Indoor Unit



SAP120CH
Outdoor Unit

Table of Contents

REFERENCE No. WM-19757

1. SPECIFICATIONS

1) Unit Specifications

Model No.			SAP 120FCH		
Unit Model No.	Indoor unit		SAP 120FH		
	Outdoor unit		SAP 120CH		
PERFORMANCE & ELECTRICAL RATINGS			Cooling		Heating
Capacity	Cooling	BTU/hr.	11,400		—
	Heating	BTU/hr.	—		12,500
Air circulation (High)		Cu.ft/min.	350		
Moisture removal (High)		Pints/hr	3.3		
SEER		BTU/whr.	9.5		—
COP			—		2.95
Phase			Single		
Frequency		Hz	60		
Rated voltage		V	115		
Running amperes		A	11.2		11.1
Power input		W	1,240		
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)	2.95 (1,340) + 40g (For quick air purge)		
Compressor oil		cc	650		
Refrigerant tubing connections			Flare type		
Refrigerant control			Capillary tube		
Max. refrigerant line length		ft (m)	33 (10)		
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.		In. (mm)	23/32 (18)		
Refrigerant tube kit			Optional		
Accessories			—		
DIMENSIONS & WEIGHT			Indoor unit		Outdoor unit
Height		In. (mm)	26-25/32 (680)		20-7/8 (530)
Width		In. (mm)	43-5/16 (1,100)		29-17/32 (750)
Depth		In. (mm)	8-15/32 (215)		11-1/32 (280)
Net weight		lbs. (kg)	66.1 (30)		92.6 (42)
Shipping size		Cu.ft (Cu.m)	11.65 (0.33)		6.71 (0.19)
Shipping weight		lbs. (kg)	88.2 (40)		94.6 (43)

DATA SUBJECT TO CHANGE WITHOUT NOTICE.

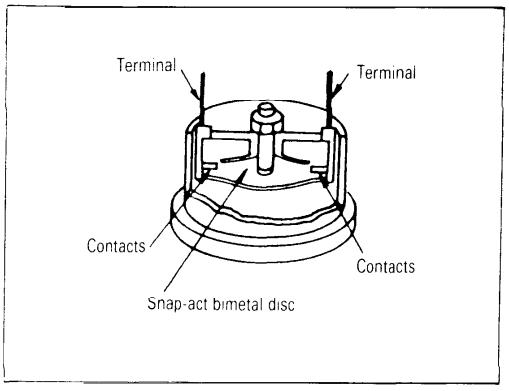
2) Major Component Specifications

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	900	
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.			SAP120FH	SAP120CH
FAN MOTOR			Capacitor run induction motor	
Fan Motor Model No.			KFH6T-21AISP	FT6-21CIPE
Source			115 V, 60 Hz, single phase	
Pole			6	
Nominal output		W	20	
Ampere	Full load	A	0.37	0.69
	Locked rotor	A	0.42	0.79
Protective device			Internal protector (17AM031A5-4)	Internal protector (9700K211-215)
Run capacitor	MFD		4	8
	VAC		220	
Coil resistance (Ω) at 68°F			BLU-BRN : 100.0 BLU VLT : 21.4 VLT-YEL : 12.4 YEL-PNK : 87.2	BLU-BRN : 62.5 BLU-PNK : 59.1

Unit Model No.		SAP120CH
OVERLOAD RELAY, COMPRESSOR		
OLR Model 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)		*1Should not operate for 30 min. at 29.8A
Reset		Automatic

*1 Reference value: measure at 176°F

External Line Break Overload Relay



Major Component Specifications

Unit Model No.	SAP120FH
Room Temperature Sensor *1	OCS5K – UL
Resistance (kΩ)	69°F: 6 – 6.5 77°F: 4.9 – 5.2 86°F: 3.9 – 4.2

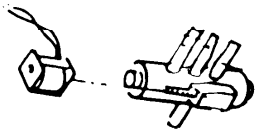
Figure

Unit Model No.	SAP120FH	
Indoor Coil Temperature Sensor *1	NTC-51H-S5	
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

Unit Model No.	SAP120FH
Power Transformer (for controller PCB)	ATR-J121UI
Resistance (Ω)	Primary: WHT–WHT 143.5 Secondary: BRN–BRN1.2

Unit Model No.	SAP120CH
Outdoor Coil Temperature Sensor *2	TRS-12M160UL
Characteristics	OFF: 39°F ON: 54°F±4°F Difference: 14.4°F

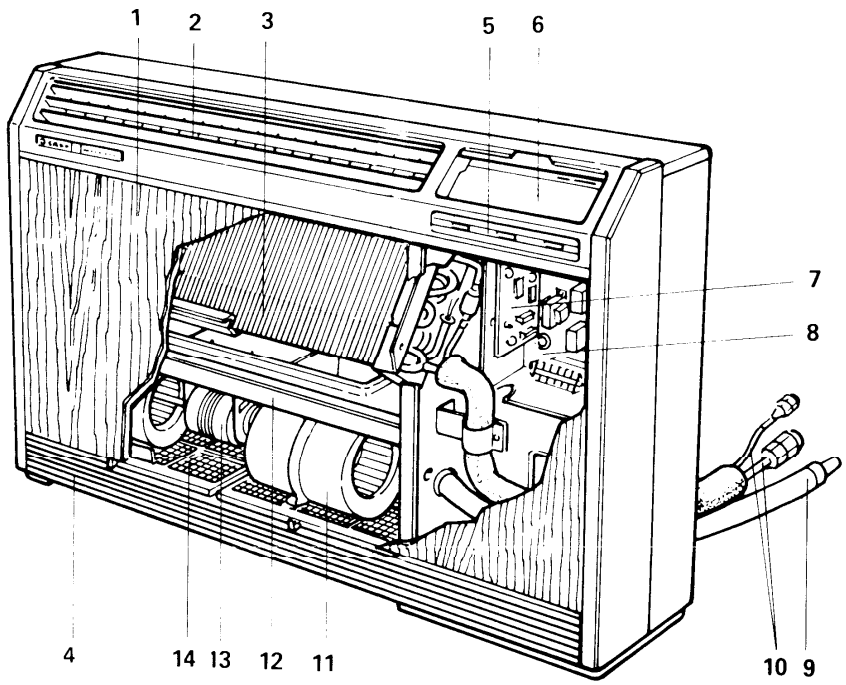
Unit Model No.	SAP120CH
4-Way Reversing Valve	L27-9072 (Coil) V26-9000 (Valve Ass'y)
Coil Voltage	115V, 60Hz



NOTE *1 = Thermistor *2 = Lead Switch

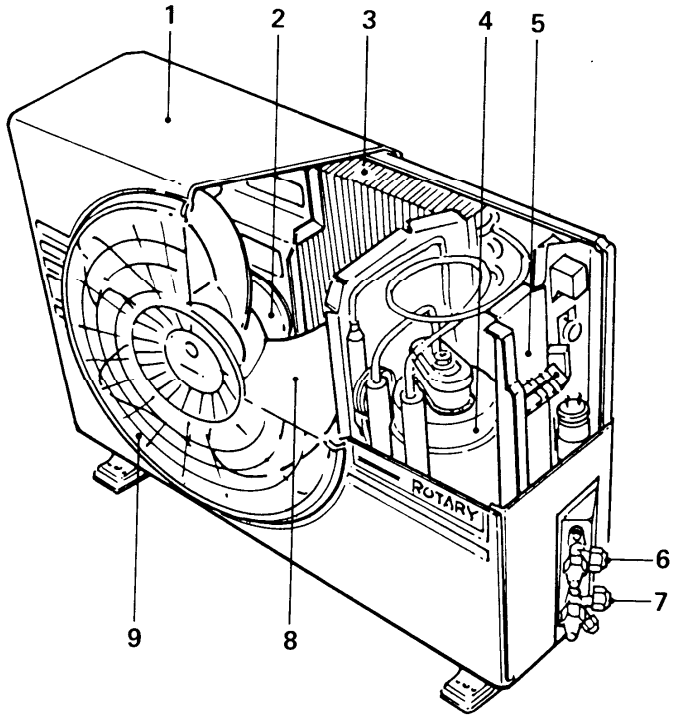
2. CONSTRUCTION OF THE UNIT

INDOOR UNIT **SAP120FH**



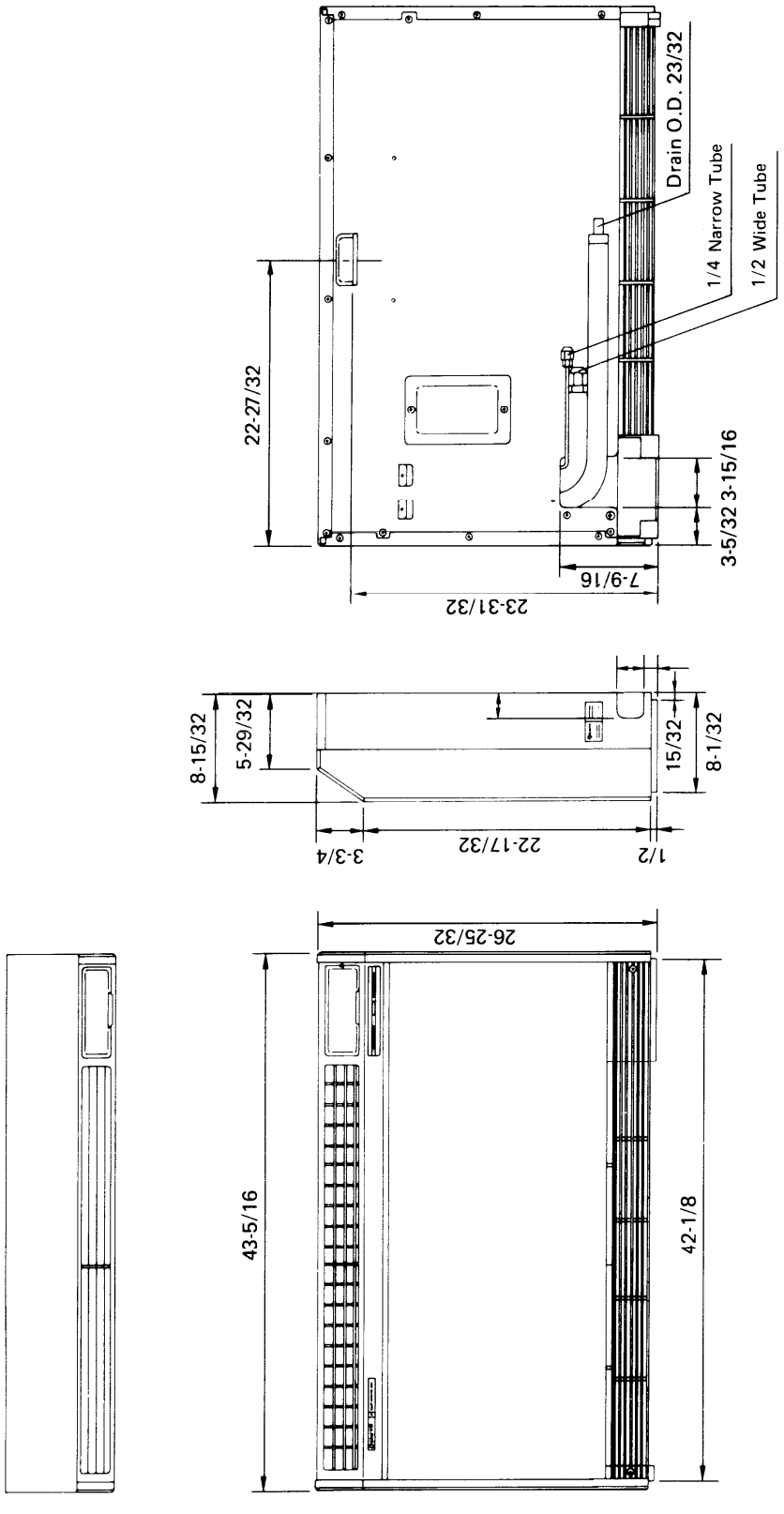
1. Cabinet
2. Air outlet
3. Evaporator (= Indoor heat exchanger)
4. Air intake
5. Operation indoor lamp
6. Control panel
7. Controller PCB
8. Electrical component box
9. Drain hose
10. Refrigerant tubing
11. Blower
12. Drain pan
13. Fan motor
14. Air filter (Slide-out)

OUTDOOR UNIT **SAP120CH**

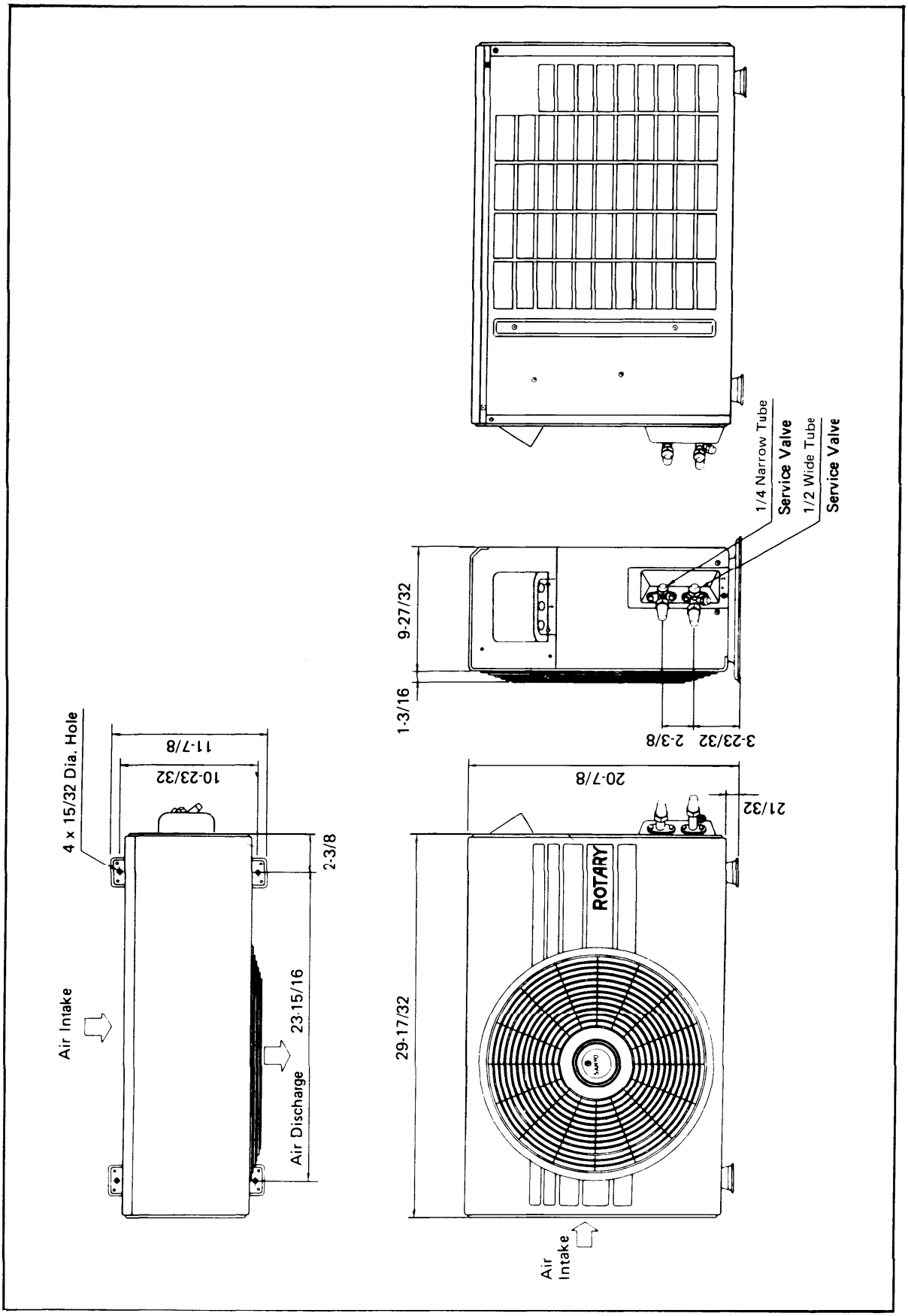


1. Casing
2. Fan motor
3. Condenser (= Outdoor heat exchanger)
4. Compressor
5. Electrical component box
6. Service valve (Narrow tube)
7. Service valve (Wide tube)
8. Outdoor fan
9. Fan guard

3. DIMENSIONAL DATA INDOOR UNIT SAP120FH



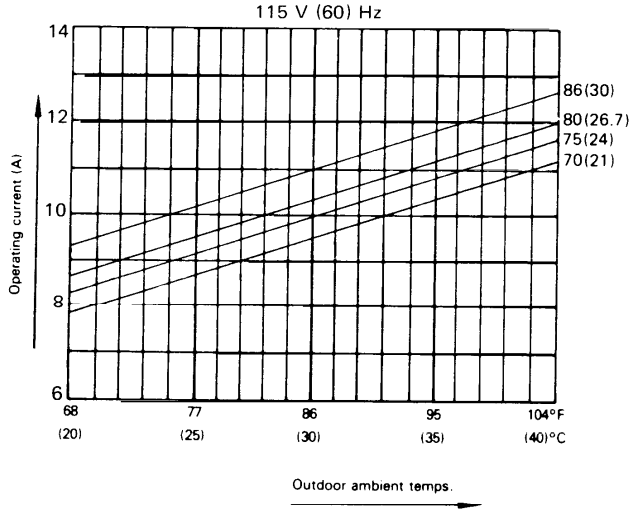
OUTDOOR UNIT SAP120CH



4. PERFORMANCE CHARTS

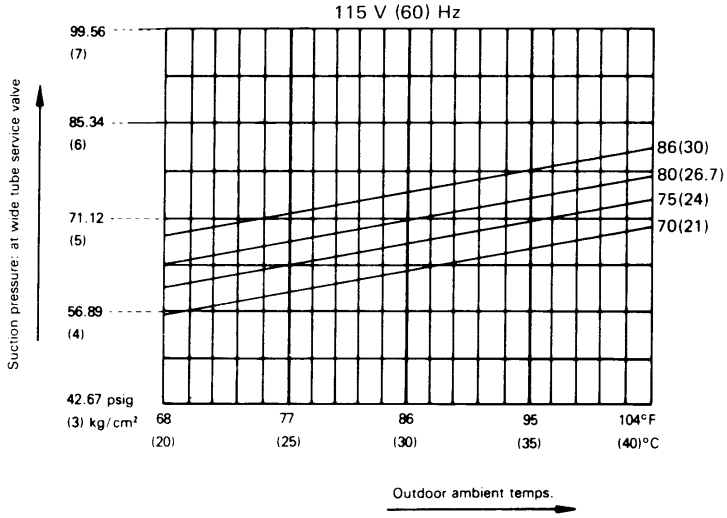
Cooling characteristics Model: SAP120FCH

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.)



