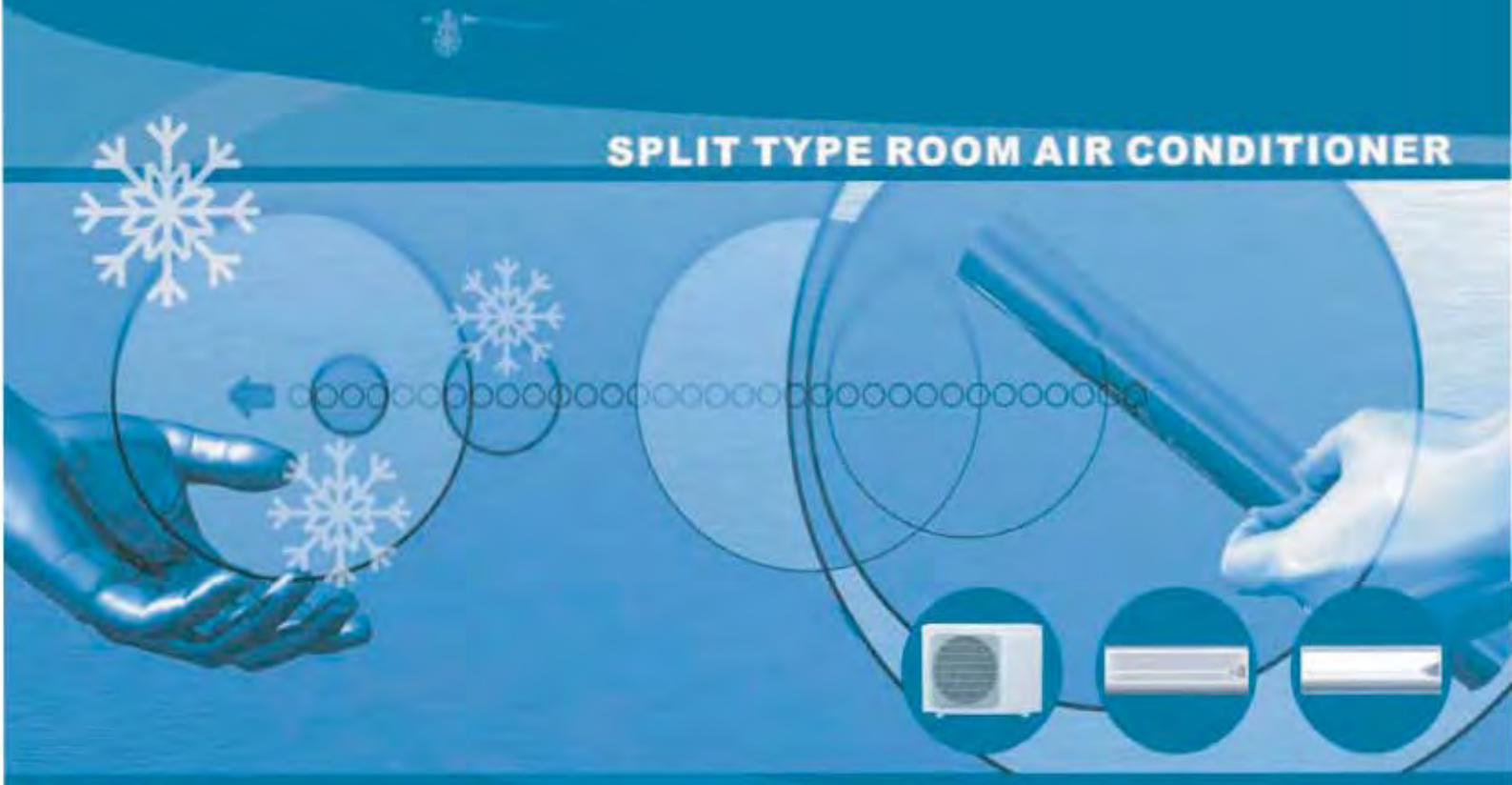
Pioneer

SPLIT TYPE ROOM AIR CONDITIONER



For 50HZ products including E&H series Wall-mounted type

Service Manual

2006

Foreword

In order to direct services of all installation and maintenance agents, provide all necessary information of Pioneerair conditioners, and make the whole service network work under the service concepts of Pioneer, we prepare this service manual.

This manual is composed of 6 parts: Part I, i.e. Chapter I, aims to represent basic work philosophy of household air conditioners; Part II, including Chapter 2 and Chapter 3, introduces products offered by Pioneer, and represents overall condition of Pioneerair conditioning products; Part III, i.e. Chapter 4, provides basic disassembly procedure of Pioneerair conditioning; Part IV, i.e. Chapter 5, introduces basic troubleshooting workflow of Pioneerair conditioning so as to enable service workers to get basic knowledge of air conditioning maintenance; Part V, i.e. Chapter 6, introduces common-used maintenance tools of air conditioning and some troubleshooting cases of Pioneerair conditioning. Part VI, i.e. Annex 1, provides all fault codes of Pioneerair conditioning so as to enable service workers to judge the faults correctly(in case of any change of Technical parameters and installation & maintenance methods in this manual, priority shall be given to "instruction manual").

Your suggestions and comments are welcome if there's any error or omission in this manual. Let's improve this manual with our joint effort.

Pioneer Air
Conditioning

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Chapter 1 the operation theory of the home Air-Conditioner

Section one the basic knowledge of pyrology and ventilation

1. Basic Definition

⑴ Temperature

Temperature is a physical value for the definition of the percentage of the cold and heat to an object. It's the one of those basic parameters used in confirming the substance's status. Currently, the world standard common thermometric scales include the absolute thermometric scale, the Celsius scale, and the Fahrenheit scale.

The Celsius scale is the most common thermometric scale in usage that has 100parts between the freezing point of 0℃ and the boiling point of water of 100℃ under a standard atmosphere (760mmHg, e.g.1.013×105Pa). Each part is one centigrade with the abbreviation of 1℃, and usually a "t" stands for its reading. The Fahrenheit scale has 180 parts between the freezing point at 32℉ and boiling point at 212℉ of water under a standard atmosphere. Each part is one Fahrenheit with the abbreviation of 1℉, and usually a"t1" stands for its reading. All the temperatures defined by the Celsius scale and the Fahrenheit scale are called relative temperature.

Absolute temperature is also called thermodynamics scale or Kelvin scale, which is adopted in the International Unit System. It deduces the temperature at the absolute stop stage of the heating activity of the molecules inside the substance is 0 degree (e.g. -273.15℃), which the absolute temperature is stood for by "K". Usually, a "T" represents its reading. 1K of the absolute temperature scale is absolutely equal to 1℃ of the Celsius scale on value.

The conversion relation between the Absolute temperature T, the Celsius scale t and the Fahrenheit scale t1 is as below:

t=T-273.16≈T-273(℃)

F= (9/5) t+32(℉) =1.8t+32(℉)

The glass thermometer, thermocouple thermometer, Electric-Contact Thermometer, resistance thermometer and semiconductor thermometer are the common meters in measuring the temperature during the refrigeration project.

⑵Pressure

The pressure means Force applied uniformly and vertically over a surface, measured as force per unit of area. It's also called intensity of pressure by the express of "P" with the unit Newton/m²(N/m2) in the shortened form Pa. In addition, there are other expresses by the way of kilogram force（kgf/cm2), liquid height(mmHg 或 mmH2O), and atmospheric pressure（atm）or bar etc.

The conversion relation between the above pressure units is as below:

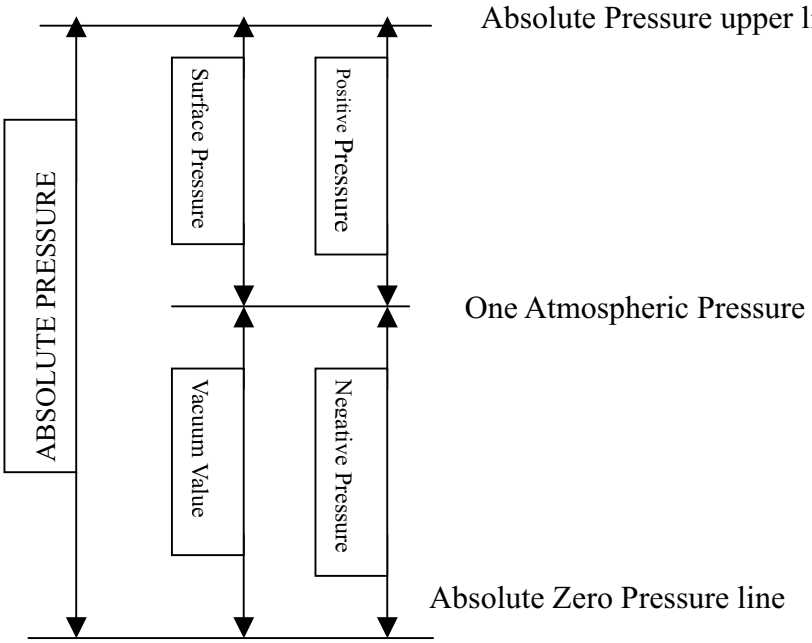
Table 1-1 the Pressure Units Conversion Table

Unit	Pa	kgf/cm^2	Atm	mmHg	Psi
Pa	1	1.02×10^{-5}	9.87×10^{-6}	7.5×10^{-3}	1.450×10^{4}
kgf/cm^2	9.8×10^{4}	1	9.68×10^{-1}	7.36×10^{2}	1.421×10^{9}
Atm	1.013×10^{5}	1.033	1	7.6×10^{2}	1.46885×10^{9}
mmHg	1.333×10^{2}	1.36×10^{-3}	1.316×10^{-3}	1	1.93285×10^{6}
Psi	0.68948×10^{4}	7.0327×10^{-2}	6.80517×10^{-2}	51.711	1

The pressure is distinguished by gauge pressure and absolute pressure applied in the practice.

The gauge pressure is validated according to the numerical value shown on the pressure gauge. This value, based on an atmospheric pressure (0), is the difference of the actual pressure of the tested gas and the ambient atmospheric pressure. If the value islower than the atmospheric pressure, then it will be negative and called vacuum value (B).The surface pressure is applicable for the observation use during the operation and running period of the refrigeration system. For example, when a negative value appears to the pressure gauge of refrigerant, it means the refrigerant in the refrigeration system totally leaks out.

The absolute pressure is the actual pressure value of the gas, which is equal to the sum of the surface pressure and the atmospheric pressure, e.g. Pa= Po+Pg. Pa stands for the absolute pressure, “Po” stands for the atmospheric pressure and “Pg” stands for the surface pressure.
The relation between the absolute pressure, the surface pressure and vacuum value are specified in the below picture1-1:



⑶Specific Volume
The specific Volume is the dimension for the substance with unit mass. υ stands for it and the unit is meter^3/ kilogram(m^3/kg) or Liter/kilogram(L/Kg). The specific volume of the vapor refrigerant is the key parameter in determining the cooling capacity of the compressor.
Specific Volume is the physics parameter in description of the compression level of the molecules in the substance. For Gas, if more large space between the molecules is, the larger the specific volume will be, consequently the compression level will be smaller and the compressibility will be more. Otherwise, the specific volume will be smaller, and consequently the compression level will be larger and the compressibility will be less.

The density (ρ), the reciprocal of the specific volume, is always being applied in the refrigeration technology, e.g.:

$$\upsilon=1/\rho \text{ 或 } \upsilon\bullet\rho=1$$

Density is the mass of the unit dimension of the substance with the unit of kg/m^3 (Kilogram/meter^3). The density of the liquid is higher than the one of the gas, which is the theory, sourced from and

applied in the separating process by the gas & liquid separator.

⑷Heat Energy

The heat energy of the substance, the internal energy, is the sum of the kinetic energy and potential energy. The quantity of heat is the physics parameter for measuring the heat absorbed or released by the physical object, and is one of the representation forms of energy. The essential of the heating process of refrigeration is the process of transmitting heat energy. The signification of the quantity of heat is only effective during the heat energy's transmitting period.

The common units in measurement include Joule or Kilo-Joule (KJ). 1J means the energy in need for rising up the physical object with the weight of 1Newton up to 1 meter height. In addition, there is Calorie or Kilo-Cal (Kcal) as the common units applied. 1Kcal stands for the absorbed or released quantity of heat for having the temperature of 1kg pure water to be increased or decreased by 1℃. British thermal unit (BTU) is applied mainly in Europe or USA. 1BTU stands for the absorbed or released quantity of heat for having the temperature of 1pound pure water to be increased or decreased by 1℉. The conversion relation of all the above units is as below:

1kJ＝1000J
1kcal=1000cal
1kcal=4.1868kJ
1BTU=0.252kcal=1.055kJ
1kcal=3.968BTU
1kJ=0.9478BTU
1W=0.86kcal/h
1HP=745.7W
1USA Refrigeration Ton(USRT）=3.024kcal/h=3576W
1 Japanese Refrigeration Ton（RT）=3320kcal/h=3860W

The relation of the temperature and the quantity of heat: The physical object's temperature will decrease if it releases the quantity of heat and consequently cause the increase to the ambiance temperature. Otherwise, the physical object's temperature will increase if it absorbs the quantity of heat and consequently cause the decrease to the ambiance temperature. In this case, it's easy to understand that the principle of the heating process is the heat releasing process by the object which increases the temperature of the ambiance medium accordingly; the principle of the refrigerating process is the heat absorbing process by the object which decreases the temperature of the ambiance medium accordingly.

2. The heat transmission forms

There must be a heat transmission process available either the quantity of heat shall be delivered from one substance to the other one or the quantity of heat shall be absorbed by one object from the other one. The heat transmission forms are consisted of heat conduction, convection and heat radiation. The three of them normally function at the same time during the actual heat transmission process in no spite of the single transmission form of them available only.

⑴Heat-conduction

Heat conduction is one of the heat transmission forms in the form of transmitting the quantity of heat from one object to the other one, or the heat transmission available between two contacting objects. For example, when you hold one end of the iron bar, and the other end is on the fire, after a while,

your hand will feel heated.

Different materials have different heat conductivity. In this case, the heat conductivity coefficient was introduced as the unit of the value for measuring purpose. Such coefficient represents the amount of heat that passes by conduction through a one meter thickness of homogeneous material, per one hour and per one square meter Measured as 1℃ difference between the two surfaces of the material. Its unit is kJ/ (m.h.℃) and stood for by symbol λ.

The heat conductivity coefficients of some common materials are listed in table 1-2.
The quantity of heat "Q" transferred from the surface is directly proportional to the heat conductivity coefficient of the material, temperatures' difference, dimension of the surface and the heat transmission time while inversely proportional to the surface's thickness. See Graph 1-4. The Algebra expression formula is as below:

$$Q=\lambda SZ(t_1-t_2)/\delta \quad (kJ)$$

In the expression formula:

λ——Stands for the heat conductivity coefficient of the material. kJ/（m·h·℃）;

S——Stands for the surface dimension，m^2;

δ——Stands for the thickness of the surface，m;

Z——Stands for the heat transmission time ，h;

t_1、t_2——The temperatures of the two surfaces，℃。

Table 1-2 the heat conductivity coefficients of some common materials

Material	λ（kJ/m·h·℃）	Material	λ（kJ/m·h·℃）
Copper	1382	Softwood	0.17-0.25
Aluminum	733	Air casing	0.25
Steel	163	Water	2.1
Frost layer	2.1	Glass	2.7-2.9
Glass filament	0.17-0.21	Wood	0.25-0.34
Glass wool	0.13	Plywood	0.62-0.84
Slag wool	0.21-0.34	Polyester formed plastic	0.042-0.11

⑵Convection
The transfer of the quantity of heat caused by the relative movement of the fluid at higher temperature and the fluid at lower temperature is called convection heat transfer. The convection is only applied to and only specifically exists in the fluid and gas. The convection heat transfer exists between the fluids or may exist between the fluid and solid, and may be accompanied by the heat conduction. The main heat transmission applied in the refrigeration technology usually contains the heat conduction and convection. The coefficient α stands for the intensity of the convection heat transfer and mainly affected by the flow speed of the fluid.

The types of convection heat transfer include natural convection and forced convection. Natural convection is formed by the changes to the density of the molecules of the liquid or gas, such as the cooling function of the refrigerator's condenser is mainly based on the effected natural convection of air. The forced convection is formed and caused by the accelerating flow speed of gas or liquid being

impacted by force, for example the convection of the refrigerant inside the pipes caused by the impact from the compressor of the refrigerator and air-conditioner, and the forced convection to the condenser and evaporator impacted by the fan. The heat transfer coefficient is directly proportional to the flow speed of the forced convection. So, the fan can be utilized as a forced convection tool for creating the effective heat transfer.

⑶Heat Radiation

Heat radiation represents the transmission of the radiation energy turned from the heat energy existing in the space between two indirect touching objects. Any objects continuously emit the radiation energy and absorb the radiation energy so as to turn it into the heat energy. Comparing with the heat conduction and heat convection, heat radiation can be realized through the vacuum space without any heat and middle medium. The heat transmitting process from the Sun to the Earth is by the way of heat radiation.

The intensity of the object's radiation energy is directly proportional to the forth power of the absolute temperature value. In this case, the final efficient result of the radiation is that the object at higher temperature will loss energy and the one at lower temperature will receive energy. Despite of the above factor, the intensity of the radiation energy is also relative to the property of the object's surface. More black or rough the surface is, more easy in radiating or absorbing heat. The white and smooth object can hardly absorb the heat, but be good at heat reflection. Because of this, the condenser of the refrigerator is painted in black color for strengthening the capability of radiation, and the shell surface of the refrigerator is light and brilliant so as to reduce the absorbance caused by the radiation from other objects.

3. The State Parameter of air

⑴ The temperature of air

The temperature of air represents the heat extent of the air. Usually Celsius temperature scale t（℃） was introduced to stand for it.

⑵ The pressure of air

The pressure of air in the nature is atmosphere pressure. Since the air is the mixture of dry air and water vapor, the air pressure is the sum of the pressures of dry air and water vapor. The value of the water vapor pressure is a parameter reflecting the quantity of the water vapor in the air.

The total air dimension is always full of the water vapor molecules. The temperature value we obtained is not only the one of the dry air but also the water vapor's. In this case, the volume or the temperature of the water vapor is equal to the-volume or the temperature of the air respectively. The weight of the air is the sum of the dry air and the water vapor.

⑶ Humidity

Humidity is one of the physical parameter for representing the quantity of the water contained in the air. There are absolute humidity and relative humidity as the specific definition for it. The absolute humidity(kg/m^3或g/kg) means the weight of the water contained in 1kg air. The relative humidity (*RH* %) means the percentage ratio of the current absolute humidity to the saturated absolute humidity under a certain ambiance temperature. It's difficult to measure the water weight directly in the air in practice. Since the pressure created by the water in the air is in direct proportion to the quantity of the

water in the air within the temperature zone under 100℃, the absolute humidity can be represented by the pressure value created by the water vapor in the air. The pressure unit is: Pa.

Less relative humidity means more dry of the air. Zero percent of the relative humidity value means 100 percent dry air. 100 percent of the relative humidity means the saturation humidity of the air. The value of the relative humidity is measurable by the hygrometer. There are various types of hygrometers, such as the Dew Point hygrometer, hair hygrometer and psychrometer, etc.

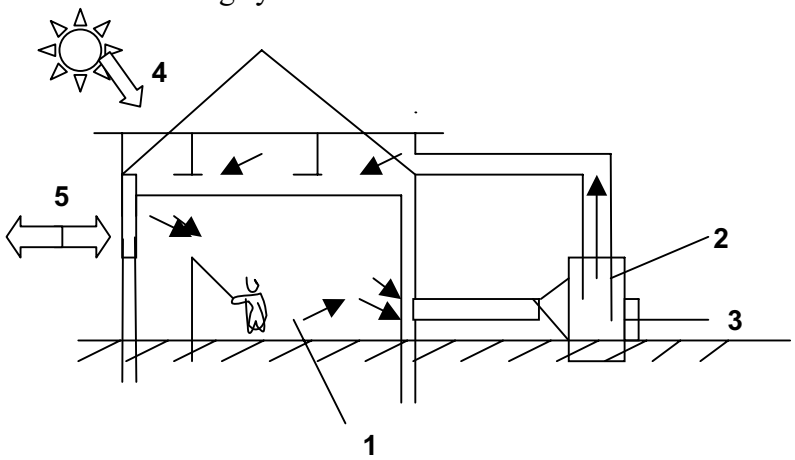
⑷ Enthalpy

The heat energy is the sum of the Kinetic energy and the potential energy. It always exists in the material due to the always-nonstop motion of its molecules no matter of any states they stay in. The heat energy in a certain state contained in one-kilogram material is the enthalpy of this material.

The enthalpy of the air is composed of the one of the dry air and water vapor, which is represented by "i", unit kJ/Kg.

4. Air conditioning

Piture.1-2 is an air conditioning system:



1. The controlled working zone(also called Air conditioning zone)
2. Air transmitting system
3. Fresh air being filtered
4. Sun radiation
5. Outdoor temperature Change

The above drawing shows the heat source, humidity source or other harmful materials, in one aspect, come from the production process of the indoor environment and the heat or wetness produced by human body, and on the other hand is caused by the changes of the sun radiation and climate condition of the outdoor environment. In this case, the idea of air conditioning that aim to control the air environment by artificial method is bourn for eliminating the indoor and outdoors influence factors subject to the environment. The air conditioning functions mainly by the way of air temperature conditioning, humidity conditioning, airflow speed conditioning and air cleanliness conditioning.

⑴Temperature conditioning

The purpose of temperature conditioning is to maintain an appropriate temperature for the indoor air. The appropriate indoor temperature value is: 25-27℃ for Summer，18-20℃ for winter. The

temperature value shall be determined by the industry & mineral enterprises, scientific & research institutes, medical and sanitary units according to their own specific purposes.

The process of air temperature conditioning is substantially the process of adding or reducing sensible heat. The value of the air temperature also expresses the quantity of the sensible heat of air.

⑵Humidity conditioning

In addition to maintain an appropriate indoor temperature, there is also a demand for maintaining an appropriate indoor humidity. The human body will feel comfortable if the relative humidity is between 50%-60% in the summer and 40%-50% in the winter.

The process of air humidity conditioning is substantially the process of adding or reducing latent heat. The quantity of the water vapor contained in the air shall be conditioned during this process.

⑶Airflow conditioning

The temperature and humidity conditioning can be realized only by the way of air flowing. In this case, the airflow conditioning is vital in air conditioning process. The airflow conditioning and distributing directly impact the operation effectiveness of the air conditioning system. The air re-circulating speed in an air-conditioned room shall not over than 0.25m/s.

⑷Air cleanliness conditioning

The harmful gas and dust existing in the air easily penetrate into the human being's windpipe and lung, etc, and all the dust are usually accompanied by the infecting virus to cause kinds of sickness. So, the filtering process to the air is quite necessary during the air conditioning process. The air cleanliness methods include: Ventilation & filtration, adsorption, absorbance and catalyzing combustion etc.

Section two the basic knowledge of refrigeration

1. Refrigerant

Refrigerant is also called refrigeration Working Medium. The first letter "R" of the English word "Refrigerant" stands for it. It absorbs the heat by boiling away the liquid through the variety of its own state in the refrigerating device and transfers the heat released from the gas' liquefaction process to the surrounding medium materials inside the condenser with the impact of the third party's work. The state variety of the refrigerant within the system is a kind of physical variety with the only function of absorbing heat and transferring heat but without any change to its property. There are around more than eighty kind of refrigerant available now and some others are under development.

⑴The Refrigerant kinds

According to the chemical composition, the refrigerants can be classified as follows:

①Inorganic compound refrigerant

These kind refrigerants were applied earlier for refrigeration purpose, such as the air, water, Ammonia and Carbon dioxide etc. Among them, some were washed out already. The typical sample is Carbon dioxide with the disadvantage of high working pressure, low critical temperature, small capacity per unit and low refrigeration performance. As the replacement item, the Ammonia is one of the Inorganic compound refrigerants being applied widely. R717 stands for it.

②Freon species refrigerant

They are the ramifications of methane and ethane with the changing character in consequence of the quantities variety of the atoms of fluorine, hydrogen and chlorine. The best option for choosing a chemical compound at the vaporizing temperature of -130℃ to +80℃ is the one with quite more fluorine atom in consideration of the easy application of the refrigeration technology, because the compound with more fluorine atom has less toxicity and can maintain a higher chemic stability. In addition, the compound with less hydrogen atoms has less possibility in explosion and inflammation, and if with more chlorine atoms the evaporation temperature will be higher. The more information about the character of Freon will be specified in details in the following paragraphs.

③Azeotropic mixture refrigerant

They are the mixture of two or above than two types Refrigerants in certain percentage. Their character is same as the one of the single compound that maintains the invariable evaporation temperature under the fixed pressure. However, the component of their vapor phase and liquid phase are same and retain in the same.

Azeotropic mixture has some distinguished character comparing with the single refrigerant, such as low evaporation temperature, large capacity per unit refrigerant and low compressor discharge temperature etc. So the application of the azeotropic mixture can enhance the performance of the refrigerant.

In compliance with the national regulation, “R” is the symbol standing for the refrigerant. The refrigerant can also be classified in three types according to the level of evaporation temperature and the condensing pressure value under normal temperature as the description in table 1-3:

Table 1-3 The classification of refrigerant

Types	Refrigerant	Rated evaporation temperature(℃)	The condensing pressure under normal temp.（Mpa）	Application Range
High temp. and low pressure	R11 R21 R113 R114	>0	<1.96-7.94	Applicable in the centrifugal compressor of the Air-conditioning system.
Middle temp. and middle pressure	R717 R12 R22 R502	-70-0	<19.6	Applicable in the piston style compressor of the air-conditioner or the freezing store system
Low temp. and high pressure	R13 R14 R23 R503	<-70	1.96-68.8	Applicable in the refrigerator system with the temperature lower than -70℃ or the low temperature parts of the cascade multiple system

2. The requirement to the refrigerant

⑴The requirement for the thermodynamic character
The basic requirements the refrigerant shall meet are:
①Under the standard atmosphere pressure, the evaporation temperature must be low and generally shall not higher than -10℃. The pressure value under the normal evaporation temperature shall be higher or closed to the atmosphere pressure value in case of the air's in leakage to the system.

②The condensing pressure of the refrigerant shall not be too high and generally shall not exceed 1.17-1.47 Mpa if within the range of the working temperatures. Otherwise it will add extra burden on the intensity of the refrigerating devices and increase the power consumption subsequently.

③The capacity per unit refrigerant shall be large enough. It is the common understanding that the refrigerant with the larger capacity per unit refrigerant can achieve larger quantity of refrigeration if at the same cylinder diameter and same strolling stroke. However, as the exception, for the centrifugal or mini type compressor, the preferable choice is the refrigerant with low capacity per unit refrigerant in consideration of the convenience in machine design and manufacture.

④The critical temperature for the refrigerant shall be high enough in order to be liquidized at the normal temperature or even the normal low temperature. The freezing temperature point shall be low enough in order to be evaporated at a low evaporation temperature.

⑵The requirement for the physical and chemical character
①The adhesiveness and density of the refrigerant shall be low enough in order to have a free cycle environment without too much resistance in the system.

②The refrigerant shall have the perfect performance in heat-exchanging in order to enhance the efficiency of the complete refrigerator or air-conditioner.

③The refrigerant shall have a certain function of water-absorbing so as to maintain the normal operation with no "ice block" when there is small water available in the system.

④The refrigerant shall be with a certain chemistry stability character for avoiding the chemolysis at the high temperature, the corrosion to the material of the preparation, the inflammation and explosion within a normal working pressure and temperature ranges; It also shall be with no much solubilization or inflation impact applied to the hermetic material and with no chemical reaction to the lubricating oil.

⑤The refrigerant shall be free of harm to the health of human beings and with no irritant.

3. The characters of the common refrigerant product:
There are many kinds of refrigerants available, the below are the typical types:

⑴Fluorine 22(**CHF_2Cl**)
①Fluorine 22 with no character of inflammation and explosion. Its toxicity is deeper than R12's, and its solubility limit is higher than R12's but also may form the phenomenon of "ice block".

②Part of R22 can be solubilized by lubricating oil. The solubility limit is variable according to the

specific type and temperature of the lubricating oil.

The capacity per unit of R22 is almost same as the one of R717 while it will be higher than R22 under a low temperature.R22 is usually applied in the middle temperature refrigerating systems with the object lowest refrigerating temperature of up than -60℃.

⑵ The property of the replacement cold medium of R407C, R410a, etc.to R22
The properties comparison between R410A, R407C and HCFC22 is listed in table 2-2. We can make a conclusion as the below after checking through this table:

①The environment-protection condition of the replacement cold medium is superior than R22 and conforming to the safety requirement.

②R407C is non-azeotrope and need to be rectified according to the specific condition in air-conditioner design, production and maintenance process; R410A is sub-azeotrope and basically can be treated as R22.

③The pressures of R407C、THR03 and R22 are basically same. But the one of R410A is higher than R22's by 60%;

④The lubricating oil for the replacement cold medium is different from the one for R22 and need to be changed completely. However, due to the water-absorption of the Polyarylether, the control on drying process must be strict;

⑤R407C, THR03 and R22 are basically same on the aspect of the capacity per unit refrigerant. The capacity per unit refrigerant of R410A is more than R22 by 40～50％.

Table 1-4 the basic property of the replacement cold medium

Property		R-22	R-410A	R-407C
The makeup of the cold medium （Mass ratio ％）		R-22	R32/R125	R32/R125/ R134a
		100	50/50	23/25/52
Environment Condition	Ozone's destruction Potential (ODP)	0.05	0	0
	Greenhouse GWP（100 years）	1730	1700	1530
Safety	Toxicity	No	No	No
	Inflammability	No	No	No
Thermophysical Properties	Azeotrope property	---	Sub-Azeotrope	Non-Azeotrope
	Boiling point（℃）	-40.8	-52.7	-43.7
	Critical temp.（℃）	96.1	72.5	87.3
Refrigerating Property	Condensing pressure（Mpa）	2.17	3.38	2.31
	Evaporating pressure（Mpa）	0.62	1.00	0.64
	Pressure ratio	3.50	3.38	3.59
	Exhaust Temp.（℃）	97.2	95.1	86.7

	Slippage temp.℃）	0	<0.17	4～6
	Capacity of refrigeration （%）	100	141	101
	COP（%）	100	92.5	97
Lubricating oil	Lubricating oil	Mineral oil	POE	POE
	Mutual solubilization	Good	Fair	Fair

2. The theory of refrigeration

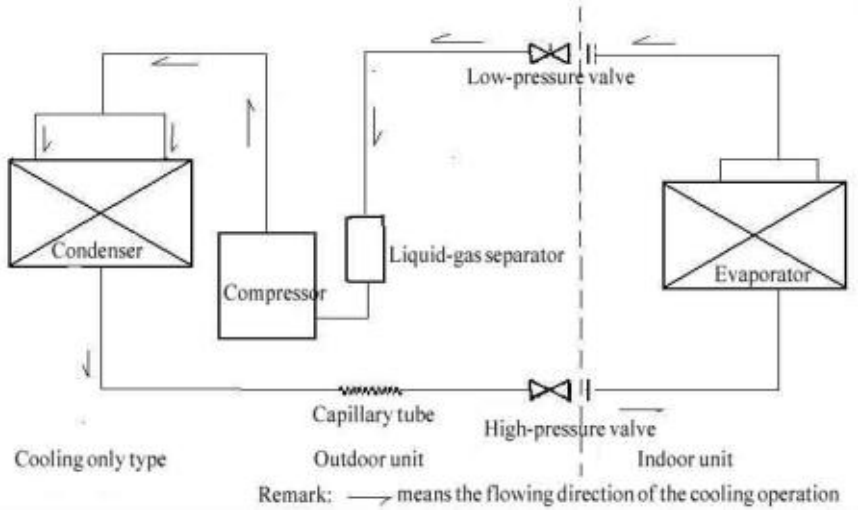
There are many methods in artificial refrigeration. The most popular one among of them applied in practice is the steam-compressing type. It completes the refrigeration task with the help of some fluid of low evaporating temperature which can maintain a stable temperature while absorbing and reducing the quantity of heat from the surrounding mediums during evaporate period. The temperature reduction function of the air-conditioner is mainly realized by the refrigerating cycle. The steam-compressing model refrigeration system, as shown in Picture 2-1, includes the most essential refrigerating cycle composed of four parts: 1.Compressor; 2.Condensor；3.Throttle device（Capillary tube or expansion valve）；4.Evaporator，which are connected in turn by the pipes and form an airtight system.

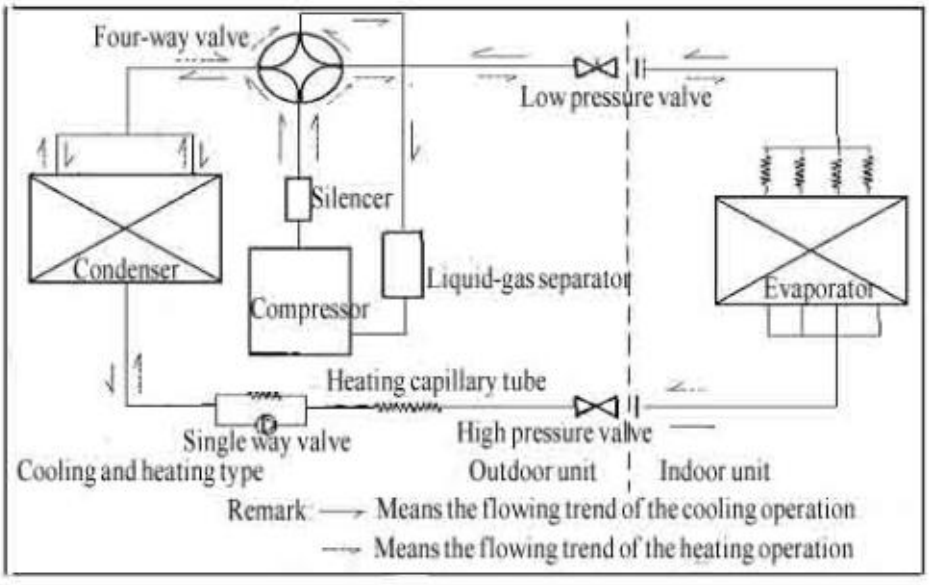
Its working process is: The liquid refrigerant absorbs the quantity of heat from the evaporator and then will be gasified as gas at a low pressure and temperature. The compressor will suck this gas from the sides of the evaporator and compress the gas (The pressure will turn high at the moment) through its mechanism energy transferred from the electricity energy. With no stop, the mechanism energy turns into the heat energy for increasing the temperature of the compressed gas (Super- heating gas) and force it enter into the condenser. The compressed gas with high pressure and temperature will undertake the heat exchange (heat release) process with the air (or heat source) around the condenser and will be cooled and condensed as liquid with high pressure and middle temperature (Super-heating gas, about 95℃)→saturated→gas→wet→gas→saturated liquid→super-cooling liquid（46℃）, the pressure value basically maintain the same (About 19Kgf/cm, and temperature is down). Because the narrow diameter of the capillary tubes creates the resistance during the flow of the processed high pressure and super-cooling refrigerant, the speed of the refrigerant flow will be accelerated, the pressure will be lower down, the temperature will fall and accompanied with the tiny gasify phenomenon. The refrigerant's temperature （about 7℃、5Kgf/cm）, after passing through the evaporator, will be lower than the ambiance temperature, and will turn into a gas state gradually from the low pressure and wet steaming state after having sucked the heat from the ambiance mediums that accelerate its gasify process. The way of its heat-absorbing results in the decline of the ambiance temperature and consequently achieves the target of air-conditioning.

As the description of the above, the refrigeration system is continuously circulating by the way of compressing →condensing→throttling →evaporating→compressing. With the function of promoting the pressure of the refrigerant and transferring the refrigerant into continuous circulation, the compressor is the heart of the whole system. The throttling components undertake the function of flow-throttling, pressure-reduction and flow quantity –adjusting towards to the refrigerant entering into the evaporator. However, the refrigerant is the blood of the refrigerating cycle for taking the responsibility of transferring the quantity of heat; It releases the heat absorbed from the evaporator and the one produced by the compressor to the air around the condenser for realizing the target of refrigeration by continuously absorbing heat from low temperature mediums and releasing heat to the

high temperature mediums.

It's absolutely necessary to a refrigeration system without lack of the Compressor, Condenser, Throttle device and Evaporator. As to the other auxiliary parts, they are configured and constructed in order to promote the economy, the reliability and the safety of the system.





3 The defined terms of air-conditioner in common use

⑴Heat pump:

The heat pump is a refrigerating system that absorbs the heat from the outdoor low temperature air and release the heat to the indoor air so as to have a calefactive indoor air by changing the flowing direction of the refrigerant. It also includes the air circulating and purifying devices as well as the damping and ventilation.

⑵Cooling capacity

It means the total quantity of heat per unit time removed by the air-conditioner from the closed space, room or area under the rating working status and specified condition. Unit: W or BTU.

⑶The consumed power for cooling It means the total input power for air-conditioner's refrigerating

operation under the rating working status and the specified condition.

⑷Heating capacity

It means the total quantity of heat per unit time transferred by the air-conditioner to the closed space, room or area under the rating working status and specified condition. Unit: W or BTU.

⑸The consumed power for heating:

The total power input for air-conditioner's heating operation under the rating working status and the specified condition Unit: W.

⑹Energy ~~and~~ efficiency ratio (EER)

It means the ratio of the cooling capacity to the effective input power consumption occurred during the air-conditioner's refrigeration process under the rating working status and the specified condition. W/W stands for the value of the ratio.

⑺Coefficient of Performance (COP):

It means the ratio of the cooling capacity to the effective input power consumption occurred during heating process of the heat pump of the air-conditioner under the rating working status and the specified condition. W/W stands for the value of the ratio.

Note: * The effective input power consumption stands for the average electric power inputted to the air-conditioner within a unit time, which includes:

① The input power shared for the operation of the compressor and the input power for defrosting.(Except the auxiliary assistant electric heating devices with no aim to defrosting);
② The input power of all control and safety devices;
③ The input power of the heat exchange transferring devices(Fan and pump);

Energy efficiency ratio (EER): It means the ratio of the cooling capacity to the effective input power occurred during the air-conditioner's refrigeration process under the rating working status and the specified condition. W/W stands for the value of the ratio.

⑻The volume of circulating air (The volume of air delivered to room):

The volume of air delivered by the air-conditioner to the airtight space, room or area per unit time under the rating refrigerating working condition when the aeration door and the ejection door are closed thoroughly (If applicable). The unit of the volume of air delivered is: m3/s（m3/h）.

⑼ Air enthalpy-difference testing method

It's a test method being applied in the measurement of the air-conditioner's performance of cooling and heating. The parameters in the need of the test include the outlet air parameter, the inlet air parameter and the volume of the circulating air of the air-conditioner. The performance of the air-conditioner is determined by the product of the volume of air and the difference between the enthalpy values of the outlet and inlet air.

The cooling capacity of the air-conditioner is relating to the area of the room, room's usage, room's orientation, and the floor it at, the room's heat preservation capability, the quantity of heat from other

electrical appliances and other factors. Basing on the experience, we can set the value of 150—240W/M^2 (120—300W/M^2 is applicable in more large room or space) as the cooling load per unit working area, and the actual applicable coverage area of the air-conditioner is the result of the cooling capacity being divided by the cooling load. For example: KFR35/HSA the cooling capacity is 3200W, the minimum applicable coverage area is 3200/240=13M（about）, and the maximum coverage area is 3200/150=21M.

Table1-5 the quantity of refrigeration in need for specific situations:

Type	Qty. of refrigeration (w/M)	type	Qty. of refrigeration (w/M)
Ordinary family room	170	Hotel room (close type)	160
Garret family room	220	Hotel room (open type)	140
Ordinary office room	200	Hotel hall	220
Haircutting house or shampoo Salon	280	Conference room, projection room	320
Front hall of hotel or Interval room	420	Family living room and dining room	200
Garment shop and Jewelry shop	220	Chess & card playing room and tea room	240

The above is the estimation to the applicable area mainly in according to the cooling capacity. Due to the available temperature difference and the sense difference by different people to the heat energy, the quantity of heat load is usually bigger than the one of cooling load per unit applicable area according to the practice experience, and generally about 180-270W/M.

⑽The time for temperature's drop and rise:

After an air-circulating all over a room by the air-conditioner, because of a ~~heat~~ temperature difference 12--15℃ available between the inletting room temperature and evaporating temperature, people may feel an obvious drop happens to the room temperature. Such as one set of 3.2Kw air-conditioner that is applied to a room with area 13—21M², height 2.8M will achieve an obvious temperature drop within （13—21 M²）*2.8M/500M/h=0.0728—0.01176h=4.4—7.1min. However, due to the distinct heat storing capacity of the wall, window & door, furniture, ornaments etc., the drop of temperature will take more time and even the temperature of the cooled air may contrarily rise up after having touching them; In addition, the stable operation of the air-conditioner also need some time since the refrigeration system just start up. In this case, the above calculation method presented and recommended as the theory reference only.

⑾The cable, ammeter and the quantity of electricity consumption

Usually, the electric connecting cables (include the plug cable) are already assembled by the manufacturers to the air-conditioner system and with no extra cost or labor for users. But the cable from the socket to the switchboard must be laid out by the user before installation. Since the air-conditioner is the largest one in consuming electricity among the home appliances, the special and exclusive circuitry (Direct sourced from the total electrical source), and must be equipped with the earth lead. The dimensions of the leads are required as the below:

The rating current (A) of the air-conditioner (As per the nameplate)	The section area of the plastic insulated leads (mm²)	
	Copper core	Aluminum core
＜＝6	1(1.5)	2.5
6-10	1.5(2.5)	2.5
10-16	2.5(4)	4
16-25	4(6)	6
25-35	6	10

Note:
①Aluminum leads are not recommended in use;
②Larger section area shall be better in use as recommended

The division of the ammeters, such as doubleness ammeter、quadruple ammeter etc., are determined by their endurance capacity to the specific electricity currents. For example the 2.5A doubleness ammeter means the maximum electricity capacity it can endure is 5A; the maximum electricity capacity of the quadruple ammeter is 20A. So, the user must ensure the total rating current shall less than the maximum capacity of the ammeter, and good consideration of the other appliances' electricity consumption at home.

⑿The electricity consumption of the air-conditioner: The consumption power, the electricity heating power and the auxiliary electricity heating power (if applicable) can be identified from the nameplate of the air-conditioner and can be used for the estimation of the quantity of electricity consumption. For instance, if the rating refrigerating consumption power is 1200W for one air-conditioner, and 1 kilowatt-hour =1kW/h, then the quantity of electricity consumption of this air-conditioner is 1200W*1h=1.2kW/h=1.2kilowatt-hour. The rating power on the nameplate is validated by the manufacturer under a certain indoor or outdoor temperature and humidity (Indoor dry bulb 27℃、wet bulb19℃，outdoor dry bulb 35℃、wet bulb 24℃), however, due to the incomplete same condition of the indoor and outdoor either on the condition of the temperature and humidity or the testing environment, the consequent actual power consumption may be different from the rating consumption power. Generally speaking, in terms of refrigeration, the higher environment temperature (the more atrocious condition) it is, the bigger actual consumption power of the air-conditioner will be. The table of the below shows the basic parameters of all specific type of air-conditioners:

Table1-6 basic parameters of all specific type air conditioners

Specification	Capacity(About)range	Power(about)range	Current range	Qty. Of Electricity consumption
1 Hp	2000-3000w	650-1100w	3-5A	0.6-1.2
1.5 Hp	3000-4000w	1100-1600w	5-7.2A	1.0-1.7
2Hp	4000-5600w	1600-2200w	7-10A	1.5-2.3
3Hp	6000-8500w	2200-3300w	10-16A	2.1-3.4
5 Hp	10000-14000w	3500-5800w	6-10A (Three phase)	3.4-6

Note: The above doesn't include the electricity heating power.

⒀The conception of Hp and the general unit conversion
The Hp said by the distributors or the shops usually indicates the power of the compressor of the

air-conditioner. Although the unit "W" is same as the one used for the cooling capacity, they have different practice signification: As we all know 1Hp=735.499W, which stands for the consumption power of the compressor, but the cooling capacity indicates the quantity of heat absorbed from the room by air-conditioner within a unit time. So, somebody may ask: is this against the energy conversation law? The answer is: we shall consider about the energy conversation law in a total air-conditioning system: e.g. the power consumption of the compressor (+other power consumption by fan and motor etc.) + the quantity of heat (e.g. the cooling capacity) absorbed from the room=the ejecting quantity of heat by the (Outdoor part) air-conditioner.

The general units' conversion is as follows:

1Hp (or 1 Horse Power) =735.499W the abbreviation is 735W (British unit Horse Power=745.7W)

1W=0.86kcal/h(Kcal. or Therm)

1kcal/h=3.9683Btu in abbreviation of 4Btu

1W=3.412Btu/h

1cooling ton=13878kJ/h=3330kcal/h=3873W (US cooling ton and Japanese cooling ton)

t Celsius degree (℃)=T absolute temperature (K)-273.16

t Fahrenheit (℉)=9/5t+32(℉)

1Pa=1.02*10-5kgf/cm²

⑭The noise of air-conditioner:

It's not allowed to have the strange noise and vibration when the air-conditioner is running. The regulations with regard to this issue are specified as following:

①The error is permitted by the manufacturer if +3dB(A) in difference with the announced figure (by nameplate, manual or adv. Etc.) of the air-conditioner's noise.

②T1、T2 model air-conditioner shall be tested in the Semi-anechoic Room, There are 2dB(A) can be added to T3, Sound Pressure Level.

③The noise value obtained from the anechoic room must be noted by the letters of "Tested in the overall noise eliminated room".

④The difference between the noise level + interference and the rating noise value shall not less than 10dB (A) when the noise test ongoing.

⑤The ground shall be the reflection surface when there is semi-noise eliminated, and the noise space is consisting of 2 indoor and outdoor rooms.

⑥The measurement to the noise shall be undertaken 30 minutes later after the air-conditioner running normally and when the ambiance temperature reach ±1.5℃ of the rating working status.

⑦The measurement shall be undertaken at the point of 1meter height and 1 meter far away to the front panel of the air-conditioner.

Table1-7 the noise to the sense of the human beings:

20dB	Silence	Broadcasting room with nobody in
30dB	Very quiet	The odium with nobody in
40dB	Almost insensible to the noise	Inside the quiet library
50dB	Feel the noise	The quiet hotel hall
60dB	quite sensible to the noise	The ordinary dining room of the plant

⑮ 3C Certification:
It's the abbreviation of China Compulsory Certification, which is aiming to test and evaluate the electrical safety (and structural safety etc.), the conformity of the electromagnetism compatibility of the products. E.g. the combination of the former Great Wall certification pluses the test of the electromagnetism compatibility. The electromagnetism includes EMS (the sensitivity of the electromagnetism e.g. the resistance performance against the interference of the electromagnetism) and EMI(interference of the electromagnetism); the performance of the EMI mainly includes: 1. the interference to the electrical net; 2 the radial interference through the connecting cable of the electric power source.

⑯CE certificate
This certificate, pushed by the EU, is a safety and quality symbol for certifying the products are in compliance with the specified basic requirement of EU; and used for insure the consumers that the products with this symbol are in conformity with the basic requirement of safety, health and environment. CE is the abbreviation of the EU in Latin language, which also express the meaning of conformity to the requirement of EU.

⑰Environment symbol certification: The materials applied in the production and the recycled are given the conception of environment protection (such as the degradation time's difference of the form packaging and paper packaging and their recycle possibility).

⑱ISO9001 International Quality System Certification:
The evaluation and validation carried out by the third independent attestation agent or institute for verifying the quality system of the plant is in conformity with the ISO 9000 standard, which includes all aspects of the whole process, such as the product design, manufacture, test status, statistic engineering, organization constructions etc., and also require the manufacturer to be in compliance with the requirement of the standard and retain.

⑲ VDE:
A testing and certifying symbol, which can be obtained from the IEC System for Conformity Testing and Certification of Electrical Equipment(CB).The test result of CB is approbated between 43 member countries, and is also accepted by many other non-CB system countries.

Section three the basic structure of the air-conditioner

Air-conditioner is the kind of machine that performs the function of cooling and heating by utilizing the heat-absorbing and heat-releasing consequence caused by the state variation of the refrigerant. Although there are kinds of models, the working theory and the main structuring parts are basically the same. Generally, the air-conditioner consists of the refrigerating system, electric control system

and air system etc., and each of them is composed of different parts. It's necessary to know the specific composition of the air-conditioner before learning it. In this case, we'd like to specify the structure and performance of each parts of the air-conditioner as the following:

1. Refrigerating system parts

The main parts of the refrigerating system of the air-conditioner include: Compressor, heat-exchanging unit (Condenser, evaporator), throttling unit (capillary tubes), brake & valve unit and other auxiliary units. All of these units form a closed refrigerating cycle system after being connected and jointed by copper pipes. The refrigerant stored inside the system complete the cooling and heating cycle depending on the performance of the compressor.

The low-pressure refrigerant gas will be compressed by the compressor and turn into the high temperature and pressure gas, and it will be cooled down and turn into the fluid again after passing through the drying and filtering unit. Such fluid will flow through the capillary tubes and to be throttled and cooled and finally inflood into the evaporator. Inside it, the fluid absorbs the quantity of heat in the air and to be gasified. In this way, the indoor room air will be cooled down and to be brought to the indoor room by the air-delivery system for further cooling down the indoor temperature, then, the fluid refrigerant inside the evaporator will turn into gas again and will be absorbed by the compressor repeatedly. Consequently by this way, the refrigerant keeps circulating between the units of compressor-condenser-capillary tubes-evaporator continuously.

⑴Compressor

Compressor is the power core of the refrigerating cycle system in the air-conditioner. It realizes the refrigeration purpose by the way of raising the temperature and pressure of the low temperature & pressure refrigerant gas it absorbed after being compressed by the compressor and the consequent conversion between the heat and power. In the air-conditioner, the structure of the compressor is usually hermetic, and the electric motor, as the impulsion of the whole unit is airproofed inside a container together with the compressor used for compressing the refrigerant, and the container is filled with the lubricating oil as well as the corresponding lubricating agents mounted. The air compressors of the air-conditioners are divided in three types: Reciprocating type, Rotary type and Scroll type.

①Reciprocating type

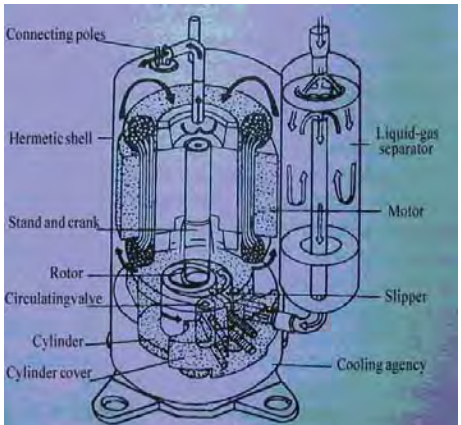
The Reciprocating type compressor mainly consists of cylinder, piston, crankshaft and connecting rod agent. The crankshaft is powered and circumrotates by the electric motor, and push the piston to move up and down inside the cylinder through the connecting rod. Once a cycle completed by the compressor, the crankshaft will turn one round for undertaking the compressing, air discharge, expansion and air absorbing process in turn. The compressor driven by the electric motor keeps continuous running, and the piston runs repeatedly in the cylinder for finally realize the refrigerating cycle. The practicality is as picture 2-1:

② Rotary type

The electric motor of the Rotary type compressor is on its top, and the compressor is at the bottom. The whole cylinder almost soaked in the freezing oil completely. The rotor inside the cylinder rolls on the surface of the cylinder wall with the guide of the *eccentric* shaft. There is a through groove on the surface of the cylinder wall, which contains a slide. The slide cooperates with the rotor precisely in the groove and contacts the outer surrounding surface of the rotor tightly with the impact of the spring so

as to form a dynamic sealing. The dynamic sealing separates the space between the rotor and the cylinder surface to be two parts, one is air inlet antrum, and the other one is compressing antrum. During very rotation of the eccentric shaft, the air will enter inside the inletting antrum and meanwhile the compressing antrum will complete the compressing and the ejecting process accordingly. The main impress of the rotary compressor is a liquid-gas separator (Liquid receiver) attached to the side of the compressor. Please refer to picture 2-2;

Picture 2-1: the figure of the Reciprocating type compressor



Picture 2-2: The figure of the Rotary type compressor

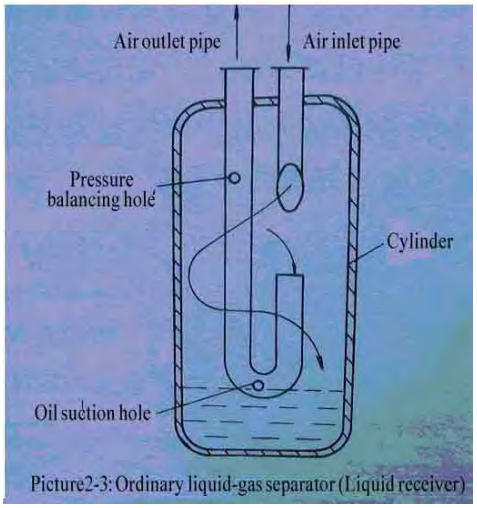
③Liquid-gas separator (Liquid receiver)

In case of the liquid impact caused by the direct entry of the liquid refrigerant to the compressor, the liquid-gas separator is mounted between the evaporator and the compressor of the air-conditioner. The function of the separator is not only a separation of the gas and liquid refrigerant, but also a storage for additional liquid refrigerant produced in the refrigerating cycle. It can automatically adjust the supplying quantity of refrigerant liquid according to the load variety for avoiding the compressor's liquid compression**.** With this function, the gas & liquid separator is also called Liquid receiver.

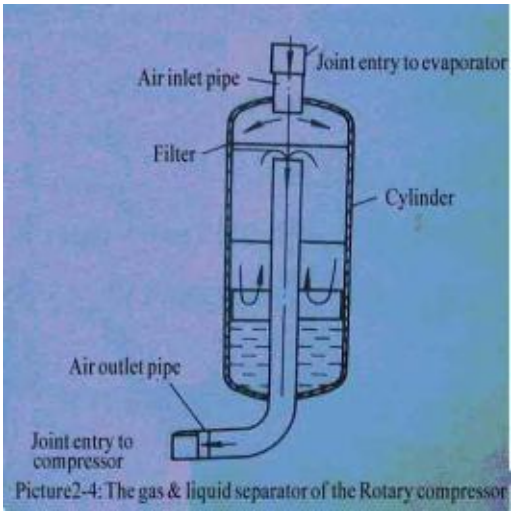
The common gas & liquid separator (Refer to Picture 2-3) consists of the cylinder, air-inlet pipe and "U" air-vent pipe etc. There is an oil-sucking hole at the bottom of the "U" pipe. When the compressor working, the gas and liquid refrigerant come from the evaporator will flow into the gas & liquid separator. The liquid refrigerant falls into the bottom of the cylinder because of gravitation, only the gas refrigerant will be sucked into the compressor. The liquid refrigerant at the bottom of sleeve can only be allowed after being ~~boiled~~ gasified by absorbing heat. The refrigeration oil at the bottom of the cylinder, after being separated from the liquid refrigerant and being located at the above of the liquid, will be absorbed by the compressor by passing through the oil-sucking hole together with the gas. When the compressor stops working, the pressure-balancing hole can prevent the redundant refrigerant of the separator's flowing into the compressor through the oil-sucking hole. This type gas & liquid separator are popularly applied in the heat pump model air-conditioner with To-and-fro type compressor. It can prevent the liquid refrigerant being brought into the compressor at the moment of exchange between heating and refrigeration process.

The structure of the Rotary type separator is as the picture 2-4. It's mainly composed by the straight air-inlet pipe, "J" air-vent pipe and the pole sleeve. There is no connection between two pipes. The separator is connected with the compressor by the air-inlet pipe. The filter net at the entrance of the separator has the function of gas & liquid separating, noisy eliminating and filtering. Passing through the air-inlet pipe, the refrigerant from the evaporator flows into the separator. Therein, the liquid refrigerant that passing through the filter net falls to the bottom of the sleeve, and will climb to the upper of the air-vent pipe until being absorbed by the compressor after being gasified in case of liquid

compression impact to the compressor.



Picture2-3: Ordinary liquid-gas separator (Liquid receiver)

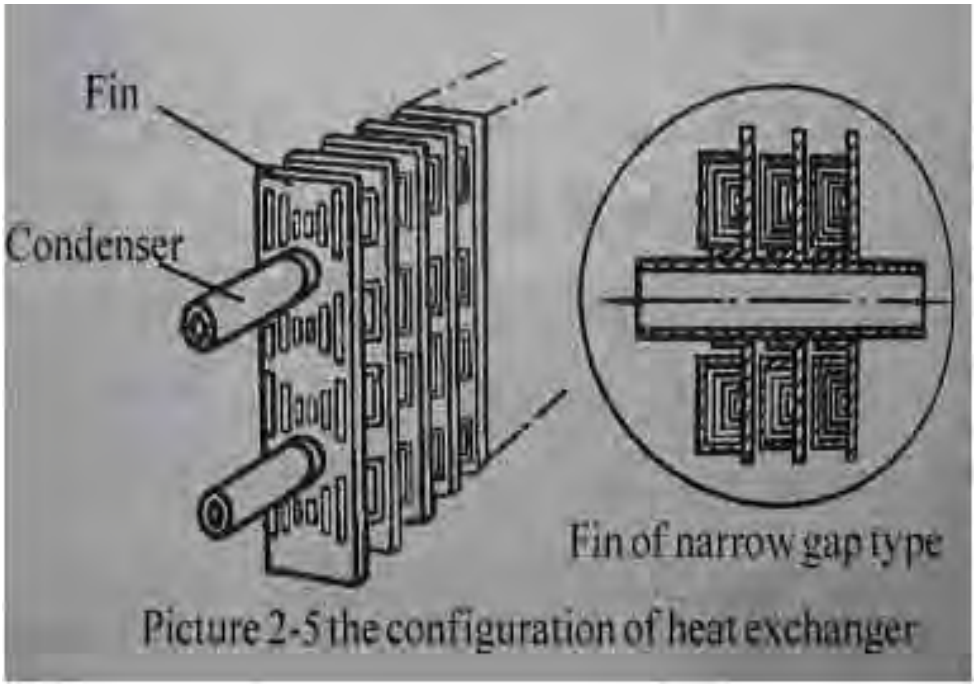


Picture2-4: The gas & liquid separator of the Rotary compressor

④Heat exchanger

The evaporator and the condenser are called heat exchanger. The evaporator gasify and evaporates the liquid refrigerant so as to absorb the heat from outside; on the contrary, the condenser releases the heat to outside so as to low down the temperature of the gas refrigerant and liquefy it. To Cooling only model air-conditioner, the indoor heat exchanger is evaporator and the outdoor heat exchanger is condenser. There are two sets of heat exchanger configured in the Heat pump air-conditioner, one is indoor type, and the other one is outdoor type, both of them are with different function because of the different direction of their flowing circulations. During cooling mode, the indoor heat exchanger acts as the evaporator and the outdoor heat exchanger acts as the condenser; during heating mode, indoor heat exchanger acts as the condenser and the outdoor heat exchanger acts as the evaporator.

The indoor and outdoor heat exchangers are in the configuration of wing coil type mostly. For promoting the efficiency of heat exchange, the patches of aluminum alloy wings are usually punched in kinds of shapes so as to enlarge the heat exchange area, for example of Picture 2-5.



Picture 2-5 the configuration of heat exchanger

a) Evaporator:

Evaporator is also called cooler. It is the apparatus used for direct cooling purpose in the refrigerating cycle and is usually installed inside the indoor unit. The evaporator applied in the air-conditioner is the wing coil type with high heat transmission coefficient and compact structure. The liquid refrigerant flows into the snake copper pipe after the throttle of the capillary tubes. The air around the outside of the copper pipe is the floating air by force. When the compressor works, the wing coil will absorb the quantity of heat from the indoor air so as to have the liquid refrigerant gasified and bring away the quantity of heat for cooling the room temperature. Meanwhile, it can also freeze the surrounding air of the evaporator until its temperature reaches the dew point to get rid of the moisture and humidity of the air.

Due to the continuous production for condensing water between the wings of the evaporator, the distance between the wings is usually required to be enlarged enough (comparing with the one of condenser) for insuring the air's free flow. In addition, the hydrophilic aluminum foil is generally applied for the wing of the evaporator so as to reduce the surface tensile force of the condensing water and quicken the water flowing speed and consequently accelerate the air flowing speed.

b) Condenser

Condenser liquefies the high temperature and pressure gas refrigerant delivered from the compressor. The structure of the condenser in the air-conditioner is basically same as the one of evaporator. When the compressor works, the high temperature and pressure gas refrigerant ejected from the compressor enters into the copper pipe of the condenser through the air-inlet mouth, and turns into the liquid after the heat exchange process undertaken by the outside wings. The condenser usually chooses the air as its cooling medium. However, due to the low heat transmission coefficient of the air, the wings on the copper pipes are used for enlarging the heat exchange area with the air, and the heat transmission ability is also enhanced by the blast of the outdoor fan. To the split type air-conditioner, condenser is assembled and located in the outdoor unit together with the compressor.

For the purpose of enhancing the heat exchange coefficient of the condenser, the number of the wings can be increased or the interval distance between the wings can be shortened. Because there is no condensing water being produced by the wings of the condenser, and there is no much air resistance as the evaporator faces, the distance between the wings can be shortened accordingly. The quantity of heat transferred by the condenser is equal to the sum of the one absorbed by the indoor evaporator and the one occurred during the operation of the compressor. The area of the surface to the common condenser is usually larger than the one of the evaporator in order to promoting cooling capacity for the room.

⑸The throttling component

The refrigerant in the refrigerating system of the air-conditioner has the need for maintaining a certain evaporating and condensing pressure in order to absorb and release the quantity of heat and realize the circulation of the system. The throttling component is the one in controlling the refrigerant and maintains a certain flux. It is the device used in the refrigerating system cycle for accommodating the flux of the refrigerant. It can have the temperature and pressure of the liquid refrigerant at middle temperature and high pressure coming from the condenser dropped, and then send them to the evaporator for obtaining the more evaporating temperature and pressure.

The air-conditioners in different specification have different capacity So, the throttling component in controlling the different flux shall be different. The throttling component type in the general air-conditioner includes the capillary tubes type and expansion valve type. But only capillary tubes applied in the home use air-conditioner because of the small flux it is. The following is the detailed introduction for it.

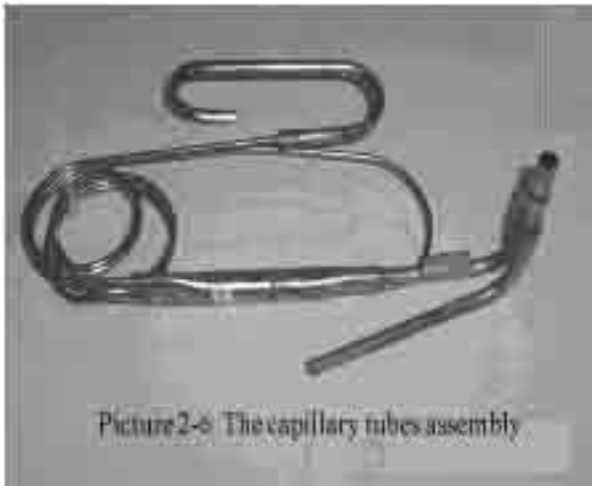
The capillary tube is a slim and long copper pipe with a small aperture. The inner diameter of it is 1mm—2mm, and the length is 500mm—1000mm. With the properties of simple structure, easy machining, low cost and reliability, especially enough capability for the throttling need at a stable indoor room temperature; it's popularly applied in the practice. However, it has a weak accommodating function, which can be workable under a rating working status but can't adjust the flux following with the variety of the load of the refrigeration system.

The capillary tube is a kind of throttling component applied in the refrigeration system. It is welded between the condenser and the evaporator for the function of reducing pressure and throttling flux. It can prevent the liquefied refrigerant at a normal temperature and pressure of the condenser entering into the evaporator directly so as to reduce the pressure of the evaporator in favor of the evaporation of the refrigerant. After stopping the operation of the compressor, it can maintain a balance between the low-pressure part and the high-pressure part for the convenient re-start of the compressor. The resistance will be reduced and the flux of the refrigerant will be increased if enlarging the inner diameter or shortening the length of the capillary tubes, and on the contrary if otherwise. The capillary tubes must match the refrigerating devices and cannot be replaced freely, especially when the inner diameter, the roughness of the inner surface and the length are in difference, it may affect the normal operation of the refrigeration system badly. As the narrowest part of the refrigeration system, the capillary tubes may easily to be jammed. The figuration of the capillary tubes is indicated in the picture 2-6 as the below.

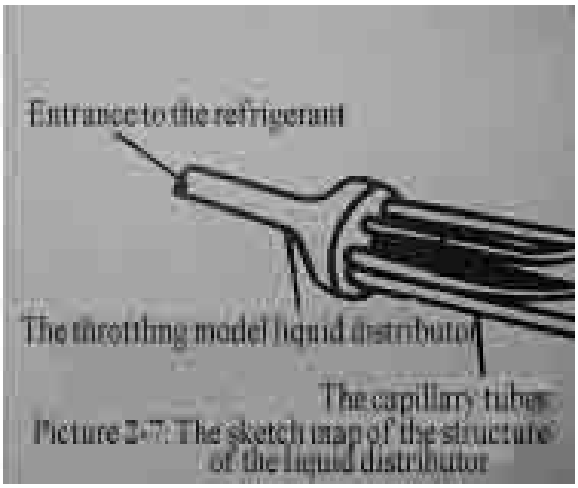
⑹Liquid distributor

To the air-conditioner with a large evaporating surface area, usually, the coil pipes of the evaporator are ranked together side by side. For enhancing the evaporation efficiency, the liquid distributor is in need to be assembled for having the refrigerant enter into the evaporator equably in various routes.

The liquid distributor of the air-conditioner generally consists of a coniform unit body and a throttling nozzle. The refrigerant enters inside through the nozzle and to be guided in different ways following the inner surface of the cone. There are many equally distributed holes at the bottom of the cone, which are connected to the various accesses of the evaporator through the capillary tubes. When the refrigerant flows through the nozzle of the throttling liquid distributor, its flow speed will be accelerated due to the sudden contraction to the section area of the stream, and force the liquid and gas mix together equally to flow into the capillary tubes which connect to the throttling ring. Consequently, the flows will enter inside the various tubes of the evaporator so as to enhance the evaporating efficiency for the evaporator. Refer to the below picture 2-7 of the figure of liquor separator.



Picture2-6 The capillary tubes assembly



Picture 2-7: The sketch map of the structure of the liquid distributor

⑺The stop valve

For controlling the braking of the refrigerant existing in the pipes of the refrigeration system, and switching its flowing direction for the purpose of switching the heating and refrigerating function of the air-conditioner as well as easy service operation, there are various types stop valve units are amounted in the pipelines of the air-conditioner's refrigeration system. The most important includes the electromagnetic reversing valve, single direction valve and cut-off valve etc.

①the electromagnetic reversing valve it's mainly applied in the heat pump air-conditioner. Since there are four main pipelines connect to it regarding to the structure, it is usually called four-way valve. It is used to changes the function of the condenser and evaporator and realize the shift between the air-conditioner's functions of refrigerating, heating or defrosting etc. through the way of changing the direction of the flow of the refrigerant in the system. Refer to the below picture 2-8 for the figure of the electromagnetic reversing valve.

