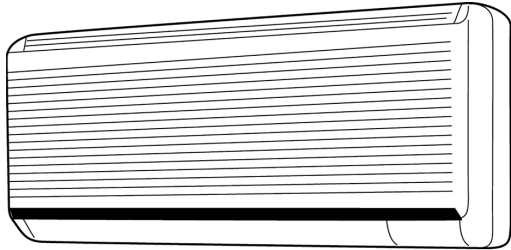
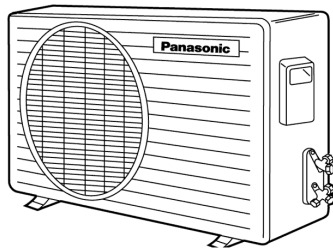


Service Manual

Room Air Conditioners



CS-VC70KE
CU-VC70KE
CS-VC90KE
CU-VC90KE
CS-VC120KE
CU-VC120KE



⚠ WARNING

This service information is designed for experienced repair technicians only and is not designed for use by the general public. It does not contain warnings or cautions to advise non-technical individuals of potential dangers in attempting to service a product. Products powered by electricity should be serviced or repaired only by experienced professional technicians. Any attempt to service or repair the product or products dealt with in this service information by anyone else could result in serious injury or death.

IMPORTANT SAFETY NOTICE

There are special components used in this equipment which are important for safety. These parts are marked by ⚠ in the Schematic Diagrams, Circuit Board Diagrams, Exploded Views and Replacement Parts List. It is essential that these critical parts should be replaced with manufacturer's specified parts to prevent shock, fire or other hazards. Do not modify the original design without permission of manufacturer.

Panasonic

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1 Features

- **R410A**

- **No Ozone Layer Damage**

- Our new models use R410A as its refrigerant. This Refrigerant does not contain chlorine, so there's no danger of damage to the ozone layer.

- **Compact Design**

- **Comfort Improvement**

- Wider range of horizontal discharge air
 - Longer hours of sleep mode operation

- **Auto Restart**

- Auto restart operation after power failure

- **Removable and Washable Front Panel**

- **Deodorizing Air Purifying Filter**

- Air Purifying Filter features a deodorizing function that removes unpleasant odors from the air.

- **Installation Work Improvement**

- Long piping up to 10 m (CS-VC70KE / CS-VC90KE)
 - Long piping up to 15 m (CS-VC120KE)

- **Quality Improvement**

- Low voltage protection
 - Gas leakage protection
 - Prevent compressor reverse cycle
 - 2-stage OLP to protect compressor (CS-VC120KE)

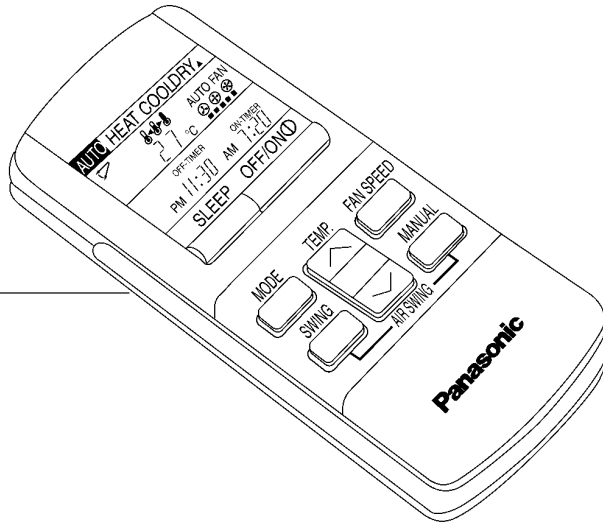
- **Service Improvement**

- Easy fan motor replacement procedure
 - Front side servicing for outdoor unit (CS-VC70KE / CS-VC90KE)

2 Functions

2.1. REMOTE CONTROL

Remote Control



OFF / ON **Operation OFF / ON**

MODE **Operation Mode Selection**

- AUTO Automatic Operation Mode
- COOL Cooling Operation Mode
- DRY Soft Dry Operation Mode
- FAN Air Circulation Mode

FAN SPEED **Indoor Fan Speed Selection**

- Low Speed
- Medium Speed
- High Speed
- AUTOFAN Automatic Fan Speed

SWING / MANUAL **Airflow Direction Control**

- SWING Automatic Airflow Direction Control
- MANUAL Airflow Direction Manual Control

TEMP. **Room Temperature Setting**

- Temperature Setting (16°C to 30°C)
- Automatic Operation
 - 2°C lower than standard
 - Standard
 - 2°C higher than standard

ON-TIMER
OFF-TIMER **Timer Operation Selection**

- 24-hour, OFF / ON Real Timer Setting.

TIME **Time / Timer Setting**

- Hours and minutes setting.

SET
CANCEL **Timer Operation Set / Cancel**

- ON Timer and OFF Timer setting and cancellation.

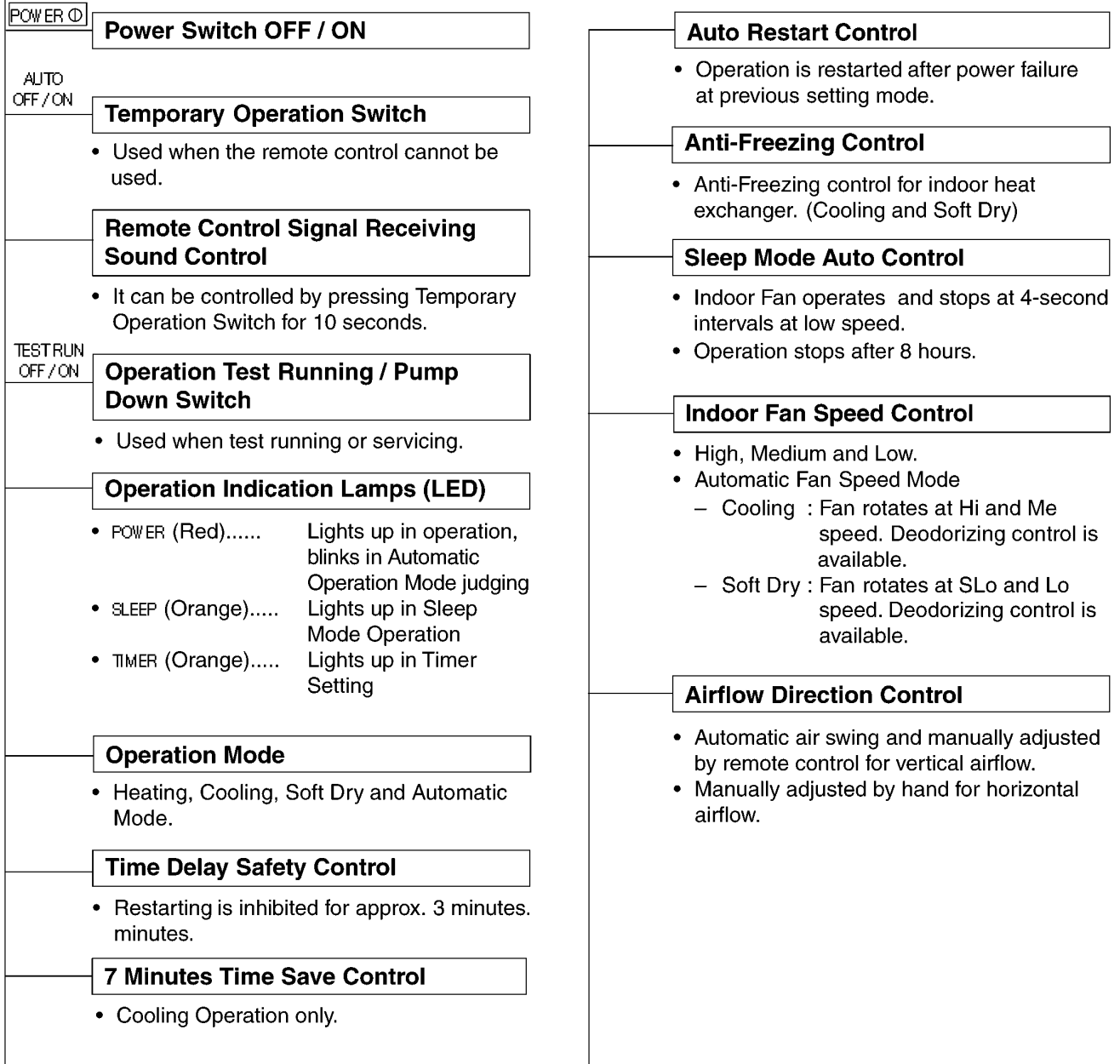
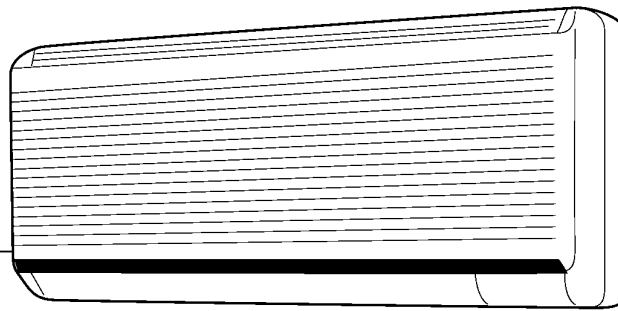
CLOCK
(時計) **Clock Setting**

- Current time setting.

SLEEP **Sleep Mode Operation OFF / ON**

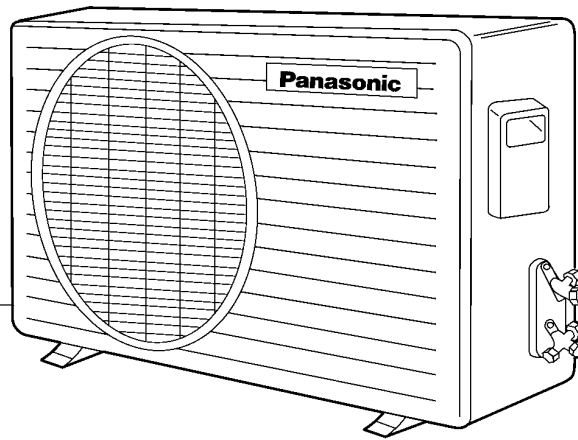
2.2. INDOOR UNIT

Indoor Unit



2.3. OUTDOOR UNIT

Outdoor Unit



Compressor Reverse Rotation Protection Control

- To protect compressor from reverse rotation when there is a instantaneous power failure.

Overload Protector

- CS-VC120KE
2-stage OLP to protect the compressor. Overload Protector will trip when
 - Temperature of compressor increases to 120°C.
 - High temperature or high current flow to compressor.
 (Refer to circuit diagram for OLP characteristics)
- CS-VC70KE / CS-VC90KE
OLP to protect the compressor.
 - Refer to the circuit diagram for OLP characteristics.

60 Secs. Forced Operation Control


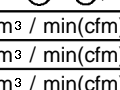
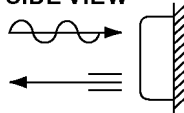
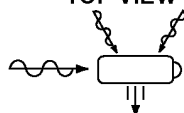
- Once the compressor is activated, it does not stop for 60 secs. (Stops immediately with remote control stop signal.)

Outdoor Fan Operation Control

- Inner protector.

3 Product Specifications

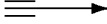

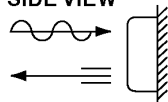
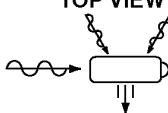
3.1. CS-VC70KE / CU-VC70KE

		Unit	CS-VC70KE	CU-VC70KE	
Cooling Capacity		kW		2.34	
		Btu/h		8,000	
Moisture Removal		ℓ /h		1.4	
		Pint/h		3.0	
Power Source	Phase V Cycle			Single	
				230	
				50	
Airflow Method		OUTLET  INTAKE 	SIDE VIEW 	TOP VIEW 	
Air Volume	Indoor Air(Lo)	m ³ / min(cfm)	6.1(220)	-	
	Indoor Air(Me)	m ³ / min(cfm)	6.8(240)	-	
	Indoor Air(Hi)	m ³ / min(cfm)	7.3(260)	-	
	Outdoor Air	m ³ / min(cfm)	-	22.4(790)	
Noise Level		dB(A)	High 35,Low 31	44	
Electrical Data	Input	kW	0.65		
	Running Current	A	3.2		
	COP		3.35		
	Starting Current	A	13		
Piping Connection Port (Flare piping)		inch	G ; Half Union 3/8" L ; Half Union 1/4"	G ; 3-Way valve 3/8" L ; 2-Way valve 1/4"	
Pipe Size (Flare piping)		inch inch	G(gas side) ; 3/8" L(liquid side) ; 1/4"	G(gas side) ; 3/8" L(liquid side) ; 1/4"	
Drain Hose	Inner diameter	mm	12	-	
	Length	m	0.7	-	
Power Cord length		m	2.1 m	-	
Number of core-wire			3 (1.0 mm ²)	-	
Dimensions	Height	inch(mm)	11 - 7/16(290)	18 - 29/32(480)	
	Width	inch(mm)	31 - 15/32(799)	30 - 23/32(780)	
	Depth	inch(mm)	6 - 29/32(175)	9 - 21/32(245)	
Net Weight		lb(kg)	18(8.0)	57(26.0)	
Compressor	Type		-	Rotary(1 cylinder rolling piston type)	
	Motor Type		-	Induction(2-poles)	
	Rated Output	W	-	550	
Air Circularizing	Type		Cross-flow Fan	Propeller Fan	
	Material		AS+Glass Fiber 30 %	AES+Glass Fiber 16 %	
	Motor Type		Transiator(4-poles)	Induction(6-poles)	
	Input	W	-	55.6	
	rated Output	W	5	15	
	Fan Speed	Low	rpm	990	-
		Medium	rpm	1,100	-
High(heating)		rpm	1,180	670	
Heat Exchange	description		Evaporator	Condenser	
	Tube material		Copper	Copper	
	Fine material		Aluminium	Aluminium	
	Fine type		Slit Fin	Corrugated Fin	
	Row/Stage		(Plate fin configuration, forced draft) 2 x 12 1 x 18		
	FPI		18	18	
	Size(W x H x L)	mm	600 x 252 x 25.4	856 x 457.2 x 22	
Refrigerant Control Device			-	Capillary Tube	
refrigeration Oil		(c.c)	-	RB68A(300)	
Refrigerant(R410A)		g(oz)	-	800(28.2)	
Thermostat			Electronic Control	-	
Protection Device			-	Overload Protector	
Capillary Tube	Length	mm	-	865	
	flow Rate	ℓ /min	-	6.8	
	Inner Diameter	mm	-	1.3	
Air Filter	Material style		P.P Honeycomb	-	
Capacity Control			Capillary Tube		

	Unit	CS-VC70KE	CU-VC70KE
Compressor Capacitor	$\mu\text{F}, \text{VAC}$	-	15 $\mu\text{F}, 400\text{VAC}$
Fan motor Capacitor	$\mu\text{F}, \text{VAC}$	0.6 $\mu\text{F}, 400\text{VAC}$	1.2 $\mu\text{F}, 400\text{VAC}$

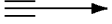
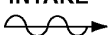
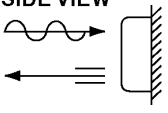
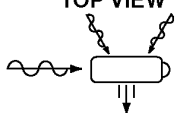
• Specifications are subject to change without notice for further improvement.

3.2. CS-VC90KE / CU-VC90KE

		Unit	CS-VC90KE	CU-VC90KE
Cooling Capacity		kW Btu/h	2.68 9,100	
Moisture Removal		ℓ/h Pint/h	1.6 3.4	
Power Source		Phase V Cycle	Single 230 50	
Airflow Method		OUTLET  INTAKE 	SIDE VIEW 	TOP VIEW 
Air Volume	Indoor Air(Lo)	m ³ / min(cfm)	6.1(220)	-
	Indoor Air(Me)	m ³ / min(cfm)	6.8(240)	-
	Indoor Air(Hi)	m ³ / min(cfm)	7.3(260)	-
	Outdoor Air	m ³ / min(cfm)	-	22.4(790)
Noise Level		dB(A)	High 35,Low 31	46
Electrical Data	Input	kW	0.80	
	Running Current	A	3.7	
	COP		3.35	
	Starting Current	A	20	
Piping Connection Port (Flare piping)		inch inch	G ; Half Union 3/8" L ; Half Union 1/4"	G ; 3-Way valve 3/8" L ; 2-Way valve 1/4"
Pipe Size (Flare piping)		inch inch	G(gas side) ; 3/8" L(liquid side) ; 1/4"	G(gas side) ; 3/8" L(liquid side) ; 1/4"
Drain Hose	Inner diameter	mm	12	-
	Length	m	0.7	-
Power Cord length			2.1 m	-
Number of core-wire			3 (1.0 mm ²)	-
Dimensions	Height	inch(mm)	11 - 7/16(290)	18 - 29/32(480)
	Width	inch(mm)	31 - 15/32(799)	30 - 23/32(780)
	Depth	inch(mm)	6 - 29/32(175)	9 - 21/32(245)
Net Weight		lb(kg)	18(8.0)	64(29.0)
Compressor	Type		-	Rotary(1 cylinder rolling piston type)
	Motor Type		-	Induction(2-poles)
	Rated Output	W	-	700
Air Circularizing	Type		Cross-flow Fan	Propeller Fan
	Material		AS+Glass Fiber 30 %	AES+Glass Fiber 12 %
	Motor Type		Transiator(4-poles)	Induction(6-poles)
	Input	W	-	55.6
	rated Output	W	5	20
	Fan Speed	Low Medium High(heating)	rpm rpm rpm	990 1,100 1,180
Heat Exchange	description		Evaporator	Condenser
	Tube material		Copper	Copper
	Fine material		Aluminium	Aluminium
	Fine type		Slit Fin	Corrugated Fin
	Row/Stage		(Plate fin configuration, forced draft) 2 x 12 1 x 18	
	FPI		18	17
Size(W x H x L)		mm	600 x 252 x 25.4	856 x 457.2 x 22
Refrigerant Control Device			-	Capillary Tube
refrigeration Oil		(c.c)	-	RB68A(350)
Refrigerant(R410A)		g(oz)	-	880(31.1)
Thermostat			Electronic Control	-
Protection Device			-	Overload Protector
Capillary Tube	Length	mm	-	535
	flow Rate	ℓ /min	-	8.7
	Inner Diameter	mm	-	1.3
Air Filter	Material style		P.P Honeycomb	-
Capacity Control			Capillary Tube	
Compressor Capacitor		μF,VAC	-	30μF,370VAC
Fan motor Capacitor		μF,VAC	0.6μF,400VAC	1.2μF,400VAC

• Specifications are subject to change without notice for further improvement.

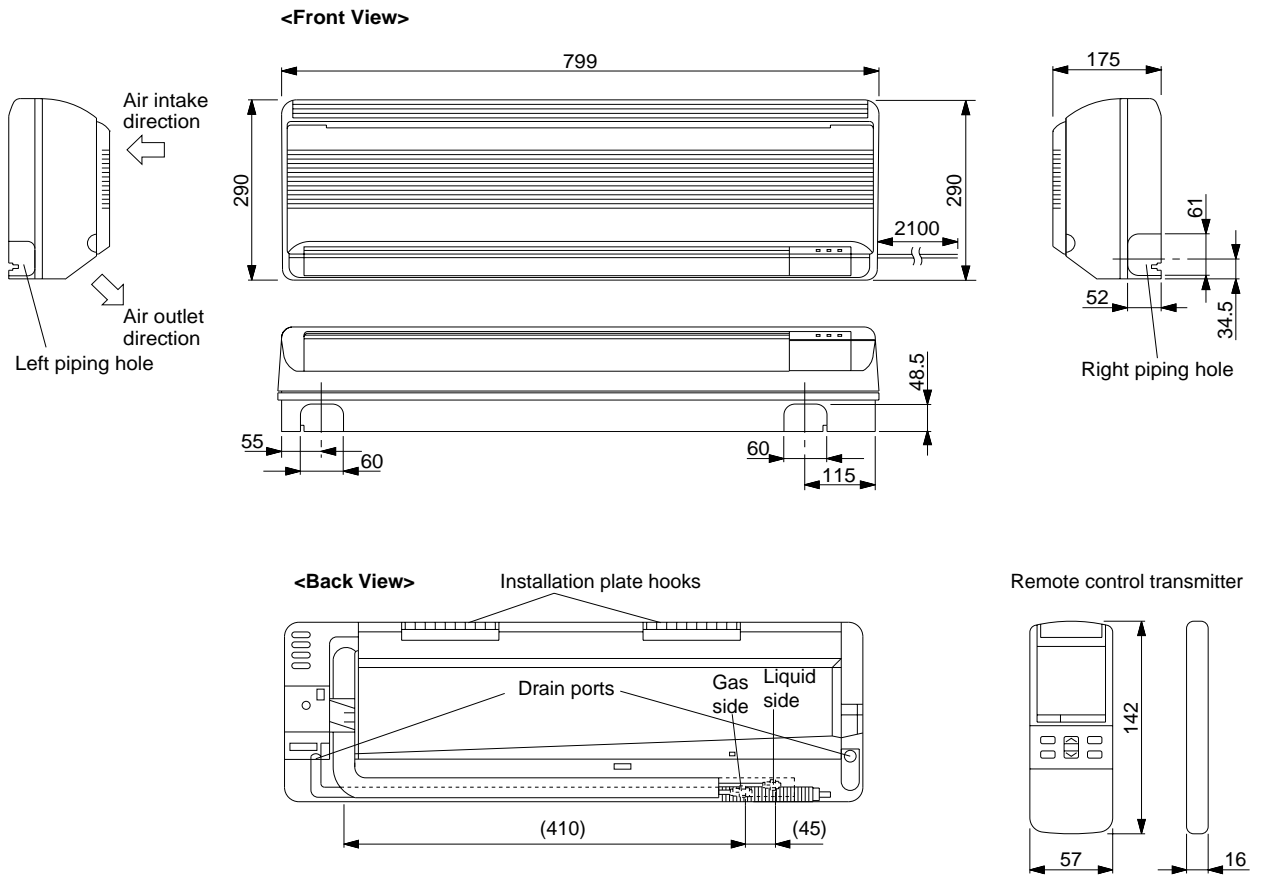
3.3. CS-VC120KE / CU-VC120KE

		Unit	CS-VC120KE	CU-VC120KE	
Cooling Capacity		kW Btu/h	3.55 12,000		
Moisture Removal		ℓ /h Pint/h	2.0 4.2		
Power Source		Phase V Cycle	Single 230 50		
Airflow Method		OUTLET  INTAKE 	SIDE VIEW 	TOP VIEW 	
Air Volume	Indoor Air(Lo)	m ³ / min(cfm)	7.3(260)	-	
	Indoor Air(Me)	m ³ / min(cfm)	7.6(270)	-	
	Indoor Air(Hi)	m ³ / min(cfm)	8.3(290)	-	
	Outdoor Air	m ³ / min(cfm)	-	22.0(780)	
Noise Level		dB(A)	High 39,Low 36	46	
Electrical Data	Input	kW	1.27		
	Running Current	A	5.6		
	COP		2.8		
	Starting Current	A	25		
Piping Connection Port (Flare piping)		inch inch	G ; Half Union 1/2" L ; Half Union 1/4"	G ; 3-Way valve 1/2" L ; 2-Way valve 1/4"	
Pipe Size (Flare piping)		inch inch	G(gas side) ; 1/2" L(liquid side) ; 1/4"	G(gas side) ; 1/2" L(liquid side) ; 1/4"	
Drain Hose	Inner diameter	mm	12	-	
	Length	m	0.7	-	
Power Cord length			2.1 m	-	
Number of core-wire			3 (1.0 mm ²)	-	
Dimensions	Height	inch(mm)	11 - 7/16(290)	19 - 29/32(505)	
	Width	inch(mm)	31 - 15/32(799)	30 - 23/32(780)	
	Depth	inch(mm)	6 - 29/32(175)	9 - 21/32(245)	
Net Weight		lb(kg)	18(8.0)	77(35.0)	
Compressor	Type		-	Rotary(1 cylinder rolling piston type)	
	Motor Type		-	Induction(2-poles)	
	Rated Output	W	-	1100	
Air Circularizing	Type		Cross-flow Fan	Propeller Fan	
	Material		AS+Glass Fiber 30 %	AES+Glass Fiber 12 %	
	Motor Type		Transiator(4-poles)	Induction(6-poles)	
	Input	W	-	60	
	rated Output	W	10	20	
	Fan Speed	Low	rpm	1205	-
		Medium	rpm	1,250	-
High(heating)		rpm	1,360	705	
Heat Exchange	description		Evaporator	Condenser	
	Tube material		Copper	Copper	
	Fine material		Aluminium	Aluminium	
	Fine type		Slit Fin	Corrugated Fin	
	Row/Stage		(Plate fin configuration, forced draft) 2 x 12 1 x 19		
	FPI		21	21	
	Size(W x H x L)	mm	600 x 252 x 25.4	776.2 x 482.6 x 22	
Refrigerant Control Device			-	Capillary Tube	
refrigeration Oil		(c.c)	-	RB68A(350)	
Refrigerant(R410A)		g(oz)	-	820(28.9)	
Thermostat			Electronic Control	-	
Protection Device			-	Overload Protector	
Capillary Tube	Length	mm	-	545	
	flow Rate	ℓ /min	-	12.5	
	Inner Diameter	mm	-	1.5	
Air Filter	Material style		P.P Honeycomb	-	
Capacity Control			Capillary Tube		
Compressor Capacitor		μF,VAC	-	30μF,370VAC	
Fan motor Capacitor		μF,VAC	1.0μF,450VAC	1.2μF,400VAC	

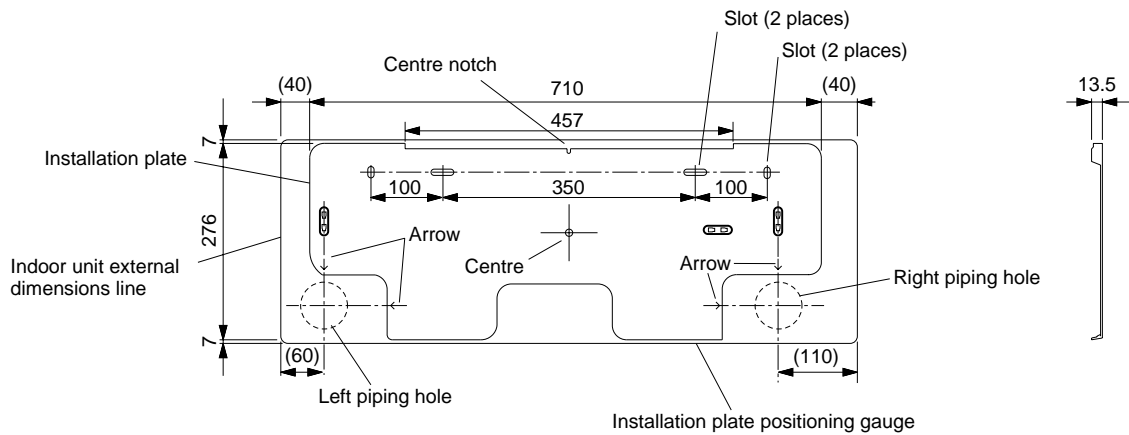
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4 Dimensions