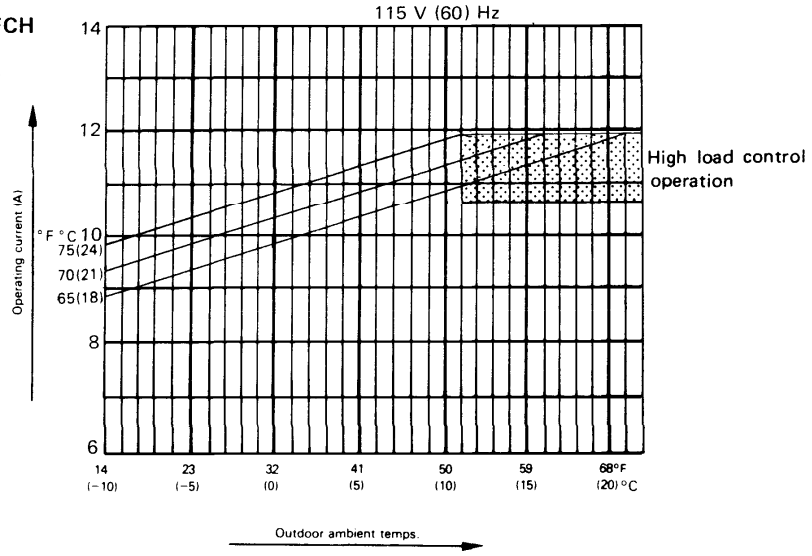
Cooling characteristics Model: SAP120FCH

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



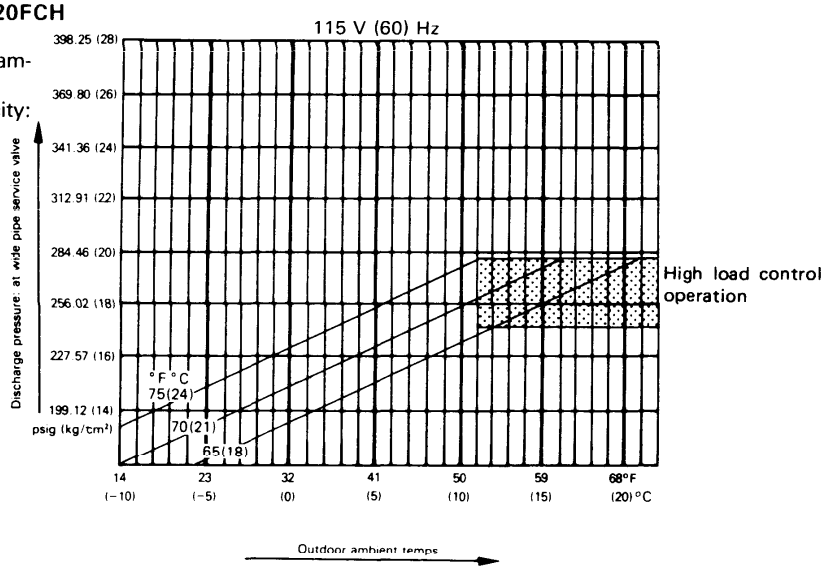
Heating characteristics Model: SAP120FCH

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 Model: SAP120FCH

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

This button is used to turn the heat pump ON/OFF

B. COOLING/HEATING SELECTOR

C. SELECTOR

TIMER ON	Used to start the system at the set time.
TIMER OFF	Used to stop the system at the set time. Refer to page ⑬
NIGHT SETBACK	Used for programmed energy saving operations. Refer to pages ⑪ and ⑭.
MANUAL	Used for conventional temperature control operation using the thermostat.

D. Service TEST RUN switch (recessed*)

This switch is a service switch for the heat pump. Do not touch it, therefore. During normal operation, this switch is set in the RUN position. If the heat pump is used with the switch in the TEST RUN position, it will not operate normally.

E. TIMER LAMP

This lamp is lit when the system is operating on the timer.

F. NIGHT SETBACK

This lamp is lit when the system is in the NIGHT SETBACK mode.

G. THERMOSTAT

You can regulate the room temperature as desired by adjusting the THERMOSTAT knob.

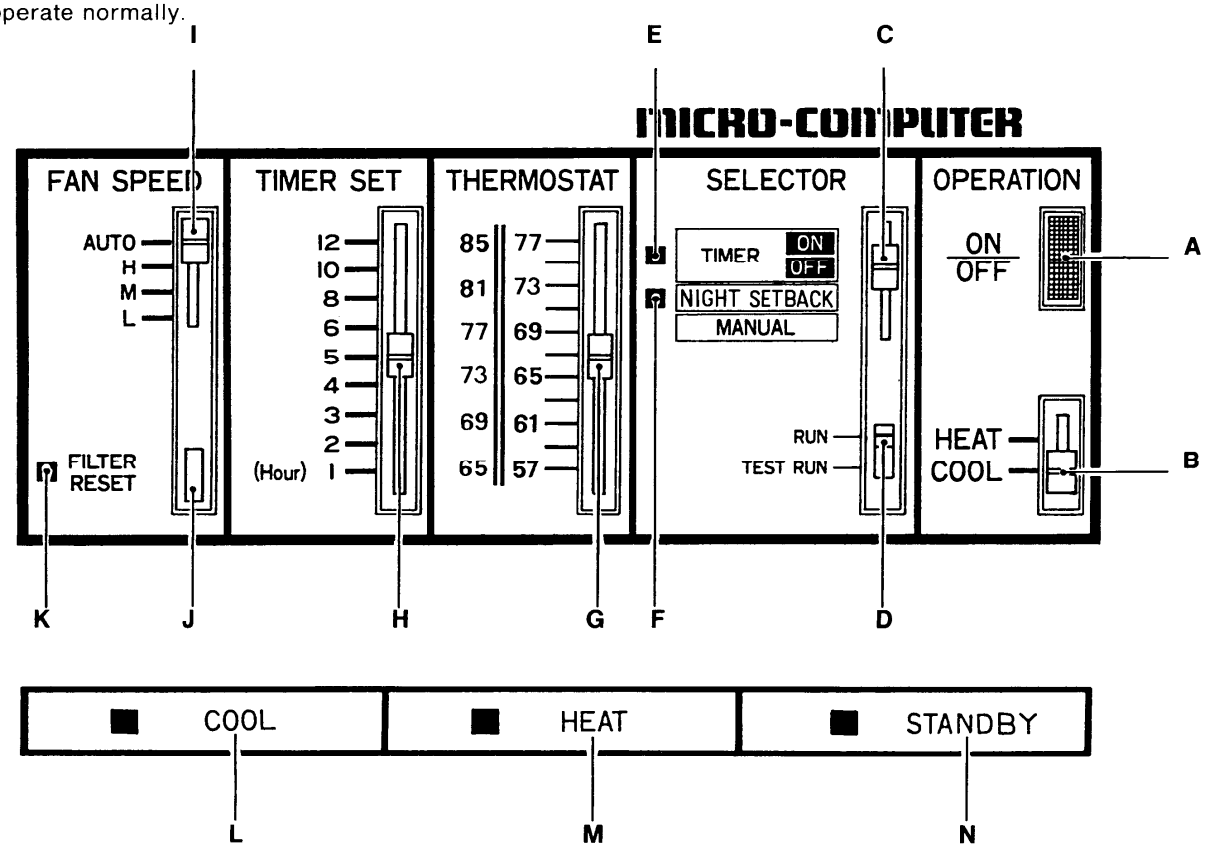
H. TIMER SET

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

I. FAN SPEED

Use this control to select the desired fan speed.

Programmed operation	Non-programmed operation
AUTO	H: High Speed M: Medium Speed L: Low Speed



J. FILTER RESET BUTTON

This button is used to turn off the FILTER CHECK LAMP.

K. FILTER CHECK LAMP

When this lamp is lit, the filter needs to be cleaned.

NOTE

The FILTER CHECK LAMP lights when the system is turned on, for the first time, or in the event of a power interruption.

L. COOLING OPERATION LAMP

The green lamp lights when the system is in the COOLING mode.

M. HEATING OPERATION LAMP

The red lamp lights when the system is in the HEATING mode.

N. STANDBY LAMP

The yellow lamp lights in the following cases:

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

Operation

COOLING

1. MANUAL COOLING

The Manual mode is used for normal cooling operation.

STEP 1: Set the COOLING/HEATING selector to COOL.

STEP 2: Set the THERMOSTAT to the desired temperature.

STEP 3: Set the FAN SPEED as desired.

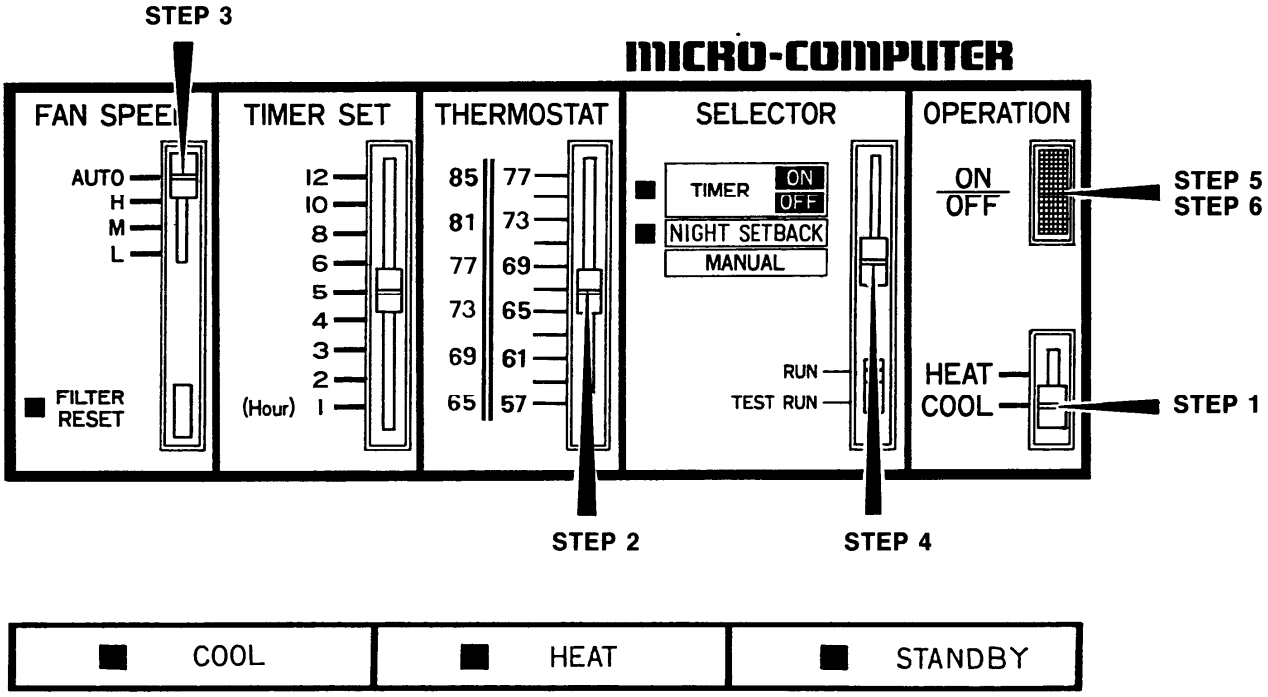
STEP 4: Set the SELECTOR to MANUAL.

STEP 5: Press the OPERATION ON/OFF button. COOL lamp (green) lights.

STEP 6: Press the OPERATION ON/OFF button again to stop the heat pump.

NOTE

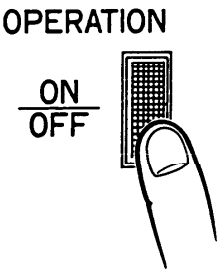
To protect the compressor from overloading, a 3-minute time delay circuit is built into the heat pump. The compressor starts runnning after 3 minutes when the operation ON/OFF button is pressed. When power is interrupted, press the operation button again to start the unit.



2. NIGHT SETBACK MODE

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

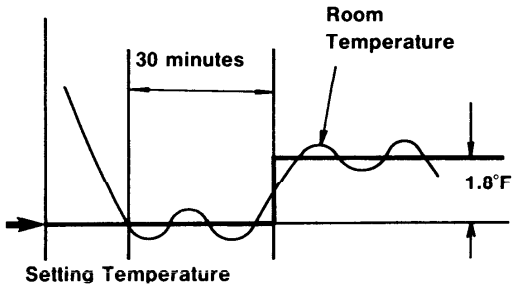
STEP 2: Press the OPERATION ON/OFF button. The NIGHT SETBACK and OPERATION (green for COOLING) lamps will light.



Cooling operation in the NIGHT SETBACK mode

Approximately 30 minutes after the room temperature reaches the thermostat setting, the set temperature is automatically raised 1.8°F as shown below, which saves energy.

In the NIGHT SETBACK mode, the compressor stops when the temperature reaches the thermostat setting. Then, the indoor fan stops 30 seconds later to prevent the moisture from blowing back into the room.



ADJUSTING THE FAN SPEED

1. MANUAL (FAN ONLY)

If you want to circulate the air without any temperature control, follow these steps.

STEP 1: Set the COOLING/HEATING selector to "COOL".

STEP 2: Set the THERMOSTAT knob to the topmost position. (This cancels the thermostat function in cooling.)

STEP 3: Set the FAN SPEED control as desired. ("H" (High), "M" (Medium), or "L" (Low).

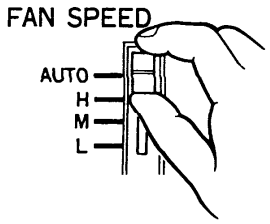
STEP 4: Set the SELECTOR to "MANUAL".

STEP 5: Press the OPERATION ON/OFF button.

STEP 6: Press the OPERATION ON/OFF button again to stop the heat pump.

2. AUTOMATIC

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



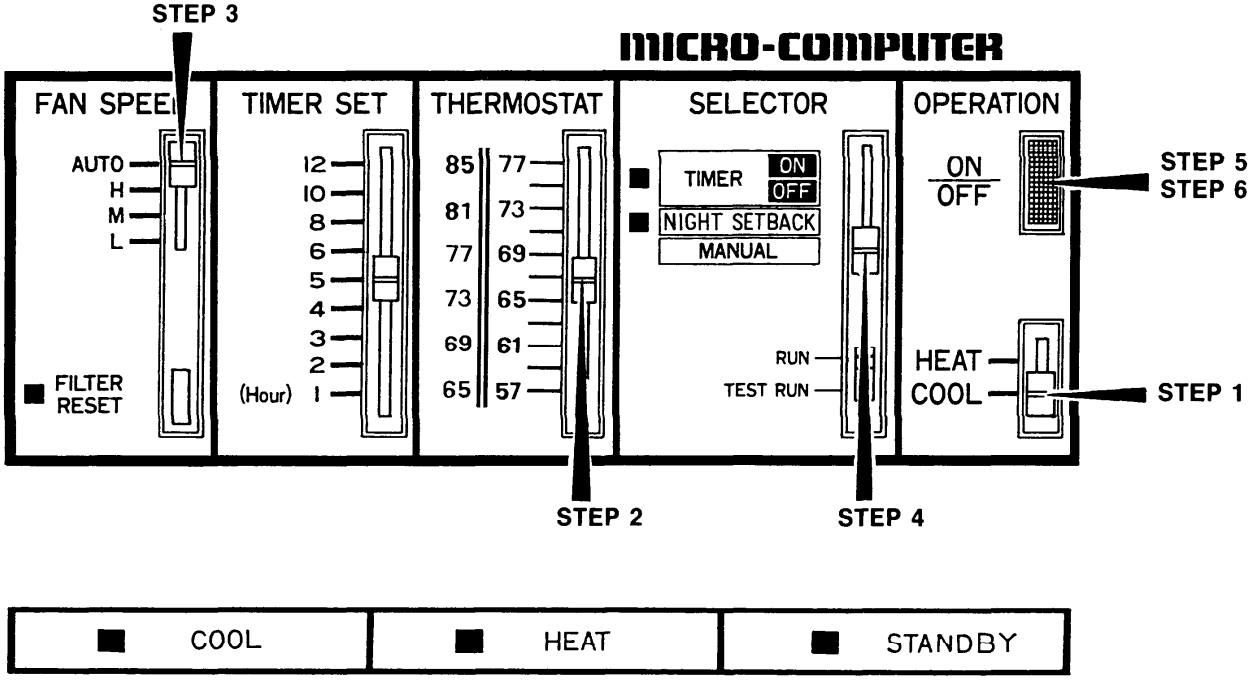
A microcomputer in the heat pump automatically controls the fan speed when the AUTO mode is selected. When the heat pump starts operating, the difference between the room temperature and the set temperature is detected by the microcomputer which then automatically switches the fan speed to the most suitable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

COOLING

When difference between room temperature and set temperature is	FAN SPEED
3.6°F and over	H (High)
Between 3.6 and 1.8°F	M (Medium)
below 1.8°F	L (Low)

HEATING

When difference between room temperature and set temperature is	FAN SPEED
1.8°F and over	H (High)
Below 1.8°F	M (Medium)

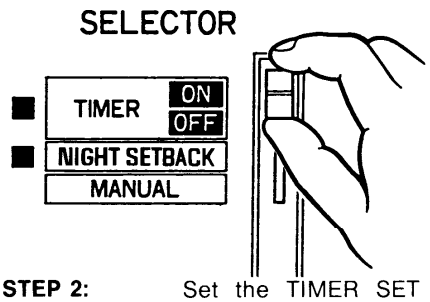


USING THE TIMER

1. TIMER ON MODE

The system starts at the set time.

STEP 1: Set the SELECTOR to TIMER ON.



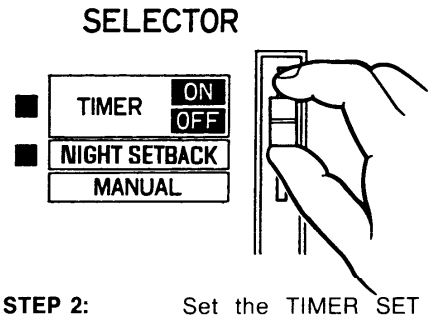
STEP 2: Set the TIMER SET control to the desired time.
(When the timer is set to 5, for instance, the system starts after five hours.)