Picture 2-8: the figure of the electromagnetic reversing val

The electromagnetic reversing valve consists of two parts. One is the solenoid guiding valve; the other one is four- way commutating valve. The solenoid guiding valve usually controls the four-way valve by three guiding capillary tubes. The structure is as the above picture:

From the picture, we can see the solenoid guiding valve consists of the valve bowl, spring, iron core and electromagnetic loop, there are four valve bores on the valve body connecting with the guide

capillary tubes. When the loop is not electrified, the iron core and the valve bowl move left by the thrust of the spring. At this moment, capillary tube d and c are contacted (in high pressure), capillary tube a and b are connected (in low pressure), thereby drive the slide of the four- way valve to move left, and the four-way valve E will be connected with S, D will be connected with C。 When the loop of the solenoid guiding valve is electrified, the solenoid field magnetizes the gag bit move right side, and compress the spring for forcing the iron core and the valve bowl move right. At this moment, capillary tube a and d are contacted (in high pressure), capillary tube b and c are connected (in low pressure), thereby drive the slide of the four-way valve to move right, and the four-way valve D will be connected with E, C will be connected with S.

The four-way valve consists of the valve body and four connecting pipes. The connecting pipes are connected separately with the air-inlet and air-outlet tube of the compressor as well as the indoor and outdoor heat exchangers. There are semicircle slide and two pistons with holes in the valve body. Acting as the valve, the slides move horizontally inside the valve body, and have the two connecting pipes at the bottom of the valve body to be connected through the two valve holes being covered by the slide. The other connecting pipe at the bottom connects with the valve body through another valve hole. The piston and the slide connect together by the valve bracket and move together in synchronization.

When the air-conditioner runs the cooling mode, the electricity current to the loop of the solenoid valve shuts off and the iron core drives the valve bowl to move left. Then the capillary tube d connects to c (in high pressure) and a connects to b (in low pressure). Because the capillaries c and d connect with the discharge pipe of compressor, they will form a high-pressure zone being filled with the high-pressure gas. However the capillaries a and b connect with the suction pipe of the compressor, they will form a low-pressure zone. At this moment, the piston moves to the left side by the pressure difference, then, D connects to C, the high-pressure gas refrigerant in D pipe flows into the outdoor heat exchanger (as condenser) for heat transmission process passing through pipe C, and enters into the indoor heat-exchanger (evaporator) passing through capillary tube. Finally, it will enter into pipe S from pipe E and return back to the compressor for concluding a refrigerating cycle. The flow process is indicated in Chart 1:

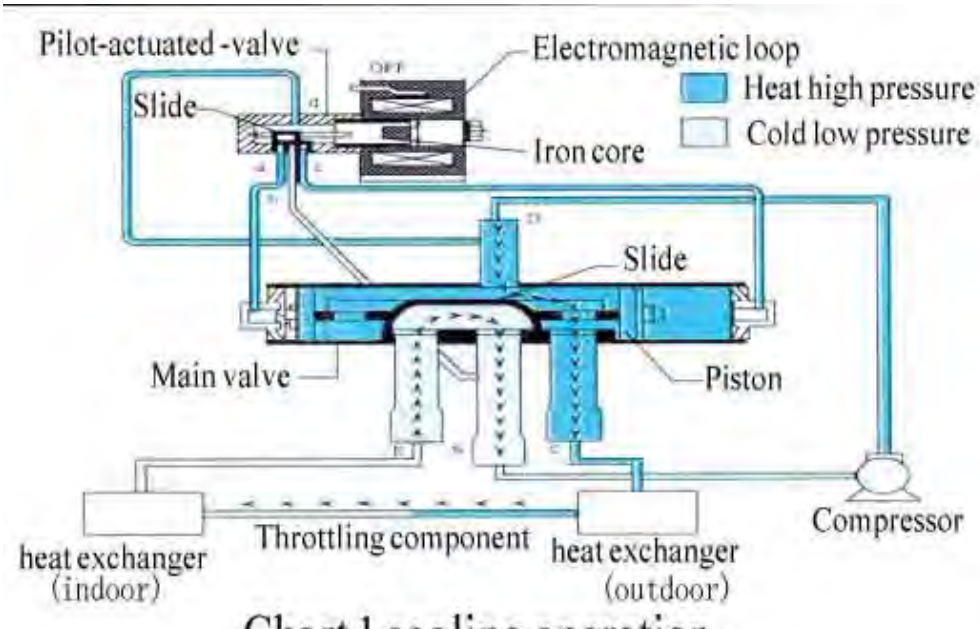


Chart 1 cooling operation

When the air-conditioner runs the heating mode, the loop of the solenoid guiding valve is electrified and the iron core drives the valve bowl to move right. Then the capillary tube a connects to d (in high pressure) and b connects to c (in low pressure). Because the capillaries a and d connect with the discharge pipe of compressor, they will form a high-pressure zone being filledwith the high-pressure gas. However the capillaries b and c connect with the suction pipe of the compressor, they will form a low-pressure zone. At this moment, the piston moves to the right side by pressure, then, D connects to E, the high-pressure gas refrigerant in D pipe flows into the indoor heat exchanger (as condenser) for heat transmission process passing through pipe E, and enters into the outdoor heat-exchanger (evaporator) passing through capillary tube. Finally, it will enter into pipe S from pipe C and return back to the compressor for concluding a heating cycle. The flow process is indicated in Chart 2:

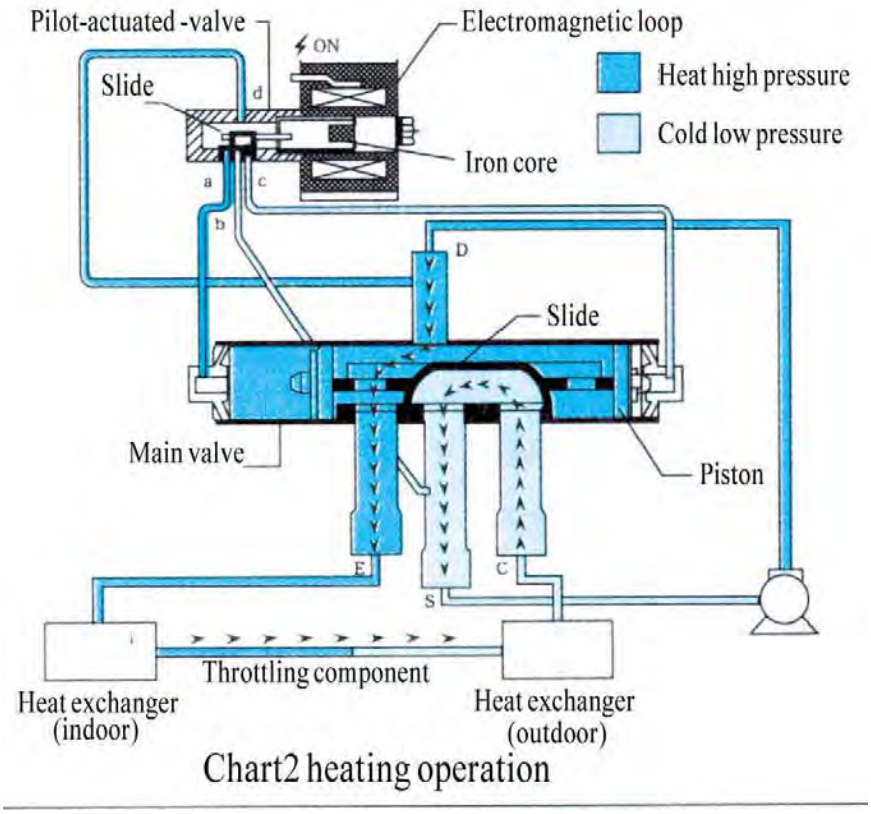


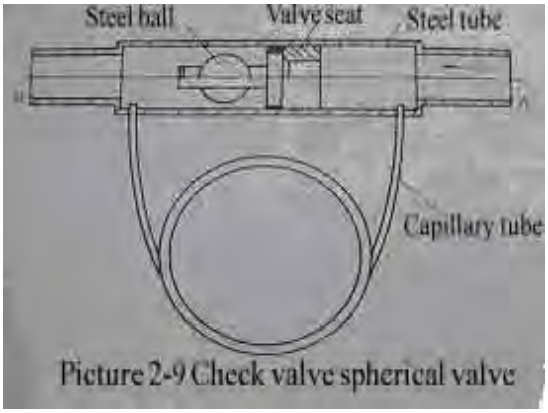
Chart2 heating operation

②one-way Valve

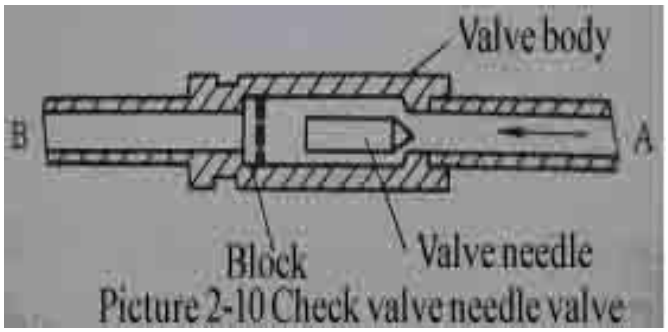
Check valve is also called anti-reverse valve. it permits the refrigerant to flow in only one direction in the refrigeration system, and to be installed in the pipes for preventing process flow from reversing. It is mainly applied in the heat pump air-conditioner and adopted as the assistant to the electromagnetic reversing valve for changing the refrigerant's flow direction and the system's pressure. Generally, there is an arrow marked on the outer surface of the one-way valve for indicating the flow direction of the refrigerant.

The one-way valve is divided into the spherical valve and the needle valve. They are in the simple structure. For example in the below picture, when the refrigerant flows in the direction as the arrow indicates and when the pressure at A side is higher than the one at B side, then the steel ball (or valve needle) moves to the left side, and the refrigerant flows from A to B, the one-way valve opens. However, when the refrigerant flows in a reverse direction and when the pressure at B side is higher than the one at A side, then the steel ball (or valve needle) moves to the right side, which jams the

refrigerant's flow route, and the one-way valve is in close status.



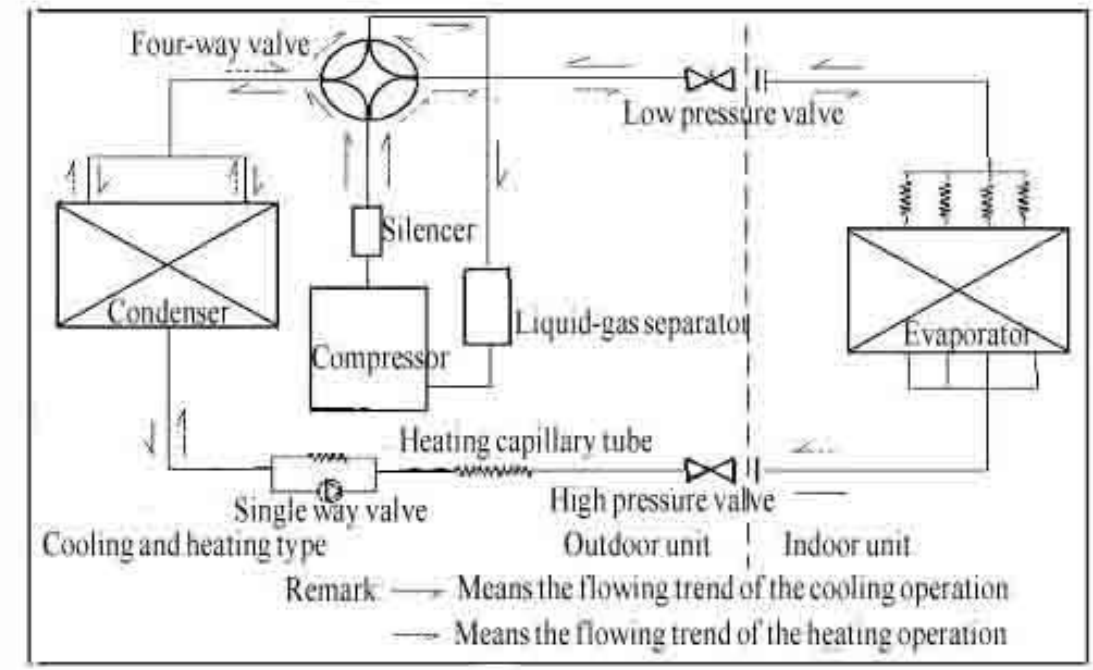
Picture 2-9 Check valve spherical valve



Picture 2-10 Check valve needle valve

It's not reliable to rely on the electromagnetic reversing valve only for controlling the flow direction of the refrigerant due to great disparity existing in the working conditions between the cooling and heating modes of the heat pump air conditioner. Hence, the one-way valve is always applied in the heat pump air-conditioner in order to switch the refrigerant's flow directions safely and effectively as shown in picture 2-11：

In the process of cooling cycle, the difference between the high pressure and the low pressure is small, the main capillary tube is throttling component, and the auxiliary capillary is short circuited by the check valve; In heating cycle, the check valve in parallel connection with the auxiliary capillary tubes is cut off, the refrigerant will flow through the auxiliary capillary, then the throttling components are the combination of the main capillary tubes and the auxiliary capillary tubes so as to strengthen the resistance of the throttling component, enlarge the difference between the high pressure and low pressure of the cycle, reduce the refrigerant temperature of the outdoor heat-exchanger for obtaining more quantity of heat from outside and achieving the heating purpose.



Picture 2-11 The location of the check valve in the refrigerating system

⑻ Stop valve

In consideration of the convenient installation and service, there are two cut-off valves connecting

separately to the joint entry of the gas tube and liquid tube of the outdoor unit of the split type air-conditioner. The cut-off valve is a kind of close valve for pipeline. It controls the pass and stop of the refrigerant flow by manual open-close control valve core. The cut-off valve can be divided into the two-way cut-off valve and three-way cut-off valve according to the structure difference.

① Two-way cut-off valve

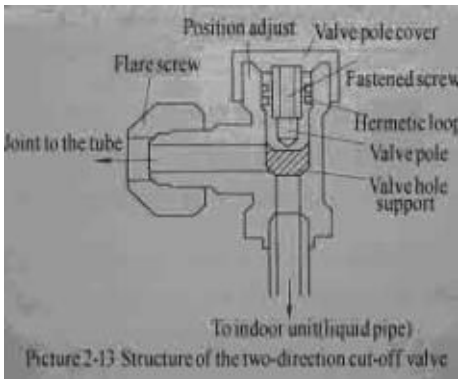
Two direction cut-off valve is used to be installed at the side of the liquid tube, which is belonging to the tubing of the outdoor unit. The practicality is as picture2-12. The two direction cut-off valve consists of the position regulator entry and two vertical cross pipelines. The configuration shown in the picture 2-13 indicates: One of the pipelines connects with the liquid tube side of the outdoor unit, the other one connects with the tubing of the indoor unit through the connecting tube of the indoor and outdoor units. Inside the position regulator entry, there are valve rod and valve hole seat. A graphite cotton rope (or oil-proof rubber) sealing ring is fixed at the middle position of the valve rod and impacts the valve rod by the force of the fastening screw so as to prevent the gas leaking from the valve rod. Before inspection or installation, screw off the copper enveloping cap, and screw off the fastening screw of the valve rod by the inner hexagonal spanner. The attention herein is: If screw off in clockwise direction, the valve rod moves down and the valve hole closes, otherwise, the valve hole opens and the two vertical pipelines get through together.

② Three-way stop valve

In addition to all the above functions of two direction cut-off valve, the three direction cut-off valve owns an extra service entry that provides the convenience for air-conditioner's inspection and service. The tree direction cut-off valve is installed on the gas tube's joint entry of the outdoor unit. It's in a right-angle shape. Despite of two pipes' joint entry and one valve rod position regulator entry, there is an additional service entry. The practicality is as the picture 2-14.

The common three direction cut-off valve is equipped with a valve core, and composed with two pipeline s' joint entry, one regulating entry and one service entry. The four entries are straight as the structure indicated in picture 2-15. The valve core inside the service entry is used for sealing the entry and shall be covered by the dust-proof copper screw cap. When the valve rod moves down to the close position, the tube breaks off from the pipeline of outdoor unit; On the contrary, when the valve rod is screwed off upward to the open position, two connecting tubes get through together and the outdoor unit get through with the indoor unit consequently. When fill in the refrigerant after service, press down the valve core, and the service entry always keep through with the tubing without concerning whether the valve rod is ON or OFF.

Picture2-12 Practicality of two-direction cut-off valve

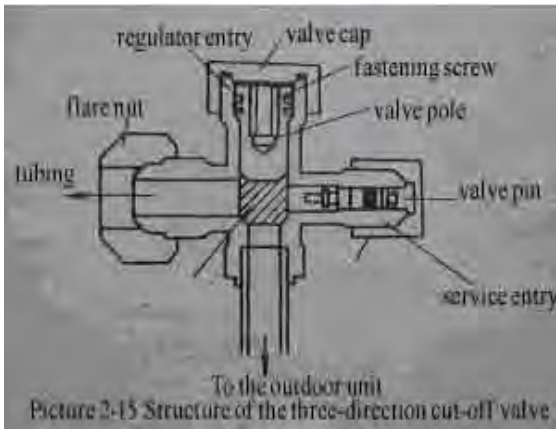


Picture2-13 Structure of the two-direction cut-off valve

⑼Pressure switch

The pressure switch of the air-conditioner is a kind of on-off component that transforms the pressure signal to be the electricity signal so as to control the air-conditioner. It provides a safety protection to the operation of air-conditioner. When installation, fix the pressure switch on the pipeline that in need of supervision and control. The switch's contact points are in series connected with the main controlling loop through the lead cables for controlling the on-off of the compressor. The pressure exerted by the motion of the switch is already fixed on the production line without further adjustment in application period. When the pressure inside the pipeline is abnormal (too high or too low), the flexible film flake will react and regulate the scale of pressure inside the pipeline by separating the standing closed electric contact points through mandril and cut off the controlling circuit.

Picture2-14 Practicality of three-direction cut-off valve

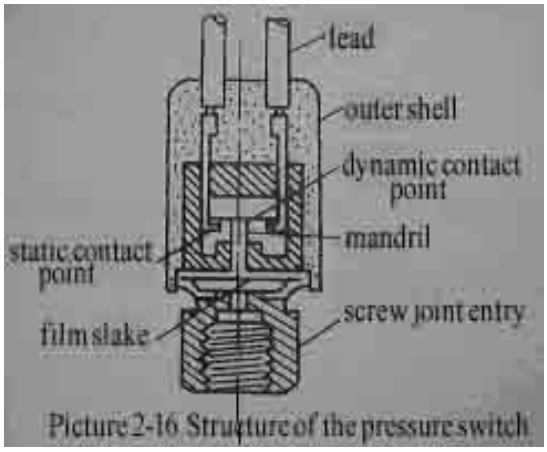


Picture 2-15 Structure of the three-direction cut-off valve

The pressure switch used for the air-conditioner includes two types: high pressure switch and low pressure switch. They are composed of the screw joint entry, thin shell film flake, dynamic contact point, static contact point and mandril etc. Such as the picture 2-16：

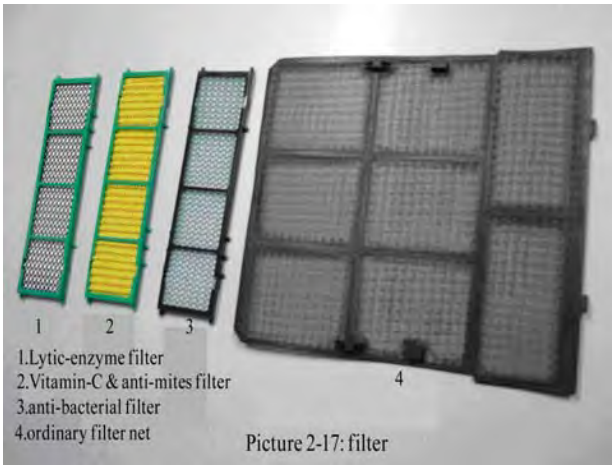
The high pressure switch is fixed at the high pressure side of the refrigerating system. It shuts off the main controlling circuit of the air-conditioner and stops the operation of the compressor in the event of: the dust accumulation on the condenser's wing blocks the air path, or the fan is damaged and the air volume is insufficient, or the refrigerant is overcharged, or the air inside the system causes the over-high pressure inside the pipeline. It will restart automatically after the pressure drops.

The low pressure switch is fixed at the low pressure side of the refrigerating system. It shuts off the main controlling circuit and stops the operation of the air-conditioner for protecting the compressor in the event of: the dust covers the evaporator's wing, or the fan air volume is insufficient, or the refrigerant is insufficient, or the surface of the evaporator is frosted, or the system is blocked, etc., which may cause the low air-sucking pressure at the low pressure side.



Picture 2-16 Structure of the pressure switch

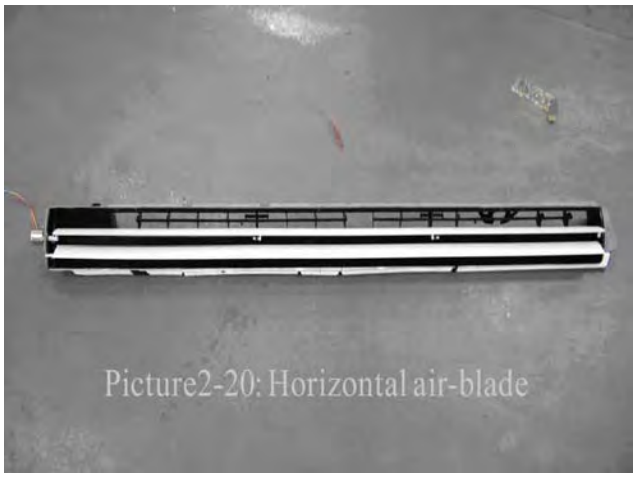
⑽The other parts:



Picture 2-17: filter


Picture 2-18: Indoor plastic enveloping motor


Picture2-19: outdoor iron shell motor


Picture2-20: Horizontal air-blade

Picture 2-21: The step motor of standing air-conditioner

Picture 2-22: The step motor of wall mounted air-conditioner

Chapter 2 Introduction of Pioneer products

Section one the split&wall-mounted type

The basic function introduction of the split wall-mounted type electric-controller (9000BTU~12000BTU):

1. The basic conditions for the operation of the controller

⑴ The applicable voltage range of the electrical power: The input voltage 175 V – 253V;

⑵The input AC current frequency: 50Hz;

⑶The operating temperature for electric controller: （-10~+70）℃;

⑷The operating moisture for electric controller: RH20%~RH90%;

⑸The indoor fan: RP plastic-sealed motor, three impulse feedback signal;

⑹The outdoor fan: tap iron-shell motor, only one speed range and the normal working current shall be lower than 1.5A;

⑺The normal working current of the four-way valve: lower than 1A/220VAC;

⑻The Swing Motor: DC12V, Four phase eight step stepping motor;

⑼Compressor: Single-phase power supply, the normal working current shall less than 15A.

2. Functions of the electric controller

The function of the controller consists of the following parts:

⑴The remote control receiving function;

⑵LED/ Digital displaying function;

⑶Force operation function;

⑷The air vane's automatic swing function and the position setting function;
⑸The buzzer's driving function;
⑹The indoor fan's driving function;
⑺The timing on-off function;
⑻The compressor restarting protection function;
⑼The indoor heat-exchanger overheating protection function under heating mode;
⑽The automatic defrosting and resume function under heating mode;
⑾The anti-cold air function under heating mode;
⑿The anti-freezing function under cooling and defrosting modes;
⒀Self-detecting function.

3. The main functions specification

⑴ The specialty terms and their express:

TA: Stands for the indoor ambiance temperature;
TE: Stands for the indoor evaporator temperature;
TS: Stands for the setting temperature;

⑵ Emergency switch

①The air-conditioner turns off if press on this button when the air-conditioner is working; The air-conditioner turns on if press on this button when the air-conditioner is off, and it will work in an automatic mode after press on this button. Then the indication light twinkles for 20 seconds and the air-conditioner does not start working until the working mode to be selected by the system;

The air-conditioner automatically selects one of cooling, dehumidification, and heating mode as the working mode according to the indoor air temperature.

a) When TA≥TA1, the controller enters into the cooling mode and follows the mode in working. The setting temperature herein is 24℃ and the setting wind speed is strong wind;

b) When TA2<TA<TA1, the controller enters into the dehumidification mode and follows the mode in working. The setting temperature is 24℃ and the setting wind speed is strong wind;

c) When TA≤TA2, the controller enters into the heating mode and follows the mode in working (The cooling only type follows the ventilation mode). The setting temperature herein is 24℃ and the setting wind speed is strong wind;

d) This mode includes the functions of timing, sleeping, /auto-restart (optional), negative ion (optional), I feel（optional）; The system mode will not change along with the variety of the indoor temperature after being selected. The default status of the horizontal air-blade is still. The operation can be adjustable by receiving the remote signal.

② Press this emergency-switch without release at least 5 seconds until the ring of the buzzer rings twice. The controller enters into the trial operation. The trial operation time is 30min:

a) The sensor of the air-inlet temperature doesn't function in the period of trial operation. The compressor starts work after 3min delay protection (The primary running has no 3min safety-guard

protection), the wind speed of the indoor fan is high wind, the running mode is cooling mode, and the wind door is maximum opening.

b) There are no anti-freezing protection and high temperature-preventing protection during trial operation.

⑶Automatic run mode

When controller select an automatic working mode, the indication light twinkles for 20 seconds and the air-conditioner does not start working until the working mode to be selected by the system; The air-conditioner automatically selects one of the cooling, dehumidification, and heating mode as the working mode according to the indoor air temperature .

① When TA≥TA1, the controller enters into the cooling mode and follows the mode in working. The setting temperature herein is 24℃ and the air-conditioner runs according to the setting wind speed;
② When TA2<TA<TA1, the controller enters into the dehumidification mode and follows the mode in working. The setting temperature is 24℃ and the air-conditioner runs according to the setting wind speed;
③ When TA≤TA2, the controller enters into the heating mode and follows the mode in working (The cooling only type follows the ventilation mode). The setting temperature herein is 24℃ and the air-conditioner runs according to the setting wind speed;
④ This mode includes the functions of timing, sleeping, auto-restart (optional), negative ion (optional), I feel（optional）;
⑤The system mode will not change along with the variety of the indoor temperature after being selected. The new working mode will be selected again after air-conditioner turns off or mode switch.

⑷Cooling mode

The setting temperature shall be set by the remote control. The temperature controlling range is 16℃ - 32℃. The setting temperature can be adjusted through the button of "+" "-". The setting wind speed can be adjusted through the button of "wind speed selection" in the selection of the four wind speed types, such as strong wind, high wind, low wind and mute wind. The four-way valve always be closed under this mode. The other action is as following:

① When TA - TS≥1℃，after the compressor meet the 3 minutes delay protection, the compressor and the outdoor fan start running;
② When TA = TS， maintain the previous status;
③ When TA - TS≤-1℃，after the compressor meet the 3 minutes protection condition, the compressor and the outdoor fan turn off;
④ The setting wind speed can be adjusted by the remote control during the ongoing cooling process, and the interior fan still retains working;
⑤ When the status of TE ≤ TE1 last for 10 seconds and the compressor keeps working for above than 5 minutes, turn off the compressor and outdoor fan, the indoor fan keep working according to the setting wind speed; quit from such protection if TE≥ 7℃;
⑥ This mode includes the functions of timing, sleeping, auto-restart (optional), negative ion (optional), I feel（optional）;
⑦ When the cooling ongoing，the button of the "Swing" can control the swing and stop of the horizontal air-blade;

⑧Automatic wind-speed control：

TA - TS≥3℃， wind-speed works in high wind;

TS +1℃≤TA＜TS +3℃， wind-speed works in middle wind;

TA – TS＜1℃， wind-speed works in low wind;

Without 3 minutes delay when the wind speed turns from the high wind from the low wind, otherwise with 3 minutes delay;

⑨Being initially electrified, the compressor doesn't have the 3 minutes extension/delay protection, the outdoor fan starts after 2 seconds of the compressor's start; TS＞TA set by the remote control, the compressor turns off immediately with no need of 3 minutes delay protection;

⑸Dehumidification mode

①The four-way valve always turns off when the dehumidification mode is ongoing. The control range of the temperature is: 16℃ - 32℃.

②Under the dehumidification mode, after the 3 minutes protection conditions being meet satisfactorily, the performance of the compressor and the outdoor fan is as following:

a)TA ≥ TS+2℃， the compressor and the outdoor fan works continuously, the wind speed retains the setting wind speed;

b)TS ≤ TA < TS+2℃，the compressor and the outdoor fan runs for 10minutes and stops for 6minutes，The indoor fan turns off during the compressor's 3 minutes stopping period and keeps on working in breeze mode under other conditions;

c)TA < TS，the compressor and the outdoor fan stop working, and the indoor fan start to work in breeze mode after stopping for 3 minutes；

Automatic wind-speed control：

TA - TS≥5℃， the wind speed is on high wind;

TS +3℃≤TA＜TS +5℃， the wind speed is on middle wind;

TS +2℃≤TA＜TS +3℃， the wind speed is on low wind;

TS≤TA＜TS +2℃， the wind speed is on fitful breeze;

TA＜TS，the indoor fan is off during the 3 minutes delay of the compressor, and 3 minutes later, the wind is at breeze speed.

③The primary electrifying to compressor has no 3 minutes protection delay, the outdoor fan starts 2 seconds later after the start of the compressor;

④When the indoor fan runs, the horizontal air-blade can be set as free swing, and the swing condition is same as the one under cooling mode；

⑤When TE ≤ TE1 last for 10seconds and the compressor runs continuously for above 5minutes，if turn off the compressor and outdoor fan, the indoor fan runs at the setting wind speed; If TE ≥ 7℃，quit the protection；

⑥This mode includes the functions of timing, sleeping, auto-restart (optional), negative ion (optional), I feel（optional）.

⑹Ventilation mode

Under ventilation mode, the outdoor unit is always off, and the indoor fan runs according to the default wind-speed. The remote control can be set with three types wind-speed, e.g. high fan, low fan and silent fan except the strong fan; The operation condition of the air door is same as the one under the refrigeration mode; The mode includes the function of timing, auto-restart (optional), negative ion (optional), I feel（optional）.

⑺Heating mode

The default temperature is determined by the remote control and to be within the range of 16℃ - 32℃, which can be adjusted by the button of "+" and "-". Press the button of "fan speed selection" for choosing the wind speed from the four gears of strong fan, high fan, low fan and mute fan. The other conditions are as following, when:

①TA-3-TS≤-1℃，if after three minutes delay time as for protection purpose, the compressor and the outdoor fan start, the indoor fan works in cold-wind prevention condition, the TA shown on the digital display has 3℃ temperature compensation.

②TA-3-TS≥1℃，if the compressor last continuously running for 3minutes, the compressor and the outdoor fan stop, the indoor fan keeps on working under anti cold-wind condition. The TA shown on the digital display has 3℃ temperature compensation.

③TA-3=TS，retain the previous status；

④Automatic wind speed control, when:

TA ＜ TS，wind speed in high fan；

TS ≤ TA＜TS +2℃，wind speed in middle fan；

TA ≥ TS + 2℃，wind speed in low fan；

When wind speed turns from the low fan to high fan without 3 minutes protection delay; wind speed turns from the high fan to low fan with 3 minutes protection delay；

⑤When the heating process is ongoing, the button of the "Swing" can control and stop the swing leaves; When swing works freely, the maximum angle of the swing leaves is 50°e.g. the swinging status between 3-5 (refer to picture 3);

⑥There is no 3 minutes' delay protection for electrifying the compressor initially. The compressor starts 10 seconds later after the start of the four-way valve. The outdoor fan starts 2 seconds later after the start of the compressor; Low down TS to be ＜TA-3，then the compressor turns off immediately without the restriction condition of 3 minutes protection delay;

⑦The mode includes the functions of timing, sleeping, auto-restart (optional), negative ion (optional), I feel（optional）

⑧The four-way valve starts immediately once being electrified.10 seconds later the compressor starts; Under the compressor opening condition, the four-way valve shuts off after 2 minutes and 50 seconds delay protection when turn off or switch the controller; The four-way valve turns off immediately after turning off the controller when the compressor is off;

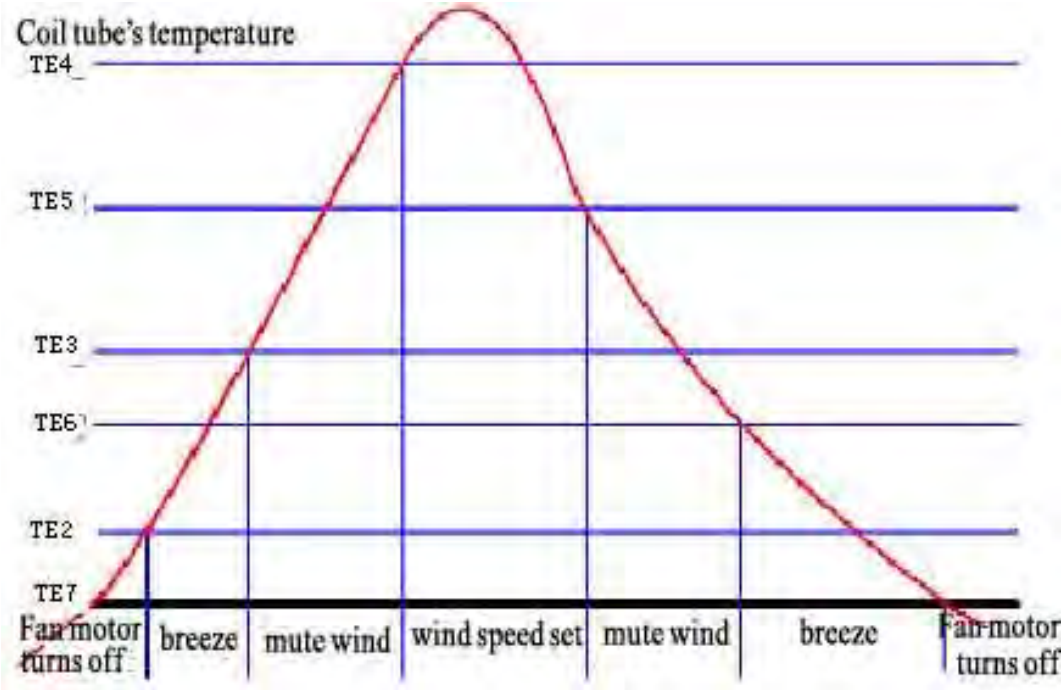
⑨Anti cold-wind and Residual-heat Removing function:

TE controls the wind speed of the indoor fan, and the specific conditions are as below:

●The anti cold-wind status when the compressor runs:

a) When TE in rise status and at the moment of TE＜TE1，the indoor fan turns off；TE2≤TE＜TE3，the indoor fan blows the breeze; TE3≤TE＜TE4，the indoor fan blows the mute wind; TE≥TE4，the indoor fan blows the set wind speed;

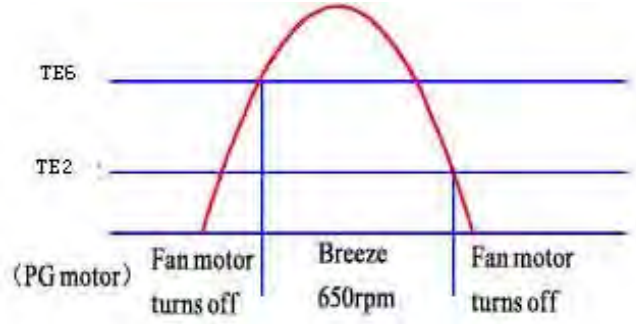
b)When TE in fall status and at the moment of TE＞TE5，the indoor fan blows the set wind speed; TE6＜TE≤TE5，the indoor fan blows the mute wind；TE7＜TE≤TE6，the indoor fan blows the breeze；TE≤TE7，the indoor fan turns off.



●The anti cold-wind status when the compressor stops working:

a）When TE is in fall status and at the moment of TE＞TE2，the indoor fan blows breeze；at the moment of TE≤TE2，indoor fan turns off；

b）When TE is in rise status and at the moment of TE≥TE6，the indoor fan blows breeze；at the moment of TE＜TE6，indoor fan turns off；



●The residual-heat Removing function：

When TE＞TE8，the indoor fan runs in breeze，if ≤TE8，the indoor fan stops working, and the time in removing residual heat ≤10seconds，Within the 10 seconds of residual heat removing, if TE< TE8, the

indoor fan stops immediately.

⑩Overheated protection：
a)When heating function runs，if TE≥TE9 and last for 10seconds，the outdoor fan stops；if TE≥TE10 and last for 10seconds, then stop the compressor； When TE< TE11 and after the 3 minutes protection delay, the compressor resumes normal working.

b）.This temperature protection is valid only when the TE temperature sensor runs normally.

⑻The auxiliary electric heating function
①The electric heating function may not start unless the heating mode runs normally e.g. the compressor starts, the outdoor fan runs, the four-way valve is electrified, the indoor fan is on as well as the availability of the below conditions:

a)TE < TE12；
b)TA < TA3；
c)TS – TA ≥ 3℃；
d)The compressor runs continuously in heating mode for 4min；

②The auxiliary electric heating may withdraw working if meet one of the below conditions:

a)TA > TA3；
b)TS – TA < 2℃；
c)TE > TE11；

③If one of the compressor, four-way valve and indoor fan doesn't work or there is error feedback from the indoor fan, the auxiliary electric heating withdraw from work;

④If the sensor of TE is damaged and the turn-off without non-electricity occurred in the ongoing auxiliary electric heating process, the indoor fan turns in the low speed wind operation for 40 seconds and stops；

⑼ Intelligent defrosting function
①Under the operation of the intelligent defrosting mode, the air-conditioner starts the defrosting process if satisfying the requirement of one of the below five conditions (the sub-conditions included shall all be satisfied). During the defrosting process, the sleeping light is twinkling:

- a) The outdoor fan starts the overloading protection and the outdoor fan stops;
  b) Restart the outdoor fan after stop and the continuous running time over than 10 minutes;
  c)The accumulated operation time of the compressor ≥45min；
  d)The continuous operation time of the compressor≥20min；
  e)TE ≤ TE12。

- a) After the 5 minutes operation of the heating mode or 5 minutes later after the defrosting process, starts the capture motion for the max. difference value between TE and TA, when the difference between TE and TA being reduced up than X min and the time lasts≥3min；
  b)The continuous operation time of the compressor≥5min；
  c)The accumulated operation time of the compressor≥45min；
  d)TE ≤ TE12；

Note：When the wind speed correction available, if the wind speed of the indoor fan drops by one gear,

the temperature difference correction value shall be -1℃， if the wind speed of the indoor fan rises by one gear, the temperature difference correction value shall be +1℃.

- a)The accumulated operation time of the compressor≥3hour；
  b)The continuous operation time of the compressor≥20 minutes；
  c) The difference value between TE and TA less than Y℃.

- a） The difference value between TE and TA less than Y℃ and continuously last for 5minutes；
  b)The accumulated operation time of the compressor is over than 45minutes；
  c)The continuous operation time of the compressor is over than 20minutes；

The air-conditioner starts the defrosting process if satisfying the conditions, and records the TE value then before defrosting starts. Compare the TE value after defrosting with the one before defrosting, if the value of the later is not 3℃ more than the former one, it will not start the defrosting process according to this condition until the mode conversed and the air-conditioner to be restarted for heating or after another defrosting process;

●The air-conditioner starts time counting after overheating protection delay (the outdoor fan stops) and starts an force defrosting process two hours later.

②The intelligent defrosting process quit if satisfying one of the below four conditions:

a)The duration of the intelligent defrosting process≥9min；
b)After the 4 minutes defrosting process，if TE≥0℃ and the TE rise by 2℃ within 10seconds；
c)After the 5 minutes defrosting process，if TE≥5℃；
d)Test the current of the compressor 1 minute later after compressor starts, When the current of the compressor ≥6A（3.2Kw、3.5Kw wall-mounted unit require the current of the compressor≥8A） and continuous lasts for 5 seconds.

⑽The sleeping control function

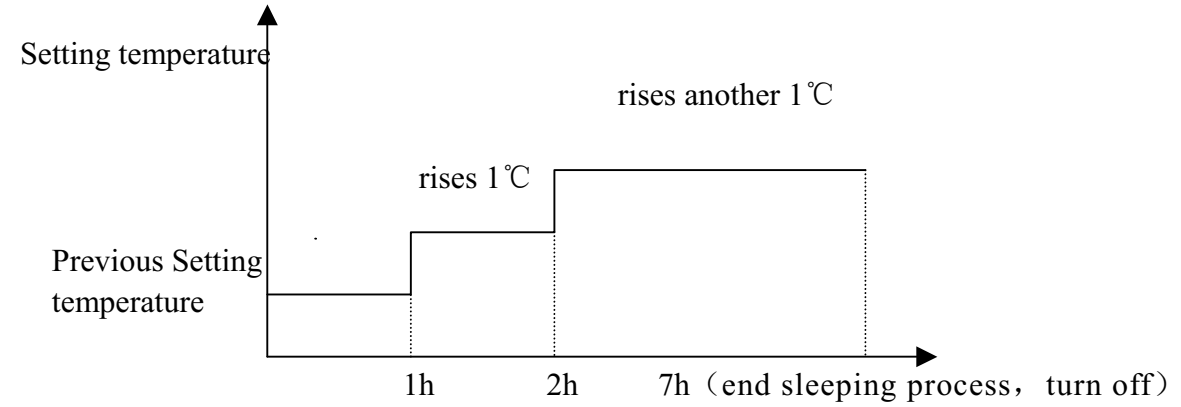
①The sleeping control function is valid during the automatic, cooling, dehumidifying and heating mode. The wind speed of the indoor fan falls by one gear after starts the sleeping control function and the sleeping indication lamp on;

②Press the button of “sleeping” and start the sleeping process. The default temperature rises by 1℃ to the ongoing cooling mode after 1 hour running; the default temperature falls by 2℃ to the ongoing heating mode after 1 hour running; after another 1 hour running, the default temperature for the ongoing cooling process rises by 1℃ and falls by 2℃ for the ongoing heating process. The sleeping process last for 7 hours until power-off.

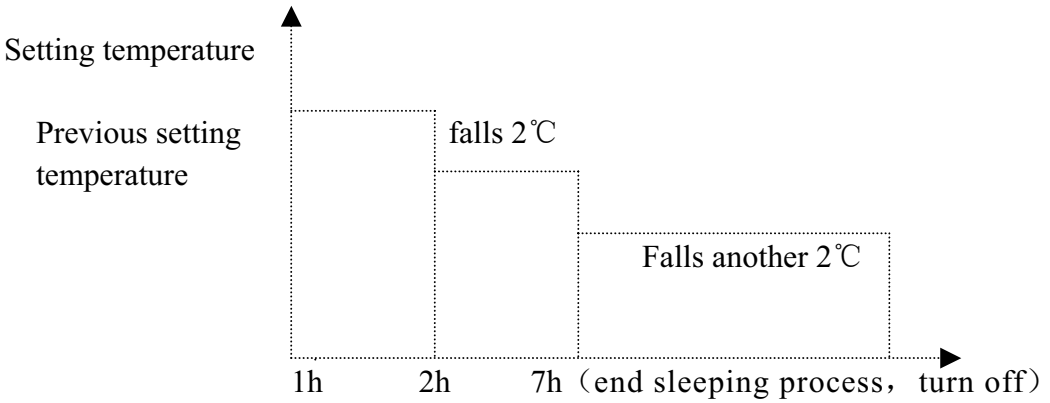
③The modes switch function is still valid after enter into the sleeping process, but will quit after modes switched. The air-conditioner runs at the temperature value of “new default temperature + correction temperature” if press the button of temperature “+”.

④Under the sleeping status, press the button of “sleeping” again or press the modes option and on-off button to quit sleeping function and end the sleeping process.

The sleeping process under cooling mode:



The sleeping process under heating mode:



⑾**Timing control function**

①The longest Timing time is 24 hour and to be counted per minute, single timing method，the timing function will not be cancelled due to the modes changed, and the timing indication light on after completing the timing setting.

②Timing power-off：The timing power-off function can be set only under the working condition of the air-conditioner. The timing range is 1min-24h，and the air-conditioner turns off automatically once the time is over.

③Timing power-on：The timing power-on function can be set only under the working condition of the air-conditioner. The timing range is 1min-24h，and the air-conditioner turns on automatically once reaching the time.

④The restart and power-off motions happen after completion of the Timing setting will cause the automatic cancellation of the previous timing and sleeping setting function.

⑿**Self-detecting function**

Press the Emergency button and electrify the air-conditioner, the self-detecting process starts after twice short buzz from buzzer:

Start the electric heating, run the indoor fan at a high fan speed, open the air door to be the maximum →the digital display and three indicating light on in 1 second→ digital displays “11”、“22”、“33”、“44” in turn and 1second for each of them →Run light on 1 second →Timer

light on 1 second →Sleep light on 1 second →Each phase of the stepping motor's motion in 1 second →the indoor fan runs for 1 second at low fan speed and middle fan speed separately→the compressor's motion for 1 second →The four-way valve's motion for 1 second →Outdoor fan's motion for 1 second →Negative generator's motion for 1 second →buzzer deliver one short tone→Electric heating runs 30 Seconds and stops, then the air conditioner turns into waiting status, the self-detecting function ends.

⑬Fault indication

When there is faults happen to the air-conditioner, the Timer lights on. The control light panel will indicate the corresponding fault codes, which are specified as the following:

FAULT	Digital Display	Phenomenon
PG abnormity	"E4"	AC stopped
TA abnormity	"E1"	AC stopped
TE abnormity	"E3"	AC stopped

After the indoor motor electrified, if there is no impulse signal feedback by the indoor motor detected within 10 seconds, cut off the output voltage supplied to the indoor fan from the controller. After 30seconds waiting time, re-electrify the indoor fan. If still has no impulse signal feedback by the indoor motor being detected within 10 seconds, the controller stays in waiting and the digital display indicates the corresponding fault code is E4.Turn off the air-conditioner by remote control, and the fault display will not show.

⑭The definition to swing angle of the air door

Picture 3 shows the swing angle of the step motor of E series wall-mounted type air-conditioner under 4.8kW (Except 4.8 kW);

① Once being electrified, the air door effect a motion of total closed, and the swinging speed is 22°/s;

② After the air-conditioner turns on, the air door effect a motion of total opening, and swing to the corresponding primary position. The primary position for heating mode is the position 5(Picture 3), for cooling mode is the position 2 (Picture 3).

③ The air door "Swing" on the remote control can set the swinging mode to be automatic swing or hand swing;

④ The maximum swing angle of automatic swing under heating mode is 50°，e.g. the angle between position 3-5 in picture 3； the angle under cooling mode is 50°e.g. the angle between position 2-4 in picture 3； The swinging speed is 5.5°/s;

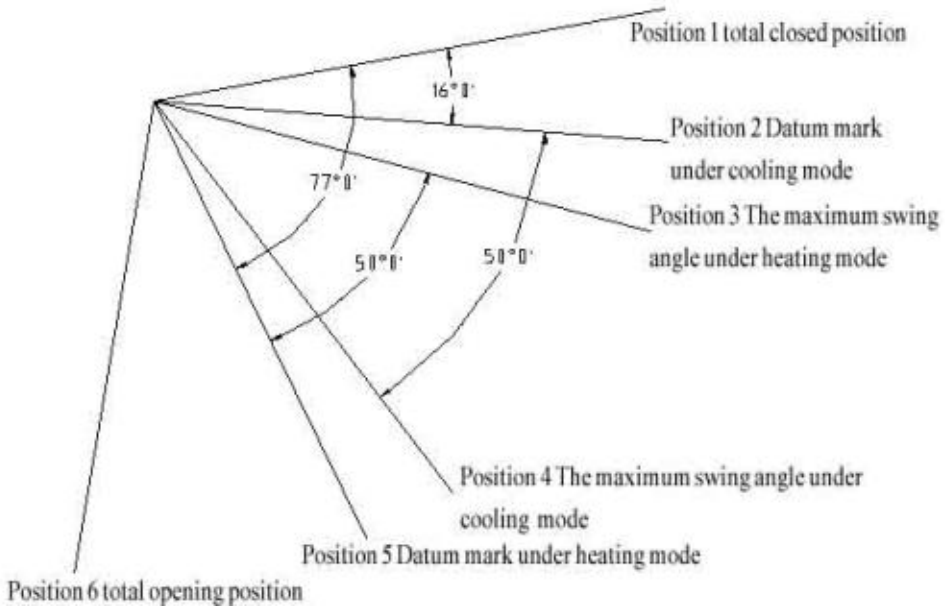
⑤After the air-conditioner being turned on and electrified, if the air door is not set "Swing", the swing angle will swing to the corresponding position according to the different modes. For example: the corresponding position under cooling mode is position 2(Picture 3), heating mode is position 5(Picture 3). The air door resumes the automatic swing after the fan starts. If the setting swing mode is hand

swing, the swing angle will never change;

⑥After turning off the air-conditioner and stopping the running of the indoor fan, the air door shut off automatically;

⑦Enter into the automatic mode by pressing the Emergency button, the air door opens after the setting mode of the system starts. Before the starting of the setting mode, the air door parks at the datum mark of cooling mode.

The below picture shows the swing angle of E type:



Picture 3

⑮The wind speed selection function

The resistance value of the wind speed option is as below:

High Fan	R24	Middle Fan	R28	Low Fan	R26
1330	1.2K	1250	1.2K	1100	1.2K
1280	3K	1200	3K	1050	3K
1230	5.1K	1150	5.1K	1000	5.1K
1180	8.2K	1100	8.2K	950	8.2K
1130	12K	1050	12K	900	12K
1080	20K	1000	20K	850	20K
1030	36K	950	36K	800	36K
980	82K	900	82K	750	82K

Note: The mute wind speed under heating mode is 850r/min. and 800r/min for non-heating mode. The breeze speed is 650r/min.

The controller added the function of high efficient wind speed, which bases on the previous strong fan plus 100r/min.

⑯Optional functions

The below functions' program are already write into the Main chip of the PCB and to be performed if being equipped with the corresponding hardware. For example, the "Auto-restart" function shall be

equipped with the corresponding E^2 main chip, the "I feel" function shall be equipped with the corresponding remote controller, and the "Negative ion" shall be equipped with the corresponding relay.

①Auto-restart control function

a)The setting method for Auto-restart function: After the controller being electrified, press the sleeping button on the remote control for 10 times within 5seconds towards to the controller, later, if the Auto-restart function is successfully set, there are four sounds delivered from the buzzer; If the Auto-restart function need to be cancelled, press the sleeping button of the remote control for 10 times within 5seconds towards to the controller, later, if the Auto-restart function is successfully cancelled, there are two sounds delivered from the buzzer otherwise there is no sound;

b) The contents memorized by the Auto-restart function are: operation modes, setting wind speed, setting temperature, negative ion function, swing status and on-off condition.

c) After the setting of non-electricity memory function succeeds, when the non-electricity event happens after turning off the air-conditioner normally, if re-electrify and turn on the air-conditioner, there is no 3 minutes protection delay occurred to the compressor; when the non-electricity event happens accidentally under the power-on status, if re-electrify and turn on the air-conditioner, there is 3 minutes protection delay occurred to the compressor;

d) If the setting of sleeping and timing functions occurs before the non-electricity event after air-conditioner owns the Auto-restart function, the default condition of the controller is power-off status after being electrified again.

②I feel function

a)The setting method for I feel function: Press the "I feel" function button on the remote controller, the controller will effect the I feel function once receiving the signal, and the controller herein will default the temperature value of the sensor on the remote control as the previous TA of the controller（Except the defrosting case）;

b) The quitting method for the I feel function:

- Press the I feel function button, the former I feel function setting will be cancelled at once;
- Position the remote controller towards to the receiving window of the controller, the remote control may deliver the signal to the controller every 3minutes. If the controller fails to receive the signal from the remote control, the I feel function will be automatically cancelled, and the TA control the temperature according to the temperature value detected by the TA sensor of the PCB.

c) When the I feel function starts, the controller doesn't test the former TA sensor on the PCB.

③Negative ion function

When the indoor fan is working, press the negative ion function button on the remote control, and the negative ion relay in the controller turns on for starting the output of the negative ions; When the negative ion function is on, press the negative ion function button on the remote control, and the negative ion relay in the controller turns off for stopping the output of the negative ion;

Ⅲ.The basic function introduction of the split wall-mounted type electric controller

(18000BTU~24000BTU)

1. The basic conditions for the operation of the controller

⑴The applicable voltage range of the electrical power: The input voltage 175 V – 253V;
⑵The input AC current frequency: 50Hz；
⑶The operating temperature for electric control: （-10~+70）℃;
⑷The operating moisture for electric control: RH20%~RH90%;
⑸The indoor fan: RP plastic-sealed motor, three-impulse feedback signal;
⑹The outdoor fan: tap iron-shell motor, only one speed and the normal working current shall be lower than 1.5A;
⑺The normal working current of the four-way valve: lower than 1A/220VAC;
⑻The Swing Motor: DC12V, Four phase eight step stepping motor;
⑼Compressor: Single-phase power supply, the normal working current shall less than 20A.

2. Partition of the controller's function

The function of the controller consists of the following parts:
⑴The remote control receiving function;
⑵Force operation function;
⑶The air vane's automatic swing function and the position setting function;
⑷The buzzer's driving function;
⑸The indoor fan's driving function;
⑹The timing on-off function;
⑺The compressor restarting protection function;
⑻The indoor heat-exchanger overheating protection function under heating mode;
⑼The automatic defrosting and reheating function under heating mode;
⑽The anti-cold air functions under heating mode;
⑾The anti-freezing function under cooling and defrosting modes;
⑿Self-detecting function

3. The Specification of the main function

⑴he specialty terms and express:

TA: stands for the indoor ambiance temperature;
TE: stands for the indoor evaporator's temperature;
TS: stands for the setting temperature;
TW: stands for the outdoor condenser's temperature;

⑵Emergency switch

①The air-conditioner turns off if press on this button when the air-conditioner is working; the air-conditioner turns on if press on this button when the air-conditioner is off, and it will work in an automatic mode after press on this button. Then the indication light twinkles for 20 seconds and the air-conditioner does not start working until the working mode to be selected by the system; the air-conditioner automatically selects one of the cooling, dehumidification, and heating mode as the working mode according to the indoor air temperature.

a) When TA≥27℃, the controller enters into the cooling mode and follows the mode in working. The setting temperature herein is 24℃ and the setting wind speed is strong wind;

b) When 20℃< TA < 27℃, the controller enters into the dehumidifying mode and follows the mode in

working. The setting temperature is 24℃ and the setting wind speed is strong wind;

c) When TA≤20℃, the controller enters into the heating mode and follows the mode in working (The cooling only type runs with the ventilation mode). The setting temperature herein is 24℃ and the setting wind speed is strong wind;

d)This mode includes the functions of timing, sleeping, auto-restart (optional), negative ion (optional), I feel（optional）; The system mode will not change along with the variety of the indoor temperature after being selected. The default status of the horizontal air-blade is still. The operation can be adjustable by receiving the remote signal.

Press this force on-off button without release at least 5 seconds until the ring of the buzzer rings twice. The controller enters into the trial operation the trial operation time is 30min:

●The sensor of the air-inlet temperature doesn't function in the period of trial operation. The compressor starts work after the 3min delay protection (The primary electrifying has no 3min delay protection), the wind speed of the indoor fan is high wind, the running mode is cooling mode, and the wind door is maximum opening.

●There are no anti-freezing protection and high temperature-preventing protection during trial operation.

⑶Automatic mode

When controller selects an automatic working mode, the indication light twinkles for 20 seconds and the air-conditioner does not start working until the working mode to be selected by the system; The air-conditioner automatically selects one of the cooling, dehumidification, and heating mode as the working mode according to the indoor air temperature .

①When TA≥27℃, the controller enters into the cooling mode and follows the mode in working. The setting temperature herein is 24℃ and the air-conditioner runs according to the setting wind speed;

②When 20℃<TA<27℃, the controller enters into the dehumidification mode and follows the mode in working. The setting temperature is 24℃ and the air-conditioner runs according to the setting wind speed;

③When TA≤20℃, the controller enters into the heating mode and follows the mode in working (The cooling only type follow the ventilation mode). The setting temperature herein is 24℃ and the air-conditioner runs according to the setting wind speed;

④This mode includes the functions of timing, sleeping, auto-restart(optional), negative ion(optional),I feel（optional）;

⑤The system mode will not change along with the variety of the indoor temperature after being selected. The new working mode will be selected again after air-conditioner turns off or mode switch.

⑷Cooling mode

The setting temperature shall be fixed by the remote control. The temperature-controlling range is 16℃ - 32℃. The setting temperature can be adjusted through the button of "+" "-". The setting wind

speed can be adjusted through the button of “wind speed selection” in the selection of the four wind speeds type, such as strong wind, high wind, low wind and mute wind. The four-way valve always is closed under this mode. The other action is as following:

①When TA - TS≥1℃， after the compressor meet the 3 minutes delay protection, the compressor and the outdoor fan start running;

②When TA = TS， maintain the previous status;

③When TA - TS≤-1℃， after the compressor meet the 3 minutes protection condition, the compressor and the outdoor fan turn off;

④The setting wind speed can be adjusted by the remote control during the ongoing cooling process, and the interior fan still retains working;

⑤When the status of TE ≤ 0℃ last for 10 seconds and the compressor keeps working for above than 5 minutes, turn off the compressor and outdoor fan, the indoor fan keep working according to the setting wind speed; Quit from such protection if TE≥ 7℃;

⑥This mode includes the functions of timing, sleeping, auto-restart (optional), negative ion (optional), I feel（optional）;

⑦When the cooling ongoing，the button of the “Swing” can control the swing and stop of the horizontal air-blade;

⑧Automatic wind-speed control：

TA - TS≥3℃， wind-speed works at high wind;
TS +1℃≤TA＜TS +3℃， wind-speed works at middle wind;
TA – TS＜1℃， wind-speed works at low wind;

Without 3 minutes delay when the wind speed turns into the high wind from the low wind, otherwise with 3 minutes delay;
⑨Being initially electrified, the compressor doesn’t have the 3 minutes delay protection, the outdoor fan starts after 2 seconds of the compressor’s start; When TS＞TA set by the remote control, the compressor turns off immediately with no need of 3 minutes delay protection;

⑩When TE ≥ 64℃ and after last for 10seconds, the compressor and the outdoor fan turn off; If meet the 3 minutes delay condition and TE ≤ 62℃, the compressor can start normally. When the air-conditioner is under overheating protection, if the wind speed setting is by hand, the indoor fan unit will run at the setting wind speed; if the wind speed setting is automatic, the indoor fan unit runs at the low fan speed.

⑸Dehumidification mode

①The four-way valve always turns off when the dehumidification mode is ongoing. The control range of the temperature is: 16℃ - 32℃.

②Under the dehumidification mode, after the 3 minutes delay conditions being meet satisfactorily, the performance of the compressor and the outdoor fan is as following:

a)TA ≥ TS+2℃，the compressor and the outdoor fan works continuously, the wind speed retains the setting wind speed;

b) TS ≤ TA < TS+2℃，the compressor and the outdoor fan runs for 10minutes and stops for 6 minutes，The indoor fan turns off during the compressor's 3 minutes stopping period and keeps on working in breeze mode under other conditions;

c)TA < TS，the compressor and the outdoor fan stop working, and the indoor fan start to work in breeze mode after stopping for 3 minutes；
Automatic wind-speed control：

TA - TS≥5℃，the wind speed is at high wind;
TS +3℃≤TA＜TS +5℃，the wind speed is at middle wind;
TS +2℃≤TA＜TS +3℃，the wind speed is at low wind;
TS≤TA＜TS +2℃，the wind speed is at fitful breeze;
TA＜TS，the indoor fan is off during the 3 minutes delay of the compressor, and 3 minutes later, the wind is at breeze speed.

③The primary electrifying to compressor has no 3 minutes protection delay, the outdoor fan starts 2 seconds later after the start of the compressor;

④When the indoor fan runs, the air door can be set as free swing, and the swing condition is same as the one under cooling mode；

a)When TE ≤ -2℃ last for 10seconds and the compressor runs continuously for above 5minutes，if turn off the compressor and outdoor fan, the indoor fan runs at the setting wind speed; If TE ≥ 7℃，quit from the protection；

b) When TE ≥ 64℃ last for 10seconds, the compressor and outdoor fan unit turns off. If meet the 3 minutes delay condition and TE ≤ 62℃, the compressor can start normally. When the air-conditioner is under overheating protection, if the wind speed setting is by hand, the indoor fan unit will run at the setting wind speed; if the wind speed setting is automatic, the indoor fan unit runs at the low fan speed.

⑤This mode includes the functions of timing, sleeping, auto-restart (optional), negative ion (optional), I feel（optional）.

⑹Ventilation mode

Under ventilation mode, the outdoor unit is always off, the indoor fan runs at the setting wind speed, the remote control can set high fan, middle fan and low fan except automatic fan; The performance condition of the air door is same as the one under refrigeration mode; This mode includes the timing function, auto-restart (optional), negative ion (optional), I feel（optional）

⑺Heating mode

The setting temperature can be decided and adjusted by the remote control within the control range of 16℃ - 32℃ through the button of temp. Add "+" and temp. Reduce "-". Press the button "wind speed option" to choose the wind speed among the options of automatic fan, high fan, middle fan and mute fan. The other conditions refer to the following:

⑴When TA-3-TS≤-1℃，if satisfying the 3 minutes protection delay condition for compressor, the compressor and outdoor fan start, and the indoor fan runs in accordance with the anti-cold wind condition.

⑵When TA-3-TS≥1℃，if satisfying the 3 minutes protection delay condition for compressor，the compressor and outdoor fan stop working, and the indoor fan runs in accordance with the anti-cold wind condition.

⑶When TA-3=TS，remain the previous status；

⑷Temperature display has the temperature compensation of 3℃

⑸Automatic wind speed control：

TA ＜ TS，run at high fan speed；

TS ≤ TA＜TS +2℃，run at middle fan speed；

TA ≥ TS + 2℃，run at low fan speed；

There is no 3 minutes protection delay when the wind speed turns to high fan from the low fan; there is 3 minutes protection delay when the wind speed turns to low fan from the high fan;

⑹When heating process ongoing, the button of "Swing" can control the swing leaves to swing or stop；

⑺Being electrified initially, the compressor has no 3 minutes protection delay. The compressor starts 10 seconds later after the start of the four-way valve, and the outdoor fan starts 2 seconds later after the start of the compressor; Set the TS ＜TA-3 by remote control，the compressor stops immediately and without the 3 minutes protection delay;

⑻This mode includes the timing function, sleeping function, auto-restart (optional), negative ion (optional), I feel（optional）.

⑼Being electrified initially, the four-way valve starts immediately ,and the compressor starts 10 seconds later; During the operation condition of the compressor, the four-way valve stops after 2min50s protection delay when stops the air-conditioner or switch mode;

In the case of compressor stops, the four-way valve stops immediately once stopping the air-conditioner；

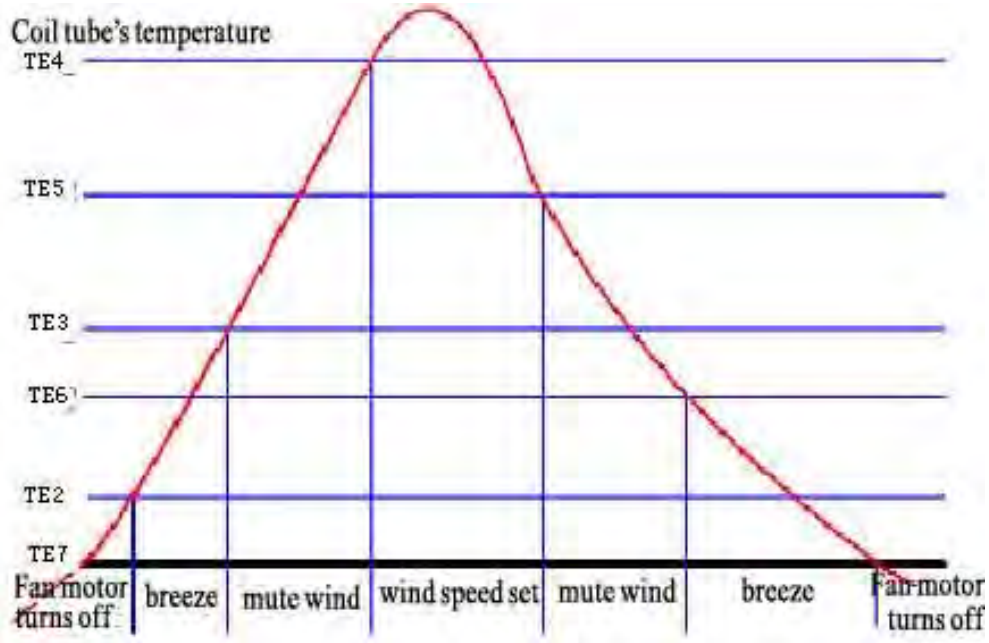
⑽Anti-cooling wind and residual-heat Removing function:

The wind speed of the indoor fan is controlled by TE, and the specific conditions are as below:

Anti-cold wind when compressor runs：

①When TE is in rise status, if Te<30℃,the indoor fan turns off;30℃≤TE＜38℃,the indoor fan runs at low fan speed;Te≥38℃, the indoor fan runs at setting wind speed;

②When Te in fall status, if TE>34℃,the indoor fan runs at the setting fan speed;28℃＜TE≤34℃,the indoor fan runs at the low fan speed;TE≤28℃， the indoor fan turns off.

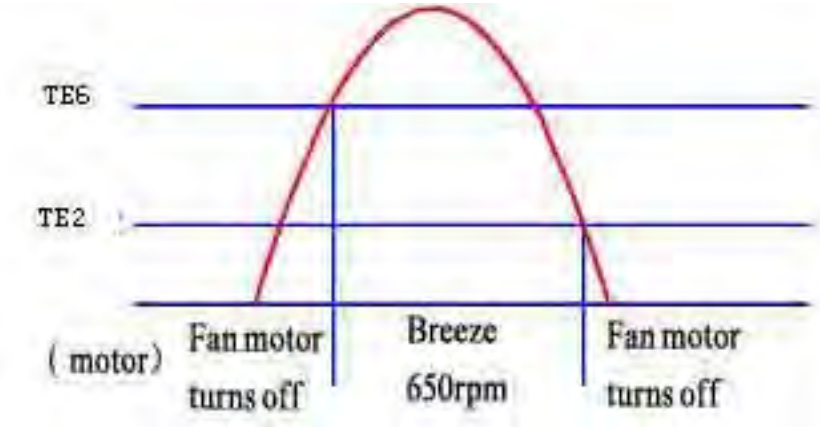


（Picture 1）

Anti-cold wind function when compressor stops：

① When TE is in the fall status, if TE>30℃,the indoor fan runs at low fan speed;TE30≤℃, indoor fan turns off;

② When TE is in the rise status, if TE35≥℃, the indoor fan runs at low fan speed; TE35<℃, indoor fan turns off;



（Picture 2）

Residual-heat removing function after air-conditioner stops：

When TE＞35℃， the indoor fan runs at the low fan speed, if≤35℃,the indoor fan turns off, and air-conditioner stops for starting the process of residual heat removal and last for ≤10seconds, within the 10second of process of residual heat removal, if TE< 35℃, the indoor fan turns off at once.

⑾Anti-high temperature protection：
①when run on Heating mode，if TE≥57℃ and continuously last 10 seconds, the outdoor fan stops; if TE≥64℃ and last for 10s，the compressor stops again； When TE< 52℃ and satisfying 3minutes protection delay condition, the compressor resume normal work.。
②Such temperature protection is valid only if the TE sensor works normally.

⑿The defrosting function under heating mode
①When the outdoor sensor in good condition, the defrosting process starts, and the sleeping light is twinkling：
a)TW≤-6℃ and continuously last for 2minutes；
b)The accumulated operation time of the compressor is over than 50 minutes, the interval time between defrosting process is 50 minutes(the accumulated time shall be recalculated if power off or remote control off), the continuous working time of the compressor is over 5 minutes.

Once the defrosting process starts, the compressor, the indoor fan and outdoor fan turn off, and the four-way valve turns off after 30 seconds, and after another 15 seconds the compressor turns on and starts the defrosting process.