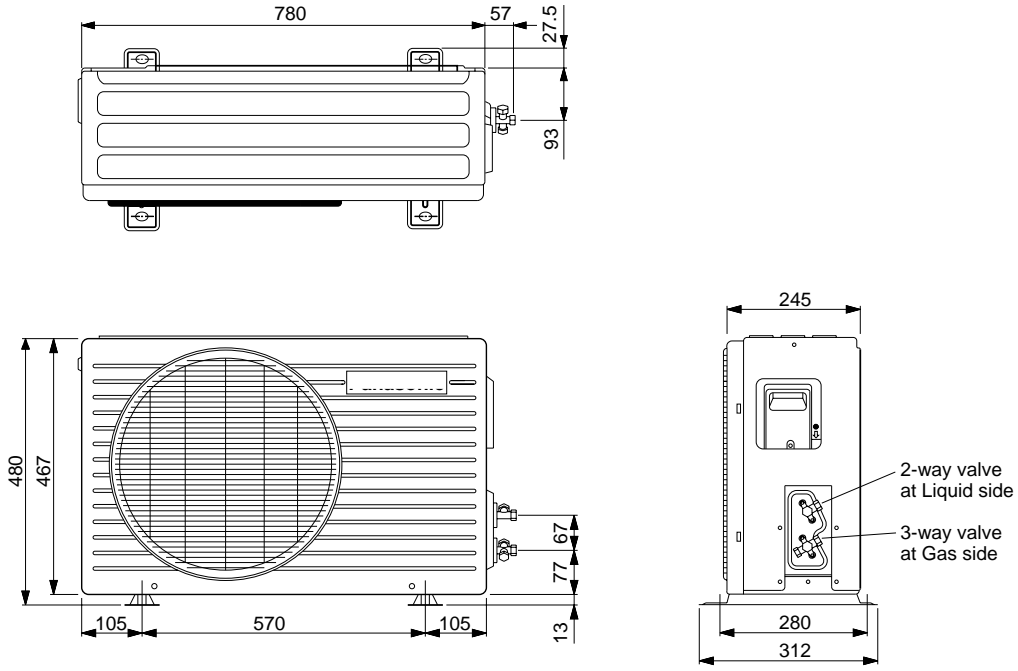
4.1. CS-VC70KE / CS-VC90KE / CS-VC120KE (INDOOR UNIT)



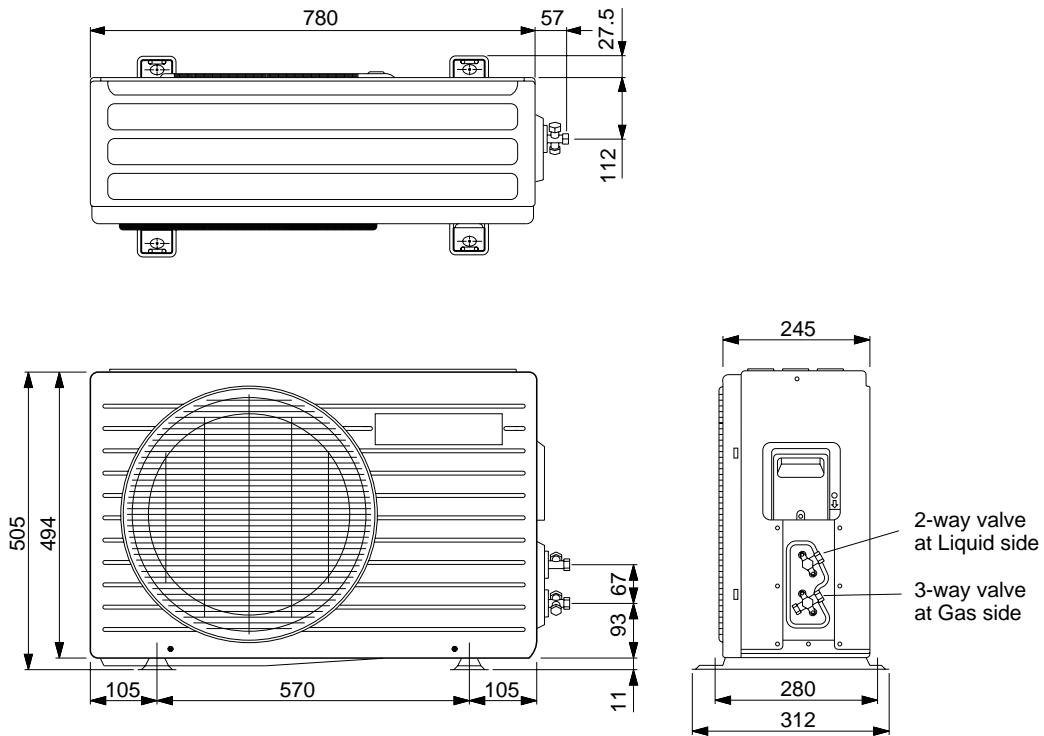
Relative position between the indoor unit and the installation plate <Front View>



4.2. CU-VC70KE / CU-VC90KE (OUTDOOR UNIT)

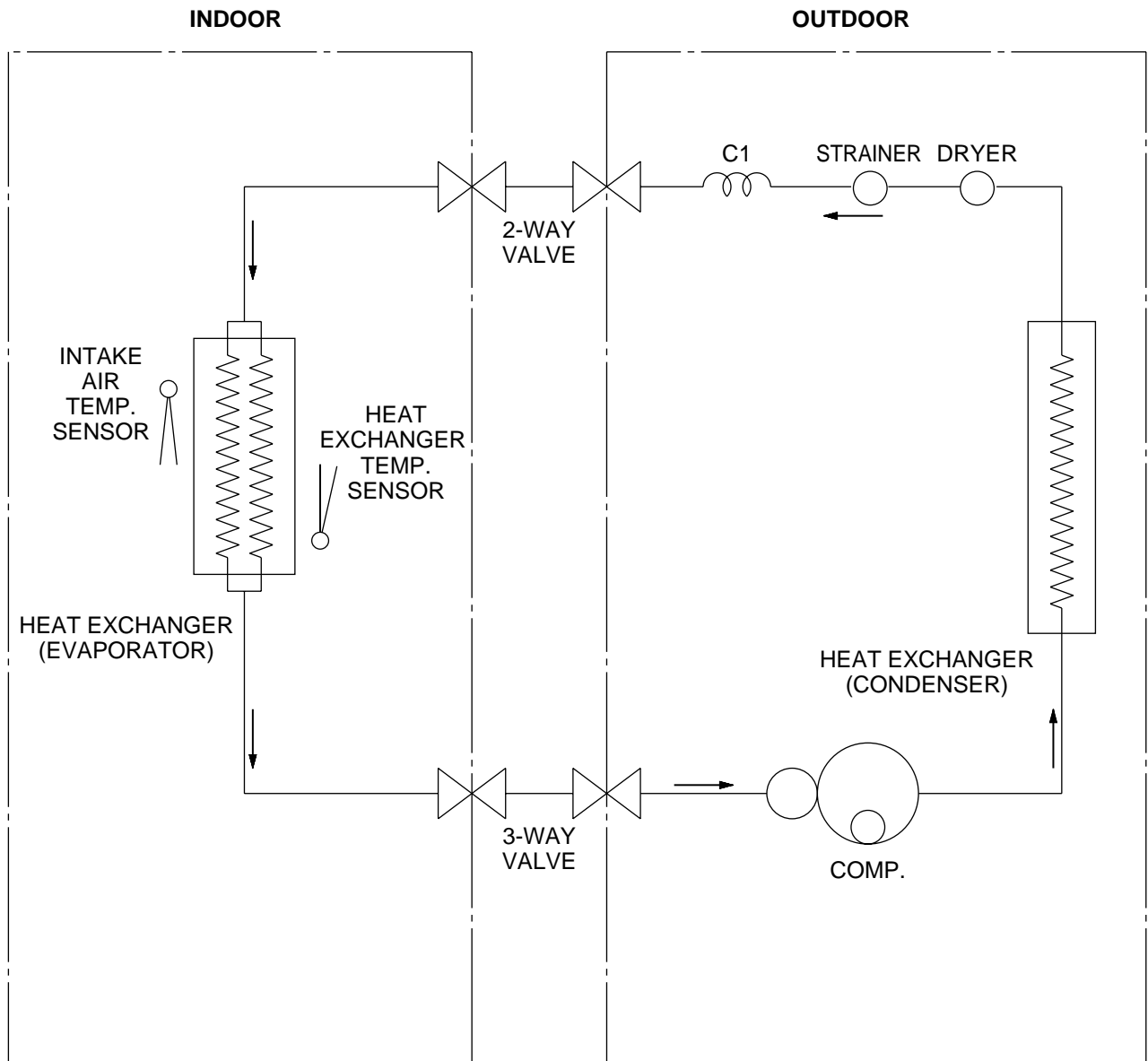


4.3. CU-VC120KE(OUTDOOR UNIT)



5 Refrigeration Cycle Diagram

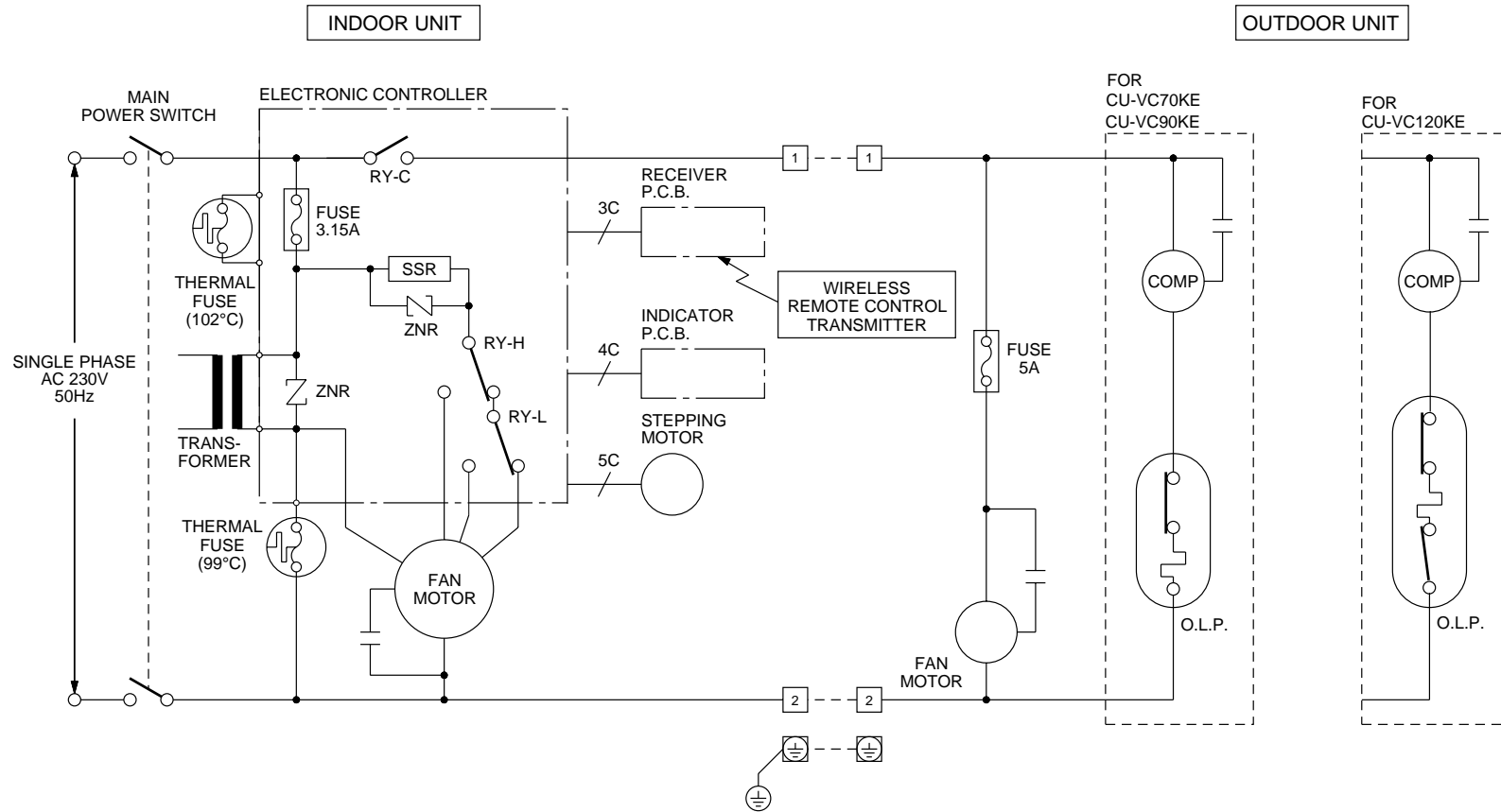
CS-VC70KE / CU-VC70KE
 CS-VC90KE / CU-VC90KE
 CS-VC120KE / CU-VC120KE



C1 ; Capillary Tube

6 Block Diagram

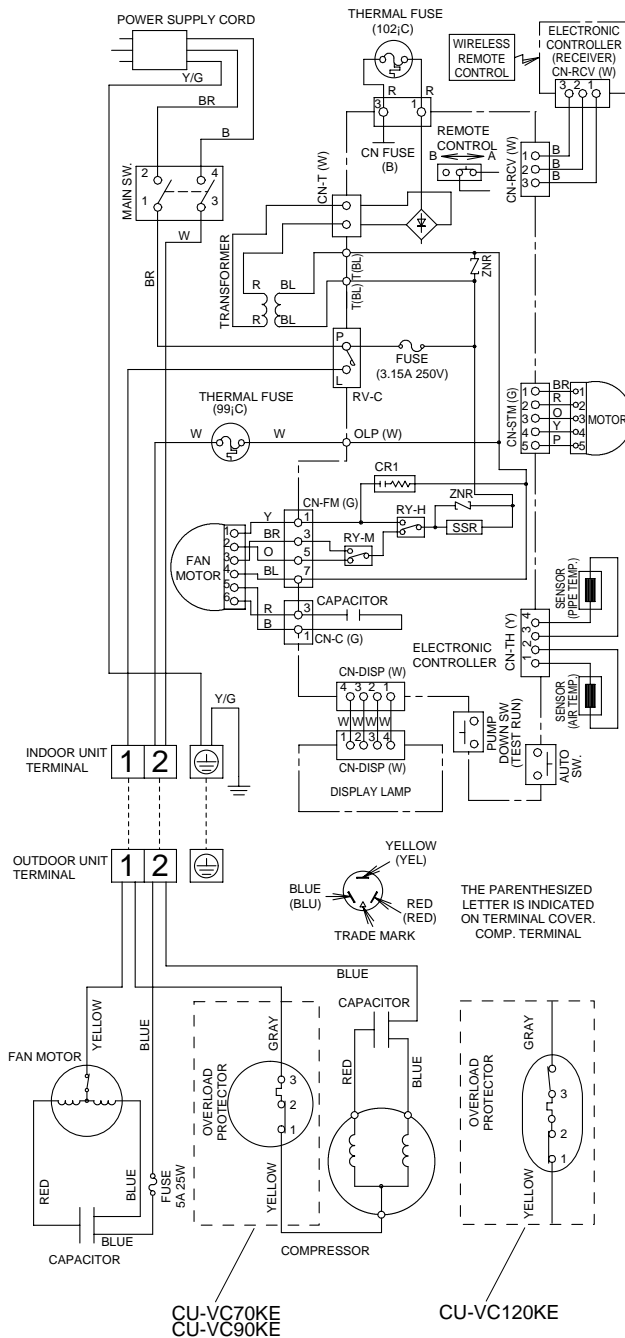
CS-VC70KE / CU-VC70KE
 CS-VC90KE / CU-VC90KE
 CS-VC120KE / CU-VC120KE



- * Indicates the electronic control unit.
- * "C" Indicates the number of core wires. (Example:6C=6 core wires).

7 Wiring Diagram

CS-VC70KE / CU-VC70KE
CS-VC90KE / CU-VC90KE
CS-VC120KE / CU-VC120KE



- REMARKS:**
 B : BLUE
 BR : BROWN
 BL : BLACK
 W : WHITE
 R : RED
 O : ORANGE
 P : PINK
 Y/G : YELLOW/
 GREEN
 GRY : GRAY

Resistance of Indoor Fan Motor Windings

MODEL	CS-VC70KE,90KE	CS-VC120KE
CONNECTION	CWA92232 (Ω)	CWA92231 (Ω)
YELLOW - BLUE	495.2	515.9
YELLOW - BROWN	74.5	139.3
BROWN - ORANGE	77.7	28.3
ORANGE - RED	370.4	311.9

Resistance of Outdoor Fan Motor Windings

MODEL	CS-VC70KE	CS-VC90KE	CS-VC120KE
CONNECTION	CWA95237 (Ω)	CWA95238 (Ω)	CWA95319 (Ω)
BLUE - YELLOW	333.9	310.0	260.5
YELLOW - RED	545.7	409.8	446.0

Resistance of Compressor Windings

CS-VC70KE / CU-VC70KE

CONNECTION	5RS080DAA (Ω)
C-R	5.81
C-S	9.30

Resistance of Compressor Windings

CS-VC90KE / CU-VC90KE

CONNECTION	5PS102DAA (Ω)
C-R	3.86
C-S	3.31

Resistance of Compressor Windings

CS-VC120KE / CU-VC120KE

CONNECTION	2TS023G3BA01 (Ω)
C-R	29.84
C-S	46.21

8 Operation Details

8.1. COOLING MODE OPERATION

Cooling in operation according to the remote control setting.

8.1.1. Time Delay Safety Control (3 minutes)

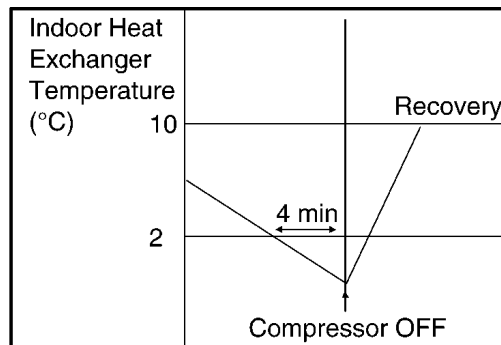
- When the compressor is stopped by Power Switch, Remote Control or when there is a power failure, it restarts after 3 minutes when the Power Switch, Remote Control is turned ON or when the power supply is resumed.
- When the setting temperature is reached during cooling operation, the compressor stops and it will not start for 3 minutes.

8.1.2. 7 Minutes Time Save Control

- The compressor will start automatically if it has stopped for 7 minutes even if the room temperature is below the compressor ON temperature.

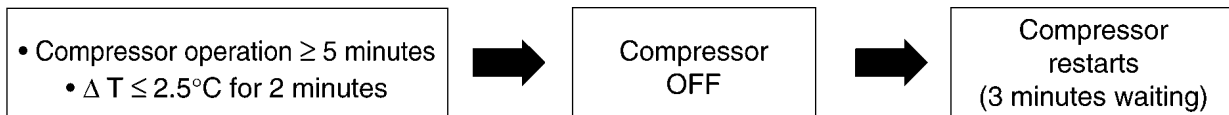
8.1.3. Anti-Freezing Control

- If the temperature of the indoor heat exchanger falls continuously below 2°C for 4 minutes, the compressor turns off to protect the indoor heat exchanger from freezing. The fan speed setting remains the same.
- Compressor recommences when the indoor heat exchanger temperature rises to 10 °C (Recovery).
*3 minutes waiting of Time Delay Safety Control is valid for Cooling Operation.



8.1.4. Compressor Reverse Rotation Protection Control

- If the compressor is operating continually for 5 minutes or longer and the temperature difference between intake air and indoor heat exchanger is 2.5 °C or less for 2 minutes, the compressor will stop and restart automatically. (Time Delay Safety Control is valid).



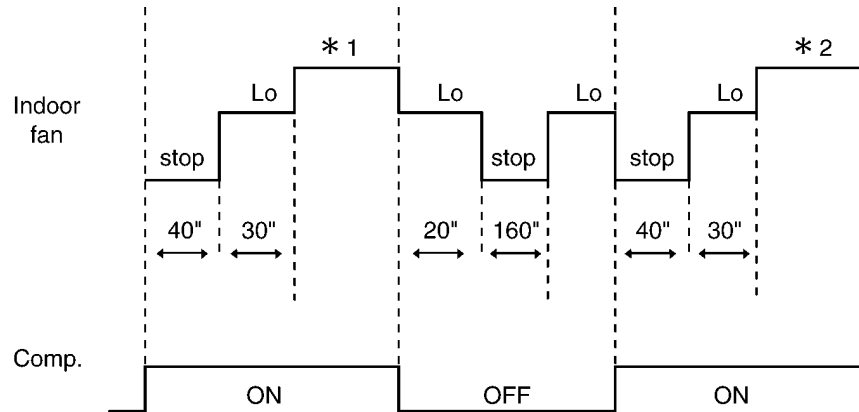
ΔT = Intake air temperature - Indoor heat exchanger temperature

This is to protect the compressor against reverse rotation when there is an instantaneous power failure.

8.1.5. Automatic Fan Speed Mode

When Automatic Fan Speed is selected on the remote control during cooling operation.

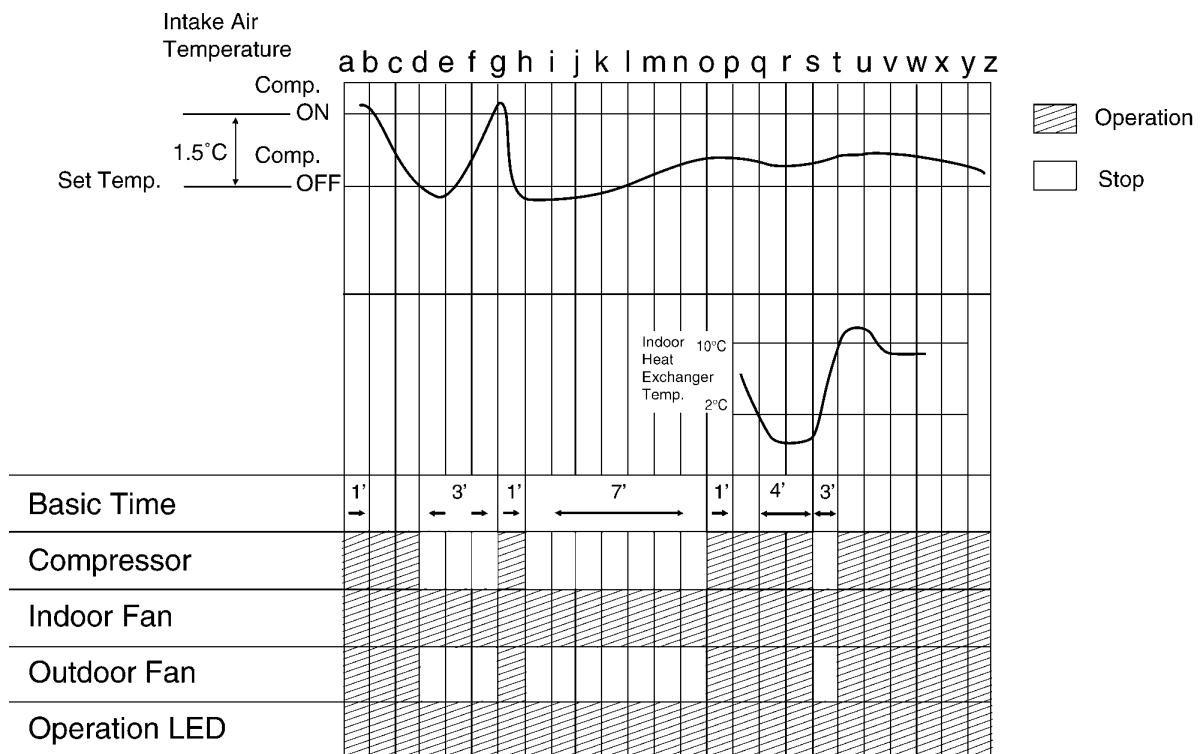
- Fan speed rotates in the range of Hi to Me.
- Deodorizing Control.



*1 Fan Speed is Hi until the compressor stops (when the set temperature is reached).

*2 Fan Speed is Me after the compressor restarts.

8.1.6. Cooling Operation Time Diagram



<Description of operation>

- d - g : Time Delay Safety Control (waiting for 3 minutes)
- g - h : 60 sec. Forced Operation
- h - o : 7 min. time Saved Control
- q - t : Anti Freezing Control

<Condition>

- a - h : When outdoor temperature is high
- h - p : When outdoor temperature is moderate
- p - w : When outdoor temperature is low

8.2. SOFT DRY MODE OPERATION

- The unit performs cooling operation until the room temperature reaches the setting temperature set on the Remote Control, and then Soft Dry operation will start.
- During Soft Dry operation, the indoor Fan will operate and stop at 4-second intervals at low speed.
- The operation will be switched on and off for up to 10 minutes “ON” and 6 minutes “OFF”. Once Soft Dry operation is turned off, it stops for 6 minutes.

8.2.1. Time Delay Safety Control

- Once the compressor stops, it will not restart for 3 minutes during Cooling operation.

8.2.2. Anti-Freezing Control

- Same as Anti-Freezing Control for Cooling Mode operation.(For Soft Dry operation,6 minutes waiting is valid during compressor stops.)

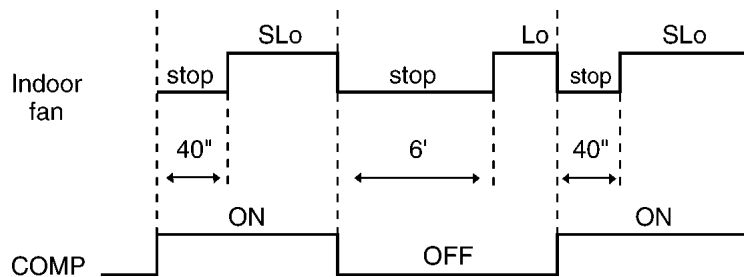
8.2.3. Compressor Reverse Rotation Protection

- Same as Compressor Reverse Rotation Protection Control for Cooling Mode Operation.

8.2.4. Automatic Fan Speed Mode

When Automatic Fan Speed is selected on the remote control during Soft Dry Operation.