STEP 3: Press the OPERATION ON/OFF button. The TIMER lamp will light.

2. TIMER OFF MODE

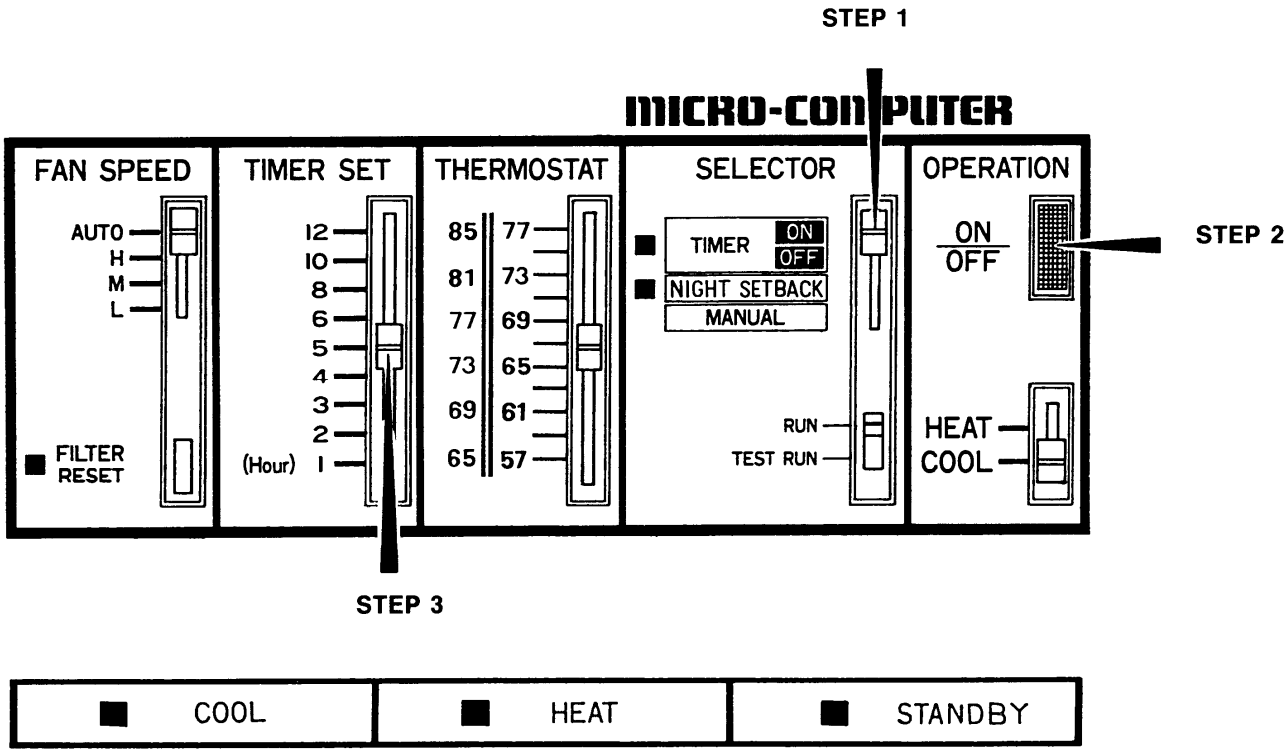
The system stops at the set time.

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 5, for instance, the system stops after five hours.)

STEP 3: Press the OPERATION ON/OFF button. The TIMER and OPERATION lamps will light.



HEATING

1. MANUAL HEATING

The Manual mode is used for normal heating operation.

STEP 1: Set the COOLING/HEATING selector to HEAT.

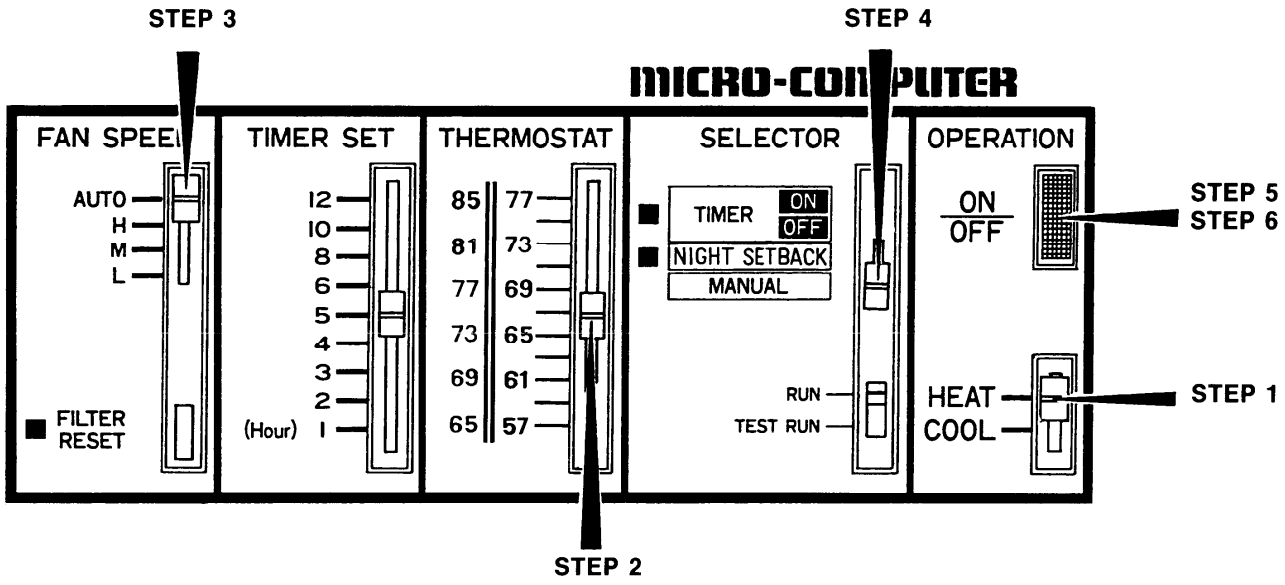
STEP 2: Set the THERMOSTAT to the desired temperature.

STEP 3: Set the FAN SPEED as desired.

STEP 4: Set the SELECTOR to MANUAL.

STEP 5: Press the OPERATION ON/OFF button.

STEP 6: Press the OPERATION ON/OFF button again to stop the heat pump.

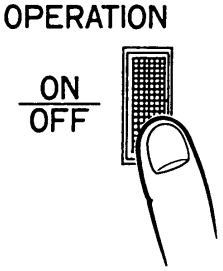


2. NIGHT SETBACK MODE

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

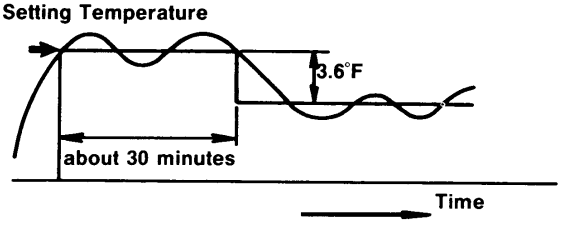
NIGHT SETBACK

STEP 2: Press the OPERATION ON/OFF button. The NIGHT SETBACK and OPERATION (red for HEATING) lamps will light.



Heating Operation in the ENERGY SAVER mode

Approximately 30 minutes after the room temperature reaches the thermostat setting, the set temperature is automatically lowered 3.6°F as shown below, which saves energy. When the temperature reaches the thermostat setting, the compressor stops and the indoor fan automatically changes to Low Speed.



3. Special remarks on heating

Heating performance

- Because this heat pump heats a room by drawing in the heat of the outside air (heat pump system), the heating efficiency will fall off when the outdoor temperature is very low. If sufficient heat cannot be obtained with this air conditioner, use another heating appliance in conjunction with it.

Defrosting

- When the outdoor temperature is low, frost may form on the heat exchanger coil, reducing the heating performance. When this happens, a microcomputer defrosting system operates. At the same time, the fan on the indoor unit stops and the standby lamp remains lit until defrosting is completed. Heating operation restarts after several minutes. (This interval will vary slighty depending upon the outdoor temperature and the way in which frost forms).

STANDBY lamp

- For several minutes after the start of heating operation, the indoor fan will not start running until the indoor heat exchanger coil has warmed up sufficiently. This is because the COLD DRAFT PREVENTION SYSTEM is operating. During this period, the STANDBY lamp remains lit.

- The STANDBY lamp also remains lit during defrosting or when the compressor has been turned off by the thermostat when the system is in the heating mode.

- Upon completion of defrosting and when the compressor is turned on again, for heating operation, the STANDBY lamp will go off automatically.

"High" Fan Speed

- If the room temperature and outdoor temperature are high when the heat pump is operating in the heating mode, the indoor fan speed will switch to High, regardless of the setting of the FAN SPEED selector, and in some cases, this condition will be repeated. This is because the safety unit operates to prevent the system from overloading.

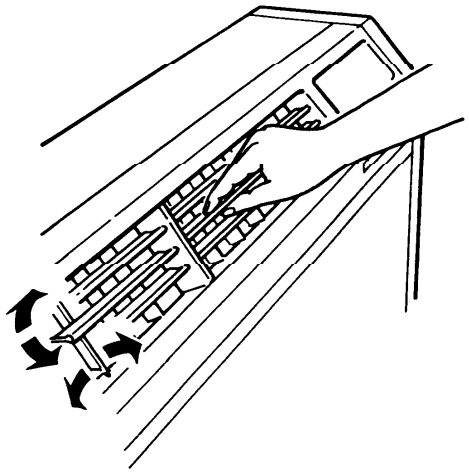
ADJUSTING THE AIR FLOW DIRECTION

1. Horizontal

The horizontal air flow can be adjusted by moving the vertical vane to the left or right.

2. Vertical

Hold the end of the flap and move it up or down to adjust the vertical air flow.



6. INSTALLATION INSTRUCTIONS

1. Installation Site Selection

Indoor Unit

AVOID:
- area where leakage of flammable gas may be expected.
- place where a large amount of oil mist exists.
- direct sunlight.
- nearby heat source that may affect performance of the unit.

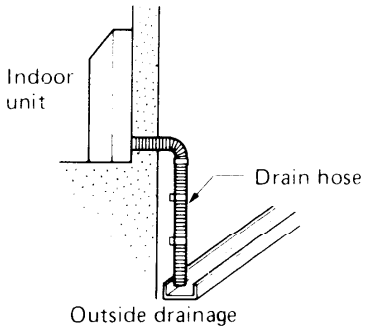


Fig. 1

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.
- install unit within 23' up or down of outdoor unit and within a total of 33' from outdoor unit. Fig. 2.
- tubing can be done either one out of two directions, i.e., right side rear or right side bottom to the front of unit.

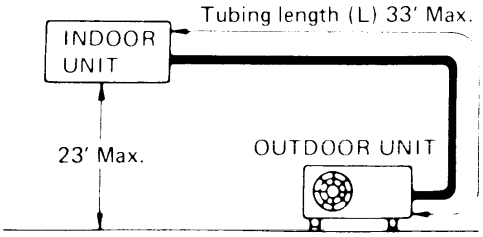


Fig. 2

Outdoor Unit

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

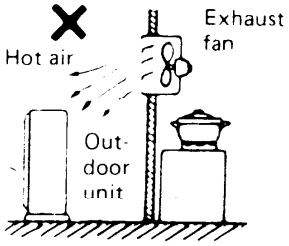


Fig. 3

DO:

- choose a place as cool as possible.
- chose a place that is well ventilated and outside air temperature does not exceed 113°F constantly.
- allow enough room around unit for air intake/exhaust and possible maintenance. Fig. 4
- provide a solid base; concrete (concrete block, 4 x 4 beams or equal), about 4" above ground level to reduce humidity and possible water damage in unit and decrease service life. Fig. 5
- use lag bolts or equal to bolt down unit, reducing vibration and noise.

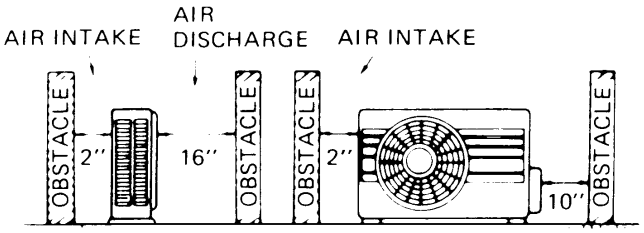


Fig. 4

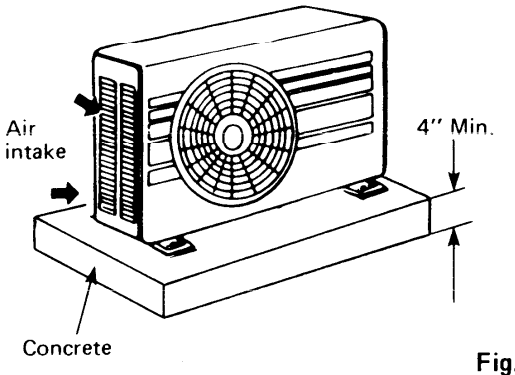


Fig. 5

2. Connecting Tubes between Indoor and Outdoor Units

Connect the indoor side refrigerant tubing extended from the wall with the outdoor site tubing tigytly. (Refer to Table-1)

Tube diameter	Tightening torque
6.35 mm (1/4")	Approx. 130 ~ 170 lbs.in.
12.70 mm (1/2")	Approx. 430 ~ 470 lbs.in.

Table-1

3. Wiring Instructions on Outdoor Unit

① To remove the access panel, remove 4 screws.
② Dismount plugs on the conduit plate.
③ Temporarily mount conduit tubes on the conduit plate.
④ Properly connect power supply mains and interunit lines to corresponding terminals on the terminal block.
Refer to the wiring diagram in Fig. 6, which is labelled on the access panel.

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

⑤ Ground unit in accordance with local codes.

WIRING SYSTEM DIAGRAM
SAP120FCH

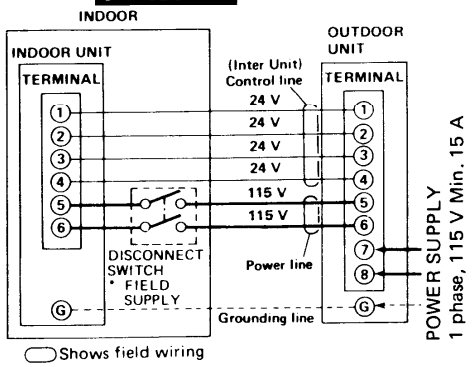


Fig. 6

⑥ When connections are completed, secure both connections on the panel with lock nuts and then close the panel. Fig. 7

⑦ 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.

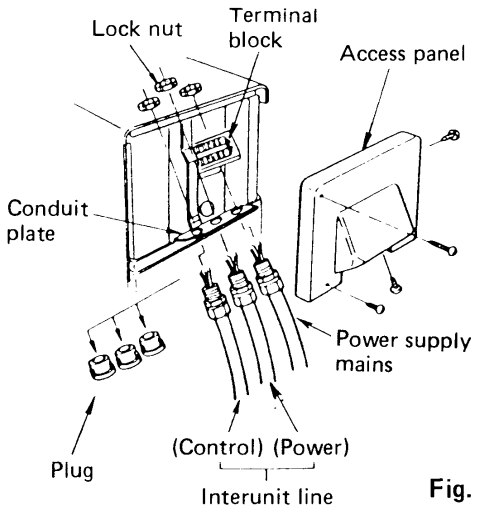


Fig. 7

4. 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. 8

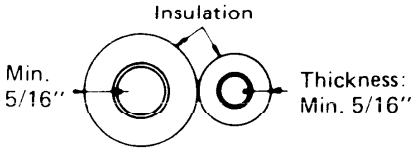


Fig. 8

- **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 polyethylen or equivalent.

CAUTION

After a tube has been insulated, never try to bend it into a narrow curve, this may cause the tube to break or crack.

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 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.

1) Tubing Diagram for Air Purging

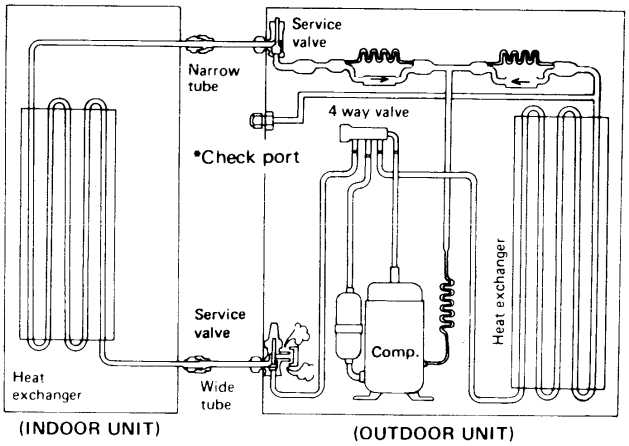


Fig. 9

2) 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 precharged in the outdoor unit.

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

* Interval required for air purging is only 15 seconds.

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.

3) Air Purging Procedure

① Remove the valve caps from the service valves on the narrow and wide tubes.
② Slacken off the flare nut at the charging port one full turn. Fig. 10
③ Open the service valve on the narrow tube by 90 degrees (1/4 turn).
(During this operation, air will be discharged from the charging port of the service valve on the wide tube.)
④ 15 seconds after opening the stem, properly tighten up the flare nut of the charging port.
⑤ Shut the stem of the service valve on the narrow tube. Fig. 11
⑥ Leak test the joints with liquid soap. Fig. 12
⑦ Fully open the stems of the service valves on the wide tube and the narrow tube.
⑧ Next, install a valve cap in which copper gasket has been inserted. Fig. 13
⑨ Here, all air purge procedure has completed and the unit is ready for trial operation.

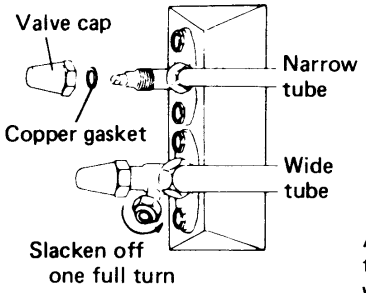


Fig. 10

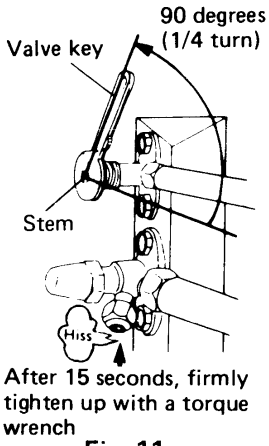


Fig. 11

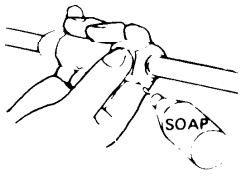


Fig. 12

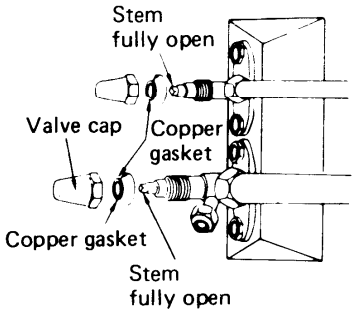


Fig. 13

6. 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.