②The defrosting process ending condition：（The defrosting process will quit if one of the below conditions to be satisfied）
a) Outdoor coil≥12℃；
b) Defrosting process last for 12minutes；
c) The defrosting process quits once change modes or air-conditioner turns off by remote control.
After the defrosting process, the compressor turns off and the outdoor fan turns on; After 55 seconds, the four-way valve turns on; after another 5 seconds, the compressor turns on; the air-conditioner resume the normal heating process, the indoor fan runs in the mode of anti-cold wind.

⑻ Auxiliary electric heating function

a)When heating mode working normally, e.g. the compressor starts and the outdoor fan runs and the four-way valve is electrified and the indoor fan starts, the electric heating starts if satisfying the below conditions:
A、TE < 48℃；
B、TA < 22℃；
C、TS – TA ≥ 3℃；
D、The compressor runs continuously for 4 minutes with the heating mode;

②The auxiliary electric heating quit operation if satisfying one of the below conditions：
A、TA > 22℃；
B、TS – TA < 2℃；
C、TE > 52℃；

③If anyone of the compressor, four-way valve and indoor fan doesn’t work or fault feedback from the indoor fan, the auxiliary electric heating quit operation；

④The auxiliary electric heating may be allowed to restart after 1 minutes rest if the auxiliary electric

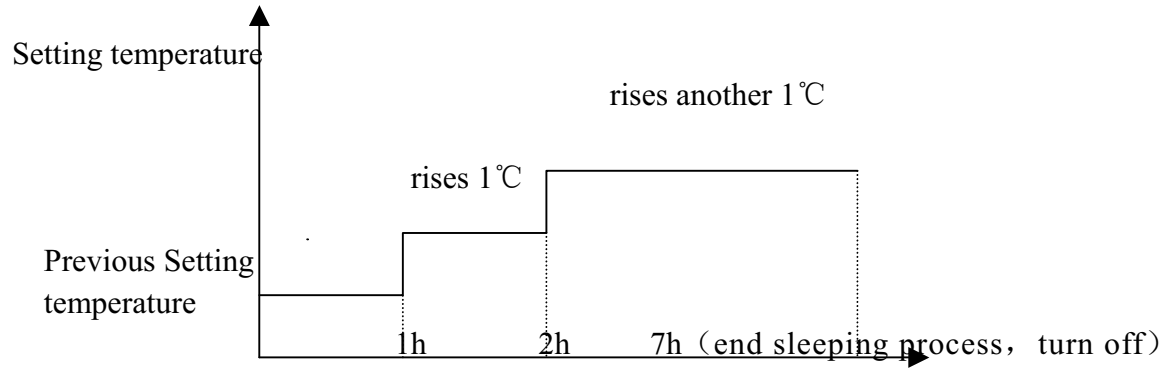
heating quit during the operation process of the compressor.

⑼ Sleeping control function

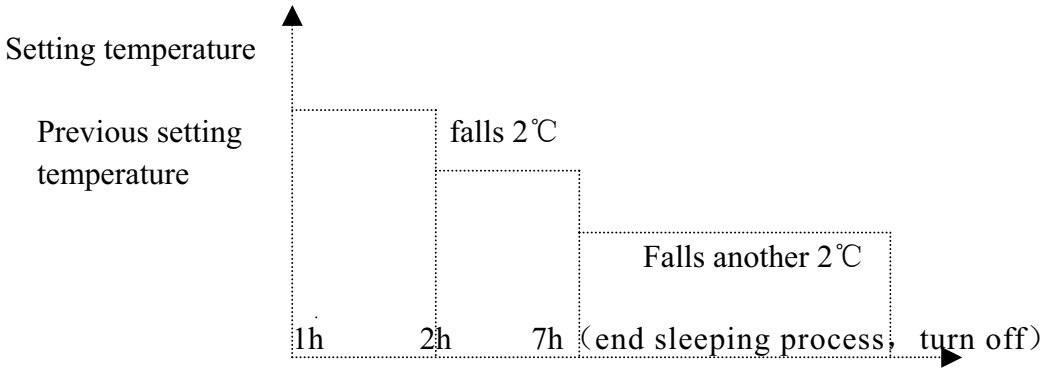
The sleeping function is valid during the automatic, cooling, dehumidifying and heating process. The indoor fan runs at low fan speed during sleeping mode, and the sleeping indication light on;
After turning into the sleeping process by pressing down the button of "sleeping" on the remote controller, to the Cooling process, the setting temperature rises by 1℃automatically one hour later; to the Heating process, the setting temperature falls by 2℃automatically one hour later. After another 1 hour, the setting temperature of the Cooling process raises another 1℃, and the one of the Heating process falls another 2℃. The sleeping process lasts 7 hours until air-conditioner turns off.

During the sleeping process, the mode switching operation is allowed and workable, but it will delete the sleeping function. The air-conditioner will run at the temperature of "new setting temperature + temperature correction" if press the button of add temp."+".Under the sleeping status, if press down the button of "sleeping" or change modes or on-off, the sleeping process will be deleted and ended.

The sleeping process under cooling mode:



The sleeping process under heating mode:



⑽Timing control function

The time range of the Timing control set is 24 hours, and the time unit is minute, single timing mode. The conversion of the modes doesn't cancel the timing function, and the timing indication light turns on after timing setting.

①Timing turns off

The timing turns off function can be set only under the running status of the air-conditioner. The

timing range is 1min.-24hour. The air-conditioner stops automatically once the setting timing reached.

②Timing turns on

The timing turns on function can be set only under the running status of the air-conditioner. The timing range is 1min.-24hour. The air-conditioner turns on automatically once the setting timing reached. The turning on and turning off action happen after setting timing set will cancel the previous set setting timing and sleeping functions

⑾ Self-detecting function

Press the Emergency button and electrify the air-conditioner, the self-detecting process starts after the buzzer delivers short tone twice:

Start the electric heating, run the indoor fan at a high fan speed, open the air door to be the maximum →the digital display and three indicating light on in 1 second→ digital displays "11"、"22"、"33"、"44" in turn and 1second for each of them →Working light on 1 second →Timing light on 1 second →Sleeping light on 1 second →Each phase of the stepping motor moves in 1 second →the indoor fan runs for 1 second at low fan speed and middle fan speed separately→the compressor moves for 1 second →The four-way valve moves for 1 second →Outdoor fan moves for 1 second →Negative ion generator moves for 1 second →buzzer deliver one short tone→Electric heating runs 30 Seconds and stops, then the air conditioner turn into the waiting status, the self-testing is ended.

⑿Fault indication

When there is faults happen to the air-conditioner, the timing lights on the display panel will indicate the corresponding fault codes, which are specifically reflected as the following:

For LED display:

FAULT	DISPLAYMODE	DISPLAY PRIORITY	APPEARANCE
TA abnormity	Timer lamp flash **1** times/8 seconds	2	AC stopped
TE abnormity	Timer lamp flash **2** times/8 seconds	3	AC stopped
TW abnormity	Timer lamp flash **8** times/8 seconds	4	AC hasn't stopped

For Digital display:

FAULT	DISPLAY MODE	DISPLAY PRIORITY	APPEARANCE
TA abnormity	display"E1"	2	AC stopped
TE abnormity	display "E3"	3	AC stopped
TW abnormity	display "E2"	4	AC hasn't stopped

⒀The definition of the swing angle

(Picture 3)It shows the swing angles of the types 18000BTU and 24000BTU stepping motor，the air

door's swing angle of 18000BTU,24000BTU and 7000BTU,12000BTU are same，but the swing directions of the motors are not same.

①Once being electrified, the air door effect a motion of totally closed, and the swinging speed is 1 step/4ms；

②After the air-conditioner turns on, the air door effect a motion of total opening, and swing to the corresponding primary position. The primary position for Heating mode is the position 5(Picture 3), for Cooling mode is the position 2 (Picture 3).

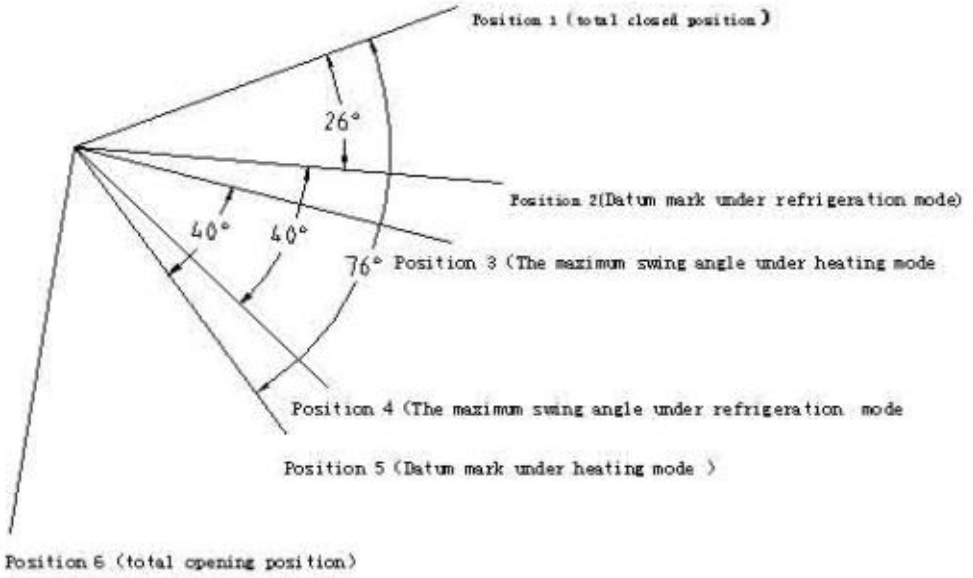
③The "Swing" button on the remote controller can set the Horizontal air-blade to be swing Automatically or not；

④The maximum swing angle of automatic swing under Heating mode is 40°， e.g. the angle between 3-5 in picture 3； the angle under Cooling mode is 40°e.g. the angle between 2-4； The swinging speed is 1step/16ms;

⑤When the indoor fan stops operation, if the setting swinging mode set by the remote control is automatic swinging, the Horizontal air-blade will turn to the corresponding position and to be orientated. For example: the corresponding position under Cooling mode is position 2(Picture 3), for Heating mode is position 5(Picture 3), resume the automatic Swing once the fan motor starts; if the setting swing mode is Manual, the swing angle of the Horizontal air-blade will never change；

⑥After turning off the air-conditioner and stopping the running of the indoor fan, the air door will shut off automatically;

⑦Enter into the Auto-run mode by pressing the Emergency switch, the setting status of the air door is in accordance with the Cooling mode, and will be adjusted again after the new mode is selected. (Picture4)



⑭ Wind speed option function

18000BTU-24000BTU are RP plastic-sealed motor， the rotate speed can not be controlled by the

PCB.

⑮Optional functions

The below functions' programs are already write into the Main chip of the PCB, and can be performed if only the corresponding hardware is available. For example: the E^2 CMOS chip is in need for the Auto-restart function, the corresponding remote control is in need for the I feel function, and the relay is in need for the Negative ion function.

①Auto-restart control function

a)The setting method for Auto-restart function: After the controller being electrified, press the sleeping button on the remote control for 10 times within 5seconds towards to the controller, later, if the Auto-restart function is successfully set, there are four sounds delivered from the buzzer; If the Auto-restart function need to be cancelled, press the sleeping button of the remote control for 10 times within 5seconds towards to the controller, later, if the Auto-restart function is successfully cancelled, there are two sounds delivered from the buzzer otherwise there is no sound;

b) The contents memorized by the Auto-restart function are: operation modes, setting wind speed, setting temperature, negative ion function, swing status and on-off condition.

c) After the setting of non-electricity memory function succeeds, when the non-electricity event happens after turning off the air-conditioner normally, if re-electrify and turn on the air-conditioner, there is no 3 minutes protection delay occurred to the compressor; when the non-electricity event happens accidentally under the power-on status, if re-electrify and turn on the air-conditioner, there is 3 minutes protection delay occurred to the compressor;

d) If the setting of sleeping and timing functions occurs before the non-electricity event after air-conditioner owns the Auto-restart function, the default condition of the controller is power-off status after being electrified again.

②I feel function

a)The setting method for I feel function: Press the "I feel" function button on the remote controller, the controller will effect the I feel function once receiving the signal, and the controller herein will default the temperature value of the sensor on the remote control as the previous TA of the controller（Except the defrosting case）;

b) The quitting method for the I feel function：

- ●Press the I feel function button, the former I feel function setting will be cancelled at once;
- ●Position the remote controller towards to the receiving window of the controller, the remote control may deliver the signal to the controller every 3minutes. If the controller fails to receive the signal from the remote control, the I feel function will be automatically cancelled, and the TA control the temperature according to the temperature value detected by the TA sensor of the PCB.

c) When the I feel function starts, the controller doesn't test the former TA sensor on the PCB.

③Negative ion function

When the indoor fan is working, press the negative ion function button on the remote control, and the

negative ion relay in the controller turns on for starting the output of the negative ions; When the negative ion function is on, press the negative ion function button on the remote control, and the negative ion relay in the controller turns off for stopping the output of the negative ion;

Ⅳ The tech. parameter of part products

1.Parameter of product R22（9000BTU~12000BTU）

Item \ Model				9000 btu A4/E*		9000 btu A4/E*		12000 btu A4/E*		12000 btu A4/E*	
				Indoor	Outdoor	Indoor	Outdoor	Indoor	Outdoor	Indoor	Outdoor
Type				Wall mounted		Wall mounted		Wall mounted		Wall mounted	
Performance	Cooling		KW	2.5		2.5		3.2		3.2	
	Dehumidifying		Kg/h	1.0		1.0		1.2		1.2	
	Heating		KW	–		2.75		–		3.52	
	Air Flow Volume	Cooling	m3/min	7	–	7	–	8.7	–	8.7	–
		Heating	m3/min	–	–	7	–	–	–	8.7	–
	Noise	Cooling	dB	38	50	38	50	40	51	40	51
		Heating	dB	–	–	38	50	–	–	40	51
	Power supply		Φ-V-Hz	1/220-240~/50		1/220-240~/50		1/220-240~/50		1/220-240~/50	
Input	Rated input	Cooling	W	940		980		1250		1250	
		Heating	W	–		980		–		1220	
	Rated current	Cooling	A	4.2		4.35		5.3		5.4	
		Heating	A	–		4.35		–		5.3	
	Input factor	Cooling	%	98%		98%		98%		98%	
		Heating	%	–		98%		–		98%	
	Starting current		A	21.7		21.7		30.5		30.5	
	Power supply cord	Length	m	–	–	–	–	–	–	–	–
		Type		250V 10A		250V 10A		250V 16A		250V 16A	
	Fuse capacity		A	3.15	–	3.15	–	3.15	–	3.15	–
Dimension	dimension	D*W*H	mm	210×745×250	320×818×540	210×745×250	320×818×540	210×745×250	320×818×540	210×745×250	320×818×540
			Inch	–	–	–	–	–	–	–	–
	Net weight		Kg	9.3	29	9.3	30	9.5	35	9.5	36
	Connection pipe	Liquid	OD (mm) *L (mm)	Φ6.35×3600		Φ6.35×3600		Φ6.35×3600		Φ6.35×3600	
		Gas	OD (mm) *L (mm)	Φ9.52×3600		Φ9.52×3600		Φ9.52×3600		Φ9.52×3600	
	Drain pipe		ID (mm) *L (mm)	Φ14×780		Φ14×780		Φ14×780		Φ14×780	
	Compressor	Type		–	Rotary	–	Rotary	–	Rotary	–	Rotary
	Fan motor Motor	Type		–	–	–	–	–	–	–	–
		Rated input	W	–	930	–	950	–	1220	–	1250
	Fan motor	Type		Through-flow fan leaves	Axial-flow fan leaves	Through-flow fan leaves	Axial-flow fan leaves	Through-flow fan leaves	Axial-flow fan leaves	Through-flow fan leaves	Axial-flow fan leaves
	Fan motor Motor	Type		Plastic-sealed	Iron-shell	Plastic-sealed	Iron-shell	Plastic-sealed	Iron-shell	Plastic-sealed	Iron-shell
		Rated input	W	13	25	13	25	19	25	19	25
Heat exchanger(row*line)				2×11	1×22	2×11	1×22	2×13	1×22	2×13	1×22
Refrigerant controller				Capillary		Capillary		Capillary		Capillary	
Freezed oil capacity				–		–		–		–	
Refrigerant/Charge(g)				R22/600		R22/700		R22/680		R22/720	
Protection equipment				–	Inner	–	Inner	–	Inner	–	Inner
Cooling test condition				Indoor unit: DB27℃ Wb19℃				Outdoor unit: DB35℃ Wb24℃			
Heat ing test condition				Indoor unit: DB20℃ Wb --				Outdoor unit: DB7℃ Wb6℃			
Max.Cooling test condition				Indoor unit: DB32℃ Wb23℃				Outdoor unit: DB43℃ Wb26℃			
Max.Heat ing test condition				Indoor unit: DB27℃ Wb --				Outdoor unit: DB24℃ Wb18℃			

Item \ Model				12000btuB4/E*		12000btuB4/E*			
				Indoor	Outdoor	Indoor	Outdoor		
Type				Wall mounted		Wall mounted			
Performance	Cooling		KW	3.5		3.5			
	Dehumidifying		Kg/h	1.3		1.3			
	Heating		KW	-		3.85			
	Air Flow Volume	Cooling	m3/min	8.7	-	8.7	-		
		Heating	m3/min	-	-	8.7	-		
	Noise	Cooling	dB	41	51	41	51		
		Heating	dB	-	-	41	52		
	Power supply		ф-V-Hz	1/220-240~/50		1/220-240~/50			
Input	Rated input	Cooling	W	1300		1300			
		Heating	W	-		1350			
	Rated current	Cooling	A	5.8		5.8			
		Heating	A	-		6.1			
	Input factor	Cooling	%	98%		98%			
		Heating	%	-		98%			
	Starting current		A	34		34			
	Power supply cord	Length	m	-	-	-	-		
		Type		250V 16A		250V 16A			
	Fuse capacity		A	3.15	-	3.15	-		
Dimension	dimension	D*W*H	mm	210X745X250	320X818X540	210X745X250	320X818X540		
			Inch	-	-	-	-		
	Net weight		Kg	9.5	37	9.5	38		
	Connection pipe	Liquid	OD(mm)*L(mm)	Φ6.35X3600		Φ6.35X3600			
		Gas	OD(mm)*L(mm)	Φ9.52X3600		Φ9.52X3600			
	Drain pipe		ID(mm)*L(mm)	Φ14X780		Φ14X780			
	Compressor	Type		-	Rotary	-	Rotary		
	Fan motor	Type		Through-flow fan leaves	Axial-flow fan leaves	Through-flow fan leaves	Axial-flow fan leaves		
	Motor	Type		Plastic-sealed	Iron-shell	Plastic-sealed	Iron-shell		
		Rated input	W	19	25	19	30		
Heat exchanger(row*line)				2X13	1X11	2X13	2X24		
Refrigerant controller				Capillary		Capillary			
Freezed oil capacity				-		-			
Refrigerant/Charge(g)				R22/700		R22/1200			
Protection equipment				-	Inner	-	Inner		
Cooling test condition				Indoor unit: DB27℃ Wb19℃				Outdoor unit: DB35℃ Wb24℃	
Heat ing test condition				Indoor unit: DB20℃ Wb --				Outdoor unit: DB7℃ Wb6℃	
Max.Cooling test condition				Indoor unit: DB32℃ Wb23℃				Outdoor unit: DB43℃ Wb26℃	
Max.Heat ing test condition				Indoor unit: DB27℃ Wb --				Outdoor unit: DB24℃ Wb18℃	

2.Parameter of product RR407C（9000BTU~12000BTU）

Item \ Model				9000btuA4/E*R		9000btuA4/E*R		12000btuA4/E*R		12000btuA4/E*R	
				Indoor	Outdoor	Indoor	Outdoor	Indoor	Outdoor	Indoor	Outdoor
Type				Wall mounted		Wall mounted		Wall mounted		Wall mounted	
Performance	Cooling		KW	2.5		2.5		3.2		3.2	
	Dehumidifying		Kg/h	1.0		1.0		1.2		1.2	
	Heating		KW	-		2.75		-		3.52	
	Air Flow Volume	Cooling	m3/min	7	-	7	-	9	-	9	-
		Heating	m3/min	-	-	7	-	-	-	9	-
	Noise	Cooling	dB	38	50	38	50	41	52	41	52
		Heating	dB	-	-	38	50	-	-	41	52
	Power supply		ϕ-V-Hz	1/220-240~/50		1/220-240~/50		1/220-240~/50		1/220-240~/50	
Input	Rated input	Cooling	W	1000		1000		1200		1200	
		Heating	W	-		980		-		1250	
	Rated current	Cooling	A	4.4		4.4		5.5		5.5	
		Heating	A	-		4.3		-		5.7	
	Input factor	Cooling	%	98%		98%		98%		98%	
		Heating	%	-		98%		-		98%	
	Starting current		A	23.0		23.0		24.0		24.0	
	Power supply cord	Length	m	-	-	-	-	-	-	-	-
		Type		250V 10A		250V 10A		250V 16A		250V 16A	
	Fuse capacity		A	3.15	-	3.15	-	3.15	-	3.15	-
Dimension	dimension	D*W*H	mm	210X745X250	320X818X540	210X745X250	320X818X540	210X745X250	320X818X540	210X745X250	320X818X540
			Inch	-	-	-	-	-	-	-	-
	Net weight		Kg	9.3	32	9.3	33	9.5	35	9.5	36
	Connection pipe	Liquid	OD(mm)*L(mm)	Φ6.35×3600		Φ6.35×3600		Φ6.35×3600		Φ6.35×3600	
		Gas	OD(mm)*L(mm)	Φ9.52×3600		Φ9.52×3600		Φ9.52×3600		Φ9.52×3600	
	Drain pipe		ID(mm)*L(mm)	Φ14×780		Φ14×780		Φ14×780		Φ14×780	
	Compressor	Type		-	Rotary	-	Rotary	-	Rotary	-	Rotary
	Fan motor Motor	Type		-	-	-	-	-	-	-	-
		Rated input	W	-	940	-	960	-	1220	-	1220
	Fan motor	Type		Through-flow fan leaves	Axial-flow fan leaves	Through-flow fan leaves	Axial-flow fan leaves	Through-flow fan leaves	Axial-flow fan leaves	Through-flow fan leaves	Axial-flow fan leaves
	Fan motor Motor	Type		Plastic-sealed	Iron-shell	Plastic-sealed	Iron-shell	Plastic-sealed	Iron-shell	Plastic-sealed	Iron-shell
		Rated input	W	13	25	13	25	19	30	19	30
Heat exchanger(row*line)				2×11	1×10	2×11	1×10	2×13	1×24	2×13	2×24
Refrigerant controller				Capillary		Capillary		Capillary		Capillary	
Freezed oil capacity				-		-		-		-	
Refrigerant/Charge(g)				R407c/670		R407c/670		R407c/950		R407c/950	
Protection equipment				-	Inner	-	Inner	-	Inner	-	Inner
Cooling test condition				Indoor unit: DB27℃ Wb19℃				Outdoor unit: DB35℃ Wb24℃			
Heat ing test condition				Indoor unit: DB20℃ Wb --				Outdoor unit: DB7℃ Wb6℃			
Max.Cooling test condition				Indoor unit: DB32℃ Wb23℃				Outdoor unit: DB43℃ Wb26℃			
Max.Heat ing test condition				Indoor unit: DB27℃ Wb --				Outdoor unit: DB24℃ Wb18℃			

Item \ Model				12000btuB4/E*R		12000btuB4/E*R			
				Indoor	Outdoor	Indoor	Outdoor		
Type				Wall mounted		Wall mounted			
Performance	Cooling		KW	3.5		3.5			
	Dehumidifying		Kg/h	1.3		1.3			
	Heating		KW	–		3.85			
	Air Flow Volume	Cooling	m3/min	9	–	9	–		
		Heating	m3/min	–	–	9	–		
	Noise	Cooling	dB	41	52	41	52		
		Heating	dB	–	–	41	52		
	Power supply		ϕ-V-Hz	1/220-240~/50		1/220-240~/50			
Input	Rated input	Cooling	W	1400		1400			
		Heating	W	–		1500			
	Rated current	Cooling	A	6.5		6.5			
		Heating	A	–		7.0			
	Input factor	Cooling	%	98%		98%			
		Heating	%	–		98%			
	Starting current		A	35.0		35.0			
	Power supply cord	Length	m	–	–	–	–		
		Type		250V 16A		250V 16A			
	Fuse capacity		A	3.15	–	3.15	–		
Dimension	dimension	D*W*H	mm	210X745X250	320X818X540	210X745X250	320X818X540		
			Inch	–	–	–	–		
	Net weight		Kg	9.5	37	9.5	38		
	Connection pipe	Liquid	OD(mm)*L(mm)	Φ6.35×3600		Φ6.35×3600			
		Gas	OD(mm)*L(mm)	Φ9.52×3600		Φ9.52×3600			
	Drain pipe		ID(mm)*L(mm)	Φ14×780		Φ14×780			
	Compressor	Type		–	Rotary	–	Rotary		
	Motor	Type		–	–	–	–		
		Rated input	W	–	1400	–	1450		
	Fan motor	Type		Through-flow fan leaves	Axial-flow fan leaves	Through-flow fan leaves	Axial-flow fan leaves		
	Motor	Type		Plastic-sealed	Iron-shell	Plastic-sealed	Iron-shell		
		Rated input	W	19	30	19	30		
Heat exchanger(row*line)				2×13	1×20	2×13	2×20		
Refrigerant controller				Capillary		Capillary			
Freezed oil capacity				–		–			
Refrigerant/Charge(g)				R407c/1270		R407c/1270			
Protection equipment				–	Inner	–	Inner		
Cooling test condition				Indoor unit: DB27℃ Wb19℃				Outdoor unit: DB35℃ Wb24℃	
Heat ing test condition				Indoor unit: DB20℃ Wb --				Outdoor unit: DB7℃ Wb6℃	
Max.Cooling test condition				Indoor unit: DB32℃ Wb23℃				Outdoor unit: DB43℃ Wb26℃	
Max.Heat ing test condition				Indoor unit: DB27℃ Wb --				Outdoor unit: DB24℃ Wb18℃	

3.Parameter of product R410a（9000BTU~12000BTU）

Item \ Model				9000btuA4/E*R1		9000btuA4/E*R1		12000btuB4/E*R1		12000btuB4/E*R1	
				Indoor	Outdoor	Indoor	Outdoor	Indoor	Outdoor	Indoor	Outdoor
Type				Wall mounted		Wall mounted		Wall mounted		Wall mounted	
Performance	Cooling		KW	2.5		2.5		3.5		3.5	
	Dehumidifying		Kg/h	1.0		1.0		1.3		1.3	
	Heating		KW	-		2.75		-		3.85	
	Air Flow Volume	Cooling	m3/min	7	-	7	-	9	-	9	-
		Heating	m3/min	-	-	7	-	-	-	8.7	-
	Noise	Cooling	dB	38	50	38	50	41	52	41	52
		Heating	dB	-	-	38	50	-	-	41	52
	Power supply		ϕ-V-Hz	1/220-240~/50		1/220-240~/50		1/220-240~/50		1/220-240~/50	
Input	Rated input	Cooling	W	850		850		1240		1240	
		Heating	W	-		900		-		1270	
	Rated current	Cooling	A	4.0		4.0		5.5		5.5	
		Heating	A	-		4.3		-		5.7	
	Input factor	Cooling	%	98%		98%		98%		98%	
		Heating	%	-		98%		-		98%	
	Starting current		A	22.0		22.0		29.0		29.0	
	Power supply cord	Length	m	-	-	-	-	-	-	-	-
		Type		250V 10A		250V 10A		250V 16A		250V 16A	
	Fuse capacity		A	3.15	-	3.15	-	3.15	-	3.15	-
Dimension	dimension	D*W*H	mm	210X745X250	320X818X540	210X745X250	320X818X540	210X745X250	320X818X540	210X745X250	320X818X540
			Inch	-	-	-	-	-	-	-	-
	Net weight		Kg	9.3	32	9.3	33	9.5	35	9.5	36
	Connection pipe	Liquid	OD(mm)*L(mm)	Φ6.35×3600		Φ6.35×3600		Φ6.35×3600		Φ6.35×3600	
		Gas	OD(mm)*L(mm)	Φ9.52×3600		Φ9.52×3600		Φ9.52×3600		Φ9.52×3600	
	Drain pipe		ID(mm)*L(mm)	Φ14×780		Φ14×780		Φ14×780		Φ14×780	
	Compressor	Type		-	Rotary	-	Rotary	-	Rotary	-	Rotary
	Motor	Type		-	-	-	-	-	-	-	-
		Rated input	W	-	910	-	910	-	1220	-	1220
	Fan motor	Type		Through-flow fan leaves	Axial-flow fan leaves	Through-flow fan leaves	Axial-flow fan leaves	Through-flow fan leaves	Axial-flow fan leaves	Through-flow fan leaves	Axial-flow fan leaves
	Motor	Type		Plastic-sealed	Iron-shell	Plastic-sealed	Iron-shell	Plastic-sealed	Iron-shell	Plastic-sealed	Iron-shell
		Rated input	W	13	25	13	25	19	25	19	25
Heat exchanger(row*line)				2×11	1×24	2×11	1×24	2×13	1×24	2×13	2×24
Refrigerant controller				Capillary		Capillary		Capillary		Capillary	
Freezed oil capacity				-		-		-		-	
Refrigerant/Charge(g)				R410a/860		R410a/860		R410a/970		R410a/970	
Protection equipment				-	Inner	-	Inner	-	Inner	-	Inner
Cooling test condition				Indoor unit: DB27℃ Wb19℃				Outdoor unit: DB35℃ Wb24℃			
Heat ing test condition				Indoor unit: DB20℃ Wb --				Outdoor unit: DB7℃ Wb6℃			
Max.Cooling test condition				Indoor unit: DB32℃ Wb23℃				Outdoor unit: DB43℃ Wb26℃			
Max.Heat ing test condition				Indoor unit: DB27℃ Wb --				Outdoor unit: DB24℃ Wb18℃			

4.Parameter of product R22（18000BTU~24000BTU）

Model				18000btuB4/E*		18000btuB4/E*		24000btuB4/E*		24000btuB4/E*	
				Indoor	Outdoor	Indoor	Outdoor	Indoor	Outdoor	Indoor	Outdoor
Type				Wall mounted		Wall mounted		Wall mounted		Wall mounted	
Performance	Cooling		KW	5.3		5.3		7.0		7.0	
	Dehumidifying		Kg/h	1.9		1.9		2.9		2.9	
	Heating		KW	-		5.8		-		7.7	
	Air Flow Volume	Cooling	m3/min	14.6	-	14.6	-	16.7	-	16.7	-
		Heating	m3/min	-	-	14.6	-	-	-	16.7	-
	Noise	Cooling	dB	46	55	46	55	49	57	49	57
		Heating	dB	-	-	46	55	-	-	49	57
	Power supply		ф-V-Hz	1/220-240~/50		1/220-240~/50		1/220-240~/50		1/220-240~/50	
Input	Rated input	Cooling	W	2080		2080		2700		2700	
		Heating	W	-		2050		-		2700	
	Rated current	Cooling	A	9.5		9.5		12.5		12.5	
		Heating	A	-		9.4		-		12.5	
	Input factor	Cooling	%	98%		98%		98%		98%	
		Heating	%	-		98%		-		98%	
	Starting current		A	49.0		49.0		60.0		60.0	
	Power supply cord	Length	m	-	-	-	-	-	-	-	-
		Type		250V 16A		250V 16A		250V 16A		250V 16A	
	Fuse capacity		A	3.15	-	3.15	-	3.15	-	3.15	-
Dimension	dimension	D*W*H	mm	320×1095×205	320×818×540	320×1095×205	320×818×540	320×1095×205	300×800×690	320×1095×205	300×800×690
			Inch	-	-	-	-	-	-	-	-
	Net weight		Kg	15	40	15	43	15	51	15	51
	Connection pipe	Liquid	OD(mm)*L(mm)	Φ6.35×3600		Φ6.35×3600		Φ9.52×3600		Φ9.52×3600	
		Gas	OD(mm)*L(mm	Φ12.7×3600		Φ12.7×3600		Φ15.88×3600		Φ15.88×3600	
	Drain pipe		ID(mm)*L(mm)	Φ14×780		Φ14×780		Φ14×780		Φ14×780	
	Compressor	Type		-	Rotary	-	Rotary	-	Rotary	-	Rotary
	Motor	Type		-	-	-	-	-	-	-	-
		Rated input	W	-	1875	-	1875	-	2510	-	2510
	Fan motor	Type		Through-flow fan leaves	Axial-flow fan leaves	Through-flow fan leaves	Axial-flow fan leaves	Through-flow fan leaves	Axial-flow fan leaves	Through-flow fan leaves	Axial-flow fan leaves
	Motor	Type		Plastic-sealed	Iron-shell	Plastic-sealed	Iron-shell	Plastic-sealed	Iron-shell	Plastic-sealed	Iron-shell
		Rated input	W	20	40	20	40	30	68	30	68
Heat exchanger(row*line)				2×13	1×24	2×13	2×22	3×16	2×26	3×16	2×26
Refrigerant controller				Capillary		Capillary		Capillary		Capillary	
Freezed oil capacity				-		-		-		-	
Refrigerant/Charge(g)				R22/1180		R22/1350		R22/1630		R22/2000	
Protection equipment				-	Inner	-	Inner	-	Inner	-	Inner
Cooling test condition				Indoor unit: DB27℃ Wb19℃				Outdoor unit: DB35℃ Wb24℃			
Heat ing test condition				Indoor unit: DB20℃ Wb --				Outdoor unit: DB7℃ Wb6℃			
Max.Cooling test condition				Indoor unit: DB32℃ Wb23℃				Outdoor unit: DB43℃ Wb26℃			
Max.Heat ing test condition				Indoor unit: DB27℃ Wb --				Outdoor unit: DB24℃ Wb18℃			

5.Parameter of product R407C（18000BTU~24000BTU）

Item \ Model				18000btuB4/E*R		18000btuB4/E*R		24000btuB4/E*R		24000btuB4/E*R	
				Indoor	Outdoor	Indoor	Outdoor	Indoor	Outdoor	Indoor	Outdoor
Type				Wall mounted		Wall mounted		Wall mounted		Wall mounted	
Performance	Cooling		KW	5.2		5.2		7.0		7.0	
	Dehumidifying		Kg/h	1.8		1.8		2.8		2.8	
	Heating		KW	-		5.7		-		7.7	
	Air Flow Volume	Cooling	m3/min	14.6	-	14.6	-	16.7	-	16.7	-
		Heating	m3/min	-	-	14.6	-	-	-	16.7	-
	Noise	Cooling	dB	49	57	49	57	49	59	49	59
		Heating	dB	-	-		57	-	-	49	59
	Power supply		ϕ-V-Hz	1/220-240~/50		1/220-240~/50		1/220-240~/50		1/220-240~/50	
Input	Rated input	Cooling	W	2090		2090		2700		2700	
		Heating	W	-		2200		-		2800	
	Rated current	Cooling	A	9.5		9.5		13.5		13.5	
		Heating	A	-		10.0		-		14.0	
	Input factor	Cooling	%	98%		98%		98%		98%	
		Heating	%	-		98%		-		98%	
	Starting current		A	52.0		52.0		63.0		63.0	
	Power supply cord	Length	m	-	-	-	-	-	-	-	-
		Type		250V 16A		250V 16A		250V 16A		250V 16A	
	Fuse capacity		A	3.15	-	3.15	-	3.15	-	3.15	-
Dimension	dimension	D*W*H	mm	320×1095×205	300×800×690	320×1095×205	300×800×690	320×1095×205	300×800×690	320×1095×205	300×800×690
			Inch	-	-	-	-	-	-	-	-
	Net weight		Kg	15	53	15	54	15	54	15	55
	Connection pipe	Liquid	OD(mm)*L(mm)	Φ6.35×3600		Φ6.35×3600		Φ9.52×3600		Φ9.52×3600	
		Gas	OD(mm)*L(mm)	Φ12.7×3600		Φ12.7×3600		Φ15.88×3600		Φ15.88×3600	
	Drain pipe		ID(mm)*L(mm)	Φ14×780		Φ14×780		Φ14×780		Φ14×780	
	Compressor	Type		-	Rotary	-	Rotary	-	Rotary	-	Rotary
	Motor	Type		-	-	-	-	-	-	-	-
		Rated input	W	-	1930	-	1930	-	2700	-	2700
	Fan motor	Type		Through-flow fan leaves	Axial-flow fan leaves	Through-flow fan leaves	Axial-flow fan leaves	Through-flow fan leaves	Axial-flow fan leaves	Through-flow fan leaves	Axial-flow fan leaves
	Motor	Type		Plastic-sealed	Iron-shell	Plastic-sealed	Iron-shell	Plastic-sealed	Iron-shell	Plastic-sealed	Iron-shell
		Rated input	W	20	68	20	68	30	68	30	68
Heat exchanger(row*line)				2×13	2×30	2×13	2×30	3×16	2×26	3×16	2×26
Refrigerant controller				Capillary		Capillary		Capillary		Capillary	
Freezed oil capacity				-		-		-		-	
Refrigerant/Charge(g)				R407c/1500		R407c/1500		R407c/1850		R407c/1850	
Protection equipment				-	Inner	-	Inner	-	Inner	-	Inner
Cooling test condition				Indoor unit: DB27℃ Wb19℃				Outdoor unit: DB35℃ Wb24℃			
Heat ing test condition				Indoor unit: DB20℃ Wb --				Outdoor unit: DB7℃ Wb6℃			
Max.Cooling test condition				Indoor unit: DB32℃ Wb23℃				Outdoor unit: DB43℃ Wb26℃			
Max.Heat ing test condition				Indoor unit: DB27℃ Wb --				Outdoor unit: DB24℃ Wb18℃			

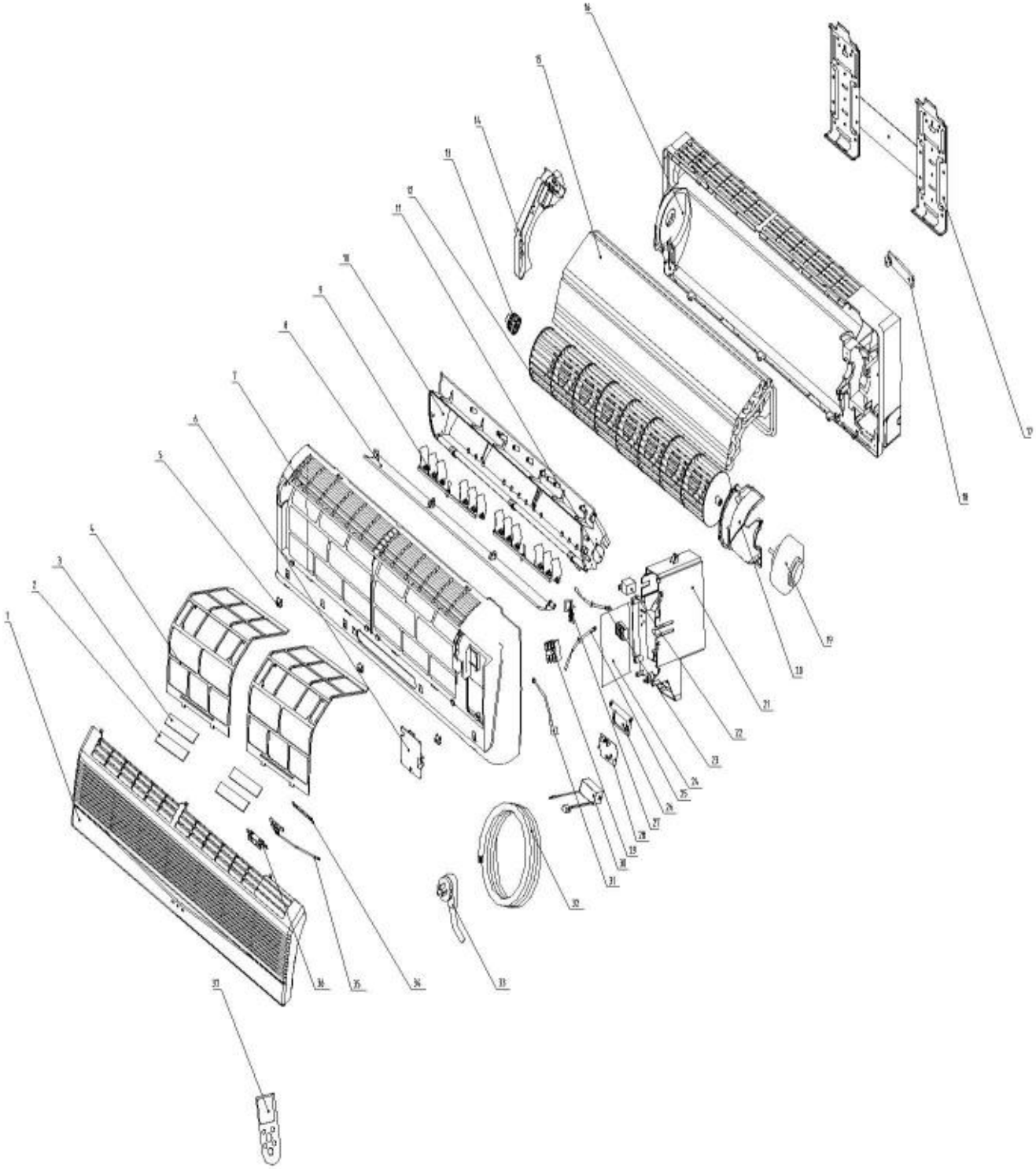
6.Parameter of product R410a（18000BTU~24000BTU）

Item \ Model				18btuB4/E*R1		18btuB4/E*R1		24000btuB4/E*R1		24000btuB4/E*R1	
				Indoor	Outdoor	Indoor	Outdoor	Indoor	Outdoor	Indoor	Outdoor
Type				Wall mounted		Wall mounted		Wall mounted		Wall mounted	
Performance	Cooling		KW	5.3		5.3		7.0		7.0	
	Dehumidifying		Kg/h	1.9		1.9		2.9		2.9	
	Heating		KW	-		5.5		-		7.3	
	Air Flow Volume	Cooling	m3/min	14.6	-	14.6	-	16.7	-	16.7	-
		Heating	m3/min	-	-	14.6	-	-	-	16.7	-
	Noise	Cooling	dB	48	57	48	57	49	59	49	59
		Heating	dB	-	-	48	57	-	-	49	59
	Power supply		ф-V-Hz	1/220-240~/50		1/220-240~/50		1/220-240~/50		1/220-240~/50	
Input	Rated input	Cooling	W	1860				2600		2600	
		Heating	W	-		2000		-		2650	
	Rated current	Cooling	A	8.2		8.2		12.0		12.0	
		Heating	A	-		8.6		-		12.2	
	Input factor	Cooling	%	98%		98%		98%		98%	
		Heating	%	-		98%		-		98%	
	Starting current		A	40.0		40.0		61.0		61.0	
	Power supply cord	Length	m	-	-	-	-	-	-	-	-
		Type		250V 16A		250V 16A		250V 16A		250V 16A	
	Fuse capacity		A	3.15	-	3.15	-	3.15	-	3.15	-
Dimension	dimension	D*W*H	mm	320X1095X205	300X800X690	320X1095X205	300X800X690	320X1095X205	300X800X690	320X1095X205	300X800X690
			Inch	-	-	-	-	-	-	-	-
	Net weight		Kg	15	48	15	48	15	54	15	55
	Connection pipe	Liquid	OD(mm)*L(mm)	Φ6.35×3600		Φ6.35×3600		Φ6.35×3600		Φ9.52×3600	
		Gas	OD(mm)*L(mm	Φ12.7×3600		Φ12.7×3600		Φ12.7×3600		Φ15.88×3600	
	Drain pipe		ID(mm)*L(mm)	Φ14×780		Φ14×780		Φ14×780		Φ14×780	
	Compressor	Type		-	Rotary	-	Rotary	-	Rotary	-	Rotary
	Motor	Type		-	-	-	-	-	-	-	-
		Rated input	W	-	1785	-	1785	-	2500	-	2500
	Fan motor	Type		Through-flow fan leaves	Axial-flow fan leaves	Through-flow fan leaves	Axial-flow fan leaves	Through-flow fan leaves	Axial-flow fan leaves	Through-flow fan leaves	Axial-flow fan leaves
	Motor	Type		Plastic-sealed	Iron-shell	Plastic-sealed	Iron-shell	Plastic-sealed	Iron-shell	Plastic-sealed	Iron-shell
		Rated input	W	20	68	20	68	30	68	30	68
Heat exchanger(row*line)				2×13	2×32	2×13	2×32	3×16	2×30	3×16	2×30
Refrigerant controller				Capillary		Capillary		Capillary		Capillary	
Freezed oil capacity				-		-		-		-	
Refrigerant/Charge(g)				R410a/1580		R410a/1580		R410a/1850		R410a/1850	
Protection equipment				-	Inner	-	Inner	-	Inner	-	Inner
Cooling test condition				Indoor unit: DB27℃ Wb19℃				Outdoor unit: DB35℃ Wb24℃			
Heat ing test condition				Indoor unit: DB20℃ Wb --				Outdoor unit: DB7℃ Wb6℃			
Max.Cooling test condition				Indoor unit: DB32℃ Wb23℃				Outdoor unit: DB43℃ Wb26℃			
Max.Heat ing test condition				Indoor unit: DB27℃ Wb --				Outdoor unit: DB24℃ Wb18℃			

Chapter 3 Exploded pictures of Pioneer products Section one E series products

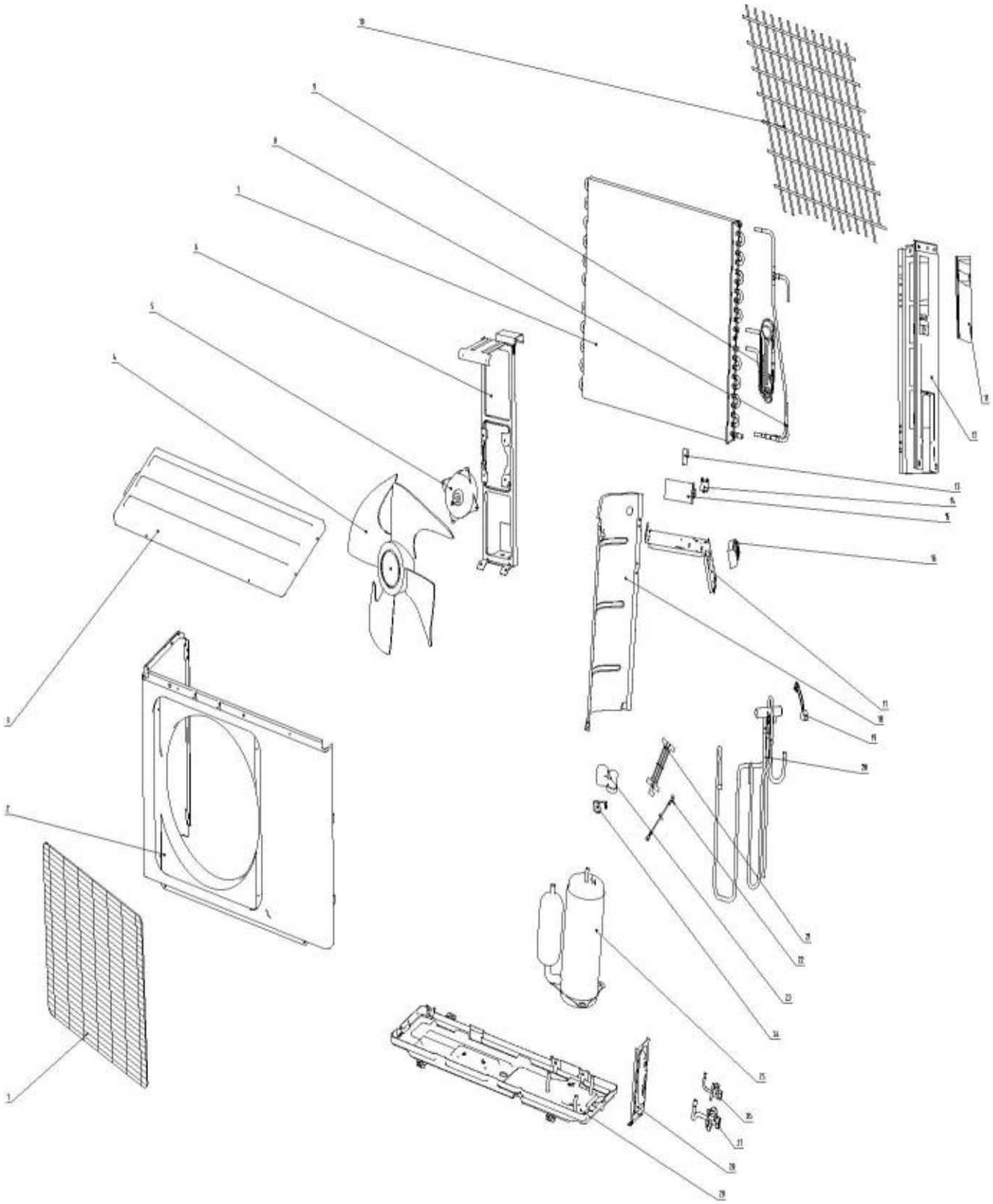
1. KFR25/ET

Indoor unit exploded picture



Detailed part list of KFR25/ET indoor unit				
No	Chinese Name	Name	Material	Number
1	面板组件	Panel		1
2	杀菌过滤网	Anti-bacterial Filter		2
3	维 C 防螨过滤网	Vitamin-C & Anti-mites Filter		2
4	过滤网组件	Filter		2
5	螺钉盖	Screw cover		3
6	中框盖	Cover of medium frame		1
7	中框组件	Medium frame		1
8	导风门	Horizontal air blade		1
9	导风叶片	Vertical air blade		2
10	导风架	Air blade holder		1
11	步进电机组件	Step motor		1
12	贯流风叶组件	Indoor fan		1
13	橡胶轴承座	Rubber bearing		1
14	蒸发器左支架	Left plastic crutch for evaporator		1
15	蒸发器总成	Evaporator		1
16	底座组件	Chassis		1
17	挂板组件	Mounting plate		1
18	管路压板	Tube clamp plate		1
19	塑封电机组件	Indoor fan motor		1
20	电机盖	Cover for indoor fan motor		1
21	电控盒	Electric controller box		1
22	变压器	Transformer		1
23	室内传感器	Plastic temperature sensor		1
24	主控板	Main PCB		1
25	内盘传感器	Copper temperature sensor		1
26	遥控器接收座	Signal receiver holder for Remote controller		1
27	温控探头支架	Temperature sensor holder		1
28	接收板	Receiver board		1
29	端子板	Terminal board		1
30	负离子发生器	Negative ion generator		1
31	连接线	Connection cable		1
32	电源连接线	Interconnection cord		1
33	电源线	Power supply cord with plug		1
34	指示灯座	Indication lamp holder		1
35	显示板	Display board		1
36	指示灯板	Indication lamp board		1
37	遥控器	Remote controller		1

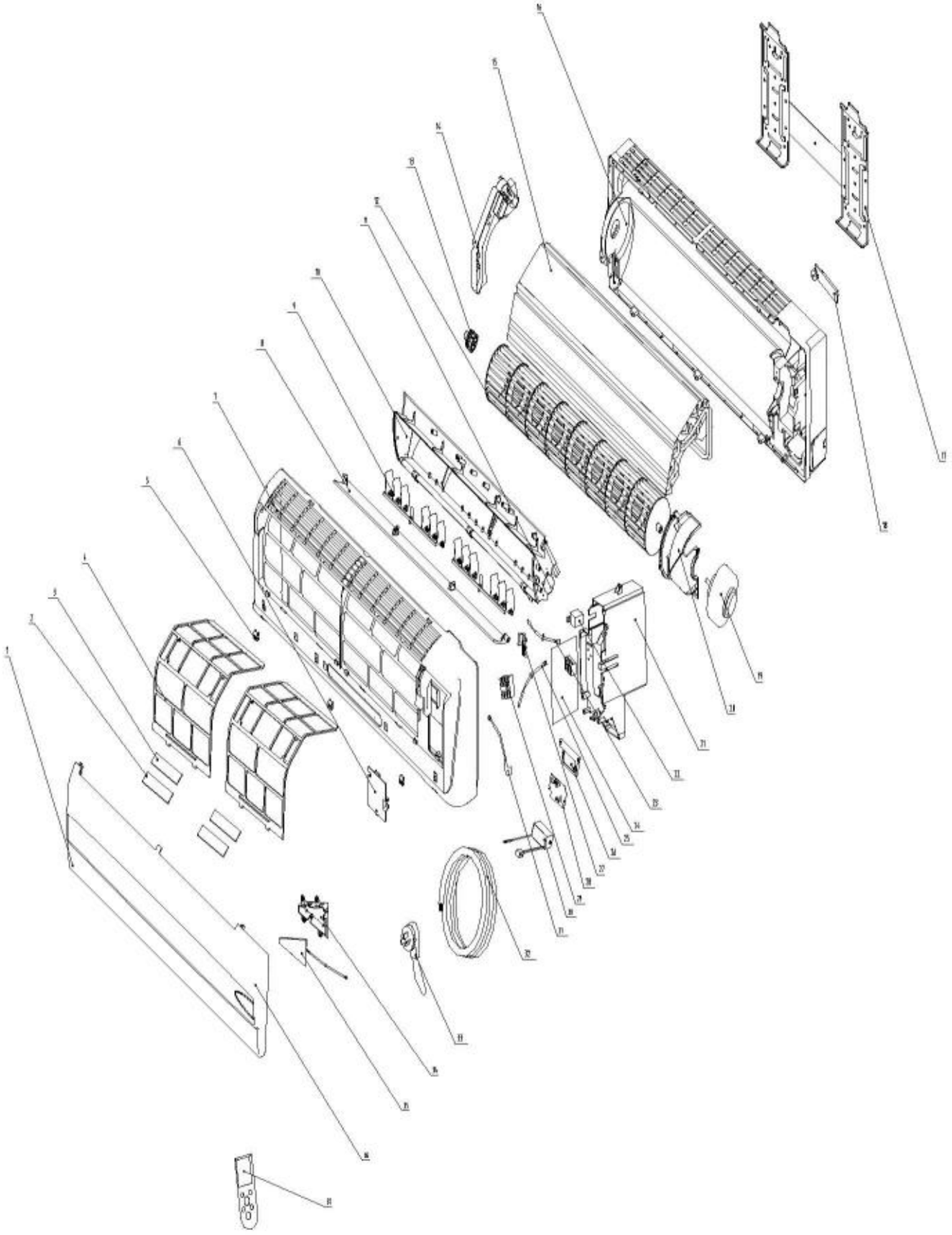
Outdoor unit exploded picture



Detailed part list of KFR25/ET outdoor unit				
No	Chinese Name	Name	Material	Number
1	面板网罩	Steel grille		1
2	面板组件	Front panel		1
3	顶盖板	Top cover board		1
4	轴流风叶	Outdoor fan		1
5	室外电机	Outdoor fan motor		1
6	电机架	Motor bracket		1
7	冷凝器组件	Condenser assembly		1
8	冷凝器进气管	Condenser gas inlet tube		1
9	毛细管组件	Capillary assembly		1
10	后钢丝网罩	Backside steel grille		1
11	电器盖板	Handle		1
12	右侧板	Right-side plate		1
13	电容抱攀	Capacitor clamp		1
14	风机电容	Fan motor capacitor		1
15	压缩机电容	Compressor capacitor		1
16	端子板	Terminal board		1
17	电器架	Electrical holding plate		1
18	隔风立板	Partition plate		1
19	四通阀线圈	Electromagnetic loop		1
20	四通阀管路组件	Four-way valve and capillary assembly		1
21	压缩机连接线	Compressor connection cord		1
22	压缩机接地线	Compressor grounding cord		1
23	电器罩	Compressor terminal cover		1
24	过载保护器	Over-load protector		1
25	压缩机	Compressor		1
26	截止阀组件 A	Liquid valve		1
27	截止阀组件 B	Gas valve		1
28	阀板	Valve plate		1
29	底盘组件	Chassis		1

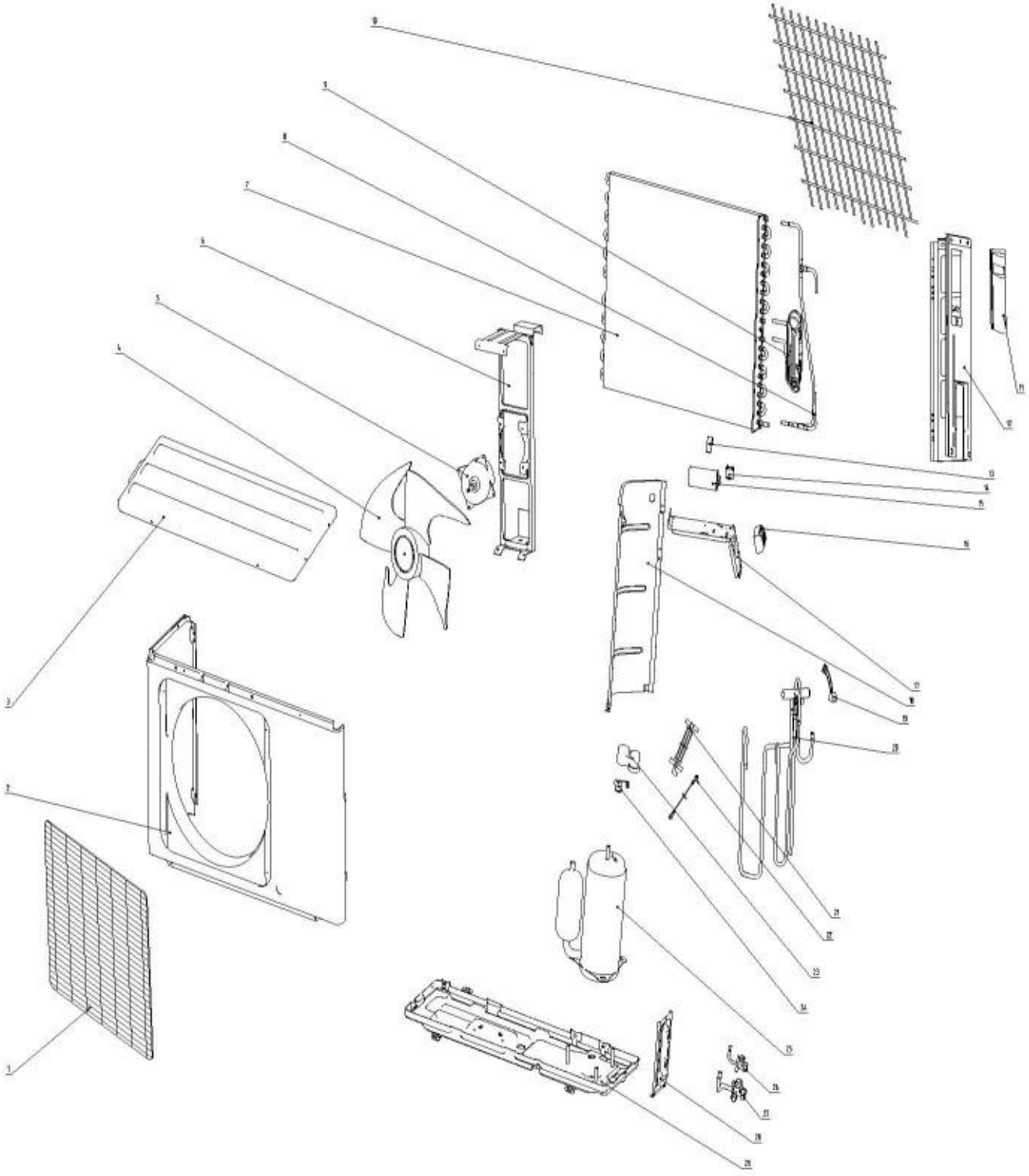
2. KFR25/EC

Indoor unit exploded picture



Detailed part list of KFR25/ET indoor unit				
No	Chinese Name	Name	Material	Number
1	面板组件	Panel		1
2	杀菌过滤网	Anti-bacterial Filter		2
3	维 C 防螨过滤网	Vitamin-C & Anti-mites Filter		2
4	过滤网组件	Filter		2
5	螺钉盖	Screw cover		3
6	中框盖	Cover of Medium frame		1
7	中框组件	Medium frame		1
8	导风门	Horizontal air blade		1
9	导风叶片	Vertical air blade		2
10	导风架	Air blade holder		1
11	步进电机组件	Step motor		1
12	贯流风叶组件	Indoor fan		1
13	橡胶轴承座	Rubber bearing		1
14	蒸发器左支架	Left plastic crutch for evaporator		1
15	蒸发器总成	Evaporator		1
16	底座组件	Chassis		1
17	挂板组件	Mounting plate		1
18	管路压板	Tube clamp plate		1
19	塑封电机组件	Indoor fan motor		1
20	电机盖	Cover for indoor fan motor		1
21	电控盒	Electric controller box		1
22	变压器	Transformer		1
23	室内传感器	Plastic temperature sensor		1
24	主控板	Main PCB		1
25	内盘传感器	Copper temperature sensor		1
26	遥控器接收座	Signal receiver holder for Remote controller		1
27	温控探头支架	Temperature sensor holder		1
28	接收板	Receiver board		1
29	端子板	Terminal board		1
30	负离子发生器	Negative ion generator		1
31	连接线	Connection cable		1
32	电源连接线	Interconnection cord		1
33	电源线	Power supply cord with plug		1
34	指示灯座	Indication lamp holder		1
35	显示板	Display board		1
36	遥控器	Remote controller		1

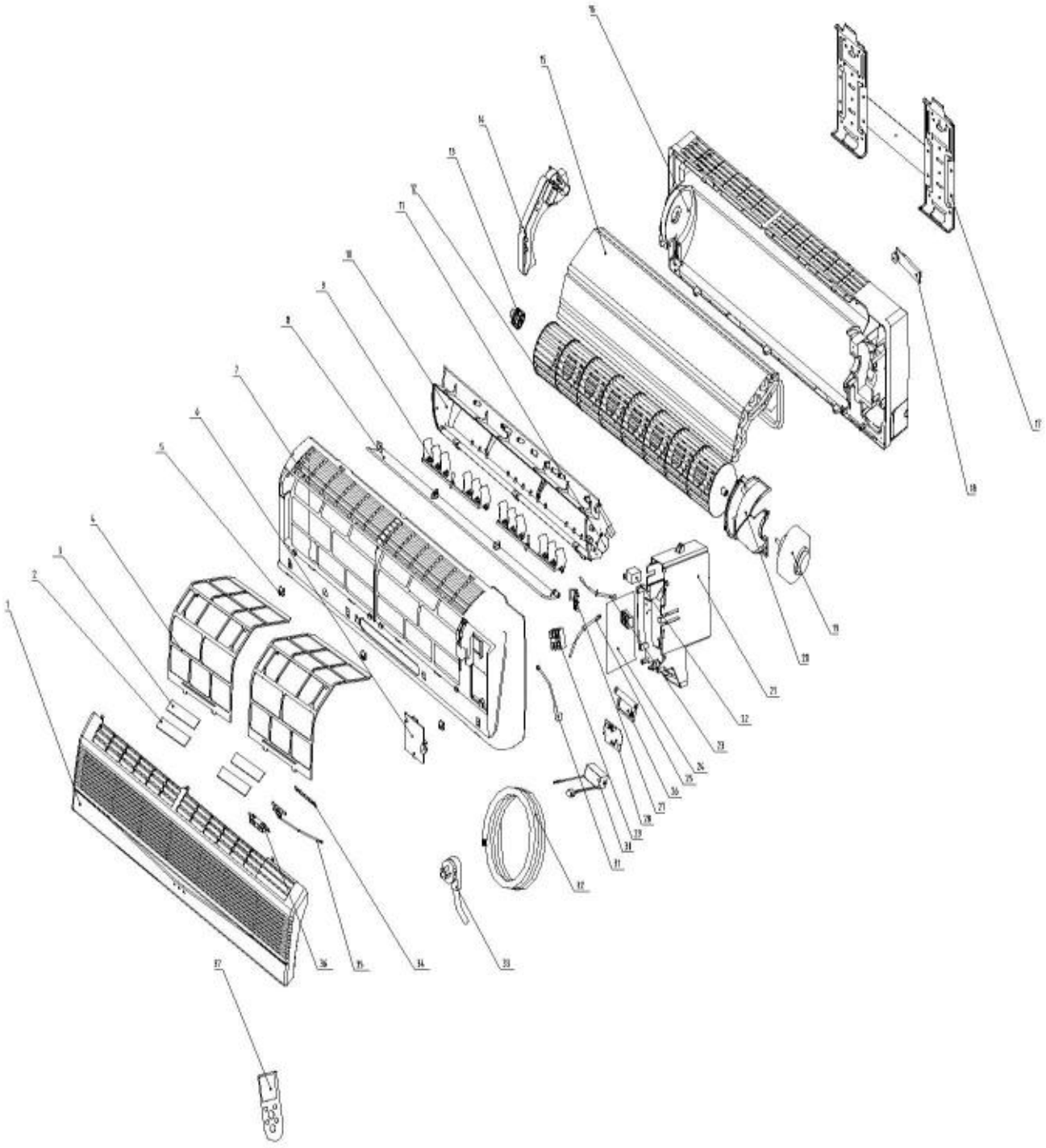
Outdoor unit exploded picture



Detailed part list of KFR25/EC outdoor unit				
No	Chinese Name	Name	Material	Number
1	面板网罩	Steel grille		1
2	面板组件	Front panel		1
3	顶盖板	Top cover board		1
4	轴流风叶	Outdoor fan		1
5	室外电机	Outdoor fan motor		1
6	电机架	Motor bracket		1
7	冷凝器组件	Condenser assembly		1
8	冷凝器进气管	Condenser gas inlet tube		1
9	毛细管组件	Capillary assembly		1
10	后钢丝网罩	Backside steel grille		1
11	电器盖板	Handle		1
12	右侧板	Right-side plate		1
13	电容抱攀	Capacitor clamp		1
14	风机电容	Fan motor capacitor		1
15	压缩机电容	Compressor capacitor		1
16	端子板	Terminal board		1
17	电器架	Electrical holding plate		1
18	隔风立板	Partition plate		1
19	四通阀线圈	Electromagnetic loop		1
20	四通阀管路组件	Four-way valve and capillary assembly		1
21	压缩机连接线	Compressor connection cord		1
22	压缩机接地线	Compressor grounding cord		1
23	电器罩	Compressor terminal cover		1
24	过载保护器	Over-load protector		1
25	压缩机	Compressor		1
26	截止阀组件 A	Liquid valve		1
27	截止阀组件 B	Gas valve		1
28	阀板	Valve plate		1
29	底盘组件	Chassis		1