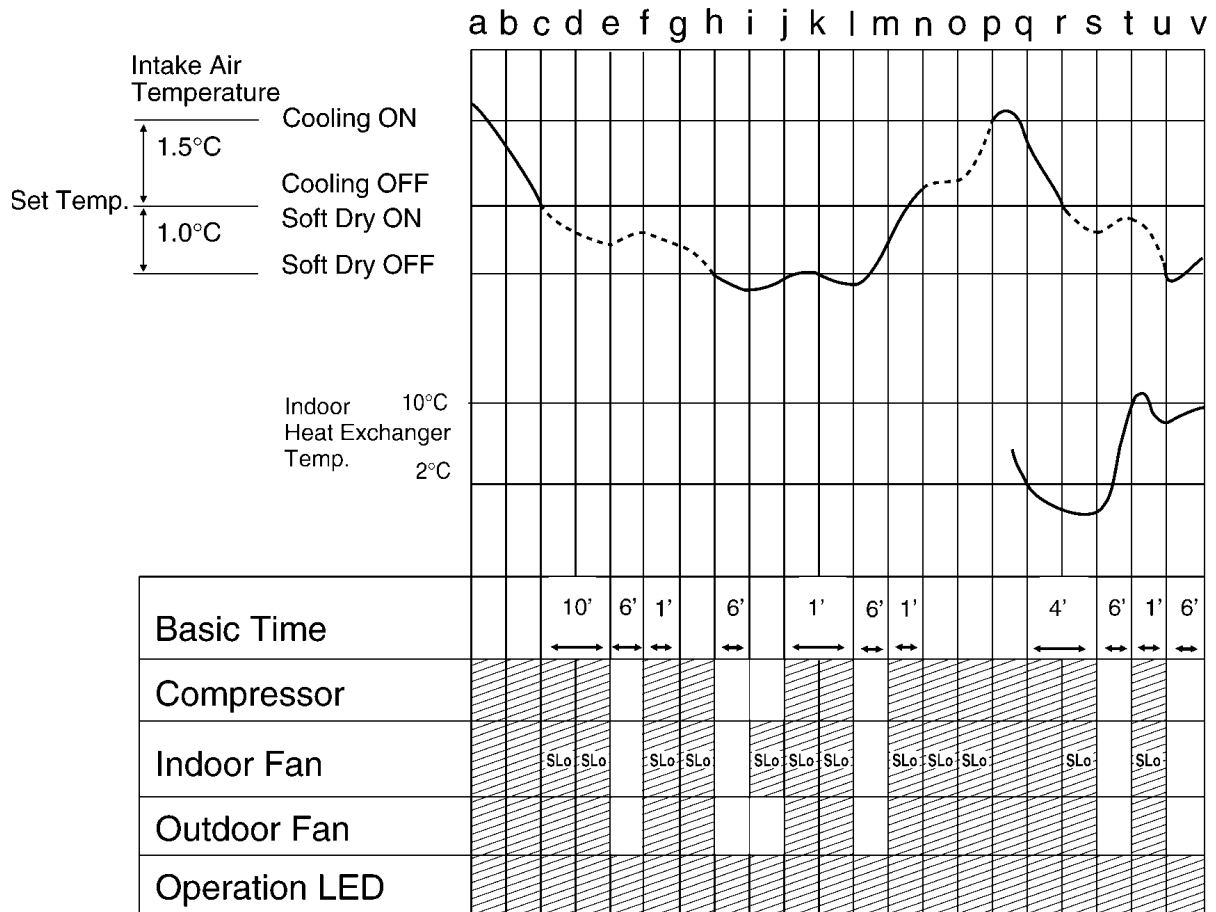
- Fan speed rotates at SLo and Lo speed.
- Deodorizing Control.



SLo : Indoor Fan rotates at 4-second intervals at low speed.

- SLo : Indoor Fan rotates at 4-second intervals at low speed.

8.2.5. Soft Dry Operation Time Diagram



<Description of operation>

- a - c : Cooling Operation
- c - p : Soft Dry Operation
- e - f : Soft Dry OFF
- j - l : 60 sec. Forced Operation
- q - t : Anti Freezing Control

- Soft Dry operation
- Operation
- Stop

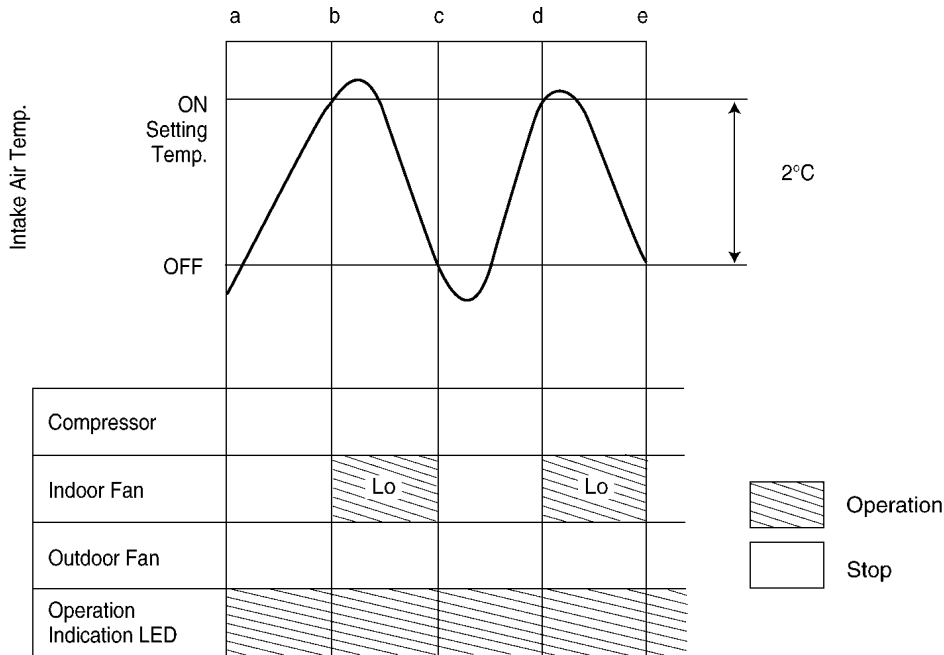
<Condition>

- a - h : When outdoor temperature is high
- h - p : When outdoor temperature is moderate
- p - u : When outdoor temperature is low

8.3. AIR CIRCULATION MODE OPERATION

· When the temperature near the ceiling reaches the setting temperature, Air Circulation Mode operation commences at low airflow volume. It stops when the temperature drops to 2 °C below the setting temperature.

8.3.1. Air Circulation Mode Operation Time Diagram



8.4. AUTOMATIC MODE OPERATION

8.4.1. Standard for Determining Operation Mode

↑
Intake air temperature

23°C

Cooling Mode
Soft Dry Mode

	Setting Temperature (Standard)
Cooling Mode	25°C
Soft Dry Mode	22°C

1. Indoor fan operates at Lo fan speed for 20 seconds.
2. After judging indoor air temperature, the operation mode is determined and operation continued at the mode determined.
3. After the operation mode has been determined, the mode does not change. However, Soft Dry mode operation includes Cooling mode operation.
4. If Automatic Mode operation is started while the air conditioner is operating, operation will continue. If current operation is in Cooling mode (including the operation which is a part of Soft Dry mode operation), it will be maintained, for 20 seconds at Lo fan speed. Then, the selected operation mode will continue.
5. Room temperature adjustment The following are added to the setting temperature specified as above.

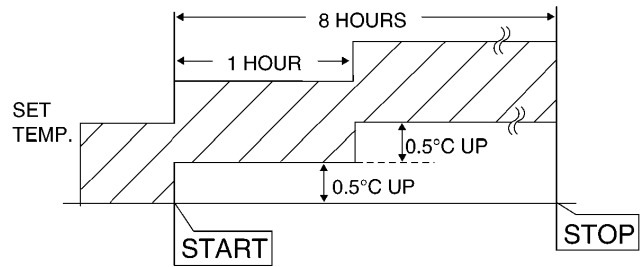
	Cooling	Soft Dry
Higher → +2°C	27 °C	24 °C
Standard → ±0°C	25 °C	22 °C
Lower → -2°C	23 °C	20 °C

8.5. SLEEP MODE AUTO OPERATION

8.5.1. Cooling or Soft Dry operation

When you press the SLEEP Mode, the following movement will start to avoid overcooling.

- The fan speed is automatically set to Low.
- The setting temperature will be increased by **0.5 °C** at the start of operation and by **0.5 °C** one hour later.
- The operation will stop after **8 hours**.



8.6. AUTO RESTART CONTROL

- If there is a power failure, operation will be restarted automatically when the power is resumed.
It will start with the previous operation mode and airflow direction.
(Time Delay Safety Control is valid)
- Auto Restart Control is not available when Timer or Sleep Mode is set.
- This control can be omitted by cutting the jumper wire J2.(Refer Circuit Diagram)

8.7. INDOOR FAN MOTOR CONTROL

- Auto Fan Speed Control
When set to Auto Fan Speed, the fan speed is adjusted between maximum and minimum setting as shown in the table.
- Manual Fan Speed Control
Basic fan speed adjustment (3 settings, from Lo to Hi) can be carried out by using the Fan Speed selection button.

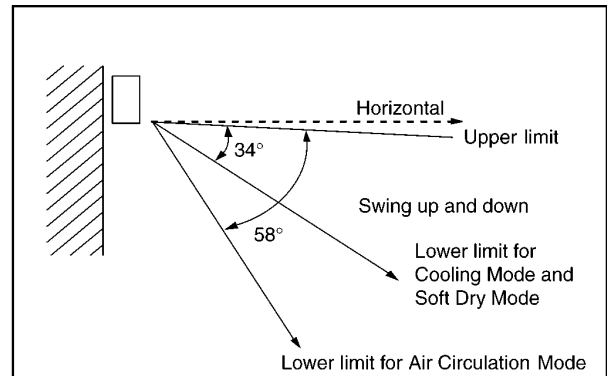
Fan Speed		High Speed ↔ Low Speed								
No.		8	7	6	5	4	3	2	1	0
Cooling	Manual		○	○	○					
	Auto		○	○						
	Sleep					○				
Soft Dry							○			○

Slo : Indoor Fan rotates at 4-second intervals at low speed.

8.8. AIRFLOW DIRECTION CONTROL

8.8.1. Airflow Direction Auto-Control

- When set to Airflow Direction Auto-Control on the remote control, the louver swings up and down as shown in the diagram.
- The louver does not swing when the Indoor Fan stops during operation.
- When stopped with the remote control, the discharge vent is closed with the louver.



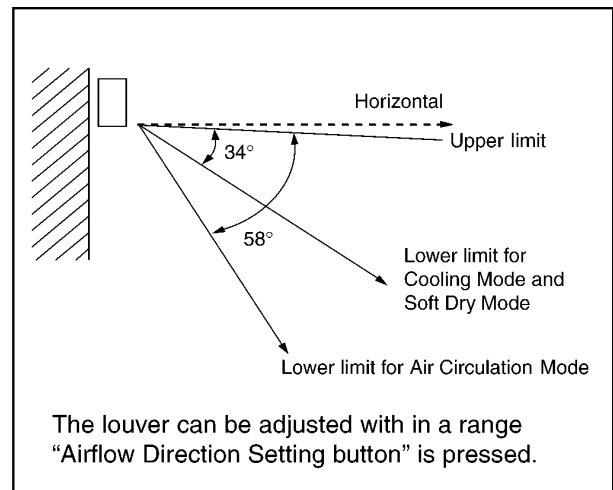
*The left and right airflow direction louvers can be adjusted manually.

*1 There is no swinging while indoor fan is stopped during Cooling and Soft Dry operation.

*2 In Air Circulation operation, when the intake air temperature reaches the set temperature, the airflow direction is changed from upper limit to lower limit. When the intake air temperature falls to 2°C lower than the set temperature, the airflow direction is changed from lower limit to upper limit.

8.8.2. Airflow Direction Manual Control

- When the Airflow Direction Setting button is pressed, the automatic airflow is released and the airflow direction louver moves up and down in the range shown in the diagram. The louver can be stopped by releasing the button at the desired louver position.
- When the remote control is used to stop the operation, the discharge vent is closed with airflow direction louver.



*The left and right airflow direction louvers can be adjusted manually.

8.9. DELAY ON TIMER CONTROL

- When the Delay ON Timer is set by using the remote control, the unit will start to operate slightly before the set time so that the room will reach nearly to the set temperature by the desired time.
- For Cooling and Soft Dry mode, the operation will start 15 minutes before the set time.
- For Automatic mode, the indoor fan will operate at SLo speed for 20 seconds 15 minutes before the set time to detect the intake air temperature to determine the operation mode. The operation indication lamp will blink at this time.

9 Installation And Servicing Air Conditioner Using R410A

9.1. OUTLINE

9.1.1. About R410A Refrigerant

1. Converting air conditioners to R410A

Since it was declared in 1974 that chlorofluorocarbons (CFC), hydro chlorofluorocarbons (HCFC) and other substances pose a destructive danger to the ozone layer in the earth's upper stratosphere (20 to 40 km above the earth), measures have been taken around the world to prevent this destruction.

The R22 refrigerant which has conventionally been used in ACs is an HCFC refrigerant and, therefore, possesses this ozone-destroying potential. International regulations (the Montreal Protocol on Ozone-Damaging Substances) and the domestic laws of various countries call for the early substitution of R22 by a refrigerant which will not harm the ozone layer.

- In ACs, the HFC refrigerant which has become the mainstream alternative is called R410A. Compared with R22, the pressure of R410A is approximately 1.6 times as high at the same refrigerant temperature, but the energy efficiency is about the same. Consisting of hydrogen (H), fluorine (F) and carbon (C), R410A is an HFC refrigerant. Another typical HFC refrigerant is R407C. While the energy efficiency of R407C is somewhat inferior to that of R410A, it offers the advantage of having pressure characteristics which are about the same as those of R22, and is used mainly in packaged ACs.

2. The characteristics of HFC (R410A) refrigerants

a. Chemical characteristics

The chemical characteristics of R410A are similar to those of R22 in that both are chemically stable, non-flammable refrigerants with low toxicity.

However, just like R22, the specific gravity of R410A gas is heavier than that of air. Because of this, it can cause an oxygen deficiency if it leaks into a closed room since it collects in the lower area of the room. It also generates toxic gas when it is directly exposed to a flame, so it must be used in a well ventilated environment where it will not collect.

Table 1 Physical comparison of R410A and R22

	R410A	R22
Composition (wt%)	R32/R125 (50/50)	R22 (100)
Boiling point (°C)	-51.4	-40.8
Vaporizing pressure (25°C)	1.56 Mpa (15.9 kgf/cm ²)	0.94 Mpa (9.6 kgf/cm ²)
Saturated vapor density	64.0 kg/m ³	44.4 kg/m ³
Flammability	Non-flammable	Non-flammable
Ozone-destroying point (ODP)	0	0.055
Global-warming point (GWP)	1730	1700

b. Compositional change (pseudo-azeotropic characteristics)

R410A is a pseudo-azeotropic mixture comprising the two components R32 and R125. Multi-component refrigerants with these chemical characteristics exhibit little compositional change even from phase changes due to vaporization (or condensation), which means that there is little change in the circulating refrigerant composition even when the refrigerant leaks from the gaseous section of the piping.

Accordingly, R410A can be handled in almost the same manner as the single-component refrigerant R22.

However, when charging, because there is a slight change in composition between the gas phase and the liquid phase inside a cylinder or other container, charging should basically begin with the liquid side.

c. Pressure characteristics

As seen in Table 2, the gas pressure of R410A is approximately 1.6 times as high as that of R22 at the same refrigerant temperature, which means that special R410A tools and materials with high-pressure specifications must be used for all refrigerant piping work and servicing.

Table2 Comparison of R410A and R22 saturated vapor density

Refrigerant Temperature(°C)	Unit:MPa	
	R410A	R22
-20	0.30	0.14
0	0.70	0.40
20	1.35	0.81
40	2.32	1.43
60	3.73	2.33
65	4.15	2.60

d. R410A refrigerating machine oil

Conventionally, mineral oil or a synthetic oil such as alkylbenzene has been used for R22 refrigerating machine oil. Because of the poor compatibility between R410A and conventional oils like mineral oil, however, there is a tendency for the refrigerating machine oil to collect in the refrigerating cycle. For this reason, polyester and other synthetic oils which have a high compatibility with R410A are used as refrigerating machine oil.

Because of the high hygroscopic property of synthetic oil, more care must be taken in its handling than was necessary with

conventional refrigerating machine oils. Also, these synthetic oils will degrade if mixed with mineral oil or alkylbenzene, causing clogging in capillary tubes or compressor malfunction. Do not mix them under any circumstances.

9.1.2. Safety Measures When Installing/Serviceing Refrigerant Piping

Cause the gas pressure of R410A is approximately 1.6 times as high as that of R22, a mistake in installation or servicing could result in a major accident. It is essential that you use R410A tools and materials, and that you observe the following precautions to ensure safety.

1. Do not use any refrigerant other than R410A in ACs that have been used with R410A.
2. If any refrigerant gas leaks while you are working, ventilate the room. Toxic gas may be generated if refrigerant gas is exposed to a direct flame.
3. When installing or transferring an AC, do not allow any air or substance other than R410A to mix into the refrigeration cycle. If it does, the pressure in the refrigeration cycle can become abnormally high, possibly causing an explosion and/or injury
4. After finishing the installation, check to make sure there is no refrigerant gas leaking.
5. When installing or transferring an AC, follow the instructions in the installation instructions carefully. Incorrect installation can result in an abnormal refrigeration cycle or water leakage, electric shock, fire, etc.
6. Do not perform any alterations on the AC unit under any circumstances. Have all repair work done by a specialist. Incorrect repairs can result in an water leakage, electric shock, fire, etc.

9.2. TOOLS FOR INSTALLING/SERVICING REFRIGERANT PIPING

9.2.1. Necessary Tools

In order to prevent an R410A AC from mistakenly being charged with any other refrigerant, the diameter of the 3-way valve service port on the outdoor unit has been changed. Also, to increase its ability to withstand pressure, the opposing dimensions have been changed for the refrigerant pipe flaring size and flare nut. Accordingly, when installing or servicing refrigerant piping, you must have both the R410A and ordinary tools listed below.

Table 3 Tools for Installation, transferring or replacement

Type of work	Ordinary tools	R410A tools
Flaring	Flaring tool (clutch type), pipe cutter, reamer	Copper pipe gauge for clearance Adjustment, flaring tool (clutch type)*1)
Bending, connecting pipes	Torque wrench (nominal diameter 1/4,3/8,1/2) Fixed spanner (opposing sides 12 mm, 17 mm, 19mm) Adjustable wrench, Spring bender	
Air purging	Vacuum pump Hexagonal wrench (opposing sides 4 mm)	Manifold gauge, charging hose, vacuum pump adaptor
Gas leak inspection	Gas leak inspection fluid or soapy water	Electric gas leak detector for HFC refrigerant*2)

*1). You can use the conventional (R22) flaring tool. If you need to buy a new tool, buy the R410A type.

*2). Use when it is necessary to detect small gas leaks.

For other installation work, you should have the usual tools, such as screwdrivers (+,-), a metal-cutting saw, an electric drill, a hole core drill (65 or 70 dia.), a tape measure, a level, a thermometer, a clamp meter, an insulation tester, a voltmeter, etc.

Table 4 Tools for servicing

Type of work	Ordinary tools	R410A tools
Refrigerant charging		Electronic scale for refrigerant charging Refrigerant cylinder Charging orifice and packing for refrigerant cylinder
Brazing (Replacing refrigerating cycle parts*1)	Nitrogen blow set (be sure to use nitrogen blowing for all brazing), and brazing machine	

*1). Always replace the dryer of the outdoor unit at the same time. The replacement dryer is wrapped in a vacuum pack. Replace it last among the refrigerating cycle parts. Start brazing as soon as you have opened the vacuum pack, and begin the vacuuming operation within 2 hours.

9.2.2. R410A Tools

1. Copper tube gauge for clearance adjustment
(used when flaring with the conventional flaring tool (clutch type))
 - This gauge makes it easy to set the clearance for the copper tube to 1.0-1.5 mm from the clamp bar of the flaring tool.

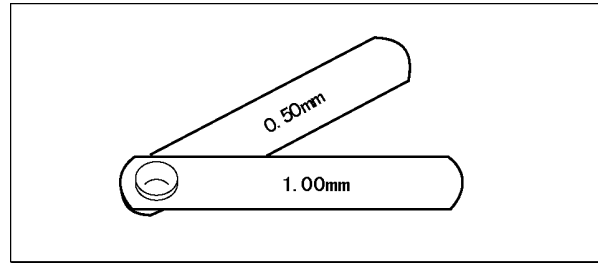


Fig. 1 Copper tube gauge for clearance adjustment

2. Flaring tool (clutch type)
 - In the R410A flaring tool, the receiving hole for the clamp bar is enlarged so the clearance from the clamp bar can be set to 0-0.5 mm, and the spring inside the tool is strengthened to increase the strength of the pipe-expanding torque. This flaring tool can also be used with R22 piping, so we recommend that you select it if you are buying a new flaring tool.

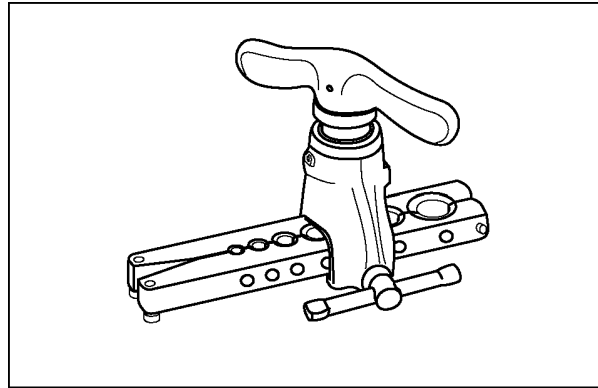


Fig. 2 Flaring tool (clutch type)

3. Torque wrenches

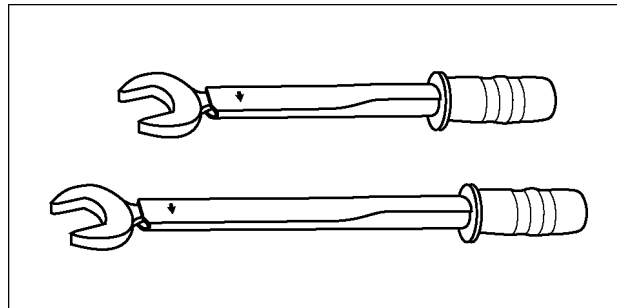


Fig. 3 Torque wrenches

Table 5

	Conventional wrenches	R410A wrenches
For 1/4 (opposite side x torque)	17mm X 18 N·m (180 kgf·cm)	17mm X 18 N·m (180 kgf·cm)
For 3/8 (opposite side x torque)	22mm X 42 N·m (420 kgf·cm)	22mm X 42 N·m (420 kgf·cm)
For 1/2 (opposite side x torque)	24mm X 55 N·m (550 kgf·cm)	26mm X 55 N·m (550 kgf·cm)

4. Manifold gauge
 - Because the pressure is higher for the R410A type, the conventional type cannot be used.

Table 6 Difference between R410A and conventional high/low-pressure gauges

	Conventional gauges	R410A gauges
High-pressure gauge (red)	-76 cmHg - 35 kgf/cm ³	-0.1 - 5.3 Mpa -76 cmHg - 53 kgf/cm ³
Low-pressure gauge (blue)	-76 cmHg - 17 kgf/cm ³	-0.1 - 3.8 Mpa -76 cmHg - 38 kgf/cm ³

- The shape of the manifold ports has been changed to prevent the possibility of mistakenly charging with another type of refrigerant.

Table 7 Difference between R410A and conventional manifold port size

	Conventional gauges	R410A gauges
Port size	7/16 UNF 20 threads	1/2 UNF 20 threads

5. Charging hose

- The pressure resistance of the charging hose has been raised to match the higher pressure of R410A. The hose material has also been changed to suit HFC use, and the size of the fitting has been changed to match the manifold ports.

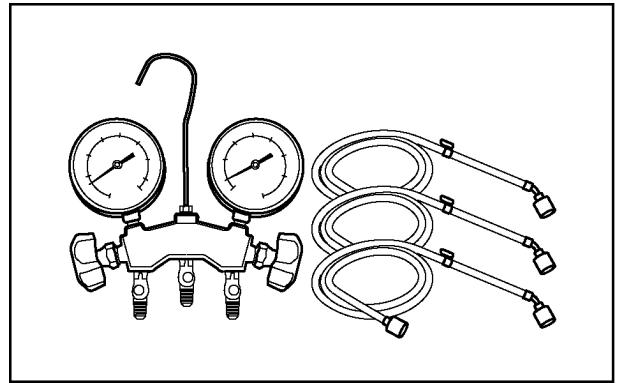


Fig. 4 Manifold gauge charging hose

Table 8 Difference between R410A and conventional charging hoses

		Conventional hoses	R410A hoses
Pressure resistance	Working pressure	3.4 MPa (35 kgf/cm ³)	5.1 MPa (52 kgf/cm ³)
	Bursting pressure	17.2 MPa (175 kgf/cm ³)	27.4 MPa (280 kgf/cm ³)
Material		NBR rubber	HNBR rubber Nylon coating inside

6. Vacuum pump adaptor

- When using a vacuum pump for R410A, it is necessary to install an electromagnetic valve to prevent the vacuum pump oil from flowing back into the charging hose. The vacuum pump adaptor is installed for that purpose. If the vacuum pump oil (mineral oil) becomes mixed with R410A, it will damage the unit.

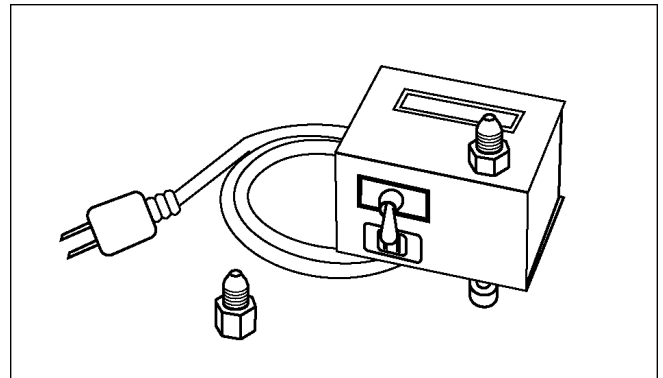


Fig. 5 Vacuum pump adaptor

7. Electric gas leak detector for HFC refrigerant

- The leak detector and halide torch that were used with CFC and HCFC cannot be used with R410A (because there is no chlorine in the refrigerant).
- The present R134a leak detector can be used, but the detection sensitivity will be lower (setting the sensitivity for R134a at 1, the level for R410A will drop to 0.6).
- For detecting small amounts of gas leakage, use the electric gas leak detector for HFC refrigerant. (Detection sensitivity with R410A is about 23 g/year.)

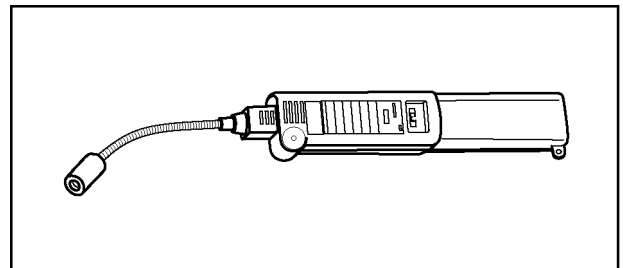


Fig. 6 Electric gas leak detector for HFC refrigerant

8. Electronic scale for refrigerant charging

- Because of the high pressure and fast vaporizing speed of R410A, the refrigerant cannot be held in a liquid phase inside the charging cylinder when charging is done using the charging cylinder method, causing bubbles to form in the measurement scale glass and making it difficult to see the reading. (Naturally, the conventional R22 charging cylinder cannot be used because of the differences in the pressure resistance, scale gradation, connecting port size, etc.)
- The electronic scale has been strengthened by using a structure in which the weight detector for the refrigerant cylinder is held by four supports. It is also equipped with two connection ports, one for R22 (7/16 UNF, 20 threads) and one for R410A (1/2 UNF, 20 threads), so it can also be used for conventional refrigerant charging.
- There are two types of electronic scales, one for 10-kg cylinders and one for 20-kg cylinders. (The 10-kg cylinder is recommended.)

Refrigerant charging is done manually by opening and closing the valve.

