R290 Heat Pump -With Auxiliary Heat Source

TECHNICAL MANUAL

Applicable model with Mitsubishi compressor

FHF-MBWHS-081HE4

FHF-MBWHS-101HE4

Important safety instructions

Read and follow all of the instructions

Save these instructions

Catalogue

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Preface

The R290 Full DC Inverter air source heat pump transfers heat from the surrounding air to the water, providing high temperature hot water up to 70℃. This high-temperature heat pump is widely used for heating. With innovative and advanced technology, heat pumps can operate at ambient temperatures of-25℃ and at output temperatures of up to 70℃, ensuring compatibility with conventionally-sized radiator-based systems without having to complement other equipment. Compared with the traditional fuel / LPG boiler, the R290 full DC frequency conversion air source heat pump can reduce carbon dioxide emissions by 50% and save operating costs by 80%. R290 full DC variable frequency conversion air source heat pump is a kind of efficient, energy saving, environmental friendly equipment, used for indoor heating, refrigeration and domestic hot water. It can be used in any type of indoor machine, such as a fan coil, radiator, or floor heating pipe, to provide heating or hot water. Monoblock heat pump can also be used in multiple indoor units.

Declaration: This device is consistent with the ERP testing device

Safety Code: Please follow these safety instructions closely to prevent accidents

1. The heat pump unit contains flammable refrigerant and belongs to the A3 safety group according to ISO 817 and ANSI / ASHRAE Standard 34. Contains the flammable refrigerant R290 (propane C3H8). If a leak occurs, the escaping refrigerant may create a flammable or explosive atmosphere in the ambient air. Define a safe area around the outdoor unit with special requirements for equipment maintenance.

2. Hazard explosion risk:

The leaking refrigerant may create a flammable or explosive atmosphere in the ambient air. Take the following measures to prevent fire and explosion in the safe area:

2.1 Keep away from ignition source, such as naked flame, high temperature surface, electrical equipment without ignition source, and mobile devices with integrated batteries (such as mobile phones, health watches, etc.).

2.2 Allowed tools: All tools working in safe areas must meet the standards and regulations applicable to A2L and A3 safety group refrigerants, such as brushless machinery (wireless screwdriver), pumping equipment, waste containers, installation auxiliary tools, vacuum pump, conductive hose, mechanical tools made of non-spark generating materials, etc. Note that the tool must also apply to the range of pressure used. The tool must be in good condition.

2.3 The electrical equipment must meet the requirements of the explosion risk area.

2.4. Do not use flammable materials, such as sprays or other flammable gases.

2.5 Discharge static electricity: before starting work, safely touch grounded objects, such as

ground wire or metal water pipe.

2.6 Do not remove, block, or bridge the safety equipment.

2.7 Prohibit to made any change of the heat pump inlet/outlet pipe, electrical connection or cable.

2.8 No components or seals shall be removed.

3. Special Notes for maintenance of heat pump unit

It is necessary to power off both the indoor and outdoor units, especially a separate fuse or main isolating switch. Check that the system is no longer charged before maintenance.

Note: Besides the control circuits, there may also be some multiple power supply circuits.

3.1 R290 refrigerant (propane) is a colorless, tasteless, flammable gas, which forms an explosive mixture with air. During handling, air must be emptied and the discharged refrigerant is properly handled by an authorized contractor.

Implement the following measures before starting the refrigerant Circuit inspection work:

■ Check the refrigerant circuit with any oil/gas leakage.

■ Ensure adequate ventilation throughout the work period, especially in the floor area. Ensure that the air ventilation volume is enough or take out other ventilation measurement.

■ Protect the surrounding area.

■ Notify all maintenance personnel and other personnel nearby the heat pump.

■ Check the area around the heat pump for flammable substances and ignition sources, and remove all flammable substances and ignition sources.

■ Before, during, and after maintenance work, use R290 detector to check the surrounding area for any escaping refrigerant risk. Ensure that the refrigerant detector does not generate any sparks and must be properly sealed.

3.2 Carbon dioxide or powder fire extinguishers must be prepared in the following cases:

■ The refrigerant is being discharged.

■ The refrigerant is being added.

■ During the welding work

■ Display of no-smoking signs area.

WARNING: Touching component with electricity may cause serious damage. Some components may maintain electric charge even after tthe power is turned off. Make sure to wait at least 4 minutes to ensure that the voltage is fully dissipated before removing the casing.

■ Make sure the System is securely connected.

■ Wear appropriate personal protective equipment for any work.

DANGER: burns or scald. Cold surfaces may cause frostbite.

■ Turn off the equipment and let it cool or heat up before performing the maintenance service.

■ Do not touch the hot or cold surfaces on the equipment, fittings, or pipes.

DANGER: Leaking refrigerant can cause fire and explosion and very serious injury or even death.

■ Do not drill or heat the refrigerant circuit filled with refrigerant.

■ Do not operate the air valve unless the filling valve or pumping equipment is connected.

■ Take measures to prevent electrostatic touch.

■ NO SMOKING！ Prevent bare flames and sparks. Never turn ON/OFF of ligting or other electrical devices.

■ Components containing or ever containing refrigerant must be indicated and stored and transported in well-ventilated areas in accordance with applicable regulations and standards.

DANGER:Direct exposure to liquids and gaseous refrigerants may cause serious health damage, such as frostbite and / or burns. If inhaled, it may a risk of suffocation.

■ Prevent the direct contact with the liquid and gaseous refrigerants.

■ Wear personal protective equipment when handling liquids and gaseous refrigerants.

■ Do not inhale the refrigerant vapor.

DANGER:Refrigerant at high pressure: applying mechanical load on pipelines and components may cause leakage in the refrigeration circuit. Do not apply mechanical load on pipelines and components, such as by supporting or placing tools.

Hot and cold metal surfaces of the refrigeration circuit may cause burns or frostbite if the skin comes into contact with these surfaces. Wear personal protective equipment to prevent burns or frostbite. The hydraulic components may get freezed when removing the refrigerant.

4. These instructions shall apply only to qualified contractors:

■ Work on a refrigeration circuit with a flammable refrigerant (safety group A3), shall be performed only by an authorized heating contractor. These heating contractors must be trained in accordance with EN 378 Part 4 or IEC 60335-2-40 Section HH and have competency certificates issued by industry recognized bodies.

■ The brazing / welding of the refrigeration circuit shall be performed by qualified contractors per ISO 13585, AD 2000 and Data Sheet HP 100R certification. Only for contractors with the required process qualification and certification. All work must be performed within the scope of application and in accordance with the prescribed procedures. Welding / brazing work on the battery connection must comply with the pressure equipment directive (2014 / 68 / EU), with personnel and process certified by the notification agency.

■ The work of the electrical equipment can only be carried out by the qualified electricians.

■ Before the first operation, all safety-related key points must be inspected by a specifically certified heating contractor. The system must be operated by the system installer or a qualified person authorized by the installer.

4.1. Special Note of installation and maintenance work.

Please pay attention to the antifreeze protection

■ Thermal insulation of all the hydraulic pipes.

■ To activate the antifreeze function, connect the heat pump to the power supply before filling the

secondary circuit. Turn on the power supply and open the switch on the indoor unit.

■ Only an appropriate fill water conforming to VDI 2035 standards, rather than a medium containing antifreeze, is used to fill the secondary circuit.

Please note to replace accessories

■ Repairing the safety function components may endanger the safe operation of the system, and spare parts and vulnerable parts not tested with the system may endanger their functions. The installation of unauthorized components and making unapproved modifications or transformations may endanger safety and may invalidate our warranty. When replacement, please use only the original spare parts provided or approved by the manufacturer.

4.2. Treatment method of refrigerant leakage

DANGER A refrigerant leak can cause fire and explosion and cause very serious injury or death. If inhaled, there is a risk of suffocation.

■ Make sure that the ground area of the outdoor unit is very well ventilated.

■ NO SMOKING！ Prevent bare fires and sparks. Never turn on or off the lights or electrical equipment.

■ Evacuate the personnel from the dangerous area.

■ Cut off the power supply to all the system components from a safe position.

■ Remove the ignition source from the dangerous area.

■ Notify user don not to introduce the ignition source into the danger area during the maintenance period.

■ Maintenance work must be carried out by an authorized contractor.■ The system can only be restarted after the system repair is completed.

■ Prevent direct contact with liquid and gas refrigerants.

■ Do not inhale the refrigerant vapor.

DANGER Direct exposure to liquids and gas refrigerants can cause serious harm to health, such as frostbite and / or burns. Inhalation may cause a risk of suffocation.

4.3. When water leakage occurs in the heat pump

DANGER：There is a risk of electric shock if the water leaks from the equipment. Turn off the external isolators of the heating system (e. g., box, home distribution box).

DANGER： There is a risk of scald if the equipment leaks water. Do not touch the hot water.

If the heat pump get freezen, take the following measures:

Note that freezing in the fan area of the condensing disk and the outdoor unit may cause damage to the equipment. Note the following items:

■ Do not use mechanical items / tools to de-ice.

■ Before using the electric heating equipment, check the refrigerant circuit for leakage using the appropriate measuring equipment.

■ The electric heating equipment shall not be an ignition source.

■ The electric heating equipment must meet the requirements of EN 60335-2-30.

■ If the heat pump often get freezen (such as in areas where frost and fog often occur), install fan ring heating (accessories) for refrigerant R290 and / or electric belt heater (accessories or factory configuration)

on the condensing plate.

4.4 Safety Guide for storage of heat pump

The heat pump has been filled with refrigerant R290 (propane) in the factory.

DANGER： Leaking refrigerant can cause fire and explosion, causing very serious injury and even death. If inhaled, there is a risk of suffocation.

Store the heat pump under the following conditions:

■ The storage site must have an explosion-proof plan.

■ Ensure that the storage site is adequately ventilated.

■ Temperature range for storage: -25°C to 70°C.

■ Only store the heat pump with factory protective packaging.

■ Protect the heat pump from damage.

■ The maximum number of heat pumps that can be stored in one location is determined by local conditions

4.5. The below regulations shall be followed:

■ National installation regulations.

■ Accident prevention regulations.

■ Environmental protection laws and regulations.

■ Pressure equipment regulatory requirements: Pressure Equipment Directive 2014 / 68 / EU.

■ Practice regulation from relevant industry associations.

■ Relevant country-specific security regulations.

■ Applicable regulations and guidelines for the operation, service, maintenance, repair and safety of refrigeration, air conditioning and heat pump systems containing flammable and explosive refrigerants.

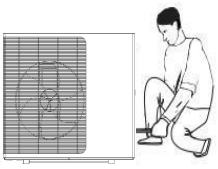
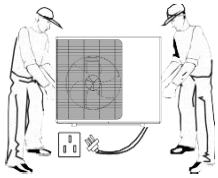
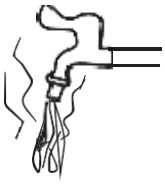
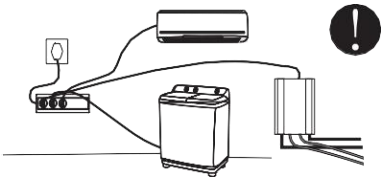
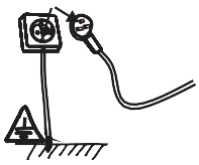
1.Safety Procedures

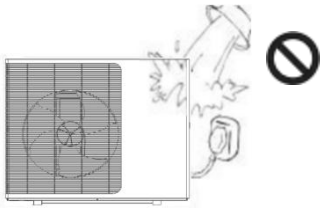
1.1 Warnings and Installation Instructions

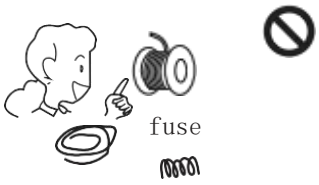
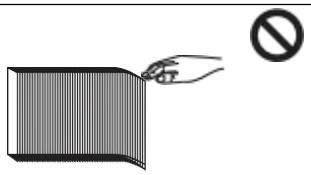
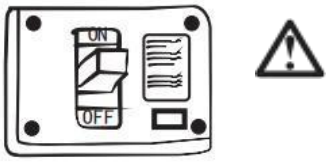
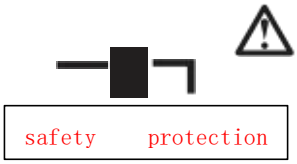
Read and follow all the warnings and installation instructions before installing this product. Failure to comply with the safety warnings and installation instructions may result in serious injury, death, or property damage.

The following symbols are very important. Please be sure to understand their meaning as it involves the product and your personal safety.

Warning Precautions Prohibition

		
The installation, disassembly and maintenance of the unit must be carried out by professional after-sales personnel. No changes to the structure of the unit, which may cause damage to the unit and personal injury.	To avoid an electric shock, please take precautions. When repairing electrical components, always disconnect the power supply for at least 1 minute. Even after a minute, use a multi-meter to measure the voltage on the main power supply terminal. Before contacting a capacitor or electrical components, ensure that its voltage is below the safe voltage of the human body.	Be sure to read this manual before operation.
		
To get clean hot water, be sure to add a mixing valve in front of the tap and set it to the appropriate temperature.	Please use a dedicated socket, or a failure may occur.	The power supply used for the unit must be grounded well.
	The device is suitable for children and adults aged 8 years and older, and other personnel need to use it under the supervision of a fully competent guardian. Children are not allowed to use this device or to clean and maintain the equipment.	

		
Do not toucht the air outlet grille when the fan motor is running.	Do not touch the power plug with your wet hands.	Do not inject water or any liquid into the product as it may cause leakage or failure of the product.

		
When the power cord is loose or damaged, please find a professional after-sales service for repair.	Please choose the correct fuse or circuit breaker as recommended. Steel wire or copper wire shall not replace a fuse or circuit breaker. Otherwise, it may cause damage.	Do not touch your fins with your fingers or you may be hurt.
		Main power cable 
Please select the appropriate circuit breaker specifications according to the rated current of the product.	Disposal of waste batteries (if any). Please treat it according to the local garbage classification standards (as shown in the figure).	It is recommended to install a leakage current protection device (RCD) with a rated leakage working current not exceeding 30 mA.
1. It is recommended to fill the system with pure water. 2. If filling with city water, please soften the water and add a filter before entering heat pump. 3. Note: After filling the water, the pressure of water supply system shall be 0.15~0.6MPa		

WARNING!

1. Unqualified parties are not allowed to install the equipment by themselves, and a qualified installer is a must. The consequences (safety accidents and use effect) caused by Unqualified parties shall be borne by the users themselves.
2. Except for the guidance of professional personnel, non-professional party shall not remove the machine or machine parts without authorization, otherwise accidents or machine damage may occur.
3. Do not use towels, paint, gasoline, alcohol and other flammable items while near this machine, as this could cause a fire.

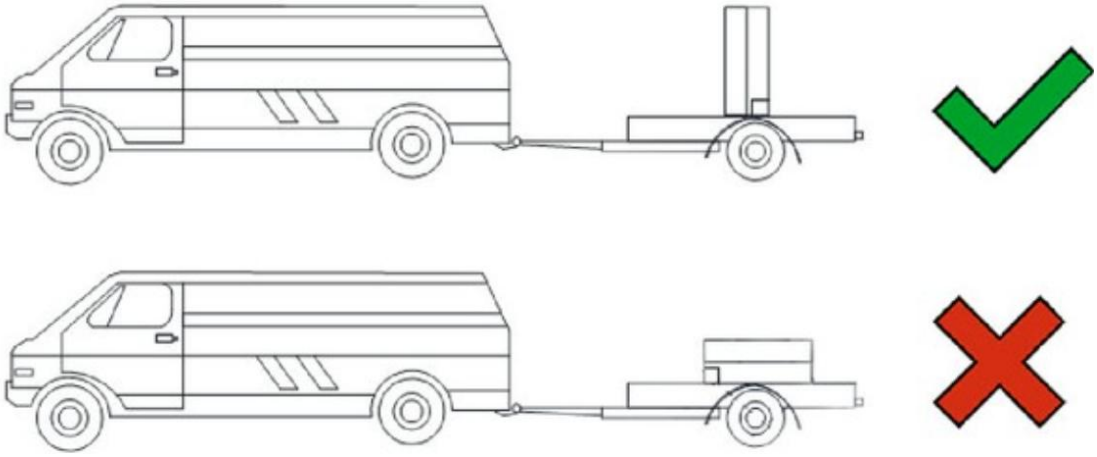
4. The main power switch of the unit should be placed in a place out of reach of children to prevent children from contacting the power switch and causing potential safety risks.
5. In thunderstorm, please cut off the main power switch of the unit, otherwise it may cause damage to the unit.
6. The unit shall adopt independent power switch to avoid sharing the same circuit with other electrical appliances, and choose the power circuit and circuit breaker (with leakage protection function) that matches the current to supply power to the unit.
7. The unit must be installed with a specified cross-section grounding wire. Do not connect the ground wire to the ground wire for gas lines, pipes, lightning lines or telephone. At the same time, it must be reliably grounded to avoid accidents.
8. Do not forcibly cut off the power supply when the unit is running to avoid accidents.
9. When the unit is not in use for a long time, please discharge the water in the pipe, close the water pipe valve, and disconnect the main power supply switch to avoid accidents.
10. The unit shall use a special power supply, and the power supply voltage shall meet the rated voltage standard.
11. When the power cord is damaged, it is necessary to use the power cord specified by the manufacturer and replaced by professional maintenance personnel.

Precaution

1. Do not put your hand or foreign body into the air outlet, because the high-speed fan may endanger personal safety.
2. Do not remove the air guide net cover of the unit, otherwise the high-speed operation of the fan may cause personnel injury.
3. Lightning and other electromagnetic radiation sources may affect the device. If this happens, turn off the power supply and turn it on again.
4. When in use, make sure that the air in the pipe is completely discharged, and then open the replenishment valve to replenish water to the system.
5. Before operating the machine, read carefully about all the warnings and precautions.
6. "Warning" and "precautions" list various important safety-related matters, please strictly implement them.
7. The working environment of the unit should be far away from the fire source. In case of fire caused by line problems, immediately close the main switch and use a dry powder fire extinguisher to extinguish the fire.
8. Power supply must be cut off before repairing the unit.
9. It is forbidden to place objects on top of the device to avoid accidents caused by falling objects while the machine is running.

1.2 Warnings for Transport

1. The heat pump must be transported, handled and stored vertically. Tipping the machine may cause the compressor or other components damage.



2. The stacking layers of the stored units are less than or equal to 2 layers.

3. Do not twist, loosen or pull the external electric cables of the heat pump. Do not insert any sharp objects through the fan grille or into the fan itself.

1.3 Safety Instructions for Storage

The outdoor unit is charged at the factory with refrigerant R290 (propane).

⚠ Danger

Escaping refrigerant can lead to fire and explosions that result in very serious injuries or death. There is a risk of asphyxiation if it is breathed in.

Store the outdoor unit in the following conditions:

■ An explosion prevention plan must be in place for storage.

■ Ensure there is sufficient ventilation at the storage location.

■ Ensure that the stacking layers of the stored units are less than or equal to 2 layers.

■ Temperature range for storage: –20 °C to 50 °C.

■ Only store the outdoor unit in its ex-factory protective packaging.