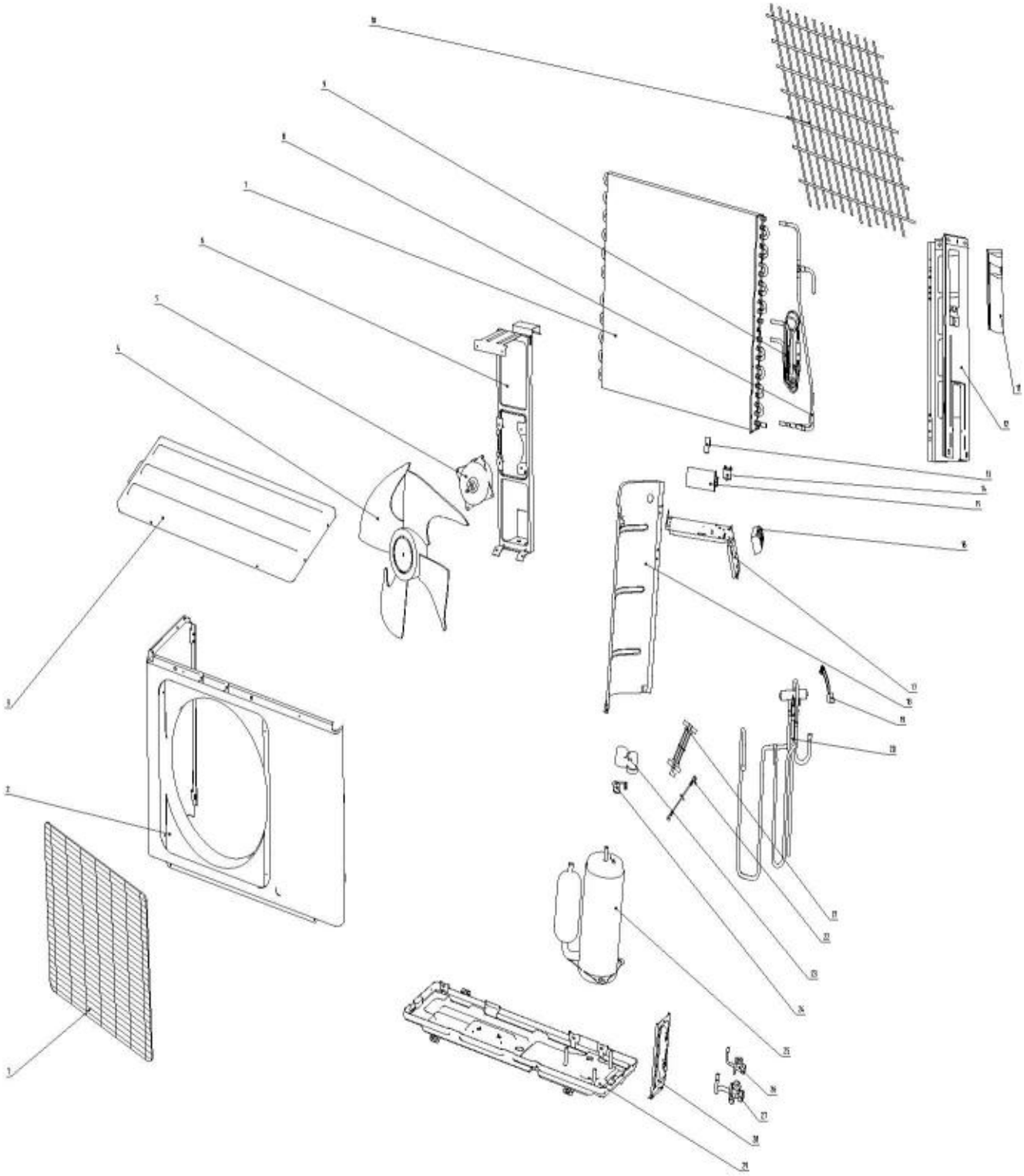
3. KFR35/ET

Indoor unit exploded picture



Detailed part list of KFR35/ET indoor unit				
No	Chinese Name	Name	Material	Number
1	面板组件	Panel		1
2	杀菌过滤网	Anti-bacterial Filter		2
3	维 C 防螨过滤网	Vitamin-C & Anti-mites Filter		2
4	过滤网组件	Filter		2
5	螺钉盖	Screw cover		3
6	中框盖	Cover of medium frame		1
7	中框组件	Medium frame		1
8	导风门	Horizontal air blade		1
9	导风叶片	Vertical air blade		2
10	导风架	Air blade holder		1
11	步进电机组件	Step motor		1
12	贯流风叶组件	Indoor fan		1
13	橡胶轴承座	Rubber bearing		1
14	蒸发器左支架	Left plastic crutch for evaporator		1
15	蒸发器总成	Evaporator		1
16	底座组件	Chassis		1
17	挂板组件	Mounting plate		1
18	管路压板	Tube clamp plate		1
19	塑封电机组件	Indoor fan motor		1
20	电机盖	Cover for indoor fan motor		1
21	电控盒	Electric controller box		1
22	变压器	Transformer		1
23	室内传感器	Plastic temperature sensor		1
24	主控板	Main PCB		1
25	内盘传感器	Copper temperature sensor		1
26	遥控器接收座	Signal receiver holder for Remote controller		1
27	温控探头支架	Temperature sensor holder		1
28	接收板	Receiver board		1
29	端子板	Terminal board		1
30	负离子发生器	Negative ion generator		1
31	连接线	Connection cable		1
32	电源连接线	Interconnection cord		1
33	电源线	Power supply cord with plug		1
34	指示灯座	Indication lamp holder		1
35	显示板	Display board		1
36	指示灯板	Indication lamp board		1
37	遥控器	Remote controller		1

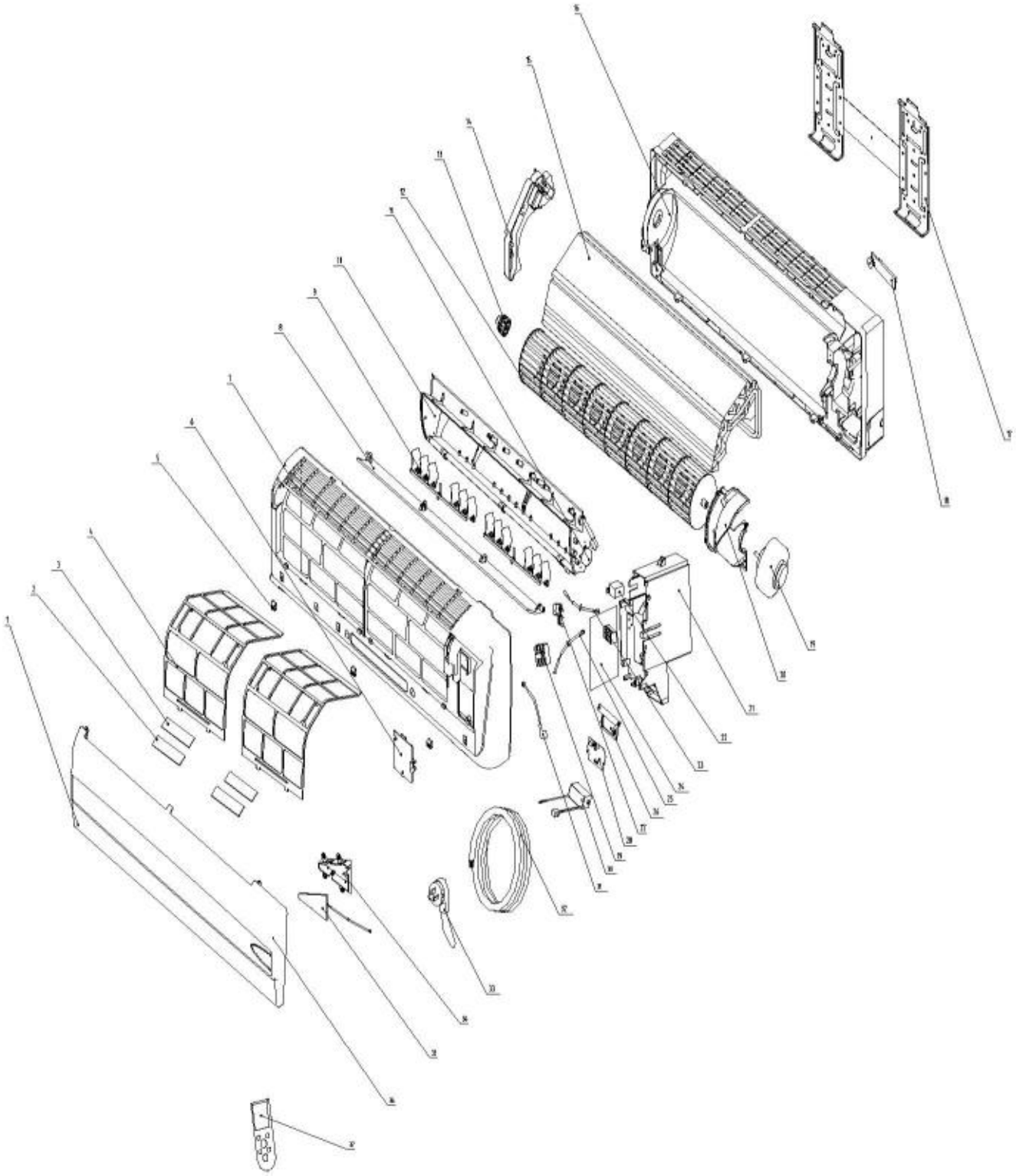
Outdoor unit exploded picture



Detailed part list of KFR35/ET outdoor unit				
No	Chinese Name	Name	Material	Number
1	面板网罩	Steel grille		1
2	面板组件	Front panel		1
3	顶盖板	Top cover board		1
4	轴流风叶	Outdoor fan		1
5	室外电机	Outdoor fan motor		1
6	电机架	Motor bracket		1
7	冷凝器组件	Condenser assembly		1
8	冷凝器进气管	Condenser gas inlet tube		1
9	毛细管组件	Capillary assembly		1
10	后钢丝网罩	Backside steel grille		1
11	电器盖板	Handle		1
12	右侧板	Right-side plate		1
13	电容抱攀	Capacitor clamp		1
14	风机电容	Fan motor capacitor		1
15	压缩机电容	Compressor capacitor		1
16	端子板	Terminal board		1
17	电器架	Electrical holding plate		1
18	隔风立板	Partition plate		1
19	四通阀线圈	Electromagnetic loop		1
20	四通阀管路组件	Four-way valve and capillary assembly		1
21	压缩机连接线	Compressor connection cord		1
22	压缩机接地线	Compressor grounding cord		1
23	电器罩	Compressor terminal cover		1
24	过载保护器	Over-load protector		1
25	压缩机	Compressor		1
26	截止阀组件 A	Liquid valve		1
27	截止阀组件 B	Gas valve		1
28	阀板	Valve plate		1
29	底盘组件	Chassis		1

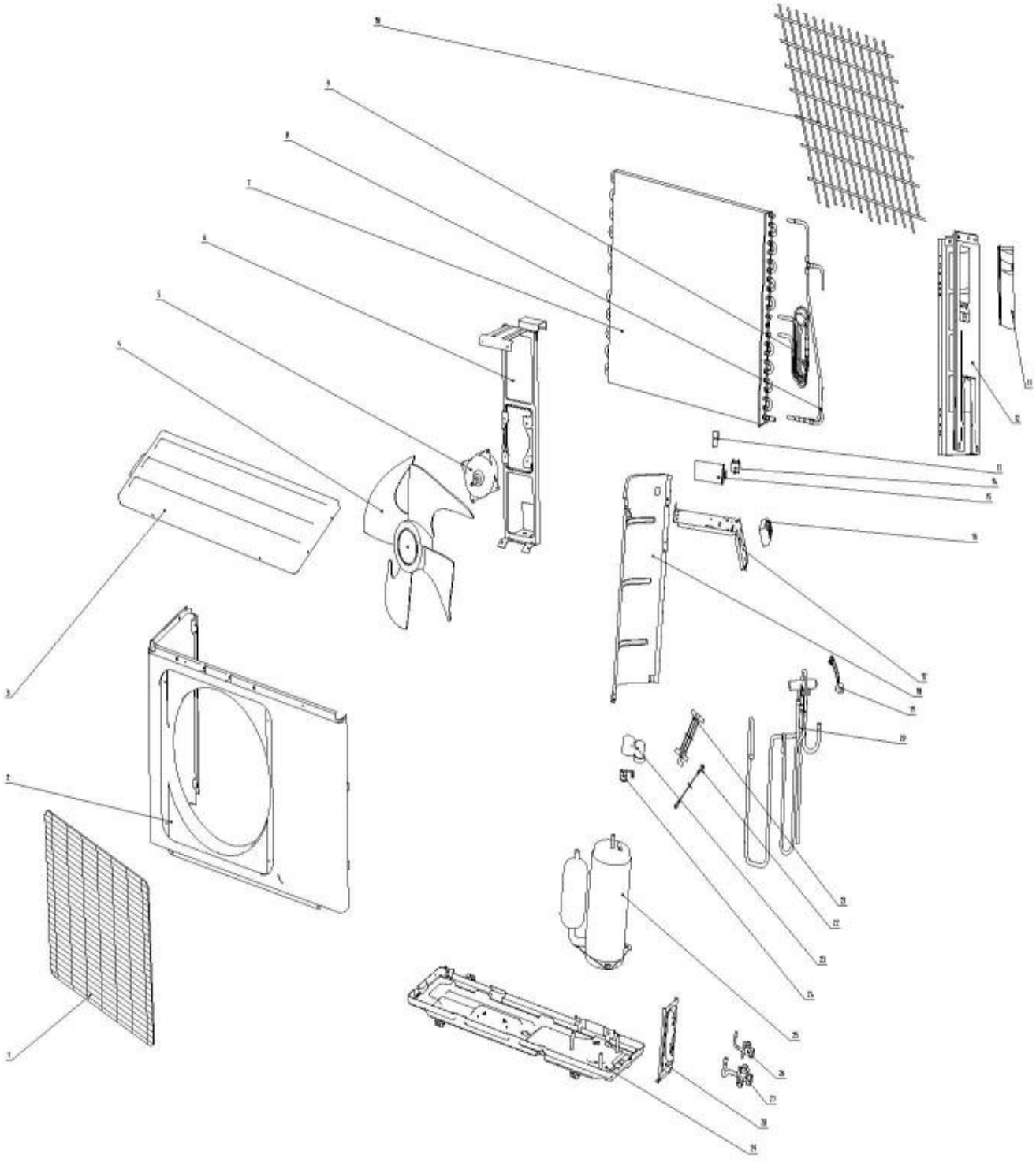
4. KFR 35/EC

Indoor unit exploded picture



Detailed part list of KFR35/EC indoor unit				
No	Chinese Name	Name	Material	Number
1	面板组件	Panel		1
2	杀菌过滤网	Anti-bacterial Filter		2
3	维 C 防螨过滤网	Vitamin-C & Anti-mites Filter		2
4	过滤网组件	Filter		2
5	螺钉盖	Screw cover		3
6	中框盖	Cover of Medium frame		1
7	中框组件	Medium frame		1
8	导风门	Horizontal air blade		1
9	导风叶片	Vertical air blade		2
10	导风架	Air blade holder		1
11	步进电机组件	Step motor		1
12	贯流风叶组件	Indoor fan		1
13	橡胶轴承座	Rubber bearing		1
14	蒸发器左支架	Left plastic crutch for evaporator		1
15	蒸发器总成	Evaporator		1
16	底座组件	Chassis		1
17	挂板组件	Mounting plate		1
18	管路压板	Tube clamp plate		1
19	塑封电机组件	Indoor fan motor		1
20	电机盖	Cover for indoor fan motor		1
21	电控盒	Electric controller box		1
22	变压器	Transformer		1
23	室内传感器	Plastic temperature sensor		1
24	主控板	Main PCB		1
25	内盘传感器	Copper temperature sensor		1
26	遥控器接收座	Signal receiver holder for Remote controller		1
27	温控探头支架	Temperature sensor holder		1
28	接收板	Receiver board		1
29	端子板	Terminal board		1
30	负离子发生器	Negative ion generator		1
31	连接线	Connection cable		1
32	电源连接线	Interconnection cord		1
33	电源线	Power supply cord with plug		1
34	指示灯座	Indication lamp holder		1
35	显示板	Display board		1
36	遥控器	Remote controller		1

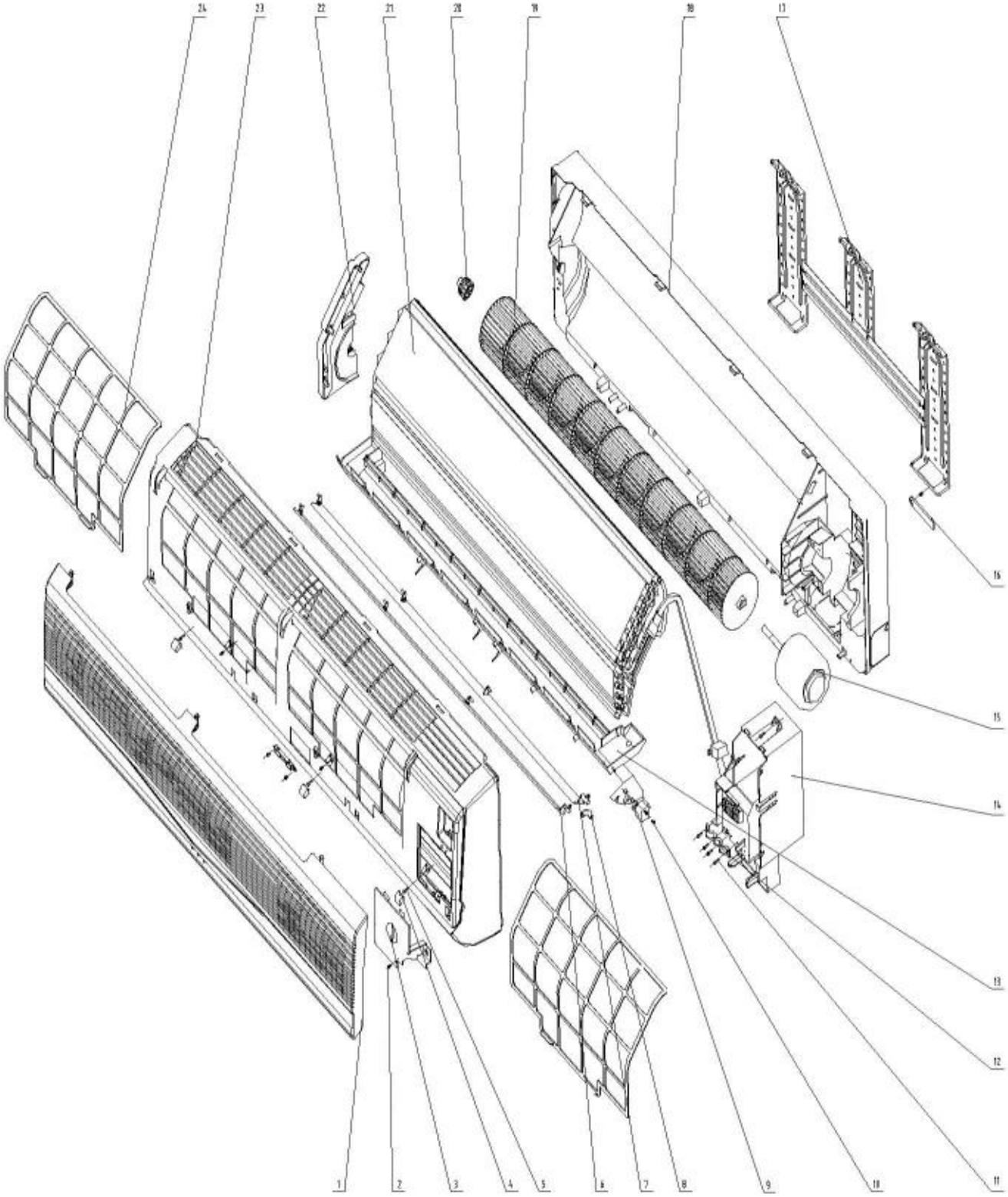
Outdoor unit exploded picture



Detailed part list of KFR35/EC outdoor unit				
No	Chinese Name	Name	Material	Number
1	面板网罩	Steel grille		1
2	面板组件	Front panel		1
3	顶盖板	Top cover board		1
4	轴流风叶	Outdoor fan		1
5	室外电机	Outdoor fan motor		1
6	电机架	Motor bracket		1
7	冷凝器组件	Condenser assembly		1
8	冷凝器进气管	Condenser gas inlet tube		1
9	毛细管组件	Capillary assembly		1
10	后钢丝网罩	Backside steel grille		1
11	电器盖板	Handle		1
12	右侧板	Right-side plate		1
13	电容抱攀	Capacitor clamp		1
14	风机电容	Fan motor capacitor		1
15	压缩机电容	Compressor capacitor		1
16	端子板	Terminal board		1
17	电器架	Electrical holding plate		1
18	隔风立板	Partition plate		1
19	四通阀线圈	Electromagnetic loop		1
20	四通阀管路组件	Four-way valve and capillary assembly		1
21	压缩机连接线	Compressor connection cord		1
22	压缩机接地线	Compressor grounding cord		1
23	电器罩	Compressor terminal cover		1
24	过载保护器	Over-load protector		1
25	压缩机	Compressor		1
26	截止阀组件 A	Liquid valve		1
27	截止阀组件 B	Gas valve		1
28	阀板	Valve plate		1
29	底盘组件	Chassis		1

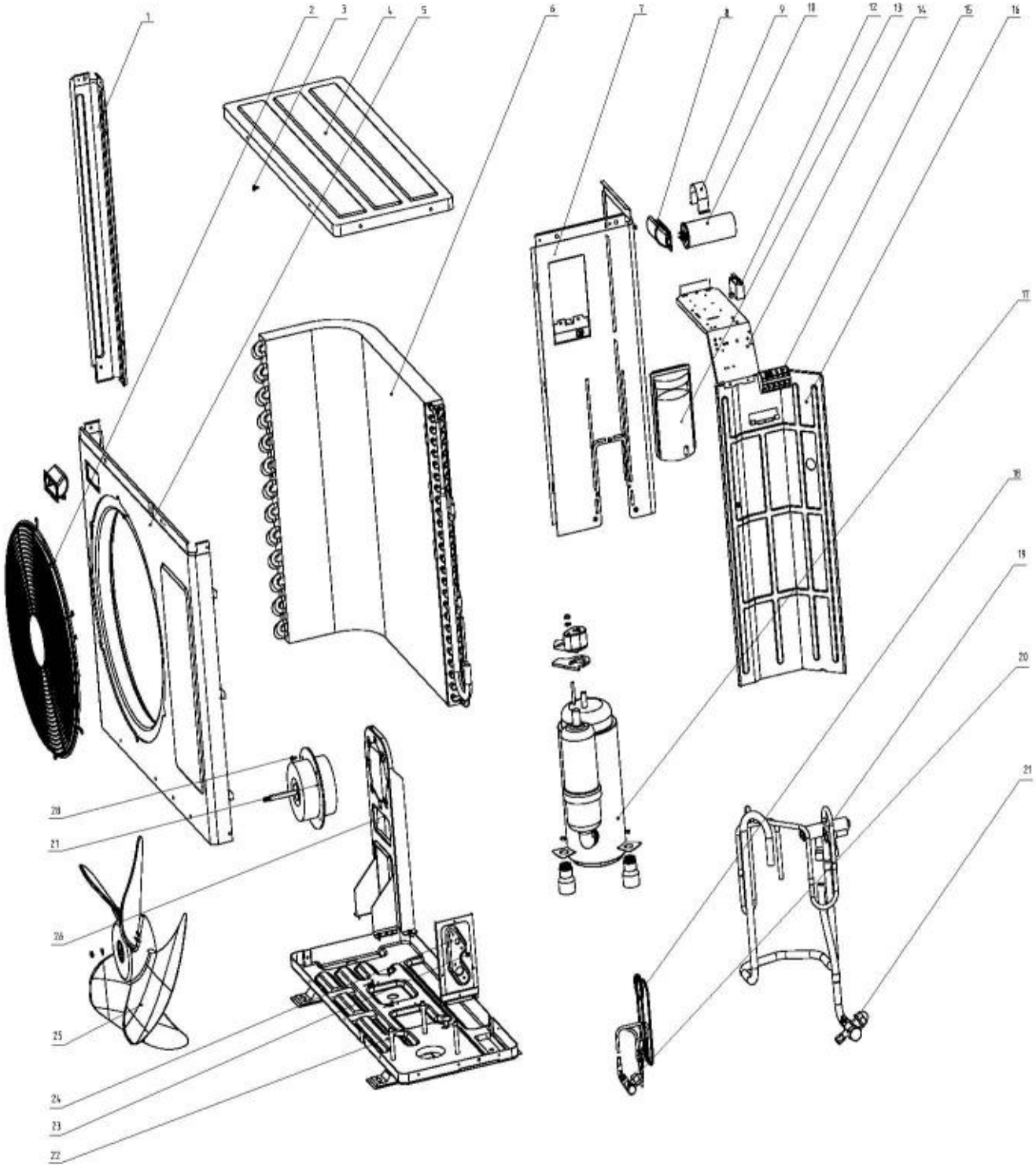
5. KFR50/ET

Indoor unit exploded picture



Detailed part list of KFR50/ET indoor unit				
No	Chinese Name	Name	Material	Number
1	面板组件	Panel		1
2	大扁头自攻螺钉	Screw		9
3	电控盒盖	Cover of medium frame		1
4	螺钉盖	Screw cover		3
5	大扁头自攻螺钉	Screw		3
6	导风门 A	Horizontal air blade A		1
7	导风门 B	Horizontal air blade B		1
8	导风门连杆	Connection-pole of horizontal air blade		1
9	步进电机组件	Step motor		1
10	十字槽自攻螺钉	Screw		1
11	大扁头自攻螺钉	Screw		12
12	压线板	Wiring clamping cover		1
13	导风架组件	Air blade holder		1
14	控制器总成	Electric controller assembly		1
15	抽头塑封电机组件	Indoor fan motor		1
16	管路压攀	Pipe clamp		1
17	挂板组件	Mounting plate		1
18	底座组件	Chassis		1
19	贯流风叶组件	Indoor fan		1
20	橡胶轴承座组件	Rubber bearing		1
21	蒸发器总成	Evaporator assembly		1
22	蒸发器支架	Left plastic crutch for evaporator		1
23	中框组件	Medium frame		1
24	过滤网	Filter		2

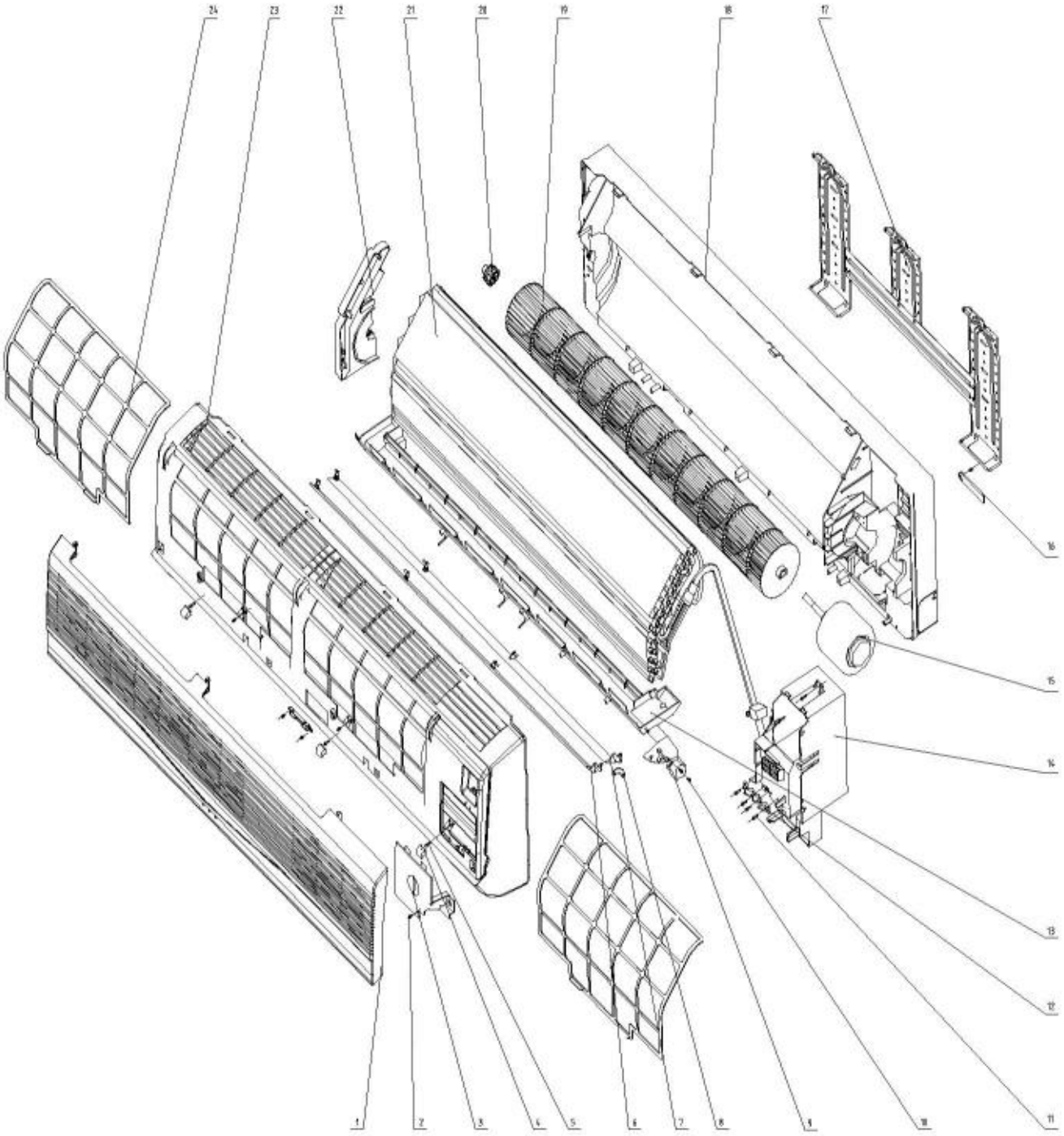
Outdoor unit exploded picture



Detailed part list of KFR50/ET outdoor unit				
No	Chinese Name	Name	Material	Number
1	左侧支撑板	Left-side supporting plate		1
2	钢丝网罩	Steel grille		1
3	大扁头自攻螺钉	Screw		4
4	顶盖板	Top cover board		1
5	大面板	Front panel		1
6	冷凝器总成	Condenser assembly		1
7	右侧板	Right-side panel plate		1
8	小挖手	Handle		2
9	电容抱攀	Capacitor clamp		1
10	压缩机电容	Compressor capacitor		1
11	电机电容	Fan motor capacitor		1
12	压线板	Wiring clamping cover		1
13	电器架	Electrical holding plate		1
14	五位端子板	Terminal board		1
15	隔风立板	Partition plate		1
16	压缩机	Compressor		1
17	毛细管组件	Capillary assembly		1
18	四通阀管路组件	Four-way valve assembly		1
19	截止阀组件 Dg4	Liquid valve Dg4		1
20	截止阀组件 Dg10	Gas valve Dg10		1
21	底盘组件	Chassis		1
22	十字槽自攻螺钉	Screw		4
23	阀板	Valve plate		1
24	轴流风叶	Outdoor fan		1
25	电机架	Motor bracket		1
26	室外风叶电机	Outdoor fan motor		1
27	十字槽盘头螺钉	Screw		4

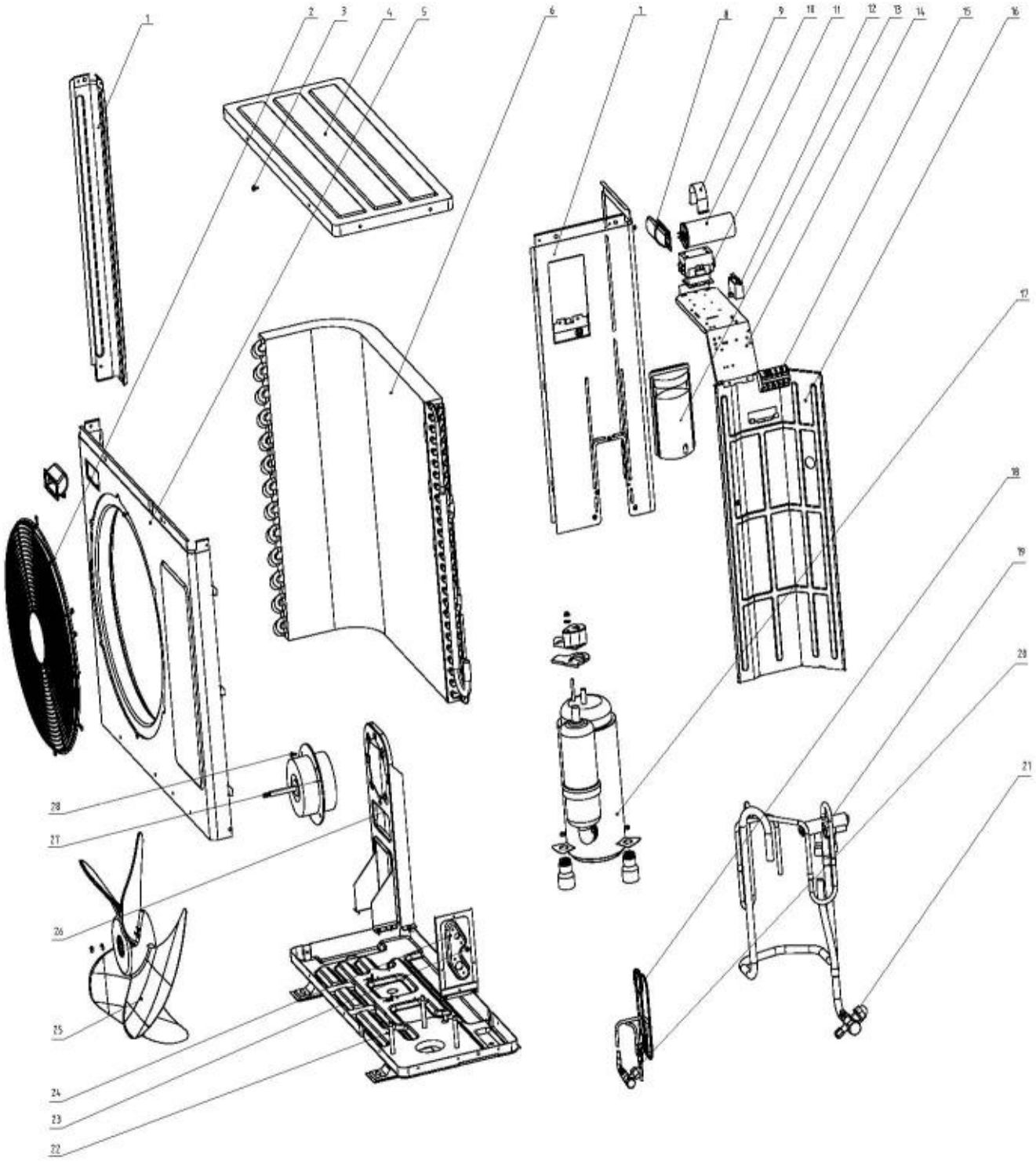
6. KFR70/ET

Indoor unit exploded picture



Detailed part list of KFR70/ET indoor unit				
No	Chinese Name	Name	Material	Number
1	面板组件	Panel		1
2	大扁头自攻螺钉	Screw		9
3	电控盒盖	Cover of medium frame		1
4	螺钉盖	Screw cover		3
5	大扁头自攻螺钉	Self-drill screw		3
6	导风门 A	Horizontal air blade A		1
7	导风门 B	Horizontal air blade B		1
8	导风门连杆	Connection-pole of horizontal air blade		1
9	步进电机组件	Step motor		1
10	十字槽自攻螺钉	Screw		1
11	大扁头自攻螺钉	Screw		12
12	压线板	Wiring clamping cover		1
13	导风架组件	Air blade holder		1
14	控制器总成	Electric controller assembly		1
15	抽头塑封电机组件	Indoor fan motor		1
16	管路压攀	Pipe clamp		1
17	挂板组件	Mounting plate		1
18	底座组件	Chassis		1
19	贯流风叶组件	Indoor fan		1
20	橡胶轴承座组件	Rubber bearing		1
21	蒸发器总成	Evaporator assembly		1
22	蒸发器支架	Left plastic crutch for evaporator		1
23	中框组件	Medium frame		1
24	过滤网	Filter		2

Outdoor unit exploded picture

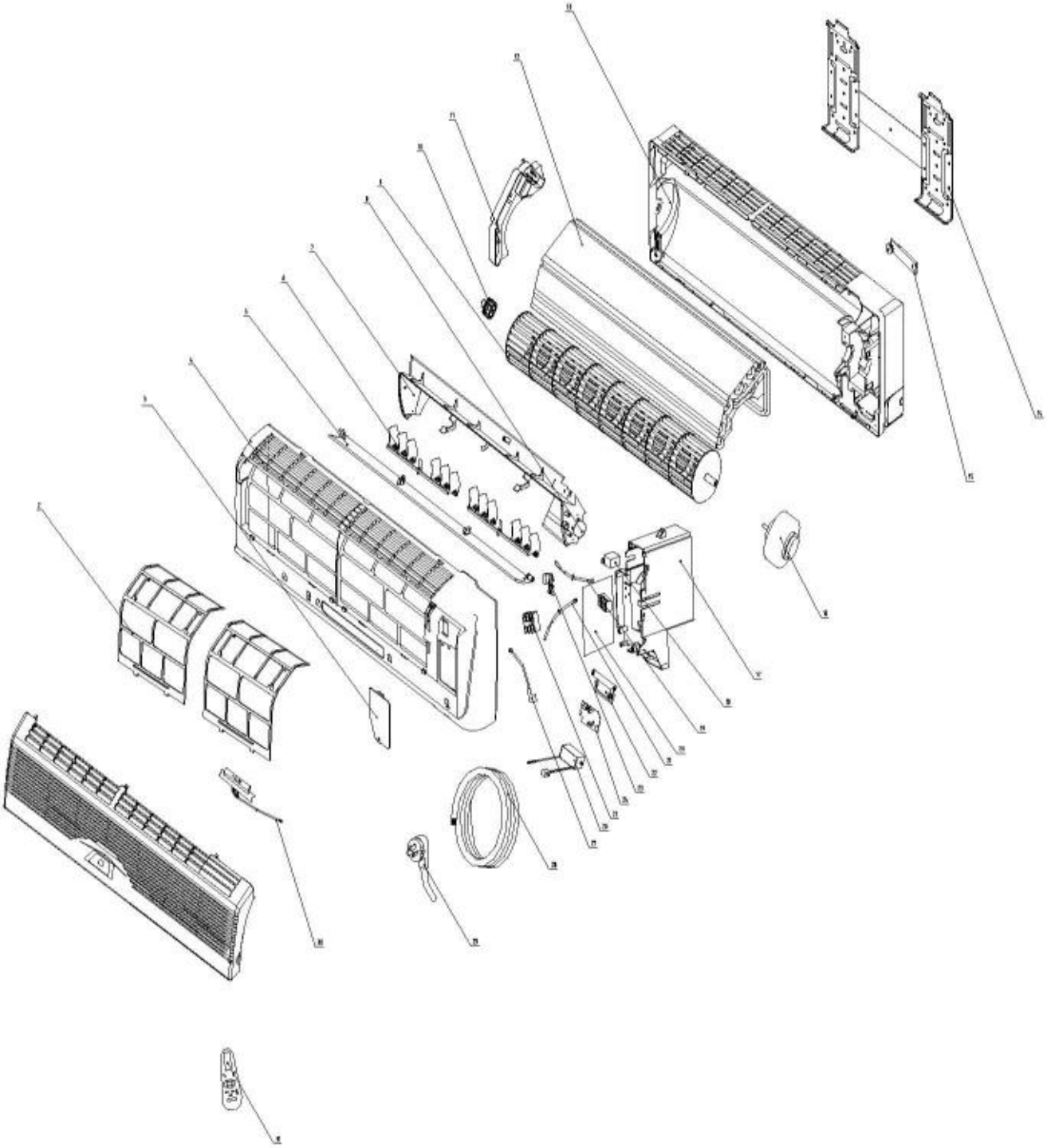


Detailed part list of KFR70/ET outdoor unit				
No	Chinese Name	Name	Material	Number
1	左侧支撑板	Left-side supporting plate		1
2	钢丝网罩	Steel grille		1
3	大扁头自攻螺钉	Screw		4
4	顶盖板	Top cover board		1
5	大面板	Front panel		1
6	冷凝器总成	Condenser assembly		1
7	右侧板	Right-side panel plate		1
8	小挖手	Handle		2
9	电容抱攀	Capacitor clamp		1
10	压缩机电容	Compressor capacitor		1
11	单极交流接触器	AC Contactor		1
12	电机电容	Fan motor capacitor		1
13	压线板	Wiring clamping cover		1
14	电器架	Electrical holding plate		1
15	五位端子板	Terminal board		1
16	隔风立板	Partition plate		1
17	压缩机	Compressor		1
18	毛细管组件	Capillary assembly		1
19	四通阀管路组件	Four-way valve assembly		1
20	截止阀组件 Dg8	Liquid valve Dg8		1
21	截止阀组件 Dg13	Gas valve Dg13		1
22	底盘组件	Chassis		1
23	十字槽自攻螺钉	Screw		4
24	阀板	Valve plate		1
25	轴流风叶	Outdoor fan		1
26	电机架	Motor bracket		1
27	室外风叶电机	Outdoor fan motor		1
28	十字槽盘头螺钉	Screw		4

Section two H series products

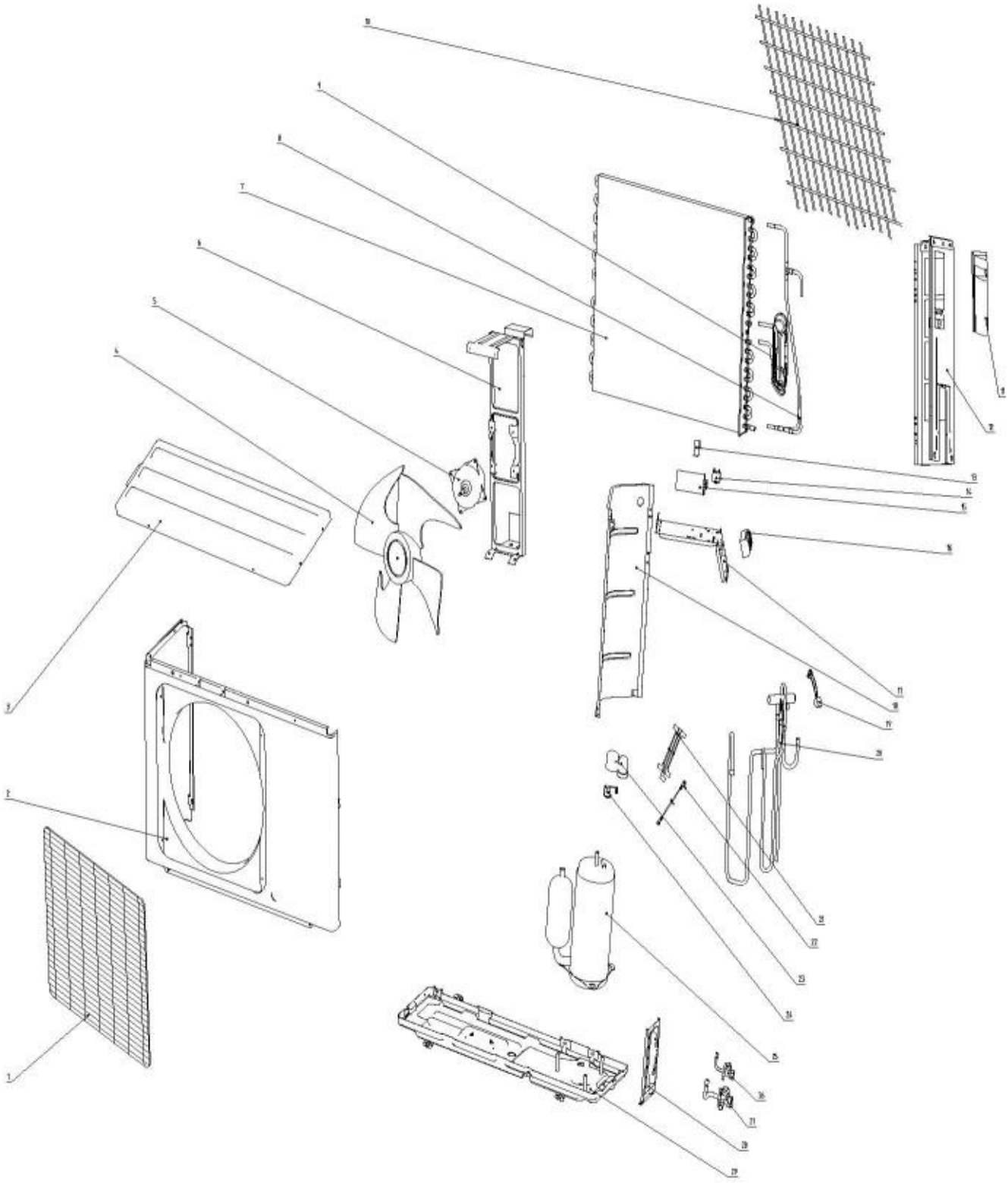
1. KFR25/HSF

Indoor unit exploded picture



Detailed part list of KFR25/HSF indoor unit				
No	Chinese Name	Name	Material	Number
1	面板组件	Panel		1
2	过滤网组件	Filter		2
3	电器盖板	Cover of medium frame		1
4	中框盖	Medium frame		1
5	导风门	Horizontal air blade		1
6	导风叶片	Vertical air blade		12
7	导风架	Air blade holder		1
8	步进电机组件	Step motor		1
9	贯流风叶组件	Indoor fan		1
10	橡胶轴承座	Rubber bearing		1
11	蒸发器左支架	Left plastic crutch for evaporator		1
12	蒸发器总成	Evaporator assembly		1
13	底座组件	Chassis		1
14	挂板组件	Mounting plate		1
15	管路压板	Tube clamp plate		1
16	塑封电机组件	Indoor fan motor		1
17	电控盒	Electric controller box		1
18	变压器	Transformer		1
19	室内传感器	Plastic temperature sensor		1
20	主控板	Main PCB		1
21	内盘传感器	Copper temperature sensor		1
22	遥控器接收座	Signal receiver holder for Remote controller		1
23	温控探头支架	Temperature sensor holder		1
24	接收板	Receiver board		1
25	端子板	Terminal board		1
26	负离子发生器	Negative ion generator	Optional	1
27	连接线	Connection cable		1
28	电源连接线	Interconnection cord		1
29	电源线	Power supply cord with plug		1
30	显示灯板	Display board		1
31	遥控器	Remote controller	“I feel” function optional	1

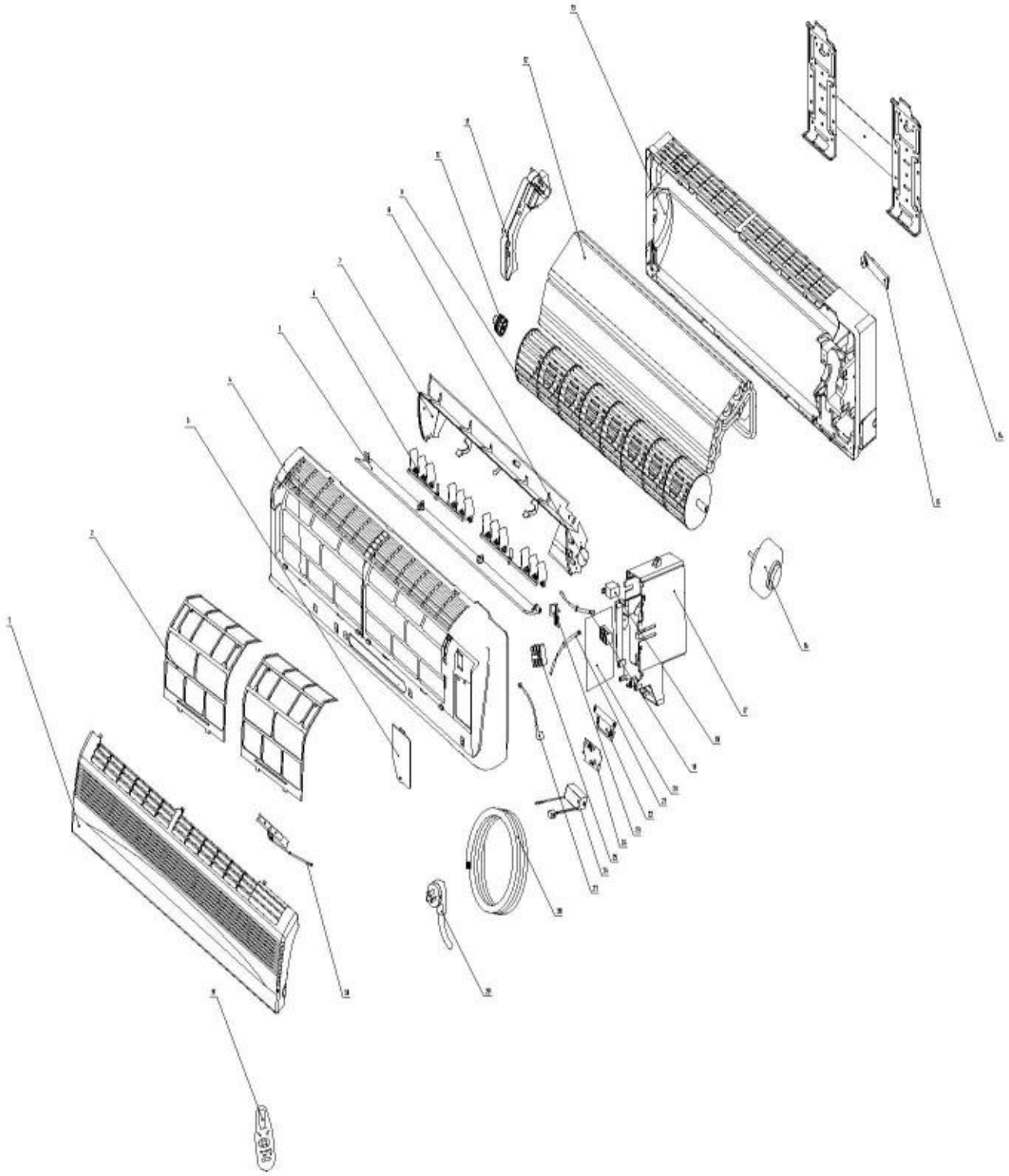
Outdoor unit exploded picture



Detailed part list of KFR25/HSF outdoor unit				
No	Chinese Name	Name	Material	Number
1	面板网罩	Steel grille		1
2	面板组件	Front panel		1
3	顶盖板	Top cover board		1
4	轴流风叶	Outdoor fan		1
5	室外电机	Outdoor fan motor		1
6	电机架	Motor bracket		1
7	冷凝器组件	Condenser assembly		1
8	冷凝器进气管	Condenser gas inlet tube		1
9	毛细管组件	Capillary assembly		1
10	后钢丝网罩	Backside steel grille		1
11	电器盖板	Handle		1
12	右侧板	Right-side plate		1
13	电容抱攀	Capacitor clamp		1
14	风机电容	Fan motor capacitor		1
15	压缩机电容	Compressor capacitor		1
16	端子板	Terminal board		1
17	电器架	Electrical holding plate		1
18	隔风立板	Partition plate		1
19	四通阀线圈	Electromagnetic loop		1
20	四通阀管路组件	Four-way valve and capillary assembly		1
21	压缩机连接线	Compressor connection cord		1
22	压缩机接地线	Compressor grounding cord		1
23	电器罩	Compressor terminal cover		1
24	过载保护器	Over-load protector		1
25	压缩机	Compressor		1
26	截止阀组件 A	Liquid valve Dg4		1
27	截止阀组件 B	Gas valve Dg8		1
28	阀板	Valve plate		1
29	底盘组件	Chassis		1

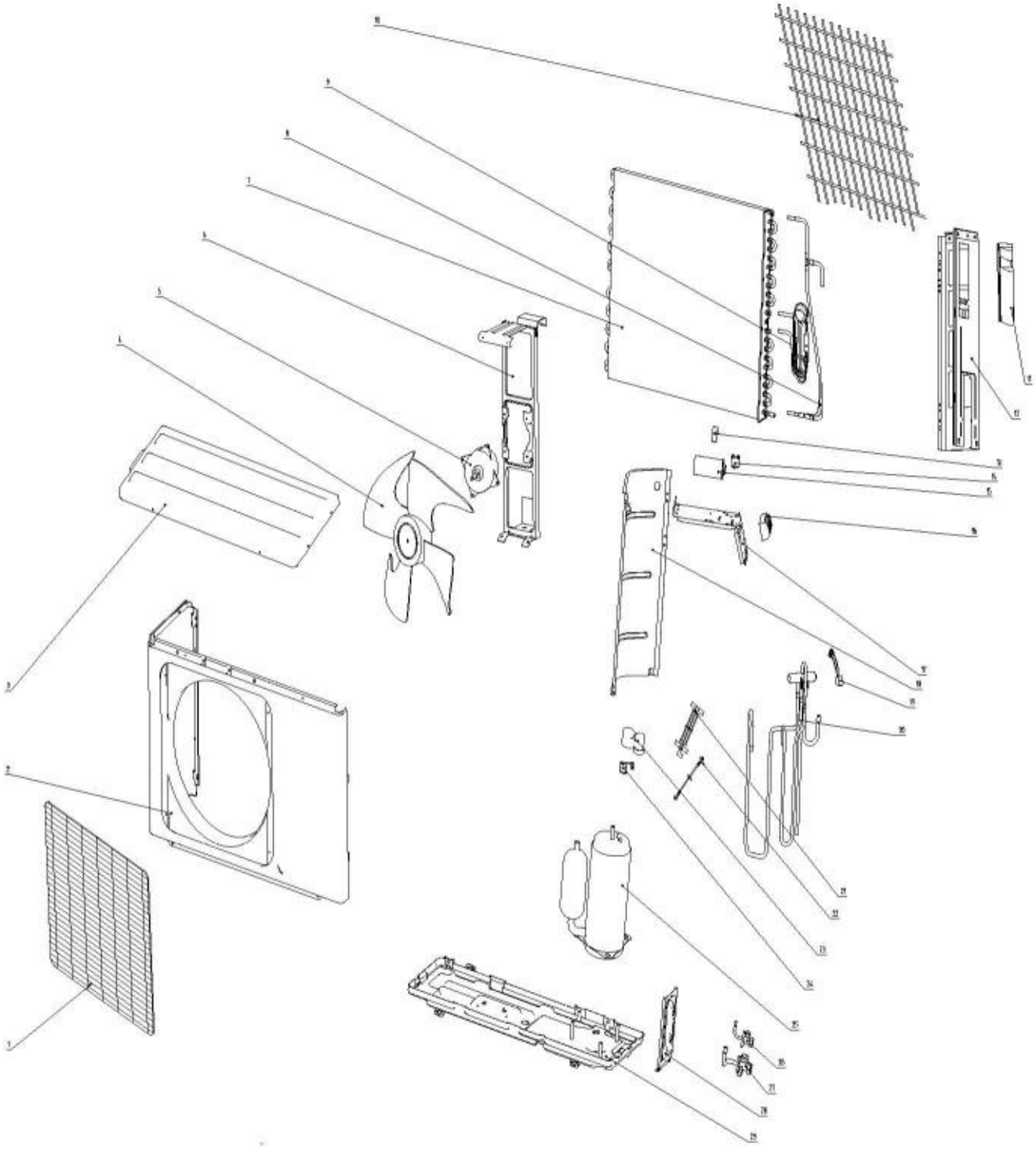
2. KFR25/HSL

Indoor unit exploded picture



Detailed part list of KFR25/HSL indoor unit				
No	Chinese Name	Name	Material	Number
1	面板组件	Panel		1
2	过滤网组件	Filter		2
3	电器盖板	Cover of medium frame		1
4	中框盖	Medium frame		1
5	导风门	Horizontal air blade		1
6	导风叶片	Vertical air blade		12
7	导风架	Air blade holder		1
8	步进电机组件	Step motor		1
9	贯流风叶组件	Indoor fan		1
10	橡胶轴承座	Rubber bearing		1
11	蒸发器左支架	Left plastic crutch for evaporator		1
12	蒸发器总成	Evaporator assembly		1
13	底座组件	Chassis		1
14	挂板组件	Mounting plate		1
15	管路压板	Tube clamp plate		1
16	塑封电机组件	Indoor fan motor		1
17	电控盒	Electric controller box		1
18	变压器	Transformer		1
19	室内传感器	Plastic temperature sensor		1
20	主控板	Main PCB		1
21	内盘传感器	Copper temperature sensor		1
22	遥控器接收座	Signal receiver holder for Remote controller		1
23	温控探头支架	Temperature sensor holder		1
24	接收板	Receiver board		1
25	端子板	Terminal board		1
26	负离子发生器	Negative ion generator	Optional	1
27	连接线	Connection cable		1
28	电源连接线	Interconnection cord		1
29	电源线	Power supply cord with plug		1
30	显示灯板	Display board		1
31	遥控器	Remote controller		1

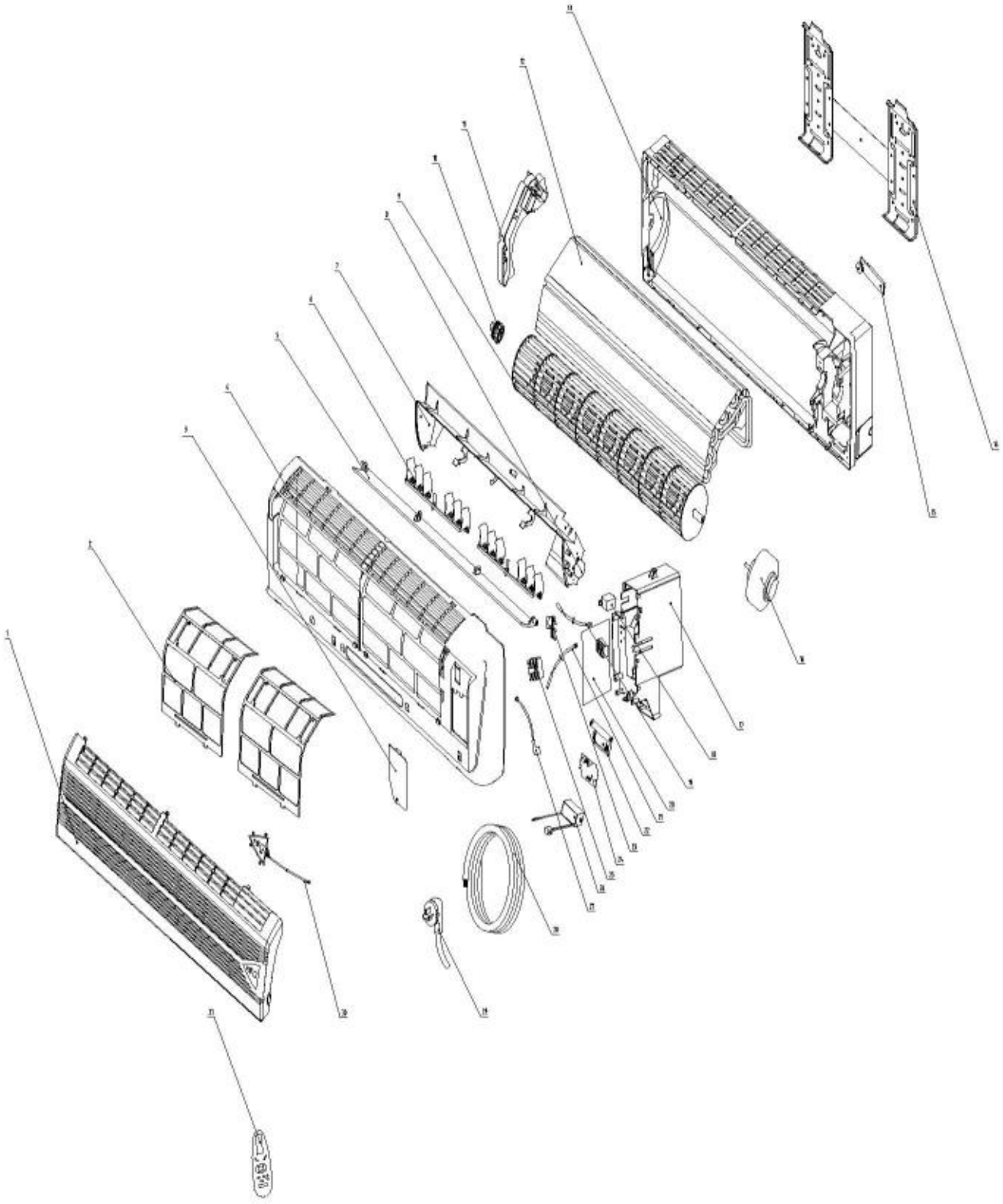
Outdoor unit exploded picture



Detailed part list of KFR25/HSL outdoor unit				
No	Chinese Name	Name	Material	Number
1	面板网罩	Steel grille		1
2	面板组件	Front panel		1
3	顶盖板	Top cover board		1
4	轴流风叶	Outdoor fan		1
5	室外电机	Outdoor fan motor		1
6	电机架	Motor bracket		1
7	冷凝器组件	Condenser assembly		1
8	冷凝器进气管	Condenser gas inlet tube		1
9	毛细管组件	Capillary assembly		1
10	后钢丝网罩	Backside steel grille		1
11	电器盖板	Handle		1
12	右侧板	Right-side plate		1
13	电容抱攀	Capacitor clamp		1
14	风机电容	Fan motor capacitor		1
15	压缩机电容	Compressor capacitor		1
16	端子板	Terminal board		1
17	电器架	Electrical holding plate		1
18	隔风立板	Partition plate		1
19	四通阀线圈	Electromagnetic loop		1
20	四通阀管路组件	Four-way valve and capillary assembly		1
21	压缩机连接线	Compressor connection cord		1
22	压缩机接地线	Compressor grounding cord		1
23	电器罩	Compressor terminal cover		1
24	过载保护器	Over-load protector		1
25	压缩机	Compressor		1
26	截止阀组件 A	Liquid valve Dg4		1
27	截止阀组件 B	Gas valve Dg8		1
28	阀板	Valve plate		1
29	底盘组件	Chassis		1

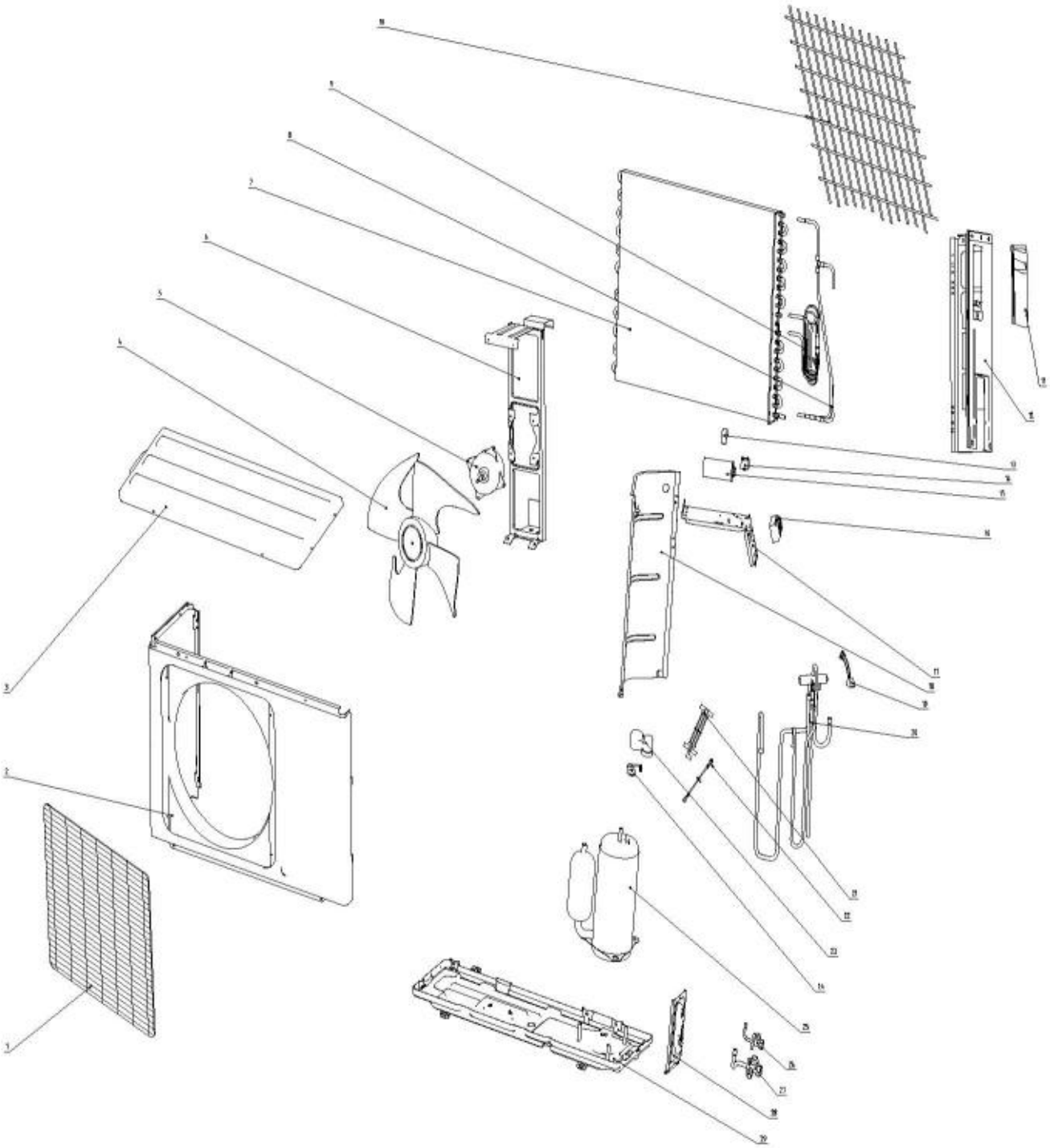
3. KFR25/HS

Indoor unit exploded picture



Detailed part list of KFR25/HS indoor unit				
No	Chinese Name	Name	Material	Number
1	面板组件	Panel		1
2	过滤网组件	Filter		2
3	电器盖板	Cover of medium frame		1
4	中框盖	Medium frame		1
5	导风门	Horizontal air blade		1
6	导风叶片	Vertical air blade		12
7	导风架	Air blade holder		1
8	步进电机组件	Step motor		1
9	贯流风叶组件	Indoor fan		1
10	橡胶轴承座	Rubber bearing		1
11	蒸发器左支架	Left plastic crutch for evaporator		1
12	蒸发器总成	Evaporator		1
13	底座组件	Chassis		1
14	挂板组件	Mounting plate		1
15	管路压板	Tube clamp plate		1
16	塑封电机组件	Indoor fan motor		1
17	电控盒	Electric controller box		1
18	变压器	Transformer		1
19	室内传感器	Plastic temperature sensor		1
20	主控板	Main PCB		1
21	内盘传感器	Copper temperature sensor		1
22	遥控器接收座	Signal receiver holder for Remote controller		1
23	温控探头支架	Temperature sensor holder		1
24	接收板	Receiver board		1
25	端子板	Terminal board		1
26	负离子发生器	Negative ion generator		1
27	连接线	Connection cable		1
28	电源连接线	Interconnection cord		1
29	电源线	Power supply cord with plug		1
30	显示灯板	Display board		1
31	遥控器	Remote controller		1