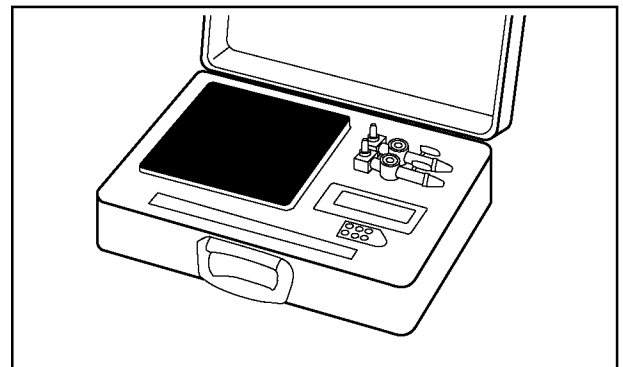


Fig. 7 Electronic scale for refrigerant charging

9. Refrigerant cylinders

- The R410A cylinders are labeled with the refrigerant name, and the coating color of the cylinder protector is pink, which is the color stipulated by ARI of the U.S.
- Cylinders equipped with a siphon tube are available to allow the cylinder to stand upright for liquid refrigerant charging.

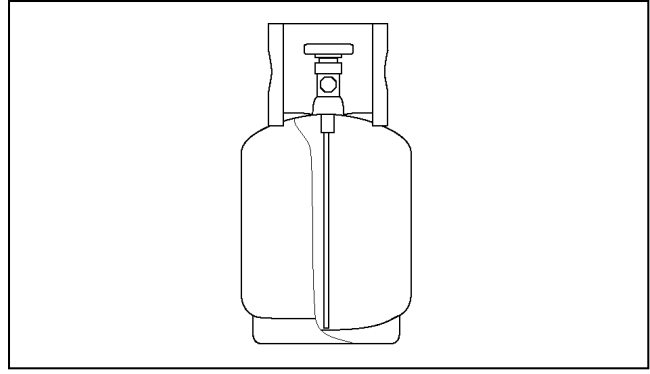


Fig. 8 Refrigerant cylinders

10. Charging orifice and packing for refrigerant cylinders

- The charging orifice must match the size of the charging hose fitting (1/2 UNF, 20 threads).
- The packing must also be made of an HFC-resistant material.

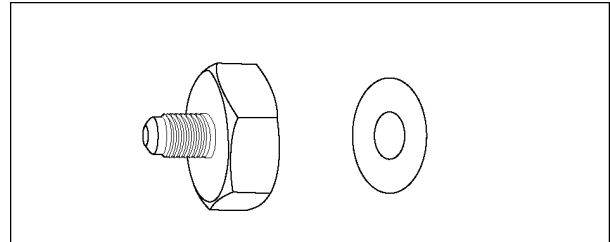


Fig. 9 Charging orifice and packing

9.2.3. R410A Tools Which Are Usable for R22 Models

Table 9 R410A tools which are usable for R22 models

	R410A tools	Usable for R22 models
(1)	Copper tube gauge for clearance adjustment	OK
(2)	Flaring tool (clutch type)	OK
(3)	Manifold gauge	NG
(4)	Charging hose	NG
(5)	Vacuum pump adaptor	OK
(6)	Electric gas leak detector for HFC refrigerant	NG
(7)	Electronic scale for refrigerant charging	OK
(8)	Refrigerant cylinder	NG
(9)	Charging orifice and packing for refrigerant cylinder	NG

9.3. REFRIGERANT PIPING WORK

9.3.1. Piping Materials

It is recommended that you use copper and copper alloy jointless pipes with a maximum oil adherence of 40 mg/10 m. Do not use pipes that are crushed, deformed, or discolored (especially the inside surface). If these inferior pipes are used, impurities may clog the expansion valves or capillaries.

Because the pressure of ACs using R410A is higher than those using R22, it is essential that you select materials that are appropriate for these standards.

The thickness of the copper tubing used for R410A is shown in Table 10. Please be aware that tubing with a thickness of only 0.7 mm is also available on the market, but this should never be used.

Table 10 Copper tube thickness (mm)

Soft pipe		Thickness (mm)	
Nominal diameter	Outside diameter (mm)	R410A	(Reference)R22
1/4	6.35	0.80	0.80
3/8	9.52	0.80	0.80
1/2	12.7	0.80	0.80

9.3.2. Processing and Connecting Piping Materials

When working with refrigerant piping, the following points must be carefully observed: no moisture or dust must be allowed to enter the piping, and there must be no refrigerant leaks.

1. Procedure and precautions for flaring work

- a. Cut the pipe
Use a pipe cutter, and cut slowly so the pipe will not be deformed.
- b. Remove burrs and clean shavings from the cut surface
If the shape of the pipe end is poor after removing burrs, or if shavings adhere to the flared area, it may lead to refrigerant leaks. To prevent this, turn the cut surface downward and remove burrs, then clean the surface, carefully.
- c. Insert the flare nut (be sure to use the same nut that is used on the AC unit)
- d. Flaring
Check the clamp bar and the cleanliness of the copper pipe. Be sure to use the clamp bar to do the flaring with accuracy. Use either an R410A flaring tool, or a conventional flaring tool. Flaring tools come in different sizes, so be sure to check the size before using. When using a conventional flaring tool, use the copper pipe gauge for clearance adjustment, etc., to ensure the correct A dimension (see Fig. 10)

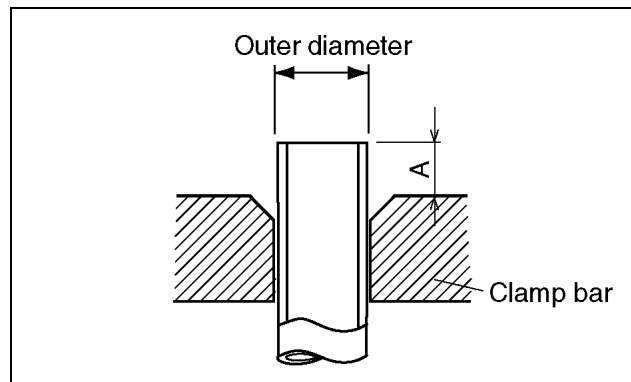


Fig. 10 Flaring dimensions

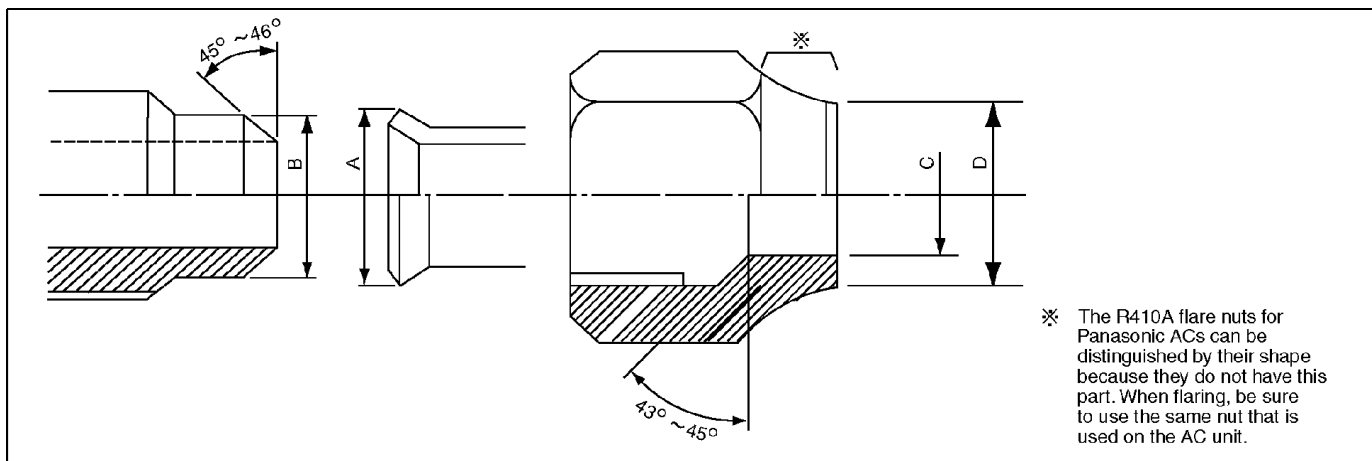


Fig. 11 Relation between the flare nut structure and flaring tool end

Table 11 R410A flaring dimensions

Nominal diameter	Outside diameter (mm)	Wall thickness (mm)	A(mm)		
			R410A flaring tool, clutch type	Conventional flaring tool	
				Clutch type	Wing-nut type
1/4	6.35	0.8	0 - 0.5	1.0 - 1.5	1.5 - 2.0
3/8	9.52	0.8	0 - 0.5	1.0 - 1.5	1.5 - 2.0
1/2	12.70	0.8	0 - 0.5	1.0 - 1.5	2.0 - 2.5

Table 12 R22 flaring dimensions

Nominal diameter	Outside diameter (mm)	Wall thickness (mm)	A(mm)		
			R410A flaring tool, clutch type	Conventional flaring tool	
				Clutch type	Wing-nut type
1/4	6.35	0.8	0 - 0.5	0.5 - 1.0	1.0 - 1.5
3/8	9.52	0.8	0 - 0.5	0.5 - 1.0	1.0 - 1.5
1/2	12.70	0.8	0 - 0.5	0.5 - 1.0	1.5 - 2.0

Table 13 R410A flare and flare nut dimensions Unit:mm

Nominal diameter	Outside diameter (mm)	Wall thickness (mm)	A +0, -0.4	B dimension	C dimension	D dimension	Flare nut width
1/4	6.35	0.8	9.1	9.2	6.5	13	17
3/8	9.52	0.8	13.2	13.5	9.7	20	22
1/2	12.70	0.8	16.6	16.0	12.9	23	26

Table 14 R22 flare and flare nut dimensions Unit:mm

Nominal diameter	Outside diameter (mm)	Wall thickness (mm)	A +0, -0.4	B dimension	C dimension	D dimension	Flare nut width
1/4	6.35	0.8	9.0	9.2	6.5	13	17
3/8	9.52	0.8	13.0	13.5	9.7	20	22
1/2	12.70	0.8	16.2	16.0	12.9	20	24

2. Procedure and precautions for flare connection

- a. Check to make sure there are no scratches, dust, etc., on the flare and union.
- b. Align the flared surface with the axial center of the union.
- c. Use a torque wrench, and tighten to the specified torque. The tightening torque for R410A is the same as the conventional torque value for R22. Be careful, because if the torque is too weak, it may lead to a gas leak. If it is too strong, it may split the flare nut or make it impossible to remove the flare nut.

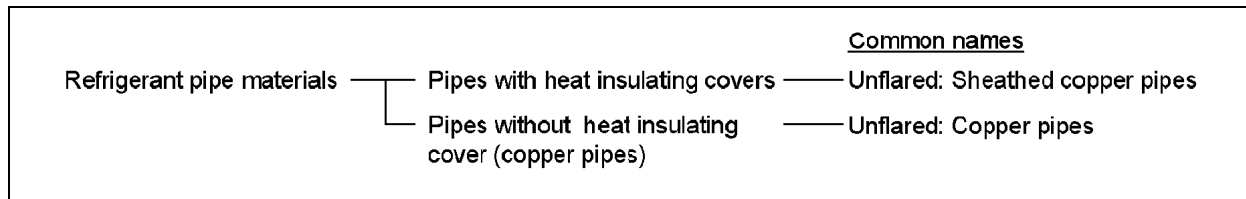
Table 15 R410A tightening torque

Nominal diameter	Outside diameter (mm)	Tightening torque N·m (kgf·cm)	Torque wrench tightening torque N·m (kgf·cm)
1/4	6.35	14 - 18 (140 - 180)	18 (180)
3/8	9.52	33 - 42 (330 - 420)	42 (420)
1/2	12.70	55 (550)	55 (550)

9.3.3. Storing and Managing Piping Materials

1. Types of piping and their storage

The following is a general classification of the refrigerant pipe materials used for ACs.



Because the gas pressure of R410A is approximately 1.6 times as high as that of R22, copper pipes with the thickness shown in Table 10, and with minimal impurities must be used. Care must also be taken during storage to ensure that pipes are not crushed, deformed, or scratched, and that no dust, moisture or other substance enters the pipe interior. When storing sheathed copper pipes or plain copper pipes, seal the openings by pinching or taping them securely.

2. Markings and management

- a. Sheathed copper pipes and copper-element pipes
When using these pipes, check to make sure that they are the stipulated thickness. For flare nuts, be sure to use the same nut that is used on the AC unit.
- b. Copper pipes
Use only copper pipes with the thickness given in table 10, and with minimal impurities. Because the surface of the pipe is exposed, you should take special care, and also take measures such as marking the pipes to make sure they are easily distinguished from other piping materials, to prevent mistaken use.

3. Precautions during refrigerant piping work

Take the following precautions on-site when connecting pipes.(Keep in mind that the need to control the entry of moisture and dust is even more important than in conventional piping.)

- a. Keep the open ends of all pipes sealed until connection with the AC equipment is complete.

- b. Take special care when doing piping work on rainy days. The entering of moisture will degrade the refrigerating machine oil, and lead to malfunctions in the equipment.
- c. Complete all pipe connections in as short a time as possible. If the pipe must be left standing for a long time after removing the seal, it must be thoroughly purged with nitrogen, or dried with a vacuum pump.

9.4. INSTALLATION, TRANSFERRING SERVICING

9.4.1. Inspecting Gas Leaks with a Vacuum Pump for New Installations (Using New Refrigerant Piping))

1. From the viewpoint of protecting the global environment, please do not release refrigerant into the atmosphere.
 - a. Connect the projecting side (pin-pushing side) of the charging hose for the manifold gauge to the service port of the 3-way valve. (1)
 - b. Fully open the handle Lo of the manifold gauge and run the vacuum pump. (2) (If the needle of the low-pressure gauge instantly reaches vacuum, re-check step a.)
 - c. Continue the vacuum process for at least 15 minutes, then check to make sure the low-pressure gauge has reached -0.1 MPa (-76 cmHg). Once the vacuum process has finished, fully close the handle Lo of the manifold gauge and stop the vacuum pump operation, then remove the charging hose that is connected to the vacuum pump adaptor. (Leave the unit in that condition for 1-2 minutes, and make sure that the needle of the manifold gauge does not return.) (2) and (3)
 - d. Turn the valve stem of the 2-way valve 90° counter-clockwise to open it, then, after 10 seconds, close it and inspect for a gas leak (4)
 - e. Remove the charging hose from the 3-way valve service port, then open both the 2-way valve and 3-way valve. (1) (4) (Turn the valve stem in the counter-clockwise direction until it gently makes contact. Do not turn it forcefully.)
 - f. Tighten the service port cap with a torque wrench (18 N·m (1.8 kgf·m)). (5) Then tighten the 2-way valve and 3-way valve caps with a torque wrench (42 N·m (4.2 kgf·m)) or (55 N·m (5.5 kgf·m)). (6)
 - g. After attaching each of the caps, inspect for a gas leak around the cap area. (5) (6)

Precautions

- Be sure to read the instructions for the vacuum pump, vacuum pump adaptor and manifold gauge prior to use, and follow the instructions carefully.
- Make sure that the vacuum pump is filled with oil up to the designated line on the oil gauge.
- The gas pressure backflow prevention valve on the charging hose is generally open during use. When you are removing the charging hose from the service port, it will come off more easily if you close this valve.

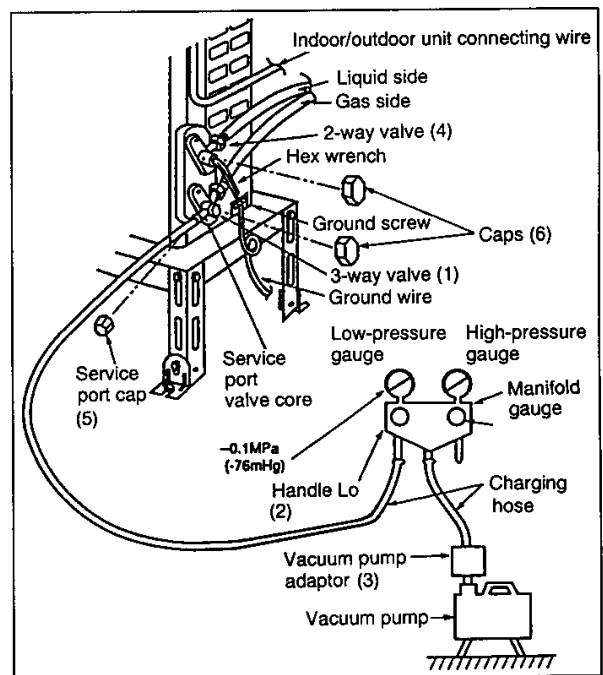


Fig. 12 Vacuum pump air purging configuration

9.4.2. Transferring (Using New Refrigerant Piping)

1. Removing the unit
 - a. Collecting the refrigerant into the outdoor unit by pumping down

The refrigerant can be collected into the outdoor unit (pumping down) by pressing the TEST RUN button, even when the temperature of the room is low.

 - Check to make sure that the valve stems of the 2-way valve and 3-way valve have been opened by turning them counter-clockwise. (Remove the valve stem caps and check to see that the valve stems are fully opened position. Always use a hex wrench (with 4-mm opposing sides) to operate the valve stems.)

- Press the TEST RUN button on the indoor unit, and allow preliminary operation for 5-6 minutes. (TEST RUN mode)
- After stopping the operation, let the unit sit for about 3 minutes, then close the 2-way valve by turning the valve stem in the clockwise direction.
- Press the TEST RUN button on the indoor unit again, and after 2-3 minutes of operation, turn the valve stem of the 3-way valve quickly in the clockwise direction to close it, then stop the operation.
- Tighten the caps of the 2-way valve and 3-way valve to the stipulated torque.
- Remove the connection pipes (liquid side and gas side).

b. Removing the indoor and outdoor units

- Disconnect the pipes and connecting electric cables from between the indoor and outdoor units
- Put capped flare nuts onto all of the pipe connections of the indoor and outdoor units, to make sure no dust or other foreign matter enters.
- Remove the indoor and outdoor units.

2. Installing the unit

Install the unit using new refrigerant piping. Follow the instructions in section 4.1 to evacuate the pipes connecting the indoor and outdoor units, and the pipes of the indoor unit, and check for gas leaks.

9.4.3. AC Units Replacement (Using Existing Refrigerant Piping)

When replacing and R410A AC unit with another R410A AC unit, you should re-flare the refrigerant piping. Even though the replacement AC unit uses the R410A, problems occur when, for example, either the AC unit maker or the refrigerating machine oil is different.

When replacing an R22 AC unit with an R410A AC unit, the following checks and cleaning procedures are necessary but are difficult to do because of the chemical characteristics of the refrigerating machine oil (as described in items c) and d) of section About R410A Refrigerant(2)). In this case, you should use new refrigerant piping rather than the existing piping.

1. Piping check

Because of the different pressure characteristics of R22 and R410A, the design pressure for the equipment is 1.6 times different. The wall thickness of the piping must comply with that shown in Table 10, but this is not easy to check. Also, even if the thickness is correct, there may be flattened or bent portions midway through the piping due to sharp curves. Buried sections of the piping also cannot be checked.

2. Pipe cleaning

A large quantity of refrigerating machine oil (mineral oil) adheres to existing pipes due to the refrigeration cycle circulation. If the pipes are used just as they are for the R410A cycle, the capacity will be lowered due to the incompatibility of this oil with the R410A, or irregularities may occur in the refrigeration cycle. For this reason, the piping must be thoroughly cleaned, but this is difficult with the present technology.

9.4.4. Refrigerant Compatibility (Using R410A Refrigerant in R22 ACs and Vice Versa)

Do not operate an existing R22 AC with the new R410A refrigerant. Doing so would result in improper functioning of the equipment or malfunction, and might lead to a major accident such as an explosion in the refrigeration cycle. Similarly, do not operate an R410A AC with R22 refrigerant. The chemical reaction between the refrigerating machine oil used in R410A ACs and the chlorine that is contained in R22 would cause the refrigerating machine oil to degrade and lead to malfunction.

9.4.5. Recharging Refrigerant During Servicing

When recharging is necessary, insert the specified amount of new refrigerant in accordance with the following procedure.

1. Connect the charging hose to the service port of the outdoor unit.
2. Connect the charging hose to the vacuum pump adaptor. At this time, fully open the 2-way valve and 3-way valve.
3. Fully open the handle Lo of the manifold gauge, turn on the power of the vacuum pump and continue the vacuum process for at least one hour.
4. Confirm that the low pressure gauge shows a reading of -0.1 Mpa (-76 cmHg), then fully close the handle Lo, and turn off the vacuum pump. Wait for 1-2 minutes, then check to make sure that the needle of the Low pressure gauge has not returned. See Fig.13 for the remaining steps of this procedure.
5. Set the refrigerant cylinder onto the electronic scale, then connect the hose to the cylinder and to the connection port for the electronic scale. (1)(2)

Precaution:

Be sure to set up the cylinder for liquid charging. If you use a cylinder equipped with a siphon tube, you can charge the liquid without having to turn the cylinder around

6. Remove the charging hose of the manifold gauge from the vacuum pump adaptor, and connect it to the connection port of the electronic scale. (2)(3)

7. Open the valve of the refrigerant cylinder, then open the charging valve slightly and close it. Next, press the check valve of the manifold gauge and purge the air. (2)(4) (Watch the liquid refrigerant closely at this point.)
8. After adjusting the electronic scale to zero, open the charging valve, then open the valve Lo of the manifold gauge and charge with the liquid refrigerant. (2)(5) (Be sure to read the operating instructions for the electronic scale.)
9. If you cannot charge the stipulated amount, operate the unit in the cooling mode while charging a little of the liquid at a time (about 150 g/time as a guideline). If the charging amount is insufficient from one operation, wait about one minute, then use the same procedure to do the liquid charging again.

Precaution:

Never use the gas side to allow a larger amount of liquid refrigerant to be charged while operating the unit.

10. Close the charging valve, and after charging the liquid refrigerant inside the charging hose, fully close the valve Lo of the manifold gauge, and stop the operation of the unit. (2)(5)
11. Quickly remove the charging hose from the service port. (6) If you stop midway through, the refrigerant that is in the cycle will be discharged.
12. After putting on the caps for the service port and operating valve, inspect around the caps for a gas leak. (6)(7)

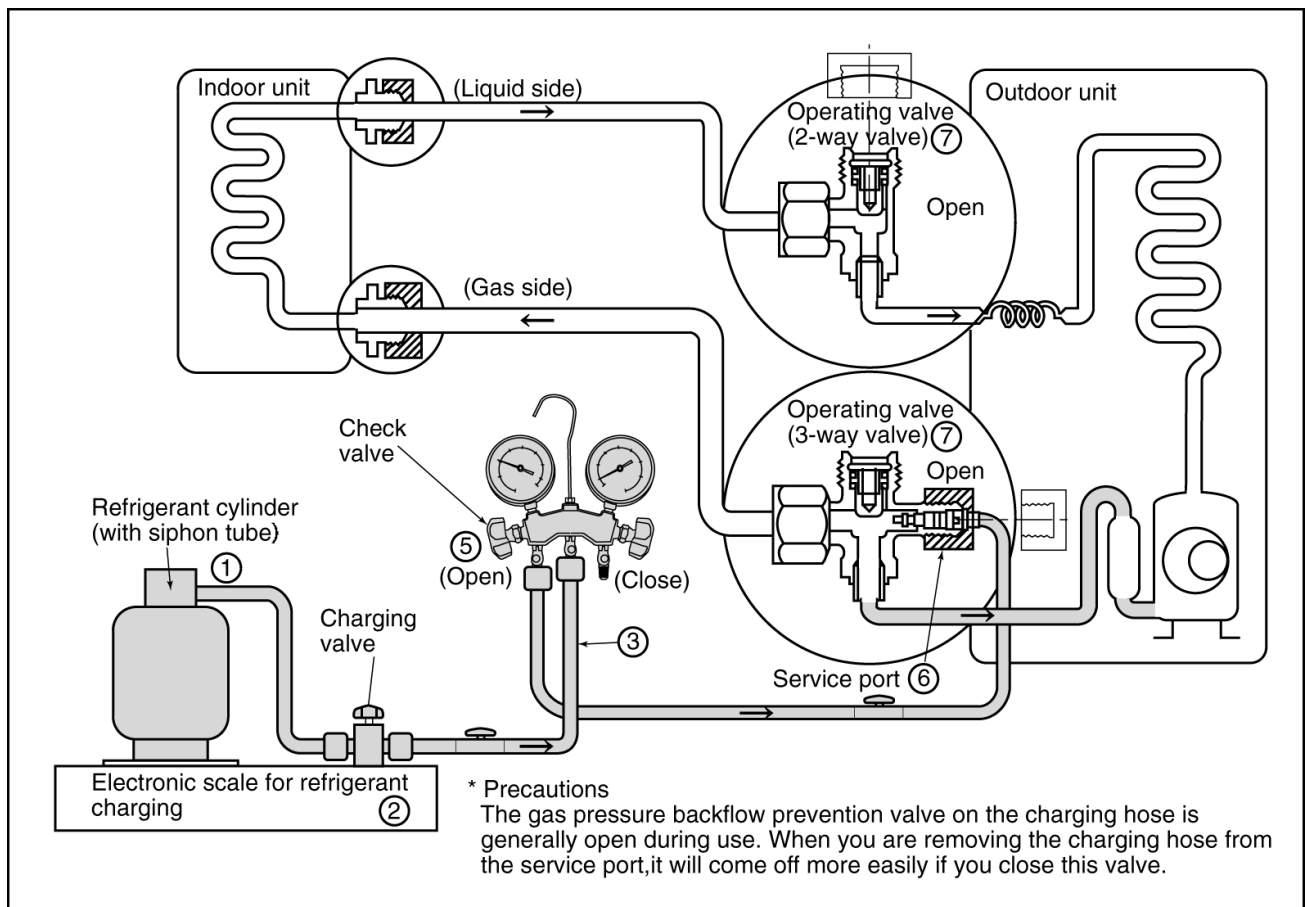


Fig. 13 Re-charging refrigerant

9.4.6. Brazing

As brazing requires sophisticated techniques and experiences, it must be performed by a qualified person.

In order to prevent the oxide film from occurring in the pipe interior during brazing, it is effective to proceed with brazing while letting dry nitrogen gas (N_2) flow.

<Brazing Method for Preventing Oxidation>

1. Attach a reducing valve to the nitrogen gas cylinder.
2. Attach a reducing valve to the nitrogen gas cylinder.
3. Apply a seal onto the clearance between the piping and inserted pipe for the nitrogen gas in order to prevent the nitrogen gas from flowing backward.
4. When the nitrogen gas is flowing, be sure to keep the piping end open.
5. Adjust the flow rate of nitrogen gas so that it is lower than $0.05 \text{ m}^3/\text{h}$, or 0.02 MPa (0.2 kgf/cm^2) by means of the reducing valve.

6. After taking the steps above, keep the nitrogen gas flowing until the piping cools down to a certain extent (i.e. temperature at which pipes are touchable with finger).
7. Completely remove the flux after brazing.