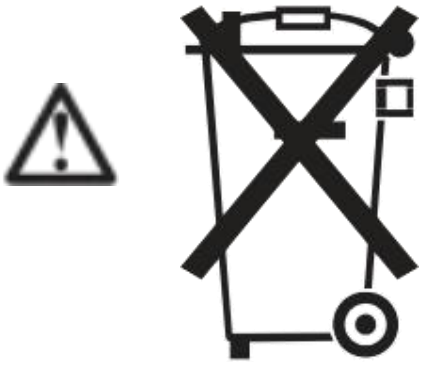
■ Protect the outdoor unit against damage.

■ The maximum number of outdoor units that may be stored in one place is determined by local conditions.

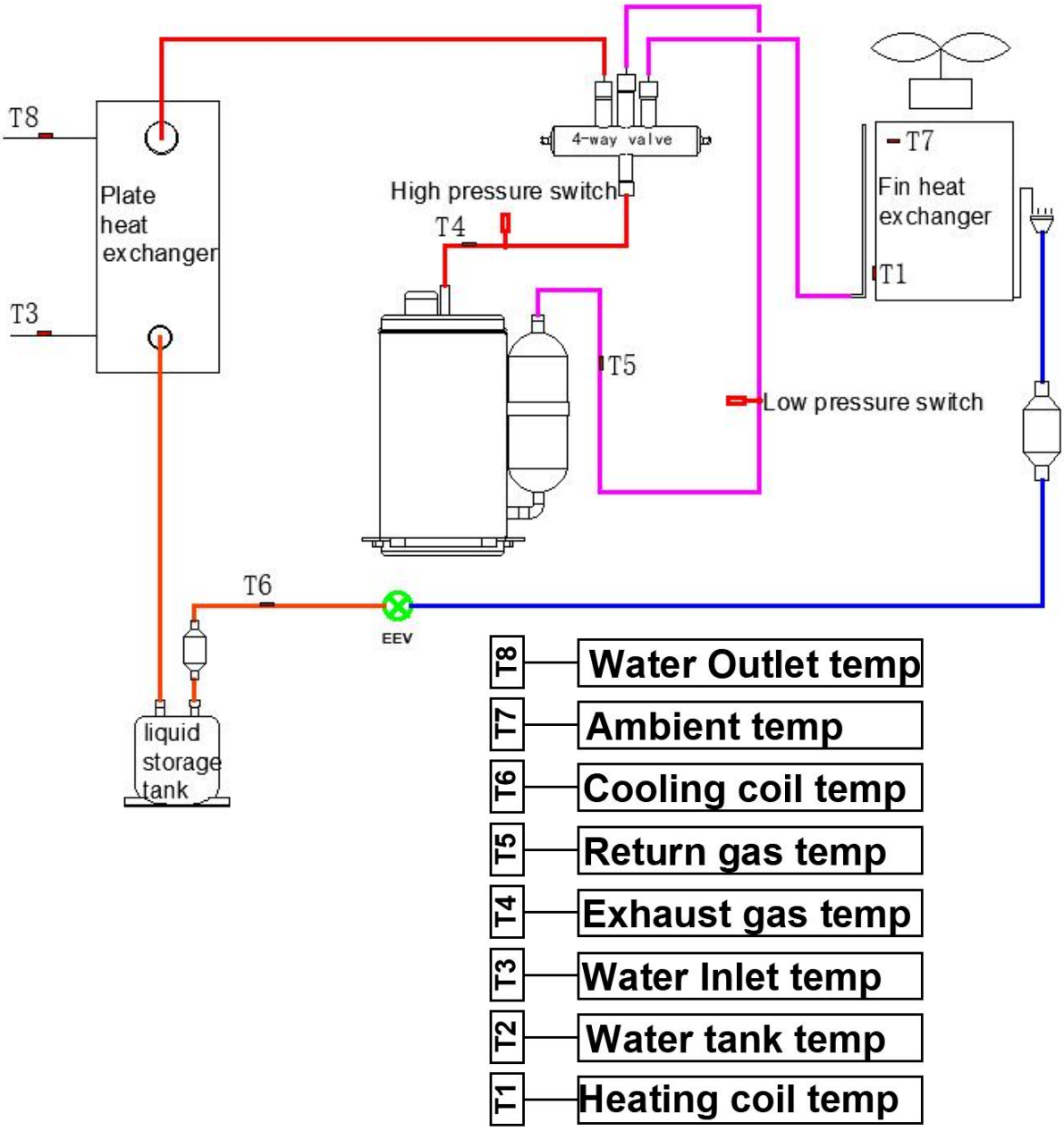
1.4 Unit Recycling and Scrapping Warning

This label indicates that the product should not be disposed of together with other household waste throughout the EU region. To prevent the potential harm of uncontrolled waste disposal to the

environment or human health, material resources should be responsibly recycled and utilized. To return the device you have used, please use a recycling and collection system or contact the retailer who purchased the product. They can use this product for environmentally friendly and safe recycling.



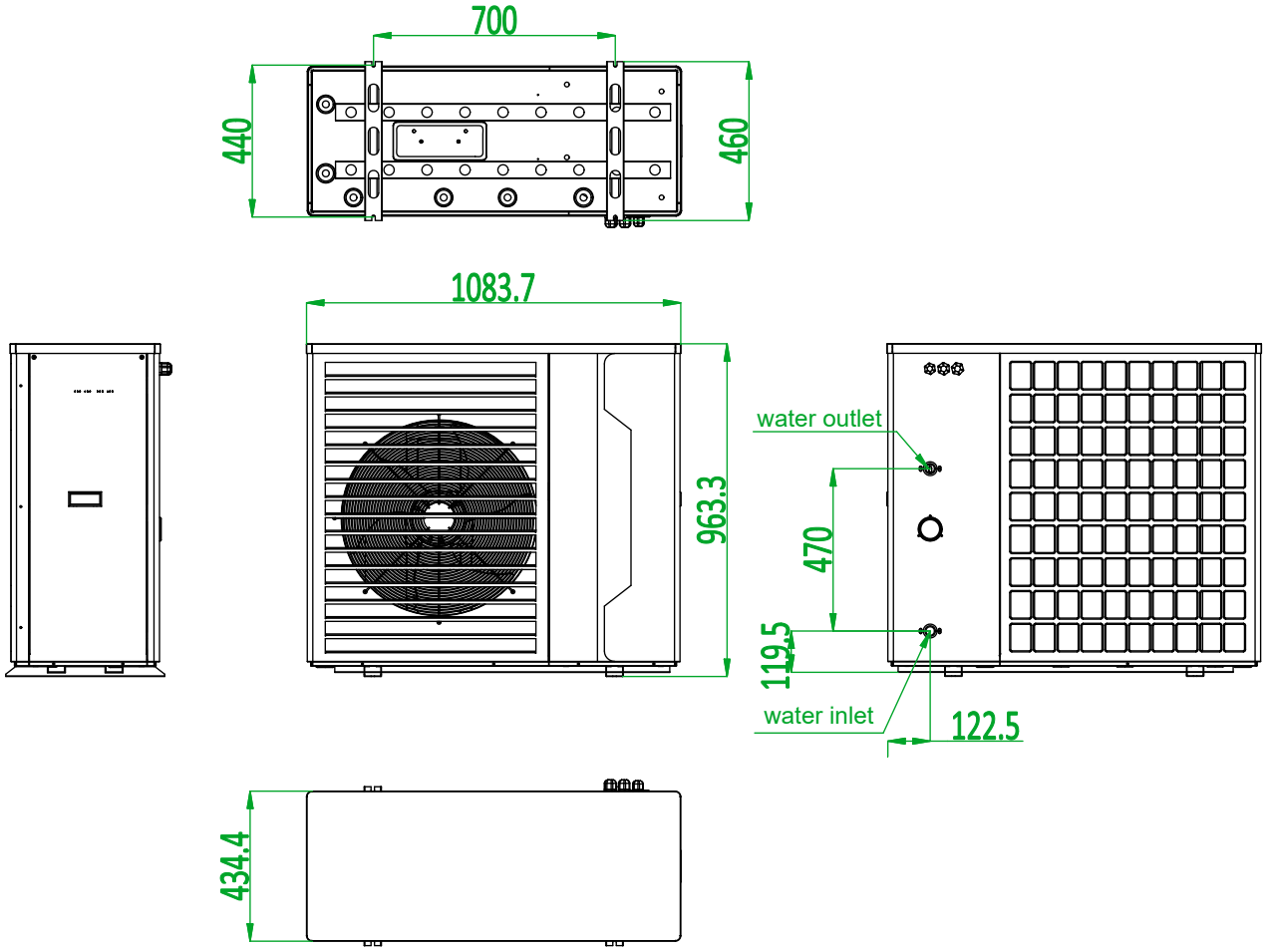
2.Working principle



3.Specifications

3.1 Dimensions (in mm)

FHF-MBWHS-081HE4



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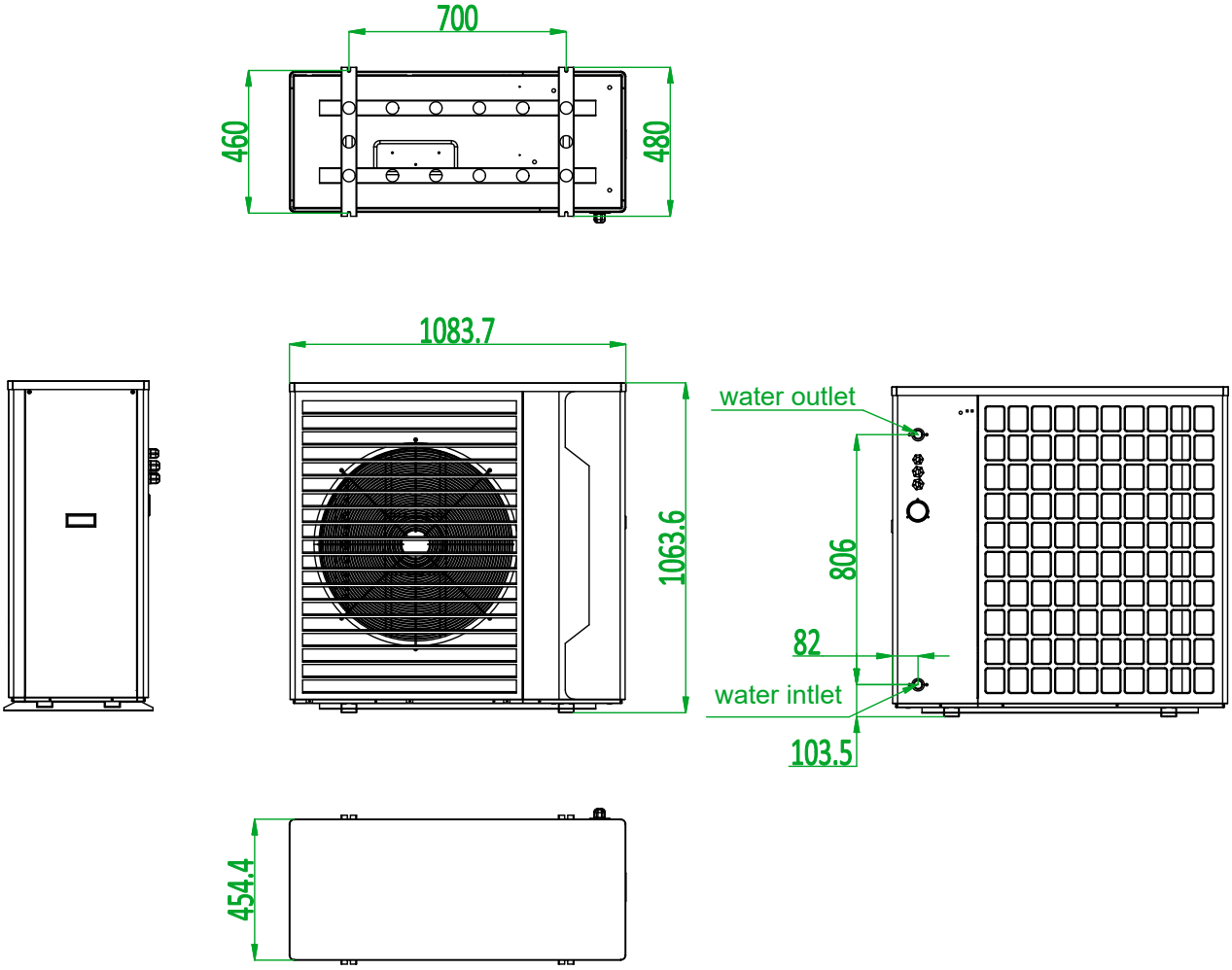


3.2 Product data

Model	FHF-MBWHS-081HE4	FHF-MBWHS-101HE4	
Heating Condition - Ambient Temp.（D WB）: 7/6℃，Water Temp.（In/Out 30/35℃			
Heating Capacity Range (kW)	4.5~11.4	6.0~14.8	
Heating Power Input Range(kW)	0.89~2.72	1.18~3.48	
COP Range	4.19~5.06	4.25~5.09	
DHW Condition-Ambient Temp.（DB/W : 7/6℃，Water Temp.（In/Out）： 55℃			
Heating Capacity Range (kW)	4.7~11.7	6.0~15.0	
Heating Power Input Range(kW)	0.89~2.72	1.13~3.49	
COP Range	4.30~5.28	4.30~5.31	
Cooling Condition - Ambient Temp.（D WB）:35/24℃，Water Temp.（In/Ou ：12/7℃			
Cooling Capacity Range (kW)	3.5~8.6	4.1~10.5	
Cooling Power Input Range(kW)	0.97~2.77	1.32~3.96	
EER Range	3.10~3.60	2.65~3.11	
ErP Level (35°C)	A+++	A+++	
ErP Level (55°C)	A+++	A++	
Refrigerant	R290/0.95kg	R290/1.3kg	
Power supply	230V/1Ph/50Hz/60		
Max. power input(kW)	4.1	5.5	
Max. current (A)	18.8	25.2	
Fuse or circuit breaker (A)	25	32	
Wire diameter mm²	4mm²	6mm²	
Water Flow(m3/h)	1.96	2.55	
Diameter of pipe (mm)	DN25	DN25	

Max water head(m)	9	9	
Noise dB(A)	≤50	≤52	
Net Weight (kg)	125	135	
Net Dimension (L/W/H) mm	1080×460×964	1080×480×1064	
Operation Ambient Temp.	-25~43℃		
Operating water temperature (℃)	28~65℃（DHW）		
Operating water temperature (℃)	15~70℃（Heating）		
Operating water temperature (℃)	7~35℃（Cooling）		

Note:

The above design and specifications are subject to change without prior notice for product improvement.

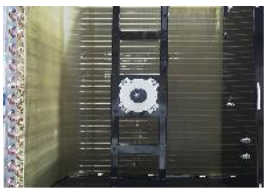
Detailed specifications of the units please refer to nameplate on the units.

Correct installation is required to ensure safe operation.The requirements for heat pumps include the following:

1. Dimensions for critical connections.
2. Field assembly (if required).
3. Appropriate site location and clearances.
4. Proper electrical wiring.
5. Adequate water flow.

This manual provides the information needed to meet these requirements.Review all application and installation procedures completely before continuing the installation.

3.3 Key Component

Item	Picture	Name	Function declaration
1		DC inverter compressor	The compressor is the heart component of the heat pump system. It is a "steam pump", which presses the low temperature and low pressure steam with high temperature and high pressure steam to provide the refrigerant in the heat pump system cycle
2		Plate heat ex-changer	It is a small plate heat exchange, its function is to reduce the exhaust temperature of the compressor, improve the compression ratio, improve the operation stability of the heat pump system at low ambient temperature; by increasing the over-cooling of the heat pump system and increasing the intermediate compression of the compressor, so as to improve the capacity and energy efficiency of the heat pump unit.
3		finned type heat exchange	The fin-type heat exchange can be used as a condenser and as an evaporator. Heating for the evaporator, the low temperature and low pressure liquid refrigerant evaporation into a gas, to absorb the heat in the air. For refrigeration condenser, the high temperature and high pressure gaseous refrigerant is condensed into a liquid of medium temperature and high pressure, and the heat is distributed into the air.
4		Reservoir	When the heat pump unit is running, the circulating amount of refrigerant in the system will change due to the change of the working conditions or the adjustment of the refrigeration capacity. After setting the reservoir, the liquid storage capacity of the reservoir can be used to balance and stabilize the refrigerant circulation volume in the system, so that the heat pump unit can always operate efficiently and reliably.
5		Gas-liquid separator	Separates the refrigerant returning from the evaporator to the compressor into gas and liquid to prevent liquid refrigerant from entering the compressor and disrupting the lubrication or damaging the pump body.

6		Electronic expansion valve	A throttling and depressurizing device that throttles medium temperature and high pressure liquid refrigerant into low temperature and low pressure liquid refrigerant.)
7		Four-way switching valve	Change the flow direction of refrigerant to realize the switching function of cooling, heating and defrost.
8		Pressure sensors	Low pressure protection of the unit, compressor / fan frequency limit reduction function control, suction overheat control, low pressure is used for low pressure protection and overheat control.
9		Red high pressure switch Black low pressure switch	High pressure switch: When the exhaust pressure of the heat pump system is higher than the protection value of the high pressure switch, the high pressure switch is disconnected and forces the unit to stop working to avoid damage to the unit. Low pressure switch: When the suction pressure of the heat pump system is lower than the protection value of the low pressure switch, the low pressure switch is disconnected and forces the unit to stop working to avoid damage to the unit.
10		Water flow switch	When the waterway of the heat pump system is cut off or the flow rate is low, the water flow switch is disconnected and the heat pump unit stops working.
11		DC circulation pump	The circulating water pump provides power for conveying the heat transfer medium (water) in

			the heat pump water system, and then takes away the heat from the water side heat exchanger through the heat transfer medium (water) to raise or reduce the temperature of the heat transfer medium (water).
12		Outdoor fan (DC motor + wind blade)	The outdoor fan provides strong air convection in the fin heat exchange to enhance the heat transfer exchange effect.
13		R290 leakage sensor	The heat pump is built in a refrigerant leakage sensor from factory, it's used to detect and monitor the leakage of R290 refrigerant, ensuring the safety and efficiency of the system. When the leakage concentration exceeds 15% LFL, the system will sound an alarm and display fault code Er75, reminding users to handle it in a timely manner to ensure safe use. The compressor and all electric heating will stop, and the fan is running at the lowest speed.
The following parts are random accessories along with units and accessories often used in the installation;			

1		Exhaust valve (Standard accessories)	The unit is equipped with an exhaust valve as standard at the factory, which can eliminate the air in the water pipe in real time. More importantly, when the refrigerant inside the plate heat ex-changer leaks and mixes into the water pipe, the exhaust valve can promptly release the refrigerant, preventing it from entering the room and ensuring system safety. Please place it on the outlet pipe of the unit.
2		Operation controller (Standard accessories)	Accessories along with the heat pump, connect the circuit board for communication use to operate the heat pump)
3		Operating the display communication extension line (Four-core) (Standard accessories)	Accessories along with the machine, extension line connecting the circuit board and display; four-core communication line
4		Heat pump rubber pad (Standard accessories)	Accessories along with the machine. Used for shock absorption and vibration protection of the foot of the main unit of the heat pump on site;
5		Manual exhaust valve (Pipe installation fittings)	When the unit is installed for the first time, the residual air in a few pipes cannot be discharged through the automatic exhaust valve. At this time it is necessary to manually unscrew the exhaust valve to discharge, and then manually close the exhaust valve after discharge.