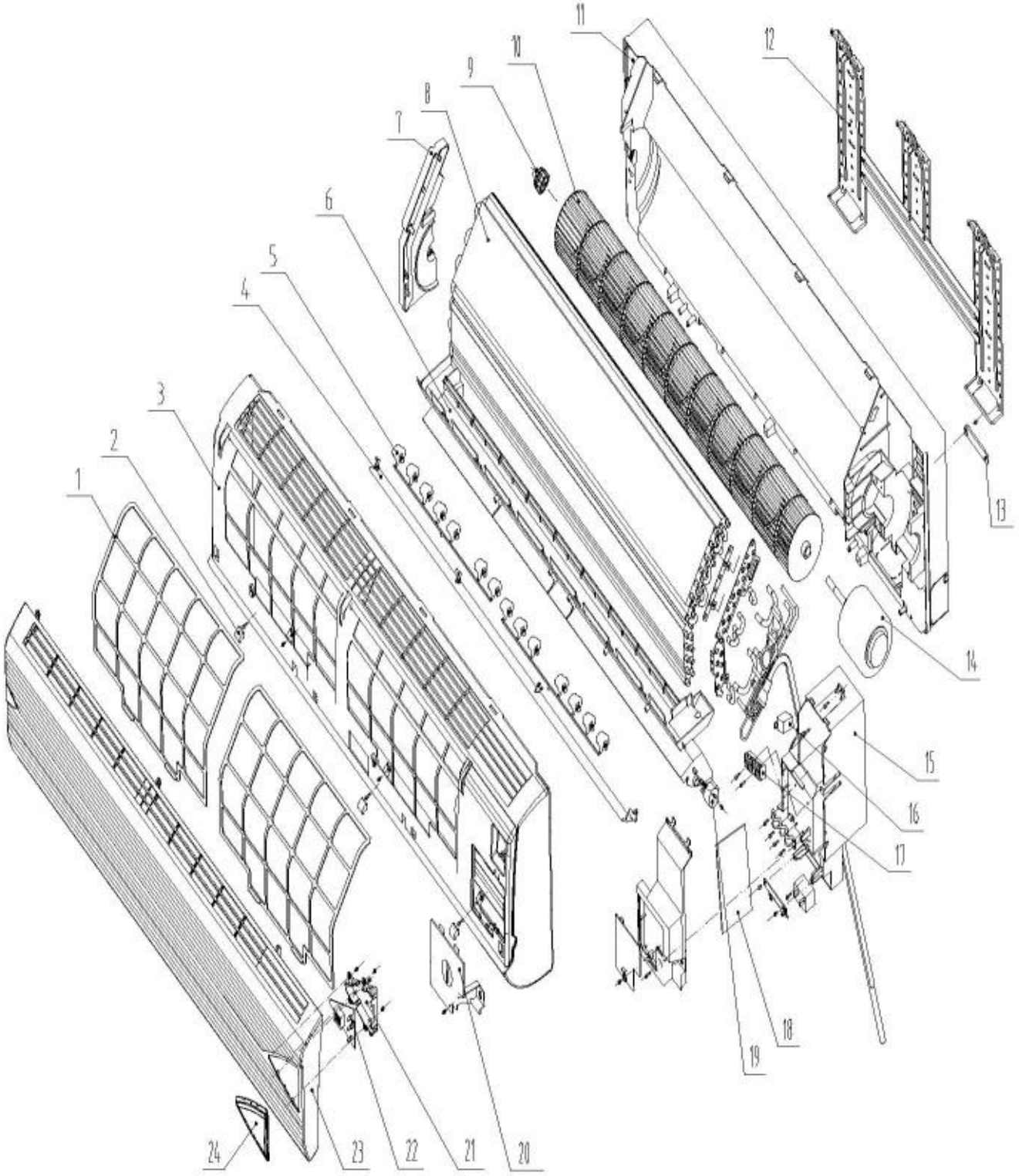
Outdoor unit exploded picture



Detailed part list of KFR25/HS outdoor unit				
No	Chinese Name	Name	Material	Number
1	面板网罩	Steel grille		1
2	面板组件	Front panel		1
3	顶盖板	Top cover board		1
4	轴流风叶	Outdoor fan		1
5	室外电机	Outdoor fan motor		1
6	电机架	Motor bracket		1
7	冷凝器组件	Condenser assembly		1
8	冷凝器进气管	Condenser gas inlet tube		1
9	毛细管组件	Capillary assembly		1
10	后钢丝网罩	Backside steel grille		1
11	电器盖板	Handle		1
12	右侧板	Right-side plate		1
13	电容抱攀	Capacitor clamp		1
14	风机电容	Fan motor capacitor		1
15	压缩机电容	Compressor capacitor		1
16	端子板	Terminal board		1
17	电器架	Electrical holding plate		1
18	隔风立板	Partition plate		1
19	四通阀线圈	Four-way valve loop		1
20	四通阀管路组件	Four-way valve and capillary assembly		1
21	压缩机连接线	Compressor connection cord		1
22	压缩机接地线	Compressor grounding cord		1
23	电器罩	Compressor terminal cover		1
24	过载保护器	Over-load protector		1
25	压缩机	Compressor		1
26	截止阀组件 A	Liquid valve		1
27	截止阀组件 B	Gas valve		1
28	阀板	Valve plate		1
29	底盘组件	Chassis		1

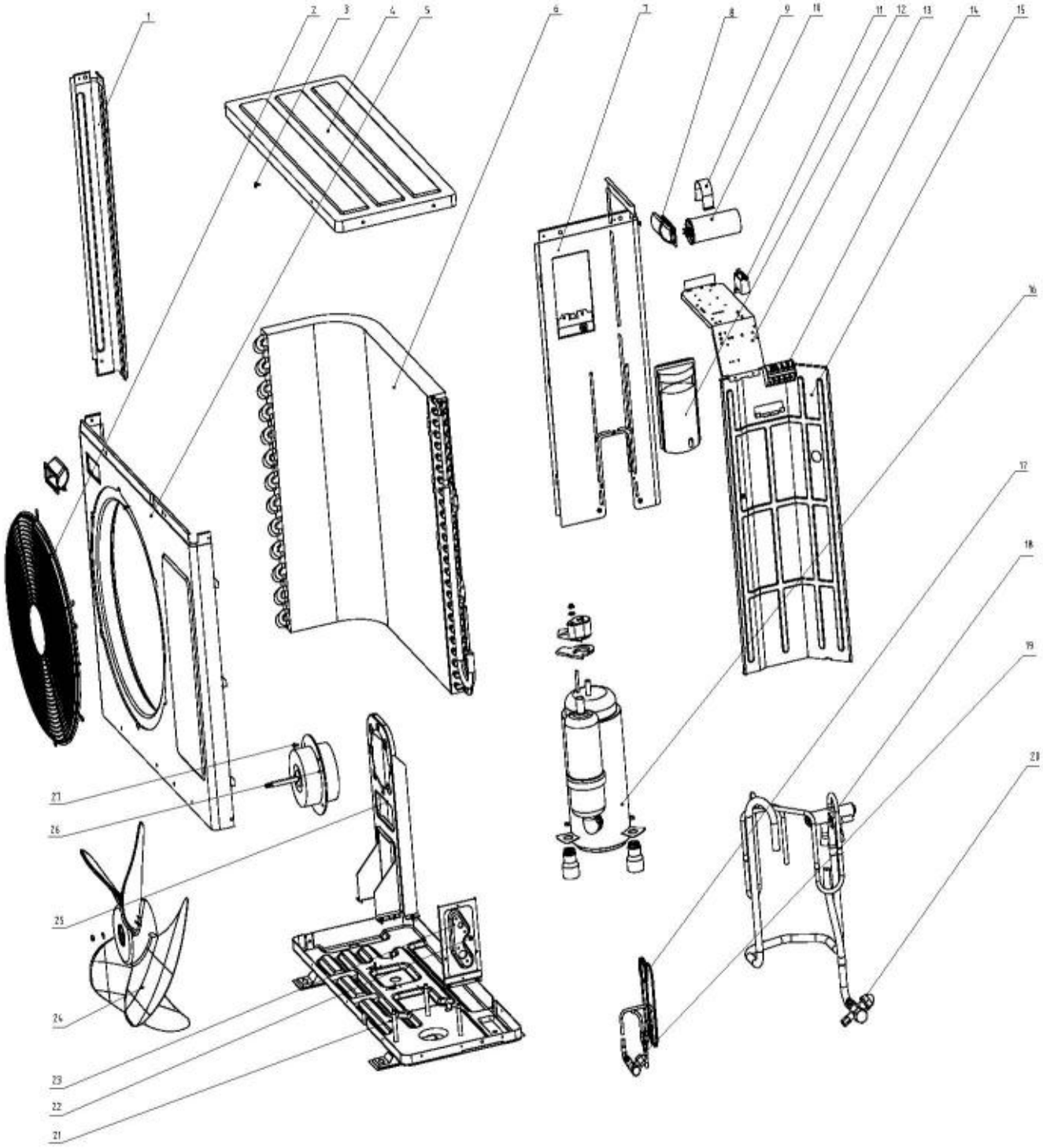
4. KFR50/HS

Indoor unit exploded picture



Detailed part list of KFR50/HS indoor unit				
No	Chinese Name	Name	Material	Number
1	过滤网组件	Filter		2
2	螺钉盖	Screw cover		3
3	中框组件	Medium frame		1
4	导风门	Horizontal air blade		1
5	导风叶片	Vertical air blade		14
6	导风架	Air blade holder		1
7	蒸发器左支架	Left plastic crutch for evaporator		1
8	蒸发器总成	Evaporator		1
9	橡胶轴承座	Rubber bearing		1
10	贯流风叶	indoor fan		1
11	底座组件	Chassis		1
12	挂板组件	Mounting plate		1
13	管路压攀	Pipe clamp		1
14	塑封电机	Indoor fan motor		1
15	电控盒	Electric controller box		1
16	变压器	Transformer		1
17	端子板	Terminal board		1
18	主控板 A	Main PCB		1
19	步进电机组件	Step motor		1
20	电控盒盖	Cover for electric controller box		1
21	指示灯座	Indication lamp holder		1
22	显示板	Display board		1
23	面板组件	Panel		1
24	显示灯板	Display board cover		1

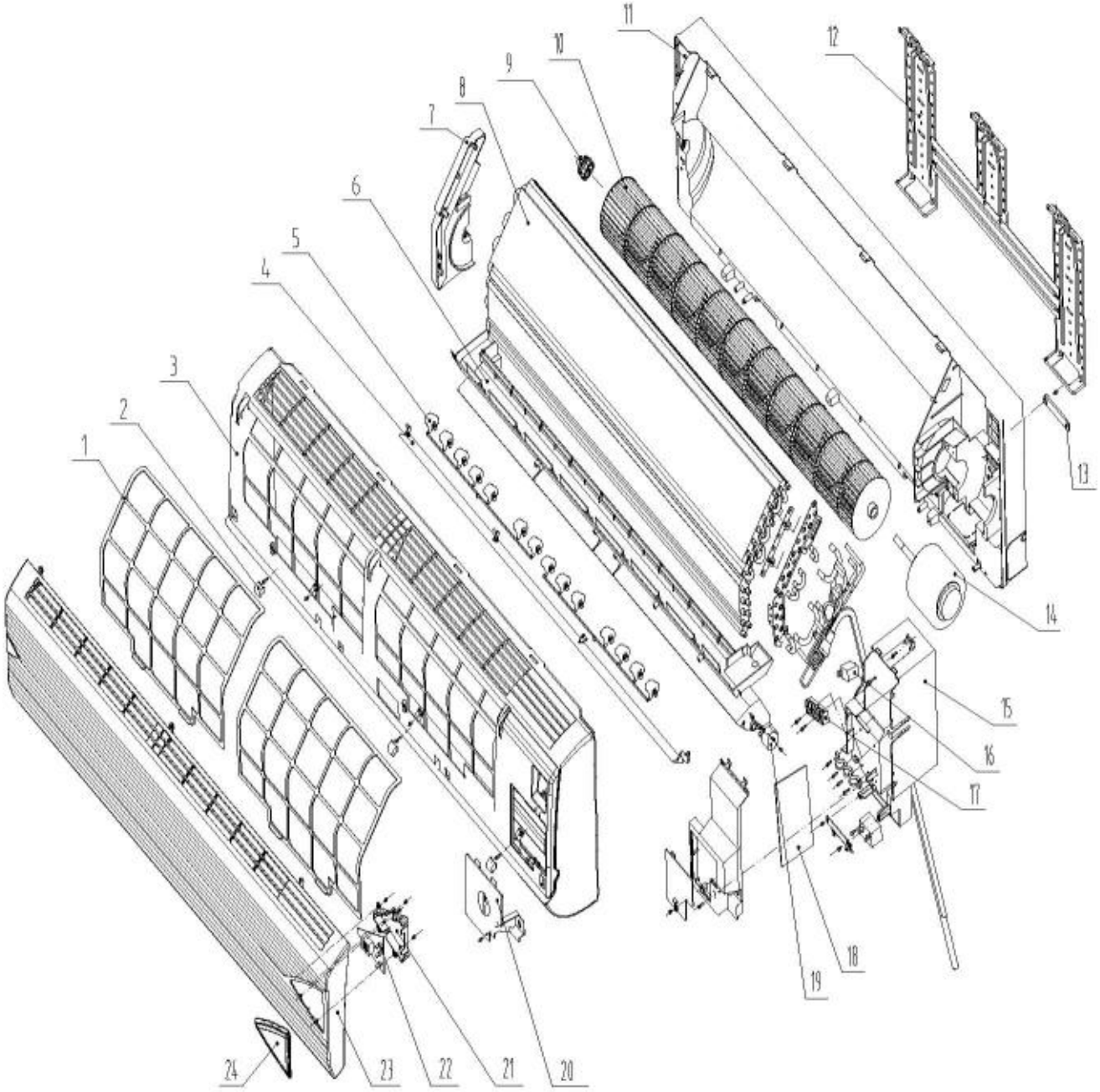
Outdoor unit exploded picture



Detailed part list of KFR50/HS outdoor unit				
No	Chinese Name	Name	Material	Number
1	左侧支撑板	Left-side supporting plate		1
2	钢丝网罩	Steel grille		1
3	大扁头自攻螺钉	Screw		40
4	顶盖板	Top cover plate		1
5	大面板	Front panel		1
6	冷凝器总成	Condenser assembly		1
7	右侧板	Right-side plate		1
8	小挖手	Handle		2
9	电容抱攀	Capacitor clamp		1
10	压缩机电容	Compressor capacitor		1
11	风机电容	Fan motor capacitor		1
12	压线盖	Wiring cover		1
13	电器架	Electrical holding plate		1
14	五位端子板	Terminal board		1
15	隔风立板组件	Partition plate		1
16	压缩机组件	Compressor		1
17	毛细管管路组件	Capillary assembly		1
18	四通阀管路组件	Four-way valve and capillary assembly		1
19	截止阀组件 Dg4	Liquid valve		1
20	截止阀组件 Dg10-1	Gas valve		1
21	底盘组件	Chassis		1
22	十字槽凹穴六角头自攻螺钉和平垫圈组合件	Screw and cushion assembly		4
23	阀板	Valve plate		1
24	轴流风叶	Outdoor fan		1
25	电机架	Motor bracket		1
26	室外风叶电机组件	Outdoor fan motor		1
27	十字槽盘头自攻螺钉	Screw		4

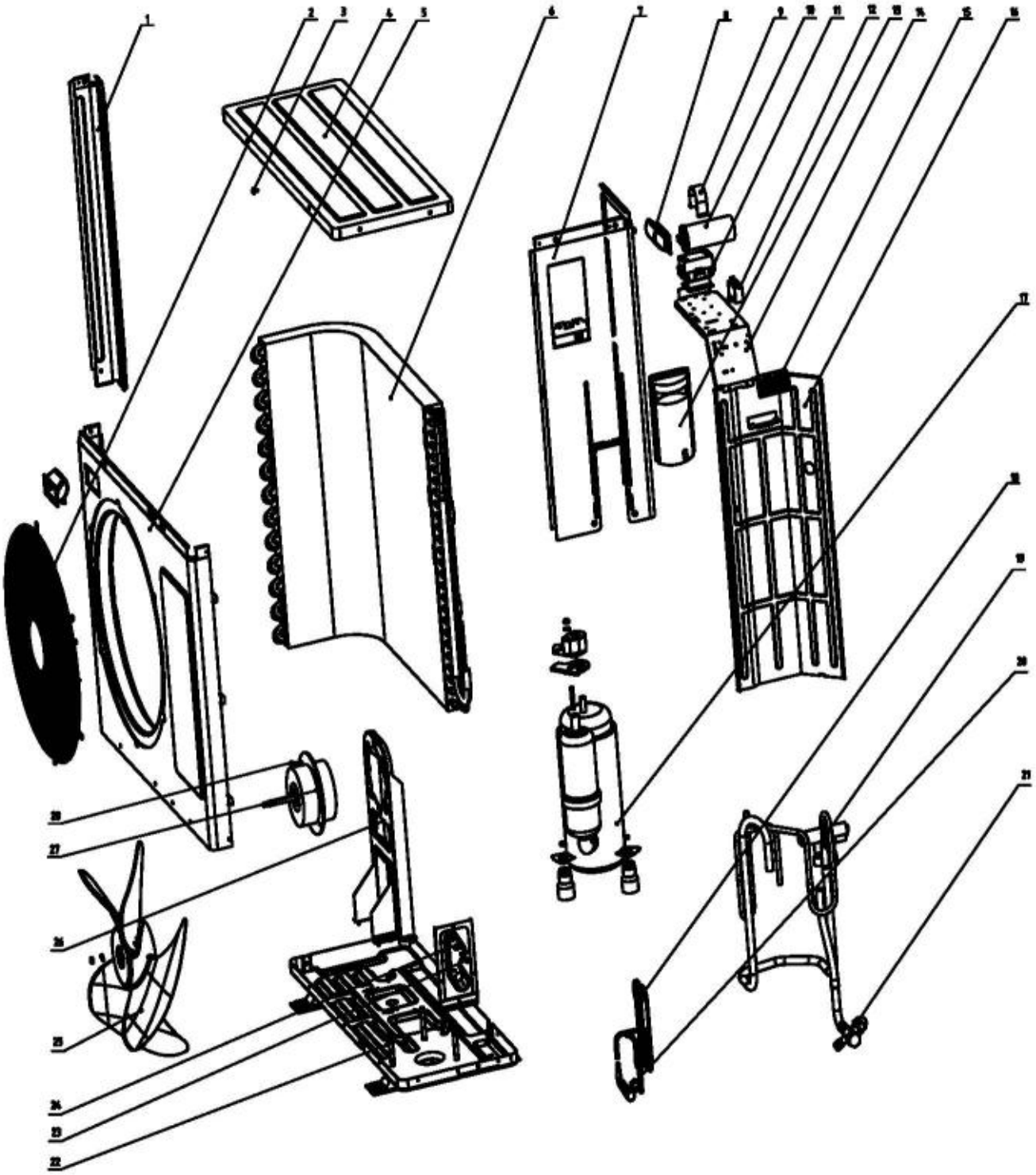
5. KFR70/HS

Indoor unit exploded picture



Detailed part list of KFR70/HS indoor unit				
No	Chinese Name	Name	Material	Number
1	过滤网组件	Filter		2
2	螺钉盖	Screw cover		3
3	中框组件	Medium frame		1
4	导风门	Horizontal air blade		1
5	导风叶片	Vertical air blade		14
6	导风架	Air blade holder		1
7	蒸发器左支架	Left plastic crutch for evaporator		1
8	蒸发器总成	Evaporator		1
9	橡胶轴承座	Rubber bearing		1
10	贯流风叶	Indoor fan		1
11	底座组件	Chassis		1
12	挂板组件	Mounting plate		1
13	管路压攀	Pipe clamp		1
14	塑封电机	Indoor fan motor		1
15	电控盒	Electric controller box		1
16	变压器	Transformer		1
17	端子板	Terminal board		1
18	主控板 A	Main PCB		1
19	步进电机组件	Step motor		1
20	电控盒盖	Cover for electric controller box		1
21	指示灯座	Indication lamp holder		1
22	显示板	Display board		1
23	面板组件	Panel		1
24	显示灯板	Display board cover		1

Outdoor unit exploded picture



Detailed part list of KFR70/HS outdoor unit				
No	Chinese Name	Name	Material	Number
1	左侧支撑板	Left-side supporting plate		1
2	钢丝网罩	Steel grille		1
3	大扁头自攻螺钉	Screw		40
4	顶盖板	Top cover plate		1
5	大面板	Front panel		1
6	冷凝器总成	Condenser assembly		1
7	右侧板	Right-side plate		1
8	小挖手	Handle		2
9	电容抱攀	Capacitor clamp		1
10	压缩机电容	Compressor capacitor		1
11	单级交流接触器	AC Connector		1
12	风机电容	Fan motor capacitor		1
13	压线盖	Wiring clamping cover		1
14	电器架	Electrical holding plate		1
15	五位端子板	Terminal board		1
16	隔风立板组件	Partition plate		1
17	压缩机组件	Compressor		1
18	毛细管管路组件	Capillary assembly		1
19	四通阀管路组件	Four-way valve and capillary assembly		1
20	截止阀组件 Dg8	Liquid valve		1
21	截止阀组件 Dg13	Gas valve		1
22	底盘组件	Chassis		1
23	十字槽凹穴六角头自攻螺钉和平垫圈组合件	Screw and cushion assembly		4
24	阀板	Valve plate		1
25	轴流风叶	Outdoor fan		1
26	电机架	Motor bracket		1
27	室外风叶电机组件	Outdoor fan motor		1
28	十字槽盘头自攻螺钉	Screw		4

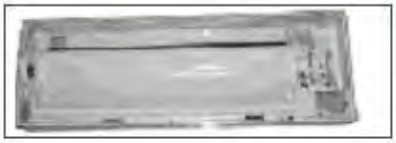
Chapter 4 The disassembly and the relating attention issues to the part of Pioneer product

Section one the disassembly and the relating attention issues to the series products of 9000BTU~12000BTU

Attention: Turn off the air-conditioner and pull out the plug of the power supply before the service.

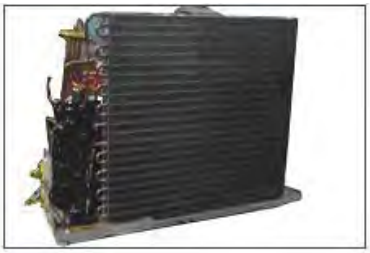
1. Indoor unit:

No.	Part	Operation Process	Remark
1	Panel	1) Turn off the air-conditioner and cut off the power supply; 2) Tear the adhesive tape sticking to the panel. 3) Hold the handles at both sides of the panel and push upward to have it slip out; 4) Grasp the both sides of the panel and push upward; 5) Turn the upper board by 90°and unload it from the connecting pole carefully; 6) Take out the filter from the right and left side. 7) Screw off the bolts on the electrical box cover and unload the box cover; 8) Screw off the 5 bolts (for 1Hp AC) or 8 bolts (for 1.5Hp AC) on the medium frame; 9) Hold the both sides of the medium frame and open it gently; 10) Turn up the medium frame by about 90°; 11) Offload the medium frame once hearing the crack sound;	

No.	Part	Operation Process	Remark
2	Electrical component	1) Do No. “1” firstly; 2) Pull out all tie-in connecting with PCB and the temperature sensor, etc.; 3) Screw off the screws and bolts as indicated in the picture. Untie the outdoor unit’s interconnection cord and power supply cord from the terminal of the electrical box. 4) If the main PCB board is loosed by chance, remove it away;	
3	Water draining tank	1) Do No.”1” and “2” firstly, offload the water drainage soft tube; 2) Offload the water draining tank from chassis and take out the electrical components.	
4	Evaporator	1) Do No.”1” , “2” and “3” firstly; 2) Offload the connecting pipe; 3) Offload the tube clip at the rear; 4) Screw off the bolts at the right and left side; 5) Lift up the evaporator, and draw it out from the indoor unit;	  
5	Indoor fan Fan motor	1) Screw off one bolt from the motor cover, and remove the motor cover; 2) Offload the motor from the fan; 3) Offload the fan from bearing;	  

2. Outdoor unit:

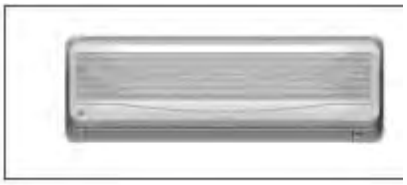
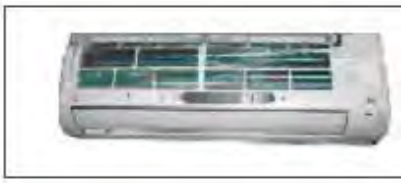
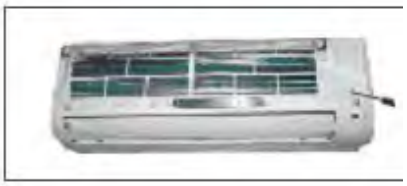
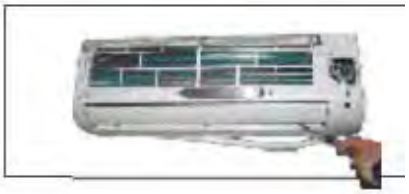
No.	Part	Operation Process	Remark
1	General operation	1) Screw off one fastening bolt from the electrical box cover, and offload the box cover; 2) Pull out the interconnection cord from the electrical box; 3) Screw off the five fastening bolts from the cover board, and offload the board; Screw the six fastening bolts from the front panel, and offload the front panel; 4) Screw off the fastening bolts from the electrical assembly; 5) Screw off the eight fastening bolts and offload the outer frame;	
2	Outdoor fan motor	1) Do No. “1” firstly; 2) Screw off the fastenings screws clockwise. 3) Offload the fan. 4) Screw off the four fastening bolts and offload the fan motor; 5) Screw off the two fastening bolts and offload the fan motor bracket.	 

No.	Part	Operation Process	Remark
3	Condenser	1) Do No.”1” and “2” firstly; 2) Screw off the two fastening bolts; 3) Weld off the inlet and outlet tube; 4) Offload the condenser.	
4	Compressor	1) Do No.”1” , “2”and “3” firstly; 2) Open the cover of compressor, release the connection cord. 3) Weld off the inlet and outlet tube; 4) Screw off the three screws; 5) Offload the compressor.	 

Section Two the disassembly and the relating attention issues to the series product of 18000BTU~24000BTU

Attention: Turn off the air-conditioner and pull out the plug of the power supply before the service.

2. Indoor unit:

No.	Part	Operation Process	Remark
1	Front panel	1) Turn off the air-conditioner and cut off the power supply; 2) Remove the adhesive tape sticking to the panel. 4) Hold the handles at both sides of the panel and push upward to have it slip out; 5) Grasp the both sides of the panel and push upward; 6) Turn the upper board by 90°and unload it from the connecting pole carefully; 7) Take out the filter from the right and left side. 8) Screw off the bolts on the electrical box cover and unload the box cover; 9) Screw off the six bolts on the medium frame; 10) Hold the both sides of the medium frame and open it gently; 11) Turn up the medium frame by about 90°; 12) Offload the medium frame once hearing the crack sound;	      

No.	Part	Operation Process	Remark
2	Electrical component	1) Do No. “1” firstly; 2) Pull out all tie-in connecting with PCB and the temperature sensor, etc.; 3) Screws off the screws and bolts at the three positions indicated in the picture. Untie the outdoor unit’s interconnection cord and power supply cord from the terminal of the electrical box. 4) If the main PCB board is loosed by chance, remove it away;	
3	Water draining tank	1) Do No.”1” and “2” firstly, offload the water draining soft tube; 2) Offload the water draining tank from the chassis and take out the electrical components.	
4	Evaporator	1) Do No.”1” , “2” and “3” firstly; 2) Offload the connecting pipe; 3) Offload the tube clip at the rear; 4) Screw off the bolts at the right and left side; 5) Lift up the evaporator, and draw it out from the indoor unit;	  
5	Indoor fan and fan motor	1) Offload the motor from the indoor fan; 2) Offload the indoor fan from bearing;	 

2. Outdoor unit

No.	Part	Operation Process	Remark
1	General operation	1) Screw off one fastening bolt from the electrical box cover, and offload the box cover; 2) Pull out the connecting cord from the electrical box; 3) Screw off the five fastening bolts from the cover board, and offload the cover board; Screw the six fastening bolts from the front panel, and offload the front panel; 4) Screw off the fastening bolts from the electrical assembly panel; 5) Screw off the eight fastening bolts and offload the outer frame;	
2	Fan motor	1) Do No.”1” firstly; 2) Screw off the fastening nut(Rotate in clockwise direction); 3) Offload the outdoor fan; 4) Screw off the four fastening bolts from the electrical motor and offload the electrical motor; 5) Screw off the two fastening bolts and offload the bracket;	 
3	Condenser	1) Do “1”,”2” firstly; 2) Screw off the fastening bolts at the left and right sides; 3) weld off the inlet and outlet tubes; 4) Offload the condenser;	

No.	Part	Operation Process	Remark
4	Compressor	1) Do “1” ,“2”, “3” firstly; 2) Open the cover of the compressor, and loosen the connecting cables; 3) Weld off the inlet and outlet tubes of the compressor; 4) Screw off three flat nuts; 5) Offload the compressor;	 

Chapter 5 Troubleshooting and electrical chart of Pioneer air conditioner Section one basic faults diagnose process of 9000BTU~12000BTU products

Troubleshooting Guide

1. The Foremost Inspecting Items

⑴The input voltage must be within +10% tolerance of the rated Voltage. If it is not the case, the air-conditioner will probably not work normally.

⑵Check the connecting cord between indoor unit and outdoor unit to see if it is properly connected. The connecting must be done according to the wiring diagram, please also notice that even different models may have the connecting cord of the same specification.

Please check if the marks at the connecting terminal and the marks on the cord can match, otherwise, the air-conditioner will not work normally.

		Causes
1	The motor is heard operating but the air-conditioner dose not work when the indoor unit is powered on	Since the air-conditioner is powered on, it will come to working condition as long as you press the ON/OFF button of the remote control and the Signal is well received.
2	The compressor stops running but the indoor fan motor keeps working when it is at cooling mode with the indoor temperature higher than set temperature.	If you turn off the air-conditioner and restart it immediately, it will return to normal in 3 minutes, after that, the air-conditioner will automatically adjust the indoor fan speed to what you set.
3	The compressor works discontinuously at dehumidifying mode.	The air-conditioner will automatically control the working of the compressor according to the inside temperature
4	The air-conditioner does not work while the LED display is on.	The TIMER is set with the air-conditioner; it will be in hold on condition. If the TIMER setting is cancelled, the air-conditioner will return to normal working condition
5	The compressor works discontinuously at cooling and dehumidifying mode, and the indoor fan motor slows down.	The compressor stops internally or the fan motor slows down to prevent the indoor heat exchanger from being frozen.

2. No Power Display

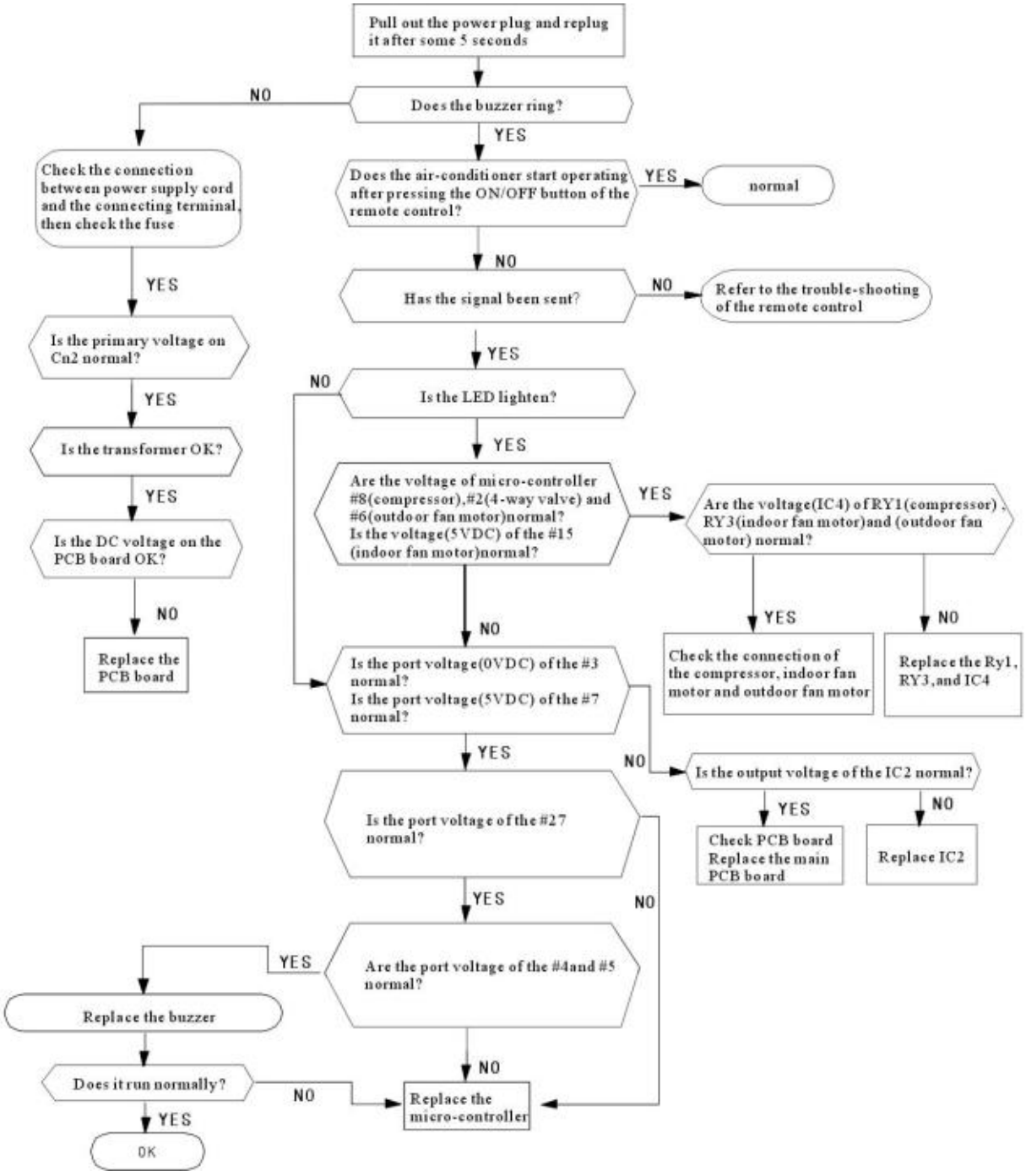
⑴Items

a) Check if the input voltage is correct?

b) Check if the AC power supply connecting is correct?

c) Check if the output voltage of the manostat L7805 (IC2) is correct?

⑵Trouble shooting procedure



3. The Indoor Fan Motor Does Not Work

⑴Items

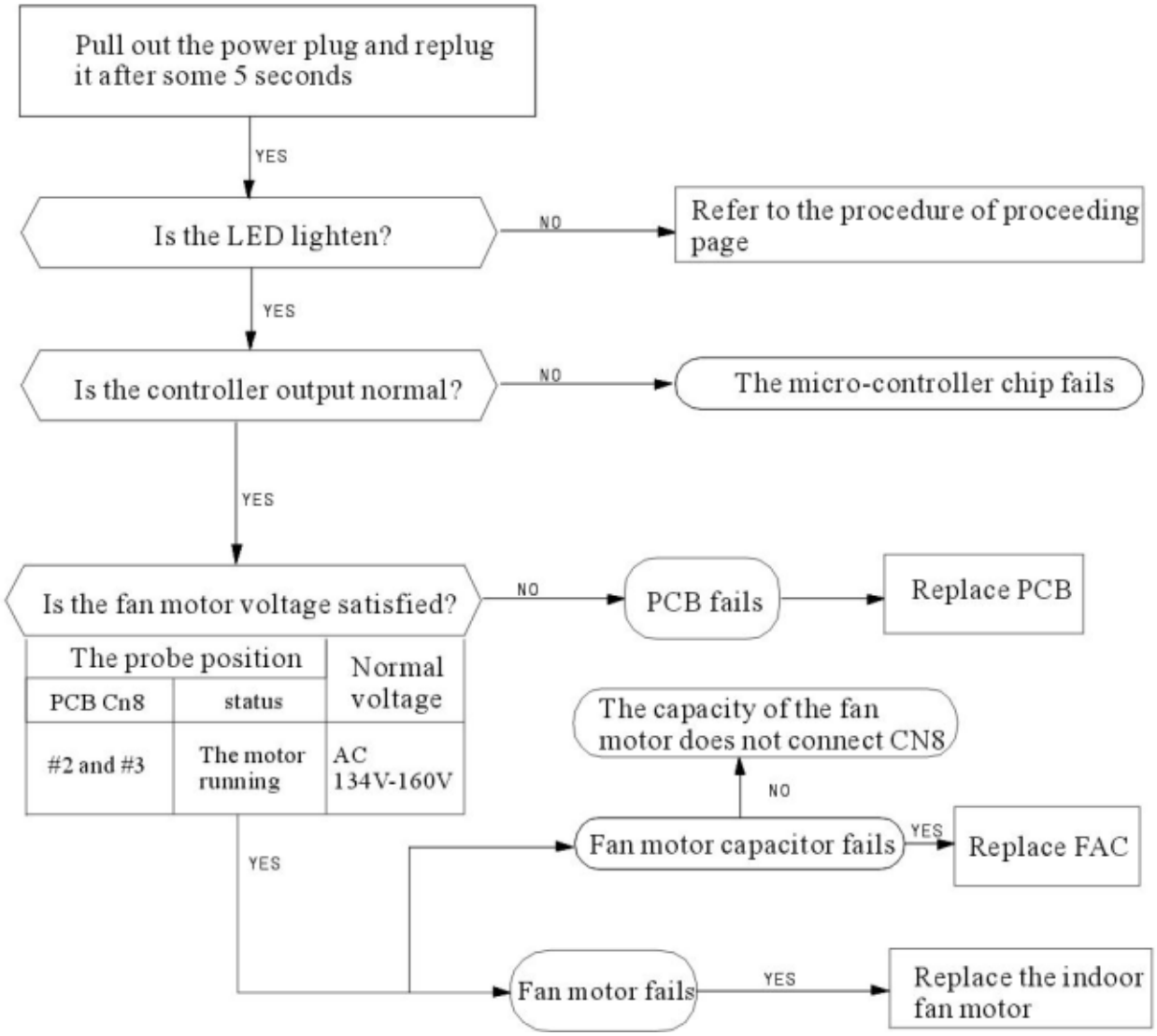
a) Check if the indoor fan motor is connected correctly to the connector (CN8)?

b) Check if the AC input voltage is correct?

c) Check if the IC of indoor fan motor is connected correctly to the connector (CN2)?

d) Check if the capacity of indoor fan motor is connected correctly to the connector (CN8)?

⑵Trouble shooting procedure



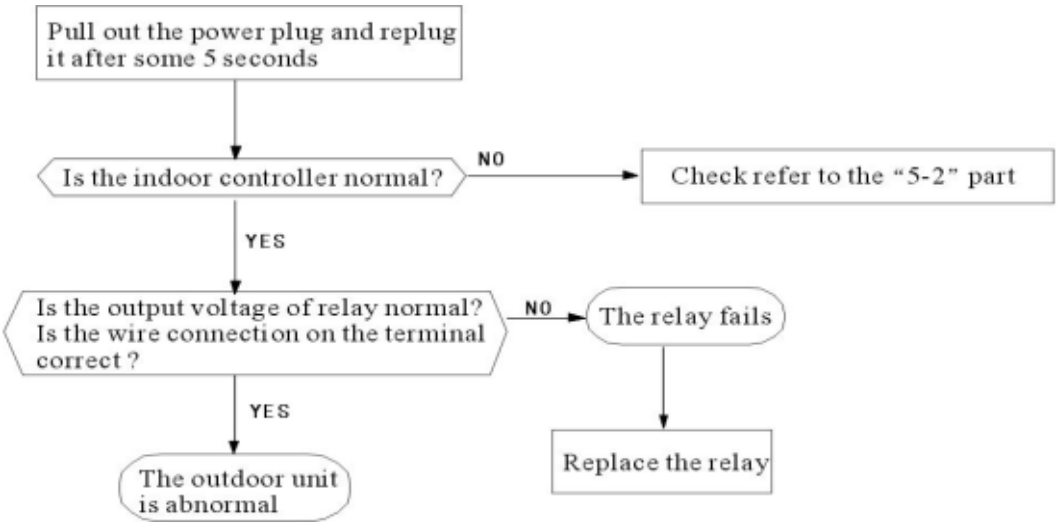
4. The Outdoor Unit Does Not Work

⑴Items

a) Check if the input voltage is correct?

b) Check if the wire connection of the outdoor connecting terminal is correct?

⑵Trouble shooting procedure



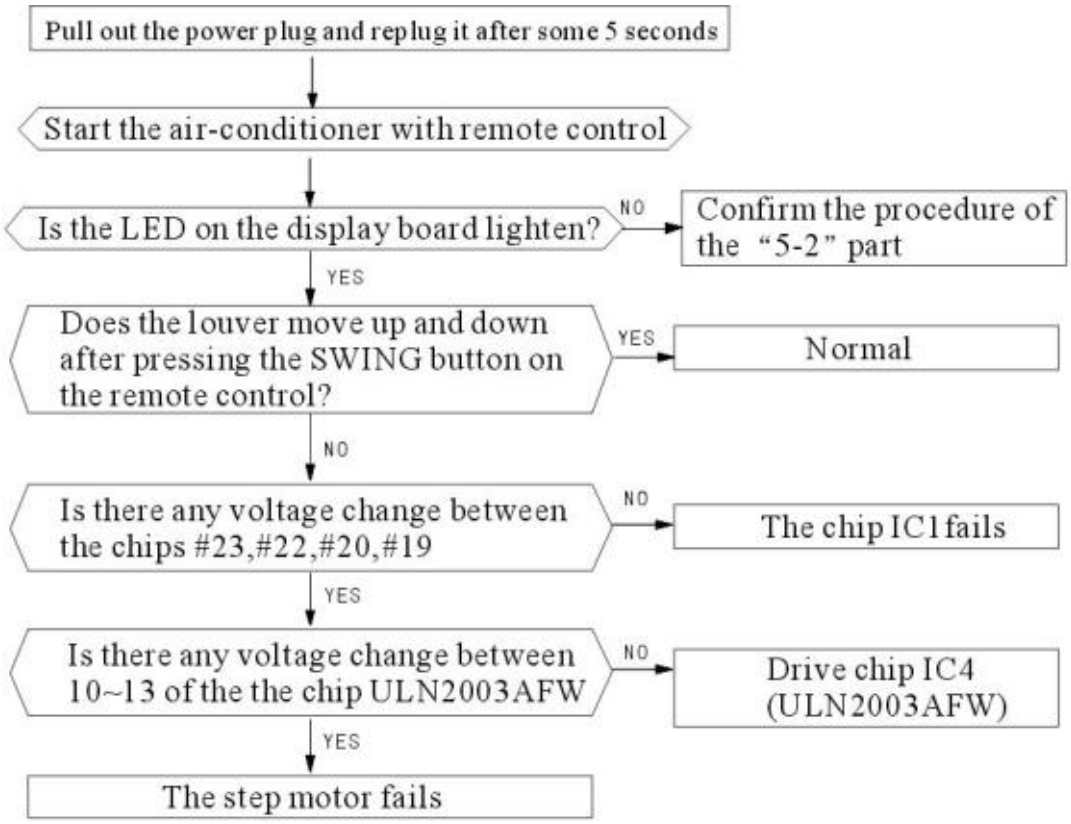
5. The Step Motor Does Not Work

⑴Items

a) Check if the input voltage is correct?

b) Check if the step motor controlling the up-down movement firmly connected to Cn2?

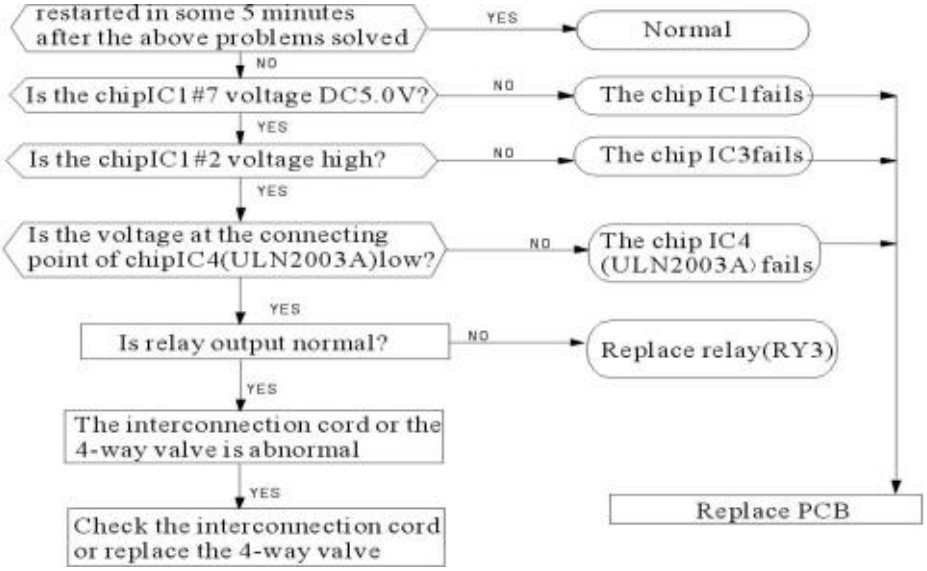
⑵Trouble shooting procedure



6. Heating Mode Can Work, But No Hot Air Blow

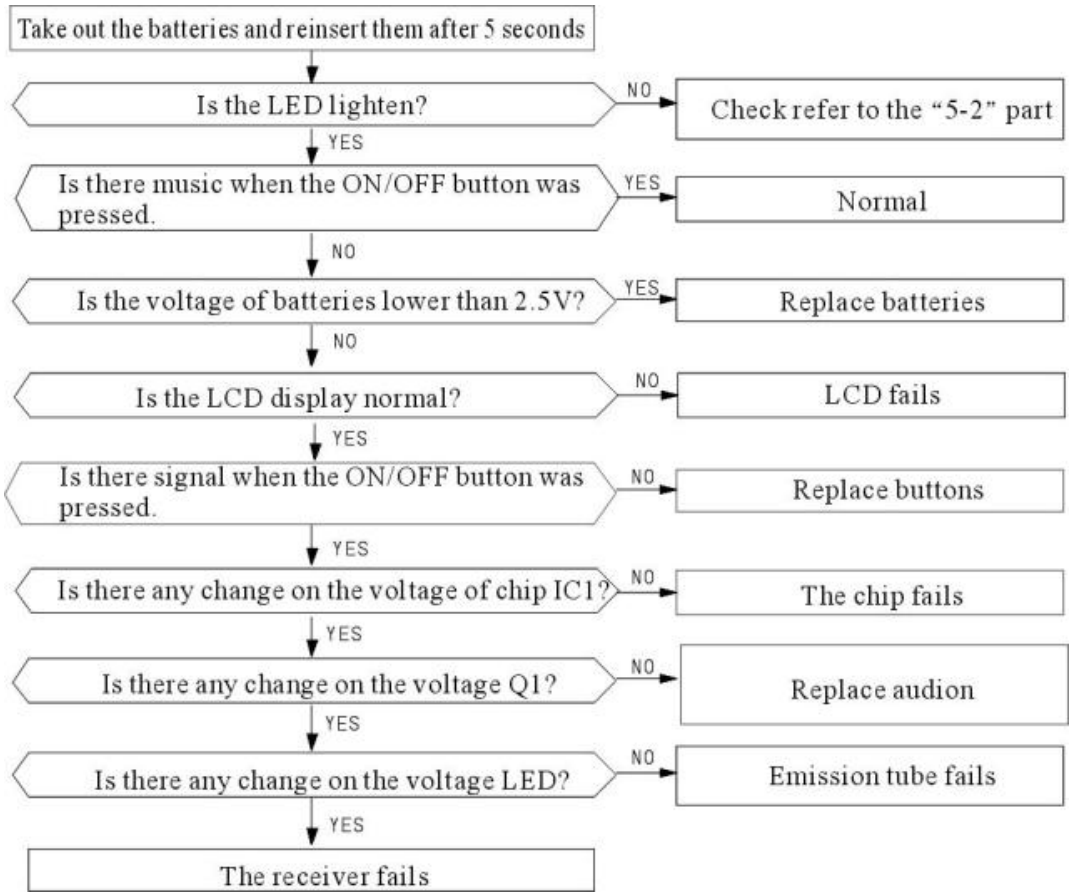
⑴Check if the set temperature is lower than the indoor temperature?

⑵Check if the indoor PCB is connected to the terminal correctly?



7. Remote Control Can Not Work

Trouble shooting procedure



8. The Failure Analysis of the Main Parts

<table>
<tr><td>Part</td><td colspan="8">Analysis</td></tr>
<tr><td rowspan="3">Heat exchanger</td><td colspan="8">Measure resistance</td></tr>
<tr><td>Normal</td><td colspan="7"><table><tr><td>Environment temperature</td><td>15℃</td><td>20℃</td><td>25℃</td><td>30℃</td><td>35℃</td><td>40℃</td></tr><tr><td>Resistance of transformer(KΩ)</td><td>7.45</td><td>6.08</td><td>5</td><td>4.13</td><td>3.43</td><td>2.86</td></tr></table></td></tr>
<tr><td>Abnormal</td><td colspan="7">∞：Turn-off ；0Ω：Short-cut</td></tr>
<tr><td rowspan="5">The indoor fan motor</td><td colspan="8">Detecting the resistance between each connecting terminal</td></tr>
<tr><td>Normal</td><td colspan="7">Environment temperature（10℃～30℃）<table><tr><td colspan="2">Between</td><td>1</td><td>2</td><td>3</td></tr><tr><td>Blue、yellow</td><td>Main</td><td>410Ω ±10%</td><td>350Ω ±10%</td><td>370Ω ±10%</td></tr><tr><td>Blue、red</td><td>Anxiliary</td><td>325Ω ±10%</td><td>270Ω ±10%</td><td>300Ω ±10%</td></tr><tr><td colspan="2">Input</td><td colspan="3">YYK13-4：13W YYK19-4：19W</td></tr></table></td></tr>
<tr><td>Abnormal</td><td colspan="7">∞：Turn-off ；0Ω：Short-cut</td></tr>
<tr><td colspan="8">Detecting the voltage between the signal wire of fan motor and ground</td></tr>
<tr><td>Normal</td><td colspan="7"><table><tr><td>Between</td><td>Voltage</td></tr><tr><td>Gray、Orange</td><td>0.5V～4.5V</td></tr><tr><td>Yellow、Orange</td><td>5V</td></tr></table></td></tr>
<tr><td>Abnormal</td><td colspan="7">voltage<0, voltage>5 is abnormal</td></tr>
<tr><td rowspan="3">Step motor</td><td rowspan="2">Normal</td><td colspan="7">Environment temperature（10℃～30℃）<table><tr><td colspan="2" rowspan="2">Between</td><td>1</td><td>2</td><td>-</td></tr><tr><td>24BYJ48</td><td>35BYJ412B</td><td>-</td></tr><tr><td>Blue、yellow</td><td>-</td><td>Above 300Ω</td><td>Around 120Ω</td><td>-</td></tr><tr><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr><tr><td colspan="2">Input</td><td>1.5W</td><td>-</td><td>-</td></tr></table></td></tr>
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<tr><td>Normal</td><td colspan="7">When the temperature is20℃～30℃ ,around 300Ω and 120Ω</td></tr>
<tr><td>Abnormal</td><td colspan="7">∞：Turn-off ；0Ω：Short-cut</td></tr>
</table>

Section two basic faults diagnose process of 18000BTU~24000BTU products

Troubleshooting Guide

1. The Foremost Inspecting Items

⑴The input voltage must be within +10% tolerance of the rated Voltage. If it is not the case, the air-conditioner will probably not work normally.

⑵Check the connecting cord between indoor unit and outdoor unit to see if it is properly connected. The connecting must be done according to the wiring diagram, please also notice that even different models may have the connecting cord of the same specification.

Please check if the marks at the connecting terminal and the marks on the cord can match, otherwise, the air-conditioner will not work normally.

⑶If the following phenomena are found, the problem is not from the air-conditioner itself.

NO.	Problems	Causes
1	The motor is heard operating but the air-conditioner dose not work when the indoor unit is powered on	Since the air-conditioner is powered on, it will come to working condition as long as you press the ON/OFF button of the remote control and the signal is well received.
2	The compressor stops running but the indoor fan motor keeps working when it is at cooling mode with the indoor temperature higher than set temperature.	If you turn off the air-conditioner and restart it immediately, it will return to normal in 3 minutes, after that, the air-conditioner will automatically adjust the indoor fan speed to what you set.
3	The compressor works discontinuously at dehumidifying mode.	The air-conditioner will automatically control the working of the compressor according to the inside temperature
4	The air-conditioner does not work while the LED display is on.	The TIMER is set with the air-conditioner; it will be in hold on condition. If the TIMER setting is cancelled, the air-conditioner will return to normal working condition.
5	The compressor works discontinuously at cooling and dehumidifying mode, and the indoor fan motor slows down.	The compressor stops internally or the fan motor slows down to prevent the indoor heat exchanger from being frozen.

2. No Power Display

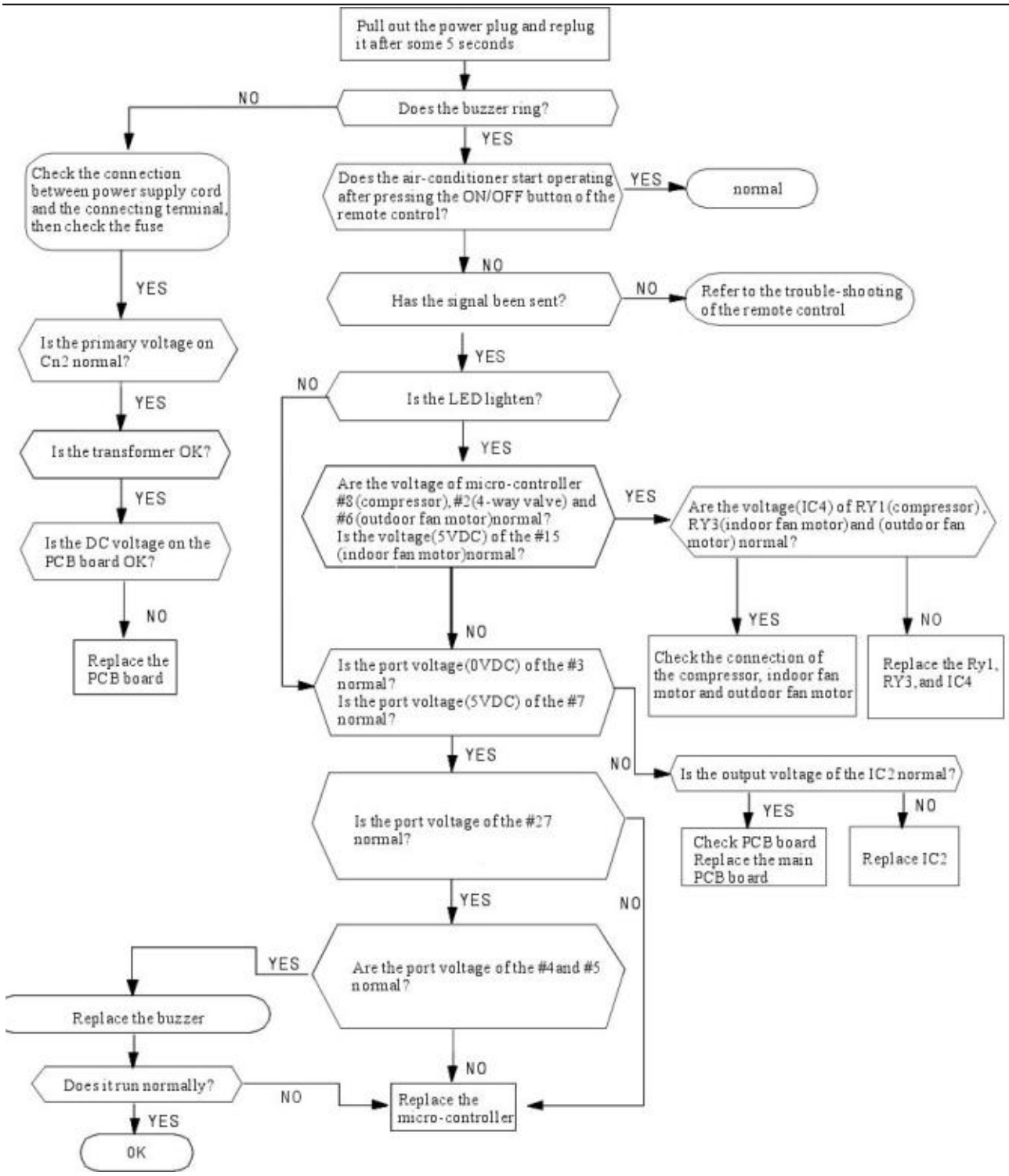
⑴Items

①Check if the input voltage is correct?

②Check if the AC power supply connecting is correct?

③Check if the output voltage of the manostat L7805(IC2)is correct?

⑵Trouble shooting procedure



3. The Indoor Fan Motor Does Not Work

⑴Items

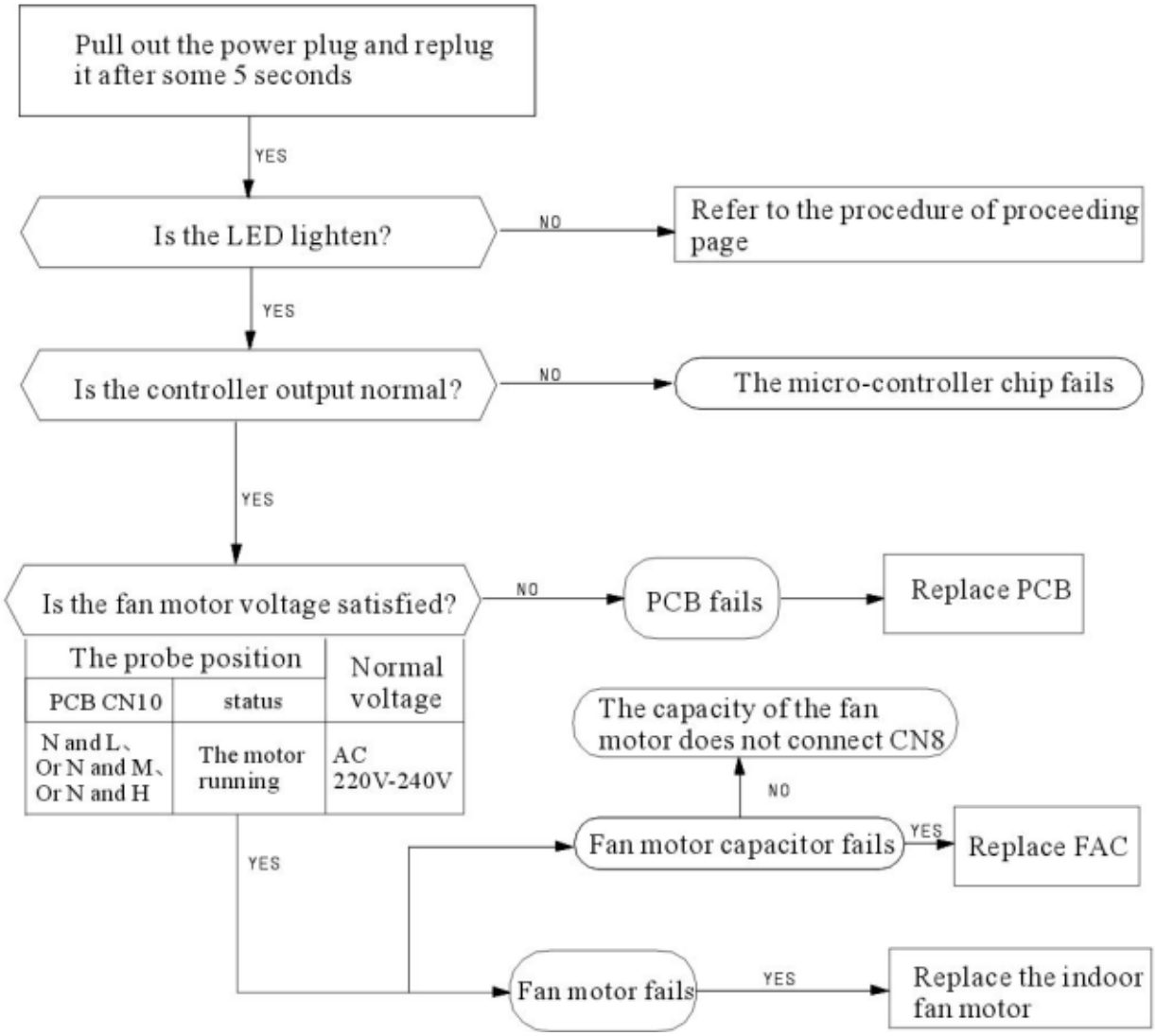
①Check if the indoor fan motor is connected correctly to the connector(CN8)?

②Check if the AC input voltage is correct?

③Check if the IC of indoor fan motor is connected correctly to the connector(CN2)?

④Check if the capacity of indoor fan motor is connected correctly to the connector(CN8)?

⑵Trouble shooting procedure



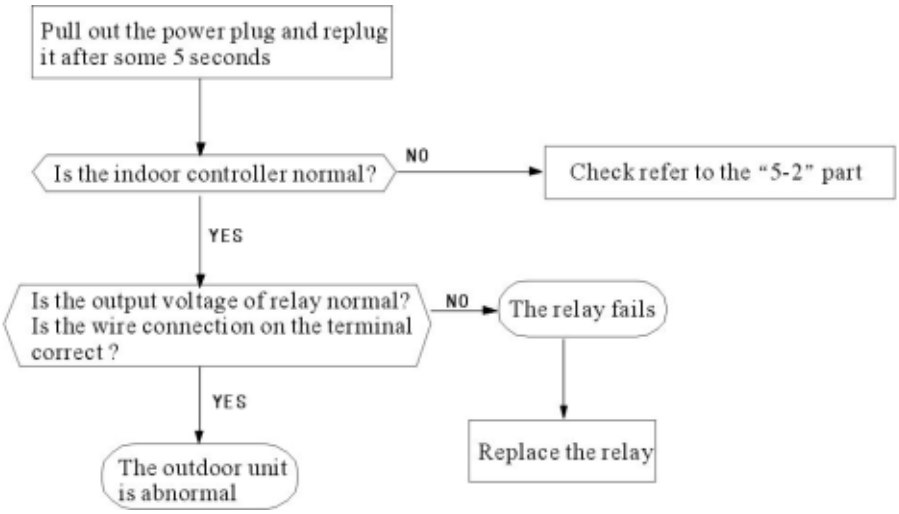
4. The Outdoor Unit Does Not Work

⑴Items

①Check if the input voltage is correct?

②Check if the wire connection of the outdoor connecting terminal is correct?

⑵Trouble shooting procedure



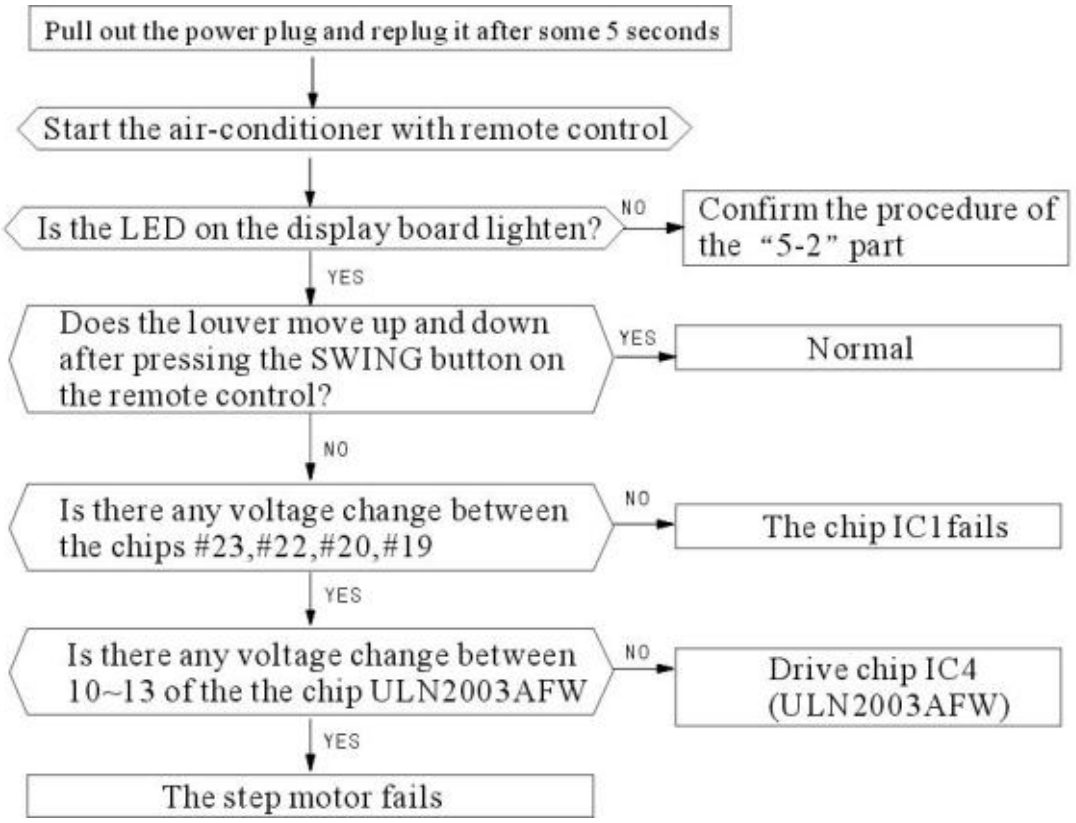
5. The Step Motor Does Not Work

⑴Items

①Check if the input voltage is correct?

②Check if the step motor controlling the up-down movement firmly connected to Cn2?

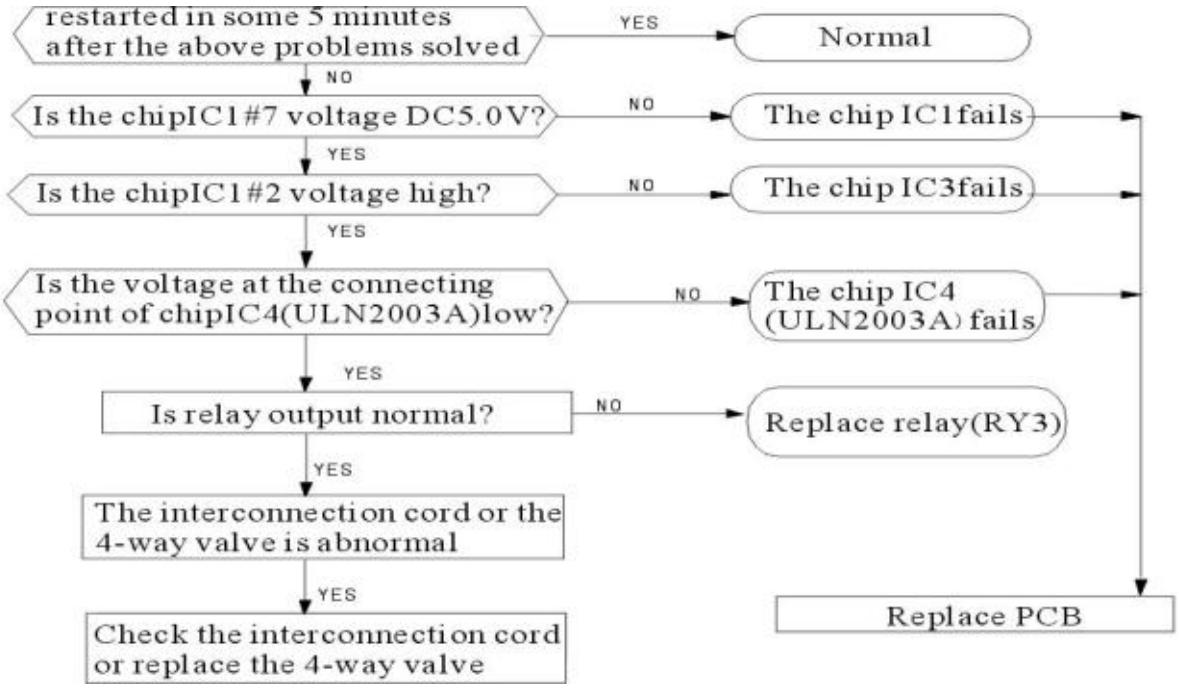
⑵Trouble shooting procedure



6. Heating Mode Can Work, But No Hot Air Blow

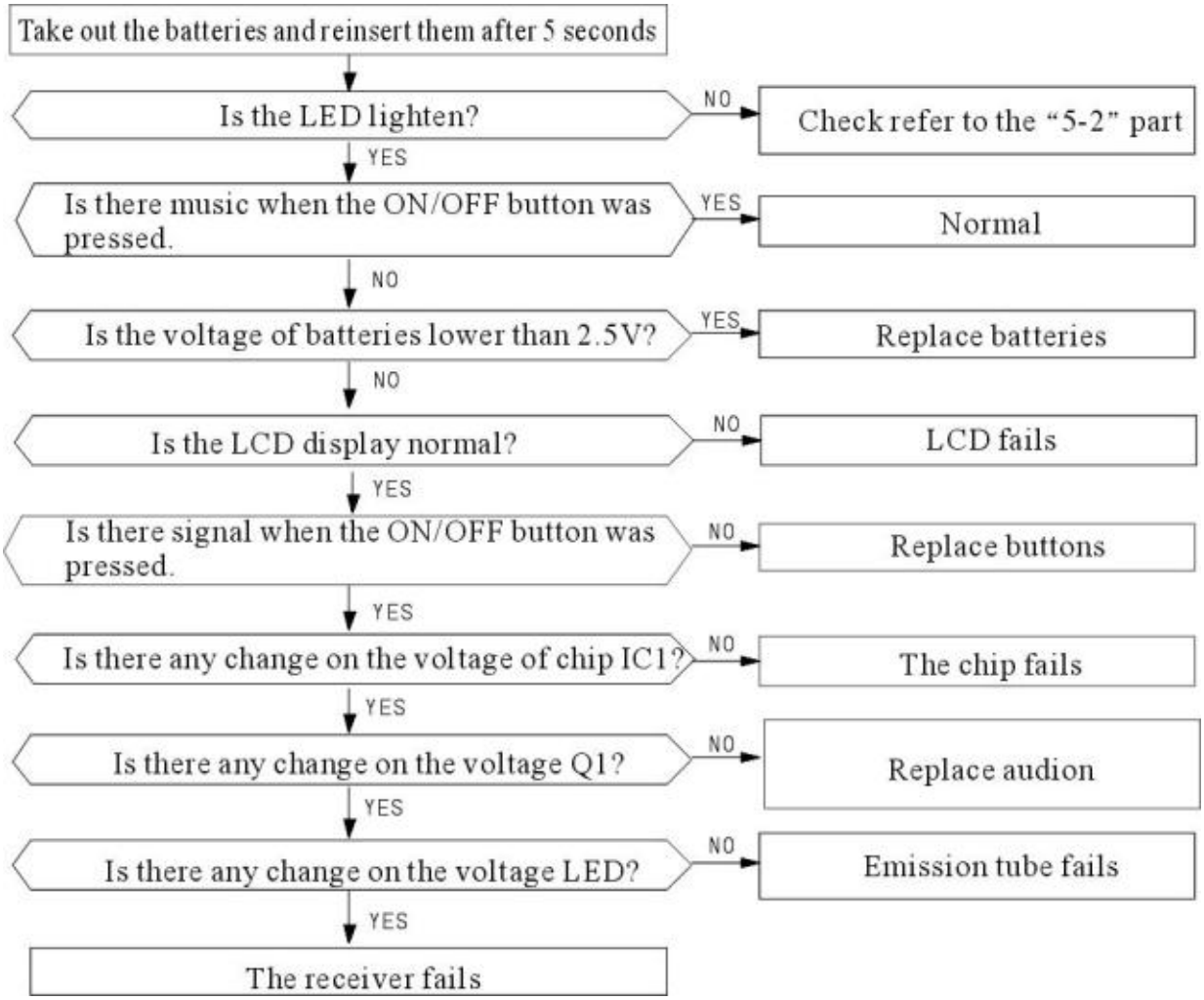
⑴Check if the set temperature is lower than the indoor temperature?