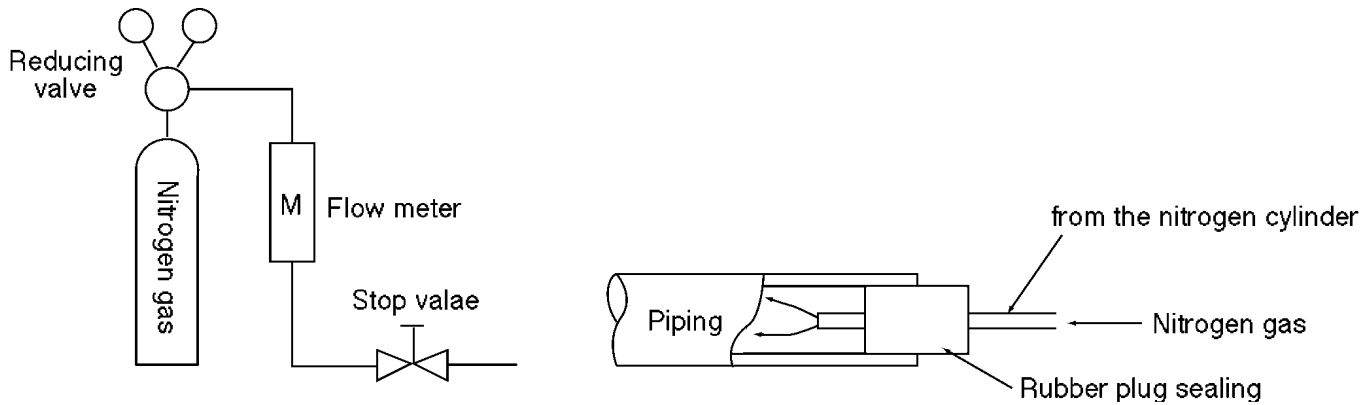


Fig. 14 Prevention of Oxidation during Brazing

* Cautions during brazing

1. General Cautions

- a. The brazing strength should be high as required.
- b. After operation, airtightness should be kept under pressurized condition.
- c. During brazing do not allow component materials to become damaged due to overheating.
- d. The refrigerant pipe work should not become blocked with scale or flux.
- e. The brazed part should not restrict the flow in the refrigerant circuit.
- f. No corrosion should occur from the brazed part.

2. Prevention of Overheating

Due to heating, the interior and exterior surfaces of treated metal may oxidize. Especially, when the interior of the refrigerant circuit oxidizes due to overheating, scale occurs and stays in the circuit as dust, thus exerting a fatally adverse effect. So, make brazing at adequate brazing temperature and with a minimum of heating area.

3. Overheating Protection

In order to prevent components near the brazed part from overheating damage or quality deterioration due to flame or heat, take adequate steps for protection such as (1) by shielding with a metal plate, (2) by using a wet cloth, and (3) by means of heat absorbent.

4. Movement during Brazing

Eliminate all vibration during brazing to protect brazed joints from cracking and breakage.

5. Oxidation Preventative

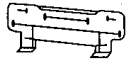






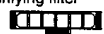
In order to improve the brazing efficiency, various types of antioxidant are available on the market. However, the constituents of these are widely varied, and some are anticipated to corrode the piping materials, or adversely affect HFC refrigerant, lubricating oil, etc. Exercise care when using an oxidation preventative.

9.4.7. Servicing Tips

The drier must also be replaced whenever replacing the refrigerant cycle parts. Replace the refrigerant cycle parts first before replacing the drier. The drier is supplied in a vacuum pack. Perform brazing immediately after opening the vacuum pack, and then start the vacuum within two hours. In addition, the drier also needs to be replaced when the refrigerant has leaked completely.

10 Installation Information

10.1. ATTACHED ACCESSORIES

No.	Accessories part	Qty.	No.	Accessories part	Qty.
1	 Installation plate	1	6	 Clamping cover of piping	1
			7	 Vinyl tape	3
2	 Installation plate fixing screw	6	8	 Vinyl tape	1
3	 Remote control	1			
4	 Battery	2			
5	 Air purifying filter	2			

10.2. SELECT THE BEST LOCATION

10.2.1. INDOOR UNIT

- There should not be any heat source or steam near the unit.
- There should not be any obstacles blocking the air circulation.
- A place where air circulation in the room is good.
- A place where drainage can be easily done.
- A place where noise prevention is taken into consideration.
- Do not install the unit near the door way.
- Ensure the spaces indicated by arrows from the wall, ceiling or other obstacles.
- Indoor unit of this room air conditioner shall be installed on the wall in a height of at least 2.3m.

10.2.2. OUTDOOR UNIT

- If an awning is built over the unit to prevent direct sunlight or rain, be careful that heat radiation from the condenser is not obstructed.
- There should not be any animal or plant which could be affected by hot discharged air.
- Keep the spaces indicated by arrows from wall, ceiling, fence or other obstacles.
- Do not place any obstacles which may cause a short circuit of the discharged air.

10.2.3. PIPING LENGTH

MODEL	Piping size		Rated Length (m)	Max. Elevation (m)	Max. Piping Length (m)
	Gas	Liquid			
VC70KE	3/8"	1/4"	7	5	10
VC90KE	3/8"	1/4"	7	5	10
VC120KE	1/2"	1/4"	10	5	15

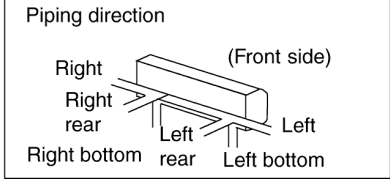
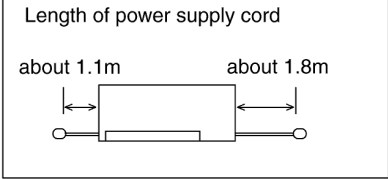
*1. The additional gas charge is unnecessary up to the Max. piping length. (CS-VC70KE, CS-VC90KE)

*2. The above models (CS-VC120KE) will be installed at a 15 m (max) distance.

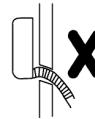
The refrigerant should be added 75g. (15m - 10m) x 15g = 75g

10.3. INDOOR/OUTDOOR UNIT INSTALLATION DIAGRAM

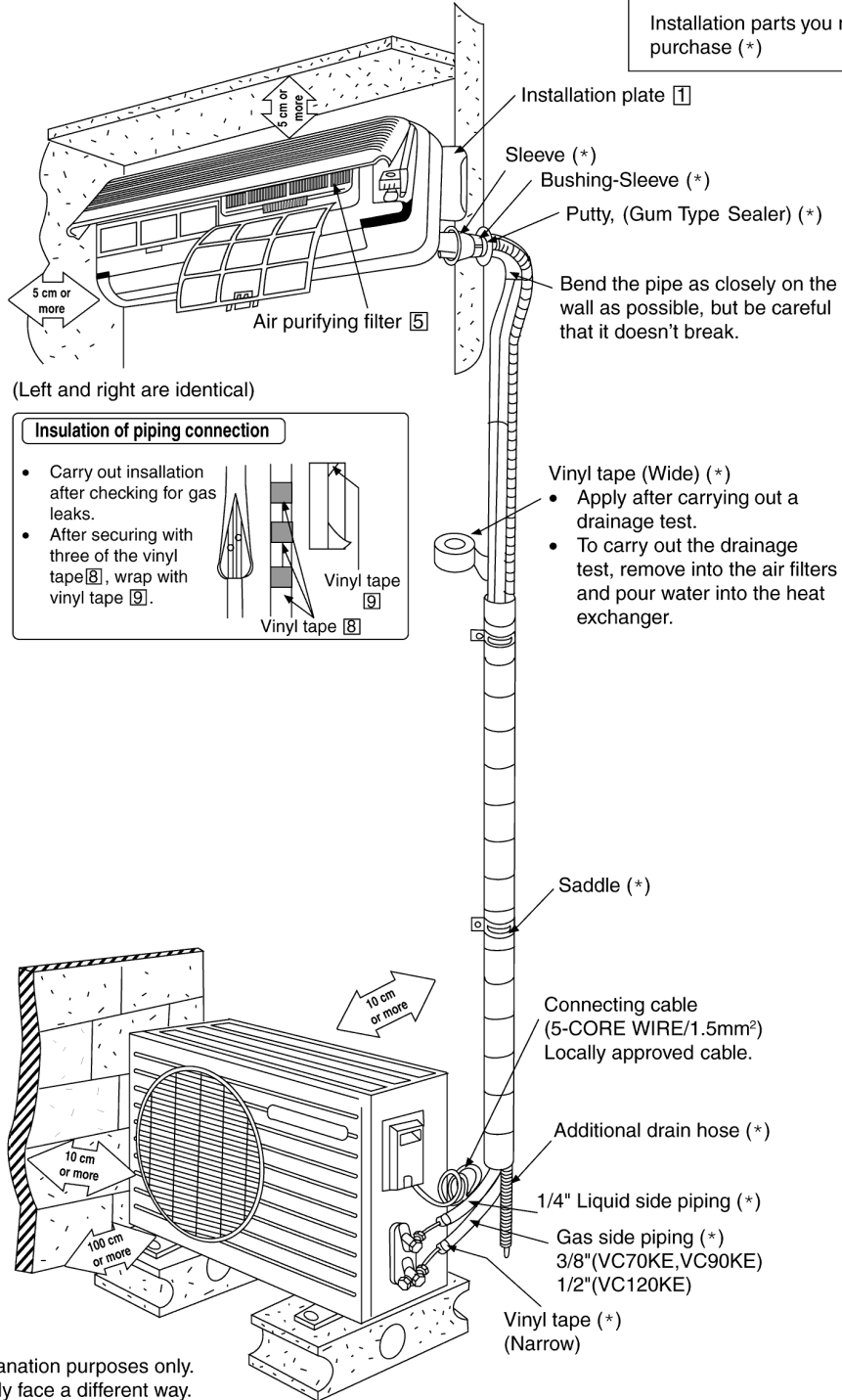
Indoor / Outdoor unit installation diagram



Attention not to bend up drain hose



Installation parts you must purchase (*)



Insulation of piping connection

- Carry out installation after checking for gas leaks.
- After securing with three of the vinyl tape 8, wrap with vinyl tape 9.

- This illustration is for explanation purposes only. The indoor unit will actually face a different way.

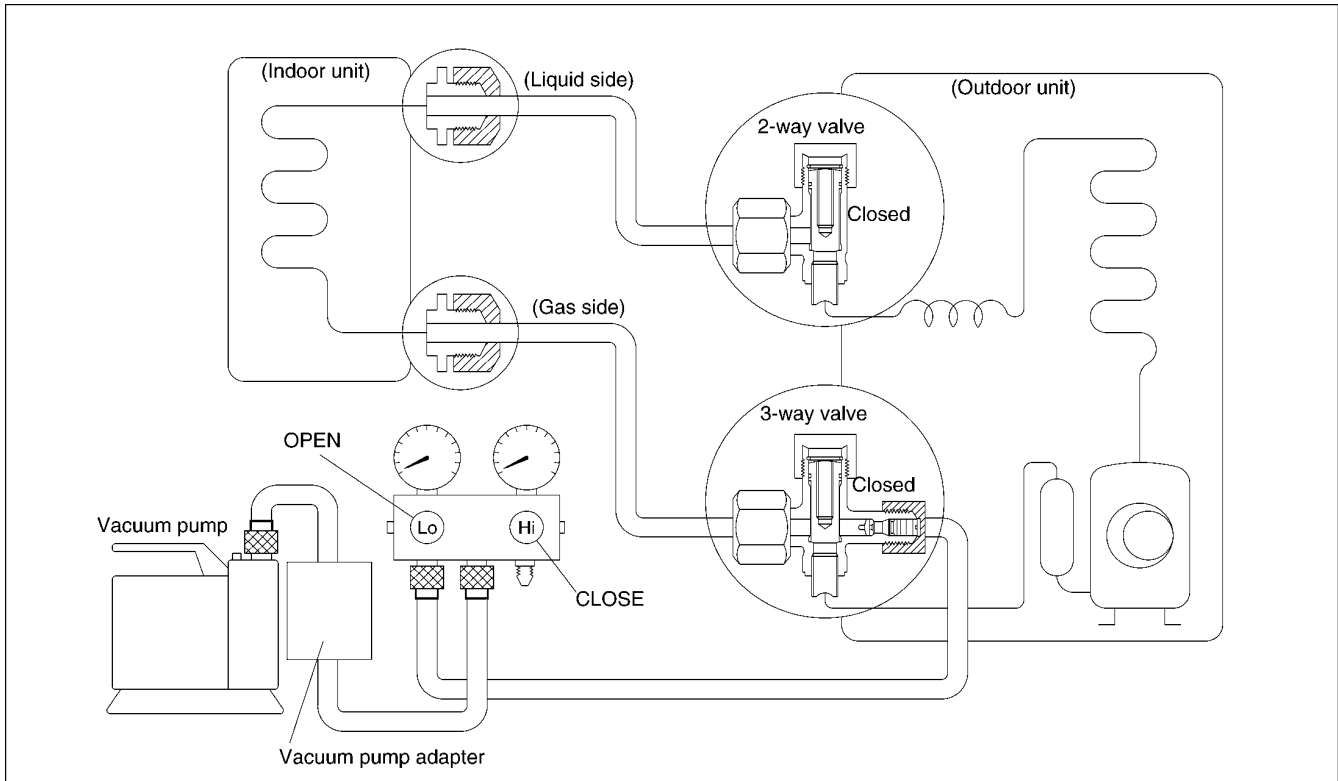
11 2-Way / 3-Way Valves

	2-way Valve (Liquid Side)	3-way Valve (Gas Side)	
Works	Shaft Position	Shaft Position	Service Port
Shipping	Close (With valve cap)	Close (With valve cap)	Close (With cap)
Evacuation (Installation and Re-installation)	Closed (Counter-clockwise)	Closed (Clockwise)	Open (Push-pin)
Operation	Open (With valve cap)	Open (With valve cap)	Closed (With cap)
Pumping down (Transferring)	Closed (Clockwise)	Open (Counter-clockwise)	Open (Connected manifold gauge)
Evacuation (Servicing)	Open	Open	Open With vacuum pump
Gas charging (Servicing)	Open	Open	Open (With charging cylinder)
Pressure check (Servicing)	Open	Open	Open (Connected manifold gauge)
Gas releasing (Servicing)	Open	Open	Open (Connected manifold gauge)

11.1. EVACUATION OF INSTALLATION

WHEN INSTALLING AN AIR CONDITIONER, BE SURE TO EVACUATE THE AIR INSIDE THE INDOOR UNIT AND PIPES in the following procedure.

If air remains in the indoor unit and refrigeration pipes, it will affect the compressor, reduce the cooling capacity, and could lead to a malfunction.



Procedure:

1. Connect a charging hose with a push pin to the Low side of a charging set and the service port of a 3-way valve.
 - Be sure to connect the end of the charging hose with the push pin to the service port.
2. Connect the centre hose of the charging set to a vacuum pump adapter and a vacuum pump.
3. Turn on the power switch of the vacuum pump and make sure that the needle in the gauge moves from 0 MPa (0 cmHg) to -0.1 MPa (-76 cmHg). Then evacuate the air for approximately ten minutes.
4. Close the Low side valve of the charging set and turn off the vacuum pump. Make sure that the needle in the gauge does not move for approximately five minutes. **BE SURE TO TAKE THIS PROCEDURE IN ORDER TO AVOID GAS LEAKAGE.**
5. Disconnect the charging hose from the vacuum pump and from the service port of the 3-way valve.
6. Tighten the service port cap at a torque of 18N · m with a torque wrench.
7. Remove the valve caps of the 2-way valve and the 3-way valve. Position both of the valves to with a torque wrench. "open" using a hexagonal wrench (4 mm).
8. Mount the valve caps onto the 2-way and 3-way valves.
 - Be sure to check for gas leakage.

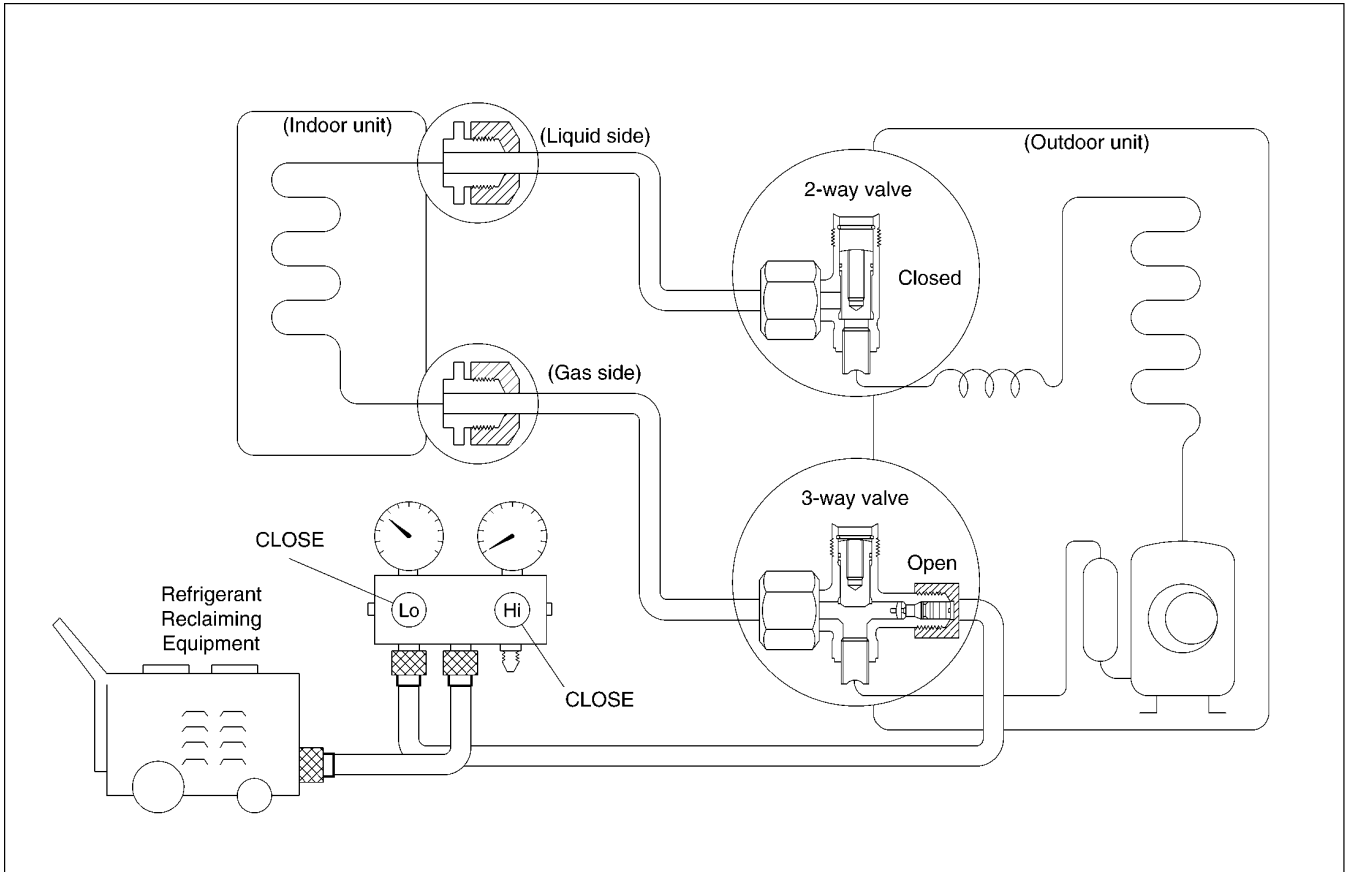
Caution

If gauge needle does not move from 0 cmHg to -76 cmHg in step (3) above, take the following measures:

If the leaks stop when the piping connections are tightened further, continue working from step (3).

If the leaks do not stop when the connections are retightened, repair the location of the leak.

11.2. PUMPING DOWN



Procedure:

1. Confirm that both the 2-way and 3-way valves are set to the opened position.

- Remove the valve stem caps and confirm that the valve stems are in the opened position.
- Be sure to use a hexagonal wrench to operate the valve stems.

2. Operate the unit for 10 to 15 minutes.

3. Stop operation and wait for 3 minutes, then connect the charge set to the service port of the 3-way valve.

- Connect the charge hose with the push pin to the Gas service port.

4. Air purging of the charge hose.

- Open the low-pressure valve on the charge set slightly to purge air from the charge hose.

5. Set the 2-way valve to the closed position.

6. Operate the air conditioner at the cooling cycle and stop it when the gauge indicates 0 MPa (0 kg/cm² G).

If the unit cannot be operated at the cooling condition (weather is rather cool), press the TEST RUN button so that the unit can be operated.

7. Immediately set the 3-way valve to the closed position.

- Do this quickly so that the gauge ends up indicating 0.1 MPa (1 kg/cm² G) to 0.3 MPa (3 kg/cm² G)

8. Use refrigerant reclaiming equipment to collect refrigerant from indoor unit and pipes.

9. Disconnect the charge set, and mount the 2-way and 3-way valves stem caps and the service port caps.

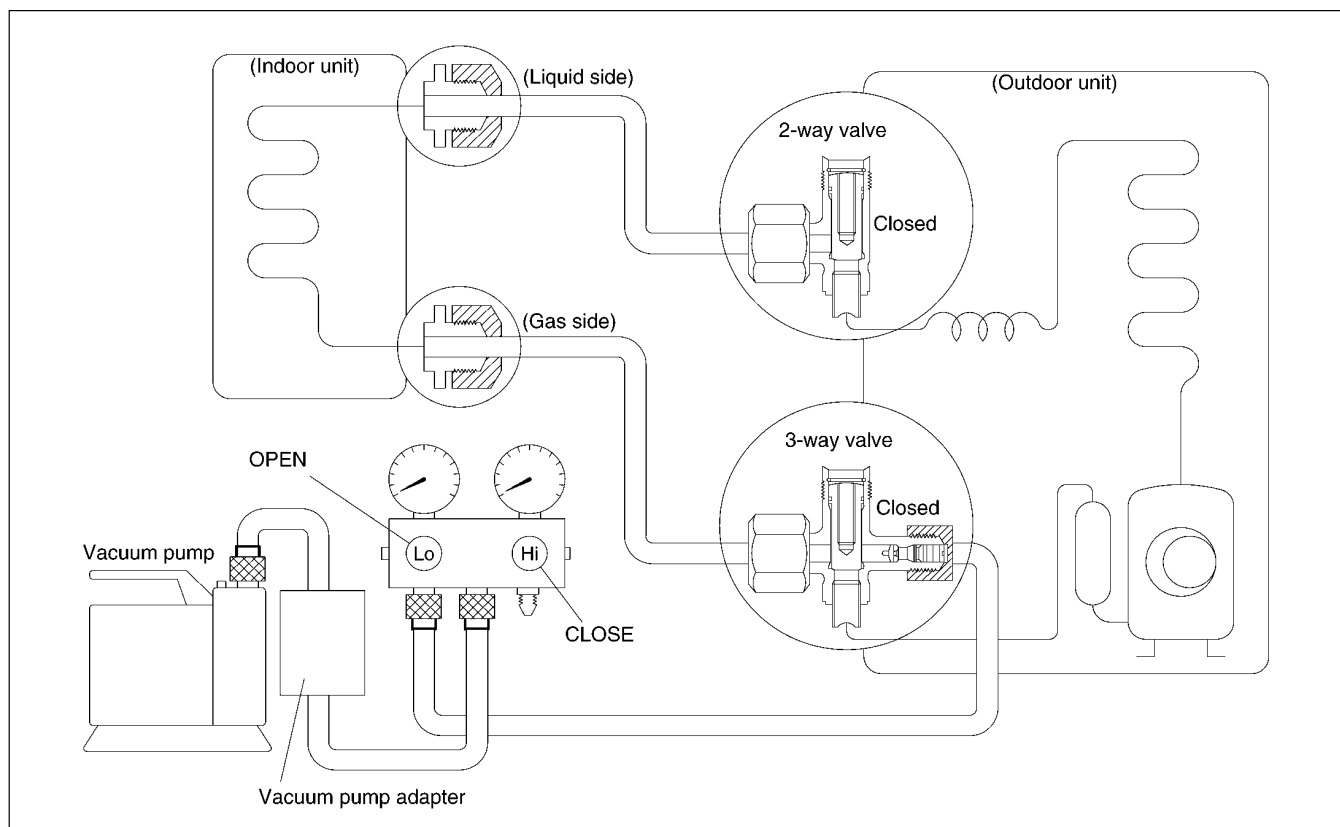
- Use a torque wrench to tighten the service port cap to a torque of 18 N·m
- Be sure to check for gas leakage.

10. Disconnect pipes from indoor unit and out-door unit.

11.3. EVACUATION OF RE-INSTALLATION

WHEN RE-INSTALLING AN AIR CONDITIONER, BE SURE TO EVACUATE THE AIR INSIDE THE INDOOR UNIT AND PIPES in the following procedure.

If air remains in the indoor unit and refrigeration pipes, it will affect the compressor, reduce the cooling capacity, and could lead to a malfunction.



Procedure:

1. Connect a charging hose with a push pin to the Low side of a charging set and the service port of the 3-way valve.

- Be sure to connect the end of the charging hose with the push pin to the service port.

2. Connect the center hose of the charging set to a vacuum pump adapter and a vacuum pump.

3. Turn on the power switch of the vacuum pump and make sure that the needle in the gauge moves from 0 MPa (0 cmHg) to -0.1 MPa (-76 cmHg). Then evacuate the air for approximately ten minutes.

4. Close the Low side valve of the charging set and turn off the vacuum pump. Make sure that the needle in the gauge does not move for approximately five minutes.

BE SURE TO TAKE THIS PROCEDURE IN ORDER TO AVOID GAS LEAKAGE.

5. Disconnect the charging hose from the vacuum pump.

6. Charge the pipes and indoor unit with gas refrigerant from 3-way valve service port, and then discharge the refrigerant until low side (gas side) gauge needle indicates 0.3 MPa (3 kg/cm²).

7. Tighten the service port cap at a torque of 18 N·m with a torque wrench.

8. Remove the valve caps of the 2-way valve and the 3-way valve. Position both of the valves to "open" using a hexagonal wrench (4 mm).

9. Mount valve caps onto the 2-way and 3-way valves.

- BE SURE TO USE REFRIGERANT RECLAIMING EQUIPMENT WHILE DISCHARGING THE REFRIGERANT.

- Purge the air from charge set's centre hose.

- Be sure to check for gas leakage.