■ SERVICE VALVE CONSTRUCTION

- **Valve Position -a-**
  The valve stems of both wide and narrow tubes are turned all the way in. The unit is shipped from the factory in this position.
  (Fig. 14-a)
- **Valve Position -b-**
  The valve stems of both wide and narrow tubes are turned all the way out ("BACK SEAT" position). This is the normal operating position.
  (Fig. 14-b)
- **Valve Position -c-**
  With the narrow tube valve kept at BACK SEAT, only the wide tube valve stem is turned halfwaydown position. This position is used for pressure measurement and gas charging.
  (Fig. 14-c)
- **Valve Position -d-**
  Like position -a-, but with the flare nut of wide tube slack. This position is used for air purging.
  (Fig. 14-d)

CAUTION

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

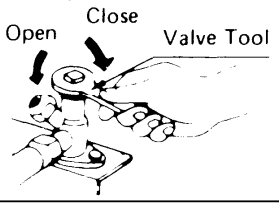


Fig. 15

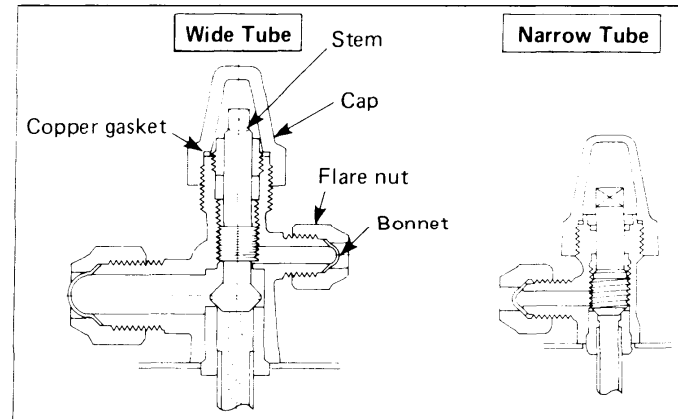


Fig. 14-a -a- Condition at Shipping

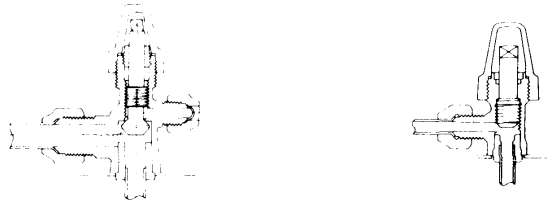


Fig. 14-b -b- Condition for Operation

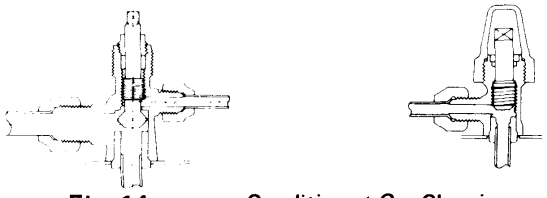


Fig. 14-c -c- Condition at Gas Charging

Fig. 14-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.

Pump Down Procedure (Be sure to carry out Pump Down in cooling operation)

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.

CAUTION WHEN UNIT IS INSTALLED

- In releasing pump down, flush in the tubing with the gas contained in the outdoor unit. Be sure to charge 1.4 oz. (40 g) of refrigerant from wide tube service valve at position -c- during cooling operation.
- No additional charging of refrigerant is necessary when vacuum evacuation was taken place for servicing.

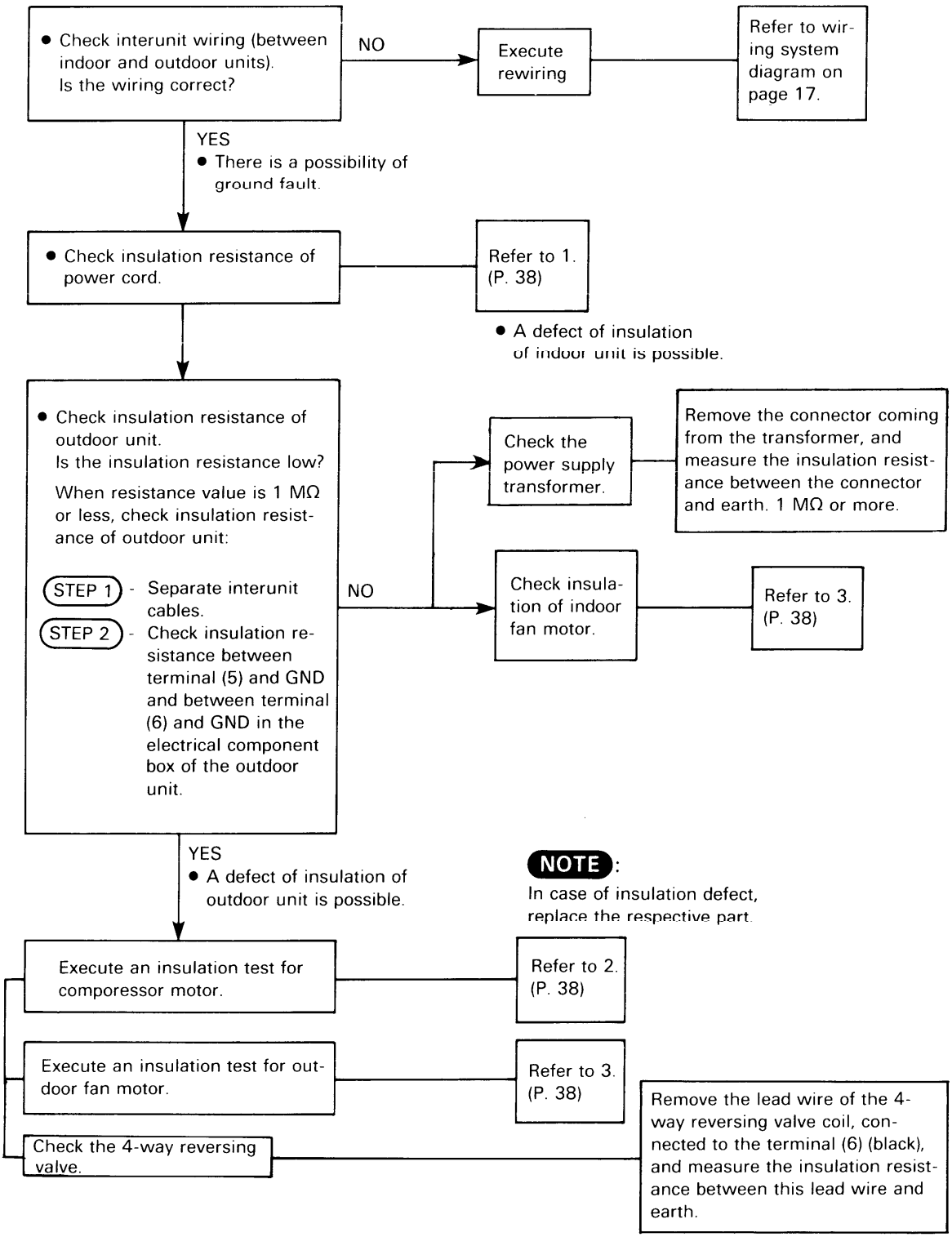
7. TROUBLESHOOTING

— Quick Access Index —

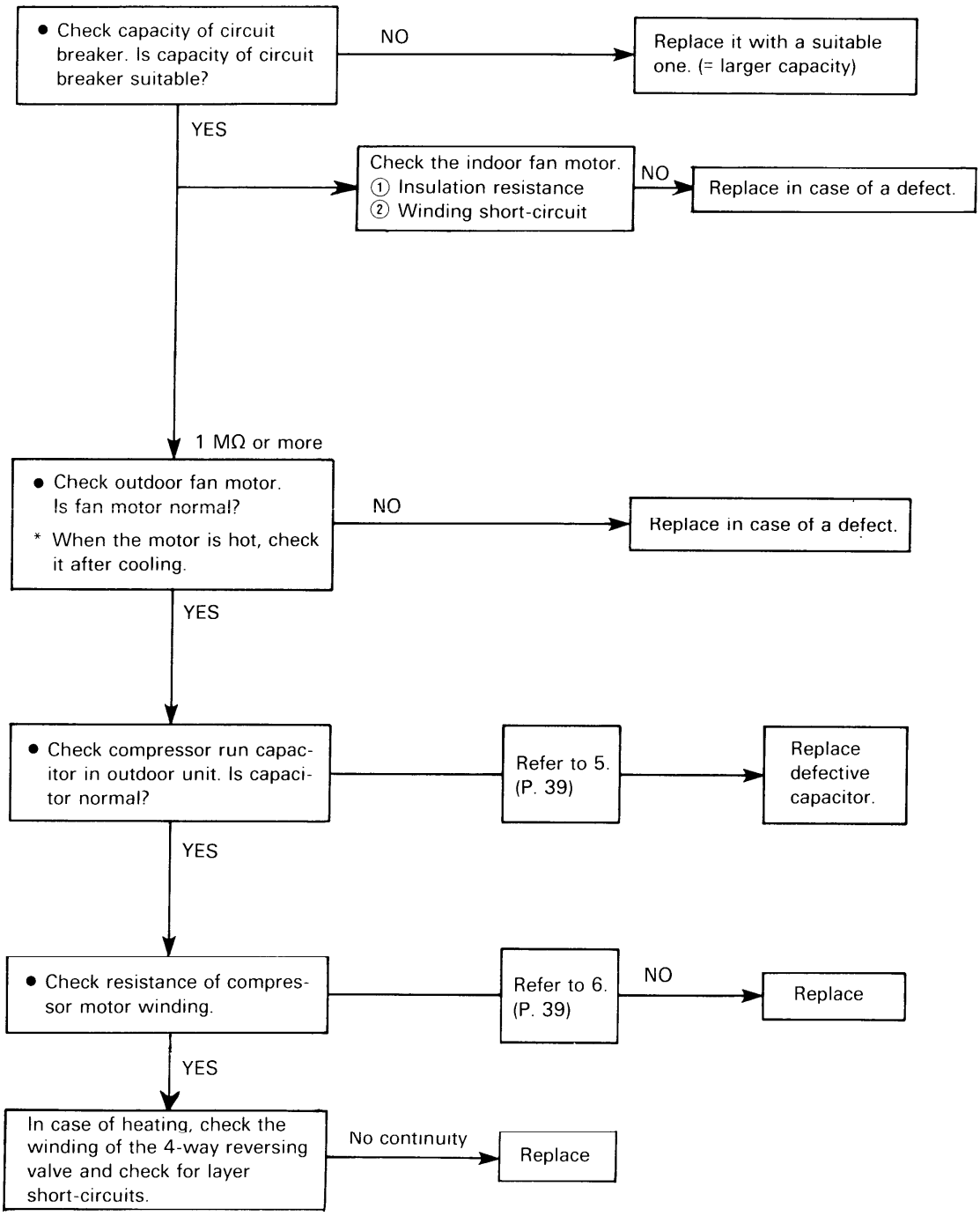
1. Air conditioner does not operate

1) Circuit breaker trips (or fuse blows)

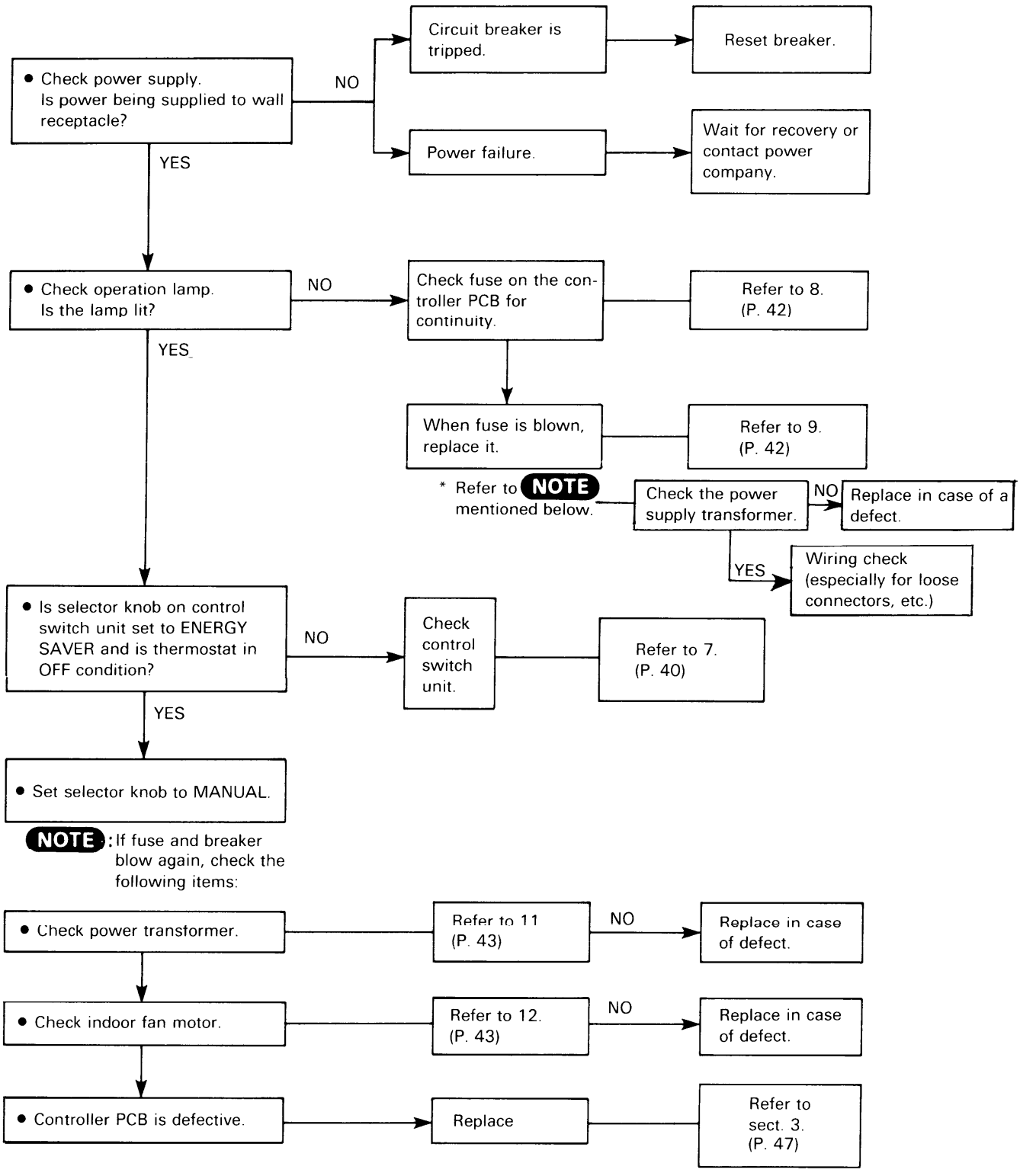
① When circuit breaker is set to ON, it is tripped soon (Resetting is not possible)



② Circuit breaker trips when the operation switch is depressed.