6		safety valves (Pipe installation fittings)	When the pressure of the water system exceeds the design value of the safety valve, the safety valve automatically opens to relieve the pressure, control the water system pressure does not exceed the specified design value which plays an important role in protecting personal safety and equipment operation.
7		Expansion Vessel (Pipe installation fittings)	The expansion Vessel plays the role of buffer against pressure fluctuation and partial water supply in the water system.
8		Check valve (Pipe installation fittings)	Install a check valve on the water outlet connection in order to prevent back siphoning when water pump stops.
9		Y-Filter (Pipe installation fittings)	Filters can filter out impurities in the water system, ensuring good water quality.
10		Ball valve (Pipe installation fittings)	Install ball valves on the heat pump water inlet and outlet pipelines to control the flow of water.
11		Water pressure gauge (Pipe installation fittings)	Installed on the inlet pipeline of the heat pump, detecting the water pressure status.
12		Thermometer (Pipe installation fittings)	Installed on the inlet pipeline of the heat pump, detecting the water temperature status.

R290 Refrigerant Leakage Detection

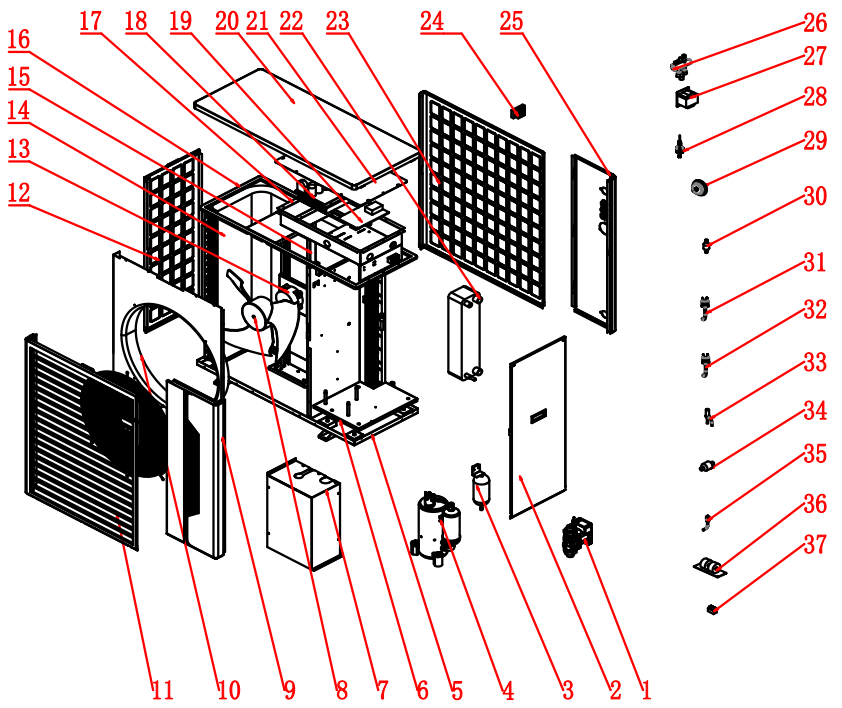
The heat pump is built in a refrigerant leakage sensor from factory, it ’ s used to detect and monitor the leakage of R290 refrigerant, ensuring the safety and efficiency of the system. When the leakage concentration exceeds 15% LFL, the system will sound an alarm and display fault code 209, reminding users to handle it in a timely manner to ensure safe use.

The compressor and all electric heating will stop, and the fan is running at the lowest speed.

Solution:
Power off the unit immediately, keep good ventilate, check the refrigerant leakage point of the unit, and repair it. (Professional installation personnel are required to operate it)

3.4 Exploded diagram

FHF-MBWHS-081HE4 FHF-MBWHS-101HE4



NO	Spare parts	NO	Spare parts
1	water pump	21	electric box cover
2	right side panel	22	plate heat exchanger
3	liquid storage tank	23	back net
4	compressor	24	transfer terminal block
5	chassis	25	rear side panel
6	damping plate	26	4-way valve
7	compressor housing	27	Reactor
8	fan blade	28	water flow switch
9	Front right panel	29	pressure gauge
10	Air guide panel	30	drying filter
11	Front left panel	31	high voltage switch
12	left net	32	low voltage switch
13	motor	33	electronic expansion valve
14	fin heat exchanger	34	filter
15	motor bracket	35	needle valve
16	top frame	36	filter board
17	electric box	37	transfer terminal block
18	driver board		
19	control board		
20	top panel		

4.Selection

4.1 Heat Pump Selection

Note: The working efficiency of heat pump is closely related to the environmental conditions, such as changes in ambient temperature, humidity, outlet water temperature, altitude, water pipe length, and insulation measures, all of which can affect the heating effect of heat pumps.

4.1.1 Calculate method

Generally, using the area indicator method, calculate the required cooling/heating capacity of the room based on the room area and cooling/heating load estimation indicators.

The estimation of cooling and heating load indicators for each building can refer to the following table:

No.	Building type	Cooling capacity(W/m^2)	Heating capacity(W/m^2)
1	Hotels, Guesthouses, Restaurants	150-250	60-80
	Guest Room (Standard Room)	80-110	
	Bar, Coffee shop	100-180	
	Western restaurant	160-200	
	Chinese restaurants, Banquet halls	180-350	
	Shops, Canteen	100-160	
	Atrium, Reception room	90-120	
	Office, School	110-140	
2	Gymnasium	280-450	120-160
	Competition Hall	120-300	
	Audience Lounge	300-350	
	VIP Room	100-120	
3	Exhibition hall, Showroom	130-200	90-120
4	Lecture hall	150-200	120-150
5	Library (Reading)	75-100	50-75
6	Apartments, Residential buildings, House	80-90	60-80

Remark: This table is only used as a reference indicator, and there may be slight differences between different regions. It needs to be considered comprehensively based on regional factors, building insulation performance, and building usage.

The above cooling and heating load estimation indicators are for energy-saving buildings, and for non energy-saving buildings, an increase of approximately 30% in load is required.

4.1.2 Calculation case

Taking a residential building in Germany as an example, the total area of the room is 70 square meters. In winter, the outdoor temp is -15 ℃ and the room temp is 20 ℃. Please calculate the appropriate model and quantity of the R290 heat pump series?

Step 1: Take its heat load index as 80W/㎡, and calculate the total heat load demand Q= 70 × 80=5,6 KW

Step 2: Query the R290 heat pumps of Power World, and analyze the variable operating conditions table and curve chart of 081HE4 When the default water outlet temp is 35 ℃ and the outdoor temp is -15 ℃, it's maximum heating capacity is 6,9KW, which has the avarage capacity 85% x 6,9kW =5,865kW

Therefore, select the model FHF-MBWHS-081HE4

The performance curve is shown as below:

FHF-MBWHS-081HE4_Capacity Table For heating

Ambient temp. (℃)			-25	-20	-15	-12	-10	-7	-5	0	2	5	7	10	12	15	21
Water temp. outlet35℃	MAX	Heating Capacity (kW)	4,2	6,0	6,9	7,5	8,1	8,8	9,2	10,1	10,5	11,1	11,4	11,6	11,9	12,1	12,7
		Input power (kW)	2,28	2,72	2,77	2,84	2,91	2,96	2,96	2,99	2,99	2,83	2,72	2,74	2,69	2,62	2,50
		COP	1,85	2,22	2,49	2,65	2,78	2,98	3,11	3,39	3,51	3,91	4,19	4,25	4,41	4,62	5,06
	MIN	Heating Capacity (kW)	1,8	2,3	2,8	3,1	3,3	3,6	3,7	4,2	4,2	4,4	4,5	4,7	4,7	4,8	4,9
		Input power (kW)	0,77	0,83	0,89	0,92	0,93	0,93	0,94	0,95	0,93	0,91	0,89	0,90	0,88	0,86	0,81
		COP	2,41	2,81	3,14	3,34	3,53	3,84	3,96	4,40	4,54	4,86	5,06	5,21	5,37	5,63	6,10
Water temp. outlet45℃	MAX	Heating Capacity (kW)	3,9	5,6	6,4	7,0	7,5	8,2	8,6	9,4	9,8	10,3	10,6	10,8	11,0	11,2	11,8
		Input power (kW)	2,54	3,02	3,08	3,16	3,23	3,29	3,29	3,32	3,38	3,20	3,07	3,09	3,04	2,96	2,83
		COP	1,55	1,86	2,08	2,22	2,33	2,50	2,61	2,84	2,88	3,22	3,45	3,50	3,63	3,80	4,16
	MIN	Heating Capacity (kW)	1,7	2,2	2,6	2,8	3,0	3,3	3,5	3,9	3,9	4,1	4,2	4,3	4,4	4,5	4,6
		Input power (kW)	0,85	0,92	0,99	1,02	1,03	1,04	1,05	1,06	1,04	1,01	0,99	0,99	0,98	0,95	0,90
		COP	2,02	2,35	2,63	2,80	2,96	3,21	3,32	3,68	3,80	4,07	4,24	4,37	4,50	4,71	5,11

4.2 Domestic Hot Water Tank

4.2.1 Calculate method

Note: The selection of domestic hot water tank is mainly based on the following three points:

1. Calculate based on the hot water quota for various types of buildings. (The water consumption of domestic hot water is shown in the below table).

2. Calculate according to customer requirements.

3.The capacity of the water tank is determined based on the daily water consumption of each person.

No.	Building type	Unit	Daily hot water consumption of each person(L)
1	Residential equipped with a bathtub	Daily/each person	80～160
	Residential equipped with a shower	Daily/each person	20～60
2	Hotel	Daily/per bed	50~100
3	Hospitals and sanatoriums	Daily/per bed	70~140
4	Public bathrooms and sauna centers	Daily/each person	60～120
5	Foot massage center	Daily/each person	15～25

6	Villa	Daily/each person	70～100

According to the above standards, **50L hot water /person/day** is taken, and the target water temperature is **55 ℃ for residential buildings.**

4.2.2 Calculation case

For example, if the building area is 70 m² and there are 4 persons, the total hot water demand is 200L per day. The heating capacity of -081HE4 is10,8 KWin 7 ℃ in hot water mode. Calculate the time to heat hot water using the following formula:

Q=C×M×△T=4.1868×200×40=33494KJ= 9.3KW

Q：Total heating load kJ

M：daily water consumption (kg or L)

C：Specific heat of water 4.1868kJ/kg·℃

△T：Water temperature difference between inlet and outlet （55-15）℃

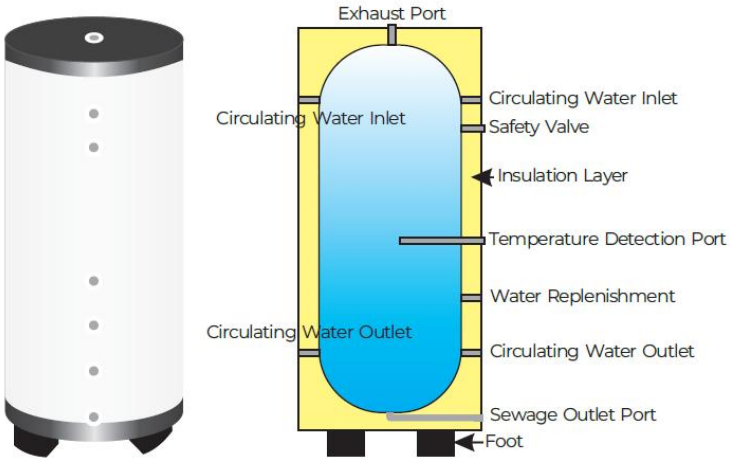
Heat Time=Q÷P= 9.3÷10,8 ≈0.86h

Note: The above calculations are under ideal conditions and are for reference only. In actual use, we should consider the pipeline heat loss, building insulation, changes in environmental temperature conditions, etc., based on the actual heating time.

4.2.3 Heating coil selection

Domestic hot water is usually heated using built-in coils, so the selection of inner coil specifications directly affects the heating effect and the reliability of unit operation. The following is the recommended selection data.

Model	Stainless steel coil pipe	Area
FHF-MBWHS-081HE4	φ25*20m φ32*15m	2.2m² 2.1m²
FHF-MBWHS-101HE4	φ32*25m	3.5m²



4.3 Circulation Water Pump

Circulating water pump: First, match the flow rate of the water pump, then match the head, and finally

determine the power.

The water flow rate of the circulating water pump is ≥ the rated water flow of the heat pump×(1.2~1.3)

The water pump should be horizontally installed on the main pipe. On the one hand, it is easy to vacuum, and on the other hand, it can ensure the flow and efficiency of the water pump.

(1) Water pump installed on the return pipe of the heat pump(Optional built in Hydraulic module)

The water head: Hmax1=K(△P1+△P2+△P3)

△P1——Unit water pressure drop head (please check product parameters, usually 1mH2O=10KPa)

△P2——Horizontal pipeline resistance head (usually 5 meters head is required for every 100 meters of pipe length)

△P3——Pipeline height difference(m)

K——Represents a safety factor ranging from 1.1 to 1.2

(2) Water pump installed between the buffer tank and user's device

The water head: Hmax2=K(△P1+△P2)

△P1——Maximum height of the user's end (m, based on the highest point designed by the user)

△P2——The most unfavorable loop pipeline resistance head (m, usually 5 meters of head is required for every 100 meters of pipe length)

K——Represents a safety factor ranging from 1.1 to 1.2

4.4 Buffer Tank

To prevent frequent tripping of the unit due to low load during operation, users must install a buffer water tank. The selection of buffer water tank can refer to the following empirical values.

Model	MBWHS-081HE4	MBWHS-101HE4
Volume of buffer water tank	60-200L	100-300L

4.5 Air Pressure Tank

Suggest installing an air pressure tank on the water supply pipe to stabilize the pressure.

(1) Basic requirement: Rust proof and suitable for water/ethylene glycol (up to 30%) solution.

(2) It is best to choose 304 stainless steel flange air pressure tanks, as carbon steel galvanized is more prone to rusting.

(3) The pre-filling pressure of the expansion tank is equal to the set pressure of the water replenishment valve.

(4) It is recommended to check the inflation pressure of the expansion tank every 1-2 years.

The following table shows the recommended selection values:

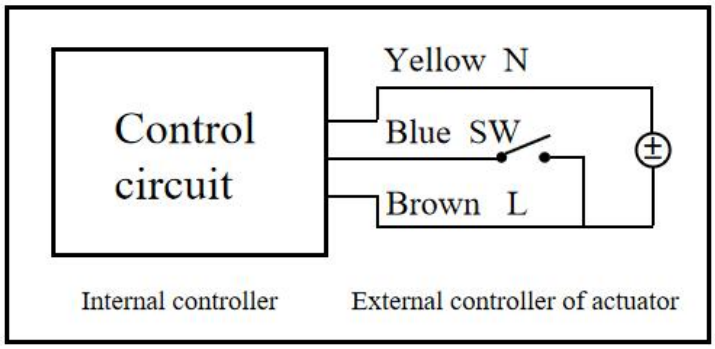
Model	Capacity(KW)	Volume(L)	Air pressure tank
MBWHS-081HE4	<12.5	5	
MBWHS-101HE4	12.5~25	8	

4.6 Three Way Valve

Basic requirements: Made of brass, stainless steel, or plastic, and suitable for water/ethylene glycol (up to 30%) solution.

Wiring method: three wires and one controls;

Drive voltage: AC220V



4.7 Safety Valve

The safety valve is generally installed at the return end of the heat pump system.

Basic requirements: The material should be brass or stainless steel, and suitable for water/ethylene glycol (up to 30%) solution.

Suggestion: The safety valve plays a safety protection role in the system. When the system pressure exceeds the specified value, the safety valve opens to discharge a portion of the hot water from the system, ensuring that the system pressure does not exceed the allowable value, thereby ensuring that accidents do not occur due to excessive pressure. The set pressure (take off pressure) of the safety valve is consistent with the maximum working pressure of the system. Safety valve specifications:

Interface size	1/2”MF	1/2”FF
Set pressure(bar)	1.5/2.5/3	1.5/2.5/3

Remark: The working pressure of the safety valve built-in in the indoor unit is **3Bar**.

4.8 Exhaust Valve

During the operation of a heat pump system, the gas released by water during heating, such as oxygen, can cause numerous adverse effects that can damage the system and reduce thermal effects. If these gases cannot be discharged in a timely manner, it can lead to many adverse consequences.

Basic requirements: The material should be brass or stainless steel, and suitable for water/ethylene glycol (up to 30%) solution. Installing exhaust valves is crucial for system safety and stability.

Exhaust valve

Suggest installing exhaust valves at the highest point of the system to ensure stable operation.

4.9 Water Filter

1. When the water quality is poor, more sediment such as scale and sand will be generated. Therefore, water must be filtered and softened with a soft water device before flowing into the water system;
2. Before using the unit, the water quality should be analyzed, such as pH value, conductivity, chloride ion , Sulfate concentration, etc. The following are the water quality standards applicable to this unit.

Item	Unit	Standard requirements
PH Value		7.5~9.0
Chlorid ion	mg/L	≤50
Sulfate	ppm	≤50
Total hardness	mg/L	≤200

3. The return water main pipe must be equipped with a system filter to keep the water quality, and ensure that the direction indicated by the filter arrow is consistent with the direction of the water flow inside the pipe. Sufficient maintenance space must be reserved around the filter.

Selection: The function of the filter is to collect materials in the system and avoid materials affecting the normal operation of the system. The larger the mesh size of the filter, the finer the particle size of the material. The smaller the mesh size, the larger the particle size of the material. The diameter of the filter should be consistent with or one specification larger than the outer diameter of the main water supply pipeline in the system.

Installation: When installing the filter, it is necessary to choose a suitable position, and **the water flow direction of the system must be consistent with the arrow direction on the filter.** For filters with a drain valve, the drain valve must be facing downwards. Incorrect installation may result in the inability to discharge garbage from the filter screen through the drain valve. Prolonged retention of garbage in the filter screen will reduce the effective area of the filter, increase the water resistance generated by the filter, and reduce the water flow rate of the system.

Y filter

4.10 Waterway antifreeze protection

Ice formation can cause damage to the whole system. Due to the possibility of outdoor units being exposed to environments below 0℃, caution must be taken to prevent the system from freezing. In the

event of a power failure, the device's own antifreeze protection function will fail. Due to the possibility of power outages when left unattended, it's recommended to use antifreeze in the water system.

The following parameters for ethylene glycol and propylene glycol antifreeze are for reference only.