Caution

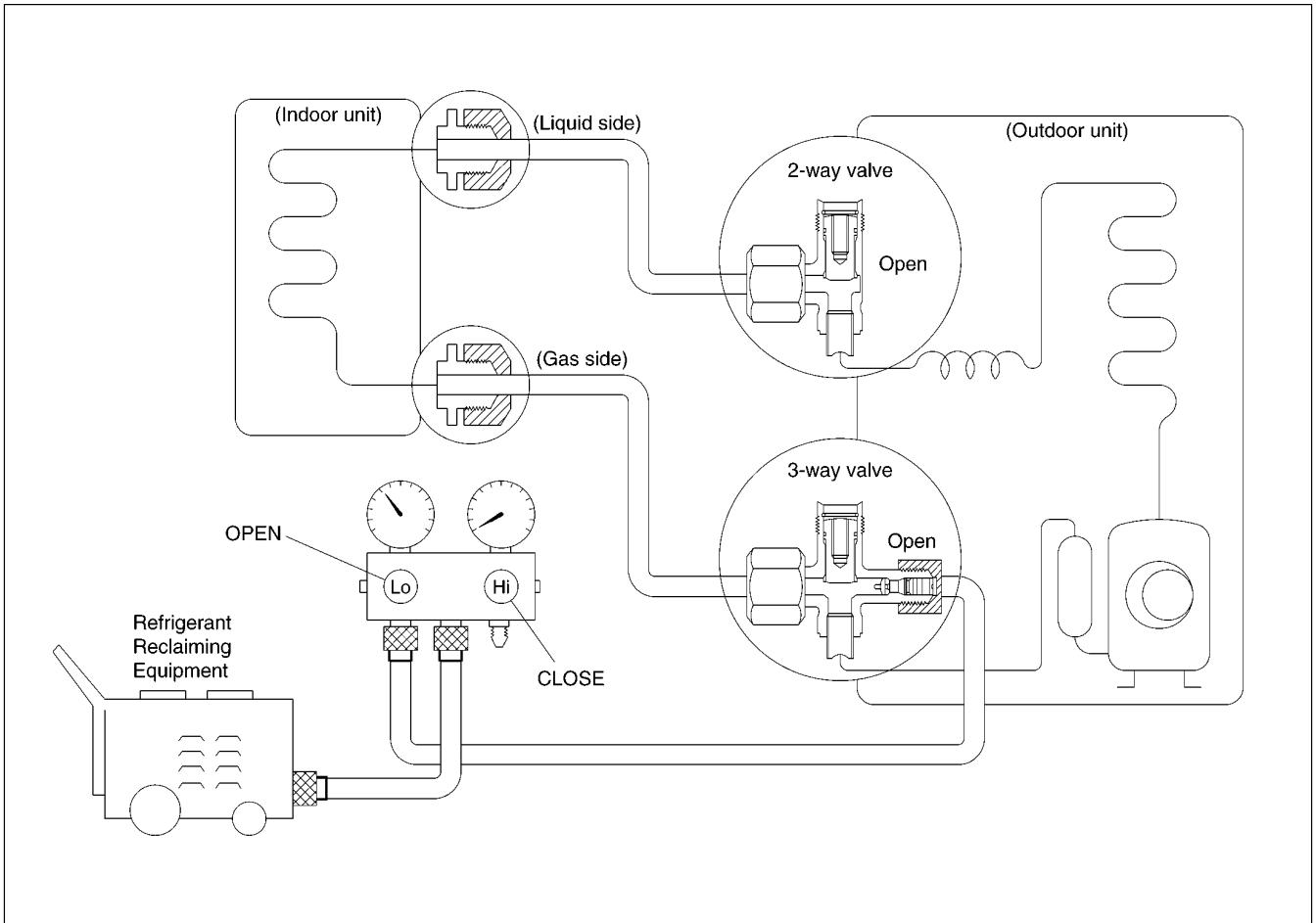
If gauge needle does not move from 0 MPa (0 cmHg) to -0.1 MPa (-76 cmHg) in step (3) above, take the following measures:

If the leaks stop when the piping connections are tightened further, continue working from step (3).

If the leaks do not stop when the connections are retightened, repair the location of the leak.

11.4. BALANCE REFRIGERANT OF THE 2-WAY, 3-WAY VALVE

(Lack of refrigerant in the refrigeration cycle)

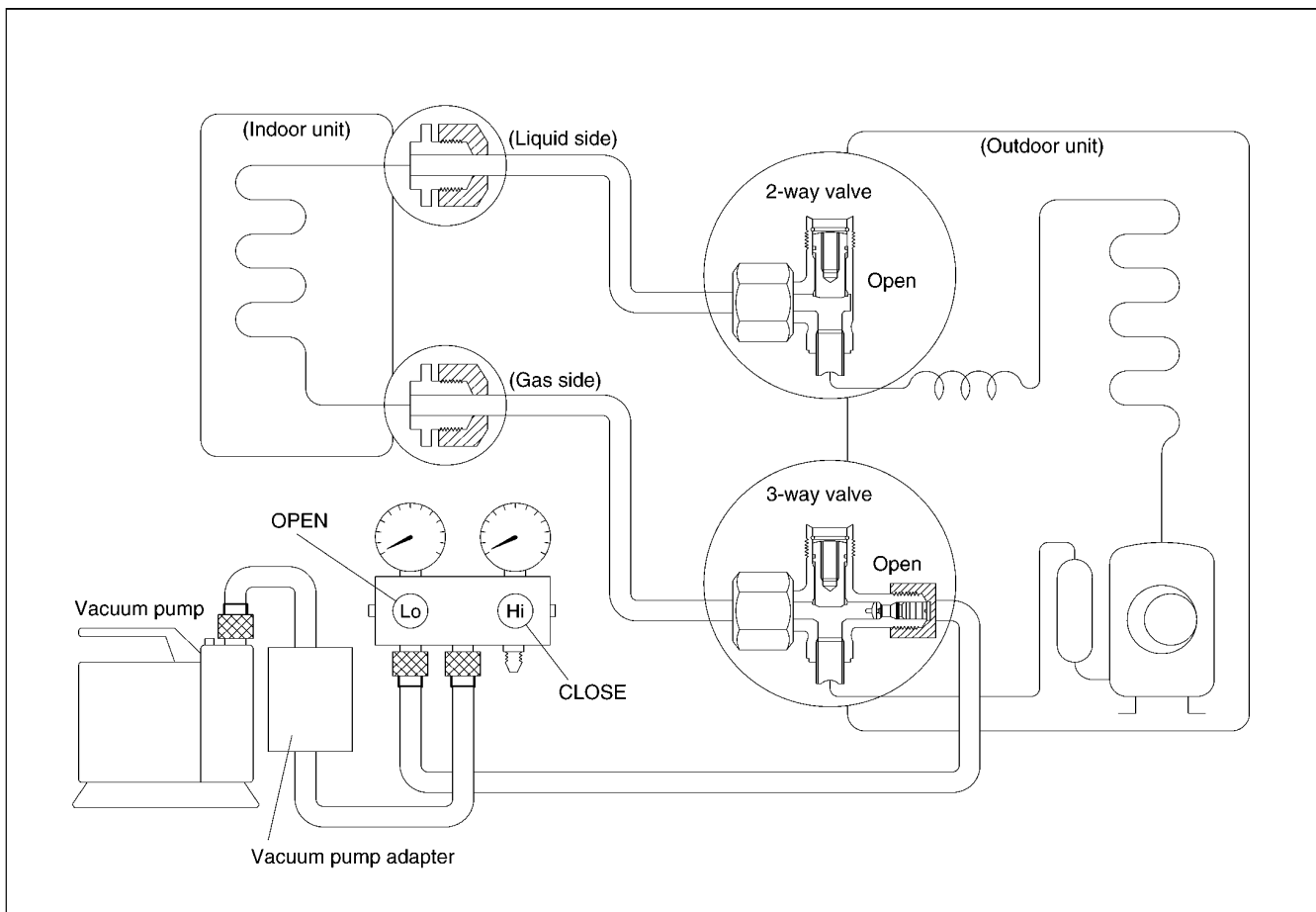


Procedure:

1. Confirm that both the 2-way and 3-way valve are set to the open position.
2. Connect the charge set to the 3-way valve's service port.
 - Leave the valve on the charge set closed.
 - Connect the charge hose with the push-pin to the service port.
3. Connect the charge set's centre hose to refrigerant reclaiming equipment.
 - Purge the air from charge hose.
4. Open the valve (Low side) on the charge set and discharge the refrigerant until the gauge indicates 0.05 MPa (0.5 kg/cm² G) to 0.1 MPa (1 kg/cm² G).
 - If there is no air in the refrigeration cycle (the pressure when the air conditioner is not running is higher than 0.1 MPa (1 kg/cm² G), discharge the refrigerant until the gauge indicates 0.05 MPa (0.5 kg/cm² G) to 0.1 MPa (1 kg/cm² G). If this is the case, it will not be necessary to apply an evacuation.
 - Discharge the refrigerant gradually; if it is discharged too suddenly, the refrigeration oil will also be discharged.
5. Turn on refrigerant reclaiming equipment.

11.5. EVACUATION

(No refrigerant in the refrigeration cycle)



Procedure:

1. **Connect the vacuum pump adapter and vacuum pump to the charge set's centre hose.**
2. **Evacuation for approximately one hour.**
 - Confirm that the gauge needle has moved toward -0.1 MPa (-76 cmHg) [vacuum of 4 mmHg or less.]
3. **Close the valve (Low side) on the charge set, turn off the vacuum pump, and confirm that the gauge needle does not move (for approximately 5 minutes after turning off the vacuum pump).**
4. **Disconnect the charge hose from the vacuum pump.**
 - Vacuum pump oil

If the vacuum pump oil becomes dirty or depleted, replenish as needed.

12 Servicing Information

12.1. INSPECTION POINTS FOR THE INDOOR ELECTRONIC CONTROLLER

1. The Electronic Controller, a Signal Receiver and an Indicator can be seen by removing the Front Grille and Control Board Cover, as shown in the Fig 1.

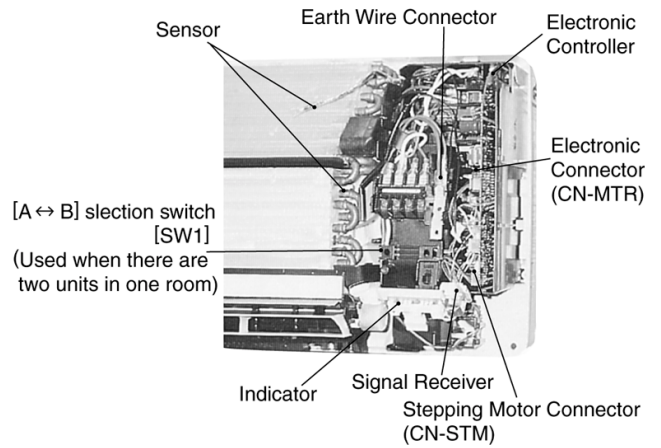


Fig. 1

12.2. INDOOR FAN MOTOR REMOVAL PROCEDURE

1. Remove the connector CN-MTR (GREEN) of Fan Motor and connector CN-STM (GREEN) of stepping motor from the electronic controller. Release the earth wire (YELLOW-GREEN) from the control board and sensors from its holders. (Refer Fig. 1)
2. Remove the Control Board
The Control Board can be removed by releasing the top, left and right tabs shown in Fig. 2, 3, 4.

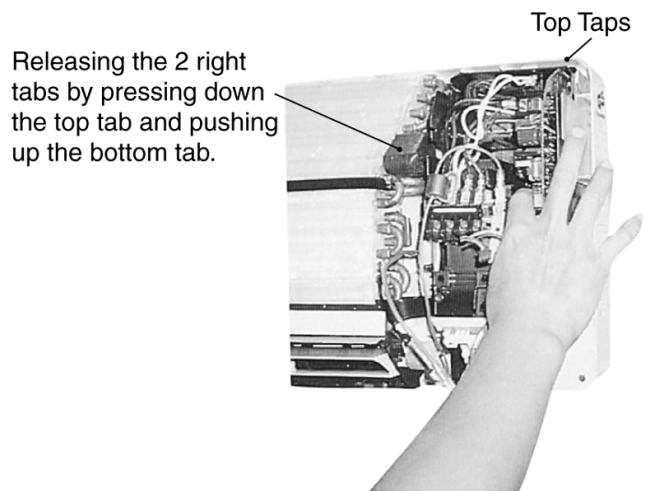


Fig. 2

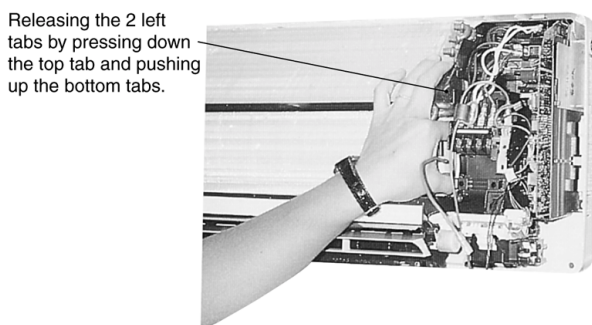


Fig. 3



Fig. 4

3. Remove the Fan Motor
Loosen the Fan Motor securing screw at the junction with Cross Flow Fan. (Fig. 5)

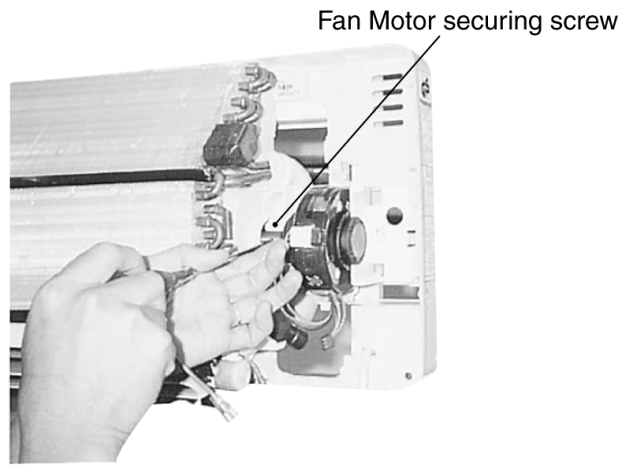


Fig. 5

Remove the particular piece and the Fan Motor can be taken off as shown in Fig. 6 and 7.

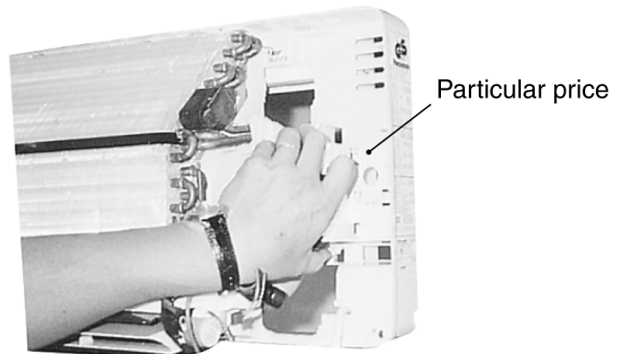


Fig. 6



Remove the Indoor Fan Motor

Fig. 7

- To fix the Indoor Fan Motor, ensure that the Fan Motor securing screw is positioned at the rear side and the Fan Motor lead wire is positioned parallelly with the Fan Motor. (Fig 8.)

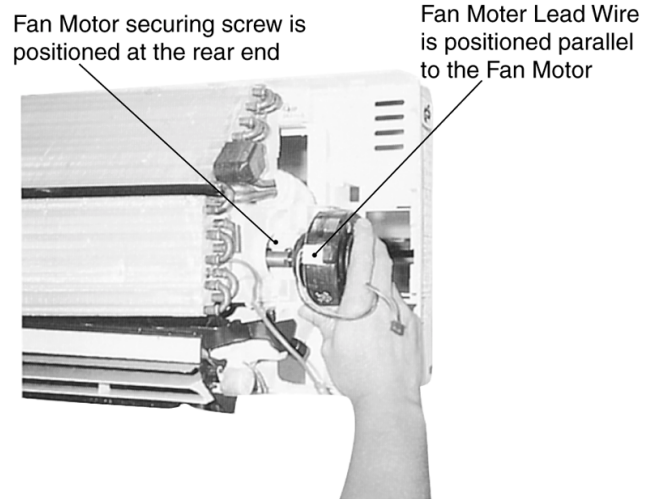


Fig. 8

12.3. CROSS FLOW FAN REMOVAL PROCEDURE

- Remove the Indoor Fan Motor.
(Refer to the removal procedure of the Indoor Fan Motor.)

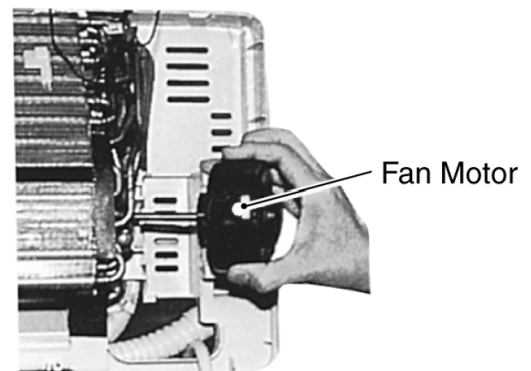


Fig. 9

- Remove the Air Discharge Grille by taking off the screws that hold the Air Discharge Grille and then pull the Air Discharge Grille in a down and forward direction.
- Pull off the Bearing at the left of the Cross Flow Fan. (Fig. 10)



Fig. 10

4. Take off the mounting tab at the left of the Heat Exchanger, pull the Heat Exchanger forward (left side) and remove the Cross Flow Fan. (Fig 11.)

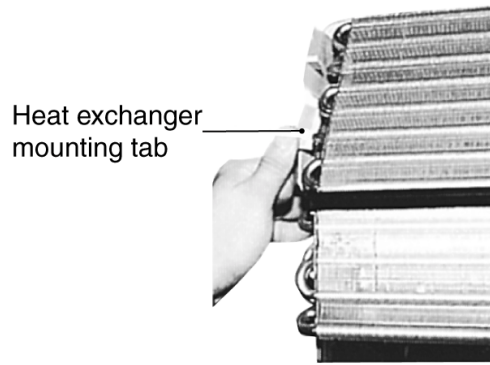


Fig. 11

12.4. OUTDOOR UNIT SERVICING

Outdoor Unit can be serviced by just removing the outdoor chassis front cover as shown in the Fig 12.

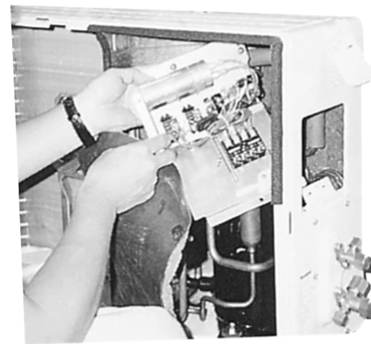
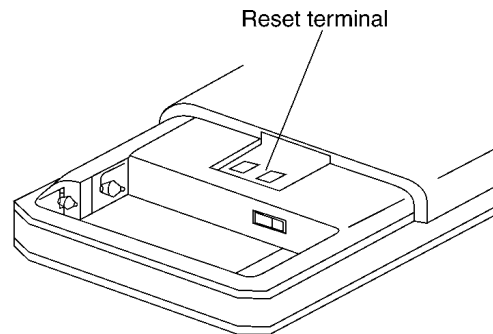


Fig. 12

12.5. REMOTE CONTROL RESET

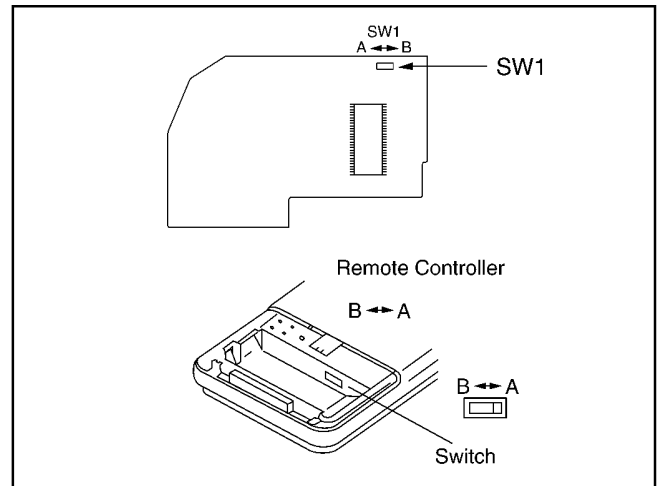
When the batteries are inserted for the first time, or the batteries are replaced, all the indications will blink and the remote control might not work.

If this happens, remove the back cover of the remote control and you will find a resetting terminal, and by shorting it with a minus screwdriver, it will return to normal.



12.6. CHANGING THE WIRELESS REMOTE CONTROL TRANSMISSION CODE

When two indoor units are installed in the same room, in order to prevent operating errors caused by using two remote controls, set up the remote control [B ↔ A] switch (SW1). The unit is set to A when it is shipped.



- By adding a jumper wire to the remote control side and a carbon resistor (1/4 W, 10 kΩ) to the indoor printed circuit board, it is possible to select from 4 types of transmission codes including the condition at time of delivery (1) condition.

	Remote control		Indoor printed circuit board		Note
	Switch SW B ↔ A	J - B	Switch SW1	RX	
1	A	-	A	-	At product delivery
2	B	-	B	-	
3	A	Jumper wire	A	10k Ω	
4	B	Jumper wire	B	10k Ω	

13 Troubleshooting Guide

Refrigeration cycle system

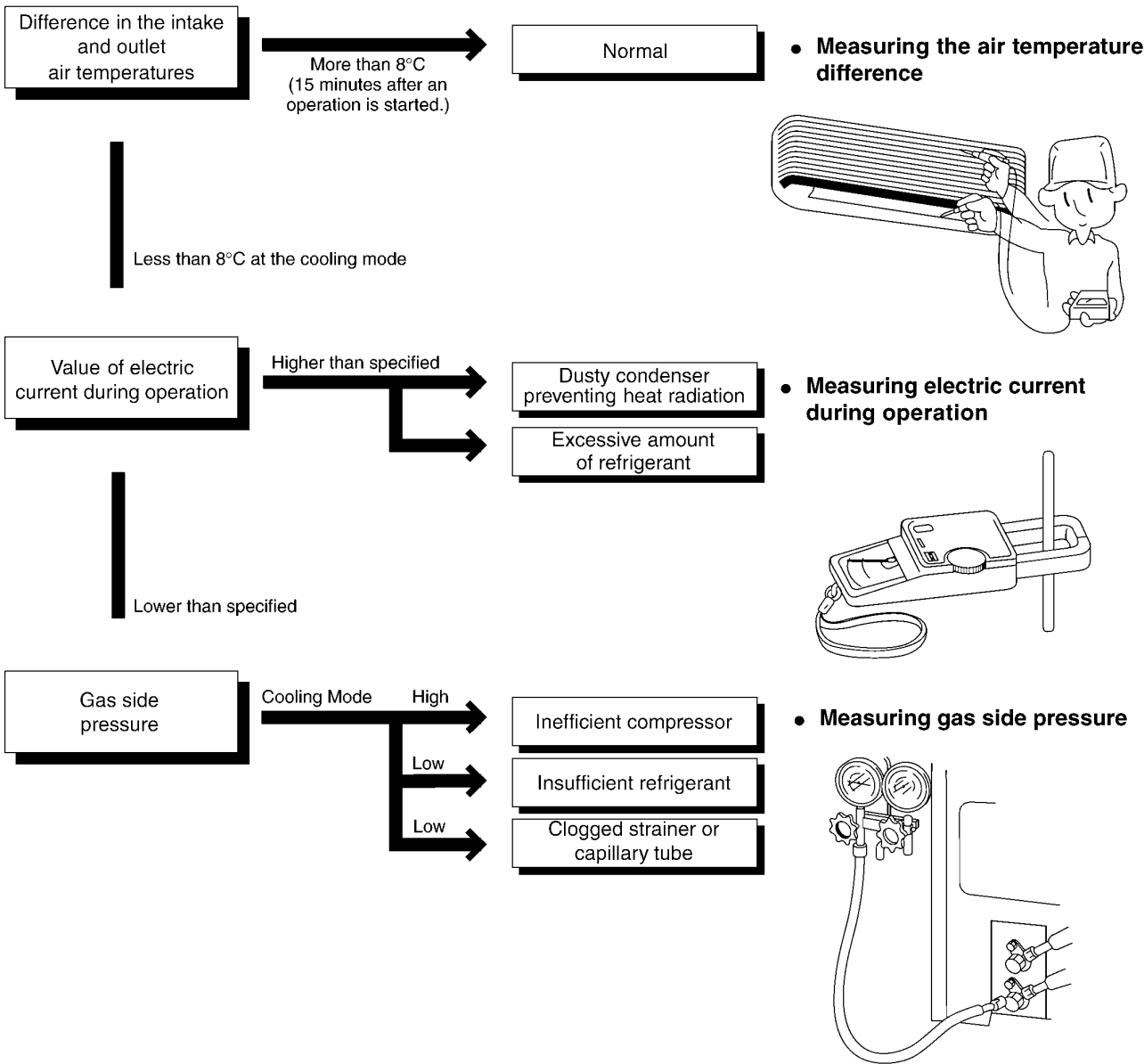
In order to diagnose malfunctions, make sure that there are no electrical problems before inspecting the refrigeration cycle. Such problems include insufficient insulation, problem with the power source, malfunction of a compressor and a fan.

The normal outlet air temperature and pressure of the refrigeration cycle depends on various conditions. The standard values for them are shown in the table to the right.

Normal Pressure and Outlet Air Temperature (Standard)

	Gas pressure MPa (kg/cm ² G)	Outlet air temperature (°C)
Cooling mode	0.9 ~ 1.2 (9 ~ 12)	12 ~ 16

★ Condition: Indoor fan speed; High
Outdoor temperature 35°C



13.1. RELATIONSHIP BETWEEN THE CONDITION OF THE AIR CONDITIONER AND GAS PRESSURE AND ELECTRIC CURRENT

Condition of the air conditioner	Cooling Mode		
	Low Pressure	High Pressure	Electric current during operation
Insufficient refrigerant (gas leakage)	↘	↘	↘
Clogged capillary tube or Strainer	↘	↘	↘
Short circuit in the indoor unit	↘	↘	↘
Heat radiation deficiency of the outdoor unit	↗	↗	↗
Inefficient compression	↗	↘	↘

- Carry out the measurements of gas pressure, electric current, and temperature fifteen minutes after an operation is started.

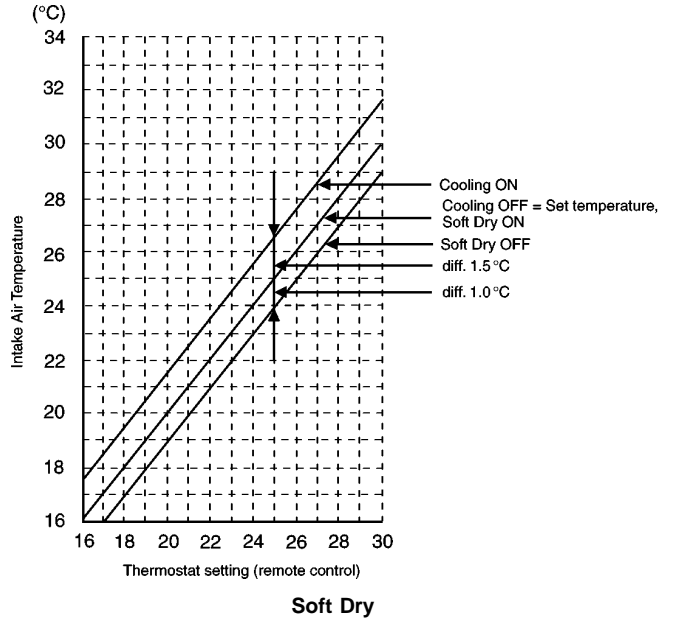
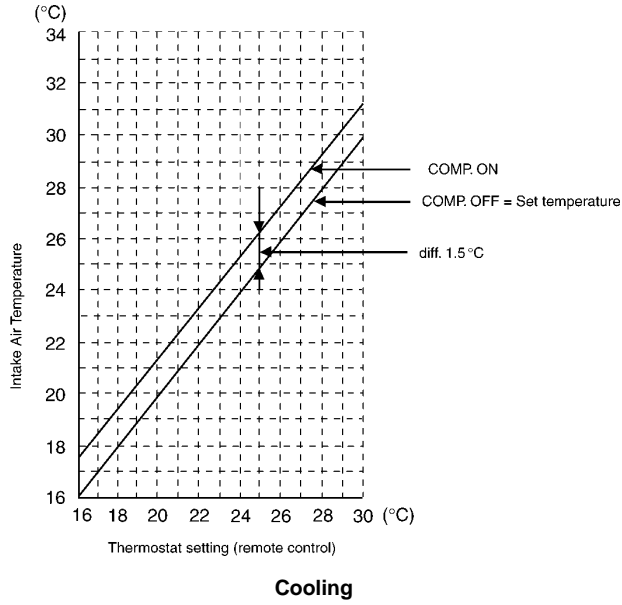
13.2. DIAGNOSIS METHODS OF A MALFUNCTION OF A COMPRESSOR

Nature of fault	Symptom
Insufficient compressing of a compressor	<ul style="list-style-type: none"> • Electric current during operation becomes approximately 20% lower than the normal value. • The discharge tube of the compressor becomes abnormally hot (normally 70 to 90 °C). • The difference between high pressure and low pressure becomes almost zero.
Locked compressor	<ul style="list-style-type: none"> • Electric current reaches a high level abnormally, and the value exceeds the limit of an ammeter. In some cases, a breaker turns off. • The compressor is a humming sound.