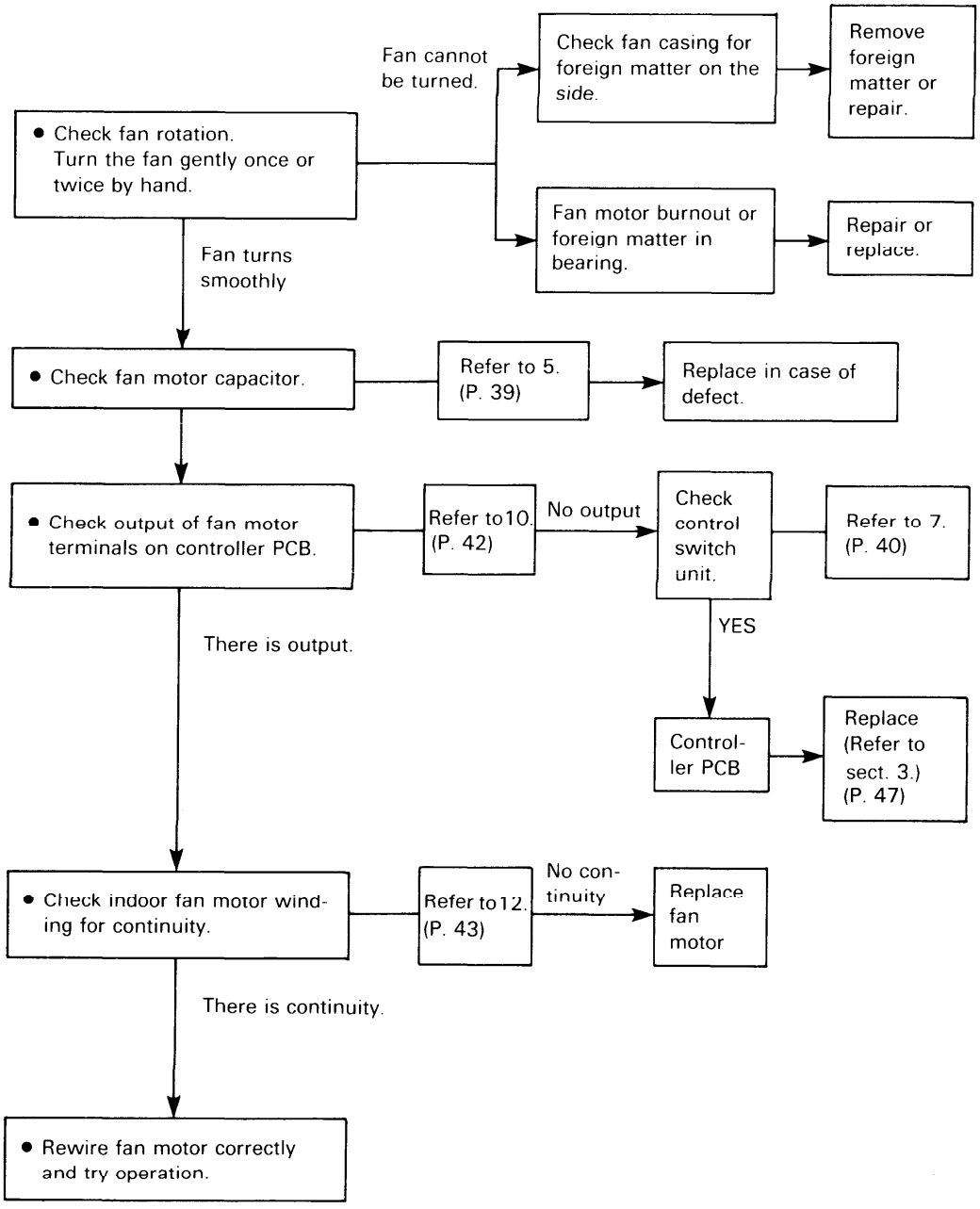


2) Neither indoor unit nor outdoor unit runs



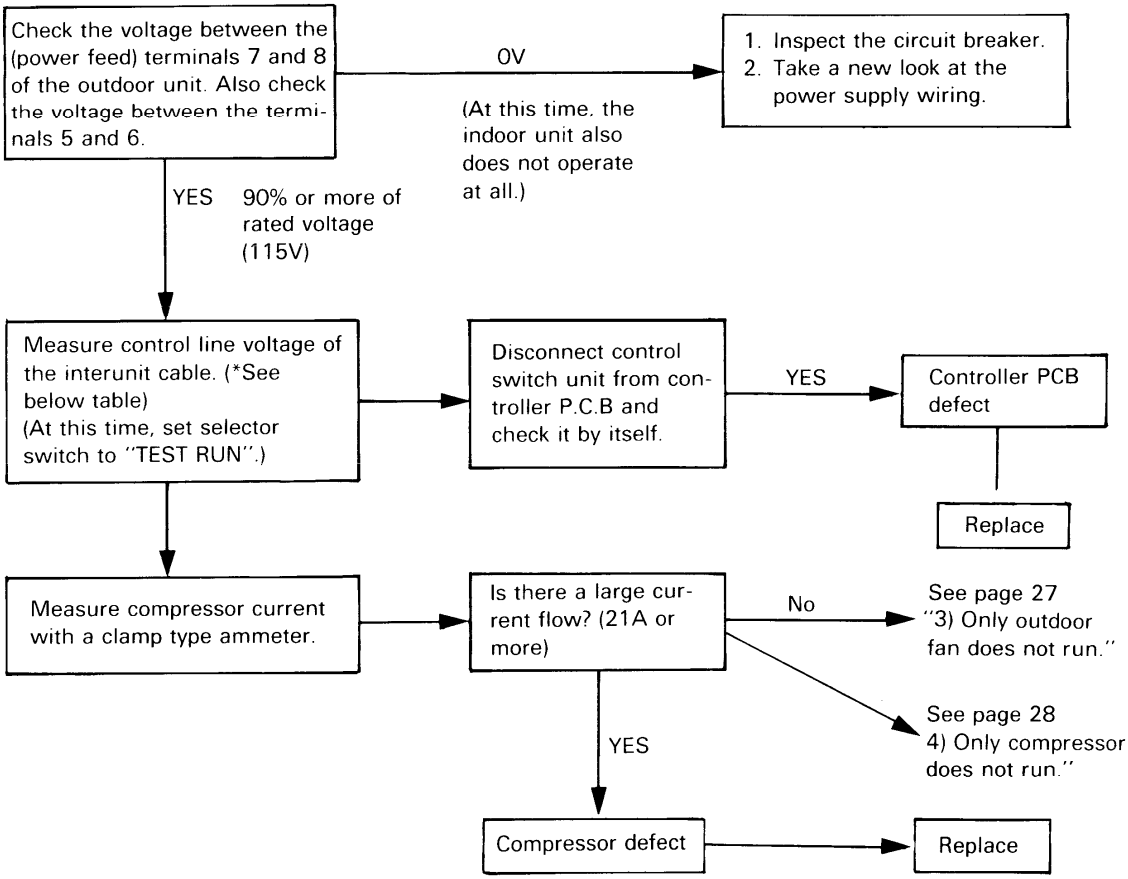
2. Some part of air conditioner does not operate

1) Indoor fan does not run



2) Neither outdoor fan nor compressor runs
(The indoor unit shall be assumed as normal)

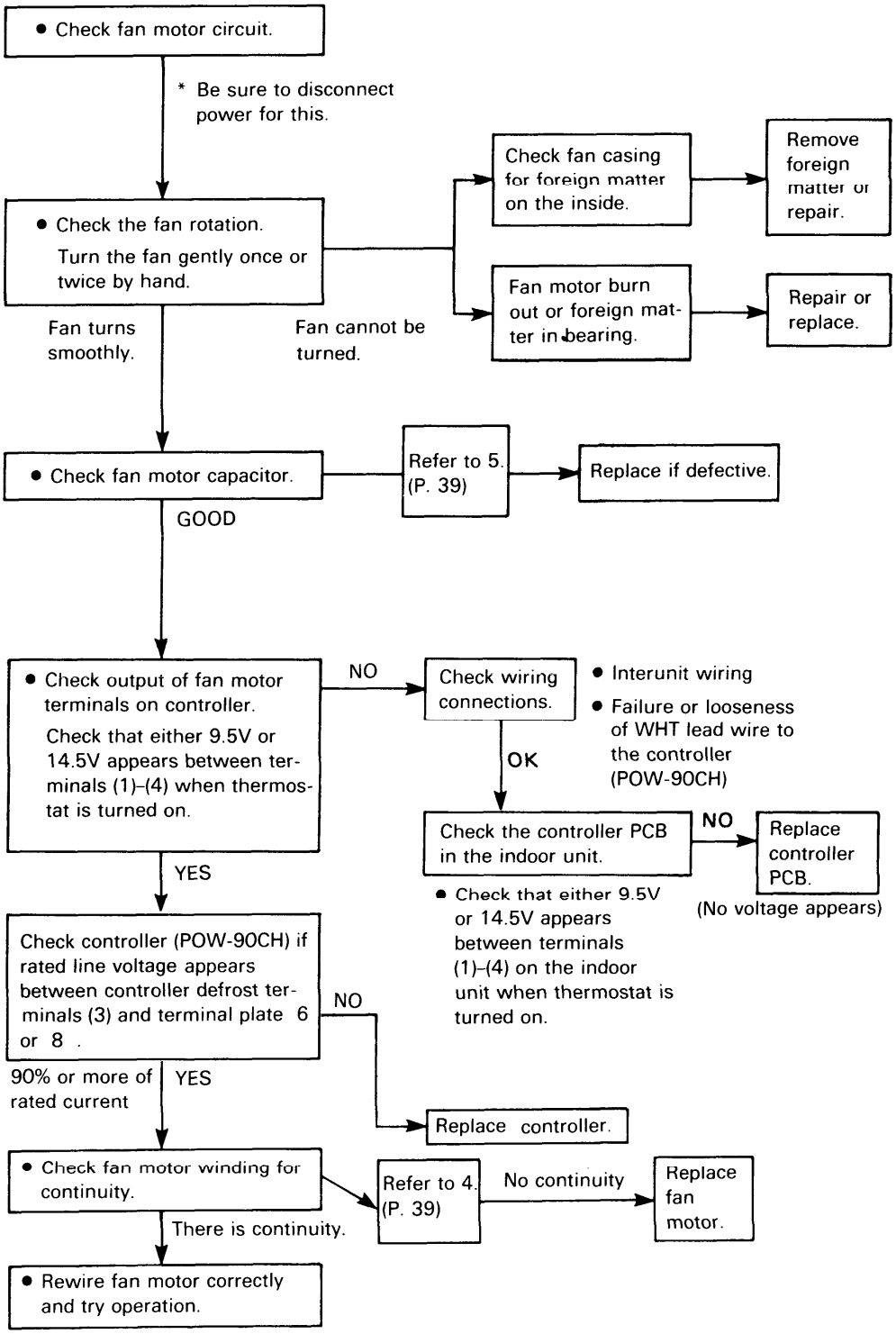
NOTE : Check following points at first;
① Is thermostat setting suitable?
② Has 3 minute timer operated?
(No operation for 3 minutes after power ON.)



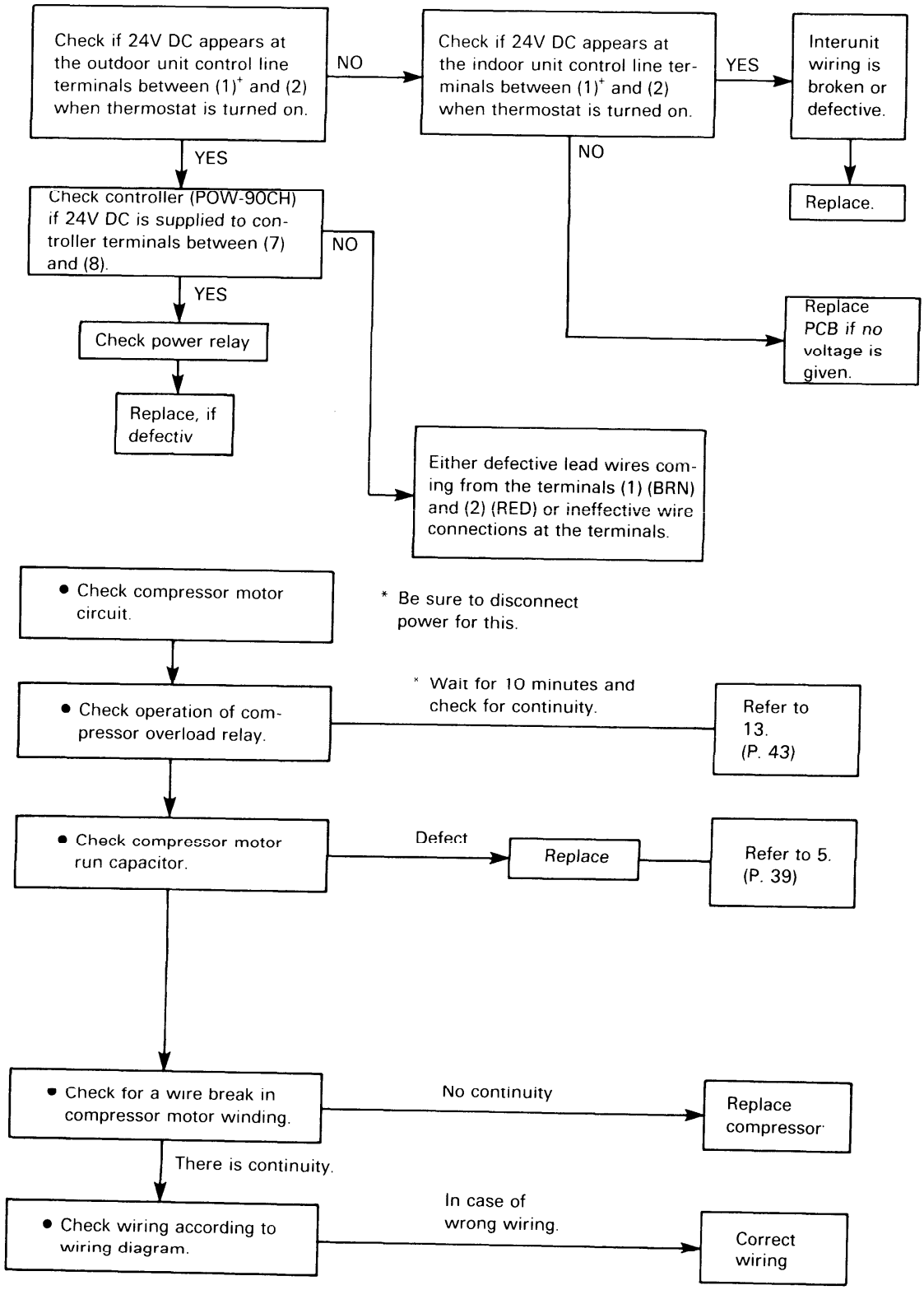
● CONTROL LINE VOLTAGE AT THE INDOOR UNIT's TERMINAL BASE

Signal	Terminal No. to be checked	Thermo. Cycle	Cooling Operation	Heating Operation
Compressor ON — OFF	1 — 2	ON	24V DC	
		OFF	0V	
Heating	1 — 3	—	0V	24V DC
				*0V when defrosting
Fan motor ON — OFF	1 — 4	ON	Approx. 9.5V or 14.5V	
		OFF	0V	

3) Only outdoor fan does not run

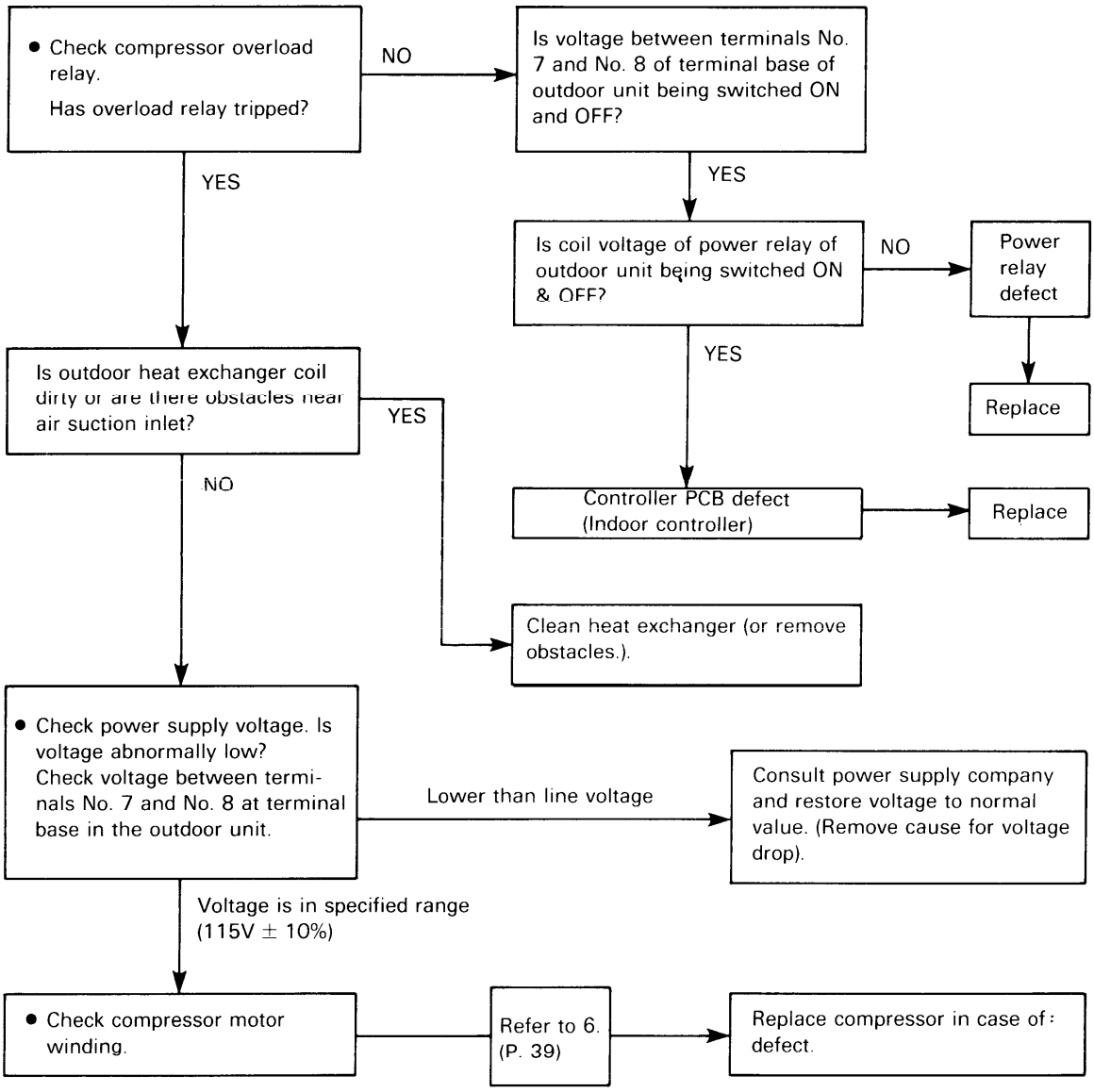


4) Only compressor does not run



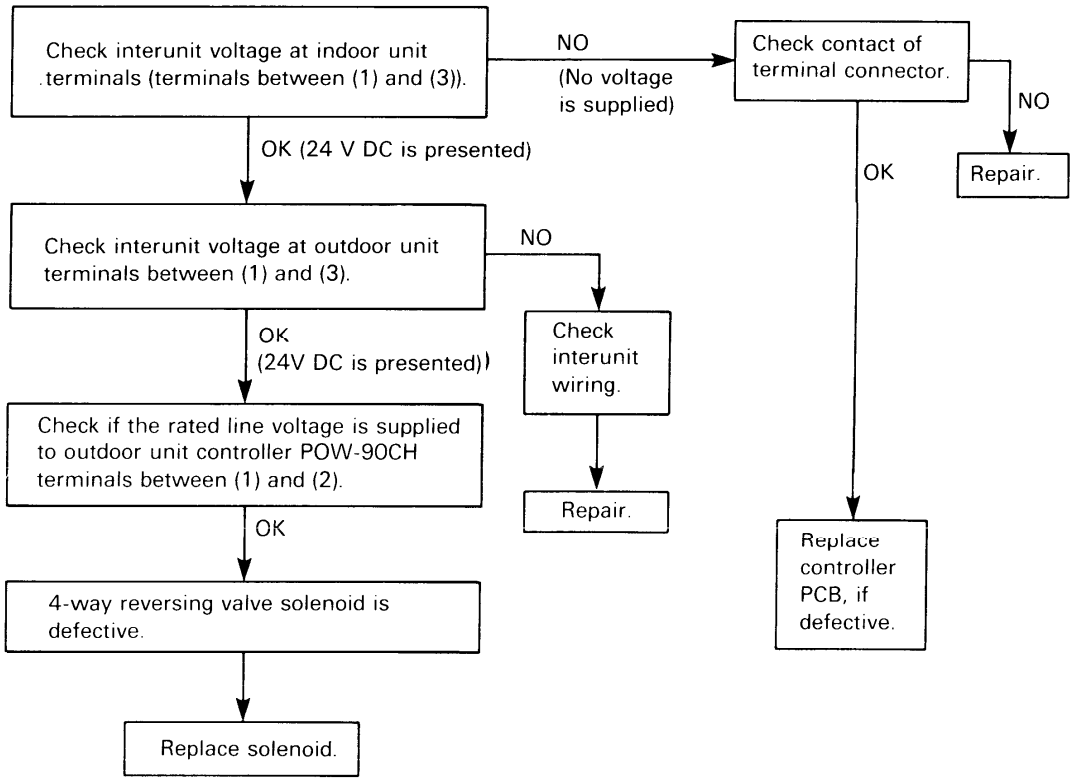
5) Compressor frequently repeats ON and OFF

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



6) Air conditioner will not enter into heating mode (Only cooling is possible).