Ethylene glycol concentration (%)	Correction factor				Freezing point(°C)
	Cooling capacity	Power input	Water resistance	Water flow	
0	1.000	1.000	1.000	1.000	0
10	0.984	0.998	1.118	1.019	-4
20	0.973	0.995	1.268	1.051	-9
30	0.965	0.992	1.482	1.092	-16

Propylene glycol concentration (%)	Correction factor				Freezing point(°C)
	Cooling capacity	Power input	Water resistance	Water flow	
0	1.000	1.000	1.000	1.000	0
10	0.976	0.996	1.071	1.000	-3
20	0.961	0.992	1.189	1.016	-7
30	0.948	0.988	1.380	1.034	-13

Caution:

1.Water treatment is carried out correctly by qualified water experts.

2. Choose ethylene glycol containing corrosion inhibitors to counteract the acid formed by ethylene glycol oxidation.

3. If a household hot water tank is installed, only **propylene glycol is allowed to be used**. In other devices, ethylene glycol can also be used.

4. Do not use automotive ethylene glycol as their corrosion inhibitors have limited lifespan and contain silicates, which can contaminate or clog the system;

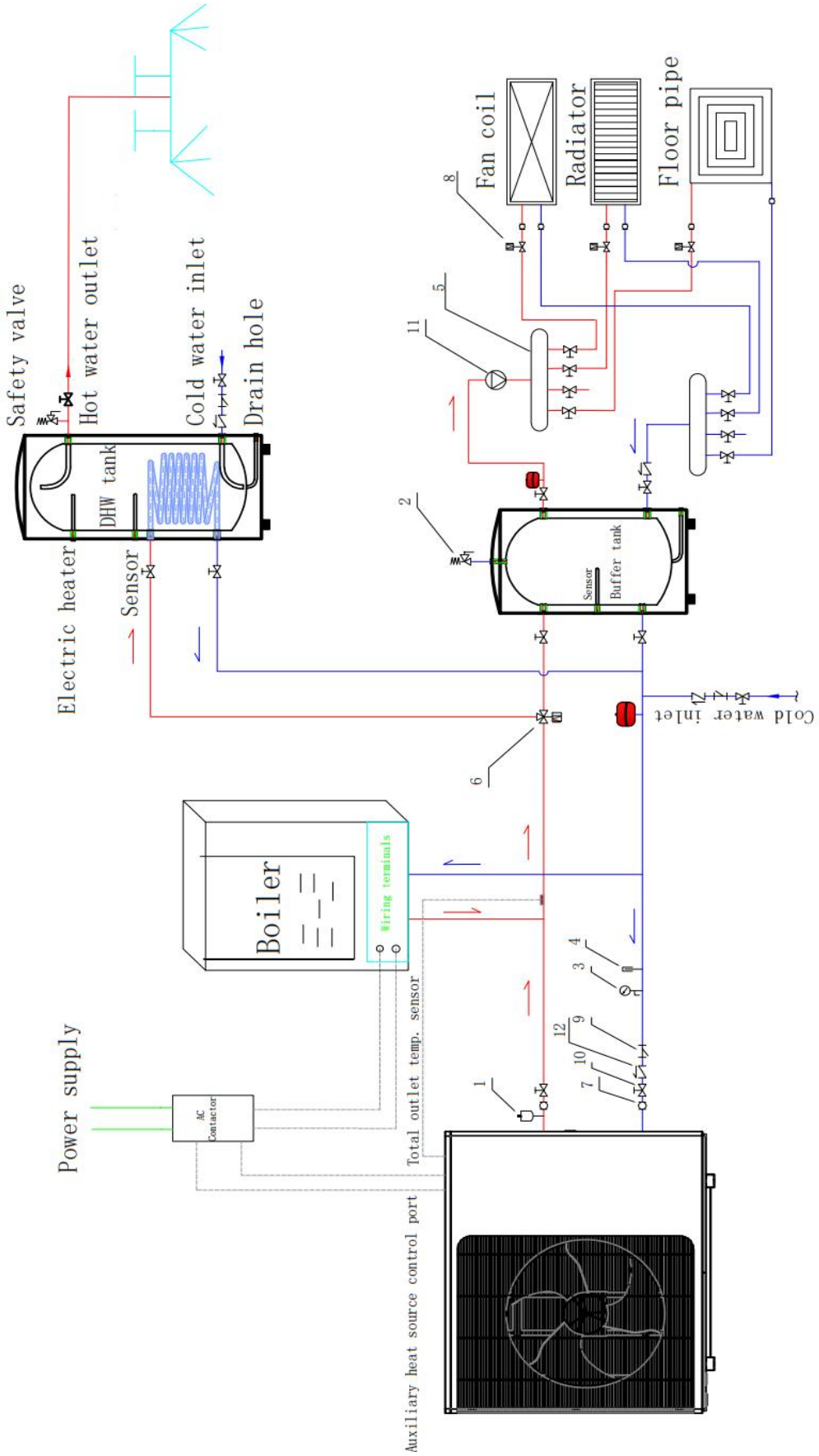
5. **Galvanized pipes are not used in ethylene glycol** systems as they may cause precipitation of certain elements in ethylene glycol corrosion inhibitors;

6. Ensure that ethylene glycol is compatible with the materials used in the system.

5.Installation

5.1 Installation method

Heating, Refrigeration and domestic hot water (secondary Circulation)



1	Air Vent Valve	
2	Safety Valve	
3	Manometer	
4	Thermometer	
5	Diverter	
6	3-way Value	
7	Rubber Connetor	
8	2-way Value	
9	Y type filter	
10	Ball Value	
11	Water pump	
12	Check valve	

5.2 Preparation work and precautions before installation

5.2.1 Product installation instructions and special precautions

A. the heat pump heating and hot water system should be a closed-loop system, if using antifreeze liquid or other liquid, please consult to Manufacture;

B. Filter must be installed before the inlet pipe of the heat pump unit, and the number of filter mesh is above 40;

C. The filter mesh in the filter must be made of stainless steel to avoid scratches on the system caused by impurities in the filter

The heat pump uses the non-toxic micro-combustion refrigerant R290:

1) Lower limit of ignition [LFL% (V / V)]: 2.1 vo1%; 0.038 kg / m^3

2) Automatic ignition temperature, refrigerant ignition point AIT: 470℃

3) Minimum ignition energy MIE: 0.31 mJ

4) Combustion speed BV: 46 cm / s

5) Combustion heat HOC: 50.3 MJ / kg

6) Occupational contact limit OEL: 1000 PPMv

7) Safety level (ASHRA34): A3

Confirm the critical concentration and take necessary measures by following the steps below

Calculate total refrigerant volume (A [M load 3]) 22 refrigerant volume + additional addition.

. Calculate the indoor volume (B [m3]) (as the minimum volume)

. Calculate the refrigerant concentration. Prevent excessive concentrations.[A / （A+B ）]<14.4%

. Install a ventilator to reduce the refrigerant concentration to a critical level.

. If long-term ventilation is impossible, please install a leakage alarm device associated with the ventilator.

5.2.2 Disclaimer instruction

1. The product shall be supplied independently by copper core power wire that meets the required wire diameter, and the unit shall have reliable grounding wire; if the wiring does not meet the requirements, the company shall not be responsible accordingly.

2. When cleaning the unit, cut off the power switch. If the unit is cleaned under electric operation, resulting in electric shock and personal safety injury.the company shall not be responsible for this.

3. In winter or when the ambient temperature is below 2℃, if the water is not used for a long time, please be sure to empty the water in the waterway and the water tank to prevent the water from freezing and expanding, which results in freezing of the water pipe and the water tank, damaging the machine. If the unit stops the anti-freezing protection due to the power failure, the company shall not be responsible for it.

Warning

1. Before installation, it shall be confirmed that the voltage of the power grid is consistent with the required voltage of the unit, and whether the open load capacity of the wires and sockets meets the maximum power requirements.

2. If the standing appliance is not equipped with power cord and plug, and there is no other device that disconnected the power supply (the contact distance is fully disconnected under the overvoltage level), the fixed wiring must be connected with the full pole disconnected leakage protection device with the contact distance greater than 3mm according to the wiring rules.

3. Please entrust the dealer or professional personnel to install; the DIY installation shall have relevant professional knowledge, otherwise may cause water leakage, fire, electric shock, or injury.

4. The auxiliary products purchased locally must use the products designated by the company;

5. Please follow the regulations of the local electrical company; confirm whether the grounding is correct. If the grounding is not perfect, it may cause electric shock.

6. When the heat pump unit needs to be moved or reinstalled, please entrust the dealer or

professionals to operate; if the installation is not perfect, it may cause the unit operation failure, electric shock, fire, injury, water leakage and other accidents.

7, must not transform and repair, improper repair, will cause water leakage, fire, electric shock, injury and other accidents, be sure to entrust dealers or professional personnel to repair.

8. Do not remove any permanent instructions, labels or nameplates on the inside of the heat pump unit shell or the various panels.

5.2.3 Precautions

1, the power supply wiring must be equipped with a leakage protector with a rated current value not lower than the high operating current of the unit,, and the grounding must be reliable, and keep dry to prevent leakage. Please often check whether the wiring is well coordinated. If the contact is bad, it will lead to overheating and burn out the devices, and even cause fire and other personal injury accidents;

2. In the place and wall where the water may splash, the installation height of the power socket should not be less than 1.8 meters, and ensure that the water will not splash on the socket, and can not be installed in the

place where children may touch;

3, during the power heating period, the pressure safety valve relief hole may have water drops, this is a normal phenomenon, if a lot of leakage, please timely find professional personnel to repair, do not plug the relief hole, so as not to cause heat pump unit damage, leading to the occurrence of safety accidents. The drainage pipe connected to the pressure relief hole shall be kept tilted downward and installed in a frost-free environment;

4. If the unit is equipped with power cord, when the power cord is damaged, the special power cord provided by the manufacturer must be used, and replaced by the service organization of the manufacturer or similar qualified professional repair personnel;

5. If the parts of the unit are damaged, please hand them over to the professional personnel for maintenance, and use the special maintenance parts provided by the company;

6. If the heat pump unit will not be used for a long time (more than 2 weeks), hot water pipe system may produce hydrogen, which is easily burning. In this case, in order to reduce the danger, it is recommended before using any electrical appliances connected with the hot water system, turn on the hot water faucet for a few minutes (such as 5~10 minutes). If there is hydrogen, then when the water begin to flow, there will be an abnormal sound like the air through the pipe. Do not smoke or light an open flame near the tap during the opening period.

7. Do not put your fingers, sticks into the air outlet or air inlet. Because the internal wind wheel runs at a high speed, it may lead to injury.

8. In case of abnormal situation (empyreumatic odour), immediately cut off the manual power

switch, stop running, and contact the after-sales service department of the manufacturer. If the abnormal operation continues, it may cause an electric shock or cause a fire.

9. The unit can not be installed in a place where combustible gas is easy to leak. Once the combustible gas leaks, a fire may be caused around the unit.

10. Confirm whether the installation foundation for long-term use is firm. If the foundation is not solid, there may be a fall injury accident.

5.2.4 Required tools

No.	Tool Name	Picture	Function
0	Safety and industrial gloves		Protect your hands
1	Digital electric pen		Preliminary maintenance voltage, small one-word screw
2	Cross screwdriver (5 * 150)		Remove the crucifix screw
3	One-word screwdriver (5 * 150)		Remove one-word screw
4	Active wrench (10-inch)		Remove screws and so on
5	Active wrench (14-inch)		Remove the pipe valve, etc
6	Laryngeal forceps (20 inches)		Remove the pipe valve, etc
7	Long-nose pliers		Line cutting, terminal removal, etc

8	Hex wrench 4~12mm		Open the stop valve, valve, etc
9	Electric screw driver		Remove screws, etc
10	Clamp meter multi-meter		Test current, voltage, resistance, capacitance, etc
11	Vacuum pump		Vacuum of the refrigeration system

12	High and low pressure gauge refrigerant tube		Measure the refrigeration system pressure, vacuum, etc
13	Scissors		Cut strapping, thermal insulation cotton, etc
14	Band tape		Measure the distance, the length, etc
15	Marker pen		Record the data, mark, etc

Note: Other special tools are not listed, and the above tools can guarantee the basic maintenance and testing, etc.

⚠ The product shall be installed by the professional installation personnel according to the instructions.

Note: Correct installation is required to ensure safe operation. The requirements for the heat pump include:

1. Dimensions of the key connections.
2. Site assembly (if required).
3. Appropriate site location and clearance.
4. Proper electrical wiring.
5. Adequate water.

This manual provides the information required to meet these requirements. Before proceeding with the installation, thoroughly check all the pre-installation preparations and review the installation steps.

5.3 Installation position

1. Do not install the heat pump near the dangerous material and location.
2. Do not install the heat pump under a deep sloping roof without a drain, which forces the rain and debris to pass through the unit.
3. Place the heat pump on a slightly tilted flat surface, such as concrete or precast slab. This would allow proper drainage of condensed water and rainwater from the unit base. If possible, the floor shall be placed on the same or slightly above the level of the filtration system / equipment.
4. The installation position, spacing and ventilation shall meet the technical requirements of the heat pump unit manufacturer.
5. Avoid flammable gas leakage or environments with highly corrosive gases.
6. Intelligent control components of the electrical system and the system shall avoid being directly affected by strong electric and magnetic fields.
7. To facilitate maintenance and troubleshooting, there are(is) no obstacles within the vertical distance of 2 meters from the unit for convenient ventilation.
8. Keep away from densely populated areas, avoid areas prone to noise and vibration, and take noise reduction measures if necessary.
9. Unfavorable natural conditions (such as heavy oil smoke, strong sandstorms and serious lampblack pollution) should be avoided.
10. Safety warning signs shall be set up at the installation position.
11. The installation position shall be convenient for the water supply pipe and the electrical connection.
12. Give full consideration to the requirements of fire fighting, ventilation and drainage to facilitate maintenance and repair.
13. Equipped with qualified power supply matching with the equipment to be installed. The power supply should be dedicated, with sufficient capacity and reliable grounding.
14. The foundation or foundation of the installation site shall be solid, with sufficient bearing capacity, and the hollow structure or buried drainage ditch shall be adopted.

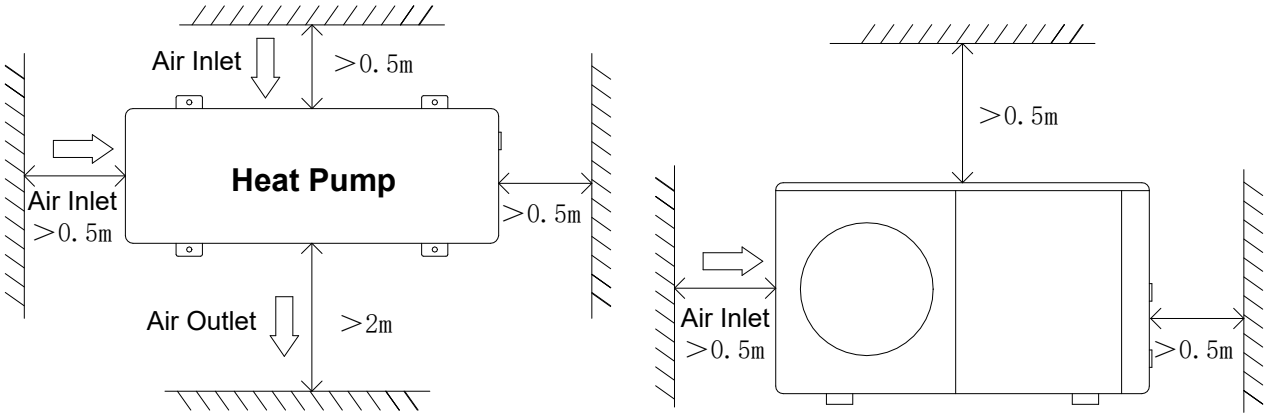
Isolation measures shall be added at the connection between the heat pump and the foundation. The process, use requirements, noise vibration amplitude, frequency characteristics, transmission mode, noise and vibration of the isolation measures shall meet the design requirements.

15. When the unit is installed on the roof or in the outdoor area, the lightning protection measures should be added.

5.4 Installation details

All of the criteria given in the following sections reflect the minimum clearance. However, each installation must also be evaluated, taking into account local prevailing conditions such as proximity and height of walls, and proximity to public access areas. The heat pump must be placed in all aspects to provide clearance for maintenance and inspection.

1. The heat pump installation area must have good ventilation, and shall not hinder the inlet and air outlet.
2. The installation area must have a good drainage system and have a solid foundation.
3. Do not install the unit in areas with corrosive gases (chlorine or acid), dust, sand and leaves.
4. For easier and better maintenance and troubleshooting, the obstacles around the unit shall not exceed 1 meter. No obstacles within 2 meters vertical from the ventilation device.(See Figure 1)



graph 1

5. Heat pumps must be fitted with shock-proof bushing to prevent vibration and / or imbalance.
6. Even if the controller is waterproof, avoid direct sunlight and high temperatures. In addition, the heat pump should be placed in an easy observation position to ensure that the use status of the wire controller can be viewed at any time.
7. Pipes must be fitted with proper supports to prevent possible damage caused by vibration.
8. Tap water pressure shall be kept above 196 kpa. Otherwise, the booster pump shall be installed.
9. The acceptable operating voltage range shall be within ± 10% of the rated voltage.
10. To ensure safety, the heat pump unit must be grounded.

5.4.1 General requirements

① Read the operating instructions before installation, use, and maintenance.

② The heat pump must be installed by a professional in accordance with the local electrical wiring specifications and this specification.

③ Before installation, please contact the local dealer center and check the complete packing before installation.

④ Do not use any method to accelerate the defrosting process or clean the cream(frost) unless specifically advised by the professional.

⑤ When repairs are needed, please contact the nearby after-sales service center.

⑥ The operation manual provided by the manufacturer must be strictly followed. Non-professional maintenance is prohibited.

⑦ The equipment shall be stored in a room without continuous fire source (e. g., open fire, illuminated gas furnace, open electric heater).

⑧ The storage environment of the equipment shall be kept ventilated to avoid direct sunlight.

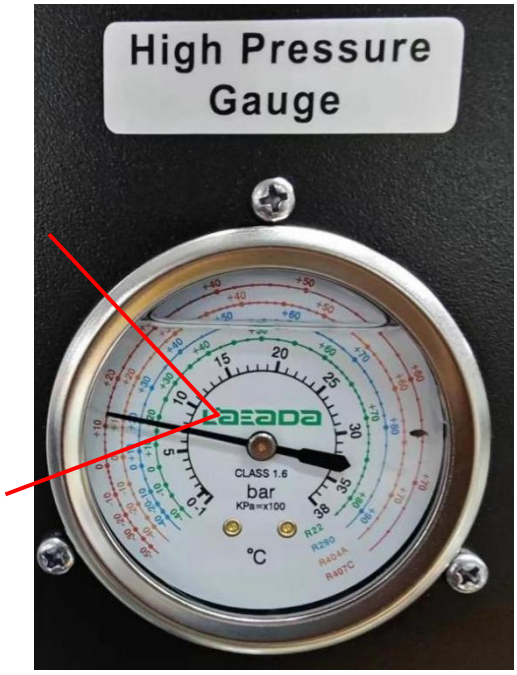
⑨ Safety checks must be performed to minimize the hazard risk prior to maintenance or repairing the R290 heat pump.