14 Technical Data

14.1. THERMOSTAT CHARACTERISTICS

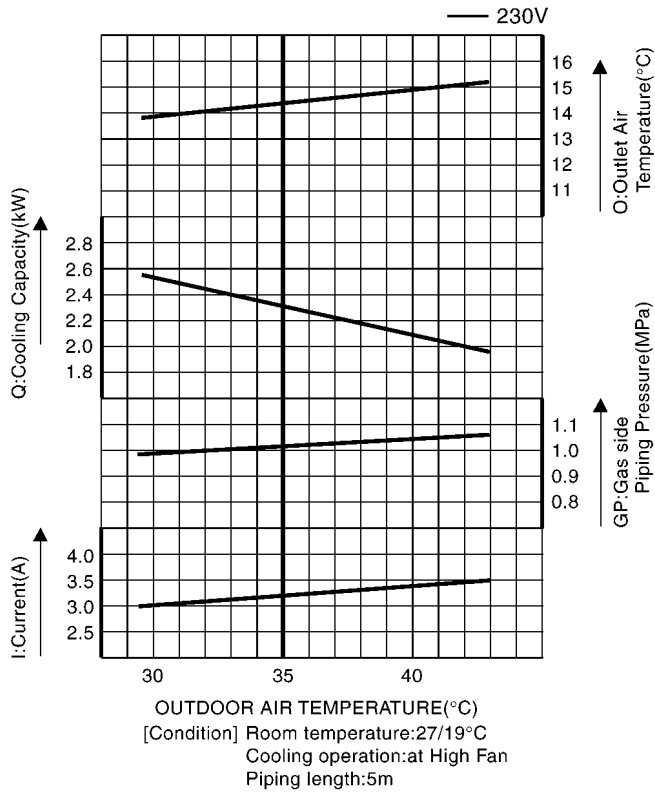
- CS-VC70KE/CU-VC70KE
- CS-VC90KE/CU-VC90KE
- CS-VC120KE/CU-VC120KE



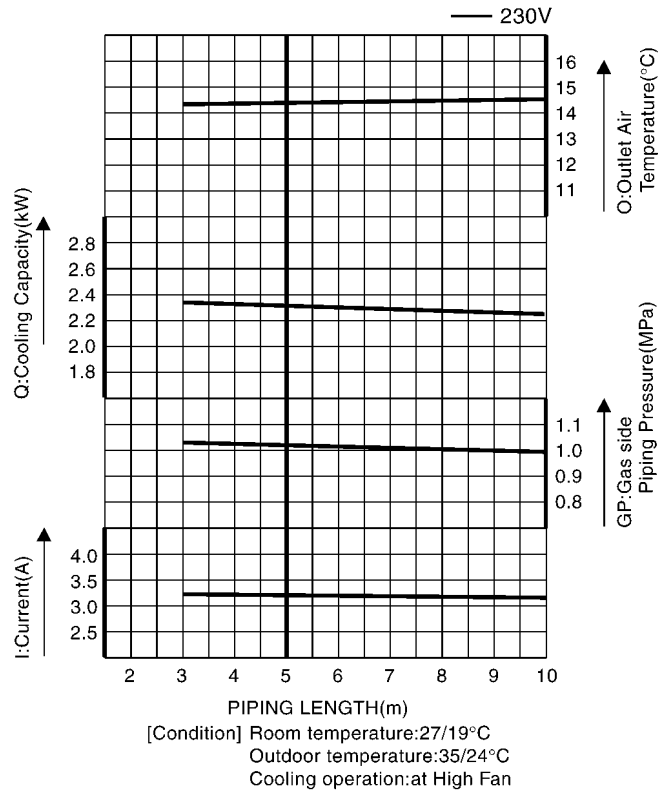
14.2. OPERATION CHARACTERISTICS

CS-VC70KE / CU-VC70KE

• Cooling Characteristic

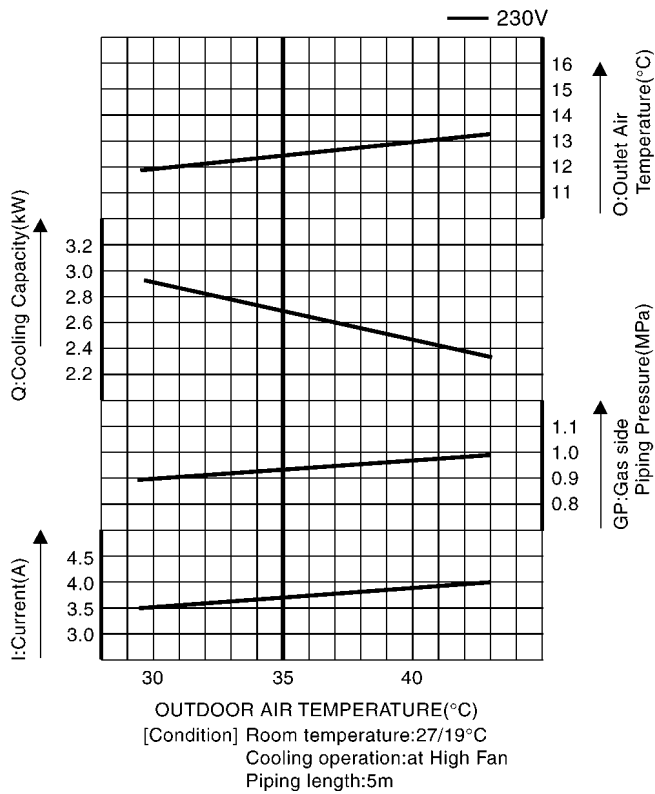


• Piping Length Characteristic

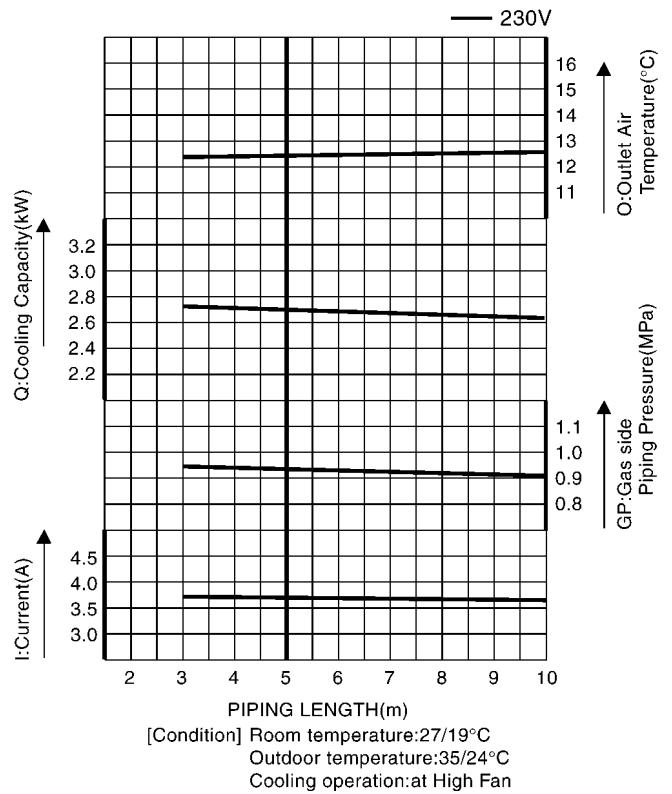


CS-VC90KE / CU-VC90KE

• Cooling Characteristic

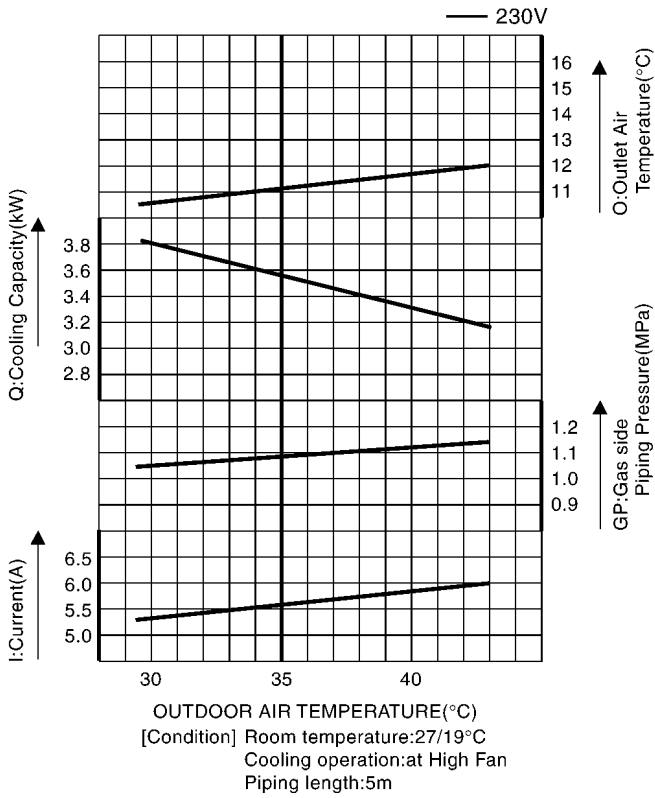


• Piping Length Characteristic

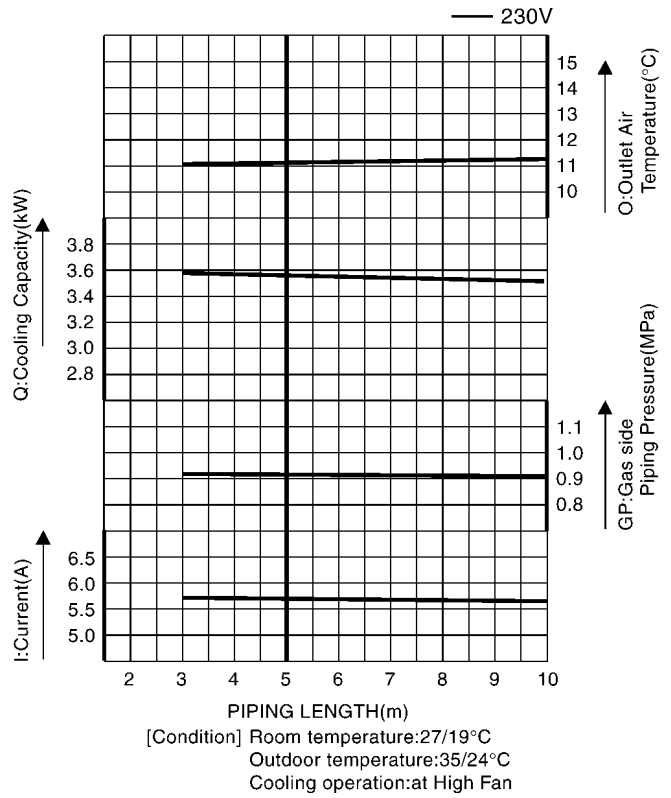


CS-VC120KE / CU-VC120KE

• Cooling Characteristic



• Piping Length Characteristic



15 Electronic Circuit Diagram

15.1. HOW TO USE ELECTRONIC CIRCUIT DIAGRAM

Before the circuit diagram, read the following carefully.

Voltage measurement

voltage has been measured with a digital tester when the indoor fan is set at high fan speed under the following conditions without setting the timer.

Use them for servicing.

Voltage indication is in Red at cooling and all operations.

	Intake air temperature	Temperature setting	Discharge air temperature	Pipe temperature
Cooling	27 °C	16 °C	17 °C	15 °C

Indications for resistance

- a. K k Ω M...MΩ
W...watt Not indicated....1/4 W

- b. type
Not indicated carbon resister
Tolerance ± 5 %
 metal oxide resister
Tolerance ± 1 %

Indications for capacitor

- a. Unit μ ... μF P ... pF
b. Type Not indicated ... ceramic capacitor
(S) S series aluminum electrolytic capacitor
(Z) Z series aluminium electrolytic capacitor
(SU) SU series aluminium electrolytic capacitor
(P) P series polyester system
(SXE)..... SXE series aluminium electrolytic capacitor
(SRA) SRA series aluminium electronic capacitor
(KME) KME series aluminium electrolytic capacitor

Diode without indication MA165

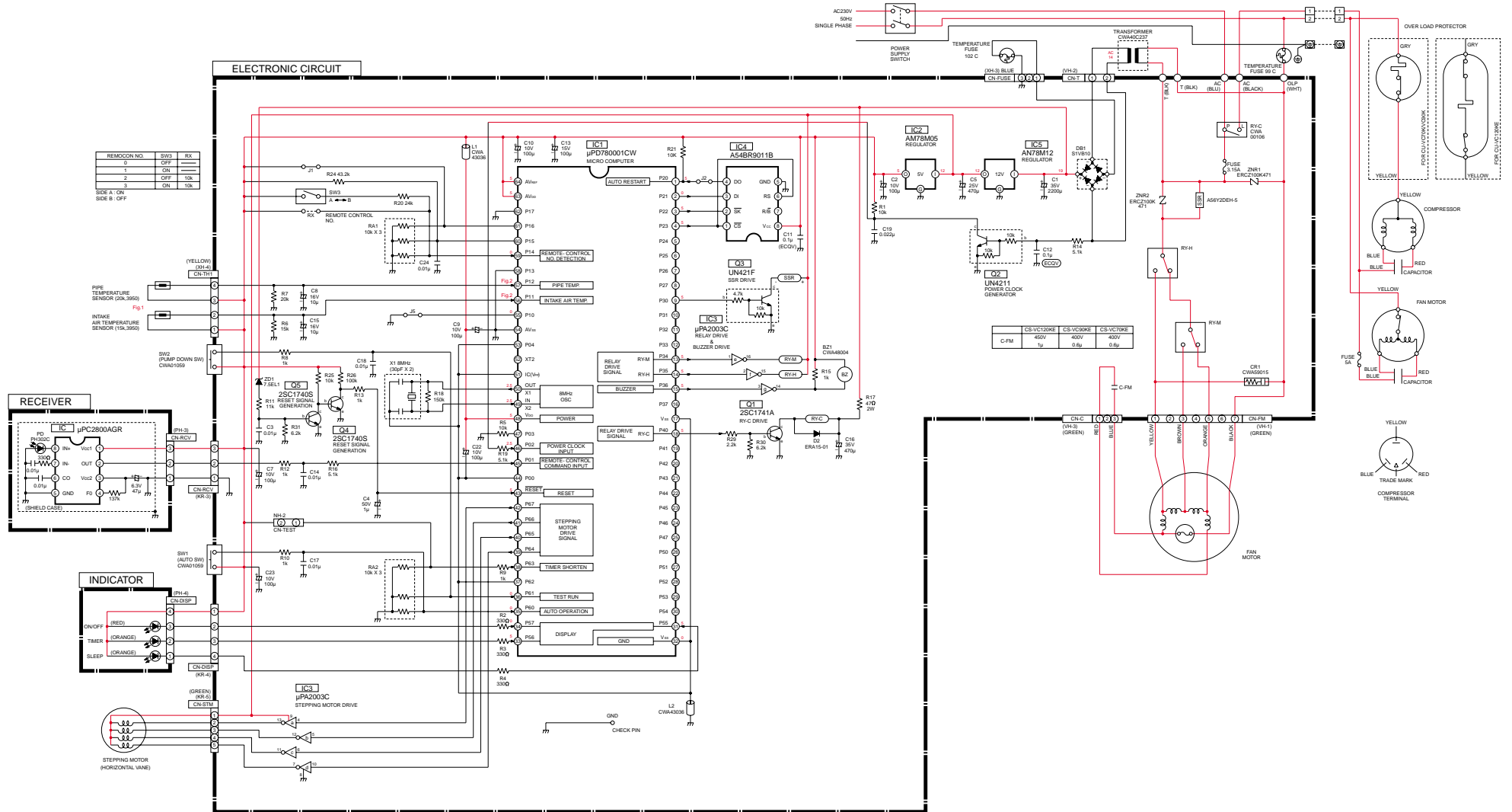
※ Circuit Diagram is subject to change without notice for further development.

15.2. TIMER TABLE

Name		Time	Test Mode (When test point Short-circulated)	Remarks
Sleep Mode Waiting		1 hr.	6 sec.	
Sleep Mode Operation		8 hrs.	48 sec.	
Real Timer		1 h.	1 min.	
		10 min.	10 sec.	
		1 min.	1 sec.	
Time Delay Safety Control		2 min. 58 sec.	0 sec.	
Forced Operation		60 sec.	0 sec.	
Time Save Control		7 min.	42 sec.	
Anti-freezing Control		4 min.	0 sec.	
Mode judgement		20 sec.	0 sec.	
Soft Dry Off	Off	6 min.	36 sec.	Soft Dry : 10 min. operation
	On	10 min.	60 sec.	Comp. ON
Deodorizing Control	Cooling	40 sec.	4 sec.	Comp. ON
		70 sec.	7 sec.	Comp. OFF
		20 sec.	2 sec.	Comp. OFF
	Soft Dry	180 sec.	18 sec.	Comp. ON
		40 sec.	4 sec.	Comp. OFF
		360 sec.	36 sec.	Comp. ON 5 min. and above
Comp. Reverse Rotation Detection		5 min.	30 sec.	
		2 min.	0 sec.	
Comp / Fan motor Delay Timer		1.6 min.	0 sec.	
Slo Timer		8 sec.	0.8 sec.	
Intake Air Anti-Freezing Prevention		16 min.	9.6 sec.	
Outdoor Fan Delay Timer		1.6 sec.	0 sec.	

15.3. ELECTRONIC CIRCUIT DIAGRAM

CS-VC70KE / CU-VC70KE
 CS-VC90KE / CU-VC90KE
 CS-VC120KE / CU-VC120KE



CHARACTERISTICS CHART

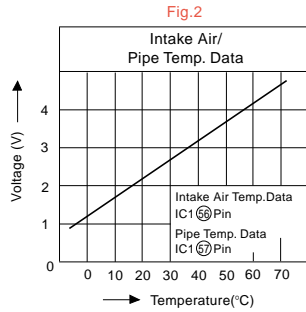
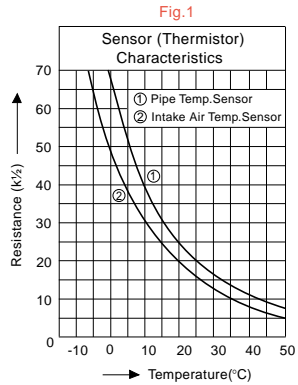
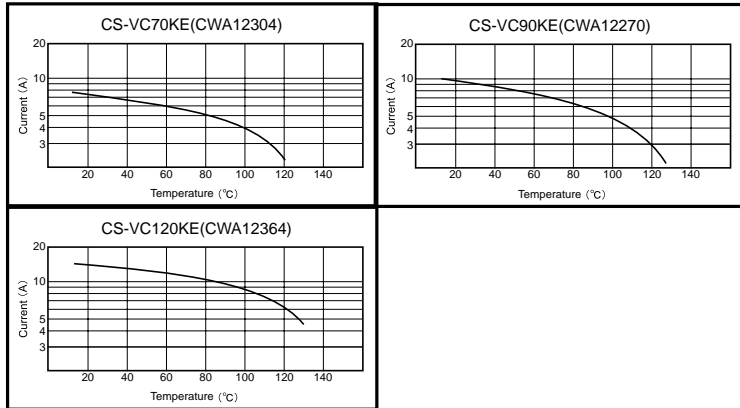
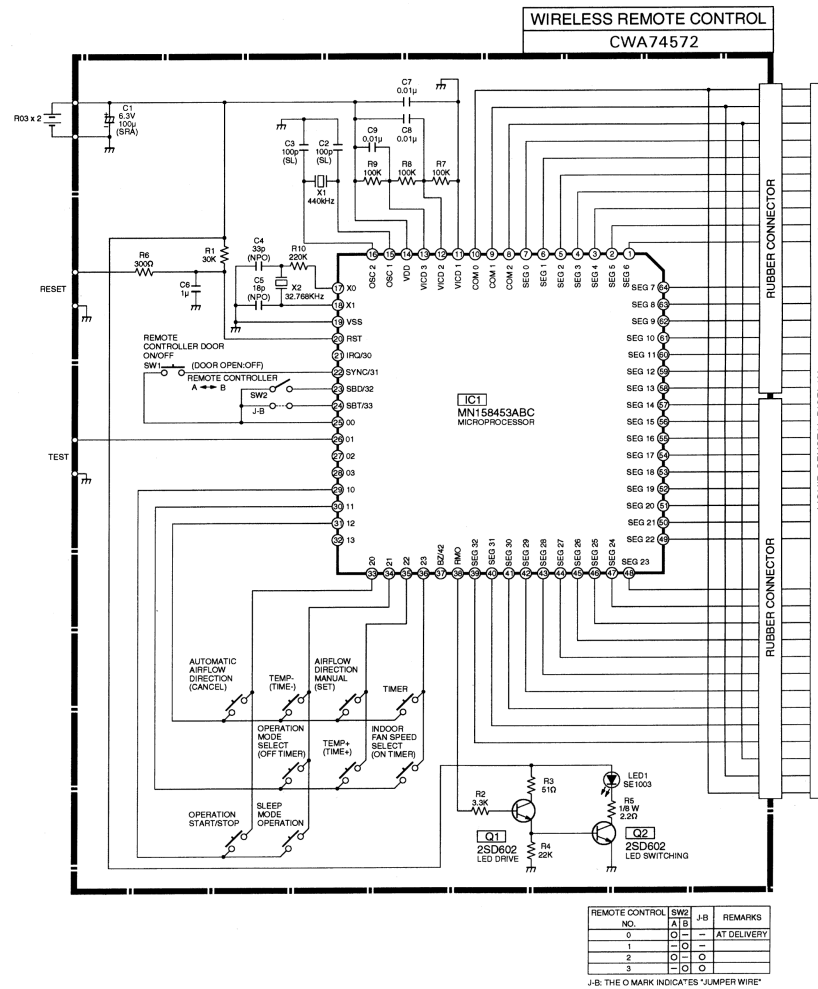


Fig.5 OLP Characteristics (Compressor)

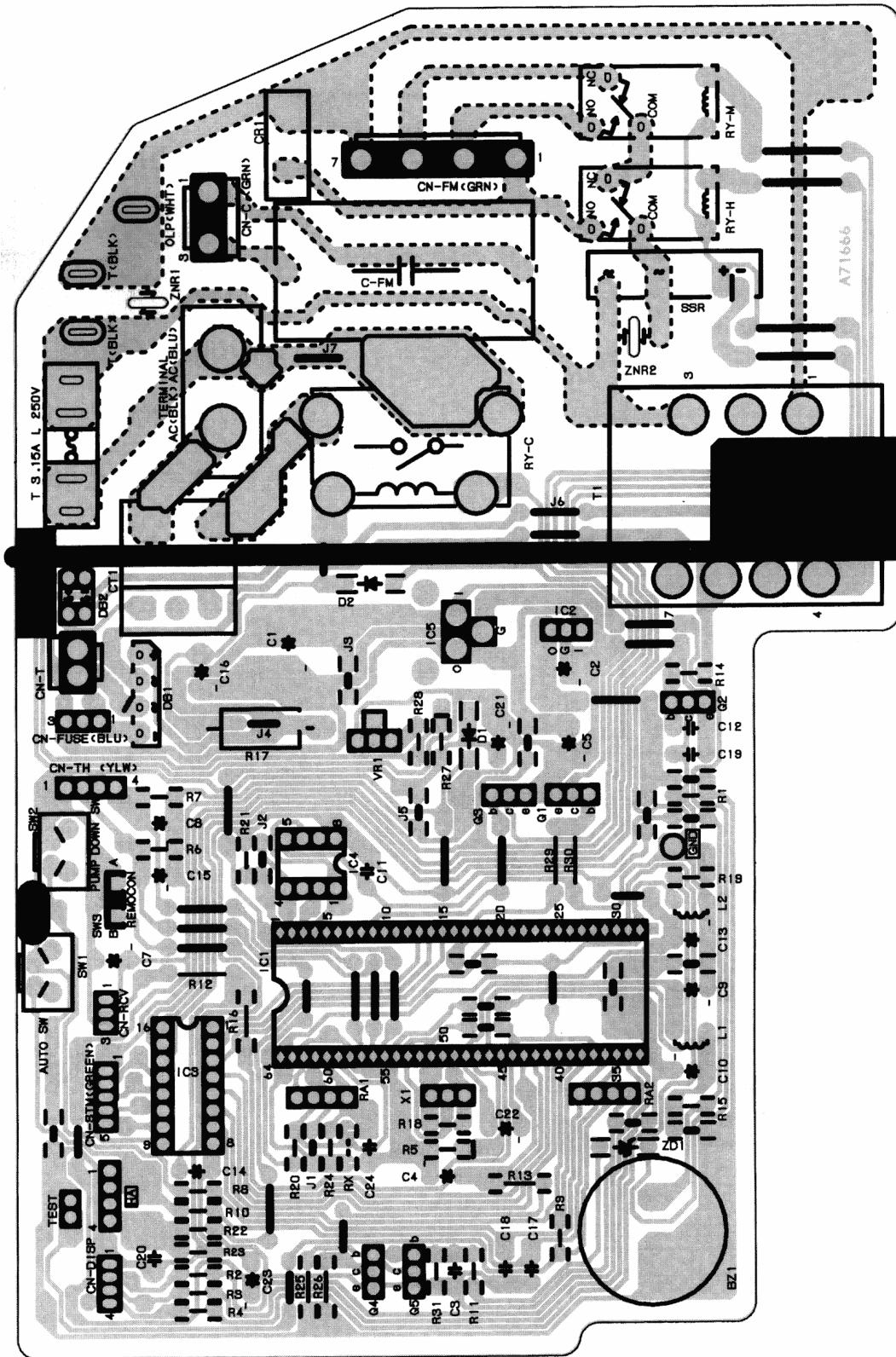


REMOTE CONTROLLER



16 Printed Circuit Board

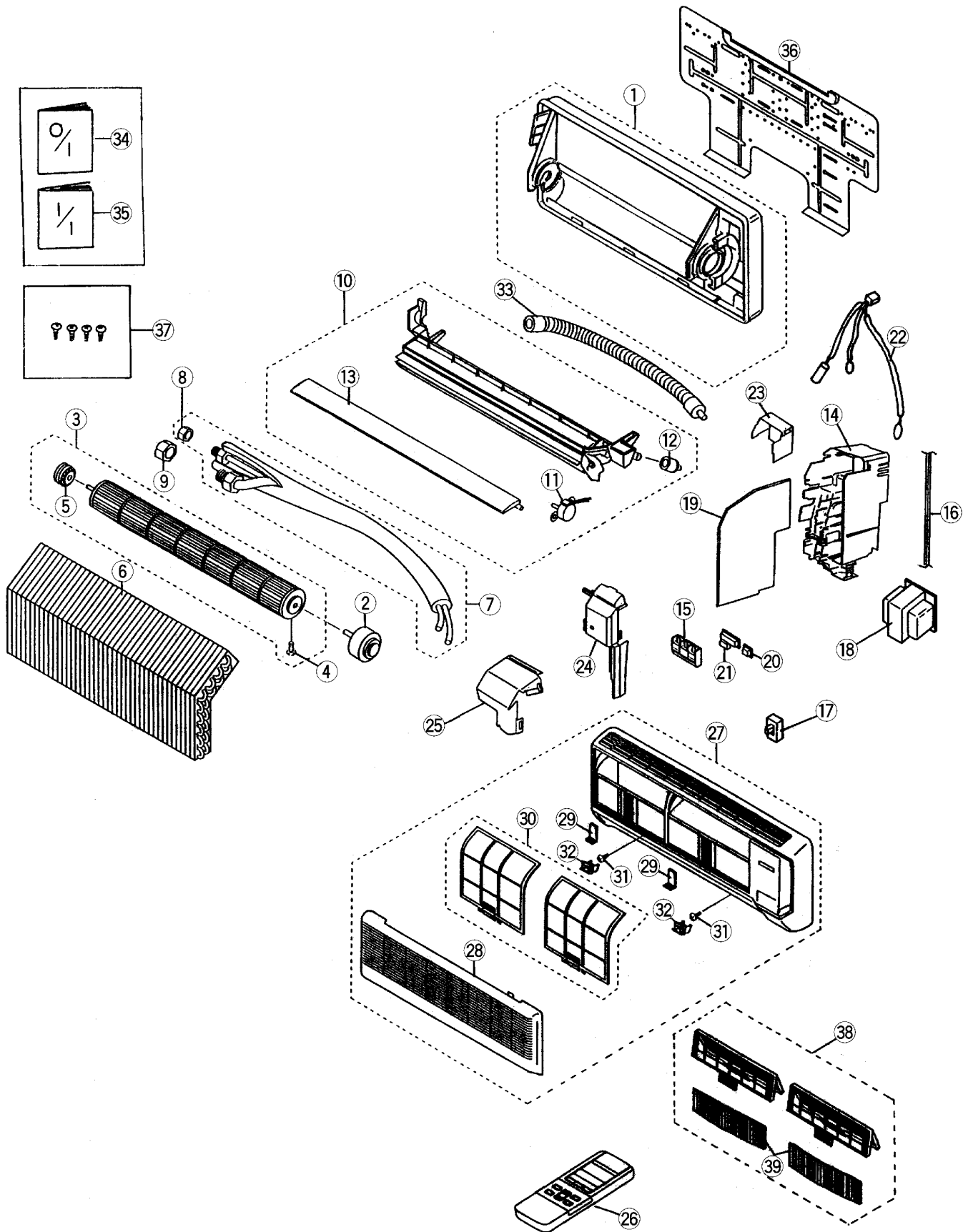
16.1. INDOOR UNIT (MAIN)