① Heating operation cannot be done (4-way reversing valve malfunction).



② Defrosting system malfunction

A. Defrosting can be achieved after continuous operation of the unit for a long time.

- Remove defrost thermostat from the controller (outdoor unit) terminals (5) and (6) and check for conductivity.

  Defrost thermostat is normal if following conditions can be satisfied:

OFF	Maximum 39°	ON	Minimum 54°

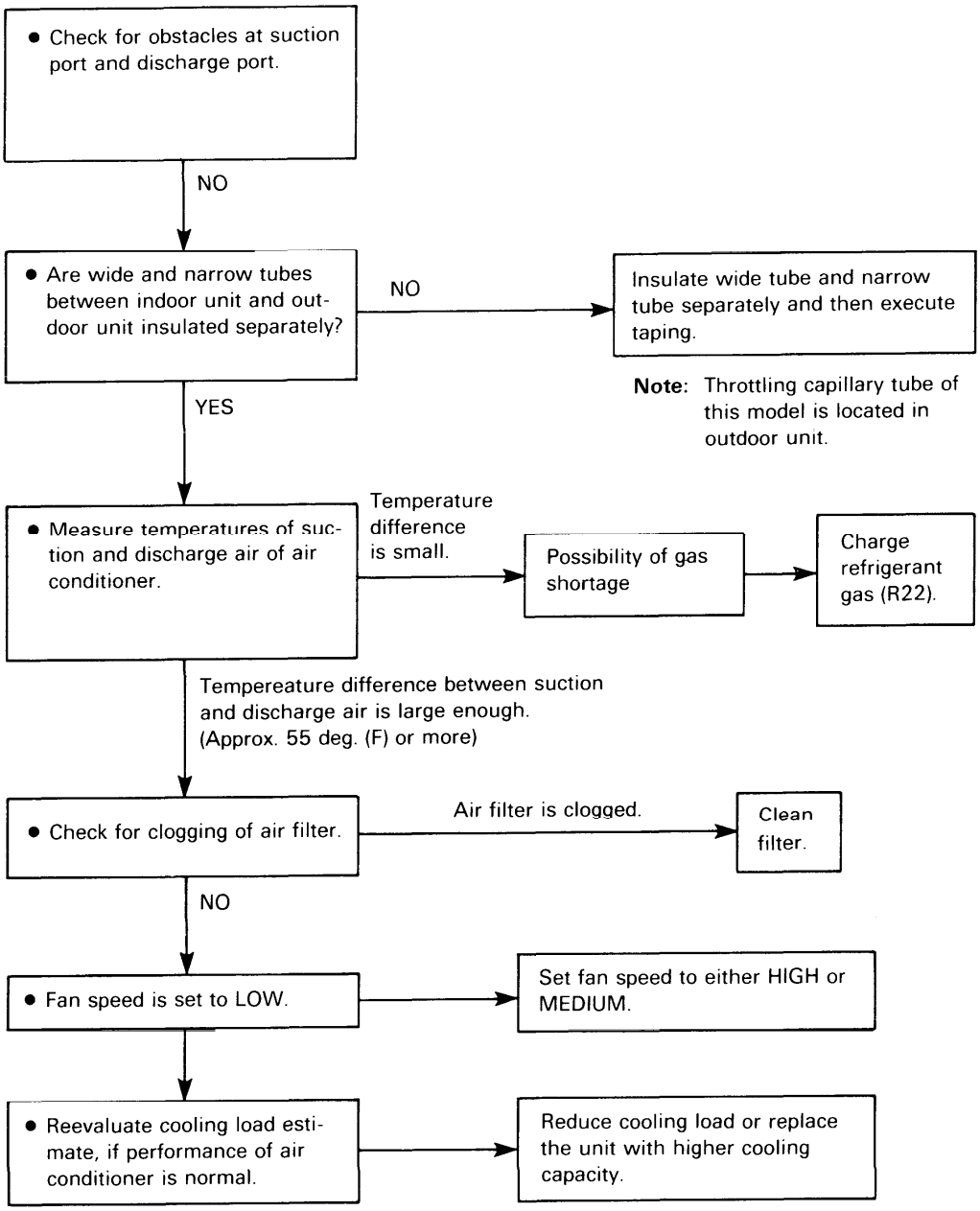
If the thermostat stays ON below 39°F, it is defective. ⟶ Replace the thermostat.

B. No defrosting can take place at all.

Controller PCB (indoor unit) is defective. ⟶ Replace the controller PCB.

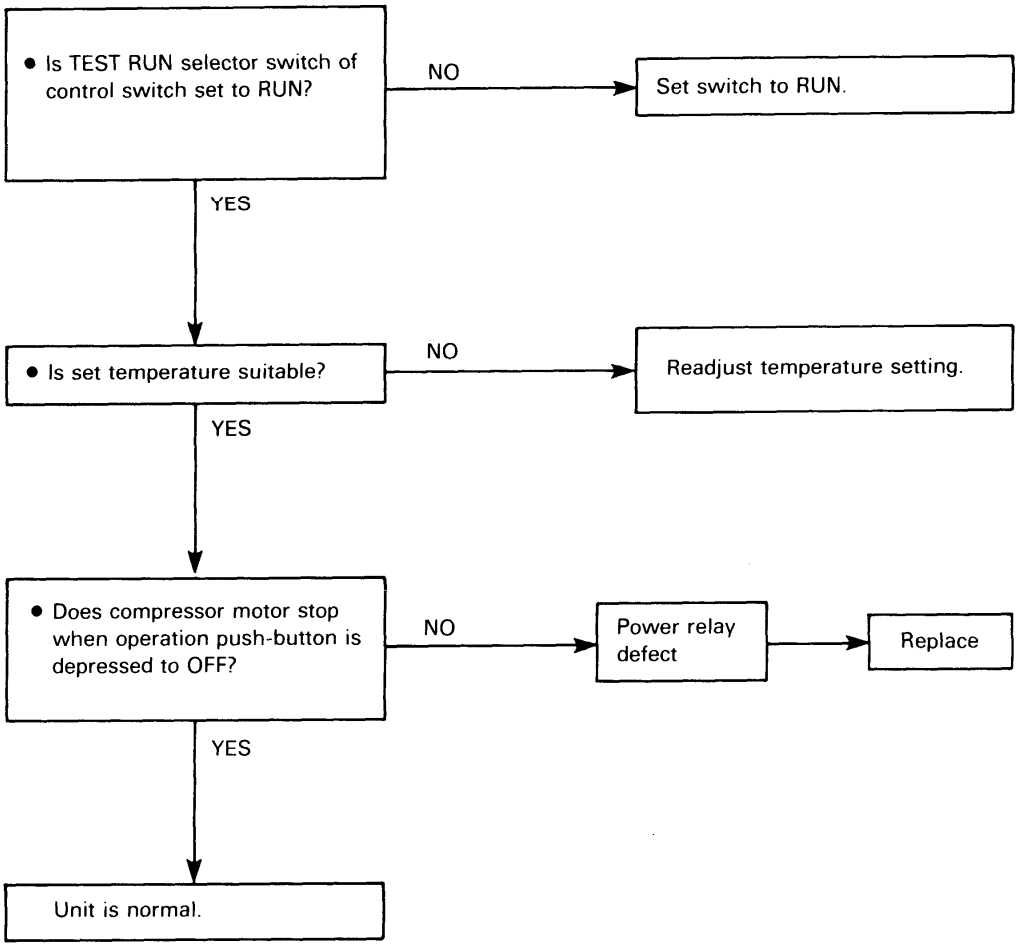
3. Air conditioner operates, but abnormalities are observed

1) Poor cooling

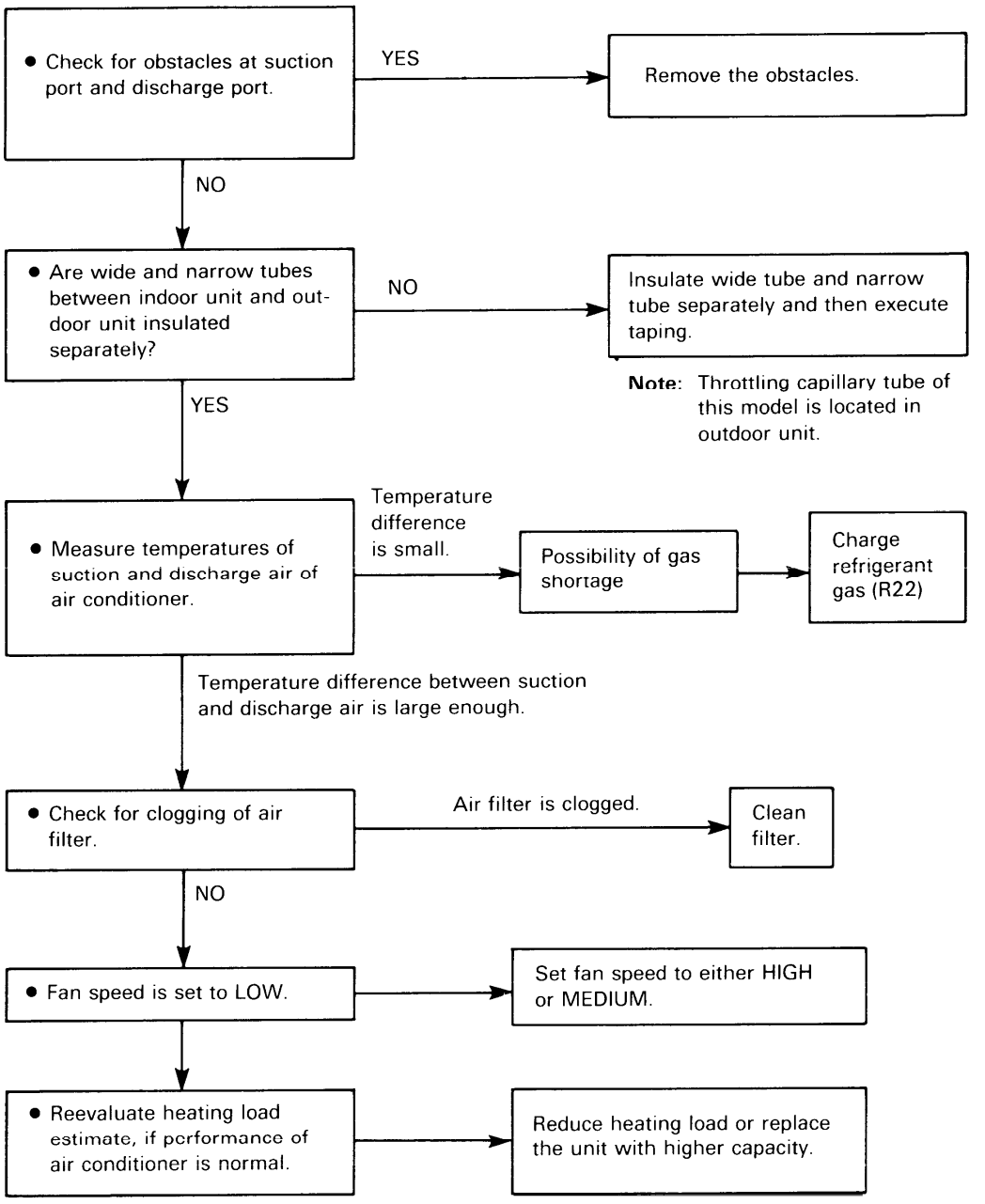


Note: Throttling capillary tube of this model is located in outdoor unit.

2) Excessive cooling



3) Poor heating



Heating **NOTE**: * If outdoor ambient temperature falls below 35°F, heating capacity may be reduced greatly. In this case, use supplementary heating appliances.

4. Respective Operation Modes at the Time of Heating

This system is so designed as to maintain a comfortable room temperature during heating operation according to the sequences described below.

1) Cold Draft Prevention (=Standby) Mode:

When the standby lamp lights on, the indoor fan motor stops, and blowout of cool air is prevented. This takes place in the following cases.

① When compressor is turned off by the thermostat at the beginning of heating operation, and when the temperature in the indoor heat exchanger is about 84°F (29°C) or lower.

② During defrosting (normally, 7 – 8 min.) and right after changeover to heating from defrosting.

2) Defrosting Mode:

When the capacity of unit has been decreased due to frost sticking to the outdoor heat exchanger during heating, the temperature drop gradient is detected by the microcomputer controlled temperature sensing system, and defrosting operation is started. At this time, the indoor and outdoor fan motors will stop, only the compressor is operated, and the system is automatically changed to cooling operation mode.

3) Thermo. Cycle Operation Mode:

30 seconds after the compressor has been shut down due to the action of thermostat, the indoor fan motor will stop to prevent blowout of cool air.

NOTE: The standby lamp will not be lit on at the time of NIGHT SETBACK programs.

4) Overload Preventive Mechanism:

When the temperature in the indoor heat exchanger has been 125°F (52°C) or higher, the indoor fan speed will automatically be changed to HIGH. Moreover, when the temperature in the indoor heat exchanger has become 127°F (53°C) or higher, the outdoor fan motor will stop.

5) Automatic Fan Speed Control:

When the fan speed has been set to AUTO, the difference between the set temperature of thermostat and actual room temperature will be sensed by the thermistor, and the fan speed will be changed to either of the two stages, (High or Medium) automatically by the aid of microcomuter.

8. CHECKING AND REPLACING ELECTRICAL COMPONENTS

— Quick Access Index —

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 MΩ. Fig. 1.

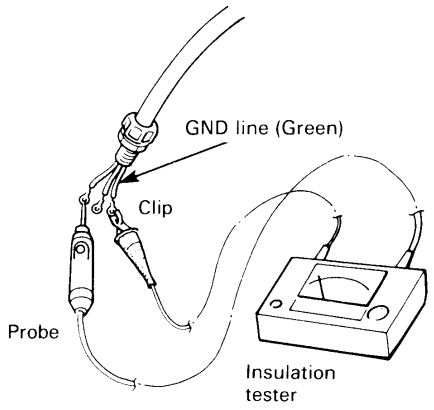


Fig. 1

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.

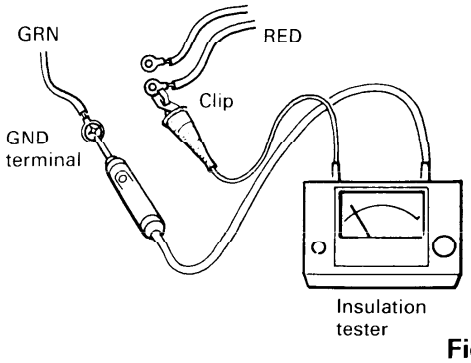


Fig. 2

3. Measurement of Insulation Resistance of the Fan Motor

1) In case of indoor fan motor

Remove the fan motor connector from controller PCB (P. 52). 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.

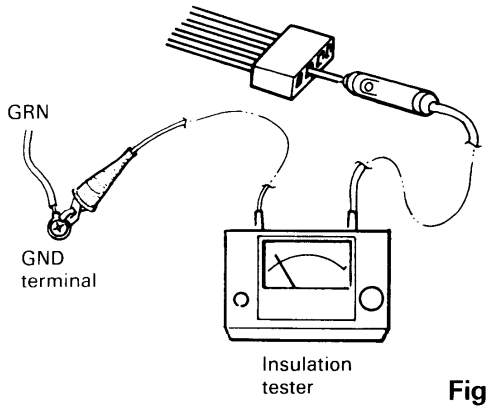


Fig. 3

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.

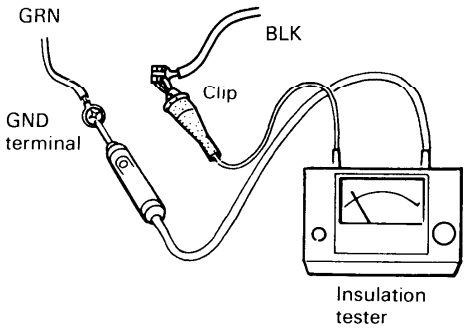


Fig. 4

4. Checking of the Outdoor Fan Motor

Remove the blue (BLU) lead wire from the terminal 3 , then brown (BRN) and pink (PNK) lead wires from the fan motor capacitor respectively as indicated in the wiring diagram. (Refer to P. 51)

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 70°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.

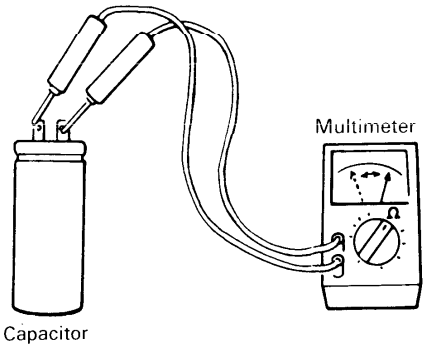


Fig. 5

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.

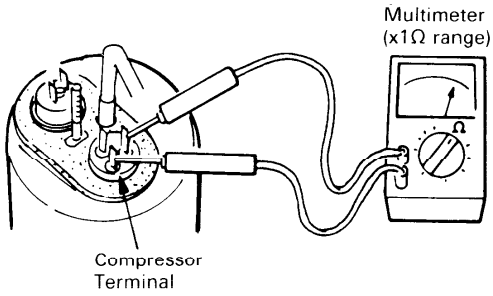


Fig. 6

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.

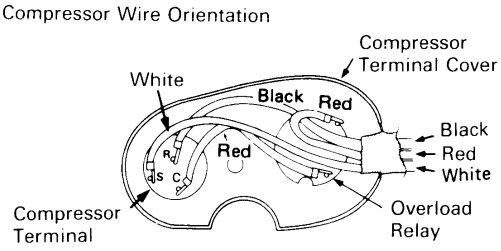


Fig. 7

7. Checking of the Control Unit Proper (Refer to P. 53)

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 connector (14P) of the control unit from the controller PCB of the unit. (Fig. 8).

① Checking of the Room Temperature Sensor
Measure the resistance between No. 1 and No. 2 connectors. (For an ambient temperature of 80°F, the resistance is about 5 KΩ)

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

② Fan Speed Selector
Check the continuity of connectors No. 7 and No. 8 against No. 13 (Place the negative (−) probe on No. 13 and positive (+) probe on No. 7 and then No. 8).