⑵Check if the indoor PCB is connected to the terminal correctly?



7. Remote Control Can Not Work

Trouble shooting procedure



8. The Failure Analysis of the Main Parts

<table>
<tr><td>Part</td><td colspan="2">Analysis</td></tr>
<tr><td rowspan="3">Transformer
Heat exchanger</td><td colspan="2">Measure resistance</td></tr>
<tr><td>Normal</td><td>
<table>
<tr><td>Environment temperature</td><td>15℃</td><td>20℃</td><td>25℃</td><td>30℃</td><td>35℃</td><td>40℃</td></tr>
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</table>
</td></tr>
<tr><td>Abnormal</td><td>∞：Turn-off ；0Ω：Short-cut</td></tr>
<tr><td rowspan="3">Step motor</td><td>Normal</td><td>
Environment temperature（10℃~30℃）
<table>
<tr><td colspan="2" rowspan="2">Between</td><td>1</td><td>2</td><td>-</td></tr>
<tr><td>24BYJ48</td><td>35BYJ412B</td><td>-</td></tr>
<tr><td>Blue、yellow</td><td>-</td><td>Above300Ω</td><td>Around120Ω</td><td>-</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td colspan="2">Input</td><td>1.5W</td><td>-</td><td>-</td></tr>
</table>
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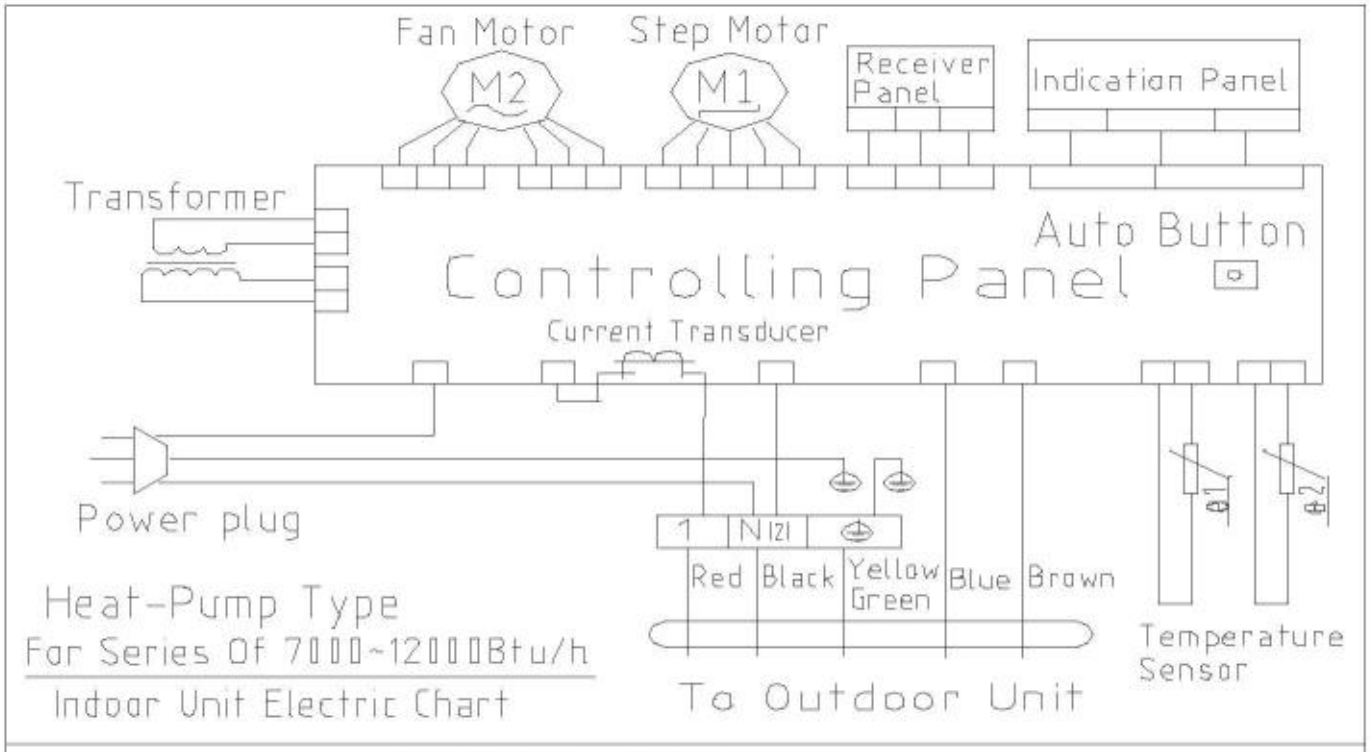
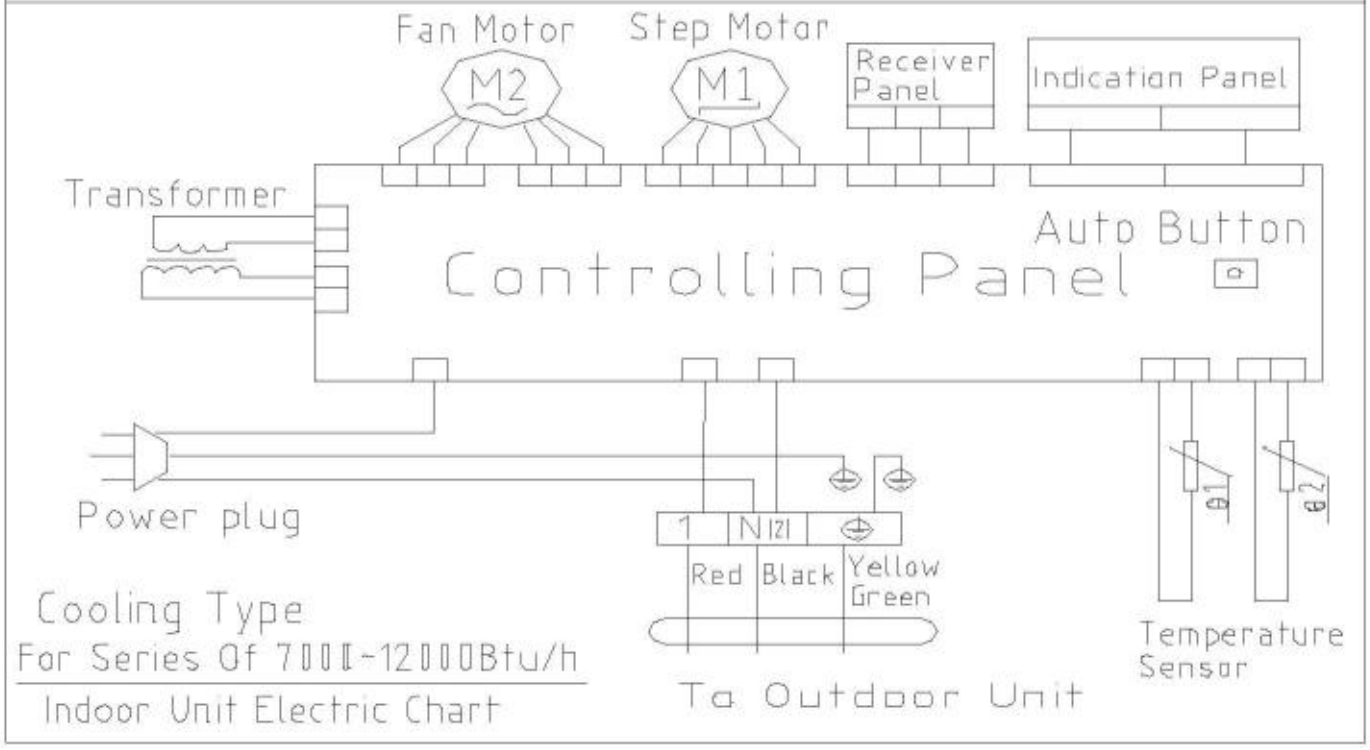
<tr><td>Abnormal</td><td>∞：Turn-off ；0Ω：Short-cut</td></tr>
</table>

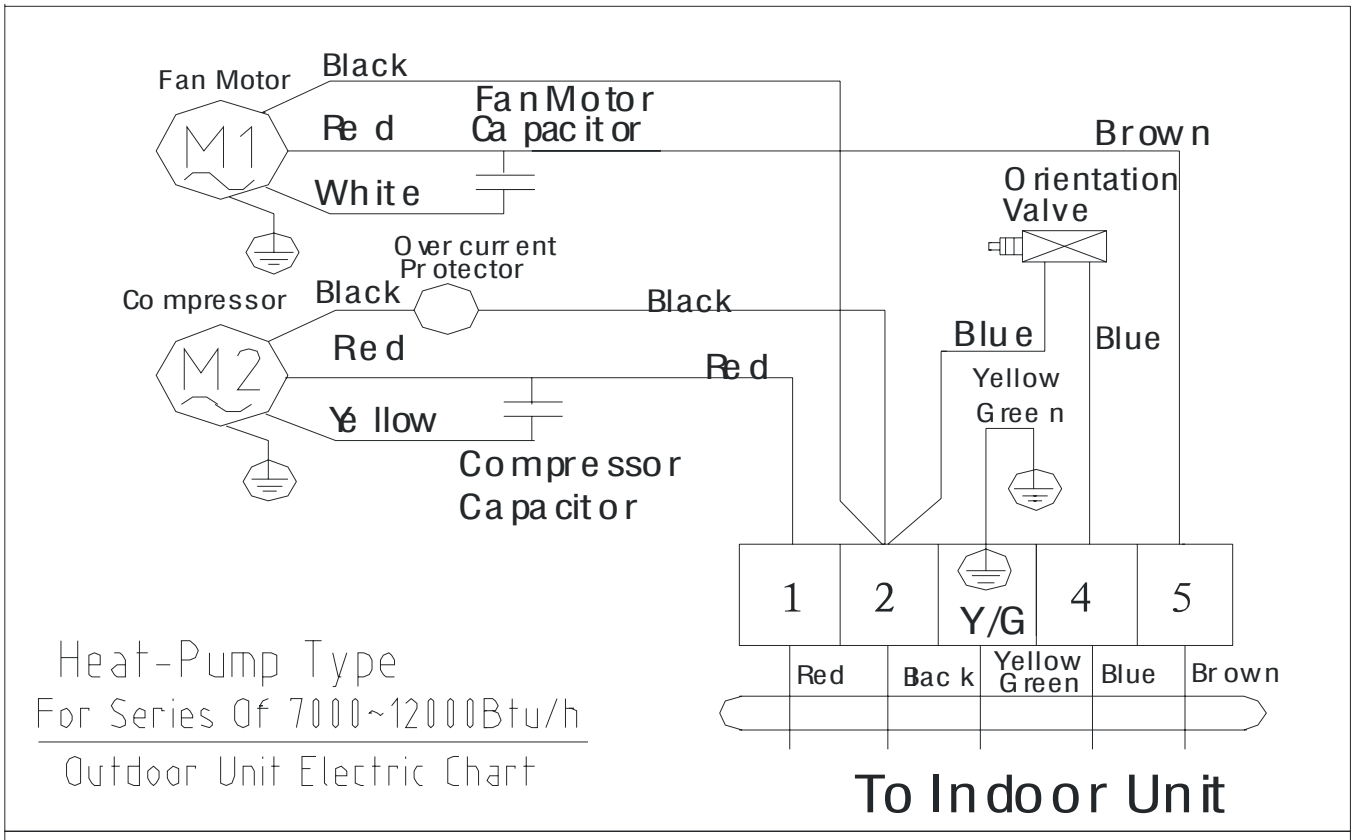
Section three electric wiring diagram of Pioneer air conditioner

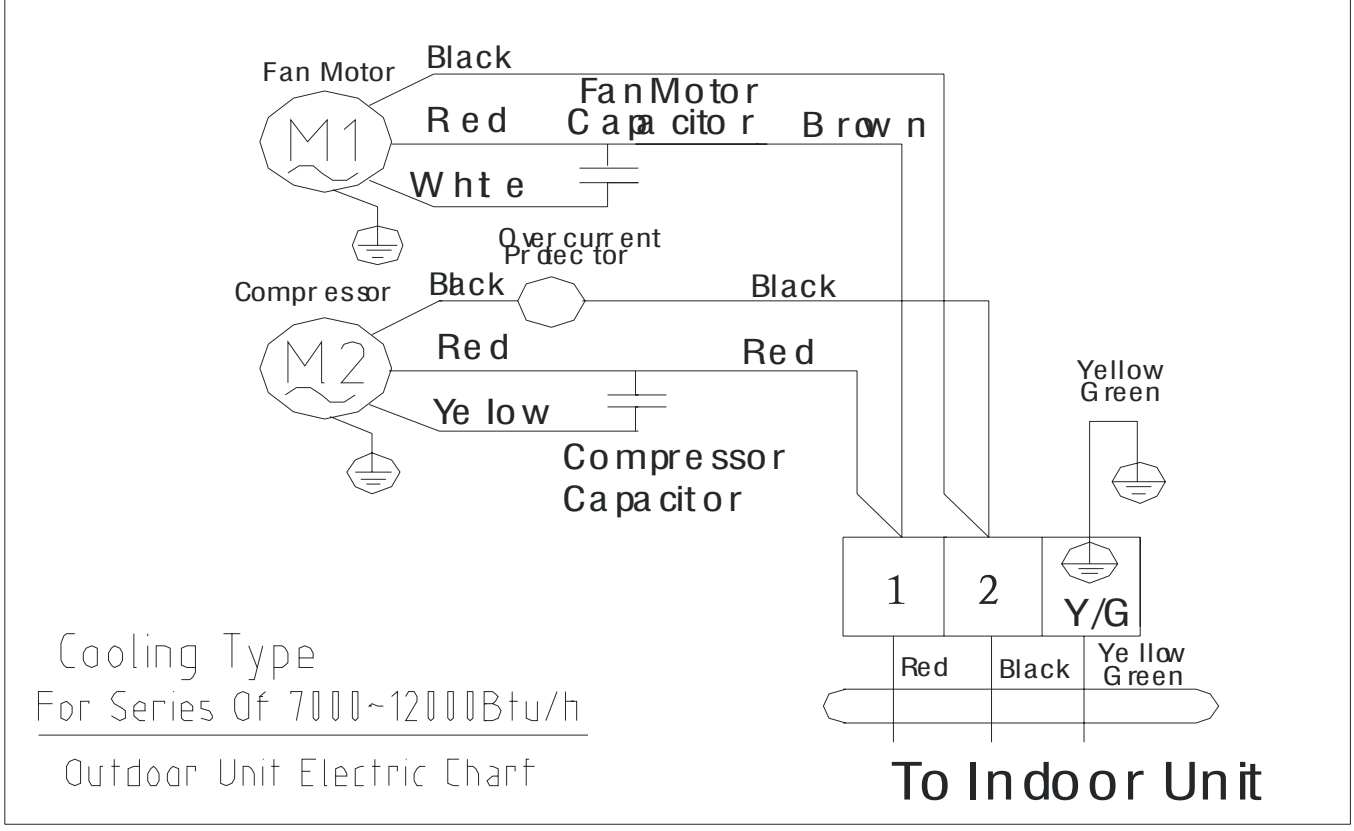
1.7000~12000BTU Electric wiring





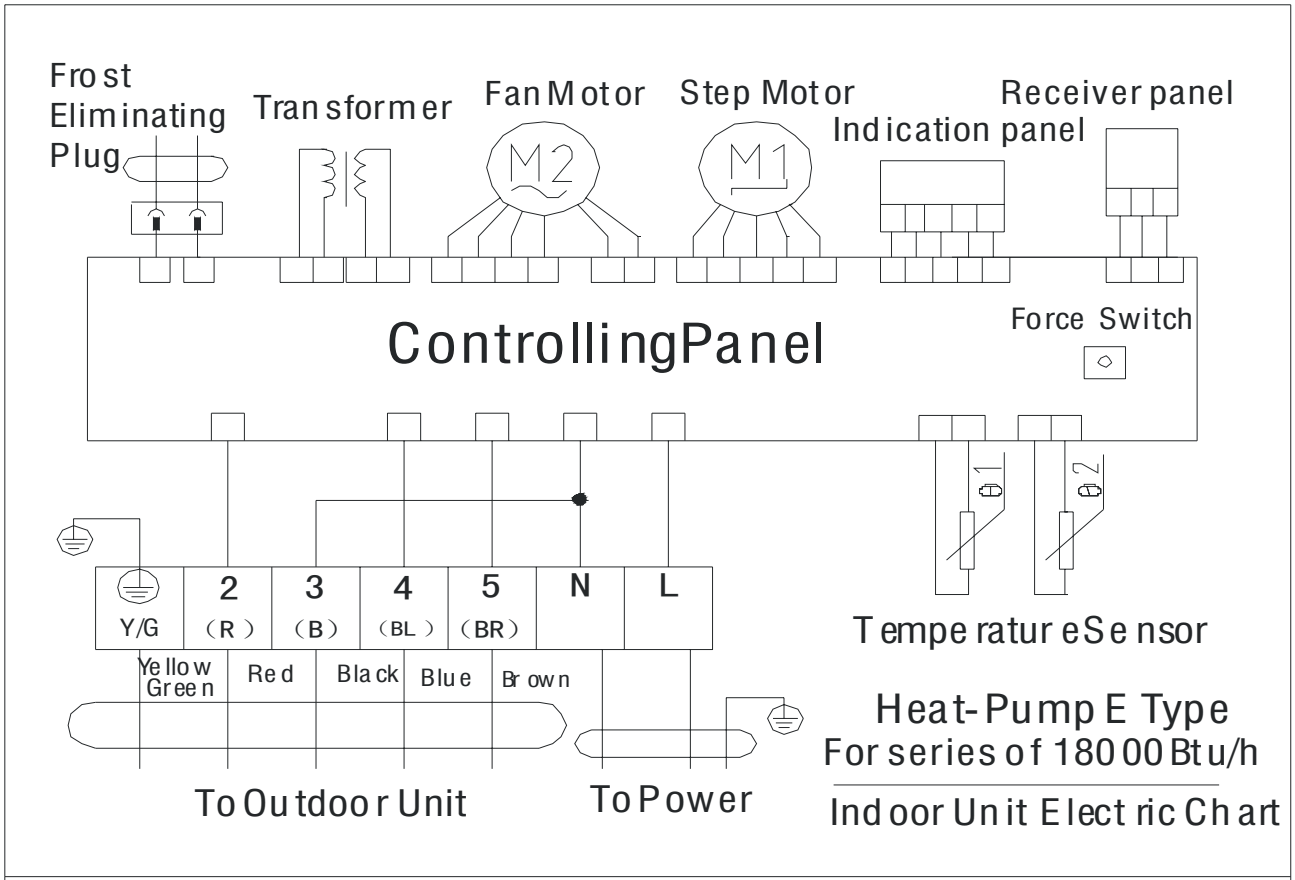
(2) Outdoor unit：

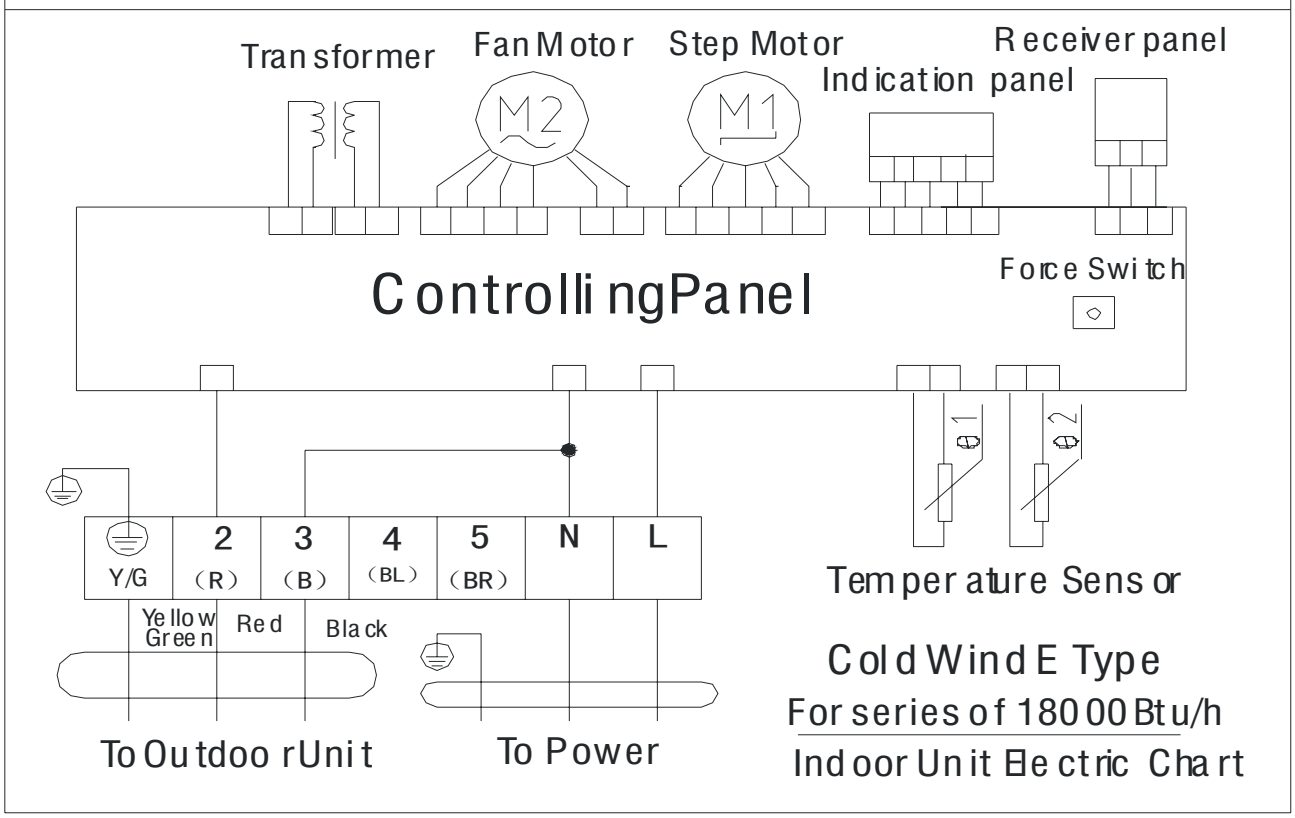




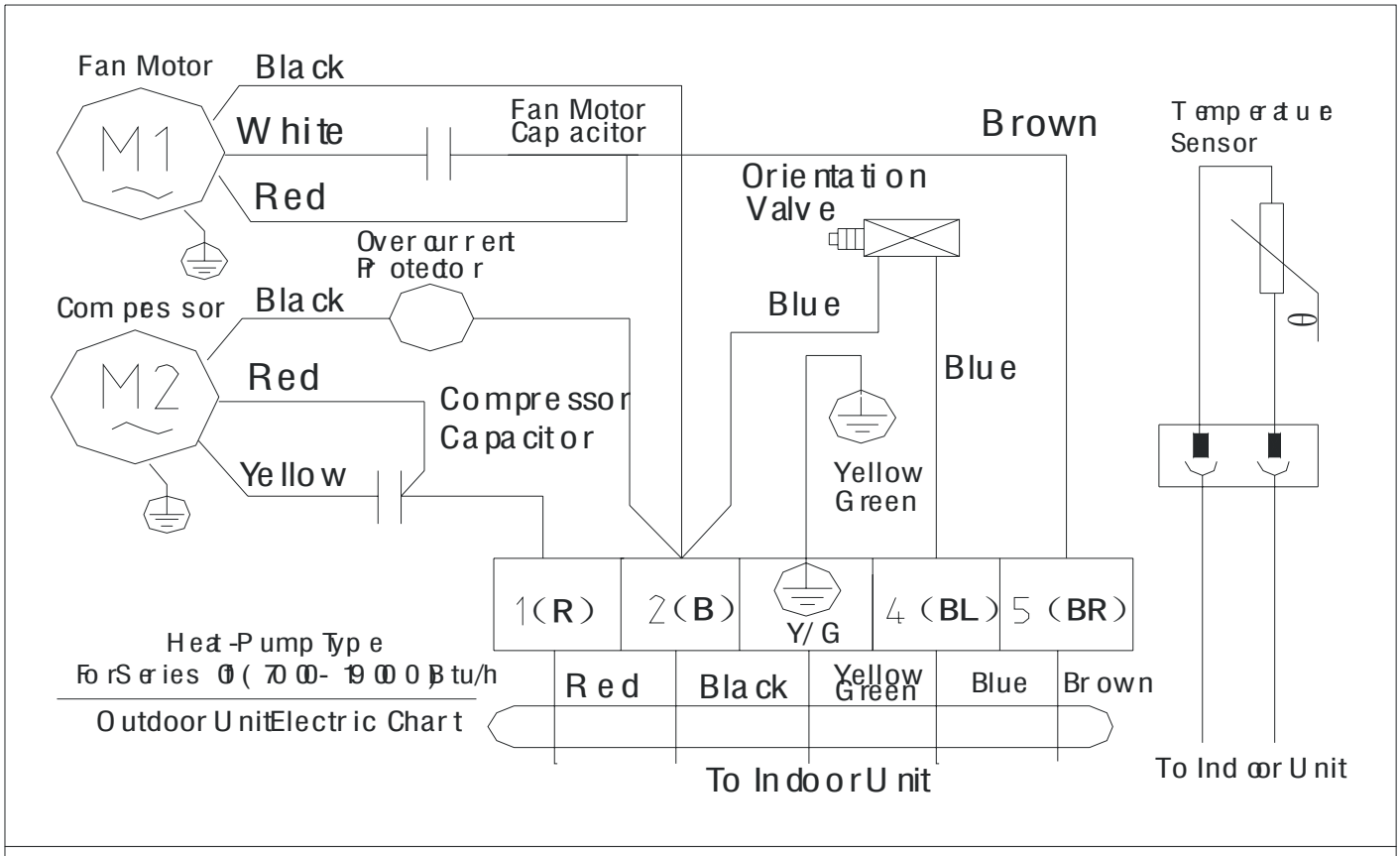
2.18000BTU Electric wiring diagram

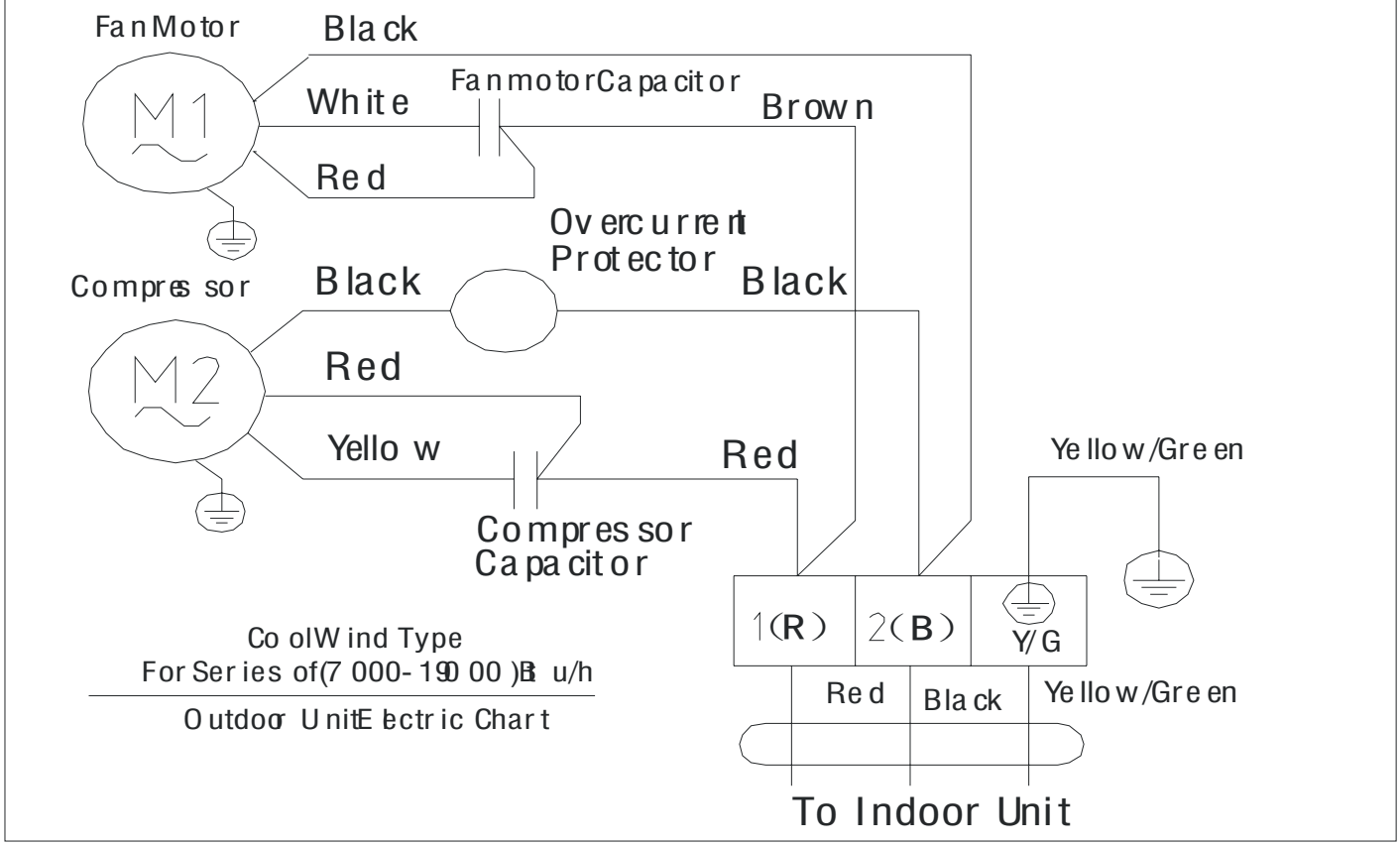
(1) Indoor unit





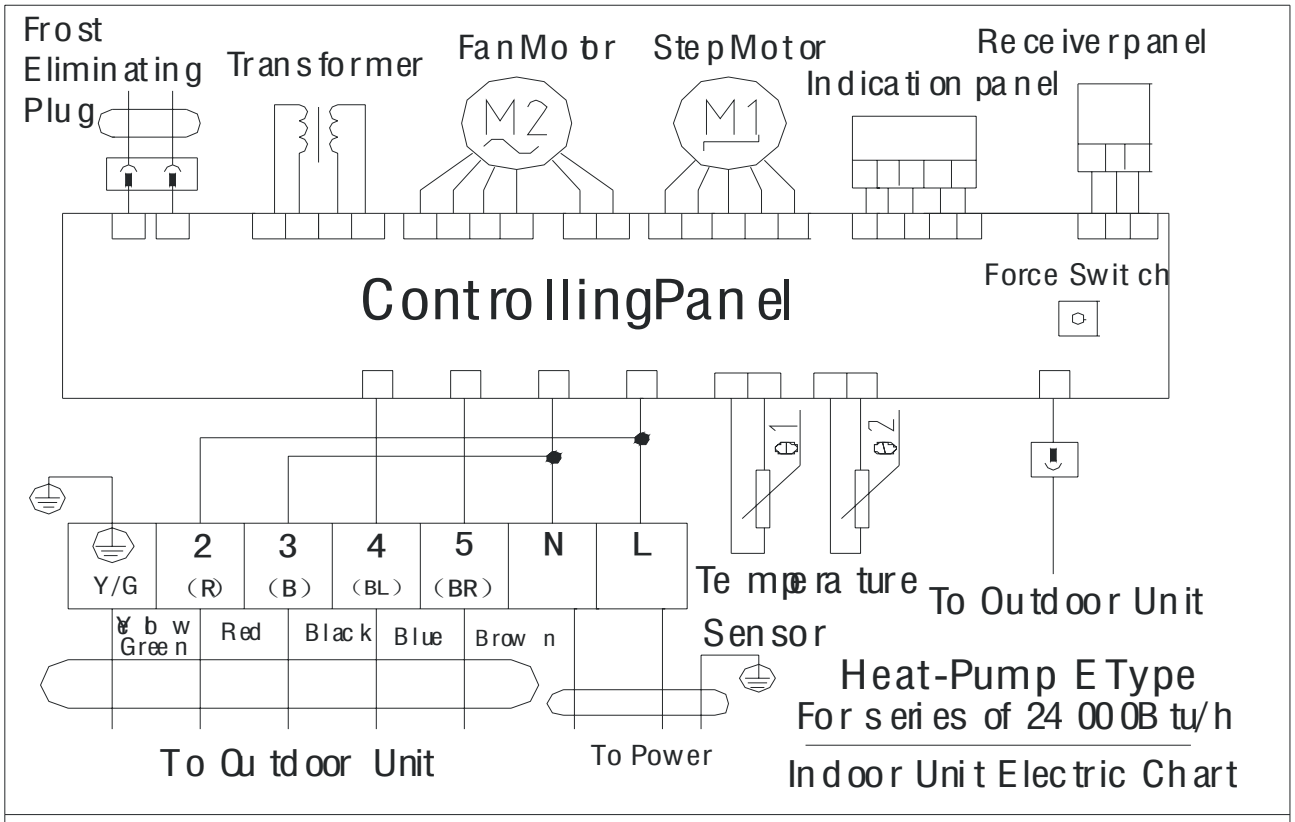
(2) Outdoor unit：

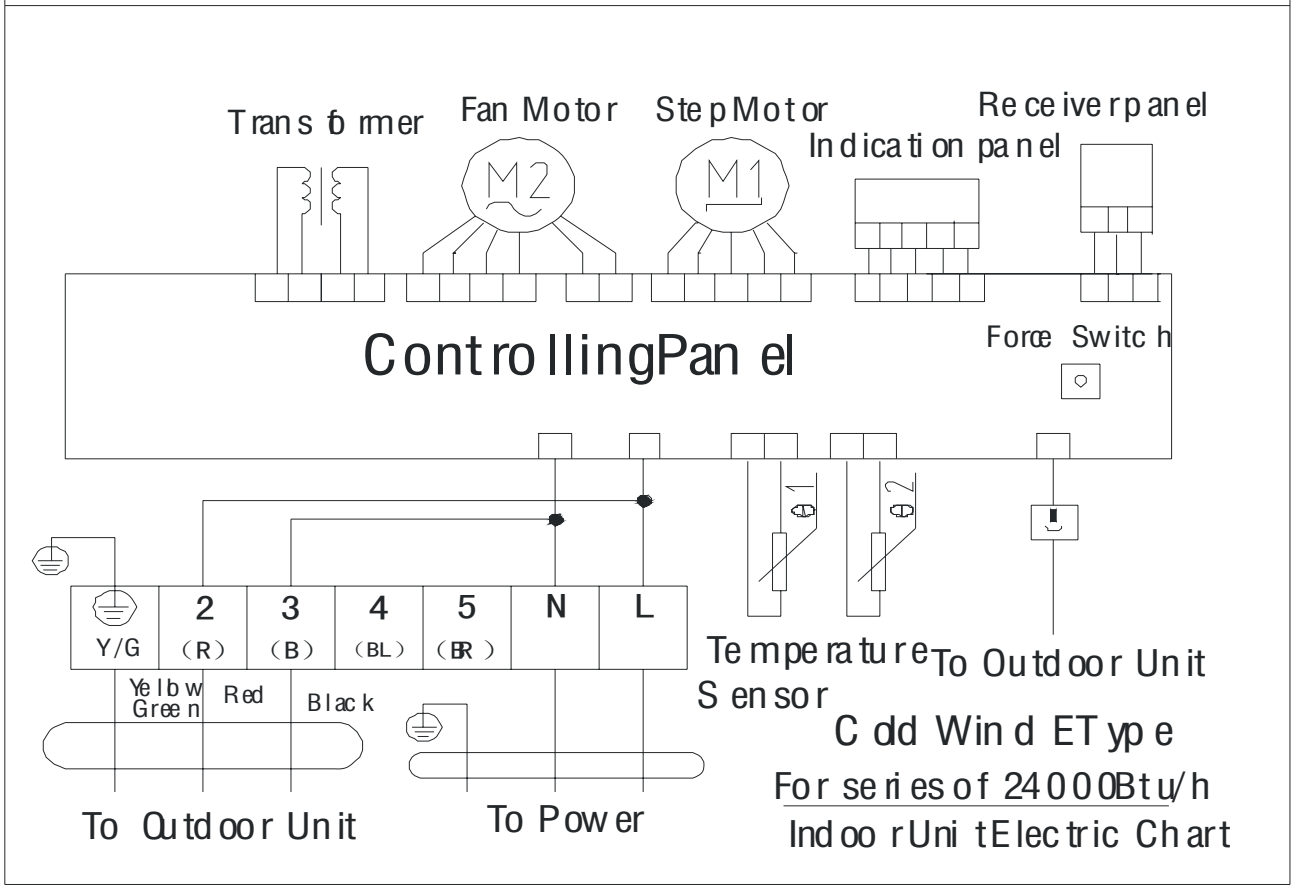




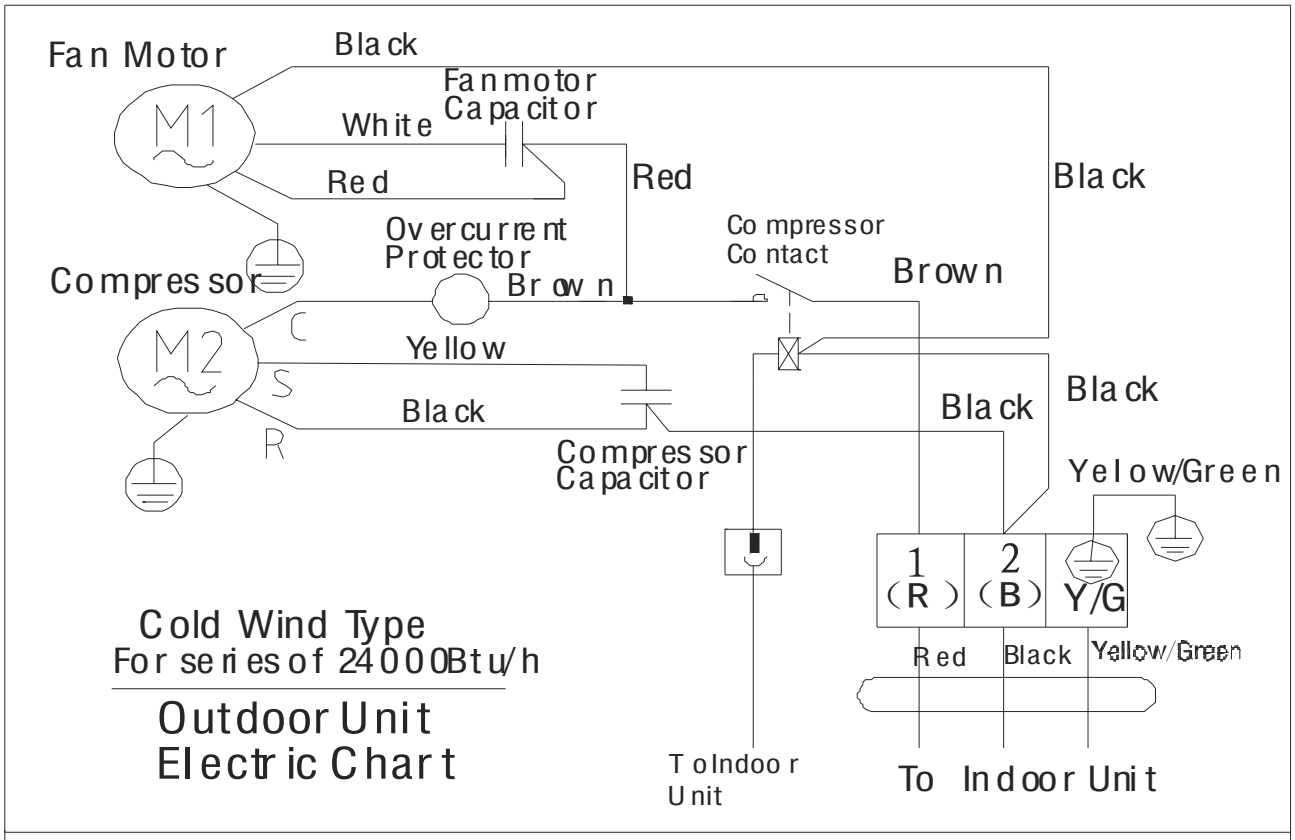
3.24000BTU Electric wiring diagram

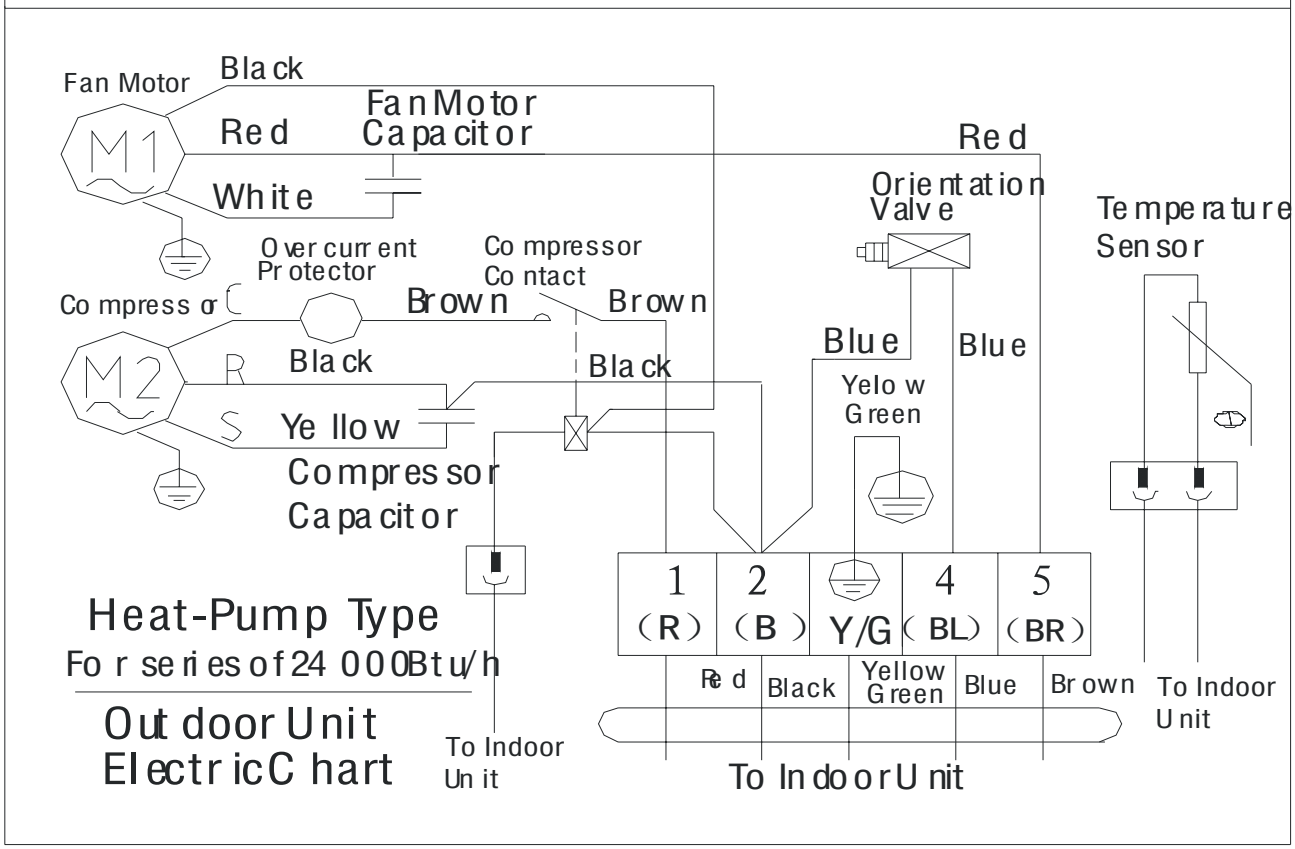
(1) Indoor unit:



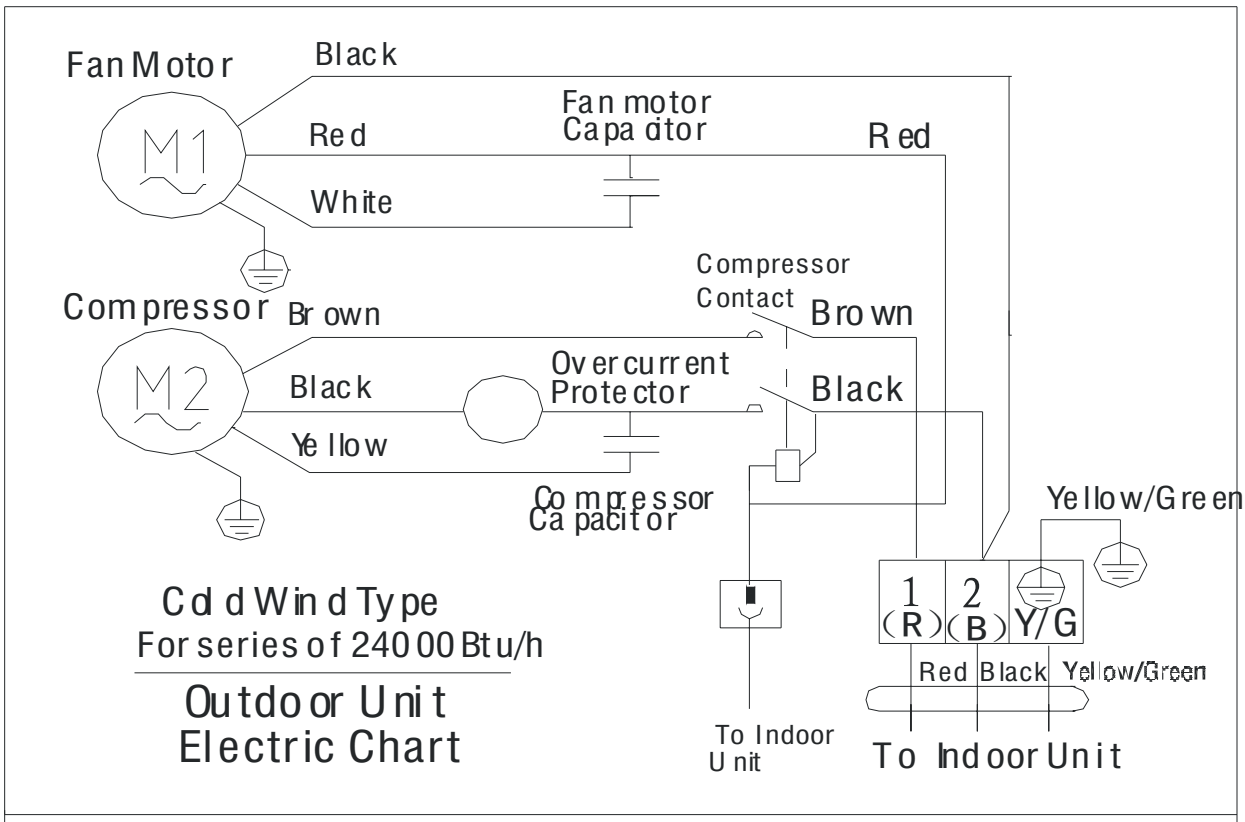


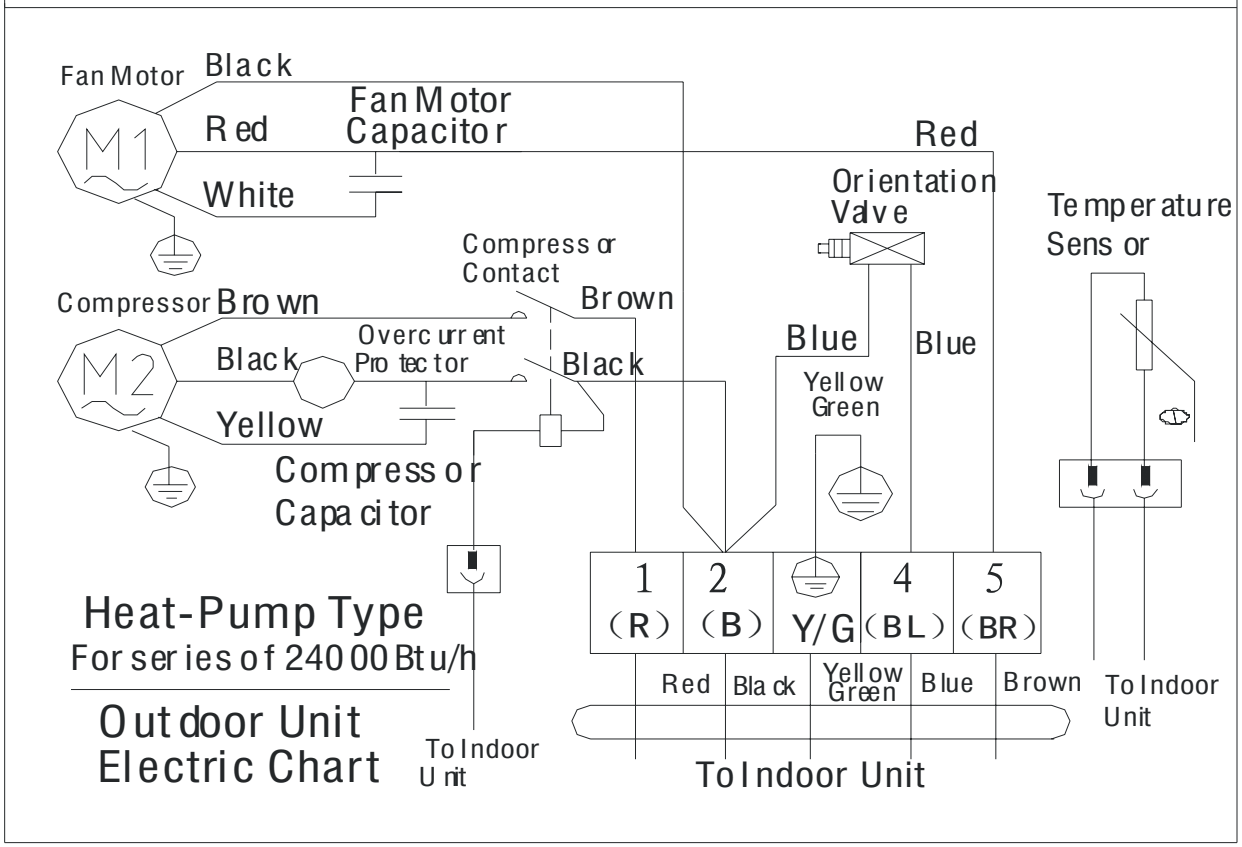
manual (2) Outdoor unit：（Single pole AC. Contractor wiring





manual (3) Outdoor unit（Double pole AC. Contractor wiring



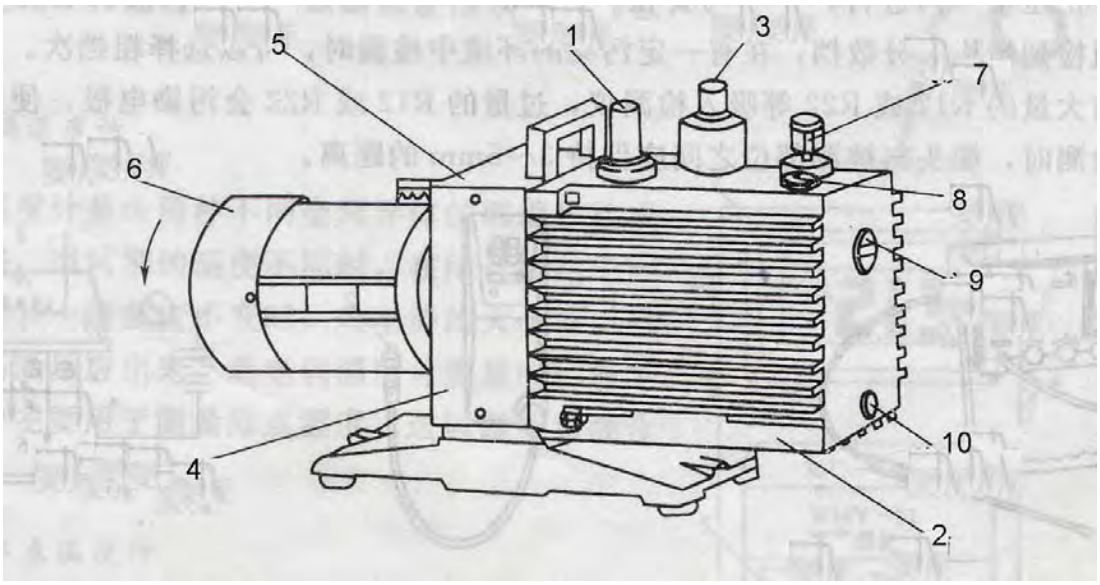


Chapter 6 introduction to the regular service tools for air-conditioner

The regular service tool and application

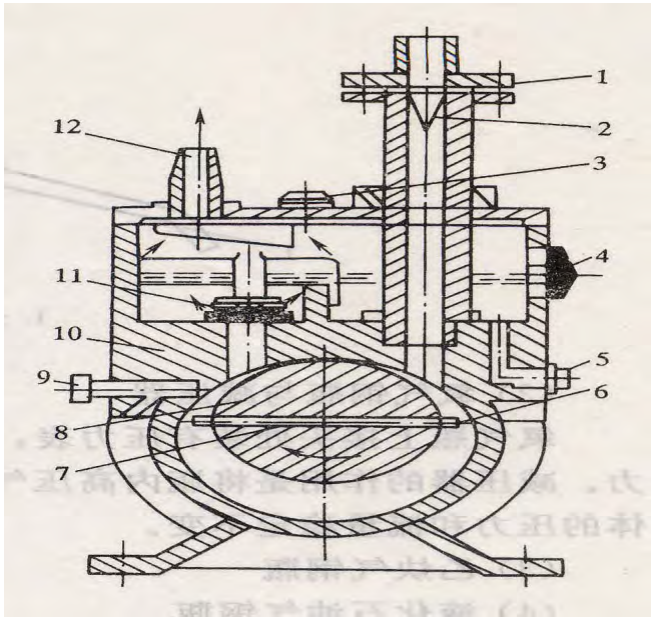
1. Vacuum Pump

Vacuum pump is a device used in vacuumize for the mini type refrigerating equipment. The common vacuum pump in practice is the revolving blade type. The exterior structure and the working theory are indicated as the below pictures:



1： air intake 2： oil tank 3： air discharge 4：fan and coupling entry 5： supporting base 6： electrical motor 7： gas ballast valve 8： oil filler plug 9： oil mark 10： oil drain plug

Picture 6-1: The exterior structure of vacuum pump



1： air intake 2： filter 3：oil filler plug 4：oil mark 5：oil drain plug 6： rotary blade 7：spring 8： rotor 9：gas ballast valve 10： Cylinder 11：exhaust valve 12： air vent Picture

Picture 6-2: Single-stage rotary Vacuum pump

There is only one cylinder installed in the Single-stage rotary Vacuum pump. Inside the cylinder, the rotor is eccentrically mounted inside the cylinder. There are two rotary blades fixed inside the rotor groove, and two of them are oppressed tightly to the surface of the cylinder by the central spring force and the centrifugal force produced in the process of rotation. The tangents created by the two rotary blades to the rotor and cyclones divide the crescent space between the cylinder and rotor into three (or two) parts. The space connects with the air intake is called air absorbing space; the spaced connects with the air vent is called air exhausting space; the space between two rotary blades is called air compressing space. When the rotor is rotated, the air absorbing space formed by the two tangents between the right side rotary blade to the rotor and cylinder is continuously expanding, and the air exists in the object system is sucked and filling in the space. When the left side rotary blade arrives at the very position that can seal the orifice of the air absorbing channel, the air absorbing process is ended and the volume of the absorbed air reach the maximum value. Along with the continuous rotation of the rotor, the air exists between the two rotary blades is compressed, and its pressure is consequently increased step by step. After the former right side rotary blade arrives at the orifice connecting with the exhaust channel, and when the air pressure exists in the compression space is over one standard atmosphere pressure value, the air will burst through the exhaust valve and vent. Two of the rotary blades work together by turn. The rotor completes the air-absorbing and air-exhausting process twice in every rotation circle. The exhaust valve is soaked in the oil in case of the atmosphere enters into the pump.

The utmost pressure the single-stage vacuum pump can tolerate is 5Pa, and the utmost pressure the double lever rotary vacuum pump can tolerate is 0.01Pa.

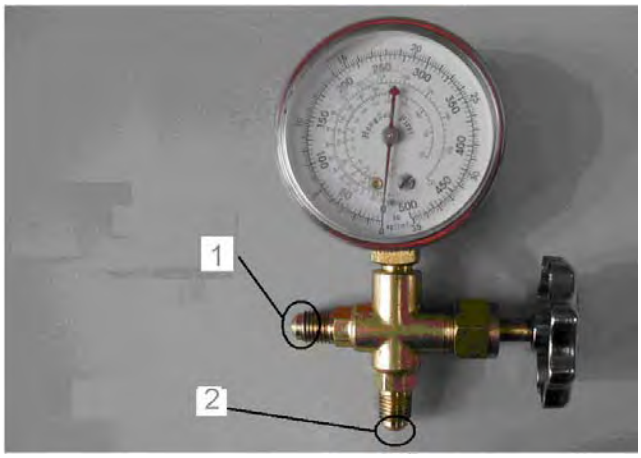
The attention proceeding during the application of the vacuum pump: The location site for the vacuum pump shall be dry, ventilated and clean. The blow-off proof hose connects with the refrigerating system and vacuum shall be short and without bend. Before starting the vacuum pump, check the joints and the welding joints carefully to ensure there are no defects available, and confirm whether the rubber plug to the air vent is off or not. Before turning off the vacuum pump, switch off the Throughway valve firstly for separating the refrigerating system and the vacuum. When the vacuum leaves unused, block the air intake and air vent by the rubber plug in case of the entry of the dust and ordure to the pump body, which may affect the precision of the interior cavity. It's necessary to maintain the neatness of the vacuum pump, check the volume of the lubricating oil through the oil window frequently, and enforce the daily maintenance applied to the vacuum pump for enhancing the equipments' perfectness ratio.

2. Pressure gauge

Due to the usual refrigerant leakage to the air-conditioner, the pressure gauge applied for the fullness inspection to the refrigerant in the system is often in need. The pressure gauge is the usual inspection tool for the refrigerant cooling system. It is in various specifications with the outer diameter from 60mm～250mm. The applicable measurement range of the vacuum pressure gauge to the air-conditioner refrigerating system is －0.1MPa～2.5Mpa, which is indicated in the Picture 2-33.

The pressure gauge usually matches with the three-way mend valve in application. The rotation applied to the knob of the three-way mend valve in clockwise direction may reduce the size of the valve bore. When the knob reaches the bottom of the rotation, the connection between the corresponding tubing and the gas path of the outdoor unit will be cut off; The rotation applied to the

knob of valve in counterclockwise direction may enlarge the size of the valve bore, and the corresponding tubing will get through with the gas path of the outdoor unit. The refrigerating system always gets through with the pressure gauge on the three-way mend valve without concerning the position of the knob. The conjunction with the knob of the three-way mend valve may carry out the process of vacuumizing, refrigerant filling and pressure testing etc. to the refrigerating system.



1： Connect with the vacuum pump or refrigerant tank

2： Connect with the mend position

Picture6-3 pressure gauge and three-way repair valve

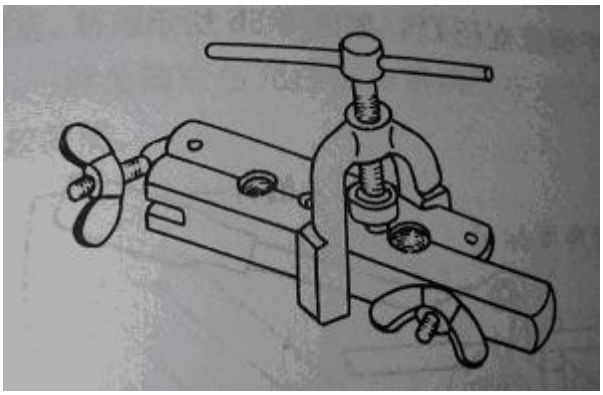
3. Expander

When two copper tubes need to be jointed together, the one shall be inserted into the other tube's mouth. In this case, the inner diameter of the latter's terminal position shall be expanded enough so as to inosculate the entry parts of the former one. Only by this way the two tubes can be welded in fastness and without easy leakage. The function of the expander is tube expanding for the various types copper tubes according to the specific requirement. When expanding the tube, insert the annealed copper tube into the corresponding aperture of the pipe wrench, and the protrusion length of the copper pipes out from the pipe wrench is different because of the different pipe size. The copper tube in bigger pipe size need longer expander and the copper tube in smaller pipe size need shorter expander. For example, to the copper tube with size of Φ8, the length of the expander shall be around 10mm. Then, screw down the nuts located on the two terminals of pipe wrench so as to clamp the copper tube, and insert copper tube into the expander head. Rotate the screw of the expander slowly in the clockwise direction until the expansion length in need achieved. The practicality of the expander is as indicated in the Picture 6-4, and the structure is as the picture 6-5.

4. Flaring tool

Flaring tool is specially applied in the copper tube's flare expansion work so as to connect the indoor and outdoor unit of the split air-conditioner by the tubing. When flare is expanded, fix the annealed copper tube by the connecting nut, and insert the copper tube into the corresponding aperture of the pipe wrench. The protrusion height of the copper tube out from the pipe wrench shall be 1/5 of the tube's diameter. Then, screw down the nuts located on the two terminals of pipe wrench, and press the cone-shaped head of the flare tool to the flare. Rotate the screw slowly in the clockwise direction until the expected flare formed. The practicality of the flaring tool is as indicated in the Picture 6-5.

Picture6-4 Expander

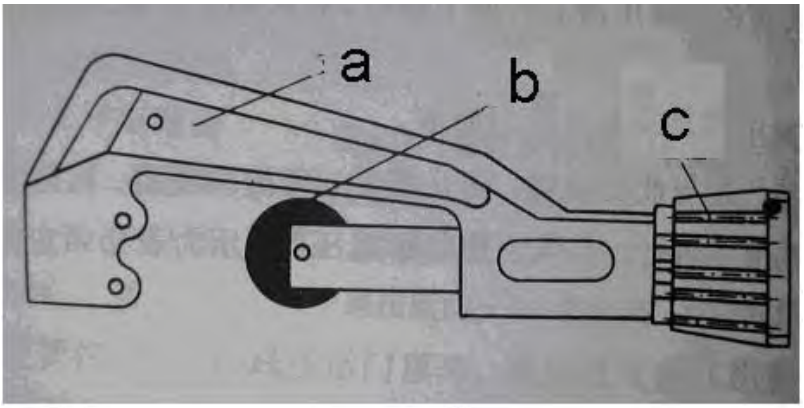


Picture6-5 Structure of expander

5. Tube-cutting knife

The tube-cutting knife is usually used for cutting the copper tubes in different lengths and diameters when repairing or installing the air-conditioner. The types of the tube-cutting knife are various. The common structure is as Picture 6-6 shows.

When cutting the copper tube, it shall be set at the place between the two rolling wheels of the tube-cutting knife. Rotate the knife-supplying knob in the clockwise direction so as to clamp the copper tube between the knife and the rolling wheel. Then rotate the knife-supplying knob and simultaneously rotate the tube-cutting knife for cutting the copper tube. The force shall be balanced and gently when rotating the knife-supplying knob, otherwise the copper tube may be distorted by rough extrusion. After the copper tube being cut, use the cutter knife to remove the burr attached to the edge of the tube mouth in case of the copper scraps enter into the refrigerating system.