17 Exploded View & Replacement Parts List

17.1. CS-VC70KE / CS-VC90KE

17.1.1. Exploded View



17.1.2. Replacement Parts List

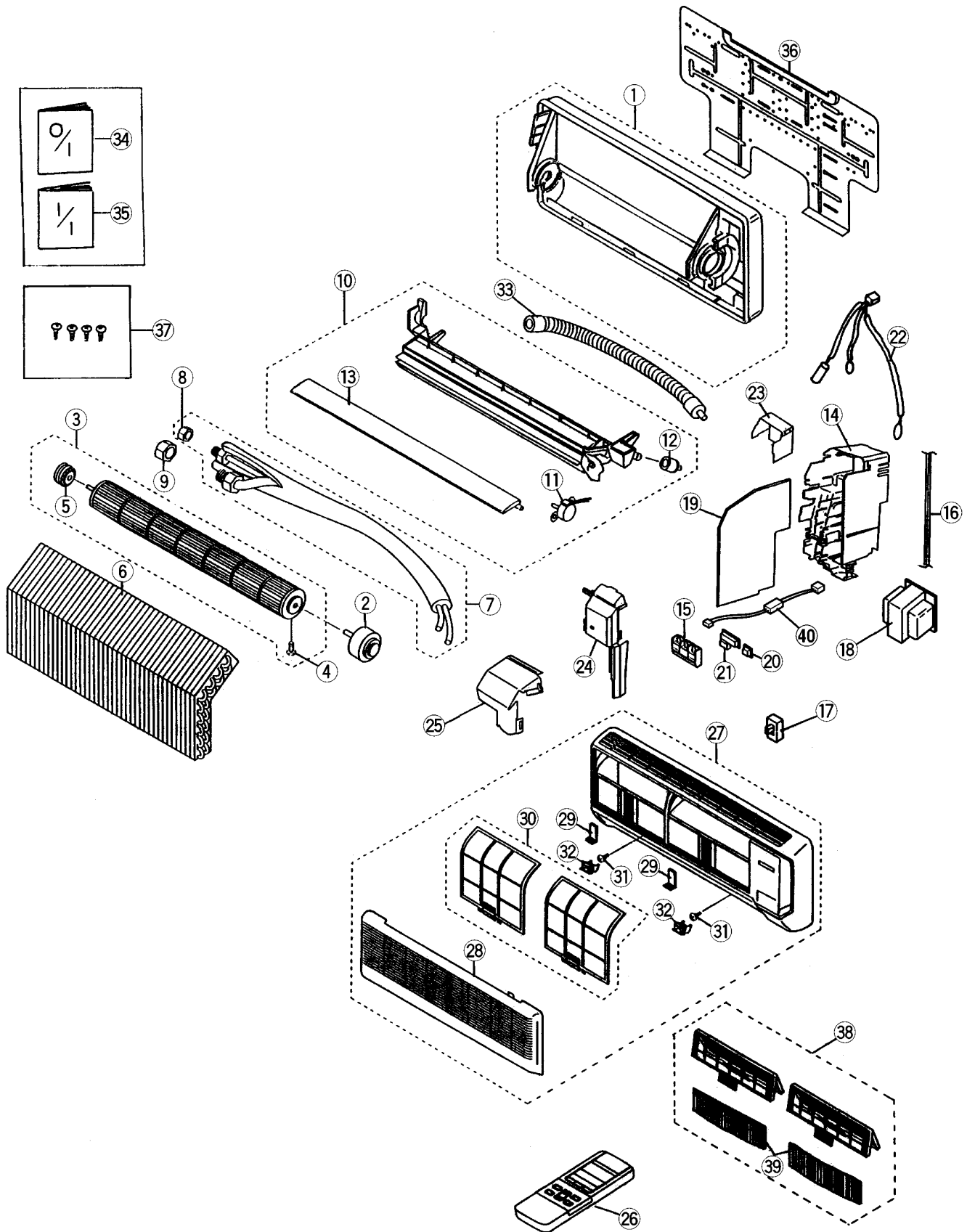
Ref.No.	CS-VC70KE / CS-VC90KE	DESCRIPTION & NAME	Q'TY	Remarks
1	CWD50C202	CHASSY COMPLETE	1	M
2	CWA92232	FAN MOTOR	1	M ●
3	CWH02C053	CROSS FLOW FAN COMPLETE	1	M
4	CWH4580304	SCREW-CROSS FLOW FAN	1	M
5	CWH64K007	BEARING ASS'Y	1	M
6	CWB30C258	EVAPORATOR	1	J
7	CWT01C605	TUBE ASS'Y COMPLETE	1	J
8	CWH6002140	FLARE NUT (1/4")	1	M
9	CWT25005	FLARE NUT (3/8")	1	J
10	CWE20C480	DISCHARGE GRILLE COMPLETE	1	M
11	CWA98245	MOTOR-AIR SWING	1	M ●
12	CWH52C003	TAP-DRAIN TRAY	1	M
13	CWE24394	VANE	1	M
14	CWH10887	CONTROL BOARD	1	M
15	CWA28C471	TERMINAL BOARD COMPLETE	1	M ●
16	CWA20C620	POWER SUPPLY CORD	1	M
17	CWA04088	SLIDE SWITCH	1	M ●
18	CWA40C246	TRANSFORMER COMPLETE	1	M ●
19	CWA74813	ELECTRONIC CONTROLLER	1	M ●
20	CWA74321	RECEIVER	1	M ●
21	CWE39C271	INDICATOR COMPLETE	1	M ●
22	CWA50C521	SENSOR COMPLETE	1	M ●
23	CWH13383	CONTROL BOARD TOP COVER	1	M
24	CWH13C256	CONTROL BOARD FRONT COVER	1	M
25	CWH13385	CONTROL BOARD COVER PIECE	1	M
26	CWA75C560	REMOTE CONTROL COMPLETE	1	M ●
27	CWE11C590	FRONT GRILLE COMPLETE	1	M
28	CWE22C287	INTAKE GRILLE COMPLETE	1	M
29	CWD93C070	PARTICULAR PIECE	2	M
30	CWD00215	AIR FILTER	2	M
31	XTN4+16C	SCREW-FRONT GRILLE	2	M
32	CWH52230	CAP-FRONT GRILLE	2	M
33	CWH5880580	DRAIN HOSE	1	M
34	CWF561577	OPERATING INSTRUCTIONS	1	J
35	CWF61658	INSTALLATION INSTRUCTIONS	1	J
36	CWH36122	INSTALLATION PLATE	1	M
37	CWH82C144	BAG COMPLETE-INSTALLATION SCREW	1	M
38	CWD00C111	AIR PURIFYING FILTER COMPLETE	1	M
39	CWD00220	AIR PURIFYING FILTER	2	M ●

(Note)

- Spare parts are supplied from ;
"M" is from MACC, Malaysia (Vender code : 086).
"J" is from Japan.
- "●"marked parts are recommended to be kept in stock.

17.2. CS-VC120KE

17.2.1. Exploded View



17.2.2. Replacement Parts List

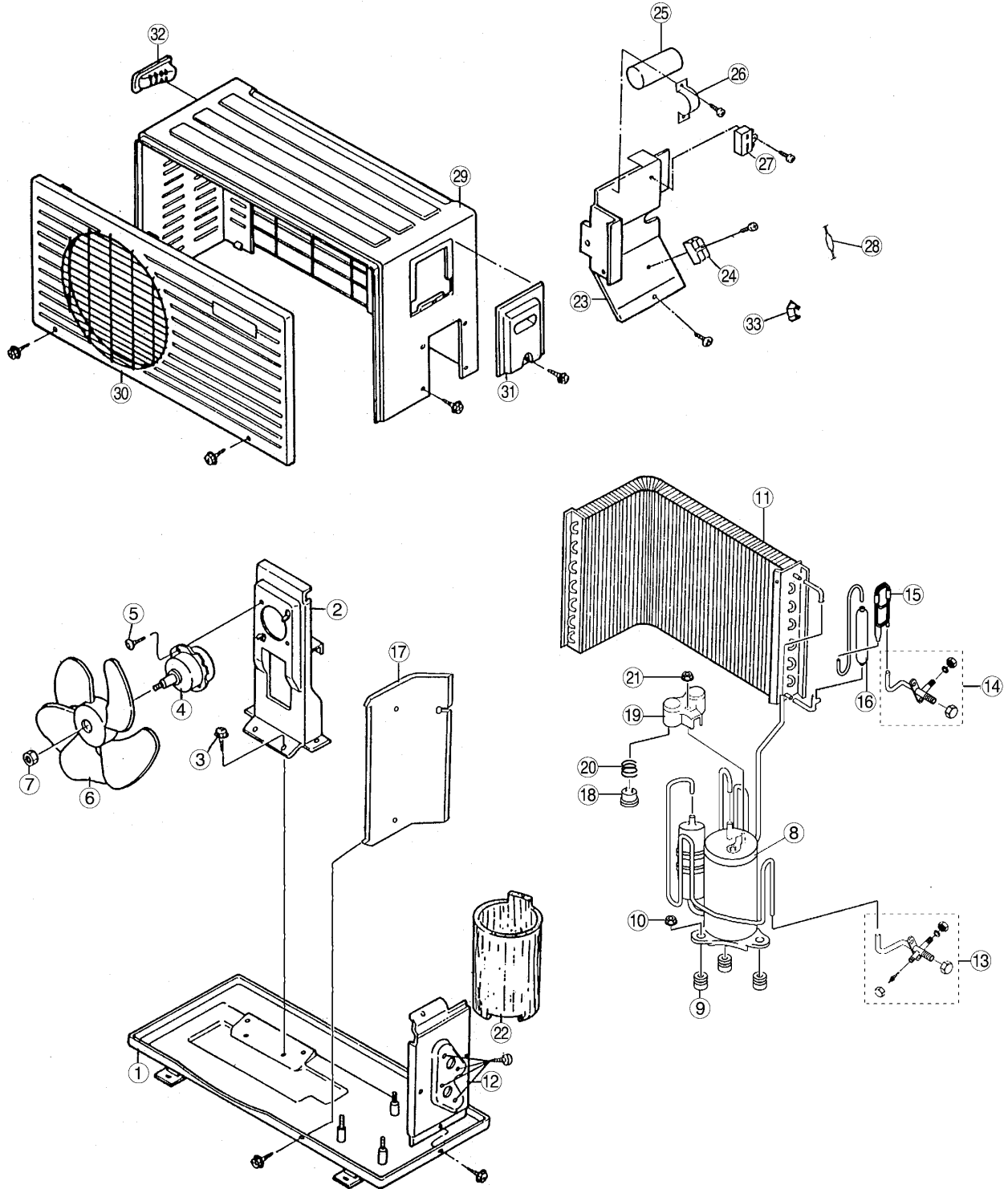
Ref. No.	CS-VC120KE	DESCRIPTION & NAME	Q' TY	Remarks
1	CWD50C202	CHASSY COMPLETE	1	M
2	CWA92231	FAN MOTOR	1	M ●
3	CWH02C053	CROSS-FLOW FAN	1	M
4	CWH4580304	SCREW-CROSSFLOW FAN	1	M
5	CWH64K007	BEARING ASS'Y	1	M
6	CWB30C211	EVAPORATOR	1	J
7	CWT01C2037	TUBE ASS'Y COMPLETE	1	J
8	CWH6002140	FLARE NUT (1/4")	1	M ●
9	CWT25096	FLARE NUT (1/2")	1	J ●
10	CWE20C481	DISCHARGE GRILLE COMPLETE	1	M
11	CWA98245	MOTOR-AIR SWING	1	M ●
12	CWH52C003	CAP-DRAIN TRAY	1	M
13	CWE24394	VANE	1	M
14	CWH10887	CONTROL BOARD	1	M
15	CWA28C472	TERMINAL BOARD COMPLETE	1	M ●
16	CWA20C616	POWER SUPPLY CORD	1	M
17	CWA04088	SLIDE SWITCH	1	M ●
18	CWA40C246	TRANSFORMER COMPLETE	1	M ●
19	CWA74859	PC BOARD WITH COMPONENT	1	M ●
20	CWA74321	PC BOARD WITH COMPONENT	1	M ●
21	CWE39C271	INDICATOR COMPLETE	1	M ●
22	CWA50C521	SENSOR COMPLETE	1	M ●
23	CWH13383	CONTROL BOARD COVER	1	M
24	CWH13C256	CONTROL BOARD COVER	1	M
25	CWH13385	CONTROL BOARD COVER	1	M
26	CWA75C560	REMOTE CONTROL COMPLETE	1	M ●
27	CWE11C590	FRONT GRILLE COMPLETE	1	M
28	CWE22C287	INTAKE GRILLE COMPLETE	1	M
29	CWD93C070	PARTICULAR PIECE	2	M
30	CWD00215	AIR FILTER	2	M
31	XTN4+16C	SCREW-FRONT GRILLE	2	M
32	CWH52230	CAP FRONT GRILLE	2	M
33	CWH5880580	DRAIN PIPE	1	M
34	CWF563050	OPERATING INSTRUCTIONS	1	J
35	CWF612035	INSTALLATION INSTRUCTIONS	1	J
36	CWH36122	INSTLLATION PLATE	1	M
37	CWH82C144	BAG COMPLETE-INSTALLATION SCREW	1	M
38	CWD00C111	AIR PURIFYING FILTER COMPLETE	1	M
39	CWD00220	AIR PURIFYING FILTER	2	M ●
40	CWA16C126	FUSE ASSY	1	M ●

(Note)

- Spare parts are supplied from ;
 - "M" is from MACC, Malaysia (Vender code : 086).
 - "J" is from Japan.
- "●"marked parts are recommended to be kept in stock.

17.3. CU-VC70KE / CU-VC90KE

17.3.1. Exploded View



17.3.2. Replacement Parts List

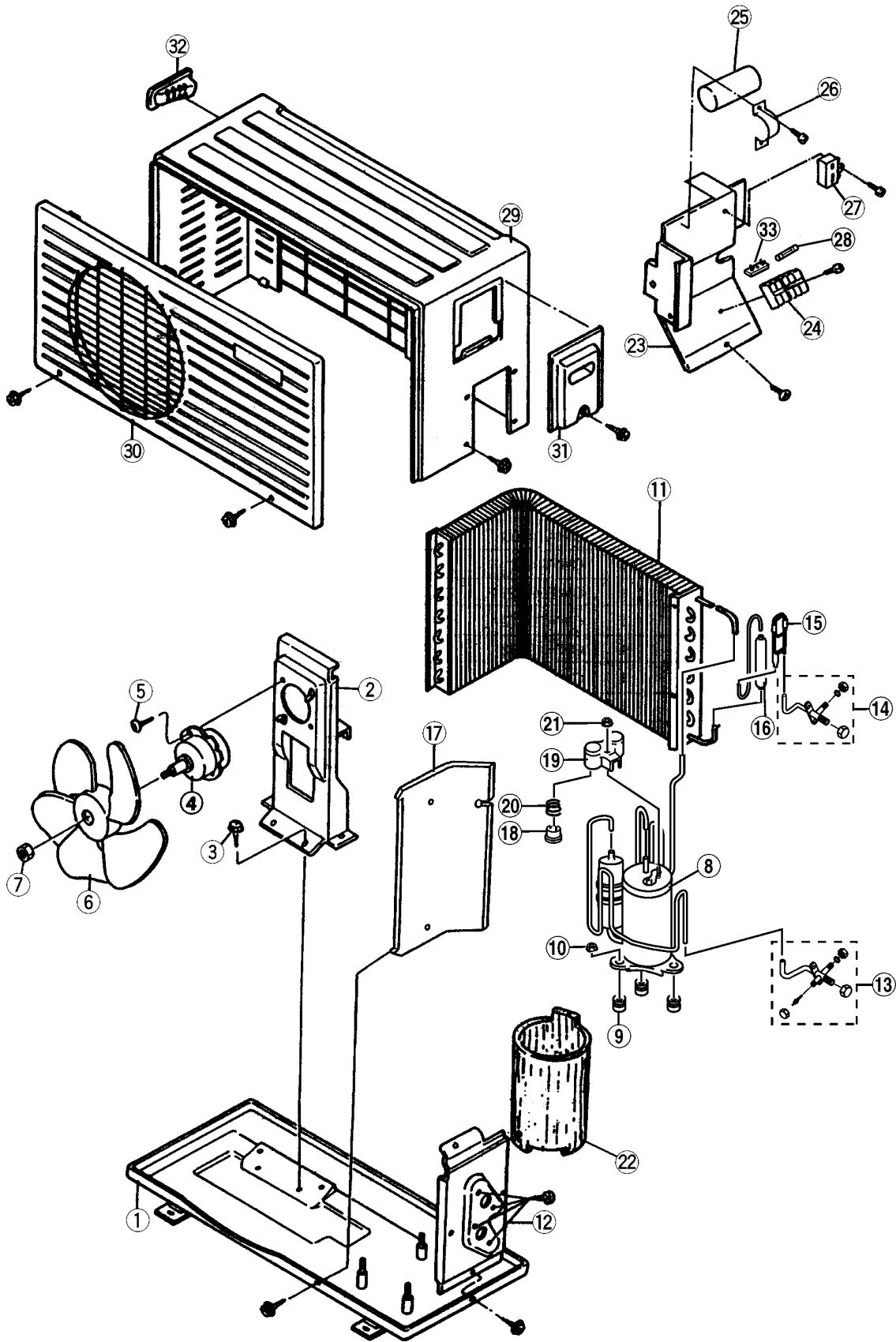
Ref.No.	CU-VC70KE / CU-VC90KE	DESCRIPTION & NAME	Q' TY	Remarks
1	CWD50K525B	CHASSY ASS`Y	1	J
2	CWD54113	FAN MOTOR BRACKET	1	J
3	CW4580399	SCREW-FAN MOTOR BRACKET	4	M
4	CWA95237 (CU-VC70KE)	FAN MOTOR	1	M ●
4	CWA95238 (CU-VC90KE)	FAN MOTOR	1	M ●
5	CWH55406	SCREW-FAN MOTOR MOUNT	3	M
6	CWH00K032	PROPELLER FAN	1	M
7	CWH56032	NUT-PROPELLER FAN	1	M
8	CWB09722 (CU-VC70KE)	COMPRESSOR	1	J ●
8	CWB09723 (CU-VC90KE)	COMPRESSOR	1	J ●
9	CWH50077	ANTI-VIBRATION BUSHING	3	M
10	CWH4582065 (CU-VC70KE)	NUT-COMPRESSOR MOUNT	3	M
10	CWH56000 (CU-VC90KE)	NUT-COMPRESSOR MOUNT	3	M
11	CWB32C327	CONDENSER	1	J
12	CWH35178A	HOLDER COUPLING ASS`Y	1	J
13	CWB01487	3-WAY VALVE	1	J ●
14	CWB02519	2-WAY VALVE	1	J ●
15	CWT01C598 (CU-VC70KE)	TUBE ASS`Y (STRAINER CAPAILLARY)	1	J
15	CWT01C599 (CU-VC90KE)	TUBE ASS`Y (STRAINER CAPAILLARY)	1	J
16	CWB10043	DRYER	1	J ●
17	CWH15266	SOUND PROOF BOARD	1	M
18	CWA67C1349 (CU-VC70KE)	OVERLOAD PROTECTOR	1	M ●
18	CWA67C2190 (CU-VC90KE)	OVERLOAD PROTECTOR	1	M ●
19	CWH17006	TERMINAL COVER	1	M
20	CWH7041200	HOLDER-O.L.P.	1	M
21	CWH7080300	NUT-TERMINAL COVER	1	M
22	CWG30401	SOUND PROOF MATERIAL	1	M
23	CWH10881	CONTROL BOARD	1	M
24	CWA28K217	TERMINAL BOARD ASS`Y	1	M
25	CWA31653 (CU-VC70KE)	CAPACITOR-COMPRESSOR	1	M ●
25	CWA31647 (CU-VC90KE)	CAPACITOR-COMPRESSOR	1	M ●
26	CWH30057	HOLDER CAPACITOR	1	M ●
27	CWA31342	CAPACITOR-FAN MOTOR (1.2 μ F, 400 V)	1	M

(Note)

- Spare parts are supplied from ;
- "M" is from MACC, Malaysia (Vender code : 086).
- "J" is from Japan.
- "●"marked parts are recommended to be kept in stock.

17.4. CU-VC120KE

17.4.1. Exploded View



17.4.2. Replacement Parts List

Ref. No.	CU-VC120KE	DESCRIPTION & NAME	Q' TY	Remarks	
1	CWD50K2012B	CHASSY COMPLETE	1	J	
2	CWD541004	BRACKET FAN MOTOR	1	J	
3	CWH4580399	SCREW-FAN MOTOR BRACKET	4	M	
4	CWA951005	FAN MOTOR	1	J	●
5	CWH55406	SCREW-FAN MOTOR MOUNT	3	M	
6	CWH03K002	PROPELLER FAN	1	M	
7	CWH56053	NUT-PROPELLER FAN	1	M	
8	CWB092012	COMPRESSOR	1	J	●
9	CWH50055	ANTI-VIBRATION BUSHING	3	M	
10	CWH4582065	NUT-COMPRESSOR MOUNT	3	M	
11	CWB32C1011	CONDENSER	1	J	
12	CWH35180A	HOLDER-COUPLING	1	J	
13	CWB011005	3-WAY VALVE	1	J	●
14	CWB021004	2-WAY VALVE	1	J	●
15	CWT01C2045	TUBE ASS'Y	1	J	
16	CWB10043	DRYER	1	J	●
17	CWH15265	SOUND PROOF BOARD	1	M	
18	CWA12364	OVERLOAD PROTECTOR	1	J	●
19	CWH17006	TERMINAL COVER	1	M	
20	CWH34033	HOLDER-OLP	1	M	
21	CWH7080300	NUT-TERMINAL COVER	1	M	
22	CWG30401	SOUND PROOF MATERIAL	1	M	
23	CWH10878	CONTROL BOARD	1	M	
24	CWA28K217	TERMINAL BOARD COMPLETE	1	M	
25	CWA31647	SH CAPACITOR	1	M	●
26	CWH30057	HOLDER-CAPACITOR	1	M	
27	CWA31342	SH CAPACITOR	1	M	●
28	XBA2C50TR0	FUSE	1	M	●
29	CWE00K302A	CABINET ASS'Y	1	M	
30	CWE06C125A	CABINET FRONT COMPLETE	1	J	
31	CWH13302	COVER CONTROL BOARD	1	M	
32	CWE16037C	HANDLE	1	M	
33	XCSCW011	HOLDER-FUSE	1	M	

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18 Electronic Parts List

(Model:CWA74813)

SYMBOL	PART NO.	DESCRIPTION & NAME	REMARKS
BZ1	CWA48005	SOUND GENERATOR	M
C-FM	CWA31496	SH CAPACITOR	M
D2	A15-01V3	DIODE	M
DB1	S1VB10E	DIODE	M
FUSE	XBA2C31TRO	FUSE	M
IC1	D0001W013	INTEGRATED CIRCUIT	M
IC2	CWA52C040	INTEGRATED CIRCUIT	M
IC3	CWPA2003C	INTEGRATED CIRCUIT	M
IC4	BR9011B	INTEGRATED CIRCUIT	M
IC5	CWA52C094	INTEGRATED CIRCUIT	M
L1, L2	CWA43036	V-COIL	M
Q3	DTC143XST	TRANSISTOR	M
Q2	DTC114EST	TRANSISTOR	M
Q4, Q5	2SC1740STPR	TRANSISTOR	M
Q1	2SC1741STPR	TRANSISTOR	M
RY-H, RY-M	CWA00160	ELECTRO MAGNETIC RELAY	M
RY-C	CWA00106	ELECTRO MAGNETIC RELAY	M
SSR	W2DEHI-5	TYRISTOR	M
SW3	CWA04042	SLIDE SWITCH	M
SW1, SW2	CWA01059	PUSH AWITCH	M
X1	CST8.0MTWT	RESONATOR	M
ZD1	RD7.5EL1TB	DIODE	M
ZNR1, ZNR2	CWA54C036	DIODE	M

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