Checking points	Position of the selector			
	High	Med.	Low	Auto
13—7	NO	YES	YES	NO
13—8	YES	YES	NO	NO

Table-3

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

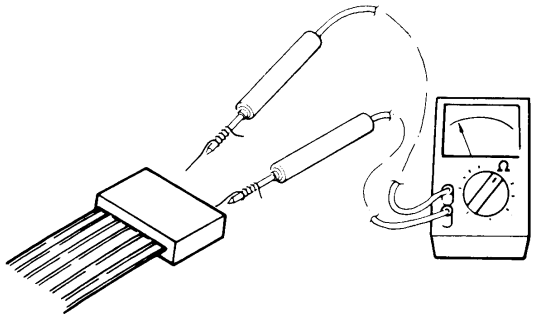


Fig. 8

③ Checking of the Selector

Check the continuity of connectors No. 7, 5 and 6 against connector No. 12.

Connector No.	Position of the Selector			
	MANUAL	NIGHT SET BACK	TIMER	
			ON	OFF
12—7	NO	NO	YES	NO
12—5	NO	NO	YES	YES
12—6	NO	YES	NO	NO

Table-4

④ Checking of the Operation Pushbutton

The operating switch is in good working condition if there is continuity between No. 12 (placing negative (—) probe and No. 8 (placing positive (+) probe) while the pushbutton is pressed.

⑤ Checking of the Timer

Measure the continuity between No. 8, 7, 5, 6 and No. 11 (placing the negative (—) probe).

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

Y for YES = There is continuity. Table-5

⑥ Checking of the Thermostat

Measure the cointinuity between No. 8, 7, 5, 6 and No. 10 (placing the negative (—) probe).

Connector No.	Position of the Selector										
	71	73	75	77	79	81	83	84	■	■	■
10 — 8	—	—	—	—	Y	Y	Y	Y	Y	Y	Y
10 — 7	Y	Y	Y	Y	Y	Y	Y	Y	—	—	—
10 — 5	Y	Y	—	—	—	—	Y	Y	Y	Y	—
10 — 6	—	Y	Y	—	—	Y	Y	—	—	Y	Y

Y for YES = There is continuity. Table 6

If there is abnormality during checking at any of the above steps from ① to ⑥, 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.

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.

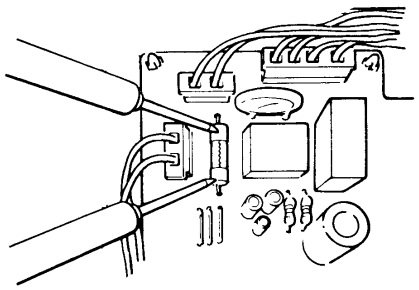


Fig. 9

9. Method of Replace Fuse on the Controller PCB

1. Remove the controller PCB according to Disassembly Procedure sect. 3 (P. 47)
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 controlleer 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.

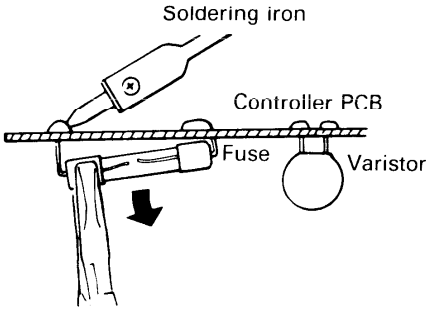


Fig. 10

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

Remove the 6P 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.

No 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 below table.

Pair of Pins	FAN		
	Low	Med.	High
3 — 6	*	0	0
3 — 5	0	*	0
3 — 4	0	0	*

* Line voltage

Table-7

11. Checking of the Power Transformer

① Remove connectors PRI and 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. 51)

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 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 100 Ω
BLU—VLT	21 Ω
VLT—YEL	12 Ω
YEL—PNK	87 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.

9. DISASSEMBLY PROCEDURES

Quick Access Index

INDOOR UNIT SAP120FH

1. Cabinet – Removal

1) Remove the two installation screws (a) of the front panel of the indoor unit with a Phillips screwdriver. Fig. 1

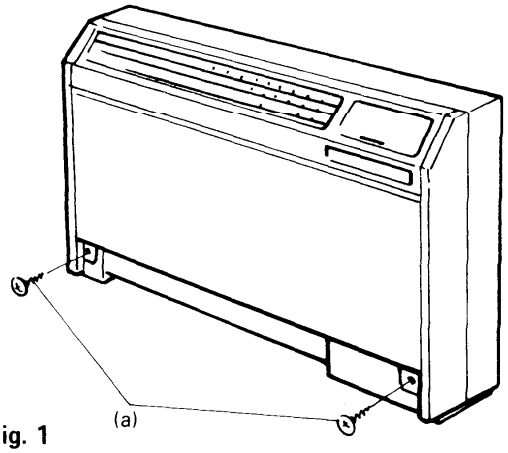


Fig. 1

② Pull the bottom part of the front panel towards you and then lift to remove the front panel. Fig. 2

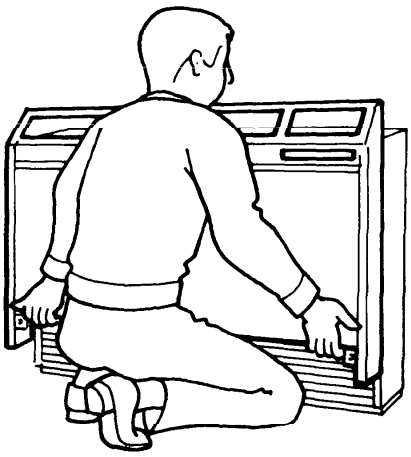


Fig. 2

2. Electrical Component Box – Access and Removal

① Remove the casing.

CAUTION :

1) Connector pins are thin and delicate, therefore never apply excessive force when disconnecting the socket.

2) Before accessing inside the electrical component box, be sure to check that power to the unit is disconnected.

② Remove the two controller installation screws (a), and raise the controller to remove it. Fig. 3

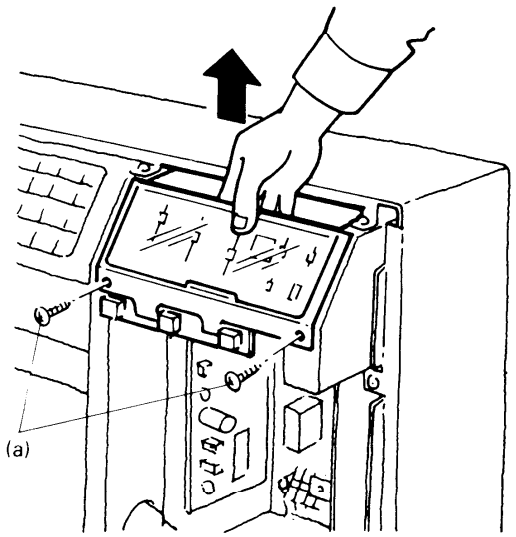


Fig. 3

③ Remove interunit power line Ⓑ from the terminal board.
④ Remove the connector Ⓓ of the thermistor lead wires.
⑤ Remove the connector Ⓔ of controller lead wires.
⑥ Remove the clampers fixing the lead wires to remove the electrical component box easily.
⑦ Remove the four installation screws Ⓐ of the electrical component box, and remove the electrical component box. Fig. 4

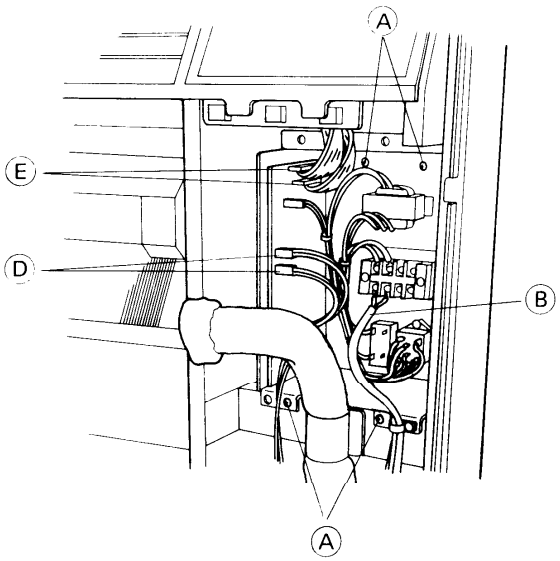


Fig. 4

⑧ Remove the lead wires connected to the exchange part. Remove the installation screws of the part. Fig. 5

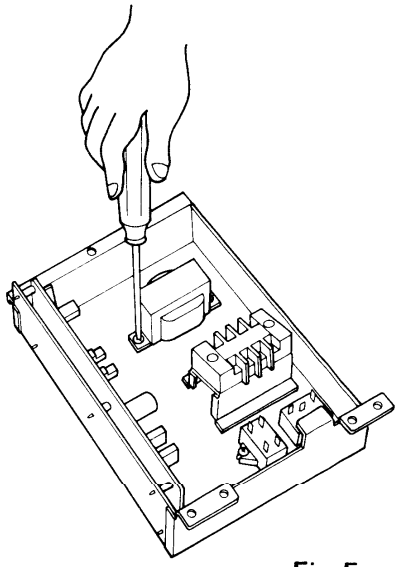


Fig. 5

3. Controller PCB — Removal

① Disengage the electrical component box from the chassis.

② Use long-nose pliers from the outside of the box to unlock the 5 spacers of the PCB and push them into the box. Fig. 6

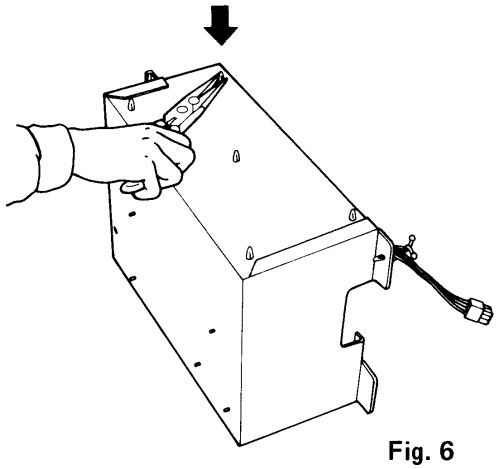


Fig. 6

③ Use long-nose pliers from the front of the PCB to unlock the spacers, and remove the spacers by pushing them to the rear of the PCB. Fig. 7

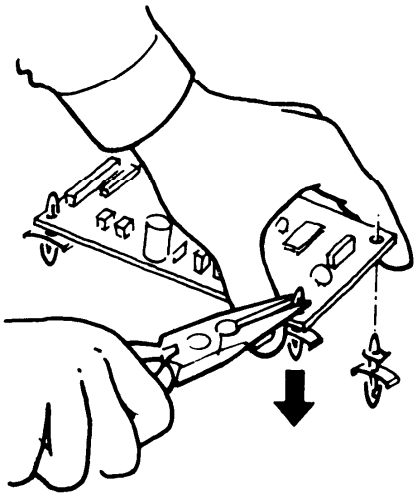


Fig. 7

4. Evaporator (= Indoor Heat Exchanger) — Removal

① Remove the two screws (A), and then remove the evaporator spacer (a).

② Remove the three screws (B), and then remove the evaporator spacer (b) on the left side.

③ Remove the three screws (C), and then remove the evaporator spacer (c) on the right side.

④ Pull the thermistor and the clip (e).

⑤ Remove the screw (E), and then take off the tube mounting (d).

⑥ Remove the screw (D), and remove the evaporator (f) by pulling it to the front. Fig. 8

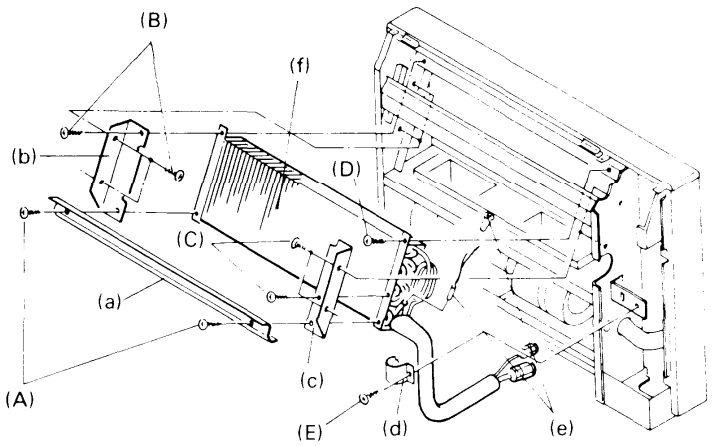


Fig. 8

5. Fan and Fan Motor — Removal

① Remove the two screws (A), and then remove the mounting plate (a).

② Remove the screws (B) (one each left and right), and then remove the reinforcement plate (b).

③ Remove the bolts (C) (one on the left and two on the right), and then remove the partition plate assembly (c) by pulling it to the front. Fig. 9

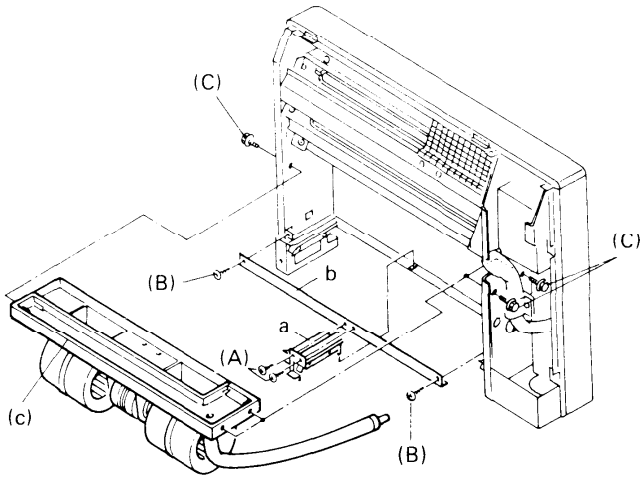


Fig. 9

④ Remove the casing connection screws (D) (3 each left and right per unit).

⑤ Remove the casing fixing screws (E) (2 each left and right per unit).

⑥ Split the casing.

⑦ Loosen the fan screws (F) (one per unit), and pull the fans.

⑧ Remove the two motor fixing screws (G), and then remove the motor (H). Fig. 10

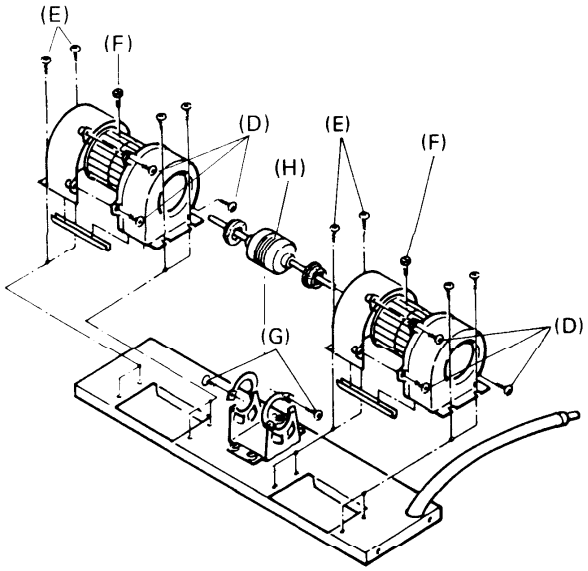


Fig. 10

6. Cabinet — Removal

Remove the cabinet by removing fixing screws using a Phillips screwdriver. Fig. 11

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. 12.

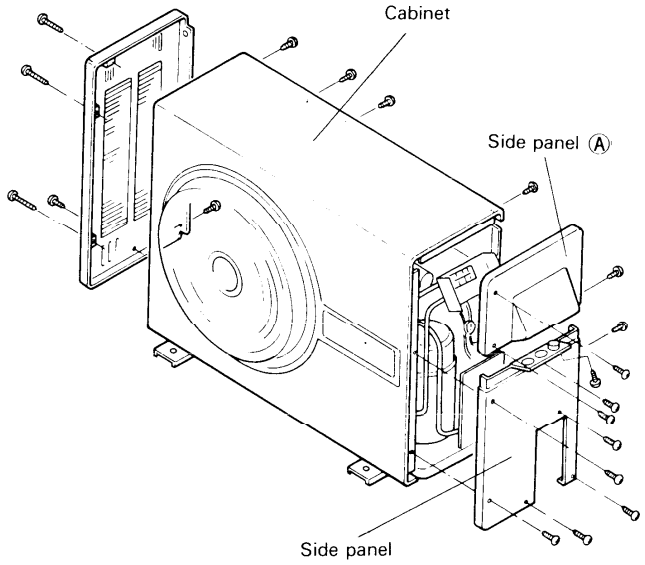


Fig. 11

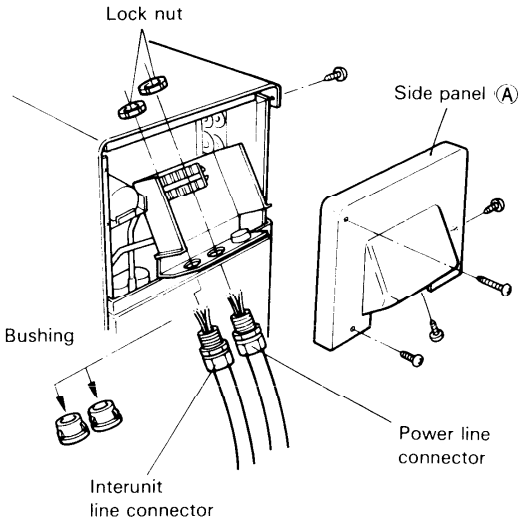


Fig. 12

7. Fan and Fan Motor — Removal

① Remove the fan by removing the propeller fan fixing screw Ⓐ using a straight blade screwdriver. Refer to Fig. 13.

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.