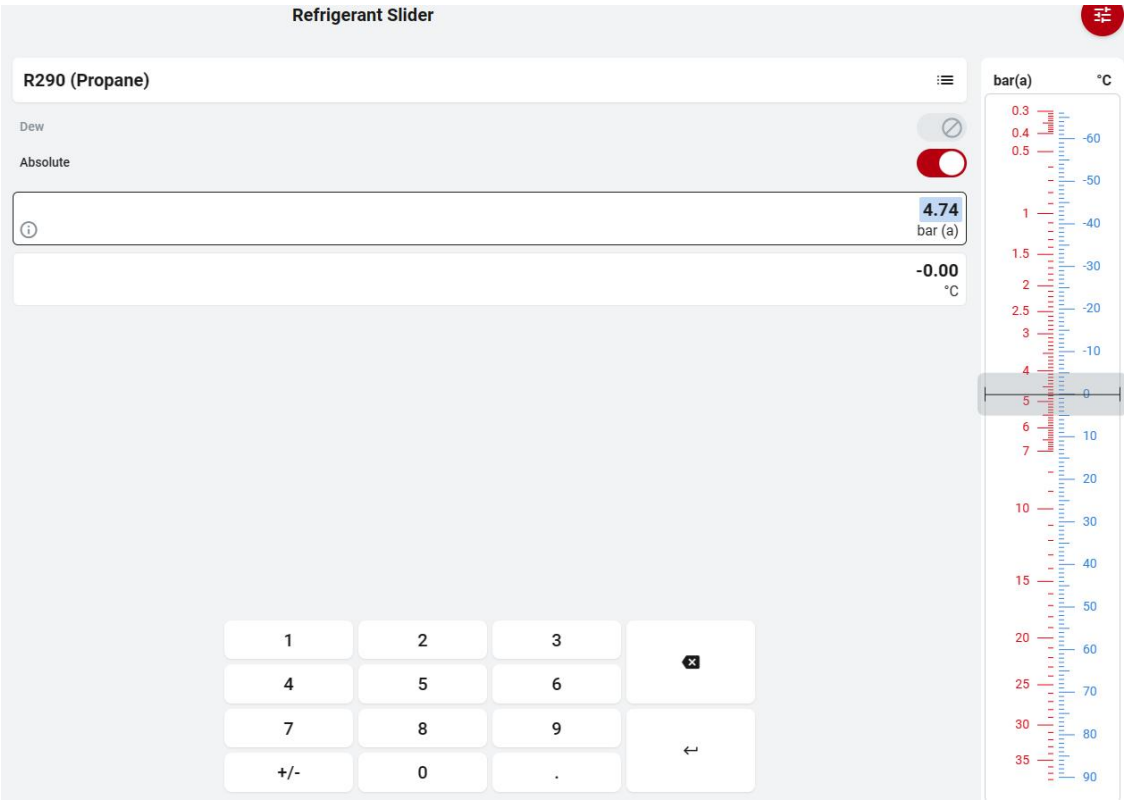
5.4.2 Open the package and check it

① The heat pump should be checked in a well-ventilated area (open doors and Windows). Fire source is strictly prohibited.

② Before opening the cabinet, check whether the pressure value of the heat pump is not in the below range and judge whether the refrigerant is leaking. If leakage is found, do not install a the heat pump.

Reference value: R290 ambient temperature -20~35℃
Corresponding to saturation pressure 0.2～1.2MPa





③ The heat pump shall be checked for trace of damage and for good appearance.

5.4.3 Safety principles for heat pump installation

① The installation site shall be well ventilated (open doors and windows).

② The use of R290 refrigerant is prohibited in areas where fire sources exist.

③ When installing the heat pump, anti-static measures should be taken, such as wearing cotton clothes / anti-static clothes, wearing cotton gloves, wearing wireless electrostatic bracelet, etc.

④ The leak detector must be in working condition.

⑤ If R290 refrigerant leakage is found during the installation process, it should immediately test the concentration of the indoor side environment, and open the doors and Windows for ventilation until the safety level is reached. If the refrigerant leakage affects the performance of the heat pump, the operation should be stopped immediately, and the heat pump must be returned to the service station for treatment.

⑥ The installation position of the heat pump should be easy for installation and maintenance, no obstacles around the inlet and exit of the unit, and not close to the heat source.

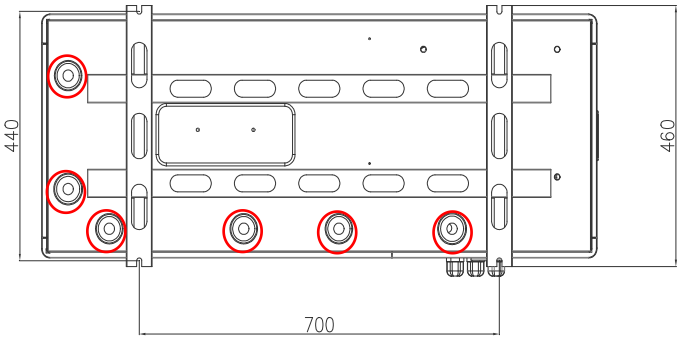
⑦ Do not be installed in a flammable and explosive environment.

⑧ When the heat pump is installed or repaired, when the length of the power line and the indoor and outdoor machine connection line is not enough, it must be replaced according to the original specifications. The connection and extension are strictly prohibited.

5.5 Drainage and Condensation

Condensation will occur from the evaporator when the unit is running and drain at a steady rate, depending upon ambient air temp. and humidity. The more humid the ambient conditions, the

more condensation will occur. The bottom of the unit acts as a tray to catch rainwater and condensation. The unit is designed 6 drain holes(see below red holes) that can drain condensate real time and keep the base clear from debris at all times.



5.6 Water system connection

It is recommended to install quick connection joints at the inlet and outlet connections. Steel and copper joints are recommended for the inlet and outlet joints of the heat pump. Heat pump piping recommends using stainless steel or PPR piping.

⚠ Note-Ensure that flow requirements and water supply pressure can be maintained shall be 0.15~0.8MPa.

5.6.1 Requirements for pipeline installation

1. It is recommended to install quick connect fittings at the connection between the inlet and outlet.
2. Suggest using stainless steel or PPR pipes for water pipelines.
3. When water pressure exceeds 0.8MPA, please use reducing valve to reduce the water pressure below 0.8MPA.
4. Each part connected to unit needs to be connected with method of loose joint and installed with intermediate valve.
5. Ensure that all plumbing has been properly completed and then proceed to do a water leakage and pressure test.
6. All the pipelines and pipe fittings must be insulated to prevent heat loss.
7. Install a drain valve at the lowest point of the system to enable the system to be drained during freezing conditions.
8. Install a check valve on water outlet connection in order to prevent back siphoning when water pump stops.
9. In order to reduce the back pressure, the pipes should be installed horizontally.
10. Minimize the elbows (90 degrees connections). If a higher flow rate is required, install a bypass valve.
11. **An exhaust valve** must be installed at the highest point of the circulating water system, and also at locally elevated areas.

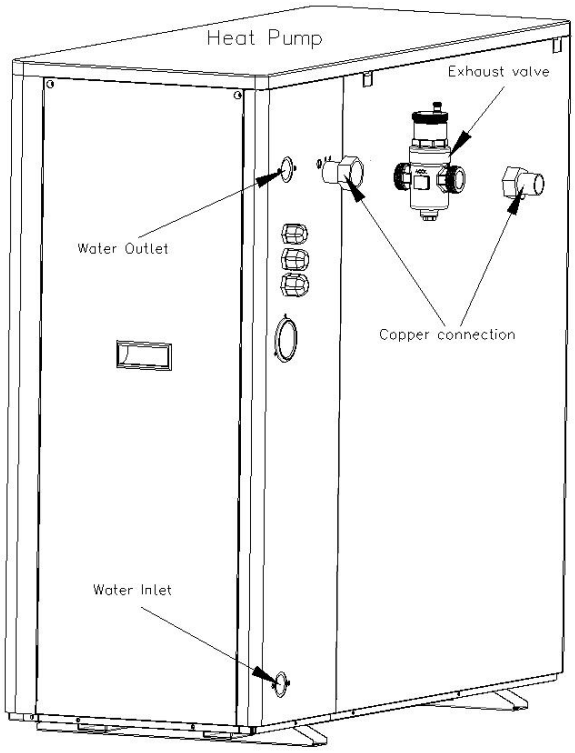
5.6.2 Main parts installation

Please refer to Part 4 for the selection and installation of key components.

5.6.3 Micro-bubble exhaust valve installation

The unit is equipped with an exhaust valve as standard at the factory, which can eliminate the air in the water pipe in real time. More importantly, when the refrigerant inside the plate heat exchanger leaks and mixes into the water pipe, the exhaust valve can promptly release the refrigerant, preventing it from entering the room and ensuring system safety.

WARNINGIt is necessary to install a micro-bubble exhaust valve, otherwise the consequences of refrigerant leakage into the water polluting the water quality will be borne by oneself. Please follow the diagram below and place it on the outlet pipe of the unit.



5.6.4 Water pipe diameter

Model	Water pipe diameter	Material
-081HE4	DN25	Copper or Stainless steel or PPR/PVC pipes
-101HE4	DN25	Copper or Stainless steel or PPR/PVC pipes

5.6.5 Water supply and pipeline exhausting steps

1. Open the exhaust valve and all valves on the water distributor first for exhaust;
2. Make up water at the pipeline filling port(**Water pressure of tap water ≥ 0.2MPa**);

3. During the water replenishment process, it is necessary to observe whether there is water overflow from the exhaust valve and drainage valve. If there is water overflow, it indicates that the system has been filled with water;

4. Close the exhaust valve and then take a look at the water pressure gauge. If the pointer is greater than 0.2MPa, close the makeup valve and the water pipeline already be emptied successfully.

Note: The water system pressure of the heat pump **design is 0.8MPA**.

Water pressure gauge

5.6.6 Water pressure debugging

1.Before the experiment, the pipeline should be fixed, the joints should be exposed, and water distribution equipment should not be connected;

2. The pressure gauge is installed at the lowest point of the test pipe section, with a pressure accuracy of 0.01Mpa;

3. Slowly fill the pipeline with water from the lowest point of the pipe section, fully eliminate the air inside the pipeline, and conduct a water tightness test;

4. Slowly increase the pressure of the pipeline, and it is recommended to use a manual pump for pressure increase. The pressure increase time should not be less than 10 minutes;

5. After boosting to the specified test pressure and stabilizing for 1 hour, the pressure drop shall not exceed 0.06Mpa;

6. Under 1.15 times the working pressure, after stabilizing for 2 hours, the pressure drop should not exceed 0.03Mpa;

7. During the test, there should be no leakage at each connection;

8. Allow two additional pressures within 30 minutes to increase to the specified test pressure.

5.6.7 Pipe insulation requirements

1. All hot water pipelines must be wrapped with insulation materials;

2. Wrap the insulation pipe flat on the hot water pipeline and wrap the tie wrap around it;

3. Wrap the insulation skin material (such as thin aluminum plate, aluminum foil, etc.) flat on the pipeline that has already been wrapped with the insulation pipe;

4. The wall thickness of the insulation pipe should be reasonably selected based on the local climate, and insulation thickness should be ≥ 20mm; Finally, wrap a layer of wrapping tape on

the insulation cotton.

6.Electrical connection

6.1 Notes for electrical wiring

Ensure that all the high voltage circuits are disconnected before you start installing the heat pump. Contact with these circuits may cause death or serious injury to the user, installer or other person, or property damage.

When repairing the heat pump, mark them before breaking the wires. Wiring failure may lead to improper and dangerous operations. After the maintenance is complete, check and ensure the normal operation.

Warning: Risk of electric or electric shock.

Ensure that all high voltage circuits are disconnected before starting the heat pump. Contact with these circuits may cause death or serious injury to the user, installer, or other person, or may cause property damage.

Note: Before before the heat pump. Wiring failure may lead to improper and dangerous operations. After the maintenance, check and ensure the normal operation.

6.2 Electrical wiring

1. If the power supply voltage is too low or too high, it may cause damage and / or cause instability

Operation of the heat pump unit because of the high rush current when starting.

2. The minimum starting voltage shall be greater than 90% of the rated voltage. Acceptable operations

The voltage range shall be within ± 10% of the rated voltage.

3. Ensure that the cable specifications meet the correct requirements for the specific installation.this one

The distance between the installation site and the mains power supply will affect the cable thickness. Select cables, circuit breakers, and isolation circuit breakers according to local electrical standards.

6.2.1 Ground protection and over-current protection

To prevent electric shock during unit leakage, heat pumps shall be installed according to local electrical standards.

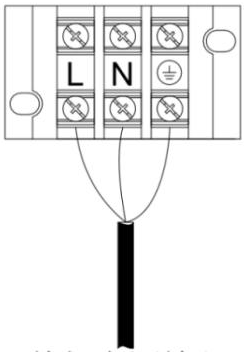
1. Do not interrupt the power supply of the heat pump frequently, otherwise it may shorten the expected life of the heat pump.
2. When installing the over-current protection, ensure that the correct current rating is met

Specific installation

3. The compressor, fan and water pump are equipped with relay protection. Therefore, during the installation and debugging process, the current of the above components is first measured to be within the current protection range. If the heat pump controller requires additional control of the secondary heater, the relay secondary heater (or power supply) must be connected to the relevant output of the controller.

6.2.2 Single-phase power supply wiring

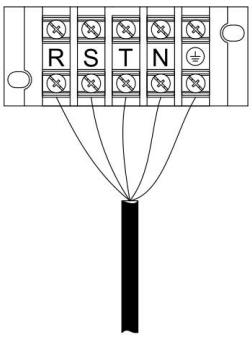
Please use a 3-core power cable of appropriate length according to local safety regulations and connect to the terminal block of the unit;



Single phase power input

6.2.3 Three-phase power supply wiring

Use 5-core power cables of appropriate length according to local safety regulations and connect them to the junction box of the unit.



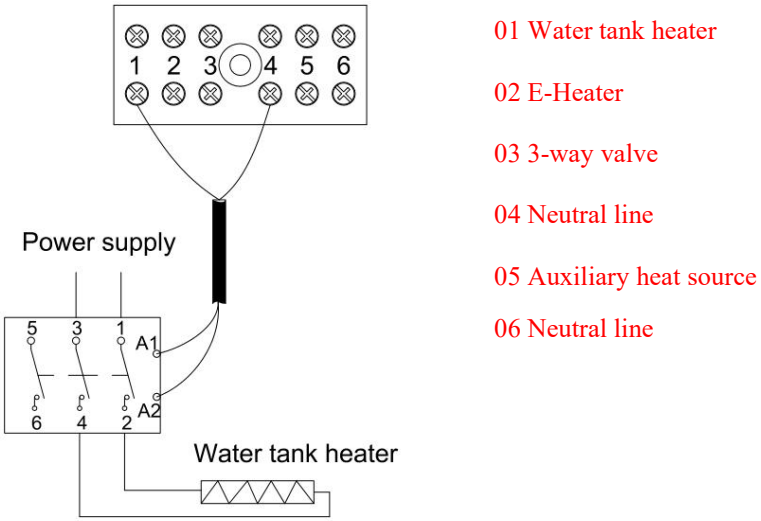
Three-phase power input

Power supply: Ensure the cable specifications meet the correct requirements for the specific installation.The distance between the installation site and mains power supply will affect the cable thickness. Follow the local electrical standards to select the cables, circuit breakers and isolation breakers.

Model	Power supply	Max. current (A)	Fuse/circuit breaker (A)	Wire diameter
	230V/1Ph/50Hz/60Hz	18.8	25	4mm²
	230V/1Ph/50Hz/60Hz	25.2	32	6mm²

6.2.4 Wiring of the water tank heater

Use 2-core power cables (1.0mm² 2) according to local safety regulations. The electric heating line of the water tank is 220V signal line, and the electric heating power exceeds 1 KW. External using appropriate relay or contactor connections.

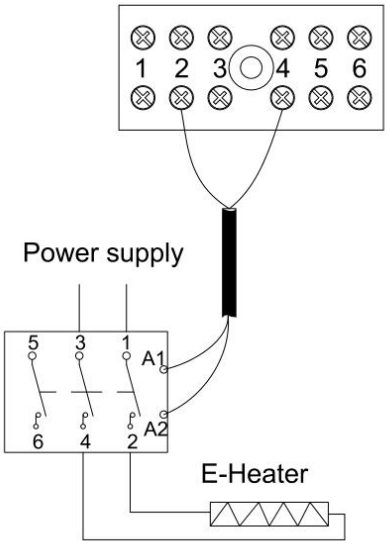


Remark: The water tank heater is optional and requires customers to purchase additionally.

6.2.5 Electric heater wiring

Please use a 2-core power cable (1.0 mm² x 2) that complies with local safety regulations. The electric heating line is a 220V signal line, and the electric heating power exceeds 1 KW, external

connection with an appropriate relay or contactor is required.



01 Water tank heater

02 E-Heater

03 3-way valve

04 Neutral line

05 Auxiliary heat source

06 Neutral line

Remark: The e-heater is optional and requires customers to purchase additionally.

6.2.6 Three-way valve wiring

1. Please use a 3-core power cable (1.0mm²×3) of appropriate length that meets local safety regulations. For example: The following wiring, brown to fire wire port (R), yellow to neutral wire port, blue wire to 3-way valve control port.
2. Please refer to the diameter of the inlet and outlet pipes of the heat pump to select the diameter of the three-way valve.
3. When in hot water mode, defrost mode, antifreeze mode, the three-way valve is turned on. Other modes, the three way valve is off.

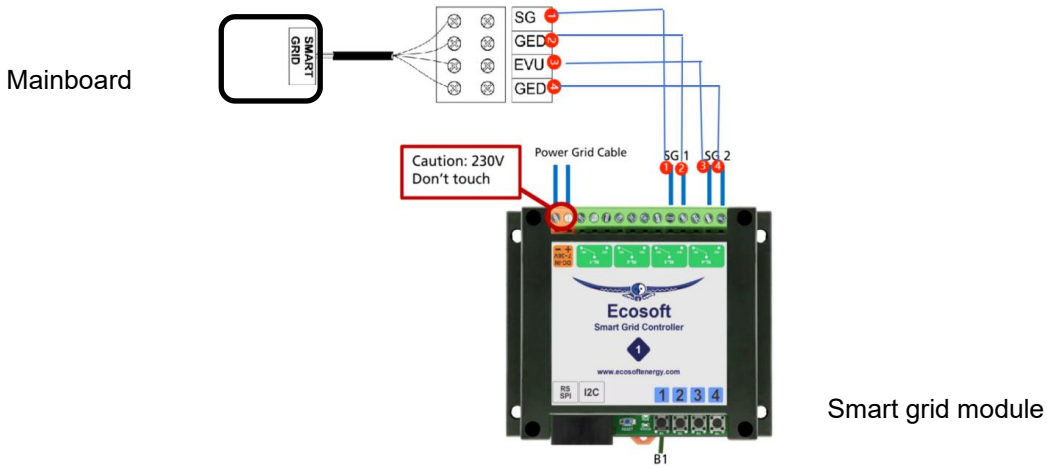
Remark: The three way valve is optional and requires customers to purchase additionally.