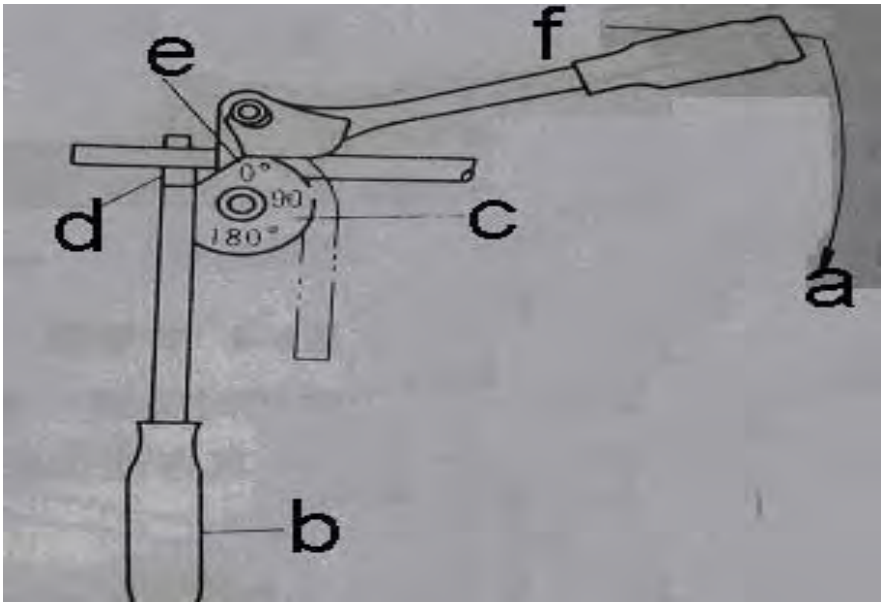


a：Bracket b：Cutting wheel c：Adjusting knob

Picture 6-6 the structure of the tube-cutting knife

6. Tube bender

Tube bender is the tool used to change the configuration of the copper tube or process the copper tube in a certain figure. The types of the tube bender are various and it is applicable in bending the copper tube with the diameter less than 20mm. When bending the tube, insert the annealed copper tube into the wheel groove of the tube bender, and lock the tube clamping hook tightly. Then rotate the handle bar slowly until reaching the required angle. The structure of the tube bender is indicated in the Picture 6-7.



a：handle movement direction b： handle bar c：wheel
d：tub-clamping hook e：tube-bending angle indicator f: handle

Picture 6-7: structure of the tube bender picture

7. Gas welding apparatus

Since the copper tubes are largely applied in the refrigerating system of the air-conditioner, the gas welding is in need for service use. The traditional gas welding apparatus uses the mixture gas of the oxygen and acetylene, which can produce the high temperature blaze. The modern welding equipment adopt the liquefied petroleum gas as the fuel and the oxygen boosting liquefied gas welding machine as the apparatus for the tube-joint welding work of the refrigerating system. The gas welding equipment mainly consists of the gas tank, the soft connecting pipe and the welding gun.

8. Digital clamp meter

Digital clamp meter is one of the widely applicable measurement apparatus in practice. It is the most common tool in the inspection process to the electric malfunction of the refrigerating equipment. It can measure the voltage of the AC or DC, the alternating current and resistance etc. Its practicality is as indicated in the Picture 6-8.

⑴Measure the AC and DC voltage

Firstly, turn the on-off switch to category of the ACV (AC voltage) or DCV (DC voltage), and select a measurement range which is bigger than the voltage to be measured. Then insert the red and black meter pens into the jacks of the object electric-supplying socket. The consequent figure shows on the reading panel is the value of the measured voltage. There is no fixed polarity to the AC voltage, so the

meter pen of the clamp meter can be freely used without consideration of the selection between positive and negative pole. When measuring the direct current voltage, turn the on-off switch to the category of the DCV (DC voltage) , pay attention to select a measurement range larger than the voltage to be measured, and confirm the polarity of the voltage to be measured. During the measurement process, connect the red pen to the positive pole and the black pen to the negative pole of the voltage. Otherwise, the clamp meter may be damaged by wrong connection.

⑵Measure the alternating current value

Rotate the on-off switch to the proper measurement range of the alternating current (ACA) firstly. During measurement process, put the electric cable to be measured into the clamp type mouth of the clamp meter, and the reading panel of the meter will show the electric current value of the cable basing on the electromagnetic induction theory.

⑶Measure the electric resistance

Turn the on-off switch to the proper measurement range. Before measuring, connect the two meter pens directly with each other (short circuit), and the figure shows on the reading panel shall be 0Ω and to be accompanied by the tweet sound. If the figure is not 0Ω, it means the clamp meter is damaged already or short of electric power. For the object electric resistance to be measured, the figure displays on the reading panel is its electric resistance value after connecting the meter pens to the two ends of the object resistance item.

Pi

Picture 6-8: digital clamp meter

Chapter 7 Failure Analysis and Inspection of Electrical Control System

Air conditioner can be controlled by both strong-current circuit control panel and weak-current electronic circuit control panel, control philosophies of which are different, so fault analysis procedures of the two types shall be described separately:

Electrical system is the device to control and protect refrigerating system and fan system. Apart from faults on electrical circuit, faults also may be resulted by the malfunction of refrigerating system and fan system but be reflected through electrical control system. Therefore, refrigerating system and fan system must be taken into consideration to analyze faults of electrical control system.

1. Strong Current Control System

Strong current control system is powered by single phase 220V or 380V service voltage, and with relative simply controls circuit, fault inspection of strong current control system is not very difficult.

(1)Compressor and fan fails to operate

When switched on, compressor and fan fail to operate, faults of electrical circuits may include:

① Power failure
② Receptacle wire breakage
③ Fuse burns out
④ Loose contact of socket or receptacle
⑤ Service voltage is too low to make the motor operate, and then heat protector trips and cuts off electrical power;
⑥ Wire breakage in option switch
⑦ Wire Breakage in Electrical Control Circuit resulted by improper operation, poor quality or faults of refrigerating system and fan system; for example, fuse burns out may be resulted by faults of refrigerating system and fan system besides wire contact and short circuit.

(2)Fan runs but compressor fails to operate

① Improper position of temperature Control knob;
② Contact of overload protective system breaks because refrigerating overloads during operation and cause trip of protective system, or protective system can’t work properly itself ;
③ Failure of compressor operation capacity resulted from improper maintenance or moisture.
④ Compressor motor burns out.

(3) Compressor starts and stops too frequently after air conditioner switches on

① Temperature sensor of temperature control system is installed too close to evaporator so that it is impacted by evaporation temperature;
② Service voltage is instable because of instable electrical power network;
③ Poor contact of bimetal of overload protective system

(4)Long term continuous operation of compressor

① Because of too many heating appliances in the room, heat load of air conditioner is excessive heavy;
② Contacts of temperature control system adhere to each other and cannot be broken off.

(5)Heat pump air conditioner fails to heat

If air conditioner can produce cooling air but fail to produce heating air, there must be some faults in magnetic reversing valve or switch.

① Magnetic loop of magnetic valve has burnt out or broken out because of:

a、Operate in severe environment;

b、Magnetic loop stops and starts up frequently;

c、Operate under excessive voltage for a long time so that loops run under high temperature rise and insulation layer has been damaged.

② Spool in magnetic valve has jammed or damaged because of:

a、Foreign substance has entered valve and jammed spool;

b、Spool has been damaged because of poor quality.

③ Reverse valve fails to work because of different reasons, but in most cases, impacted by unclean refrigerant and poor manufacture or assembly quality.

④ Cool-heat switch fails to operate because of damaged structure and oxidized contact surface

⑤ Electric Leakage

Electric leakage on the surface resulted from declined insulation property, being affected by damping, poor ground wire or even no ground wire connected.

2. Fault Analysis for Electronic Circuit Control System

Control panel of electronic circuit control system is a circuit with 5V or 12V low voltage, which is a kind of small, safe, reliable and attractive panel with more control functions comparing to the Electrical Circuit Control System.

(1)Air conditioner fails to work after switched on

When function button pushed on, air conditioner fails to work, and creates no sound, under this circumstance, electrical power is not connected and all appliances connected with electrical power shall be checked as per following sequence:

① Check whether there's current in electrical power wire. Devices controlling the electrical power wire shall be checked, for example, whether knife switch or air switch is broken.

② Check whether there's any phase lack. For example, for three-phase air conditioner, one or two phases of three- phase power network may break off, or phase of electrical power wire may break off.

③ Check whether fuse of control panel of indoor unit breaks off or piezo-resistor has been damaged. Protector shall be installed to cut off service power before excessively high voltage or large current enters the control circuit.

④ Check if socket connector between control panel wire of indoor unit and power wire contacts well. Socket connector may be self-locked, but also it may be loose contacted.

⑤ Check if key switch fails to work, for example, whether buttons contact well or whether components of buttons have been broken.

⑥ Check whether indoor electronic control panel has been broken. Circuit or electronic components of control panel may be damaged.

(2)Indoor fan runs, while compressor fails to work and trouble light blinks.

Blinking trouble light shows that system has some problems, including faults in electrical appliance or system.

① Phase lack of service power wire or over low voltage: check if voltage of power wire is 10%

lower than rated value;

② Over-current on compressor: check if heat protector on the compressor pump shell has broken off. Normally, heat protector will break off if current is excessively large. Heat protector of three phase motor is embedded in motor winding in pump shell. Check junction box on the pump shell by using universal meter, both for single phase and three phase motor; if winding is current off, protector has cut off the power. Wait for 5 minutes, protector will restore to original position.

③ Fan overheats or heat protector has damaged (refer to fan of outdoor unit). When fan runs under excess load, its winding temperature will rise, and heat protector will break off and power will be cut off. Check if inlet wire connector of fan is current on. If not, it shows that heat protector works, and it will restore to original position after cooling down. If protector fails to restore, it has been damaged and need to be replaced.

④ Poor contact of connector. Fan motor is also jointed with socket connector, connector lugs may not contact well. In addition, check if wire in junction box of compressor pump shell is loose or does not contact well;

⑤ AC contactor loops break off. If loops break off, contact points can not be closed, so that power can not enter the motor;

⑥ Electronic circuit control panel has been broken;

⑦ High pressure switch has broken. If high voltage switch has been broken, connection lugs cannot contact well. Check connection lugs with universal meter.

⑧ Trip of low pressure switch. When refrigerating system runs normally, connection lugs of low voltage switch contact well. When refrigerating system has trouble or refrigerant leaks, pressure in the system will decrease below trip point; low pressure switch will trip and cut off service power.

(3)Air conditioner shuts down short after it starts up

① Excess high discharge pressure, which causes high pressure switch tripping;

② Excess low suction pressure causing trip of low pressure switch;

③ Fan motor has burnt out;

④ Heat protector trips.

(4)When air conditioner starts up, power indicator lights, indoor fan runs but compressor fails to operate

It shows that there's no problem in refrigerating system and fan system, but people operate the air conditioner in wrong way or thermostat switch has broken, therefore, trouble light doesn't blink.

① Wrong buttons have been pushed Air conditioner may be in ventilation situation instead of refrigerating situation.

② Temperature has not reached set value. When set temperature of thermostat switch is higher than room temperature, connection lugs of temperature controller opens all along, refrigerating system cannot run. Proper temperature shall be set.

③ Sensor (thermal resistor) of temperature controller has broken, which cause improper temperature control. Check resistance and temperature to decide whether it has broken according to corresponding value of resistance/temperature.

3. Troubleshooting for compressor motor

There're two types of motors for totally enclosed compressor of air conditioner: single- phase and

three- phase. Single phase motor has two windings, i.e. startup winding and running winding. There're 3 binding posts, in shell junction box of compressor. They are marked by A, B and C individually, representing running post, startup post and common post. R and S are series connection points of two windings, resistance value is sum of startup and running winding resistances; between C and S is connection point of startup winding; between C and R is connection point of running winding.

Common faults of single phase motor are winding short circuit, disconnection and shell connecting. Check the resistance of any two of three binding posts by using Rx1 of universal meter. Resistance of windings of most compressor shall be as follows: $R_{SR}= R_{CS}+ R_{CR}$，$R_{CS}\geq R_{CR.}$ Among which, R_{CR} stands for running winding resistance, R_{CS} stands for startup winding resistance and R_{SR} stands for total resistance of windings.

Foregoing rule doesn't work in all totally enclosed compressors, for some compressors, $R_{CS}\geq R_{CR,}$ for some compressors, $R_{CS}= R_{CR.}$ For some compressor, main winding and assistant winding can not be judged according to normal rules because of different ways of wiring. Therefore, wire shall be connected correctly as per connection diagram provided by manufacturer.

(1)Short circuit inspection for motor windings
Short circuits of windings refer to the fact that insulation performance of winding has been disrupted which cause short circuit, including inter-turn short circuit, winding burnout, inter-winding and inter-phase short circuit.

In some cases of short circuit, motor still runs, but runs slowly and current is excess large. Contrast value of velocity /current depends on how many windings have short circuited. Remove outside wire of motor, check resistance between C and S, and resistance between C and R, if resistance of terminal of certain winding is lower than normal value, it shows that this winding has short circuited.

(2)Broken-circuit inspection of motor winding
Connection lugs in junction box are not welded or locked firmly and loose or break during operation. In addition, insulation wires don't insulate properly, and winding burns out. The motor can't be run because of broken-circuit.

Remove outside wire of motor, check conduct condition of two connection points with R×1 of universal meter. If two connection terminals don't conduct, i.e. resistance between them is infinite large, undoubtedly, this winding has broken. Find out broken points and connect them again.

(3)Grounding inspection of motor windings
Motor windings being affected by moisture, insulation layer aging or being damaged and other condition may cause short circuit of motor windings and shell. Under such circumstance, motor can not start up and fuse will burn out or relay will trap. Check the winding with universal or megohm meter, with one handle touching common terminal and the other handle touching motor shell. If resistance is very low, windings touch the shell and cause short circuit. While checking, remove a scar on the motor shell and touch the bare metal for measure.

There're two connection forms for windings of three phase motor: star(Y)type and triangle (△) type. Resistance values of three windings are same in both cases. Winding short circuit, breakout circuit and

winding touching shell can also occur in three phase motor. Check the faults with universal meter.

For star- type connection motor, resistance can be measured individually; for triangle- type connection motor, three windings shall be disconnected before resistance values are measured.

4. Inspection of switches and components of appliances

(1)Inspection of selection switch

Check corresponding contact points for different functions with universal meter, if, two connection points conduct, resistance shall be zero; two connection points don't conduct, resistance is infinitely great, otherwise, selection switch has some problems.

(2)Inspection of temperature controller

① Expansion bag is broken, and temperature sensitivity gas leaks, so expansion bag doesn't expand in response to the change of ambient temperature, and therefore, fails to act with linked pole. Check method: check the switch on and switch off points with universal meter, and turn the temperature setting button at the same time. If controller fails to respond, it proves that expansion bag is broken and temperature controller needs to be replaced with new one.

② Electronic contact points fail to contact well. If temperature changes regularly and in a large scale, it will cause frequent startup and stop of compressor and also contact points contact and break time and again , and contact point surface will be burned and create carbon layer which stops electrical conduct. Contact points are in the position of switch on, but fail to connect with power. Check method: clean contact points with absolute alcohol, and check the conduct condition of temperature controller with universal meter when it is in the position of "switch on".

③ Tension of offsetting spring is not enough. When pressure temperature sensitive gas in expansion bag decreases and fails to push the linked pole back. Offsetting spring shall be replaced with a new one.

④ There're some burrs or other dirt on the surface of electrical contactors which cause contactors failing to break off. Abrade the burrs with 0# sand paper and make the contactor surface smooth.

(3)Inspection of protection relay

In normal condition, contactors of protection relay are closed, and check with universal meter, contactors shall be in conducting situation, or the relay shall be replaced.

(4)Check of running capacitor

Remove a handle of capacitor to be tested, check resistance of two ends of capacitor with universal meter. In the normal condition, index finger of universal meter swings back rapidly and then rises to infinitely great. If index finger doesn't move and resistance remains infinitely great, capacitor has broken off; if index finger swings to "0" and stop moving and resistance is zero, capacitor has disrupted; if resistance remains at certain value, capacitor leaks.

(5)Check of transistor

① Check of diode capacity

a、Commute, demodulation, switch and stabilivolt diode. Remove diode from electrical panel, check its single phase conductivity with R×1K and R×100 of universal meter. Check method: contact two ends of diode with two handles of meter, record the resistance value, then change two handles with each other and measure again. For a normal diode, two resistance values are different greatly; large one is called reverse resistance and the smaller one forward resistance. Normally, forward resistance of silicon diode is several hundreds or thousands ohm, and reverse resistance can be 1 1MΩ; for germanium diode, forward resistances is 0~1000Ω, while reverse resistance over 100KΩ. If reverse resistance is very low, this diode has been broken; if both reverse and forward resistances are ∞, diode has broken; If difference between reverse and forward resistances is very slight or any of the two resistances deviates greatly from normal value, this diode is defective and shall be replaced. However, the said standard doesn't apply to some special diodes, for example, high-voltage silicon stack, (forward resistance of which is also very large, index finger only moves slightly even in the R×10K of universal meter), and some stabilivolt tubes (reverse resistance around 20KΩ).

b、Light-emitting diode(LED). Except low voltage types, forward conductive voltage is larger than 1.8V, while most universal meters are of a voltage of 1.5V(except for R×10K), so they are unable to make diode conduct, which cause reverse and forward resistances very large or even infinitely great. To check LED, R×10K or universal meters with 9V or over voltage shall be used. When we use R×10K of universal meter, LED can be checked in the same way as normal diode. No matter what kind of diode, positive and negative poles can be judged. When you measure reverse resistance, the end touched by red handle is positive pole, the other end is negative pole.

② Performance check for common triode

Main parameters to be measured are Iceo and h_{FE}. In general, actual-measured resistance of germanium triode with middle-small power shall be over 10~20KΩ; resistance of silicon triode shall be over 100KΩ, and actually-measured value is infinitely great, i.e. index finger doesn't swing. If actual resistance is excess slight, it shows that Iceo is very large, and this kind of triodes can not be used for their poor capacity. If actual resistance nears zero, c and e poles triode has broken down. ICBO can also be measured in the same way: touch two handles of universal meter on b and c poles to measure reverse resistance between them. Normally, resistance of germanium triode is larger than that we obtain when we measure Iceo, and resistance of silicon triode is infinite great.

Based on the situation of measuring $I_{ceo,}$ another 100KΩ resistance(silicon triode) or 20KΩ resistance(germanium) shall be connected to b and c poles. The more value indicated by index finger becomes small, and the more h_{FE} is large; if resistance doesn't change much or changes slightly, triode is broken or its enlargement capacity is very poor. Also, you can touch b and c with wet hands, but avoiding direct touch of b and c, to measure the resistance. In addition, most universal meters produced in recent years have position to measure h_{FE} of small power triode. Operation method: turn resistance position to 0Ω, and then turn to h_{FE} position, Insert handles to related test hole, and read the enlargement coefficient from h_{FE} rule directly.

5. Cases of Maintenance of Electrical Control System

Case 1 Silicon Control is broken and indoor unit creates noise

Product Model：KFR20/HA

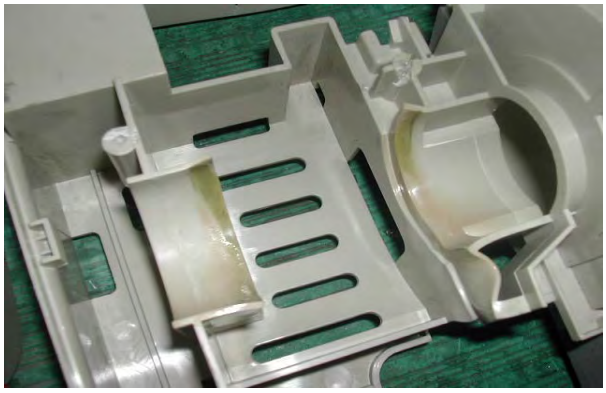
Phenomena：When unit is switched off, indoor fan runs slowly, and when it is turned on,

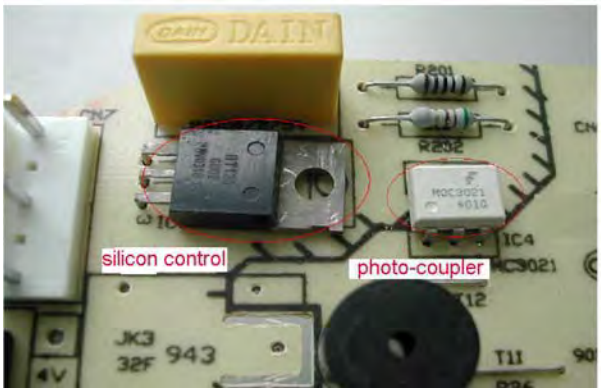
noise can be heard.

Cause analysis: according to clients description and phenomena analysis, we presumed that indoor motor couldn't provide power properly; checked power voltage of indoor motor, it was 100V voltage when motor was switched off; when switched off, motor still moved slowly, and produced heat and caused its plastic support deformed, plastic-mould motor moved from its original position, and then wind blades touched with basement and produce unpleasant noise, and smell like something burning can be smelt in the room. We concluded that silicon control of fan has damaged.

Solution: replace main control panel.

Experience conclusion: fan running velocity of indoor split- mounted unit is controlled by silicon control, when electrical voltage becomes very low or fluctuates within a large range, silicon control can be disrupted in one phase, and indoor fan still has voltage when the unit has been turned off. Because silicon is disrupted, motor produces non-sine wave power, which cause instable running of motor and loud noise.





Case 2 Indoor fan still runs when unit has been turned off and starts to run before it is turned on
Product Model：KFR35/HS
Phenomena: indoor fan still runs when the unit has been turned off and starts to run before it is turned on.

Analysis: according to the client, when the unit is electrified, the client turned on the power with remote controller and then turned off, indoor fan still run. We presumed that indoor motor fails to provide power properly. Checked the voltage of indoor fan, motor produced 158v voltage when unit was electrified but the unit is turned off, so motor run when motor was electrified. We concluded that fan control silicon is broken.

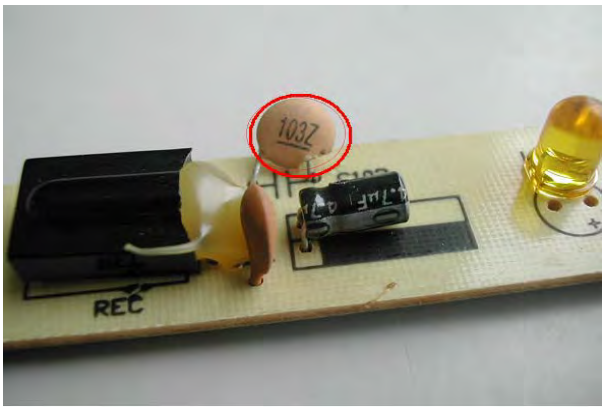
Solution: unit operated normally after controller was replaced with another of same model.
Experience Conclusion: Velocity of split mounted indoor fan is controlled by silicon, when power voltage is relative low or fluctuate within a large range, controlled silicon can be disrupted, fan still has voltage when the unit is turned off, and can not stop running.

Case 3 Receiver of remote controller can not function properly
Product Model: KFR35/H
Phenomena: remote controller can't turn on the unit

Reason Analysis: to check remote controller, point the remote controller to an ordinary radio and push any buttons on it, radio responded, so remote controller worked well, and there must be some faults in main control panel or receiver of remote controller of indoor unit. Opened outside cover of indoor unit to check 220V input power and 12V and 5V voltage, and found that they functioned properly; started up air conditioner manually and it operated well, so main control panel had no problem. We presumed that fault must occur on the components of remote receiver. We checked the receiver and found that insulation resistance of ceramic chip capacitor (103Z/50v) was only several thousand ohm, while resistance of good ceramic chip capacitor shall be over 10000MΩ, leakage current was too large so that receiver failed to function.

Solution: cut 103 capacitor or replaced display panel, air conditioner had been functioning normally since then.

Experience conclusion: there're many causes of malfunction of remote receiver, besides leakage of capacitor, dry joint of components also can result in faults of remote receiver. In addition, environment where air conditioner is used also can impact function of remote receiver; when environment humidity is relatively high, condensate will condense on the weld joints on the back of remote display panel, circuit panel is musty and its insulation performance declines, and welding joints leak, so remote controller can't turn on the air conditioner or fails to work. Clean circuit panel, dry the panel with blower and then weld a layer of glass glue on the back of display panel, remote controller can function properly. AM channel of radio can check whether remote control can send signal. If air conditioner functions after turned on manually, main control panel has no problem, so there must be some faults in receiver. When air conditioner need repair, especially repeated repair, it is very important to analyze the reason why components can not function well instead of replacing components without careful consideration.



Case 4 Temperature sensor cannot function well

Product Model：KFR-H24B4/FS

Phenomena: Poor heating efficiency, air velocity is relatively low.

Cause analysis: we went to client's home to check the air conditioner, turned on the unit and pushed on the heating button. Air velocity was relatively low, air outlet was very hot; under cooling and ventilation mode, air velocity was adjustable and varies obviously, we concluded that fan functioned well. So we presumed that there may be certain problem in indoor temperature sensor.

Solution: replaced indoor temperature sensor, and air condition functioned normally

Experience conclusion: when air conditioner heats the room, it can prevent producing of cold wind, so

when indoor temperature sensor and heat exchanger exceed 25 Celsius degree, fan produces gentle wind; when temperature exceeds 38 Celsius Degree, fan produces wind of set velocity. We checked and found that wind velocity is very low, and wind temperature is quite high, so fan works well. So we presumed that the sensor failed to reflect the correct temperature, and then indoor fan can't run at set velocity, so it must be replaced.

Problems in temperature sensor constitute a large percentage of all air conditioner faults. First of all, we should know its function: detecting indoor temperature, when indoor temperature reaches set value, it will control the function of indoor and outdoor units: under cooling situation, outdoor unit stops running, while indoor unit continue to work; under heating situation, indoor unit will stop after surplus heat has exhausted by fan.

3、Outdoor anti-frost temperature sensor: Detecting outdoor condenser coil
When outdoor loop temperature drops blow －6 Celsius Degree and maintains for 2 minutes, indoor unit will be in the anti-frost situation; When resistance of outdoor coil sensor is relatively large, indoor unit can't work normally.

Case 5 Air conditioner can't refrigerate the room (communication fault)
Product Model：KFR70/A
Phenomena: function light of indoor unit blinks (other lights extinguish), indoor and outdoor units fail to work.
Reason Analysis: we turned on the air conditioner, and it worked well. After about 30 minutes, indoor and outdoor units stopped to work, function light blinked, and we pushed buttons, air conditioner didn't respond; we pulled the socket from the power receptacle, and then tried to start up the air condition once again; the unit worked for 30 minutes and then the same phenomena occurred again. So we presumed that there's no problem in unit, and probably outside communication interfered the proper function of air conditioner. Fault code provided by our company also indicated outside interference. We checked communication line between outdoor and indoor units and didn't find any problem, so we confirmed that our presumption was right.

Solution: parallel connect a 103 ceramic chip capacitor to signal line of computer panel, or replace anti-interference C3Y computer panel.

Experience conclusion: pay attention to the indication panel, and find out cause of faults. If outdoor temperature sensor has problem or indoor and outdoor signal line disconnect, time indicator of non digital indication panel will blink 1 time/second, and E2 code will be displayed on the digital indication panel, temperature light of three-phase A series will blink and other indication lights will extinguish.

Case 6 outside Communication Interference
Product Model: KFR35/HSA
Phenomena: close down irregularly, and produce continuous buzz sound.
Cause analysis: we checked remote controller, emergence unit and all sensors and found that they functioned well. The client bought two air conditioners of same model; one functioned well, but the other failed. We suspected that there's some interference source, and we found that there was a electronic rectifying energy-saving lamp in the room where air condition at fault was installed. When

the lamp was turned off, air conditioner functioned properly. When lamp was turned on, we checked receiver and found 2V AC electricity on the input end; when we turned out the lamp, and didn't operate remote controller, there's no voltage on receiver.

Solution: replace fluorescent lamp with product of other brand
Experience Conclusion: wave produced by electron rectifier fluorescent lamp may superpose on infrared wave and cause failure of receiver. To fix such kind of failure, we shall asked client for details and check surrounding electrical appliances of air condition. Interference resources of air conditioner signal include electromagnetic interference due to poor quality of power circuit, frequency interference, and infrared interference. To fix the failure, we shall put a transparent dark-color light-filtering plate in front of remote receiver, or install a magnetic ring on receiver panel, or replace controller.

Case 7 Protection of Power Phase Sequence
Product Model：KFR-H41A5/A
Phenomena: timing indicator and running indicator blinked when we started up the air conditioner
Cause Analysis: according to fault code, we judged that outdoor unit was in protection situation and forced compressor running. The air conditioner could function properly, and pressure switch and power circuit were also in good condition; we presumed that problem was caused by sequence check protection. We changed phase sequence and turned on the air conditioner, compressor suddenly run reversely. All these proved that phase sequence detecting panel had some problems.
Solution: replace detecting panel of outdoor unit.

Experience Conclusion: service personnel shall have some knowledge of circuit operation philosophy, and find out the problems according to fault code. We shall work under the principle of "from simple to complicated way", (for example, in this case, when we adjusted phase sequence, compressor run reversely after we turned on the air conditioner again. So compressor wiring shall be changed, and make compressor run properly.) Our A series air conditioners adopt three-phase power, installation personnel sometimes may fail to connect phase line and zero line correctly, in this case, compressor also can't be started up. We should pay attention to this when we fix the fault of air conditioner.

Case 8 FS and DS Control Panel Button Failure
Product Model：KFR-H18B4/DS
Phenomena: control panel buttons couldn't function, but remote controller worked.
Cause Analysis: because remote controller can receive signal, main computer panel has no problem. After check, we found that low frequent diode IN4007 was used on the display panel produced by Changzhou Hongdu Co., but according to main program, this button shall be high frequent. Control panel and main panel are not compatible, and main program can't respond to the signal from buttons. Incompatibility of control panel and main panel mainly happened in the air conditioners manufactured by Changzhou Hongdu Electronic Product Co. Ltd before February 2004.

Solution: replace the said control panel with that produced by Changzhou Hongdu Electronic Product Co. Ltd after February 2004 or products from other companies; we also can replace D1～D12 diode on control panel with IN4148 high-frequent diode.

Experience Conclusion: besides failures in buttons of DS panel, temperature regulation button on FS(Y) also may fail to work well. Spaces for buttons on display panel may be too narrow and buttons

on plastic panel may deform, so buttons may fail to work. In this case, control panel shall be replaced with same model product.

Case 9 Compressor low -pressure can't be started up

Product Model：KFR35/HS

Phenomena：Compressor of outdoor unit can't be started up

Cause Analysis: Indoor unit works well; voltage output and resistance of outdoor compressor are in normal scope, so there's some problem in compressor. Resistance of each winding of compressor is in normal scope, the client's voltage was 198 V, which was within the scope of design standard. So startup performance of compressor (48D129) is not good enough.

Solution: replace capacitor for 35UF compressor and parallel connect a auxiliary starter to compressor capacitor. There's no need to replace compressor

Case 10 Compressor Capacitor and fan capacitor

Product Model：KFR35/A

Phenomena: when air condition was in cooling situation, once compressor started up, air switch tripped.

Cause Analysis: when air conditioner was in cooling function, compressor tripped once air condition started up. We checked indoor unit and found it was in good condition, so fault is in the outdoor unit. Opened outdoor unit and checked power line, resistance between L and N was infinitely great, but there were no short circuit on two lines. Checked outdoor components one by one, we found that compressor capacitor was disrupted.

Solution: replace compressor capacitor

Experience conclusion: if compressor trips when air conditioner is turned on, we shall check L and N are short circuited. We shall further check indoor and outdoor components, and find out whether they're short circuited.

Case 11 Outdoor fan capacitor fault

Product Model：KFR-H24B4/DS

Phenomena: the air conditioner stops to work frequently and can't function properly

Cause Analysis: air conditioner has been used in a restaurant for over one year under 220V power. According to the client, air conditioner failed to refrigerate sometimes. We checked and found that pressure was 5kg; current was 1.5A, so we suspected condenser was too dirty. We cleaned condenser and fault wasn't eliminated. We checked outdoor unit and found that outdoor fan run too slow, and compressor stopped to work when current rose. We checked winding of fan motor, and motor shell was very hot. We checked winding resistance after motor cooled down, it had no problem. So we presumed that fan capacitor was broken.

Solution: replaced fan and capacitor

Experience conclusion: because fan capacitor can't function well, so fan is in the protection situation, heat can't be exhausted, and pressure unit stops to work. After 3 minutes, pressure unit will be started up again. The process repeats again and again, so air condition starts and stops frequently. Based on the faults we can conclude that causes of faults can be various, and problems can be caused by the mutual interference of electrical control and system. Therefore, we should check and observe carefully

when we're repairing air conditioners and avoid replicated work.

Case 12 Transformer Failure

Product Model：KFR-H18A4/FS

Phenomena: air conditioner didn't function after it was turned on

Cause Analysis: checked power supply, there's 220V input power, so power supply circuit has no problem. Checked power socket, resistance is infinite great, so fuse or transformer might burn out. Opened and checked indoor panel, we found that fuse was in proper situation, but transformer broke off.

Solution: replace transformer

Experience Conclusion: if air condition fails to respond when it is turned on, we should check power circuit first of all to find out faults quickly and accurately.

Case 13 AC Contactor

Product Model：KFR70/A

Phenomena: failing to produce heat

Cause analysis: turned on air conditioner, and switched to heating function, outdoor fan didn't run, and four-way valve closed; we checked and found power supply of AC contactor was regular; pushed on AC contactor forcibly, compressor functioned; when we checked and found loop of AC contactor broke off.

Solution: replace AC contactor.

Experience Conclusion: air conditioner fails to produce heat, if power supply of indoor unit is regular, outdoor fan and four-way valve function well, compressor still fails to work, we shall check whether contactor pulls on, loop resistance value is normal, and then check if there's any problem in compressor. Main problems in AC contactor may include loop burning out, contacting points loosing, contaminated and burning out and etc.

Case 14 Power supply circuit failure

Product Model：KFR35/H

Phenomena: cooling failure

Cause Analysis: we started up the air conditioner, indoor worked well, but outdoor unit couldn't start up normally and produced abnormal sound; its voltage decreased from 230v to 138v, so we presumed that there's problem in power supply circuit. We checked power receptacle and found that decoration worker had used grounding line as zero line.

Solution: connect grounding line and zero line correctly

Experience Conclusion: connect N end to zero line, and don't replace zero line with grounding line, or air switch will trip. If new air conditioner has problems, we should check power circuit firstly; sometimes, power line is too thin, and startup current of air conditioner is quit large and produces large voltage drop which will cause difficulties in startup. Besides electrical power problem, air switch may cause startup trip.

Chapter 8 Troubleshooting guide for Refrigerating System

Refrigerating system faults are very common to air conditioners; faults are various but they still have some rules and also many maintenance experiences for reference. Troubleshooting steps here for refrigerating system are not a must, but can be followed to eliminate faults.

1. Main steps for refrigerating system troubleshooting

⑴Check work condition of indoor and outdoor units including display condition of indicator panel, check whether indoor unit works and air velocity is normal, whether outdoor fan and compressor runs; Based on foregoing steps, we can judge what is the cause of refrigerating fault, electrical system or the refrigerating system.

⑵Check all data of air conditioner

①Water drainage condition: Normally drainage water from indoor unit shall be continuous, but impacted by environment humidity and temperature, this condition only can be taken for reference.

②Indoor unit air inlet and outlet temperature difference: Normal temperature difference shall be within 12-14 Celsius degree, but they will also be impacted by temperature and wind velocity.

③Measure pressure of system: Generally speaking, in cooling operation, low pressure shall be within 0.45Mpa-0.50Mpa, and in heating operation, high pressure shall be within 1.8Mpa-2.2Mp; but pressure may be impacted by ambient temperature. If outdoor air inlet temperature rise, gas discharge pressure will be higher and condense temperature will be higher; on the contrary the result would be lower. When load on air conditioner increases, return gas pressure will be higher and evaporate temperature will be higher (normal evaporate temperature shall fall within 5 to 7 Celsius Degree).

2. Refrigerating system faults type

⑴Refrigerating system is blocked, often in capillary and dry filter which are narrowest in the whole system. Normally, there’re 3 causes for block: dirt, ice and weld blocks.

①Dirt block generally occurs on the inlet of capillary because dirt in copper tube (such as slug, rust scrap and scale) blocks refrigerating system. Knock the capillary slightly and air conditioner may restore normal condition temporarily; In addition, we can judge block position and features from condensate and frost on the surface of components as well as time for velocity restoration when air condition is turned off.

②Ice block normally occurs on the outlet of capillary, because there’s some water in the system, which suddenly vaporizes, cools down, condenses and becomes little ice particle and block the outlet of capillary. We can heat the capillary outlet with welding machine, if air conditioner works again or functions better, or switch off the air conditioner and then turn on again, it can refrigerate again for a while, we can conclude that the refrigerating system is blocked by ice. In general, ice block occurs on the newly installed or newly repaired air conditioner.

③Weld block occurs on the welds of capillary with similar phenomena as dirt block, and also often happen in newly installed air conditioners.

⑵Leakage of refrigerating system: media of heating and cooling in air conditioner is refrigerant, if

there is some leak source, refrigerant will leak out and air conditioner can't cooling proper or absolutely stop refrigerating. Leakage sources locate mainly on welds of evaporator, condenser, and capillary, return gas and discharge tube of compressor, flare mouth, copper nut, connection tubes and etc. Check the air conditioner visually and then inspect joints of tubes carefully. Generally, there's grease spot on the leakage source.

⑶Four-way valve fault: Generally occur when air conditioner works in heating mode. If four-way valve can't close tightly or is blocked, air conditioner can't have a good effect. We can check close condition of four-way valve when it is switched on or switched off. To fix the problem, we can switch on air conditioner repeatedly or slightly knock four-way valve and make it restore its original position.

⑷One-way valve fault: one-way valve can only work in cooling mode, but when air conditioner operating in heating mode, refrigerant will flow through auxiliary capillary, and if one-way valve can't close tightly or auxiliary capillary is blocked, heat-producing will be impacted, so if air conditioner can be operated in cooling mode but fails to produce heat properly, we shall check one-way valve carefully, if it is not caused by fault on four-way valve.

Section one Refrigerant Filling and Filling Volume Determination

Filling refrigerant is a common problem in maintenance of air conditioner. After air conditioner running for a long time, welding or copper tube may leak little refrigerant out to ambience. Refrigerant in split units also will slowly leak out and cause air conditioner failing to work properly. There're two problems in refrigerant filling: how to fill and how to decide filling volume so that refrigerant can meet design standard of air conditioner.

Different air conditioner has different refrigerant filling volume. Too much or too less refrigerant in air conditioner will cause poor efficiency, higher power consumptions, shorter life and so on.

Under following conditions refrigerant shall be refilled or added:
⑴When welds or copper tube leaks, refrigerant shall be discharged completely, After welded, fixed and vacuum properly refilling the air conditioner.
⑵If air conditioner has been running for a long time, refrigerant is not sufficient, so it shall be refilled.
⑶If the connection tube in split air conditioner had been extended, the refrigerant should be added according to per design standard.

1. Operation steps for refrigerant filling

Air conditioners of different types and capacities shall be filled with different volumes of refrigerant in different way.

⑴Add refrigerant with low pressure valve
If only small cooling capacity is required, refrigerant can be filled with low pressure valve. Refrigerant flowing in low pressure is relatively slow, but that is safer and easier to control, so most household air conditioners are filled with refrigerant in this way.

①Connect Low pressure hose with maintenance hole of low pressure valve and connect intermediate hose with small refrigerant bottle. If vacuum pumping is required, firstly we shall connect high

pressure hose with vacuum pump and vacuum the system.

②Tighten thimble head; Discharge air in the hose with refrigerant steam in system or refrigerant in the bottle. If small refrigerant bottle has been connected with hose and vacuum pumping has been done, there's no need to discharge air.

③Start up air conditioner, check low pressure value when it runs stably and judge the remaining refrigerant in system. Open valve on the refrigerant bottle and then refrigerant enters into refrigerating system. At the same time, we should observe and control low pressure; continue to fill the refrigerant until pressure reaches standard evaporate pressure.

④Refrigerant from low pressure valve is in gaseous form. When gas pressure in bottle is no longer larger than pressure in system, we shall heat the bottle with warm water so as to promote gaseous pressure in bottle and push refrigerant continue to flow into system. Do not stand refrigerant bottle upside down to avoid liquid slugging accident.

⑵Add refrigerant with high pressure valve

Connect high pressure valve to special hose (with thimble) to add refrigerant. Tighten thimble head, discharge air in the hose, and then stand the refrigerant bottle upside down and open bottle valve, liquid refrigerant will flow into high pressure side of air conditioner. When pressure in bottle is no longer larger than that in system, refrigerant will stop to flow into system. Heat the bottle with warm water to promote pressure in bottle, and then liquid refrigerant continues to flow into system. The whole operation process is conducted when compressor is switched off.

High pressure filling method shall be used to fill relatively large air conditioner or air conditioner by using liquid reservoir. To control refrigerant filling volume, usually a weighing appliance will be used. If no weighing appliance is available, refrigerant volume shall be controlled based on experience. For the equipment without reservoir or requiring accurate filling volume, we can connect filling appliance with low pressure valve, add or release part of refrigerant by using the same steps as the said low pressure valve filling method.

⑶Determination of refrigerant volume

At present, R22 refrigerant is commonly used in household air conditioner. According to the thermal feature, under normal work condition of air conditioner, volume of refrigerant shall be calculated as per following parameters:

① Low pressure: evaporate pressure shall close to pressure on return gas tube of compressor which is 0.5MPa(absolute pressure 0.6MPa), and the evaporate temperature is 5℃;

② Return gas temperature: temperature on the return gas tube of compressor shall be within 7℃~15℃, condensate instead of frost can occur on the return gas tube;

③ Running current: Generally running current of compressor shall not exceed rated value on the nameplate;

④ Indoor unit air inlet and outlet temperature difference: In cooling operation, temperature difference

shall be no less than 10℃ and in heating operation, temperature difference shall be over 15℃;

⑤ High pressure: High pressure value of cooling operation shall be about 1.5~1.9MPa;

⑥ Weighing: When we fill the air conditioner with refrigerant, we shall weigh refrigerant with electronic weighing appliance if available. It is one best way to add the refrigerant.

⑦ Temperature of high and low pressure valves: Normally, the low pressure valve has the lower temperature and more condensate than the high pressure valve of split units.

To check high pressure value, the ambient temperature should add about 15℃, for example, ambient temperature measured is 35℃, actual temperature of refrigerant in condenser shall be about 50℃, so we can know high pressure is 16.6MPa(absolute pressure); to check low pressure, evaporating temperature is assumed as 5℃, superheat temperature shall be 5℃~7℃, according to the Temperature/Pressure Relation Table, low pressure is 0.59MPa(absolute pressure).

Refrigerant volume shall be determined by combining all foregoing data. However, to air conditioners with different types and brands, foregoing data are different, especially for the air conditioners which have been used for many years, differences are more noticeable, and detailed volume shall be analyzed by integrating various factors. For example, evaporation pressure of an air conditioner is lower than 0.5MPa, but running current of compressor has reached rated value. In order to use compressor safely, evaporating pressure has to be set below 0.5MPa, though under this circumference, refrigerating capacity of air conditioner has been lowered.

⑷ Adding of refrigerant

During installation of the air conditioner, connection tube often has to be extended because of installation positions; all manufacturers have their own requirement of refrigerant adding for extension tube, normally, following principle shall be complied with:

Experience Value of Refrigerant adding for Extension Tube

Refrigerating. Capacity(W)	Connection Tube Size (Dia.)	Adding volume /M（g）
2000~3000	Φ6.35×0.6/ Φ9.52×0.6	15
3000~5000	Φ6.35×0.6/ Φ12.7×0.6	20
5000~7000	Φ9.52×0.6/ Φ16×1.0	30
7000~12000	Φ12.7×0.6/ Φ19×1.0	35

We can also calculate the volume of long tube, and then calculate adding quantity of refrigerant according to its density.

Section two Cleaning and blowing of refrigerating system

1. Cleaning of refrigerating system

When air conditioner can't operate properly, insulation of compressor motor may be disrupted, coils has been short circuited or windings have been burned, a large amount of acid oxide can be produced and refrigerant may be polluted. So, besides replacing of compressor, the whole refrigerating system shall be cleaned.

Pollution degree of refrigerating system can be classified as: slightly polluted and seriously polluted. When system is slightly polluted, condensed oil in it has not been polluted completely, and if refrigerant and lubricant is released from line of compressor, it is transparent and will become light yellow(normally they should be in white) if tested with litmus paper. If system has been seriously polluted, when line of compressor is opened, tar odor can be smelt immediately, and condensed oil from line is black, and if litmus paper is put into the oil, it will become mahogany in 5 minutes.

Refrigerant in totally enclosed compressor for small air conditioner shall be R22 which can be cleaned with R113 ($C_2F_3CL_3$—trichloroethane) according to following procedure:

⑴ Release refrigerant in refrigerating system, check color and odor to determine the pollution degree of refrigerating system;

⑵ Remove compressor, release a little refrigerant from technical tube to check its color and odor, and inspect whether there's any foreign substance.

⑶ Fill liquid tank with R113, and then start pump to clean the system. For the slightly polluted system, pump only need to run around 1 hour, but serious polluted system should be washed for 3~4 hours. If washing need to last for a long time, cleaning agent is dirty and filter has been blocked and smudged, and so shall be replaced.

⑷ Cleaning agent shall be recovered after the system has been cleaned, and can be reused after being treated. Cleaning agent in liquid tank shall be recovered from liquid tube.

⑸ When cleaning has finished, refrigerating system shall be purged with nitrogen and dried.

In the foregoing sketch, parts in broken line pane shall be disconnected from line as the system is being dried. Blinds shall be installed on the flange disk of liquid squeeze line and liquid suction line; to dry the system quickly, blow heat wind outside the refrigerating line when system is being evacuated by vacuum pump. Install the refrigerating system again, and replace compressor and filter with new ones.

Following aspects shall be noticed during cleaning

⑴ To avoid cleaning agent leaking out, pressure resistant hose shall be used and connection joints shall be packed tightly.

⑵ Replace capillary or expansion with by pass pipe or pressure resistant pipe and connect evaporator and condenser directly;

⑶ Water in refrigerating system shall be drained completely;

⑷ If compressor has been burned, acid in system shall be purged with nitrogen.

⑸ Compressor, expansion valve (capillary) and filter shall be cleaned with gasoline first and then be dried with nitrogen.

2. Blowing of refrigerating system

After refrigerating machine has been removed, inevitably, there're some slag, rust, scale and water in the system which will abrade running parts, for example, score and rough the cylinder or pistol surface, or impress concave on the contact surface of some parts, for example, blades of compressor becomes rough, and valve spool has been damaged. Sometimes dirt may block system on the expansion valve, capillary and filter (dirt block). Dirt and water also reflects with refrigerant and condensate and create corrosive substance. Currently, cleaning equipment is rarely used to clean refrigerating system. High pressure nitrogen is often used to blow the polluted system.

Generally, system shall be purged under a pressure of 0.6MPa which can be pressurized with refrigerating compressor, nitrogen bottle or air compressor (compressed air can't be used in Freon system). System shall be blown in sections, with dirt outlet set on the lowest point of each section. Each dirt outlet shall be plugged up with cork (tied with steel wire). When pressure reaches 0.6MPa, stop pressuring, and draw out cork, and discharge the dirt in this system by using high-velocity air flow.

Hang a piece of white cloth on the dirt outlet to check if system has been cleaned completely. If white cloth is clean, dirt in the system has been evacuated with gas, blowing can be stopped; if there's some stain on the white cloth, blowing shall continue.

Section three Troubleshooting for four-way valve and compressor

1. Troubleshooting method for four-way valve of heat pump air conditioner

⑴ Troubleshooting of four-way valve

① Air conditioner can make cooling air but can't make any heating air

Check service power voltage of electromagnetic loop by using millimeter; when unit is turned off, measure the resistance of loop which normally shall be around 1400Ω. Switch on the air conditioner and try to hear sound of magnetic operation so as to judge if control valve works well; check high pressure with pressure meter, if it is very low, so we can judge that slide of reverse valve can't be moved and can't change the flow direction of refrigerant when the unit made in heating operation.

② Fail to function in both cooling and heating operations

There're two possibilities: discharge capacity of compressor is not sufficient or four-way valve itself is of poor quality. Firstly, judge the quality and discharge capacity of compressor: remove four-way valve, connect refrigerating system and run it. If the system can cool the room in a relative high efficiency, the compressor is of good quality, and so it's the four-way valve that can't work well and cause leakage of four copper tubes, high and low pressure tubes are short circuited.

③ Air conditioner is set in cooling operation but functions in heating operation.

Four-way valve is blocked inside and can't reverse the direction;

④ Cooling normally after it is started and run 2~3 times

According to the work principle of four-way valve, we can judge that valve core can't seal tightly, and air leaks in 4 directions under high pressure, so pressure is not large enough to seal capillary control valve, and slid of reverse valve can't function successfully in one time.

⑵ Steps to change four-way valve

If it is clear that four-way valve is broken, it shall be replaced with the new one of same size and type, and in the following way:

①、Remove the old four-way valve from air conditioner

②、Install new four-way valve and remove electromagnetic loop. 4 copper tube nozzles shall be positioned in their original directions and angles, reverse valve shall be positioned horizontally.

③、Weld high pressure tube first, and then the middle one of three low pressure tubes, finally left and right tubes;

④、Select proper welding machine, flame shall be adjusted and can weld the valve immediately. Pack the valve body with wet towel to avoid burning rubber and nylon sealing elements in it and causing the leakage of four-way valve.

⑤、; Weld the tube one by one and start welding the second one after the first one cools down. Welding shall be performed quickly and finished before temperature of four-way valve rises;

⑥、After four nozzles have been welded, clean the welds with wet tower, at the same time, lower the temperature of four-way valve. Check the weld quality and adjust the angles of four tubes.

2. Troubleshooting for the compressor

⑴ Replace of compressor

If totally enclosed compressor has some fault, because its components can't be bought easily, so even motor is broken and renew the loop, the quality of compressor still can't be ensured. Therefore, compressor shall be replaced. During replacement of compressor, following 6 aspects shall be complied with:

① New compressor shall be of the same type and specification as the old one. If unavailable, main performances and characteristics of the new compressor, including nominal cooling capacity (same work condition), power and capacity (voltage, phase number & frequency and current) of motor and capacity of capacitor shall be same and similar as the old one,;

② Efficiency of new compressor shall be not lower than the old one;

③ Power voltage shall be based on the demand of client;

④ Refrigerant shall not be changed;

⑤ Outside dimension shall be same or similar to old one so that it can be installed on original position.

⑥ Basement dimension shall be the same. If unavailable, basement shall be adjusted based on the old dimension. Direction and position of discharge tube and return gas tubes shall be same or similar as the old one. If unavailable, tube dimension shall be changed.

⑵Troubleshooting for totally enclosed compressor

① Poor refrigerating efficiency

Actual discharge capacity of compressor lowers and can't reach the nominal capacity of product and meet the original cool load. There are four factors for the poor refrigerating efficiency:

a) Severe abrasion of pistol and cylinder (including rotating type): Requirement of clearance between pistol and cylinder is very strict, grease film inside is for lubrication and sealing. If clearance is too wide, grease film will be broken and cause gas leakage; if clearance is too narrow, grease film may be

burned or components can't start up. So clearance scope between pistol and cylinder is very small. For Dia ϕ 50mm cylinder without pistol ring, fit clearance shall be within 0.011~0.018mm. If pistol or cylinder wears out severely, when pistol compresses and exhaust the gas, a part of gas in cylinder will leak into pump shell through clearance, so compressor can reach its original discharge capacity;

b) Gasket rib of cylinder cover is cracked (reciprocating): There's a rib on the middle of gasket and it separates and seals discharge cavity and return gas cavity, preventing high pressure (discharge) gas from flowing to gas return cavity, and causing a part of gas being short-circuited. If a part of rib is broken, some gas will be short-circuited, and exhausting quantity of compressor will lessen. To avoid this type of fault, apply anti-florin rubber on two sides of steel rib. If asbestos rubber gasket is used, risk of fault like this will be very high.

c) Severe leakage of gas valve(including rotary type): If discharge and return gas valve blades can't match tightly with valve line on the valve plate and there's certain seam; when valve discharges or returns gas, some gas will leak out from seam, and discharge capacity of compressor will lessen. Follows are Main factors for this kind of faults: 1) system is not clean enough, there's some dirt flowing with refrigerant. Dirt sticks to the valve line and valve blades, when valve blades run, abrasion of valve blades and valve line will speed up, and sealing performance will lessen gradually; 2) discharge temperature is excess high often and so refrigerant produces particles, which sticks to valve structure and damages tightness of valve; 3)slightly liquid hammering often happens in the system, due to the impact of liquid, valve blades are deformed or damaged, or abraded severely, so tightness of valve structure is decreased; valve plate has been liquid hammered severely, gas valve is damaged and valve blades are broken, so that tightness of valve is severely damaged.

d) Crack of exhaust tube in pump shell(reciprocating). To the compressor with unbalanced reciprocating, pump body librates sharply, exhaust tube will be cracked or broken and refrigerant steam will circulate in pump shell; steam can't be exhausted outside pump shell, so refrigerating capacity of the system is almost zero.

The same symptoms of the foregoing four faults are: discharge pressure drops, return gas pressure rises, and pressure difference between return gas and discharge pressure becomes relatively low or very low, or becomes almost zero in the serious condition. In the normal condition, pressure difference shall be very large, pump shell shall be hot in various degrees, and some discharge tube will be very hot.

② Compressor can't run normally

When compressor is switched on, motor will produce buzz in pump but fails to run. After 3~5 seconds, heat protector trips and cut off the power supply. This symptom is resulted by following faults:

a) Main journal and bearing or big end and crankpin burn out and melt because of lack of oil(commonly called coherence) , for oil in compressor is not enough or oil nozzle is blocked by pistol;

b) Air valve is broken and broken valve blades fall into cylinder and block the pistol, so valve can't reciprocate;

c) Connection rod is broken and motor can't be driven.

③ Motor in compressor is broken.

Symptom is: when air conditioner is switched on, fuse protector breaks or air protector trips immediately. There're three reasons for this symptom:

a) Because motor stator windings have burn out, and insulation layer of electromagnetic loop has been broken and windings touch the motor shell and are short circuited. These faults are caused by long term overload running of air conditioner, at the same time, protector is broken, so windings run on the over heat condition for a long time, insulation layer has been damaged;

b) Coils are short circuited which cause disruption of insulation layer of part of coils around the stator winging, and some coils touch the shell. All the faults are caused by slight damage of some coils, scar of which expands and disrupts insulation layer;

c) Short circuit: Insulation layer of power wire of motor is damaged or cut off and short circuited.

d) Insulation layer of stator windings has aged severely but hasn't burned out. It symptom is different from the former one: it can run 1~2 minutes, then fuse protector is burned or air protector trips. With same reason, this kind of motor can't work like motor with burnt windings. ④ Abnormal noise can be heard when air condition is running

When air conditioner runs, steady, low and rhythmic noise is inevitable. If it creates unpleasant noise, it is abnormal. If it is not handled in time, components will be damaged, so we must pay attention to it. Components loose and clash with each other, and create noise, generally, exhaust tube will clash with pump shell, pistol clashes with valve plate and stator abrades with rotator. In addition, magnetic noise may be created by motor.

Section 4 Cases of Refrigerating System Troubleshooting

Case 1: Capillary of outdoor unit is blocked by ice

Unit Model：KFR35/H

Phenomena：Cooling fault

Cause Analysis: we went to client's home to fix the air conditioner. It can cool when it was turned on, after about 25 minutes, pressure and current of air conditioner decreased. According to the client, compressor was replaced before, so compressor functioned well. Because cooling was normal in the first 25 minutes, so we presumed that system was blocked by dirt or ice. Open top cover plate of outdoor, we found that capillary outlet was frosted. Heat the frost with lighter, pressure and current returned to the normal value, so we judged that system was blocked by ice. According to the client, it was raining when the compressor was replaced, and water entered the system.

Solution: recover refrigerant to outdoor unit and install desiccation filter on the low pressure tube; run the air conditioner until ice is removed completely. Remove desiccation filter and start the air conditioner again, it can cool normally.

Experience Conclusion: water shall be prevented from flowing into system when maintenance personnel are fixing the air conditioner, or it is likely that system will be blocked by ice. If capillary inlet is frosted, the system has been blocked by dirt, if capillary outlet is frosted, blocked by ice.

Case 2: Capillary of outdoor unit was blocked by dirt

Unit Model：KFR-H24B4/FS

Phenomena：Poor cooling

Cause Analysis: turned on the air conditioner, it could run normally. Checked filter of indoor unit and heat exchangers, and found that they were quite clean and wouldn't impact the cooling efficiency. Checked capacitors and all parameters of indoor and outdoor fans, voltage was 220v, current was 13.5A, low pressure was 0.4MPa and there's no extension line, outdoor compressor also run normally, in addition, no flow restriction was found. After air conditioner run about 20 minutes, measured current and pressure: current became 15A, system pressure became 0.3MPa, refrigerating efficiency became worse. According to the data, we presumed that system was blocked or flow was restricted somewhere. We checked the connection line between indoor and outdoor units and didn't find flow restriction. So we checked outdoor unit, and found two groups of capillaries connecting distributor were frosted, so we believed that there's some problem on the capillary. Separated the distributor and capillaries and found that filter net in the distributor was blocked by oil sludge and foreign substance, but hadn't been blocked up, so flow in the capillary should be sufficient and caused flow restriction and frost.

Solution: replace new distributor, purge the system with nitrogen, vaccumize the system, and then fill refrigerant in the system; air conditioner functions well since then.

Experience Conclusion: to air conditioner with relatively poor cooling performance, we should consider all conditions comprehensively and have clear philosophy: check from main to secondary, from inside to outside and from outer to inner; following aspects shall be considered:
1. Check whether air conditioner works well;
2. Check heat exchange condition of outdoor and indoor units, consider the interference of surrounding appliances;
3. Outdoor and indoor fan velocity will impact heat exchange;
4. Measure all parameters and judge if they're normal, and analyze reasons;
5. Consider impact of extended tube on the performance of air conditioner;
6. Consider interruption of running of indoor and outdoor compressor;
7. Check if there's no throttle in the system, and consider impact of cold flow on cooling performance.

Case 3: Capillary of separator of indoor unit evaporator is blocked

Unit Model： KFR-41A5/A

Phenomena: Poor cooling efficiency

Cause Analysis: this air conditioner was brand new, indoor and outdoor units were very clean and ventilate normally; service power functioned well, indoor unit air outlet well; but we found that temperature difference of air inlet and outlet of indoor unit was relatively low; checked connection pipe of outdoor and found that low pressure tube was frosted, so we presumed that refrigerant in the system was excessive, so we released some Freon and refrigerating efficiency became worse; so we judged that there's flow restriction in the system; opened the panel of indoor unit, touched evaporator, and found that temperature difference of upper and down part of evaporator was obviously large. Touched capillary of evaporator of indoor unit, found that two groups of capillaries were slightly frosted. So faults were caused by block in capillaries.

Solution: removed capillaries with welding machine, found that capillary outlet was blocked by weld liquid. Replaced capillaries and air conditioner functioned well since then.

Experience Conclusion: according to phenomena, we presumed there's excessive refrigerant; when we

analyze this phenomenon, we shall check whether air flow of indoor unit is sufficient. If it is in normal condition, check whether there's secondary flow restriction; judge the fault by analyze phenomena carefully.

Case 4: Filter of outdoor unit was blocked by dirt

Unit Model：KFR50

Phenomena: air conditioner can't cool and start & stop frequently

Cause Analysis: air conditioner failed to cool, outdoor unit started and stopped frequently, indoor unit could be started by remote controller and run normally, but outdoor unit started and stopped every three minutes, and air was not cool in the three minutes, so we presumed that refrigerating system couldn't work well; check low pressure with pressure meter: balanced pressure was 1.1MPa when air conditioner was turned off, and pressure dropped to 0.1MPa when air conditioner was turned off and returned to balanced pressure when it was turned off again. When outdoor unit run, frost could be found from filter to capillary to high pressure tube, so the air conditioner was blocked by dirt.

Solution: replaced filter

Experience Conclusion: If outdoor unit starts up frequently, we should find out it is resulted by faults in circuit or in cooling system. Generally, following symptoms will occur if filter is blocked: capillary outlet and sometimes evaporator are frosted; low pressure is lower than normal, high pressure is slightly lower than normal value; when air conditioner is turned out, balanced pressure closes to the saturated pressure in ambient temperature; compressor discharge temperature and shell temperature rise. If current is higher than normal value and air conditioner starts and stops frequently, fault may not be in the compressor. We should consider symptoms comprehensively. Generally, when we fix an air conditioner, we should check current and maintenance pressure, if current is relative large and pressure is a relative low, system is blocked, and so we should check filter and capillary firstly.

Case 5 Leakage of connection line of evaporator

Unit Model：KFR25/H

Phenomena: couldn't cool

Cause Analysis: according to the client, air conditioner can't cool. We checked indoor and outdoor units, both run properly, so circuit is in good condition; we checked running pressure of outdoor unit was minus and there's no refrigerant leaking from line joints, there's no leakage on indoor evaporator and outdoor unit; we disassembled the indoor unit and found that there's a crack on the protection spring of evaporator junction.

Solution: welded the line again, vacuums the system and added refrigerant, and air conditioner functions proper since then.

Experience Conclusion: It is very difficult to find out leakage sources, we shall pay particular attention to connection tube of evaporator.

Case 6 flare mouth of connection tube is broken

Unit Model：KFR25/HY

Phenomena：Poor cooling and heating efficiency

Cause Analysis: turned on the air conditioner and pushed on cooling mode, indoor unit produced wind properly, two units were very clean, but temperature different of air inlet and outlet is very low; air

conditioner run 5 minutes, and evaporator of indoor unit was frosted, so we presumed that refrigerant was not sufficient; we checked and found that low pressure was 3KG. Turned off air conditioner, checked indoor & outdoor units and connection tube and found oil stain on the junction of low pressure copper tube.

Solution: released refrigerant, twisted off line junction and found a small crack; repaired flare mouth, checked leakage sources under high pressure, vacuum the system, added refrigerant, and then test run the air conditioner and it worked properly.

Experience Conclusion: to fix the air conditioner, maintenance personnel shall have flexible thoughts and broad vision; find out actual problems according to principle of air conditioner.

Case 7: Nut of connection tube is broken.

Unit Model：KFR35/HSA

Phenomena: Poor cooling efficiency and indoor unit was frozen

Cause Analysis: checked and found that low pressure of outdoor unit was very low, return gas tube was frosted, but the tube was not bent. Turned on ventilation mode, we found that low pressure was lower than normal value when ice was melted. We checked leakage sources and found that nut of connection tube on indoor unit was broken.

Solution: replace nut, vacuum the system and add refrigerant.

Experience Conclusion: analyze the actual condition carefully, generally, analyze fault according to the frosted position and area. Refrigerant lack will cause frost on liquid tube; upper part of evaporator will be frozen.

Case 8 Welds of high pressure valve leaked

Unit Model： KFR35

Phenomena: Poor cooling efficiency and indoor unit leaked water

Cause Analysis: checked air conditioner and found that air conditioner failed to work well and the cooling efficiency is poor. Evaporator of indoor unit was frosted, so we presumed that system was lack of refrigerant; we found system pressure was very low. We checked the system and found leakage source on the connection tube of High pressure valve body. Welded the leakage source and added refrigerant; turned on air conditioner and it worked well.

Experience Conclusion: air conditioner lacks in refrigerant and is frosted, so indoor unit leaks and the cooling efficiency is poor. The fundamental problems are weld leakage and lacking in refrigerant

Case 9 Weld leakage of condenser distributor

Unit Model：KFR-41A5

Phenomena: Failed to cool, running indicator and 18# indicator blinked at the same time, air conditioner couldn’t be turned on.

Cause Analysis: air conditioner was only used for two days, according to client, air conditioner failed to cool. We checked the air conditioner, voltage was 390v, balanced pressure was 0MPa; according to phenomena and data, we presumed that the system lacked of refrigerant, the air conditioner was in low pressure protection situation. Opened outdoor unit, we found oil stain on the weld of distributor of

condenser, so refrigerant leaked out.

Solution: repair-welded leak source and added refrigerant

Experience Conclusion: when air conditioner is running, system pressure is zero, we can judge that refrigerant leaks out; generally, oil stain can be seen on leak sources. Maintenance personnel shall be familiar with blinking conditions of indicator.

Case 10 Weld of U type tube of condenser leaked

Unit Model：KFR35/HY

Phenomena: failed to cool

Cause Analysis: air conditioner was used less than one month, cooling efficiency was unsatisfactory. Checked the air conditioner, temperature of compressor was relatively high; current was 3A, low pressure was 3kg, outdoor fan run normally. We presumed that system was blocked, leaked or return gas and discharge capacity of compressor was quite unsatisfactory. We brought air conditioner to Maintenance Office, purged the system with nitrogen, checked leak sources under high pressure and found that weld of U type tube under condenser leaked.

Solution: repair-welded, vacuum the system and filled the system with refrigerant.

Experience Conclusion: air conditioner has been used for a short time, but refrigerating efficiency is unsatisfactory, in most cases, system leaks, so firstly we shall check leak source.

Case 11 Four-way valve was broken

Unit Model：KFR-H24B4

Phenomena：Air conditioner produced heat once it was started up.

Cause Analysis: once we turned on the air conditioner, it worked in heating mode. It was a new appliance, so we presumed that four-way valve had some problems. We checked circuit, and it was connected correctly; coil resistance of four-way valve was normal and conducted electricity well, so four-way valve was blocked: because it was a new appliance, there's very low chance that four-way valve was broken. We knocked the four-way valve and started the air conditioner repeatedly; it still failed to work properly. So finally we confirmed that four-way valve was broken.

Solution: replace four-way valve

Experience Conclusion: don't replace four-way valve easily, slightly blocked phenomena can be fixed by simply physical method, especially for the appliance used for a short time.

Case 12 the retaining valve was broken

Unit Model：KFR50/ III

Phenomena: Poor cooling efficiency

Cause Analysis: voltage of client's house was 220v. According to client, room was not cooled down although air conditioner had worked for some time. We checked the air conditioner, low pressure was 0.65Mpa, being relatively high. We released refrigerant until the pressure was 0.55Mpa, cold wind from outlet of indoor unit was weak, and work current was 7.3A, which was normal. We touched high and low pressure copper tubes, low pressure tube became colder, but high pressure tube was not cold, so there's no failure in compressor. At that time, pressure increased to 0.36Mpa, we touched 4 copper

tubes, the one connecting discharge pipe of compressor was hot, and other three were also a little hot. Turned on the air conditioner in heating mode, heating efficiency was also unsatisfactory. So we were sure that four-way valve had some problems.

Solution: replaced four-way valve, vacuum the system to check leakage sources and finally added refrigerant.

Experience Conclusion: to fix this kind of faults, we should judge compressor and four-way valve, which one has problem. Check the pressure and touch the unit with hand to find out fault points. In the event of gas blowby, temperature difference between inlet and outlet gas is relatively low, gas flow sound can be heard in valve body, suction force of gas-return pipe of compressor is relatively large and liquid temperature is relatively high.

Case 13 back valve is broken

Unit Model ： KFR35/HY

Phenomena ： Seal of back valve is not tight

Cause Analysis: according to client, air conditioner could cool properly, but failed to heat the room. We turned on the air conditioner, checked the whole unit and found that eudiometer pressure was 14kg, being relative low, according to fault phenomena, refrigerant in system might be not enough, but we checked the system and found that balanced pressure was 10kg, and air conditioner could cool normal in summer, the system didn't leak, so we presumed that the fault was caused by four-way valve blowby or poor seal of back valve. Switched on and off four-way valve, valve could operate tightly and sound of gas discharge was normal. Released refrigerant, vacuumed the system again, added refrigerant and started the air conditioner again, it still couldn't work properly. We checked four-way valve, temperature of its four copper tubes was normal, so we were sure that seal of single-way valve was not tight, which cause that capillary couldn't function properly, so the pressure of gas tube was relative low, and heating efficiency was not so good.

Solution: replaced back valve, vacuum the system and added refrigerant.

Experience Conclusion: back valve can't close tightly, on high pressure, gas leaks from clearance between nylon valve block and valve seat, refrigerant fails to enter capillary totally, so air conditioner fail to produce heat properly, while in cooling mode, single-way valve can work and won't impact cooling efficiency.

Case 14 Failed to open the valve enough during installation

Unit Model：KFR20/HY

Phenomena: Poor cooling efficiency

Cause Analysis: turned on air conditioner for a while, indoor evaporator was frosted, checked the pressure, it was 3.5kg, relatively low than normal. Added refrigerant and pressure remained unchanged. Air conditioner continued to work, and after a while, we found that return gas tube of outdoor unit was frosted, so we presumed that the system was blocked by ice. When we released the refrigerant, we found that low pressure valve hadn't opened enough.