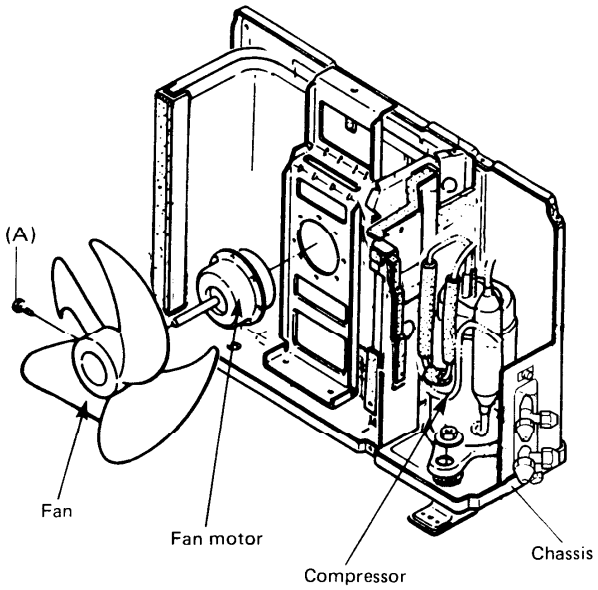
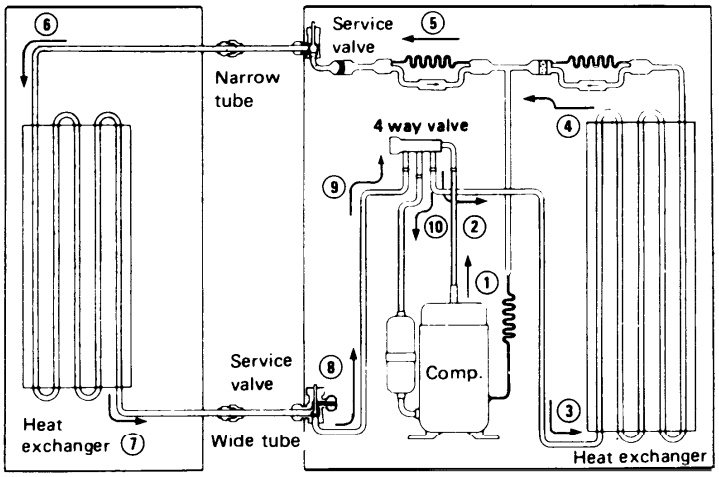


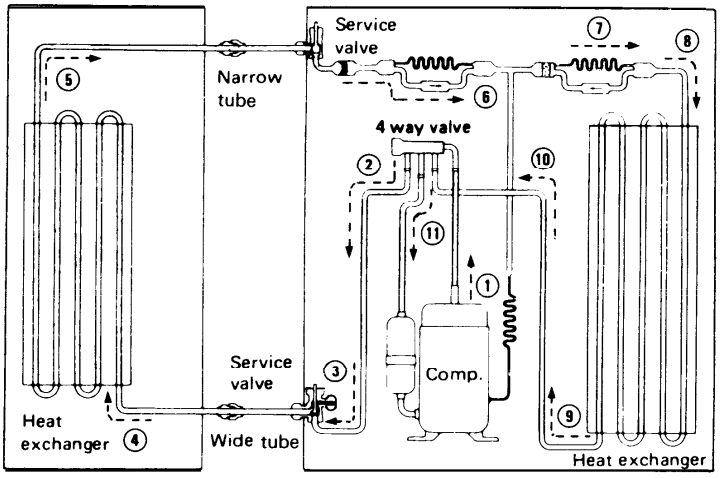
Fig. 13

10. REFRIGERANT FLOW DIAGRAMS

COOLING CYCLE



HEATING CYCLE



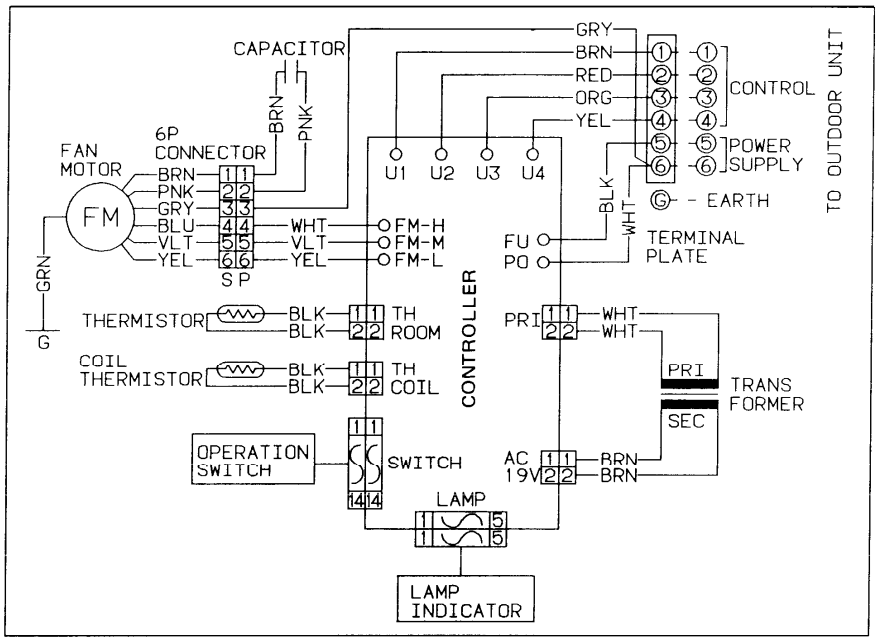
Note:

—►with sequential number shows flow of refrigerat in COOLING CYCLE.

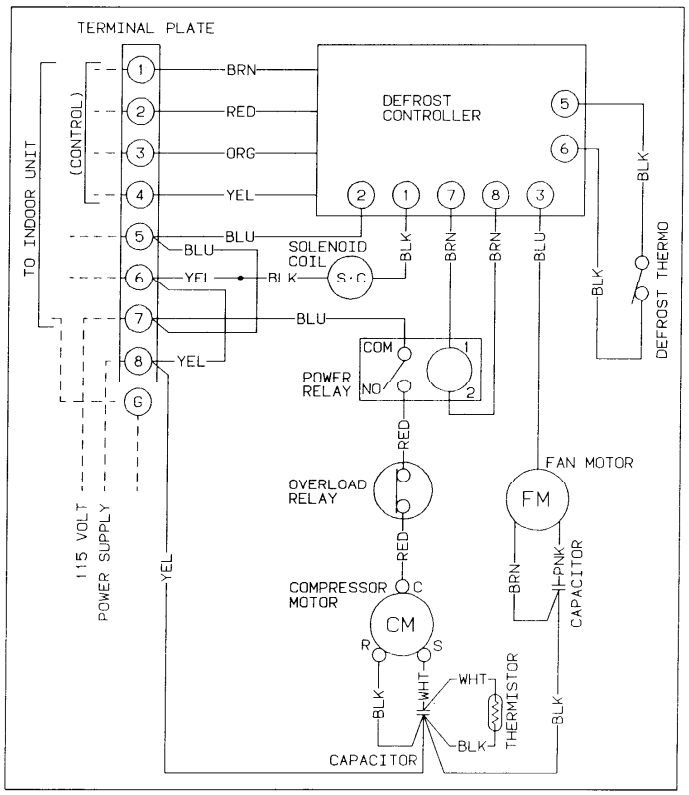
----►with sequential number shows flow of refrigerant in HEATING (= Reverse) CYCLE.

11. ELECTRIC WIRING DIAGRAMS

Indoor Unit: SAP120FH 60Hz, 115 V

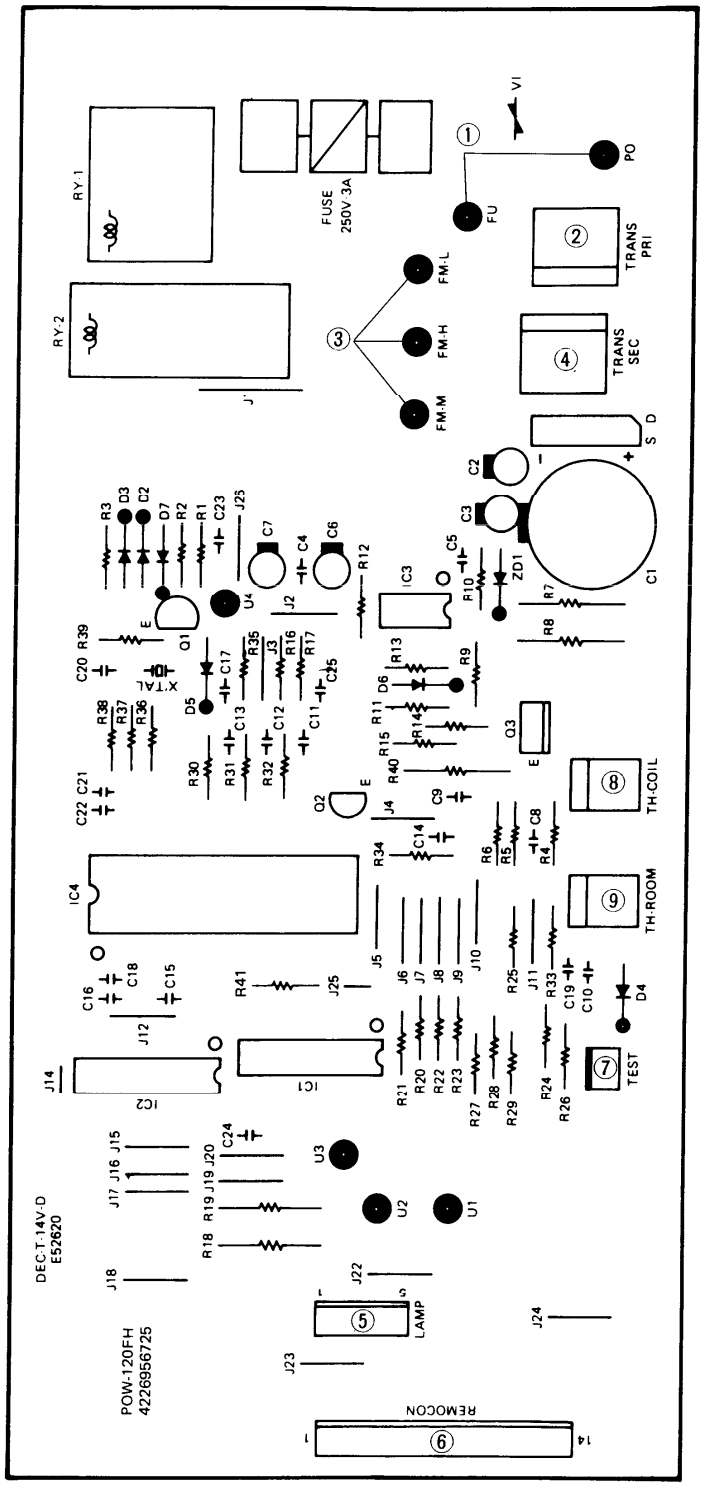


Outdoor Unit: SAP120CH 60Hz, 115V



CONTROLLER P.C.B. (PRINTED PATTERN)

POW-120FH (for SAP120FH)

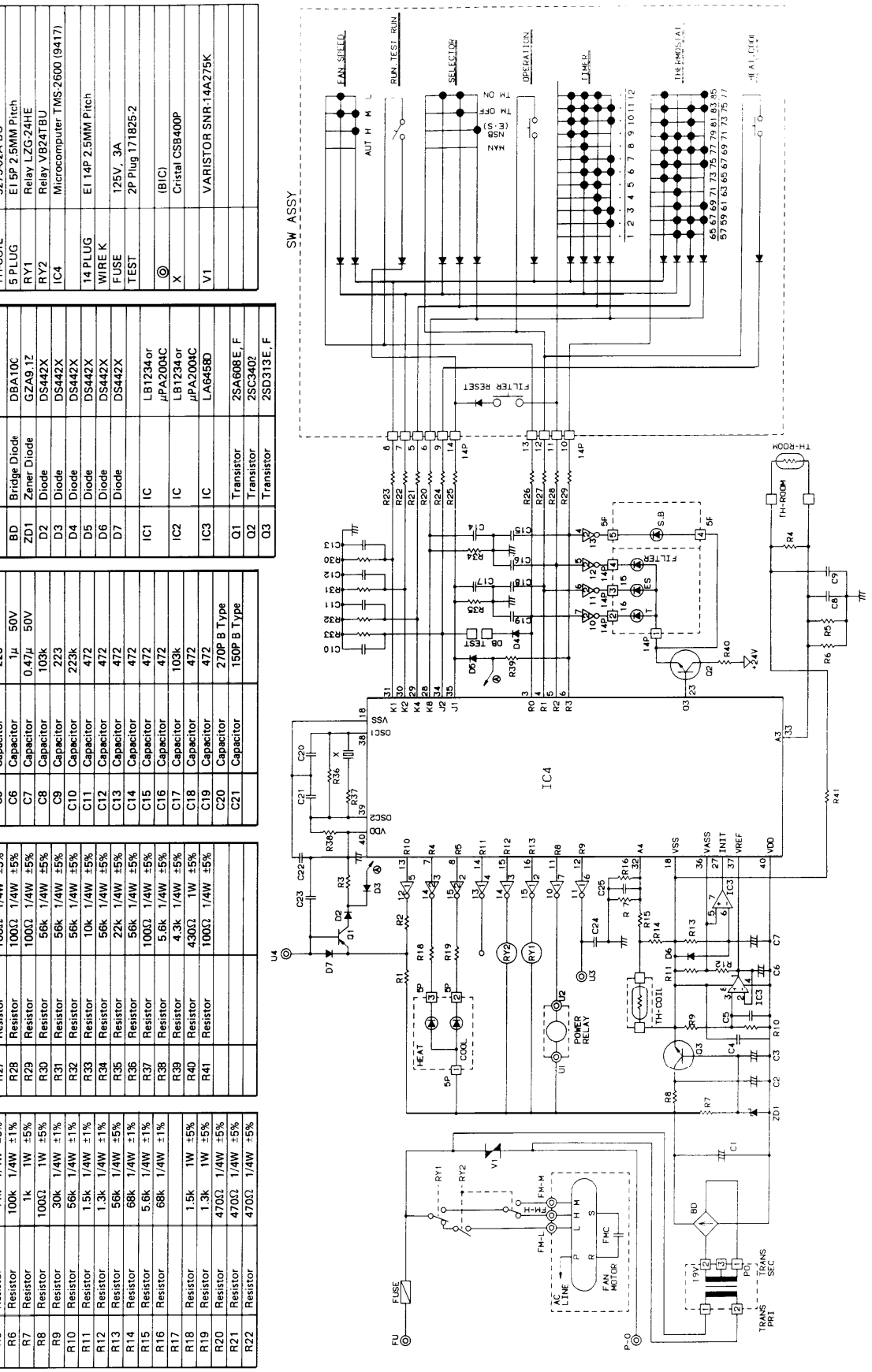


1. Board Pins, Power Supply to PCB: *
2. Connector, Transformer (Primary: *)
3. Board Pins, Fan Motor: *
4. Connector, Transformer (Secondary: 19V)
5. Connector, Lamp Board Ass'y: 24V
6. Connector, Control Panel: 9V
7. Connector, Test Pin: 9V
8. Connector, Thermistor Sensor (COIL): 9V
9. Connector, Thermistor Sensor (ROOM): 9V

An asterisk (*) indicates that line voltage is applied.

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

POW-F120FH (for SAP120FH)



Symbol	Name	Description
R1	Resistor	2k 1/4W ±5%
R2	Resistor	3.3k 1/4W ±5%
R3	Resistor	3k 1/4W ±5%
R4	Resistor	9.1k 1/4W ±1%
R5	Resistor	11k 1/4W ±5%
R6	Resistor	100k 1/4W ±1%
R7	Resistor	1k 1W ±5%
R8	Resistor	100Ω 1W ±5%
R9	Resistor	30k 1/4W ±1%
R10	Resistor	56k 1/4W ±1%
R11	Resistor	1.5k 1/4W ±1%
R12	Resistor	1.3k 1/4W ±1%
R13	Resistor	56k 1/4W ±5%
R14	Resistor	68k 1/4W ±1%
R15	Resistor	5.6k 1/4W ±1%
R16	Resistor	68k 1/4W ±1%
R17		
R18	Resistor	1.5k 1W ±5%
R19	Resistor	1.3k 1W ±5%
R20	Resistor	470Ω 1/4W ±5%
R21	Resistor	470Ω 1/4W ±5%
R22	Resistor	470Ω 1/4W ±5%

Symbol	Name	Description
R23	Resistor	470Ω 1/4W ±5%
R24	Resistor	470Ω 1/4W ±5%
R25	Resistor	470Ω 1/4W ±5%
R26	Resistor	100Ω 1/4W ±5%
R27	Resistor	100Ω 1/4W ±5%
R28	Resistor	100Ω 1/4W ±5%
R29	Resistor	100Ω 1/4W ±5%
R30	Resistor	56k 1/4W ±5%
R31	Resistor	56k 1/4W ±5%
R32	Resistor	56k 1/4W ±5%
R33	Resistor	10k 1/4W ±5%
R34	Resistor	56k 1/4W ±5%
R35	Resistor	22k 1/4W ±5%
R36	Resistor	56k 1/4W ±5%
R37	Resistor	100Ω 1/4W ±5%
R38	Resistor	5.6k 1/4W ±5%
R39	Resistor	4.3k 1/4W ±5%
R40	Resistor	430Ω 1W ±5%
R41	Resistor	100Ω 1/4W ±5%

Symbol	Name	Description
C1	Capacitor	470W 50V
C2	Capacitor	1μ 50V
C3	Capacitor	10μ 16V
C4	Capacitor	473
C5	Capacitor	223
C6	Capacitor	1μ 50V
C7	Capacitor	0.47μ 50V
C8	Capacitor	103k
C9	Capacitor	223
C10	Capacitor	223k
C11	Capacitor	472
C12	Capacitor	472
C13	Capacitor	472
C14	Capacitor	472
C15	Capacitor	472
C16	Capacitor	472
C17	Capacitor	103k
C18	Capacitor	472
C19	Capacitor	472
C20	Capacitor	270P B Type
C21	Capacitor	150P B Type

Symbol	Name	Description
C22	Capacitor	473
C23	Capacitor	473
C24	Capacitor	223
C25	Capacitor	473
BD	Bridge Diode	DBA10C
ZD1	Zener Diode	GZA9.1Z
D2	Diode	DS442X
D3	Diode	DS442X
D4	Diode	DS442X
D5	Diode	DS442X
D6	Diode	DS442X
D7	Diode	DS442X
IC1	IC	LB1234 or μPA2004C
IC2	IC	LB1234 or μPA2004C
IC3	IC	LA6458D
Q1	Transistor	2SA608E, F
Q2	Transistor	2SC3402
Q3	Transistor	2SD313E, F

Symbol	Name
TRANS PRI	5289-02A-BL
TRANS SEC	5273-02A
TH-ROOM	5273-02A-YE
TH-COIL	5273-02A-BU
5 PLUG	EI 5P 2.5MM Pitch
RY1	Relay LZG-24HE
RY2	Relay VB24TBU
IC4	Microcomputer TMS-2600 (9417)
◎	(BIC)
X	Cristal CSB400P
V1	VARISTOR SNR-14A275K

For parts or service contact

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