6.2.7 Smart Grid wiring

Connect the SG and the EVU terminals

The system monitors the power situation through the smart module, receives different SG and EVU signals, and determines whether the system is using photovoltaic power or mains power to operate the heat pump.

When connecting the SG and EVU signal, the heat pump will run in hot water mode priority to heat the water, then, according to peak electricity consumption or other conditions, provide hot water to users.



When the smart grid function parameter is selected to be enabled (S1 = 1), the heat pump starts running the smart grid function according to different SG and EVU signal.
EVU - Power grid signal controlled by the power company
SG - Smart grid, connect with smart meter, use the electricity from PV

Mode	EVU	SG	Operating state	Control logic
Operating mode 1	ON	OFF	Block out	The heat pump will be forced to shut down the compressor and fan(Compressor icon flashing)
Operating mode 2	OFF	OFF	Normal operation	The heat pump operates in normal mode
Operating mode 3	OFF	ON	Increased recommendation	1. Heating/cooling mode operates in powerful mode; 2. When operating in hot water mode: a. The target water temp. will be S2 degrees (S2 range 0-30) higher than the normal setting, the maxi water temp is 70℃; b. R290 refrigerant (if the set temp. plus S2 temp. increment exceeds 55℃, the electric heating will be turned on and the compressor operates continuously); c. R32 refrigerant (if the temp. plus S2 temp. increment exceeds 55℃, the back up electric heating will be turned on and the compressor will be turned off).
Operating mode 4	ON	ON	Increased command	1. Heating/cooling mode operates in powerful mode; 2. When operating in hot water mode: a. The target water temp. will be S2 degrees (02 range 0-30) higher than the normal setting, the maxi water temp is 70℃; b. Heating mode forcibly turns on back up electric heating, R290 refrigerant (hot water mode forcibly turns on water tank electric heating, (P30 set to enabled, electric heating forcibly turned on)); c. R32 refrigerant (if the temp. plus S2 temp. increment exceeds 55℃, the electric heating will be turned on and the compressor will be turned off).

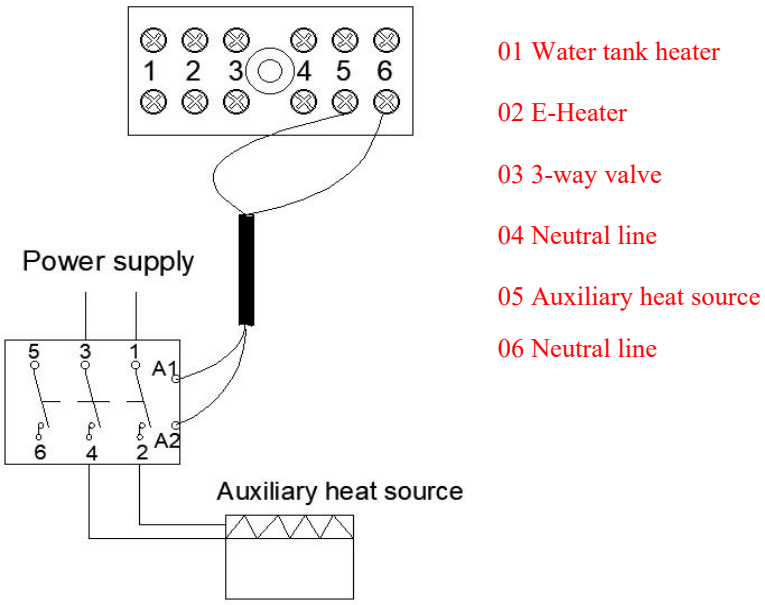
***Attention: When electric heating needs to be turned on, it is necessary to select the electric heating mode (P30) in advance:**

P30	E-heater mode selection	0: disable 1: backup E-heater 2: water tank electric heating 3: backup E-heater + water tank electric heating

Remark: The smart grid module is optional and requires customers to purchase it in the local market.

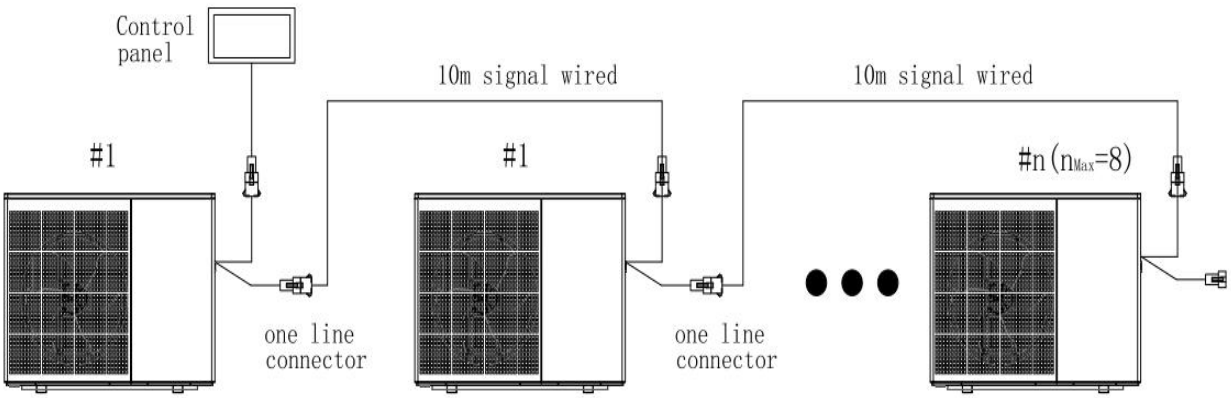
6.2.8 Auxiliary heat source

Please use a 2-core power cable (1.0-1.5 mm² x 2) that complies with local safety regulations. The Auxiliary heat source is a 220V signal line, and the auxiliary heating power exceeds 1 KW, external connection with an appropriate relay or contactor is required.



Remark: The auxiliary heat source is optional and requires customers to purchase additionally.

6.2.9 Multiple heat pump units Cascading



When conducting a cascade connection, set the dialing number for each mode on the main control board to control up to 8 units. The detailed dialing codes are listed below:

Unit	SW1-2	SW1-3	SW1-4
#1	OFF	OFF	OFF
#2	OFF	OFF	ON
#3	OFF	ON	OFF
#4	OFF	ON	ON
#5	ON	OFF	OFF
#6	ON	OFF	ON
#7	ON	ON	OFF
#8	ON	ON	ON

Water pipeline installation

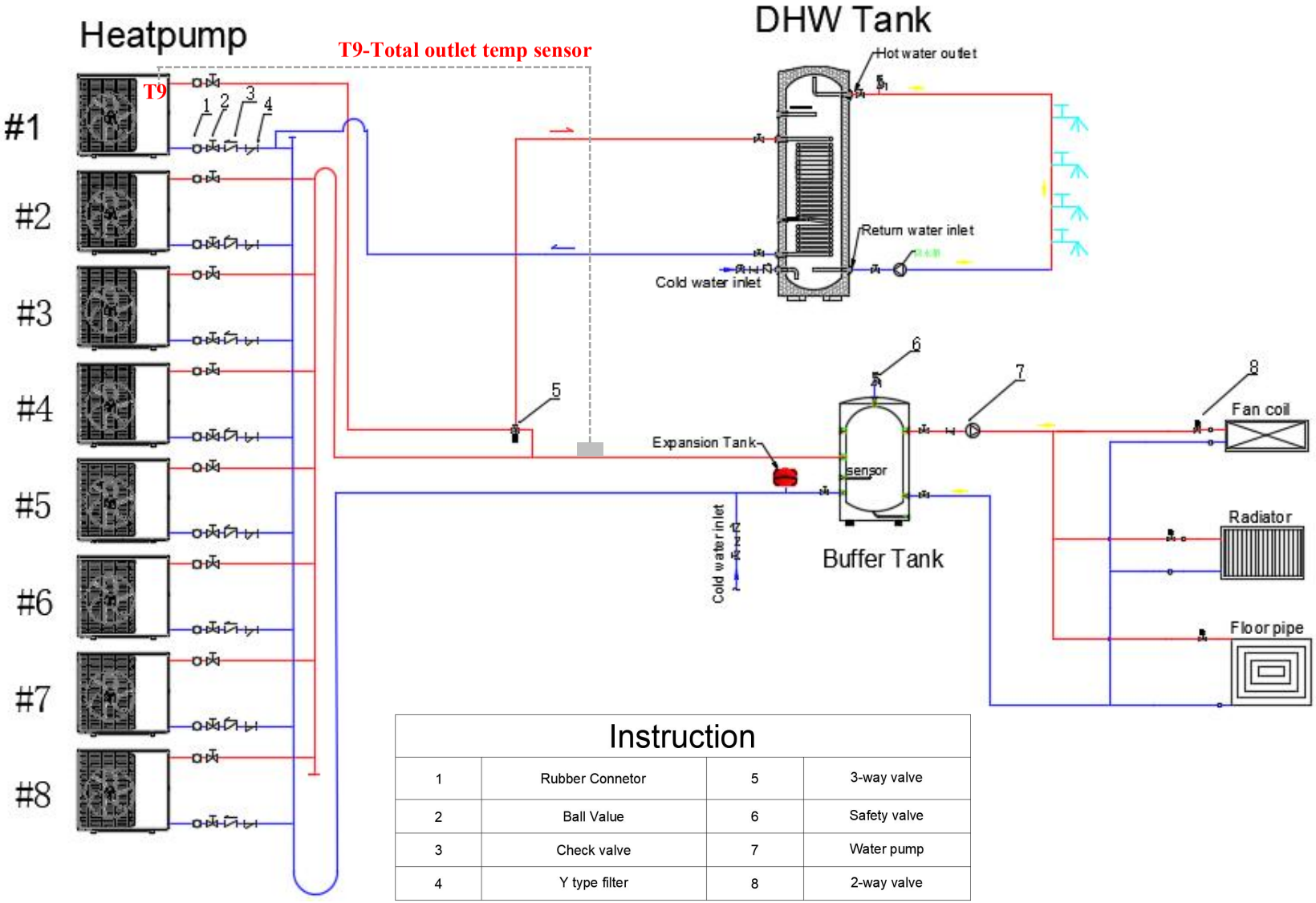
Up to 8 sets are online, and the slave address is as shown in the figure: 0=off; 1=on; Sw-1 is reserved without change;

1.The first heat pump is set as the master(#1), and the addresses #2~#8 are slave units. The slave units only operate for heating mode, not for hot water mode;

2.The master unit can provide both hot water and heating. If a hot water function is required, the master unit provides hot water to the hot water tank, while the slave units operate for heating.

3.The three-way valve is connected to the water circuit of the master unit and the hot water mode is controlled by the master unit. Shown as below:

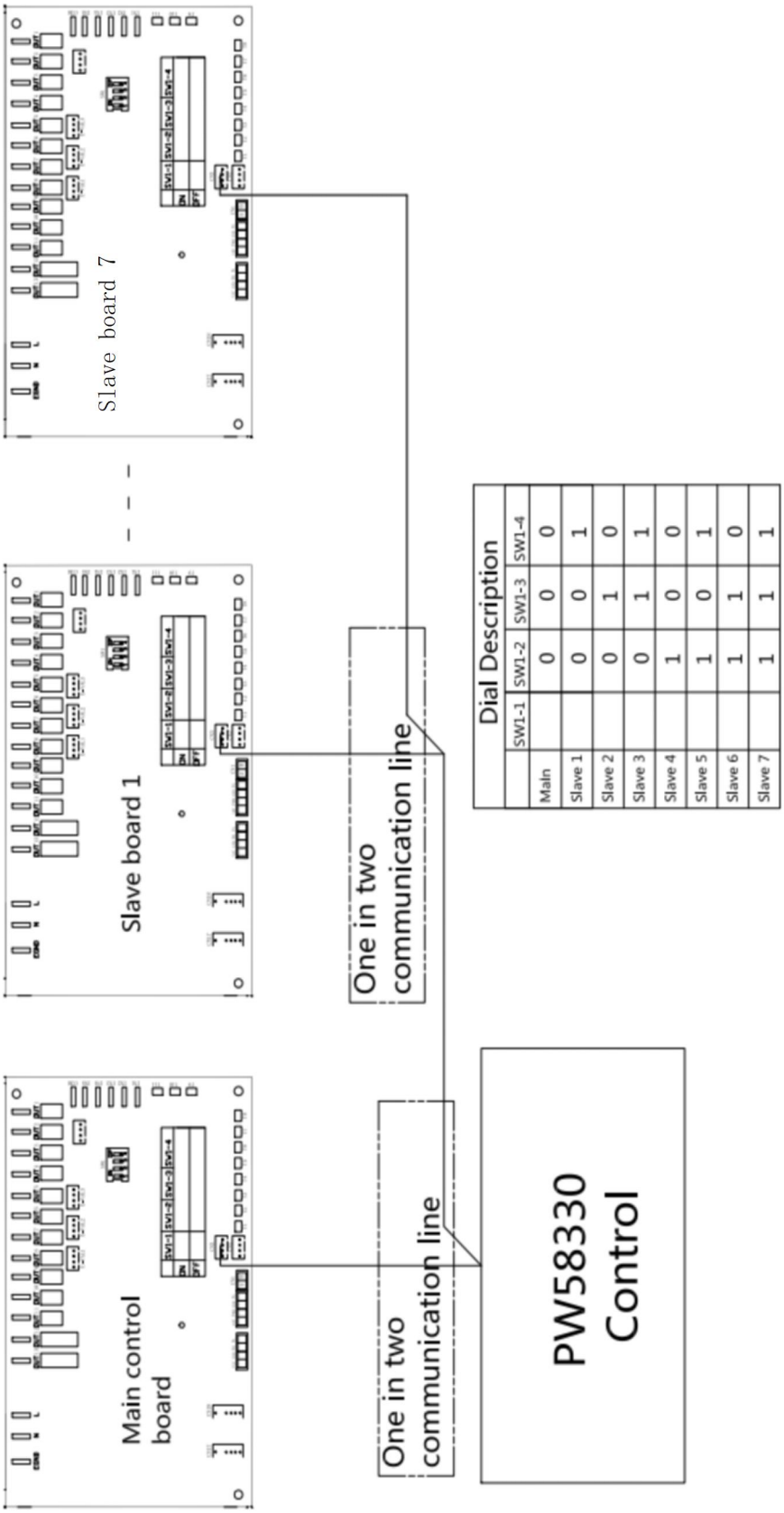
4.The entire cascading units are controlled by the master unit, and users can set the number of startup and shutdown units according to their needs.



Instruction			
1	Rubber Connetor	5	3-way valve
2	Ball Value	6	Safety valve
3	Check valve	7	Water pump
4	Y type filter	8	2-way valve

5.Up to 8 units are connected, and the unit address is shown in the figure: 0=off; 1=on; SW1-1 is reserved and does not require modification;

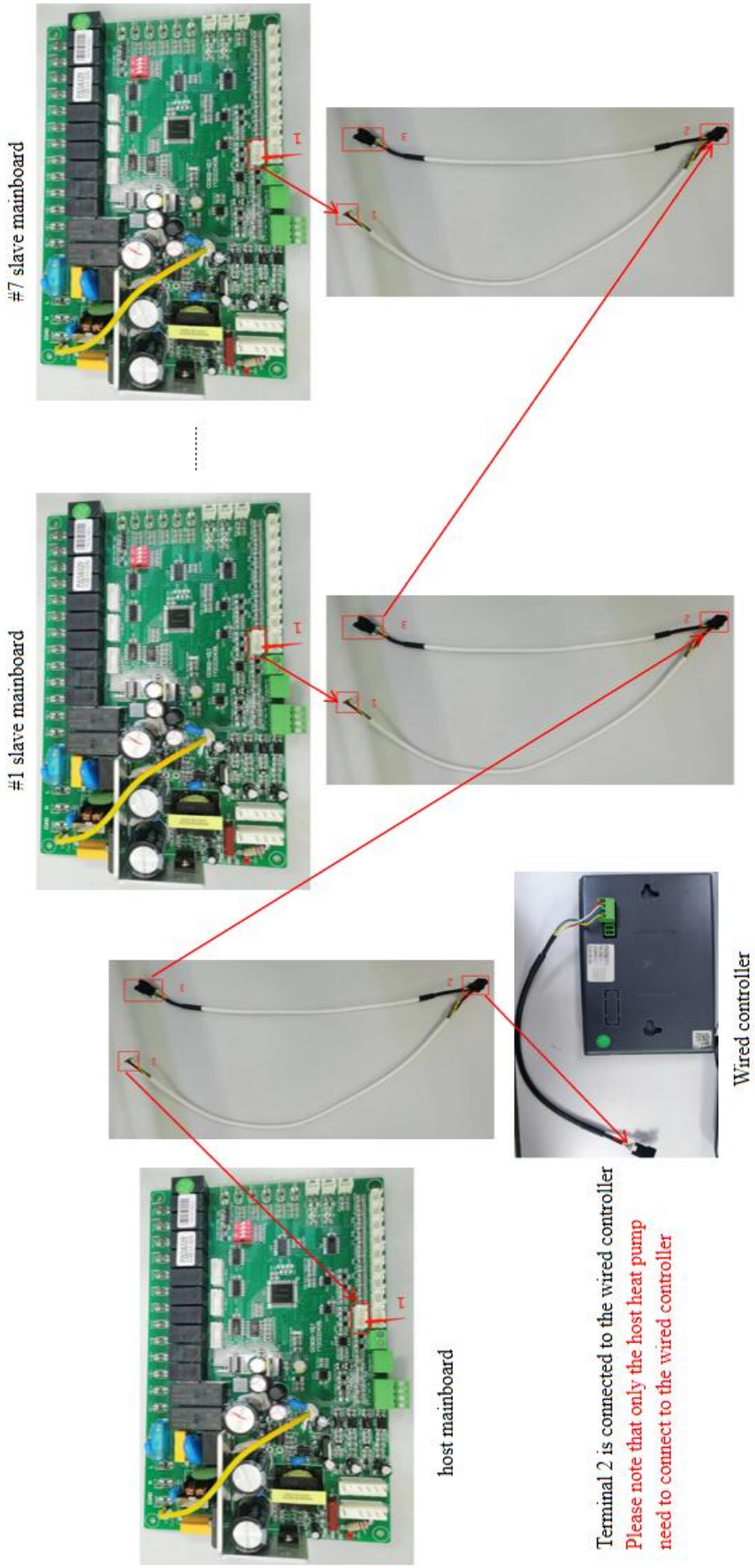
6.Set the number of cascades on the wired controller P28 to 1-8, and the circuit connection steps are as shown in the figure.