Solution: opened the valve fully, adjusted refrigerant pressure to normal value.

Experience Conclusion: valve is too tight, so system is obstructed and then frosted. When refrigerating efficiency of new unit was unsatisfactory, do not add refrigerant without careful consideration.

Case 15 Air conditioner was blocked by dirt

Unit Model：KFR-H41A5/A

Phenomena：Poor cooling efficiency, wind velocity didn't change obviously

Cause Analysis: totally 5 cabinet air conditioners were used in a workshop of a Garment Company, which occupied an area of 350m^2. According to the client, air conditioners were repaired many times in this year, but they still failed to work properly. We checked the air conditioner, voltage was 380v, and current was 9A, low pressure was 5kg, which was normal; however, temperature of wind outlet was relatively high. Based on the forgoing data, we presumed that faults were caused by weak wind. The main factors may be: 1.fault in fan 2. Fault in capacitor of fan 3. Filter and evaporator were dirty;

4. Fault in control panel. Checked the system, we found that wind was weak, fan and capacitor were in good condition; adjusted wind velocity (high, intermediate and low), three levels of fan relay closed with obvious sound, but wind velocity failed to change distinctively. So we judged that fault was caused by dirt-block of evaporator. Disassembled evaporator and found that there was a great deal of fiber in it, and it was frosted.

Solution: clean indoor evaporator, wind volume became normal, air conditioners could produce cool properly

Experience Conclusion: in some special places, for example, garment factories, hair salon, cotton mill and other places with more dirt as well as public. In such case, poor cooling efficiency was generally caused by discharge fault, because the system was blocked by dirt. Firstly we should check filter and evaporator to find out if they were dirty. To fix such kind of fault, we should check surrounding factors and then checked faults in air conditioners; checked wind volume of indoor and outdoor units, if ambient temperature is too high; if the two units' heat exchange properly, finally checked the system itself.

Case 16 Folding of Connection pipe

Unit Model：KFR50/TA

Phenomenon：Poor cooling efficiency

Cause Analysis: Abnormal sound could be heard in indoor unit. When air conditioner runs for three minutes and under ventilation mode, no abnormal sound was heard, but when compressor was turned on, indoor evaporator produced abnormal loud sound of cold flow. Checked the system and found that outlet tube of indoor evaporator and copper tube of condenser were bent on the junction between the two tubes.

Solution: replace connection tube

Experience Conclusion: in such case, abnormal flow sound is produced by unsmooth flowing of refrigerant, and only when we check the system carefully can we find where the line is bent, which is caused by unprofessional performance of maintenance workers.

Case 17 Bending of connection line

Unit Model：KFR-H24B4

Phenomena：Refrigerating efficiency was unsatisfactory, outdoor unit stopped to run after it operated for some time.

Cause Analysis: air conditioner was installed last year, and failed to run properly since then. Maintenance personnel checked the air conditioner many times, and had following data: running current was 12.5A, pressure was 5kg.f/com2, inlet wind temperature was 12 Celsius Degree, and outlet wind temperature was 30 Celsius Degree. From these data, air conditioner was normal, current of air conditioner rose after it run for some time, outlet wind temperature rose gradually. After 1.5 hours, air conditioner was in protection mode. Maintenance workers judged the outdoor unit was in heat protection mode, and checked discharge environment of outdoor unit, but condenser was clean and the outdoor unit was not exposed to the sun. Maintenance workers sprinkled water on the outdoor unit, it was not in protection mode, so the faults were caused by: 1. faults of compressor; 2 refrigerants were slightly polluted; 3. problems in line. We checked the system and line, low pressure connection line was bent where it penetrated the wall, the system was blocked and caused poor cooling efficiency. Solution: replaced bent line, and air conditioner started to work properly

Experience conclusion: such fault is caused by improper installation, so it is often neglected. To fix such kind of fault, maintenance workers shall check air conditioner carefully and shouldn't add refrigerant or change outdoor unit without careful consideration. Generally, it is bending of connection line and unsmooth circulation of system that result in fault of air conditioner.

Case 18 Pressure switch was broken

Unit Model：KFR-H41A5/A

Phenomena：Couldn't produce cooling air

Cause Analysis: Turned on air conditioner for less than 1 minute, "run" indicator and "18" indicator on control panel blinked, so we presumed that it was in protection mode. High pressure and low pressure switches worked properly, discharge temperature of compressor is normal. Replaced outdoor check board, tested the air conditioner, fault remained the same. Turned on air conditioner again and watched running condition of outdoor unit, we found that air conditioner refrigerated for one minute, low pressure switch broke off, outdoor unit stopped to work; connected low pressure protector and tested it, it run normally, low pressure was also normally. So we're sure that pressure switch was of poor quality and couldn't work properly.

Solution: replaced low pressure switch, tested air conditioner and it run properly.

Experience Conclusion: observe faults indicators on control panel which can help us find out causes of faults.

1. Heating defrosting: "heat "indicator blinks
2. Anti-frozen protection: "run" and "cool" indicators blink
3. Anti-cold wind protection: "run" indicator blinks
4. Over current protection: "run" and "29" indicators blink
5. Low pressure protection: "run" and "18" indicators blink
6. Phase sequence protection: "run" and "time"
7. Fault in Communication: "run" indicator blinks and other indicators extinguish
8. Fault in Sensor: "temperature" indicator blinks

Case 19 Water entered the system in installation

Unit Model：KFR35/H

Phenomena：Air conditioner could be turned on but couldn't produce cool air

Cause Analysis: run air conditioner for 10 minutes, it could cool normally, pressure and current was normal; air conditioner continued to run, low pressure decreased gradually, current also decreased, and cooling efficiency became unsatisfactory, so we presumed water entered system when air conditioner was installed. Because the air conditioner passed quality check when it left the factory, and according to the client, air conditioner was installed in rainy day, so water might entered the system.

Solution: released refrigerant, vacuum the system and added refrigerant again, air conditioner worked normally since then.

Experience Conclusion: in most case, these kinds of faults were caused during installation or maintenance; maintenance workers shall investigate, check and touch air conditioner to find out the cause of faults.

Case 20 Failed to evacuate air in the system fully during installation

Unit Model ：KFR50/TB

Phenomena： Tripped frequently

Cause Analysis: generally, in summer air conditioner may have problem in heat discharge and voltage. But this air conditioner had been installed for only one month odd. It was installed on the roof, so heat exchange efficiency was not so good, but it shouldn't trip so frequently. We checked the system, pressure was not so stable, and compressor was overheating, and presumed that air was not evacuated when the worker installed the air conditioner.

Solution: released refrigerant, because air is lighter than refrigerant, we found there's air in the refrigerant obviously. We filled the equipment with refrigerant, air conditioner worked well since then and it didn't trip any more.

Experience Conclusion: for air conditioner, installation is more important than manufacture, so installation workers shall follow installation procedure as they install air conditioners, installation and wind direction shall be considered. If newly installed air conditioner has problem, they should check other reason, and then consider possible faults of air conditioner from the simple to the complicated until fundamental reason is found.

Chapter 9 Maintenance Cases of Noise and water leakage of AC

Section one cases of air conditioner noise reduction

Air conditioner noise is a common problem seen in our maintenance work, causes of which shall be paid attention to. Noise can be classified based on Positions: indoor noise, outdoor noise; based on sound types: friction noise, wind sound, air flow sound, and electromagnetic sound; based on causes: assembly problems, structure design problems, components and parts quality problems and installation problems. We shall distinguish sound types, positions and causes of air conditioner noise, and deal with the problems accordingly.

1. Common noises of indoor unit

⑴Dirt in indoor unit
⑵Indoor fan motor axis, poor concentricity and fix screw becoming loose
⑶Poor concentricity of indoor fan, blade breakage and wearing of left blade axis bush ⑷Loosing of the panel and the auto-switch
⑸Abnormal sound (friction sound from connection parts) from step motor and horizontal air blade,
⑹Whistle (poor balance of blades, if necessary change a blade; or 25A failure of evaporator itself)
⑺Refrigerant flow sound of indoor unit (line bending position 32M and capillary 100S)
⑻Air inlet was obstructed because of dirt filter

2. Common noises of outdoor unit

⑴Loud noise from compressor
⑵Tube vibrating and touching outdoor casing
⑶Whistle from blades (blade breakage)
⑷ Loud sound from outdoor fan motor(replace 70W， 930rmp,YDK48-6-354 3UF with YDK48-6A-354 4UF)
⑸Outdoor blade touching outdoor casing, condenser or steel grille
⑹Sympathetic vibration of outdoor unit, especially removing the motor bracket of the small outdoor unit
⑺Outdoor steel grille colliding with outdoor casing
⑻Indoor unit motor frame becoming loose
⑼Air conditioner installation holder becoming loose
⑽Improper installation position of outdoor unit

3. Method to find noise positions

⑴Denying one by one: When it is difficult to find noise sources, for example, to decide it's compressor or outdoor motor producing noises, firstly we should break off compressor, and listen if outdoor motor produces noise, if not, it's compressor creating noises.

Case 1: Blade axis of indoor unit colliding with rubber seat

Unit Model：KFR35/HY
Phenomena： Loud indoor noises
Cause Analysis: indoor unit creates same sound in both cooling and ventilation modes, with similar fault phenomena. Noise was louder when air conditioner was turned on. Removed panel and shell of indoor unit, fault still remained the same and sound came from left bearing, so maintenance

presumed that fault was on bearing bush of left blade. Replaced bearing bush, noise could still be heard. Maintenance personnel checked wind blades and found that they're installed left to the center and blade axis touched rubber seat of bearing and produced noise when running.

Solution: move wind blade to right by 2mm and noise was eliminated.

Experience Conclusion: foregoing noises also can be created from following problems:

(1) Screw of fix motor gland becoming loose
(2) Bearing seat left to indoor fan becoming loose
(3) Oily bearing left to indoor fan is broken or lacks oil; (4) Left axis of blade colliding with rubber bearing holder (5) Fix screw of indoor fan becoming loose; (5) Two ends of indoor fan colliding
(7) Chassis has deformed and collides with blades
(8) Blades trip too excessively and collide with chassis (9) Blades being broken

Case 2 : Indoor fan motor noise

Unit Model ： KFR-H18A4/FSY

Phenomena： Whistling from indoor unit

Cause Analysis: air conditioner was newly installed, during test running, air conditioner made whistle-like noise. Maintenance personnel presumed that it was caused by blades. Maintenance personnel replaced blades of the same model, but noise remained the same. Replaced the motor with an YDK30-8-155 motor produced by Jiangsu Weiteli Co., replaced capacitor with a new one of 3.5μF YDK30-8A, noise cleared off. We analyzed faulty motor and found that amplitude and frequency produced by running motor vibrated with unit shell and wind system, and interfered with air flow.

Solution: replaced indoor fan motor

Experience Conclusion: indoor unit noise is generally resulted by blades or motor, if it is difficult to decide the fault source, we can adopt method of denying one by one.

Case 3: Wind Sound of H-Series Air Conditioner

Unit Model：KFR35/HS

Phenomena：Wind sound of indoor unit

Cause Analysis: when indoor unit was running, wind sound varied with the swing of fan blades; according to our analysis, plastic-sealed motor or controller has some faults, change motor and controller, faults remain the same. Maintenance personnel pushed on manual swing button; wind sound disappeared, so the reason was as follows: when air blades swung, wind outlet area varied; when it swung to the top position, outlet area was smallest; wind was obstructed and produced wind sound.

Solution: replaced the faulty controller with Motorola chip controller

Experience Conclusion: the said noise is wind sound, which isn't beyond noise standard. In such case, do not change motor or controller without careful consideration.

Case 4: Noise produced by friction between fan blade and wind baffle

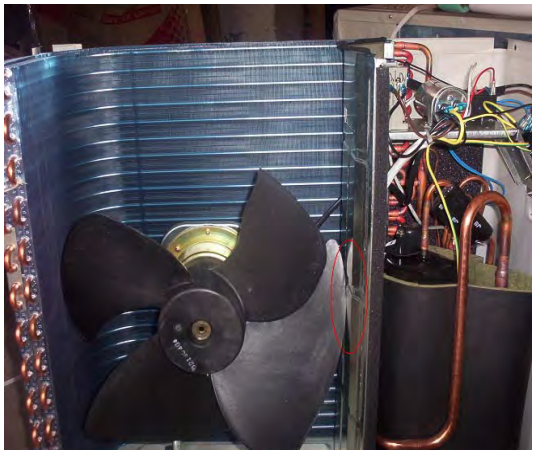
Unit Model No：KFR-H24B4/FSY

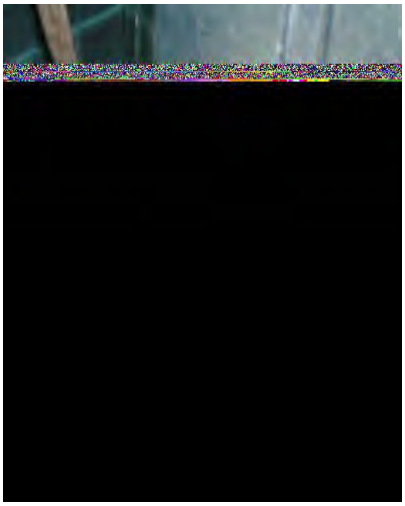
Phenomena：Noise in outdoor unit

Cause Analysis: We run the air conditioner when we finished installation, outdoor unit produced unpleasant sound, and we suspected outdoor fan was broken or steel casing scraped with each other. Opened the cover of outdoor unit, rotated fan with hand, no noise was heard; turned on air conditioner again, we found that blade collided with wind baffle and produced noise. Maintenance personnel failed to insert wind baffle in locating slot.

Solution: inserted wind baffle into locating slot, the noise was eliminated.

Experience Conclusion: if there's noise in outdoor unit, attention should be paid to decide what kind of noise it is: friction noise or resonance vibration noise or magnetic noise, and then deal with it accord-





Case 5: Fix screws of fan blade loosed

Unit Model：KFR35/M

Phenomena：Indoor unit noise

Cause Analysis: air conditioner was newly installed, and it didn't make noise during test running. Noise occurred one month later. Maintenance personnel suspected that there's foreign substance in indoor air duct or problem was caused by improper installation. We opened indoor unit but didn't find anything wrong. When we rotated wind wheel with hand, and found that fan blades moved to the left and right and collided with shell because of the loose screws. We tightened the screws, air conditioner worked properly since then.

Solution: adjusted position of wind wheel and tightened fix screws.

Experience conclusion: if noise can be heard even the air conditioner works in ventilation mode, fan wheel should be checked first.

Case 6: Noise caused by friction in actuating mechanism of air blades

Unit Model: KFR35/A
Phenomena：Indoor Noise
Cause Analysis: the air conditioner was newly installed; according to client, noise of indoor unit was loud. Maintenance personnel of service network visited the client and checked the air conditioner many times and believed the appliance worked well, so client was unhappy. We checked the air conditioner and found that air blades made noise sometimes. We adjusted the position of air blades, and added some lubricate, the air conditioner worked well since then.

Solution: adjusted position of air blades, and filled with some lubricant

Experience Conclusion: if maintenance personnel suspect noise is caused by air blades, he can stop swing of air blades, and sees if noise still can be heard. Main causes for noise from air blades are: 1. it is fixed too tightly, 2. there're burrs on transmission pole3. Concentricity of air blades is not so good. If maintenance personnel find the cause, he can deal with the problem accordingly.

Case 7: Outdoor fan motor noise
Unit Model: KFR35/HY
Phenomena：Outdoor unit made abnormal sound and vibrated
Cause Analysis: broke off compressor and run outdoor fan, noise still could be heard. Removed the blades, run the fan again, we found that poor concentricity of bearings made them collide with each other and made noise. We replaced outdoor fan motor, and abnormal sound was eliminated. Solution: replaced outdoor fan motor

Experience Conclusion: small fault is likely to be neglected, generally, people believe that vibration of outdoor unit is caused by unbalance of fan blades, but in fact, improper clearance of air outlet grille also can cause noise. So maintenance personnel should check carefully so as to reduce the chance of making mistake.

Case 8: Noise caused by vibration and collision of copper tube
Unit Model: KFR35/HSY
Phenomena：Copper tube vibrated and made noise
Cause analysis: turned on the newly installed air conditioner, found that outdoor unit vibrated abnormally, opened the shell, we found that compressor, fan motor and fan run normally; touched copper tube, it vibrated severely, so it was copper tube making noise.

Solution: applied anti-vibration agent on copper tube

Experience Conclusion: generally, exhaust tube and air returned tube are likely to vibrate when air conditioner operates, which can be checked visually or touched by using screwdriver. Install damp piece or insulation sleeve on the position vibrating most severely. Noises of tube are caused by following reasons:

⑴ Copper tube is too close to compressor, and when compressor runs, it causes tube vibrating. We can install insulation sleeve on the tube；

⑵ Copper tube is too close to sheet-metal pieces, vibration of compressor causes collision between

tube and sheet-metal. We should install damp piece or insulation sleeve.

⑶ Vibration of compressor causes collision between copper tubes. Install insulation to isolate two tubes.

In such case, we should explain to client that it's not air conditioner fault, it is caused by improper installation and can be handled easily.

Case 9: Outdoor fan motor bracket deformed because of the vibrating

Unit Model: KFR35/HY

Phenomena：Outdoor unit made loud noise in operation

Cause Analysis: air conditioner buzzed when it was in cooling mode. Maintenance personnel judged that sound was made by outdoor unit. Opened outdoor shell, checked the internal tubes and compressor and found that they operated normally. So maintenance personnel suspected noise was made by outdoor fan. Turned off compressor, noise was still very loud. Changed fan motor, but noise remained the same. Check carefully and found that fan motor bracket bent; adjusted the bracket vertically, installed fan again, and run the air conditioner, buzz was eliminated.

Solution: adjusted outdoor fan

Experience Conclusion: to reduce noise, more attention shall be paid to stability of auxiliary support and fasteners and whether they have deformed.

Case 10: Outdoor grille collided with front panel

Unit Model : KFR20/Y

Phenomena：Outdoor unit made loud noise

Cause Analysis: according to client, outdoor unit made loud noise. We checked outdoor unit and it was installed properly, its shell was also quite normal. Touched the cover of outdoor unit, noise was reduced, but not eliminated and outdoor grille made slight quaver. Compacted or pulled out this grille, noise was eliminated. Checked carefully and found that plastic clip between grille and front panel hadn't been fastened tightly and made noise.

Solution: filled small plastic cushion between outdoor grille and front panel and avoided impacting the appearance of the outdoor unit.

Experience Conclusion: compared to indoor unit noise, outdoor unit noise can be eliminated easily, the most important thing is to find out the right orientation and handle the problem smartly.

Case 11: Noise caused by blocking of indoor separate capillary

Unit Model: KFR70

Phenomena: Outdoor unit made loud noise and cooling and heating efficiency was unsatisfactory.

Cause Analysis: indoor unit produced air-stream sound, temperature difference of air outlet was only 7 Celsius Degree and low pressure was 0.3 MPa, both data were relatively low; high pressure tube was over-cold, and compressor was easy to change to over-heat protection mode. Broke off compressor, noise disappeared; broke off indoor fan, refrigerant made loud noise, so maintenance personnel judged that noise was caused by flow throttling. Touched branches of evaporator, and found that temperature

of two back branches was obviously lower, so system was blocked when it was welded. Released refrigerant, welded the system again and fault was eliminated.

Solution: welded the copper tube again, air conditioner run normally

Experience Conclusion: generally, air-stream sound was produced by over throttling, so we shall analyze causes for throttling.

Case 12: Noise caused by bending of connection pipe

Unit Model: KFR35/M

Phenomena：Indoor unit made loud noise

Cause Analysis: opened the indoor unit and checked all components, we found that when compressor run, it made noise, so air duct, motor and other components had no problem. We checked the components of evaporator and listened to the sound and then found that noise was made by evaporator. Gas pipe pressure was relatively lower than normal value; we continued to check and found that connection pipe between indoor and outdoor units was folded badly.

Solution: after we replaced deformed part of connection pipe, the foregoing faults disappeared.

Experience Conclusion: only when air conditioner is in cooling and heating modes can noise be heard, so gas pipe, motor and components have no problems. Check the system carefully, whistle is from evaporator, which has been blocked with dirt and ice or blocked when the tube is welded. Decide the fault position through listening, visual check and measuring temperature difference, and then deal with the faults accordingly.

Case 13: Noise caused by improper installation

Unit Model: KFR35/ED

Phenomena：Abnormal noise could be heard after the air conditioner was turned on and run for some time.

Cause Analysis: according to client, “coo” could be heard occasionally. Maintenance personnel checked the air conditioner for about 3 hours, “coo” could be heard sometimes, we believed it was from water collection pan in indoor unit when air condition was in cooling mode, and water drain pipe might have some obstacles. We checked the pipe from indoor unit to outdoor unit carefully, and found that water drain pipe in indoor unit was tied too tightly, and water couldn’t flow smoothly; water line outside had a U type bending, so we considered that air flow returned sometimes and produced abnormal sound. Because water pipe was not flat completely, water could still be drained and indoor unit didn’t leak, it was very difficult to find the problem. We wrapped water pipe again, and adjusted water pipe of outdoor unit, and then air conditioner could operate properly.

Solution: adjusted water drain pipe

Experience Conclusion: to deal with such kind of strange problems, maintenance personnel shall be patient to check and consider in various aspects.

Case 14: Noise caused by improper outdoor unit installation

Unit Model: KFR70/TB
Phenomena：Outdoor unit made loud noise according to client
Cause Analysis: according to client, noise made by air conditioner was not so loud in the daytime, but it was much louder at night. We turned on air conditioner; outdoor unit noise could be heard in the room. Checked the air conditioner, noise from it was quite normal; but it was installed in balcony, which was only separated from bedroom by a wall, and air conditioner was installed under the window and sound could be transmitted directly to the room.

Solution: Moved outdoor unit to a suitable place, noise was reduced.

Experience Conclusion: if possible, do not install outdoor unit, especially large power outdoor unit on balcony.

Case 15: Heat expansion sound of plastic components
Unit Model: KFR35/H
Phenomena：When the air conditioner was turned on and off, clap could be heard sometimes.

Cause analysis: indoor unit made clap-like sound, plastic components of indoor unit produces sound of heat expansion; opened panel and run the air conditioner; noise was eliminated, so we presumed that water collection pan was too close to plastic panel, which may expand when temperature rises.
Solution: cut brink of plastic water collection pan with knife, turned on air conditioner again, noise was eliminated.

Experience Conclusion: special faults shall be handled with special methods.

Section two maintenance cases for water leakage of air conditioner

There are various causes for air conditioner water leakage, we should check carefully to find leak source and deal with the problems accordingly. In general, water leak can be analyzed from following aspects:

⑴ Air supply system: Filter is blocked by dirt. In moisture environment, if air conditioner is operating in low wind mode, wind amount is relatively small and indoor evaporation temperature will decrease and evaporator will be frosted or even frozen. If such condition remains for a long time, air conditioner will leak.

⑵ Drainage system: mainly includes guiding channel, drain pipe, pipe wrapping and discharge pump faults, when air conditioner has been used for a long time, guiding channel and drain pipe may be blocked by dirt, plastic guiding channel may crack, connection joints of pipe may be wrapped improperly and drain pipe may be flattened, all these will result in water leakage.

⑶ System lacks in refrigerant or evaporator is blocked: when system lacks in refrigerant, refrigerant will be gasified quickly in 2-3 pieces of U-shaped tubes near inlet tube after it enters evaporator, so temperature of fins of these U-shaped tubes is relatively low, but temperature of others is close to room temperature, so water in fins of these 2-3 U-shaped tubes will condense and will freeze after a long time. When evaporator is blocked by ice, fins of U-shaped tubes with large refrigerant flow will

be in low temperature, while those with small refrigerant flow will be in higher temperature, so temperature difference between two circuits will be relatively large, which will produce a large number of condensate in the former fins. Condensate is blown outside the outlet with wind. In addition, cold and hot air meet in wind pipe and steam condenses in air pipe, causing water leakage.

(4) Improper installation: newly installed air conditioner or air conditioner installed in winter may leak because of non-levelness of air conditioner or improper wrapping of drain pipe or connection joints.

Case 1: Filter was blocked by dirt

Unit Model: KFR35/M

Phenomena：Indoor unit leaked water

Cause Analysis: Cause Analysis: after air conditioner operated in cooling mode for some time, water dropped between front panel and upper air outlet grille, but wind amount was relatively small. We opened the cover, and found that filter was blocked by dirt and wind amount decreased, so evaporate temperature fell, evaporator was frosted and connected with dirt filter. Removed the filter, turned on air conditioner again, we found wind amount increased and water didn't leak again.

Solution: we cleaned filter, installed it again, and asked client to clean and maintain the filter regularly.

Experience conclusion: air conditioner is likely to leak if filter is dirty and blocked, so we shall instruct client to clean filter and maintain air conditioner regularly. In addition, it is difficult to distinguish frost of evaporator and frost due to refrigerant lack of system. If system lacks refrigerant, evaporator will be frosted, generally on the inlet; if filter is blocked, air returned tube (low pressure tube) of system will be frosted.

Case 2: Indoor unit leaked water in low wind mode

Unit Model: KFR35/TD

Phenomena：Beads dropped form air outlet

Cause analysis: according to client, water was blown form air outlet after air conditioner run for 2 or 3 hours, maintenance personnel observed the phenomena and found that tiny bead was blown from air outlet when air conditioner was in low wind mode. Air conditioner was used in a 15 m^2 room, and set temperature was 17 Celsius Degree, evaporation and exchange amount decreased when temperature dropped, so too much condensate was produced and blown outside the air outlet.

Solution: changed low wind mode to high wind mode (or automatic mode), set temperature on 24 Celsius Degree, condensate never occurred again.

Experience Conclusion: foregoing fault was caused by physical factors, so the only thing need do is to explain to client. Fog blown from air conditioner is more common in rain season, in addition, in southern China, raininess, low ambient pressure and high humidity may result in such problem. To fix the problem, we should check evaporator and fan blades to see if they're clean; if they're clean, we should operate air conditioner in high wind and high temperature mode.

Case 3: Guiding channel was blocked and leaked water

Unit Model: KFR35/M

Phenomena：Indoor unit leaked water

Cause analysis：air conditioner had been used for two years and never leaked water before, so it was not caused by improper installation, it was possibly caused by obstruction in water drain pipe. When air conditioner worked for a long time, condensate leaked from notch of basement connection tube. We checked the appearance of air conditioner, it was installed on a level plane and filter had been cleaned. Removed the panel, we found that evaporator was clean; filled the evaporator with water, it didn't leak, and could drain water smoothly. We disassembled evaporator and water flowed from connection notch of basement. Removed indoor unit from wall, we found that rear guiding channel had been blocked by sand, and water spilled over from channel. The main reason of block was that wall was affected with damp and became loose, indoor unit vibrated when it operated, so sand fell into channel.

Solution: cleaned foreign substance in channel and installed anti-moist plastic cushion to avoid sand falling into air conditioner again.

Experience Conclusion: causes for leakage of M Series air conditioner are various, mainly including following aspects:

⑴ Connection position of left motor bracket and water collector channel has an aperture because of faulty injection mould, and water leaks from it;
⑵ Top of right side of water collection channel has a small aperture because of faulty injection mould and water leaks form it;
⑶ Insulation sponge on the outlet of air blades is not appropriate affixed or insulation sponge has fall off, so that condensate drops from the outlet.
⑷ Design of air blades is unreasonable and causes condensate dropping from it.

Solution:
⑴ In 1 and 2 cases, aperture can be filled with glass cement or ironed out with electric iron.
⑵ In third case, we shall affix insulation sponge(38×36×5mm, cutting a Φ17mm hole in the center) properly, detailed to see Picture (1).
⑶ In the fourth case, we shall affix a 15×10×10mm PE sponge on air blades support to stuff air blades and change zero position of stepping mode to avoid non-uniform wind of air blades.

To find out cause of leak, we shall pay attention to following aspects:
⑴ Observe air conditioner carefully before maintenance and investigate use condition, do not disassemble air conditioner without careful consideration and cause more faults;
⑵ In case that two-folded evaporator leaks water, because it has two guiding channels, back guiding channel is sometimes neglected by maintenance.
⑶ There are many causes for leak of air conditioner, such as structure, assembly, system, environment and installation problems, we shall observe air conditioner carefully to find leak source, and then deal with the problems accordingly, so that we can get twice the result with half the effort.

Case 4: Water barrier leaked water
Unit Model KFR25/ED
Phenomena：Indoor unit leaked water

Cause analysis：We turned on air conditioner, found that air pipe of indoor unit leaked, especially on left and right ends. This air conditioner adopted four-folded evaporator, two water collection channels: upper and down, upper channel was on the back of evaporator, where a water barrier guided water to upper channel, condensate flew from two ends of water barrier, which were affixed with sponge, to indoor unit.

Solution: adjusted sponge on water barrier; air conditioner did not leak again.

Experience conclusion: ED-Series air conditioner adopted four-folded evaporator, leak of which is caused by many factors, including following aspects:
⑴ Guiding plate is not installed (in such case, air conditioner leaks badly, condensate will be blown or flown from air duct.)
⑵ Tubing angle of evaporator is not proper;
⑶ Sponge on evaporator has fallen off.
⑷ Evaporator and plastic mould basement fail to fit tightly
⑸ Sponge on water guiding plate is not affixed properly.
During maintenance, we should check air conditioner carefully to find leak source and find water leak condition: dropping or weeping, and then deal with the problems accordingly; in this way, we can get twice the result with half effort.

Case 5: Condensate leaks from connection line joint
Model No: KFR35/HB
Cause analysis：Water dropped from connection tube in indoor unit, we suspected condensate leaked. We checked the air conditioner and found that insulation sleeves of high and low pressure connection tube of indoor unit were of poor insulation efficiency, which caused leak of condensate. Solution: Re-wrapped connection tube joints with insulation sleeves (the more belt is wrapped, the better insulation efficiency will be).

Experience Conclusion: insulation sleeve and tube are of same length when air conditioner leaves the factory, so before wrapping connection tube, power wire and water drain line, and maintenance personnel shall measure length difference between inlet and outlet tubes of evaporator, reserve space for connection tube. Because expansion capacity of insulation sleeve is different, to obtain good insulation effect, we shall wrap insulation tightly with belt, so that insulation sleeve on tube joint will not be loose and cause joint cap being exposed and leaking water. In addition, tube joint shall be affixed with water-proof adhesive tape, or it is likely to leak. Foregoing leak is caused by improper installation, so for newly installed air conditioner, such problems shall be noticed.

Case 6: Water drain tube was flattened and leaked
Unit Model: KFR35/H
Cause Analysis：According to client, the newly installed air conditioner leaked water. We checked and found that indoor unit was installed in a level plane; the hole on the wall was lower than indoor unit and drain tube of indoor unit was not broken; later, we found that discharge amount of outdoor drain tube was relatively small, but indoor unit leaked water, so water drain tube might be obstructed. For it was a new air conditioner, it's impossible that the system had been blocked. Finally, we found that water drain tube was wrapped under other lines as all lines penetrating the hole on the wall, so water couldn't flow smoothly and water drain tube leaked.

Solution: adjusted position of water drain tube.。

Experience Conclusion: pay attention to details during installation and have water drain test after installation.

Case 7: Water Drain Tube wasn't wrapped tightly enough and leaked condensate

Unit Model: KFR20/HA

Phenomena： After air conditioner run for half an hour, water drain tube of indoor unit was full of condensate and leaked water.

Cause analysis: according to client, indoor unit of newly installed KF-23GW/I1Y air conditioner leaked. We turned on the unit for half an hour, 2m water drain pipe of indoor unit was covered by beads; we noticed that the office neared riverside, so environment humidity was relatively high, in addition, room was also large and closeness was poor, so a great deal of condensate was discharged from indoor unit; because drain tube was only wrapped by a layer of adhesive tape, air condensed on it and produced water.

Solution: wrapped the outer wall of drain tube with more insulation sponge, and tied the insulation sleeve tightly

Experience Conclusion: in southern area with high humidity, heat insulation sponge shall be wrapped properly.

Case 8: Water drain tube was broken and leaked water

Unit Model: KFR25/M

Phenomena：Turned on air conditioner for a while, indoor unit discharged a large amount of water, but outdoor drain tube didn't discharge condensate water.

Cause Analysis: the main reason of leakage was that water drain tube connecting indoor unit and water collection pan as well as drain tube outside the unit were bitten through by mice.

Reasons for damage during installation:

⑴ Water drain tube is broken when it is pulled out from indoor unit(especially cabinet unit), because steel casing parts are too sharp without folded edges or other protection measure; ⑵ When connection pipes and water drain pipe penetrate the wall, if hole on the wall is not large enough, it may break the drain pipe;

⑶ Other reasons: Drain pipe is of poor quality and thickness is very thin; drain pipe connecting with water collection pan is of poor quality, and leaks condensate; drain line is bitten through by mice and so on.

Solution: replace broken water drain tube, check if drain tube will be broken again easily and take proper protective measures.

Experience Conclusion: take cautious steps to protect drain tube and do not damage it during installation.

Case 9: System leaked water because of refrigerant lack

Unit Model: KFR25/A

Phenomena：Air conditioner leaked water after running for some time, evaporator was frosted or frozen.

Cause Analysis: according to client, indoor unit leaked water. We turned on air conditioner and observed, after 10 minutes, water started to be blown from indoor fan. Disassembled shell, we found that 2-3 U-shaped fins near evaporator were very cold and covered with condensate, and other fins were not so cold; turned on the air conditioner again, and it run in refrigeration mode for more than 20 minutes, fins near evaporator were frosted slightly. System pressure was very low (3KG), so system lacked in refrigerant seriously; refrigerant gasified in fins near input tube when it flew into evaporator, so temperature of these fins were very low, but temperature of other fins closed to room temperature, and then fins of low temperature produced condensate, which was blown through outlet with wind; 20 minutes later, evaporator was frosted or frozen.

Solution: checked leak sources and found that connection tube was not connected correctly with low pressure valve body, and so lock position of nut leaked refrigerant. Connected the tube again and tighten the nut, vaccumized the system and filled with refrigerant, air conditioner worked well since then.

Experience Conclusion: air conditioner leaks water, if indoor heat exchanger doesn't leak air, touch heat exchanger at different positions to judge whether there's obvious temperature difference, so as to judge whether condensate is caused by system problem (generally, if water leak is caused by system problem, we can see tiny beads inside air duct and obvious beads c on fan blades.)

Case 10: Evaporator was half-blocked and leaked water

Unit Model: KFR35/HSFY

Phenomena：Air conditioner leaked water after running for some time

Cause Analysis: according to client, air conditioner leaked water after running for some time. We turned on the air conditioner and it run for 20 minutes, water started to be blown form indoor unit. Disassembled front shell, we found that 2-3 U-shaped fins near evaporator were very cold and covered with condensate, and other fins were not so cold, so we suspected that system lacked in refrigerant. Measured system pressure, but it was normal. Later, we found that these fins were covered with beads. Putting hand on air outlet, we could feel there's water flowing out with air; we touched fins with hands, and found temperature of different fins was different obviously, so we suspected that part of evaporator was blocked and caused deflection of refrigerant; temperature of fins with large refrigerant flow was low, and that of fins with small refrigerant flow was high, and large temperature difference cause fins with large refrigerant flow condensed and water was blown outside with wind.

Solution: replaced evaporator after consulting with client, air conditioner worked well since then.

Experience Conclusion: it is easy to judge water leak because of partial block or weld block: whole air duct is full of tiny beads, and beads can also be seen on fan blades.

Case 11: System leaked air

Unit Model: KFR35/HDY

Cause analysis：We operated the newly installed air conditioner, fan blades of indoor unit sprayed beads. We checked and found that air conditioner was installed on a level plane, water pipe was smooth, and water drain tube could discharge water normally. We opened indoor unit shell, checked

and found that evaporator and basement were assembled properly, but there's a leak between left bracket and left fin of evaporator, which leaked air. Affixed the leak with sponge and turned on air conditioner again. Water leakage was reduced, but fault hadn't been eliminated. Opened indoor unit panel again, and checked temperature of different streams of evaporator and U shaped fins and found that temperature difference was very large, so flow deflected in evaporator. Checked air return pressure of low pressure valve and found that it was very low (3kg).

Solution: filled the system with refrigerant until system pressure exceeded ambient pressure; run air conditioner for 20 minutes, there're no beads seen on fan blades, so fault had been eliminated.

Experience Conclusion: if air returned temperature and air outlet temperature is different obviously, and return air way of evaporator is large, hot air will mix in air chamber and produces condensate, which will attach on fan blades and sprays outside the unit. If surface temperature of evaporator is uneven, same fault will occur. We can handle the problem of uneven temperature on the surface of evaporator by increasing or decreasing refrigerant according to air returned pressure of low pressure valve and ambient temperature. If temperature difference on evaporator exceeds 9 Celsius Degree, evaporator is blocked partly, so it shall be replaced with a new one.

Case 12: Flush air conditioner leaked water

Unit Model: KORa-H41A5

Phenomena：Indoor unit leaked and running indicator blinked

Cause analysis: water spilled over from water collection pan, we checked drainage condition of water drain pipe, and found drain amount was very small, so we judged that drain pump failed to drain water properly

Solution: replaced water drainage pump

Experience Conclusion: drainage method of flush air conditioner is different with split units, the later can discharge water without any other equipment, but the former shall have discharge pump to drain water. If air conditioner leaks, discharge pump shall be checked first. Blinking of running indicator also proves that air conditioner is in water drainage protection mode. Of course, leak of flush air conditioner also can be resulted by non-plainness of water discharge pump. We shall analyze causes carefully when we repair air conditioner.

APPENDIX 1 Introduction to the fault display CODE of Pioneer air conditioner

1. 70S .100S.120S.45T.50T.60T45TA.50TA.60TA.70T1，when the faults happen, the LCD panel displays "fault" and the corresponding code.

⑴ The fault of the indoor plastic temperature sensor：

System turns off, the panel displays "E1".

⑵ The fault of the outdoor tube temperature sensor on the indoor panel：

System doesn't turns off, the panel displays "E2".

⑶ The fault of the indoor copper tube temperature sensor：System doesn't turns off, the panel displays "E3" and keep on working as per the mode without indoor copper tube temperature sensor.

⑷ When the outdoor panel available，the communication fault：

System turns off; the panel displays"E4".

⑸ When the outdoor panel available，the outdoor compressor under self protection(overloading protection)：

System turns off, the panel displays "E5" (The fault may be the low on-off voltage protection, overloading protection or the reacting motion of the overloading relay).

⑹ When the outdoor panel available，the outdoor three phases' self protection against failure of phase：

System turns off，the panel displays "E6"，(The fault may be the three phases are in reverse).

⑺ When the outdoor panel available, over-current protection:

System turns off，the panel displays "E7".

⑻ When the outdoor panel available，the fault of the temperature sensor to the exhaust pipe of the compressor：

System doesn't turns off, the panel displays "E8". (The fault may be the unsteadiness of the joint & plug or the fault of the outdoor computer board)

⑼ When the outdoor panel available，the temperature protection of the discharge pipe of the compressor：

System turns off; the panel displays "E9".

2、KFR50/TBPModel transducer faults display

Indoor unit faults display:

⑴ Fault 11 The indoor ambiance temperature sensor is open circuit or short circuit.

⑵ Fault 12 The tube temperature sensor of the indoor heat exchanger is open circuit or short circuit.

⑶ Fault 13 Indoor heat exchanger anti-freezing protections.

⑷ Fault 14 Indoor heat exchanger overheating protection.

⑸ Fault 15 Indoor communication fault.

⑹ Fault 16 Indoor electric source's instant off

⑺ Fault 17 Indoor over-current protection

Outdoor faults display:

⑴ Fault 21 The outdoor ambiance temperature sensor is open circuit or short circuit. ⑵ Fault 22 The tube temperature sensor of the outdoor heat exchanger is open circuit or short circuit.

⑶ Fault 23 The temperature sensor of the air vent of the outdoor compressor is open circuit

short circuit.

⑷ Fault 24 No load.

⑸ Fault 26 Outdoor over-current protection.

⑹ Fault 28 Outdoor voltage abnormal.

⑺ Fault 29 Outdoor electric source's instant off.

⑻ Fault 2A Outdoor refrigeration's overloading protection.

⑼ Fault2B Outdoor defrosting display.

⑽ Fault 2C IPM module fault.

⑾ Fault 2d Outdoor E2 data fault.

Simultaneously press the key of "hour", "minute" again and last for 2 seconds. Resume displaying the temperature after the sound of the buzzer.

3、KFR-H24B4/A,KFR-H41A5/A,KFR-H41A5/C faults display and protections display

⑴ Heating and defrosting：

The "heating" indication light on the panel is twinkling, （0.5/0.5），the others are invariable.

⑵ When the indoor tube temperature available, the indoor refrigeration anti-freezing protection：

The "running" and the "cooling" indication light on the panel is twinkling（0.5/0.5），the others are invariable. ⑶ When the indoor tube temperature available, the indoor heating over-heating protection：

The "running" and the "heating" indication light on the panel is twinkling（0.5/0.5），the others are invariable.

⑷ When the indoor tube temperature available, the indoor heating long time anti-cooling wind protection：

The "running" indication light on the panel is twinkling（0.5/0.5），the others are invariable.

⑸ Over-current protection:

The "running" light and "29" indication light on the panel are twinkling and simultaneously last for 0.5/0.5 second, the system turns off.

6、Low pressure protection：

The "running" light and "18" indication light on the panel are twinkling and simultaneously last for 0.5/0.5 second, the system turns off.

⑺ Fault of the indoor temperature sensor：

The "temperature" indication light on the panel is twinkling and last for 0.5/0.5 second, the system turns off.

⑻ Fault of the indoor coil pipe sensor：

The "temperature" indication light on the panel is twinkling and last for 0.5/0.5 second, runs without the interior tube sensor.

⑼ The outdoor coil pipe sensor and the compressor discharge sensor fault：

The "running" indication light on the panel is twinkling and last for 0.5/0.5 second，the others are invariable.

⑽ Outdoor failure of phase or the phases sequence protection:

The "timing" light and "running" light on the panel are twinkling and simultaneously last for 0.5/0.5 second, the system turns off.

⑾ fault of Communication:

The "running" light on the panel is twinkling and last for 0.5/0.5 second, the other indication lights are off, and the system turns off.

⑿ Compressor discharge protection:

The “running” light and “swing” light are twinkling and last for 0.5/0.5 second, the other indication lights are invariable, and the system turns off.

4. KFR-H24B4/B, KFR-H41A5/B faults display and protection display:

⑴ Fault of the Indoor temperature sensor：

System turns off; the panel displays “E1” ⑵ The fault of the outdoor tube temperature sensor on the indoor panel：

System doesn’t turn off; the panel displays“E2”.

⑶ Fault of the interior tube temperature sensor：

System doesn’t turn off, the panel display “E3”，runs under the mode without interior temperature sensor：When under the heating mode, there is no overheating protection, anti-cooling wind protection and residual heat removal function, the indoor fan starts running at the setting fan speed 30 seconds later after the compressor’s starting, and stops after 30 seconds running at the ultra low fan speed without compressor; When under the refrigeration mode, there is no anti-freezing protection.

⑷ Communication fault：

The system turns off or can’t start, the panel displays “E4”，which may be displayed under either on or off status.

⑸ The protection of outdoor reverse phase and failure of phase:

System stops, and the panel displays “E6”

⑹Heating and defrosting：

The “defrosting” indication light on the panel is twinkling, (0.5/0.5) the other are invariable.

⑺ When the indoor tube temperature available, the indoor refrigeration anti-freezing protection：

The “running” light and “cooling” light on the panel are twinkling (0.5/0.5), the other are invariable.

⑻ When the indoor tube temperature available, the indoor heating overheating protection：

The “running” light and “heating” light on the panel are twinkling (0.5/0.5), the other are invariable.

⑼ When the indoor tube temperature available, the indoor heating long time anti-cooling wind protection：

The “running” light on the panel is twinkling (0.5/0.5), the other are invariable.

5、KFR50/III fault display and protection display

⑴ Damage to the outdoor coil pipe：

The timing light on the panel twinkles one time/second.

⑵ The damage to the indoor temperature sensor：

The timing light on the panel twinkles one time/8 seconds.

⑶ The damage to the indoor coil pipe sensor：

The timing light on the panel twinkles two times/8 seconds.

⑷ Heating and defrosting

The sleeping light twinkles (0.5/0.5 second）

⑸ Refrigerating anti-freezing protection：

The operation light and the timing light of the panel twinkle (0.5/0.5 second）

6、Heating anti-overheating protection：

The “running” light and “sleeping” light are twinkling（0.5/0.5second）

⑺ Heating long time anti-cooling wind protection：

The “running” light is twinkling（0.5/0.5second）

6、FS(Y)、DS(Y) 、ZVY、CSY model air-conditioner faults display and protection display

When the faults happen, the LED digital screen of the operation panel displays the corresponding code.

⑴ Fault of The indoor temperature sensor：

System turns off, and the LED digital screen of the operation panel displays “E1”.

⑵ Fault of the outdoor tube temperature sensor on the indoor panel：

System doesn’t turn off, and the LED digital screen of the operation panel displays “E2”.

⑶ Fault of the indoor tube temperature sensor：

System doesn’t turn off, and the LED digital screen of the operation panel displays “E3”. System works under the mode without indoor tube temperature sensor.

⑷ When outdoor panel available, the communication fault：

System turns off, and the LED digital screen of the operation panel displays “E4”.

⑸ When outdoor panel available, the protection of outdoor compressor (overloading protection)：

System turns off, and the LED digital screen of the operation panel displays “E5”. (The fault may be the protection of low on-off voltage, overloading protection or the reacting motion of overloading relay)

⑹ When outdoor panel available ， the phase failure protection of the outdoor three phases：

System turns off, and the LED digital screen of the operation panel displays “E6. (The fault may be three phases in reverse connection).

⑺ When outdoor panel available, over-current protection：

System turns off, and the LED digital screen of the operation panel displays. “E7”.

⑻ When outdoor panel available, the fault of the exhaust pipe temperature sensor of the compressor：

System doesn’t turn off, and the LED digital screen of the operation panel displays. “E8”. (The fault may be the unsteady joint or plug of the temperature sensor or the damage of the outdoor computer board)

⑼ When outdoor panel available, the temperature protection to the exhaust pipe of the compressor：

System turns off, and the LED digital screen of the operation panel displays “E9”.

7. HS(Y)、HSA(Y)、HSB(Y)、HSF（Y）、HV(Y)、HVA(Y) digital display for the series air-conditioner faults：

Fault source	Display mode	The display precedence level
PG motor feedback is abnormal	“E4”	1
Plastic temp. sensor is abnormal	“E1”	2
Copper temp. sensor is abnormal (indoor)	“E3”	3
Copper temp. sensor is abnormal (outdoor)	“E2”	4

8、H（Except KFR-25G/H）、H1、HA、HB series faults display：

Fault source	Display mode	The display precedence level

PG motor feedback is abnormal	Timing light twinkles 4 times in every 8 seconds	1
Plastic temp. sensor is abnormal	Timing light twinkles 1 times in every 8 seconds	2
Copper temp. sensor is abnormal (indoor)	Timing light twinkles 2 times in every 8 seconds	3
Copper temp. sensor is abnormal (outdoor)	Timing light twinkles 1 times in every 1seconds	4

9、H(Y) model air-conditioner fault display：

Fault source	Display mode	The display precedence level
PG motor feedback is abnormal	Timing light twinkles 4 times in every 8 seconds	1
Plastic temp. sensor is abnormal	Timing light twinkles 1 times in every 8 seconds	2
Copper temp. sensor is abnormal (indoor)	Timing light twinkles 2 times in every 8 seconds	3
Copper temp. sensor is abnormal (outdoor)	Timing light twinkles 1 times in every 1seconds	4

10. EA、EC、EM、EY、EZ、EAA、EAD、EL、HS1、HSZ、HL1、HLZ、P、P1、ZZ、CZ digital display series air-conditioner faults:

Fault source	Display mode	The display precedence level
PG motor feedback is abnormal	“E4”	1
Plastic temp. sensor is abnormal	“E1”	2
Copper temp. sensor is abnormal (indoor)	“E3”	3

11. All of the other E series except EA、EC、EM、EY、EZ、EAA、EAD:

Fault source	Display mode	The display precedence level
PG motor feedback is abnormal	Timing light twinkles 4 times in every 8 seconds	1
Plastic temp. sensor is abnormal	Timing light twinkles 1 times in every 8 seconds	2
Copper temp. sensor is abnormal (indoor)	Timing light twinkles 2 times in every 8 seconds	3

12. Faults display of 18000BTU~24000BTU wall unit series air-conditioner：

Non-digital tube displays:

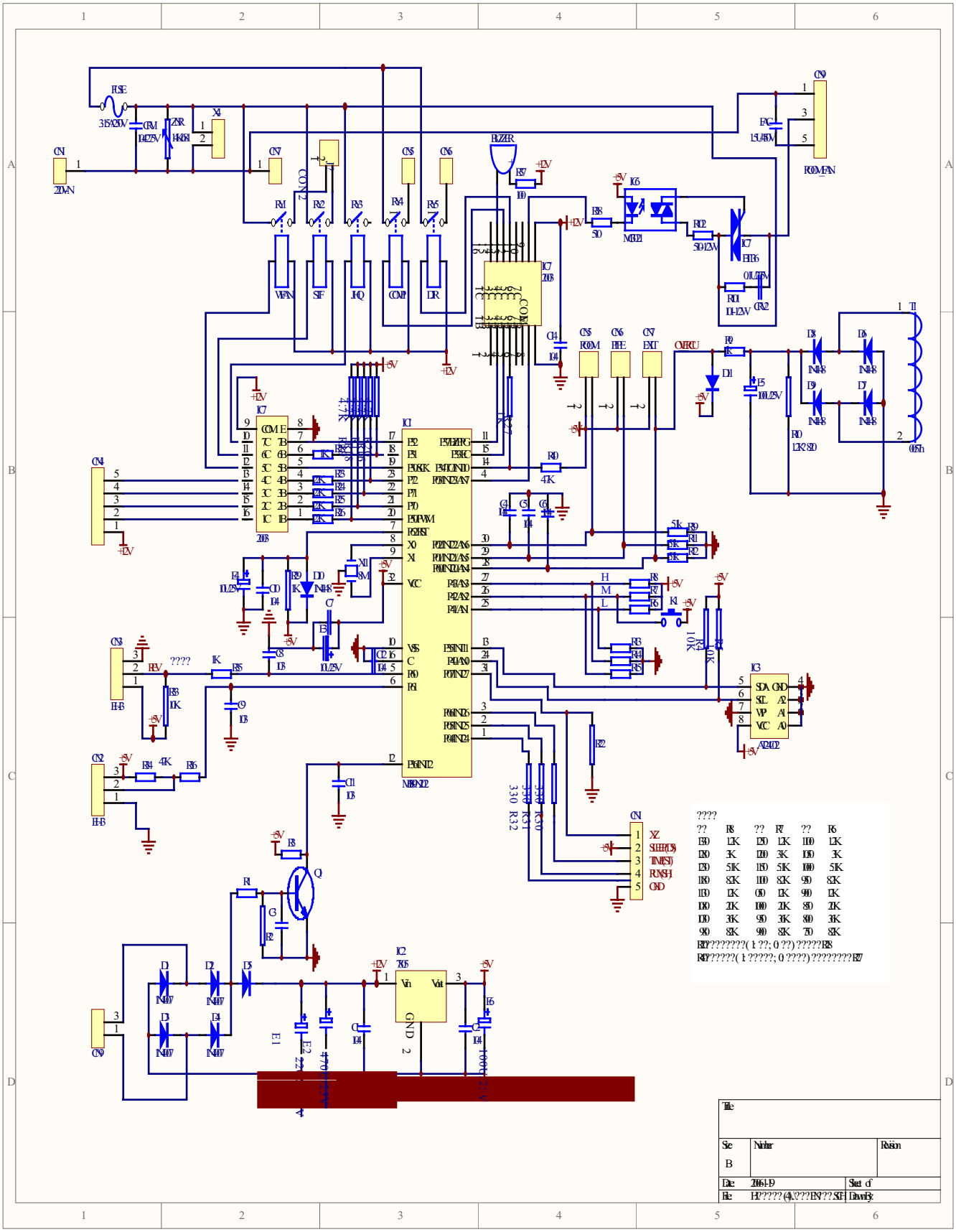
Fault source	Display mode	The display precedence level	Appearance
PG motor feedback is abnormal	Timing light twinkles 1 time in every 8 seconds	2	System turns off
Plastic temp. sensor is abnormal	Timing light twinkles 2 times in every 8 seconds	3	System turns off
Copper temp. sensor is abnormal (outdoor)	Timing light twinkles 8 times in every 8 seconds	4	System doesn't turn off

Digital tube displays:

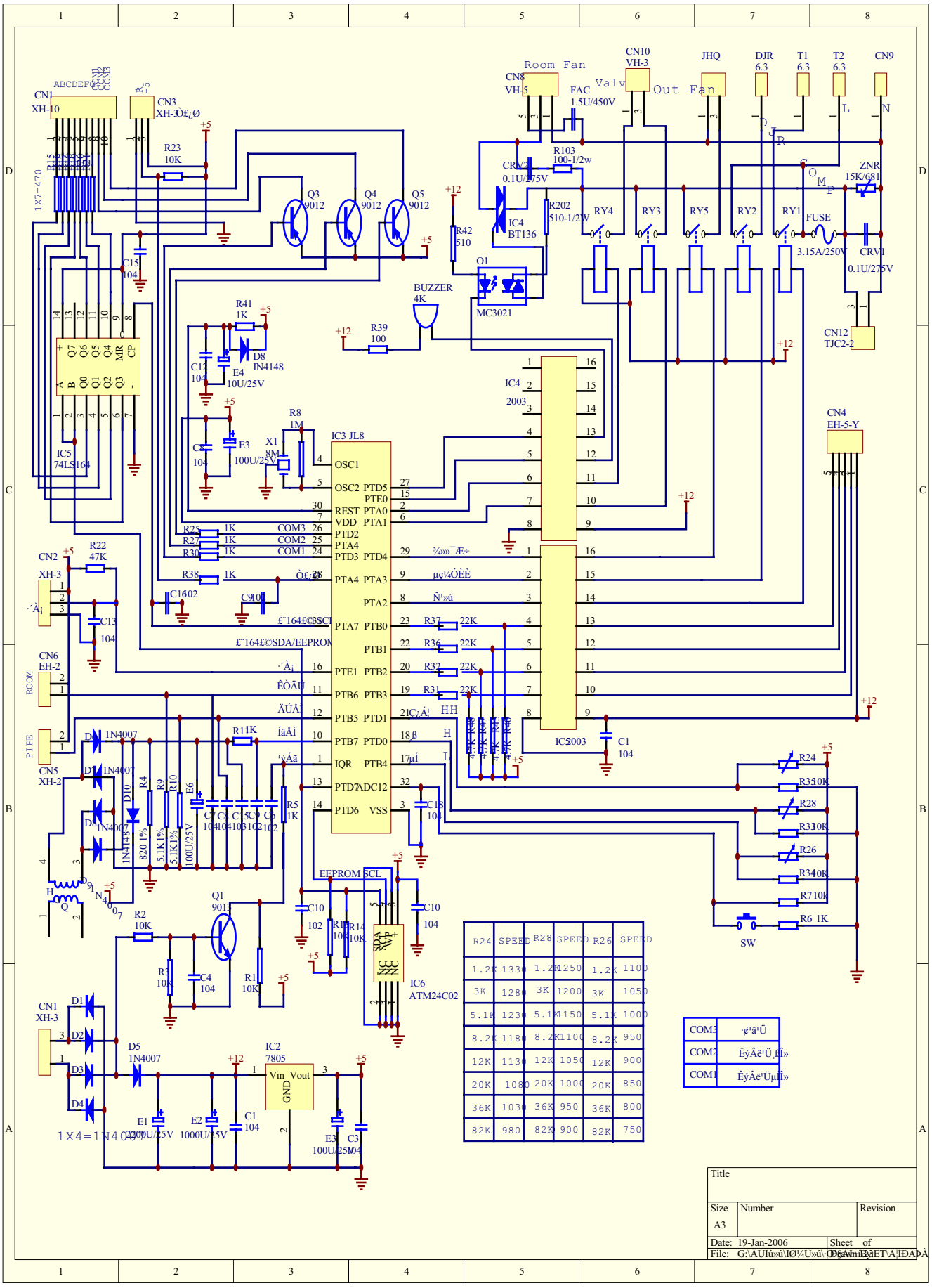
Fault source	Display mode	The display precedence level	Appearance
PG motor feedback is abnormal	"E1"	2	System turns off
Plastic temp. sensor is abnormal	"E3"	3	System turns off
Copper temp. sensor is abnormal (outdoor)	"E2"	4	System doesn't turn off

APPENDIX 2 Schematic Diagrams of Some Controller Panels

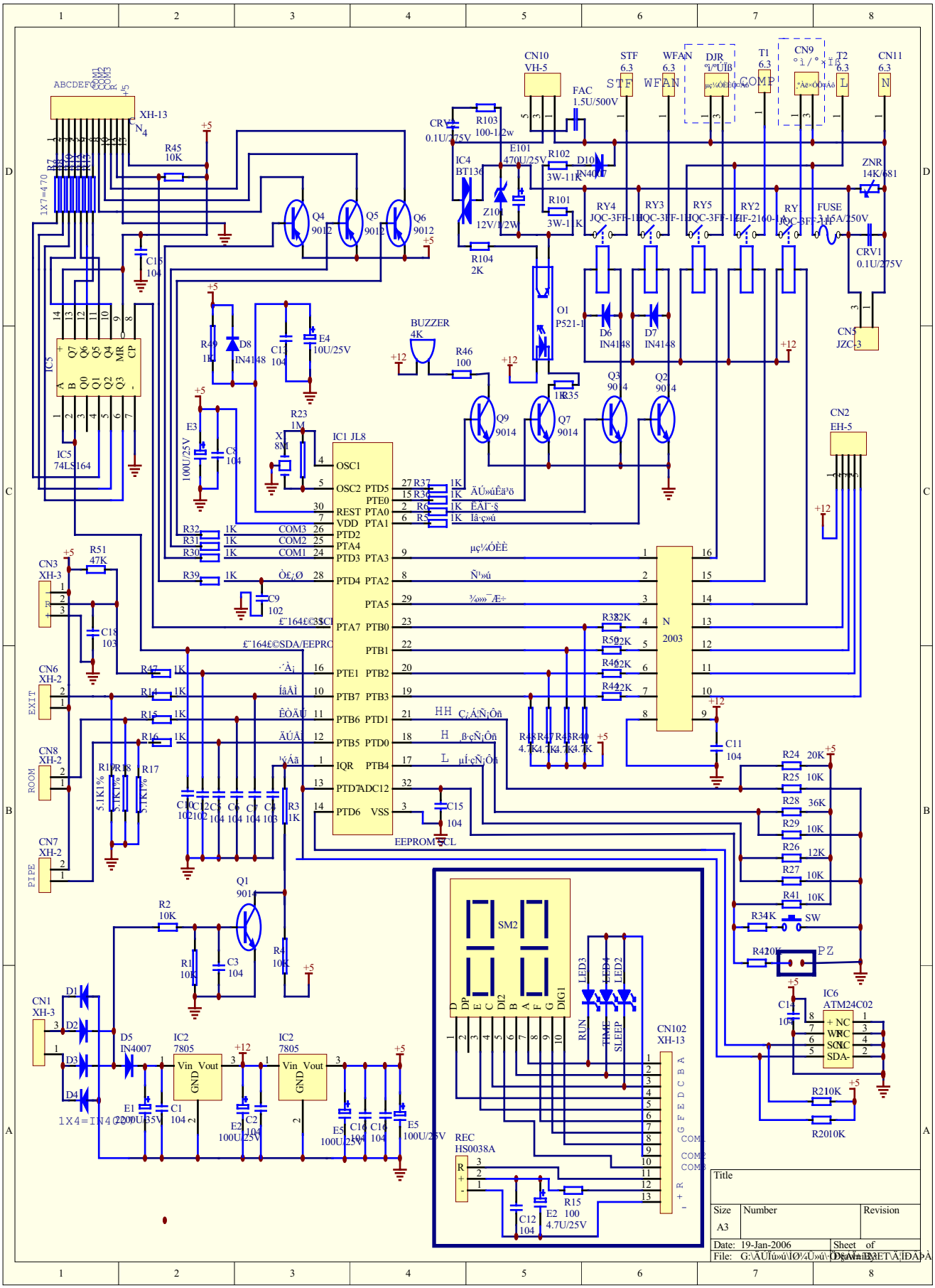
1. Schematic Diagram of Controller Panel of E Series Air Conditioner with Display Screen (FUJITSU Chip)



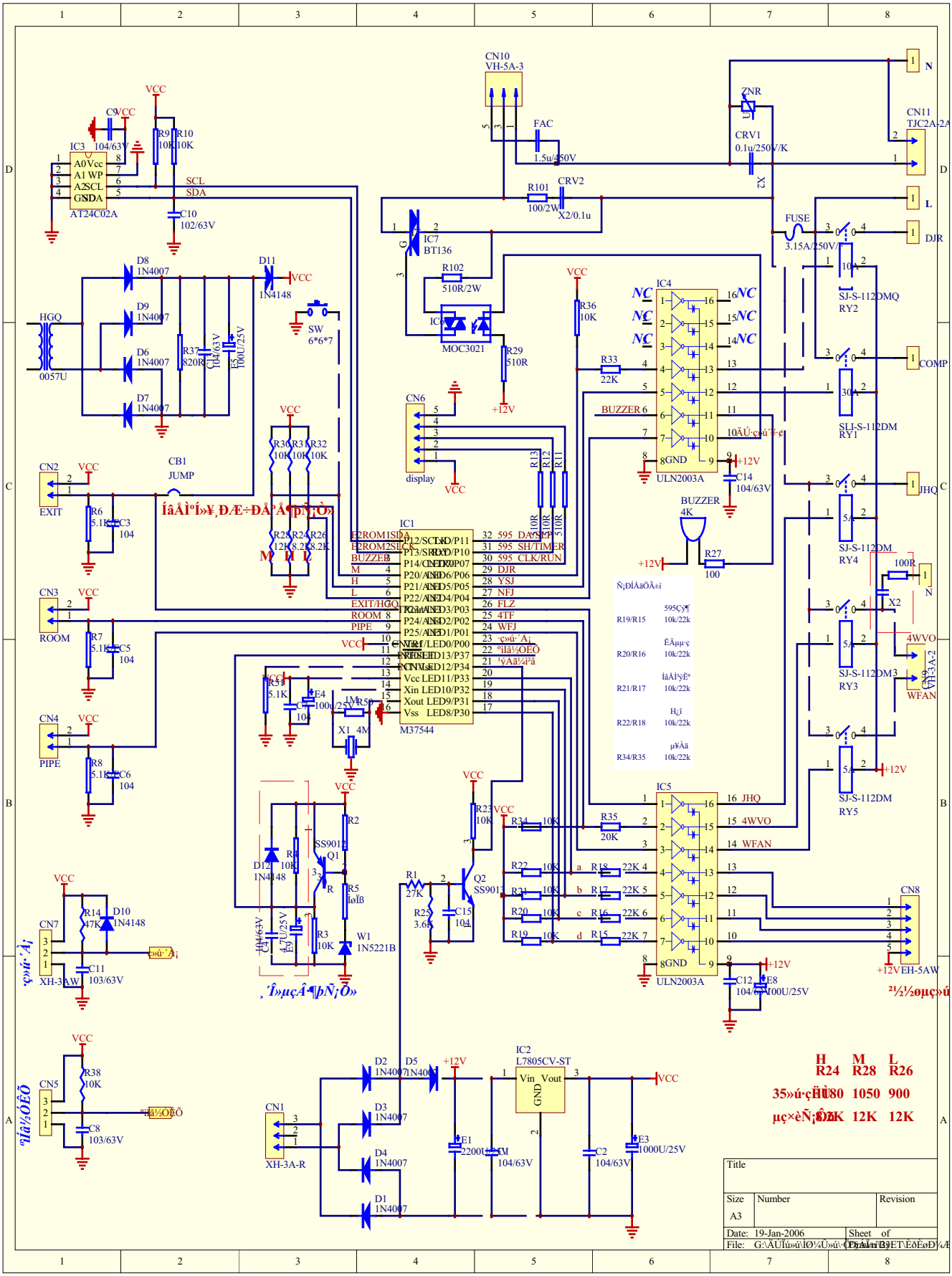
2. Schematic Diagram of Controller Panel of EA Series Air Conditioner (Motorola Chip)



3. Schematic Diagram of Controller Panel of HS Series Air Conditioner (Motorola Chip)



4. Schematic Diagram of Controller Panel of E Series Air Conditioner with Display Screen (with Renesas Chip)



APPENDIX 3 Conversion Table of Major Units

1. Conversion Table of Pressure Units

Unit	Pa	kgf/cm^2	Atm	mmHg	Psi
Pa	1	1.02×10^{-5}	9.87×10^{-6}	7.5×10^{-3}	1.450×10^{4}
kgf/cm^2	9.8×10^{4}	1	9.68×10^{-1}	7.36×10^{2}	1.421×10^{9}
Atm	1.013×10^{5}	1.033	1	7.6×10^{2}	1.46885×10^{9}
mmHg	1.333×10^{2}	1.36×10^{-3}	1.316×10^{-3}	1	1.93285×10^{6}
Psi	0.68948×10^{4}	7.0327×10^{-2}	6.80517×10^{-2}	51.711	1

2. Conversion of Energy Units

1kJ＝1000J

1kcal=1000cal

1kcal=4.1868kJ

1BTU=0.252kcal=1.055kJ

1kcal=3.968BTU

1kJ=0.9478BTU

1W=0.86kcal/h

1HP=745.7W

1 USRT=3.024kcal/h=3576W

1 Japan.RT=3320kcal/h=3860W

1 Horsepower=735.499W, simplified to 735W (1UKHorsepower =745.7W)

1kcal/h=3.9683Btu, simplified to 4Btu

1W=3.412Btu/h

3. Conversion of Temperature Units

t=T-273.16≈T-273(℃)

F=(9/5)t+32(℉)=1.8t+32(℉)

4. Heat Conductivity Factors of Several Common Used Material

Material	λ（kJ/m·h·℃）	Material	λ（kJ/m·h·℃）
Copper	1382	Cork	0.17-0.25
Aluminum	733	Air Interlayer	0.25
Steel	163	Water	2.1
Frosty layer	2.1	Glass	2.7-2.9
Fibre Glass	0.17-0.21	Saw Timber	0.25-0.34
Glass Cloth	0.13	Plywood	0.62-0.84
Slag Wool	0.21-0.34	Polyurethane Foam	0.042-0.11

5. Basic Property of Substitute Refrigerant

Property		R-22	R-410A	R-407C
Refrigerant Composition （Mass Ratio ％）		R-22	R32/R125	R32/R125/ R134a
		100	50/50	23/25/52
Environment Protection	ODP	0.05	0	0
	GWP（100Y）	1730	1700	1530
Safety	Toxicity	None	None	None
	Combustibility	Incombustible	Incombustible	Incombustible
Thermo-physical Properties	Azeotropic Prop	---	Subazeotropic	Subazeotropic
	Boil Temp（℃）	-40.8	-52.7	-43.7
	Critical Temp（℃）	96.1	72.5	87.3
Refrigeration Properties	Refrigeration Pressure（Mpa）	2.17	3.38	2.31
	Evaporation Pressure（Mpa）	0.62	1.00	0.64
	Pressure Ratio	3.50	3.38	3.59
	Exhaust Temp（℃）	97.2	95.1	86.7
	Slip Temp（℃）	0	0.17 以下	4～6

	Refrigeration Amount（%）	100	141	101
	COP（%）	100	92.5	97
Lubricate	Lubricate Type	Mineral Oil	POE	POE
	Inter-solubility	Good	Fair	Fair