Dial Description

	SW1-1	SW1-2	SW1-3	SW1-4
Main		0	0	0
Slave 1		0	0	1
Slave 2		0	1	0
Slave 3		0	1	1
Slave 4		1	0	0
Slave 5		1	0	1
Slave 6		1	1	0
Slave 7		1	1	1

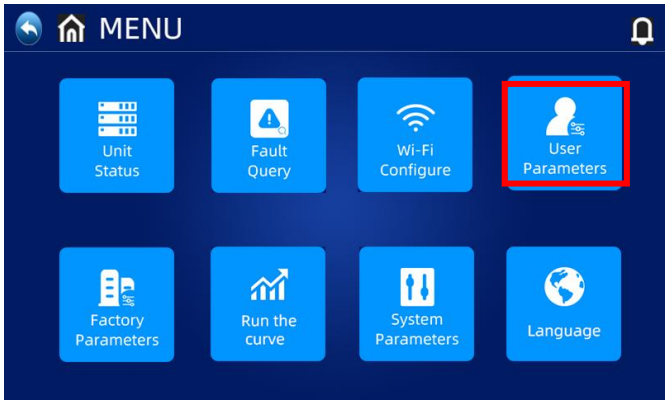
Main Board Connect Procedure

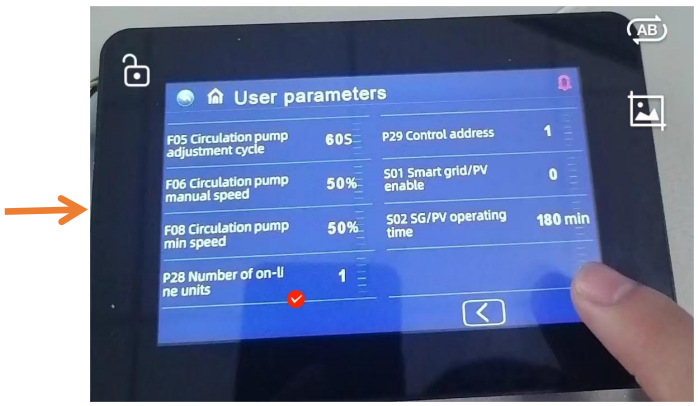


Wired controller setting

After finishing the above installation steps, please go to the wired controller to set the numbers of cascade.

Setting→Factory Parameters→input code “666” and then adjust P28 to set the number of online units, indicating how many units are cascaded.

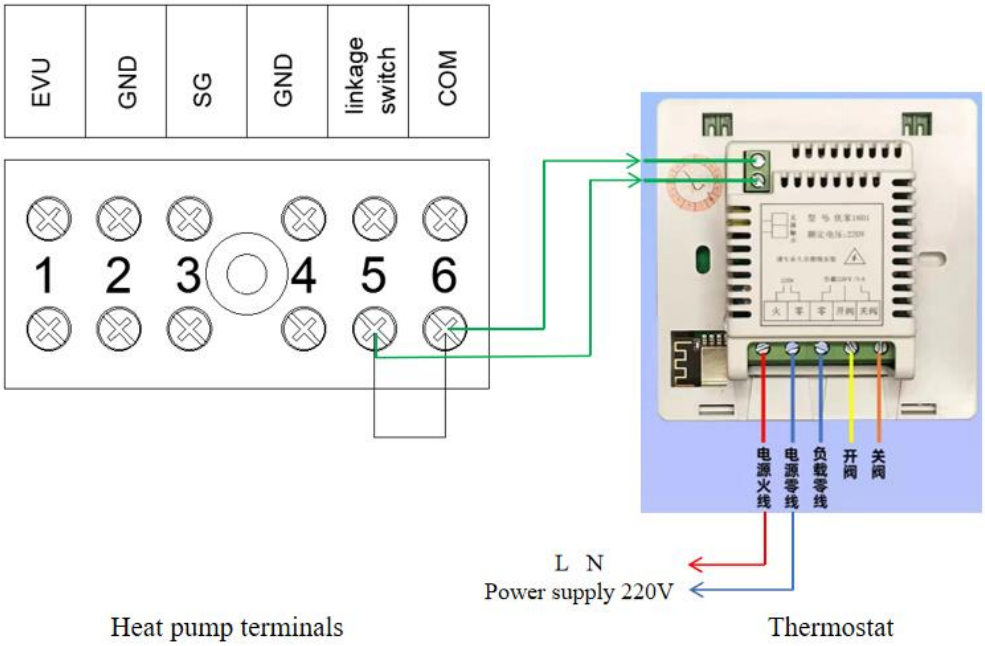




6.2.10 Linkage switch wiring

The linkage switches 5 and 6 need to be short circuited in order to perform normal cooling or heating(Factory setting);

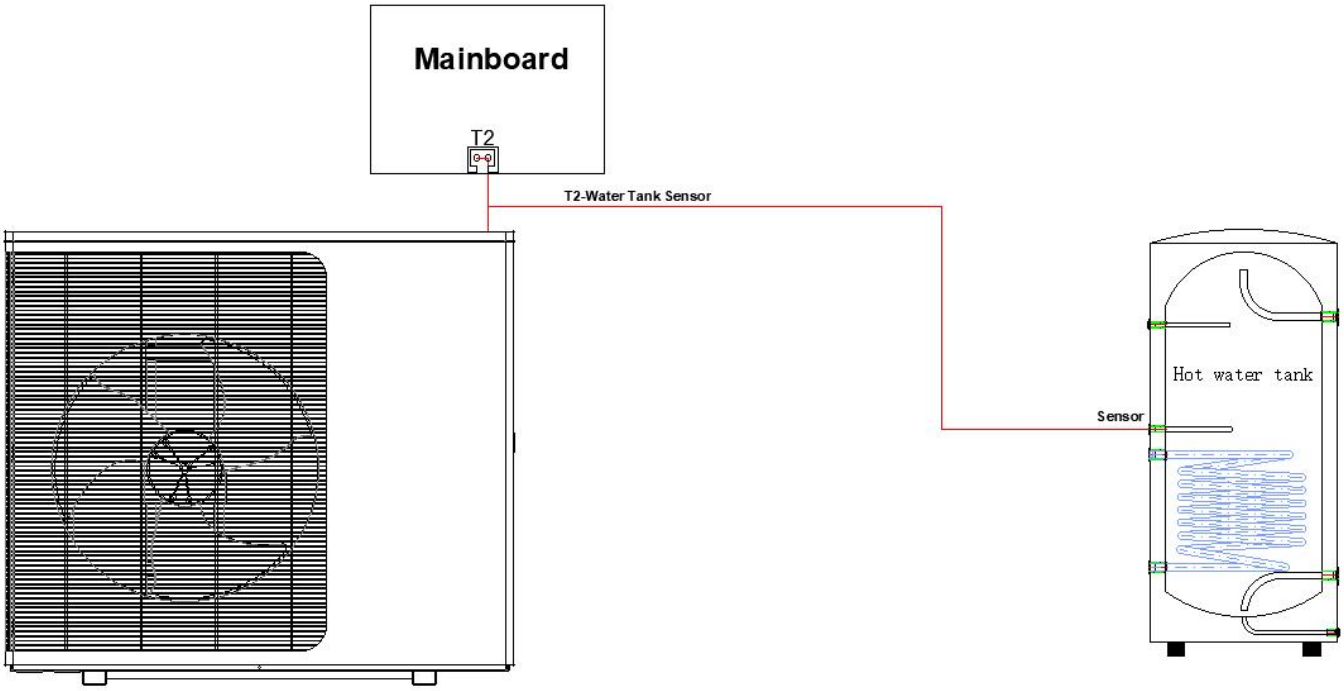
If the customer needs to connect the room thermostat, the communication wire needs to be connected to the linkage switch 5 and 6 terminals in order to control the heat pump.



Remark: The thermostat is optional and requires customers to purchase additionally.

6.2.11 Water tank sensor wiring

The heat pump is standard with a water tank sensor(T2) from factory, the length is about 10m, users can directly install the sensor probe to the corresponding position in the hot water tank.



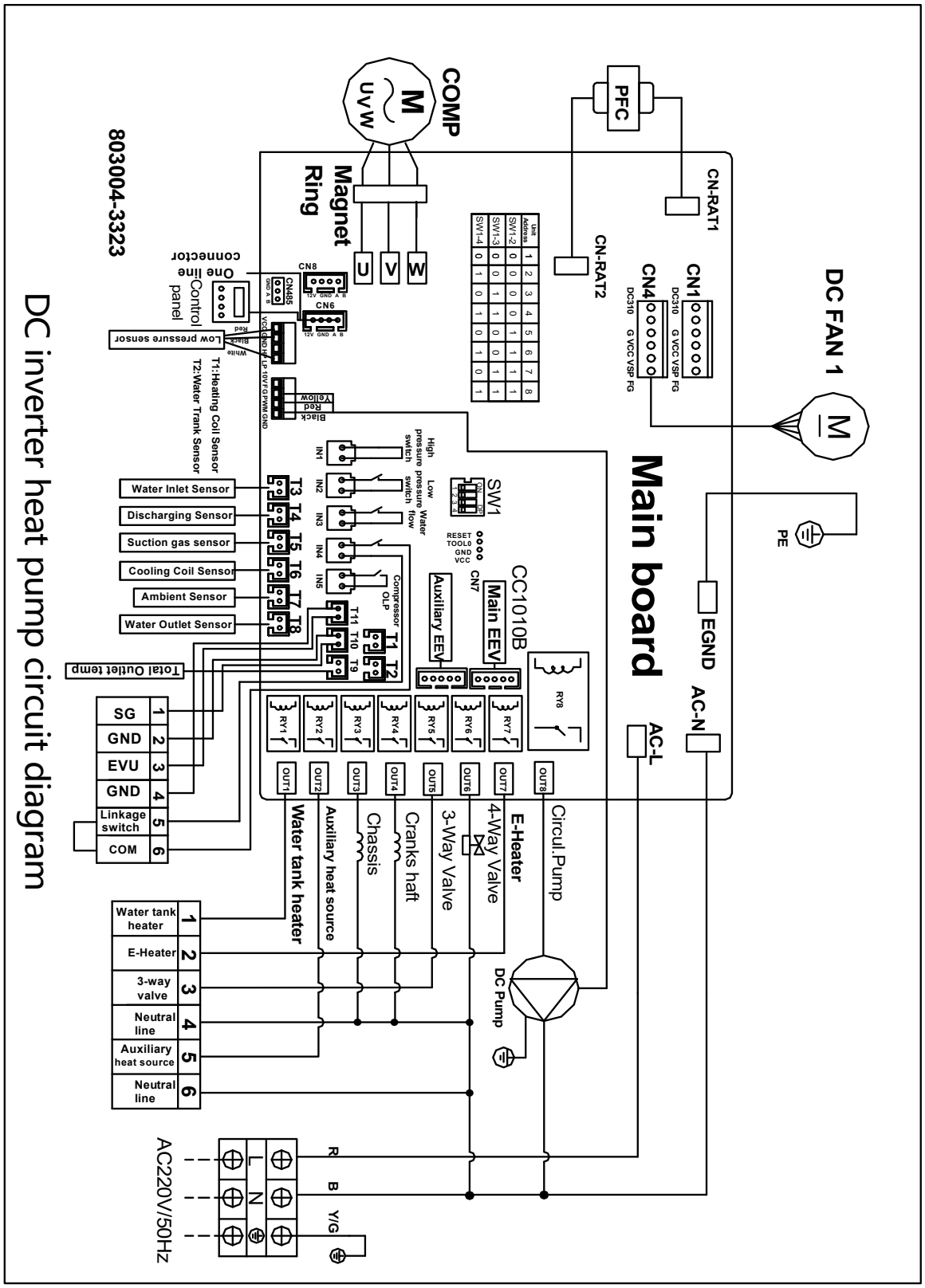
6.2.12 Temperature Sensor Position

The heat pump is designed with 8 temperature sensors at the factory, that are used to detecting the temperature and translate the temperature signal to electricity signal to the mainboard.

The installation positions of each temperature sensor and the resistance values measured at a 25 ℃ ambient temperature are shown in the table below.

Description	Sensor	Location in heat pump	Resistance
Heating Coil Temp. Sensor	T1	Evaporator pipe	5K
Water Tank Temp. Sensor	T2	Sensor has put in Electric Box(Accessory). Need to set it in the water tank	5K
Inlet Water Temp. Sensor	T3	Inlet Water pipe port	5K
Exhaust Gas Temp. Sensor	T4	Compressor outlet pipe	50K
Suction Gas Temp. Sensor	T5	Compressor inlet pipe	5K
Cooling Coil Temp. Sensor	T6	Condenser pipe	5K
Ambient Temp. Sensor	T7	On the side of the fins heat exchanger	5K
Outlet Water Temp. Sensor	T8	Outlet Water pipe port	5K
Total Outlet Temp. Sensor	T9	Total outlet pipe	5K

6.3 Wiring diagram



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7.Commissioning

7.1 Precautions

1. Trial operation can only be conducted after electrical safety inspection.
2. Do not block the inlet and outlet of the air, as this may cause the unit performance degradation or start the protection procedure that will make the machine unable to operate.
3. Ensure that all valves are opened, flush the water system piping, and ensure that the water cleanliness meets the requirements.
4. Fill and empty the water system to ensure that there is no air in the water system.

7.2 Trial Operation

1. Use the control panel to control the operation of the machine, and check the following items according to the operation instructions.
2. Check whether the control panel on/off button is normal.
3. Check whether the function key on the control panel is normal.
4. Whether these parameters are normal.
5. Whether the drainage system is normal.
6. The temperature difference between inlet and outlet should be (4-7℃).
7. Whether the vibration and sound are normal during the operation.
8. Whether the discharged air, noise and condensate generated during the operation will affect the neighbors.
9. Whether there is any refrigerant leakage.

Note: When the unit stops and starts, the unit has protection function and the compressor is delayed for 3 minutes.

Note: Please refer to Appendix B and C for commissioning checking.

8.General Maintenance

The R290 DC inverter air source heat pump unit is a highly automated device. Regular and effective maintenance on the unit will greatly improve the operation reliability and service life of the unit.

During the maintenance process, pay more attention to the following important tips:

1. The water filter should be cleaned regularly to ensure that the water quality is clean and avoid the damage caused by the blockage of the filter element.
2. Users shall not change the internal structure or wiring of the equipment. All the safety protection devices have been set up before leaving the factory, and changes on them are strictly prohibited. We shall not assume any responsibility for the equipment damage caused by user adjustment.
3. The unit shall clean the surface of the evaporator regularly (every 1-2 months). If the unit is operating in a dirty or oily environment, professionals shall clean the evaporator with designated detergents to ensure the performance and efficiency of the unit.
4. Regularly check the feeding and exhaust device of the water system to prevent air from entering the system, leading to reduced water circulation or water circulation failure, and affecting the cooling and heating efficiency and working reliability of the unit.
5. The intelligent control system can automatically analyze various protection problems in daily use, and display the fault code on the controller. The unit can recover by itself. No maintenance is required for the piping within the unit under normal operating conditions.
6. The power supply and electrical wiring of the unit should be checked regularly to ensure that the wiring is firm and the electrical components are normal. If abnormal, it should be repaired or replaced, and the unit shall be reliably grounded.
7. During the operation of the unit, check all kinds of parts regularly. Check whether the working pressure of the refrigerant system is normal. Check the pipe joint and air injection valve for grease. Ensure that there is no refrigerant leakage in the refrigerant system.
8. Check whether the unit is firmly installed. Do not pile up any debris around the equipment to prevent the blockage of the air outlet. The environment around the unit shall be kept clean, dry and ventilated.
9. When the unit will not be used for a long time to rest after a period of operation, the water in the water system should be drained. And turn off the power supply, cover the equipment. When the unit needs to be used again, wait for the water system to fill the water, until the unit is thoroughly checked, start and preheat for at least 6 hours and restart the unit only after everything is OK.
10. No special repair or maintenance on the water system of the unit unless the water pump is damaged. It is recommended to clean or replace the water filter regularly when it is very dirty or blocked.

Precautions:

1. The unit shall be equipped with a specialized power supply. The voltage range shall be

within ± 10%. The switch shall be an automatic air switch. The set current shall be 1.5 times of the operating current and equipped with no phase protection device. No knife switch is used in the unit.

2. It must be powered up for at least 12 hours before seasonal operation. If the machine does not work for a long time in winter, you must drain all the water in case the pipe and the unit are frozen and damaged. The controller shall be consistent with the unit. If the heating machine stops working in winter, no power shall be removed to avoid freezing and damage.

3. Heat pump switch can not be operated frequently, not more than 4 times within 1 hour. Electrical cabinet shall be protected from damp influence.

4. It is strictly prohibited to flush the DC inverter air source heat pump with water to avoid electric shock or other accidents.

8.1 Daily inspection of heat pump

1. Before starting up, check the temperature parameters, switch status, and load output:

A.The temperature displays are not significantly different from the ambient temperature

B. It is normal to measure with a multi-meter that the high and low pressure switches are normally closed, while the water flow switch is normally open

C. Main parts load display off

3. Check if the voltage is normal before starting up.

4. After starting up, check if the water pressure is normal, listen for any abnormal sounds when starting each part, and check if the current matches the nameplate markings after running smoothly;

5. Check if all parameters are within the normal range according to system and user parameters after operation.

8.2 Maintenance of Main Structural Components

1.The surroundings of the unit should be kept clean to avoid storing debris. Avoid blocking the air outlet and affecting heat exchange efficiency.

2.It is strictly prohibited to connect air energy heat pump units to substandard water sources such as excessive water, lake water, river water, and groundwater.

3.When maintaining the unit, the main unit must be in a power off state. If the shutdown time is long, the water in the unit pipeline should be drained, the power should be cut off, and a protective cover should be put on. When running again, conduct a comprehensive inspection of the system before starting up.

4.Heat exchanger

A.Regularly clean the water side heat exchanger, it is recommended to clean it every 3 months, and use a hot oxalic acid solution with a concentration of 15% at 50 ℃ -60 ℃ to clean the heat exchanger, then start the built-in circulation pump of the unit to clean for 3 hours, and finally rinse it three times with tap water.

B.When installing pipelines, it is recommended to reserve a three-way valve interface to prevent cleaning solution from entering the water tank, and seal one interface with a

screw plug in case of connection during cleaning.

C.Do not use corrosive cleaning solution for heat exchangers or water tanks.

D.The air side heat exchanger should be cleaned regularly (3-6 months) to maintain good heat exchange efficiency. Before cleaning, the power must be cut off. When cleaning surface stains, please use a damp cloth dipped in a small amount of neutral cleaning agent to gently scrub, do not use gasoline or other solvents. Finally, wipe dry with a dry cloth to keep the unit dry.

5.Compressor

Open the junction box, check if the terminals are tightly connected and if there are signs of rust or blackening, and check if the resistance values between the three-phase windings are the same.

6.Water tank

The water tank needs to be cleaned of scale after a period of use (usually 3 months, depending on local water quality), and the drainage valve should be opened until clean water flows out.

8.3 Maintenance of Main Electrical Components

1. General inspection of air circuit breakers, AC contactors, and relays: Check whether the wiring terminals are tight, rusted, and burnt black. Close the switch and check whether the input and output of each phase of the electrical terminal are connected; Check whether the coil of the AC contactor and relay is sensitive and fully engaged.

2. Capacitor: Check for bulging and oil leakage.

3. Mainboard: Check if the power light is on, if the fuse is blown, and if there are any burnt black marks on the board surface.

4. Wired controller: Check whether the buttons are sensitive, whether the interface is not fully displayed, and whether the temperature can be set.

5.Check if the primary voltage and secondary voltage match the nameplate.

8.4 Maintenance of Main Water pipeline Components

1. Water replenishment device: Check if the replenishment pressure is ≥ 0.2MPA and if the check valve is working normally;

2. Filtering device: The Y-filter in the pipeline should be cleaned regularly to prevent blockage. Suggest cleaning every 15-30 days. The waterproof cover of the water pump effectively protects against rainwater immersion, and manually rotate the fan blades of the water pump to check if they are stuck;

3. Exhaust device: Check if it can exhaust normally. If it cannot exhaust normally, remove and clean the filter inside;

4. Water pump device: Check whether it operates smoothly, whether the rotation direction is correct, and whether it is blocked or idling.

8.5 Maintenance of anti-freeze

1. Keep powered on

Please do not turn off the power when the heat pump is temporarily out of use or when it is not in use, as the unit is equipped with anti freeze protection function. Only when the unit is running normally or the circulation pump is running normally, can the unit ensure that water does not freeze in cold weather. Therefore, the water temp can be appropriately lowered to save power. (It is recommended to set the water temp to 25-30 ℃ when not in use for a short period of time, which not only saves electricity but also prevents freezing.).

2.Pipeline insulation

Adequate insulation measures should be taken for the pipeline. Please pay attention to checking whether the insulation wrapping of the pipeline is in place to avoid freezing blockage of the pipeline. The pipeline insulation mainly uses insulation cotton and polyurethane foam.(Small pipes are generally insulated with insulation cotton, while large pipes are insulated with polyurethane foam.)

3.Shutdown precautions

If the user is not at home for a long time, the heat pump needs to be shut down for a long time, or if the power outage lasts for more than 15-30 minutes, the user must drain the water in the heat pump pipeline to prevent the water from freezing when the unit stops running. After thoroughly draining the water, the power should be turned off to prevent the unit from running incorrectly due to water shortage.

4.Precautions for antifreeze

For heat pump systems, it is recommended that users add antifreeze to protect the pipelines from freezing.

It is recommended to pay attention to the following points when using antifreeze:

Choose high-quality antifreeze. Although counterfeit products are cheap, the quality cannot be guaranteed.

2. The amount of antifreeze used is equivalent to the water amount in the system, and a suitable antifreeze should be selected based on the local minimum temperature, the freezing point of antifreeze should be 5-10 degrees lower than the local min temperature. (such as ethylene glycol antifreeze -25 ℃ type, -30 ℃ type).

3. When preparing antifreeze, the ethylene glycol content should not exceed 68%, otherwise the freezing point will no longer decrease, and instead, it will cause an increase in the low-temperature viscosity of the antifreeze and a decrease in heat dissipation.

4. Different types of antifreeze should not be mixed to prevent chemical changes, precipitation, or corrosion.

5. Please regular inspect the pipeline antifreeze status, and it is recommended to replace the antifreeze every 2-3 years.

8.6 Refrigerant Charging

Refrigerant plays an important role in the cooling or heating process, and the lack of refrigerant directly affects the effect of cooling or heating. Before adding the refrigerant, please note the following:

(1) The work shall be done by a professional personnel.

(2) If there is insufficient refrigerant, check leakage in the system. If yes, repair before charging refrigerant, otherwise the unit will run out of refrigerant again after short operation.

(3) Do not add too much refrigerant, otherwise it may cause other faults, such as high pressure, poor performance, etc.

(4) There must be no air in the refrigerant system because air can cause abnormal high pressure, damage the gas pipe and affect the cooling or heating efficiency.

(5) If there is a refrigerant leakage in the room, keep the window open for several minutes, evacuate persons at the site and evacuate the refrigerant naturally.

Note: Always use a weight scale to measure the refrigerant amount entering the unit.

The heat pump has been charged with refrigerant before leaving the factory, and the charging amount is shown in the table below.

Model	Power supply	R290 Refrigerant amount from factory
-081HE4	230V/1Ph/50Hz/60Hz	0.95kg
-101HE4	230V/1Ph/50Hz/60Hz	1.3kg

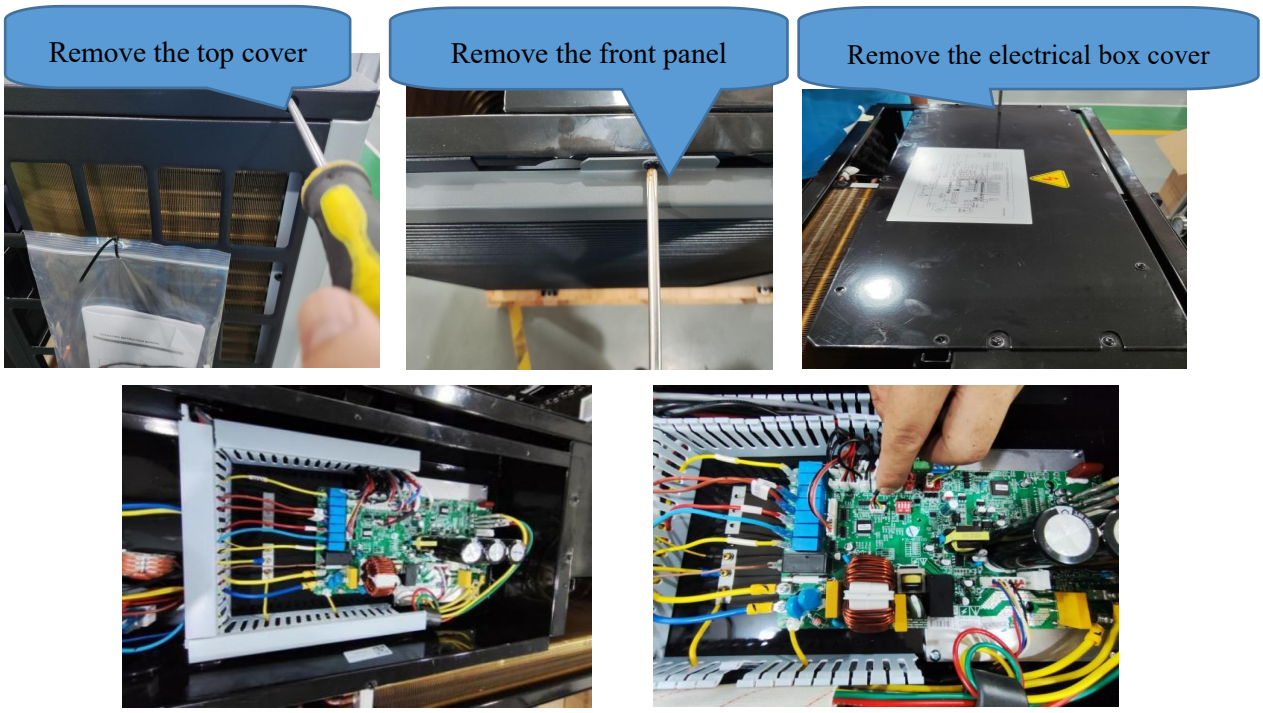
Note: If there is a leakage during the operation of the heat pump, please power off it and then drain the refrigerant in the system and vacuum it, next it is necessary to refer to the refrigerant charging amount on the nameplate.

8.7 Inspection and Maintenance on the Heat Pump

Dangerous: requires professional operation

8.7.1 Maintenance of the wired controller

Disconnect the power supply, remove the top cover of the unit, and remove the electrical box cover. Conduct the necessary maintenance work on the controller and electrical components of the unit.

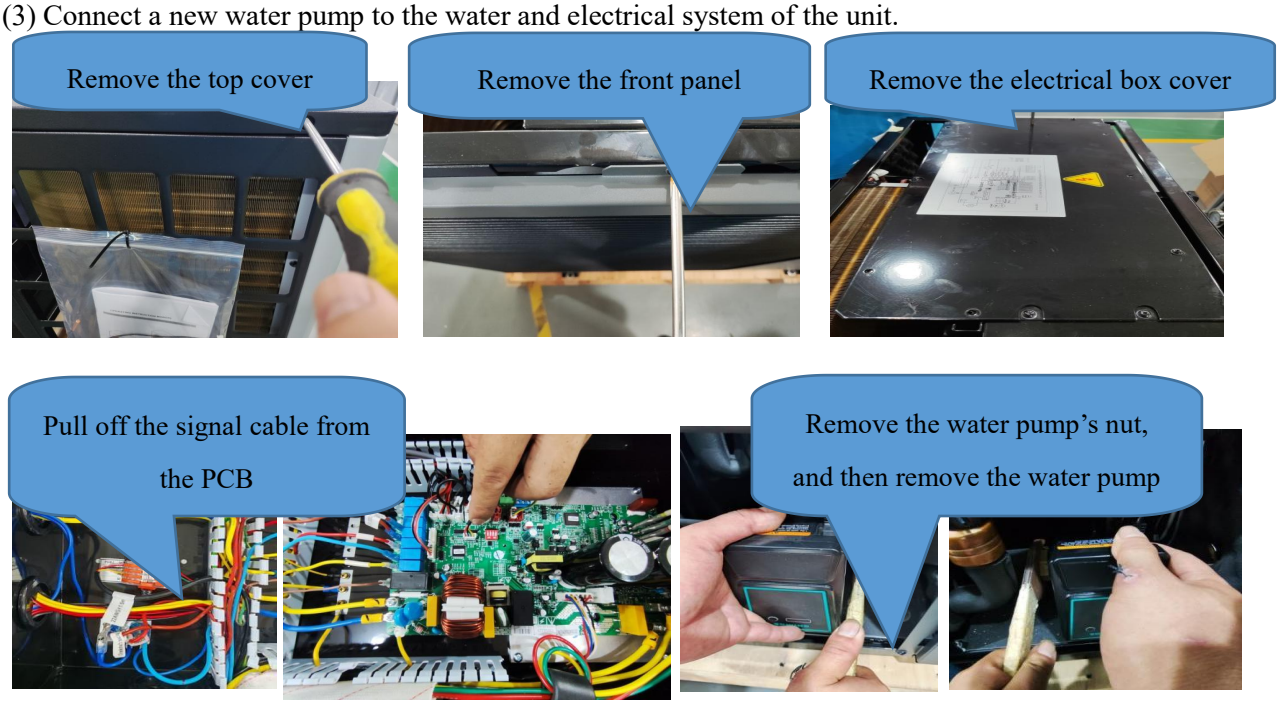


8.7.2 Replace the Water Pump

(1) Disconnect the power supply, open the front panel, and then remove the electrical box cover. Disconnect the quick connector for the water pump's power supply and unplug the signal cable connected to the PCB.

(2) Stop the water supply of the unit and drain the water of the unit. Release the joint of the water pump with a wrench and remove the water pump from the equipment.

(3) Connect a new water pump to the water and electrical system of the unit.



8.7.3 Replace the Fan Motor

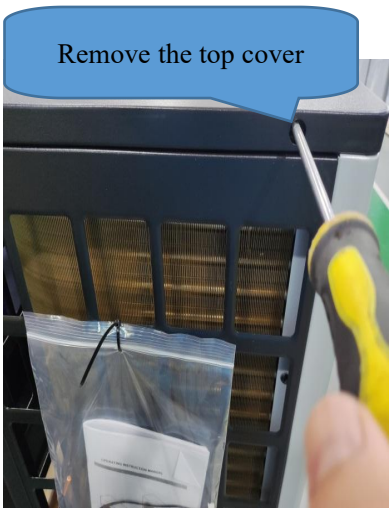
(1) Disconnect the power supply and remove the screws on the front grill.

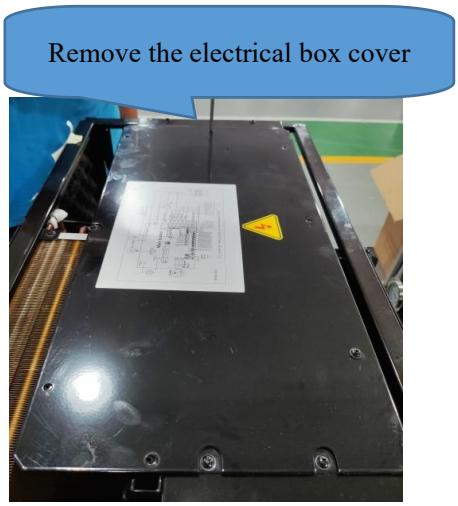
(2) Release the nut of the fan blade with a wrench, and then remove the fan blade.

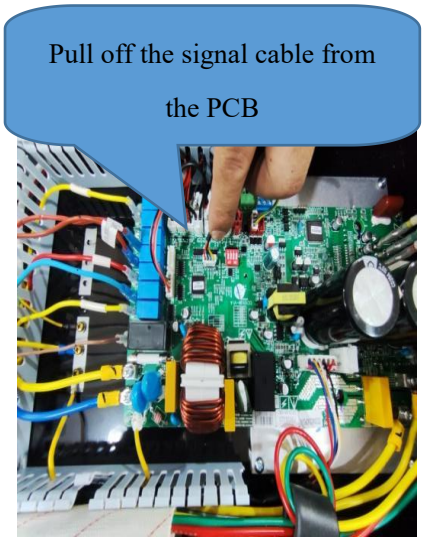
(3) Remove the screws from the fan motor.

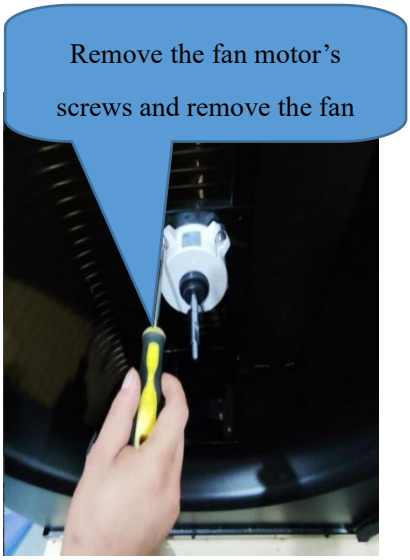
(4) Pull off the power cable of the fan motor from the PCB.

(5) Replace with the repaired or new fan motors and connect all the cables.









8.8 Precautions for heat pump operation in summer

During the operation of the heat pump in summer, to ensure efficient and stable operation of the equipment and extend its service life, please pay attention to the following matters:

8.8.1 Outdoor unit ventilation

1.Make sure there are no obstacles around the outdoor unit to maintain good air circulation.

2.Clean the heat sink of the outdoor unit regularly to prevent dust accumulation from affecting the heat dissipation effect.

3.If the air circulation is not smooth and the heat cannot be discharged in time, it may easily cause the unit to report a high pressure alarm.

8.8.2 Regular cleaning and maintenance

1.Filter Cleaning: Check and clean or replace filters regularly to keep them clean and ensure smooth waterflow.

2.Tank and heat exchanger cleaning:

- Clean the dirt and algae in the water tank regularly to prevent biological fouling.
- Clean the heat exchanger regularly to prevent scaling from affecting heat exchange efficiency.

8.8.3 Monitoring Water System

1.Replenish water in time: Check the water level in the water tank frequently and add softened water or deionized water in time to prevent the water pump from running idle.

2.Drainage system inspection:

- Ensure that the condensate drain pipe is unobstructed to prevent blockage and water accumulation.
- Clean the condensate pan regularly to prevent water accumulation and bacterial growth.

3.Water flow switch inspection:

- Make sure the unit is equipped with a water flow switch and the port of the water flow switch on the main control board is not short-circuited.
- If the water flow switch is short-circuited, resulting in a small water flow, the temperature inside the plate heat exchanger may be too low, causing the water to freeze and crack the components.

8.8.4 Operating environment temperature control

1.Ambient temperature monitoring:

- Ensure that the heat pump operates within the ambient temperature range specified by the manufacturer to avoid high temperature environments affecting the life of the equipment.
- If the unit consists of indoor and outdoor unit, keep the indoor and outdoor units well ventilated and avoid high temperatures and stuffy environments.
- If the unit is used in an environment with too high temperature, the power of the unit will increase, which may easily cause the compressor to fail with an overcurrent alarm of Er20.

8.8.5 System pressure and refrigerant management

1.System pressure monitoring: Regularly monitor the high and low pressures of the system to ensure that the pressures are operating within the normal range.

2.Refrigerant inspection: Ensure that the refrigerant is sufficient and leak-free, and check and refill the refrigerant regularly.

8.8.6 Electrical system maintenance

1.Electrical connection inspection: Check the electrical connections regularly to ensure that they are not loose or aged.

2.Compressor and fan inspection: Check the operating status of the compressor and fan to prevent abnormal noise and vibration.

8.8.7 Reasonable temperature setting

1.Reasonable temperature settings: Avoid setting the temperature too low. It is generally recommended to set the indoor temperature between 24-26℃.

8.8.8 Fault prevention and handling

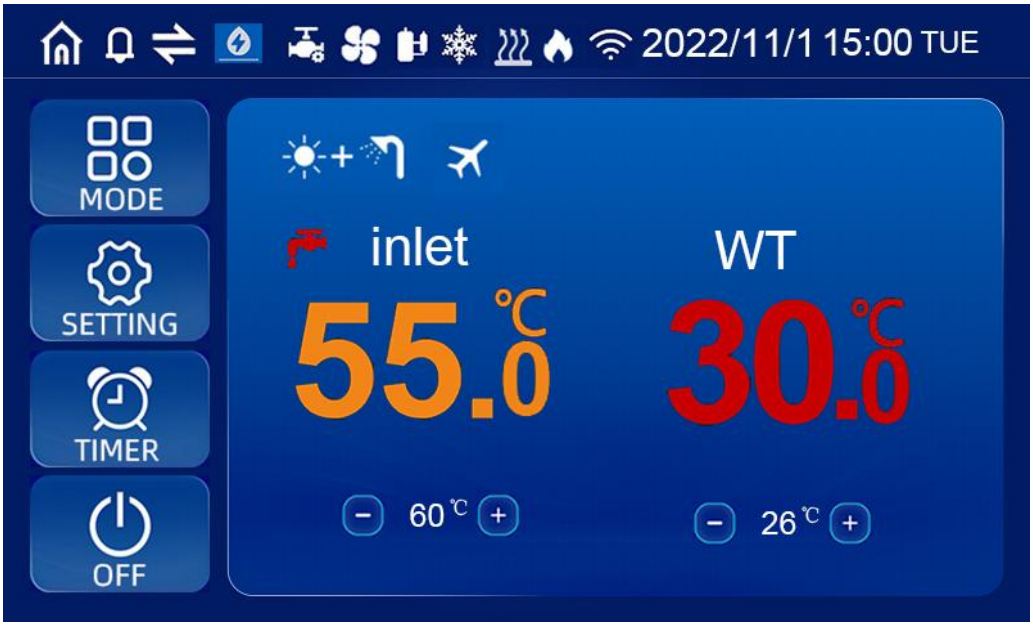
1.Prevent frequent mode switching: Avoid frequent switching between cooling and heating modes to prevent equipment wear and increased energy consumption.

2.Handling of abnormal situations: If the equipment is found to be operating abnormally, it should be stopped and checked in time, and professionals should be contacted for repair to prevent small faults from causing big problems.

By following the above precautions, you can ensure that the heat pump operates efficiently and stably in summer, extend the service life of the equipment, and maintain a good cooling effect.

9.Heat pump operation

9.1 Controller panel



9.2 Display icon lists:

	meaning
	Heating mode
	Hot water mode
	Cooling mode
	Heating and Hot water Mode (Hot water function as priority)
	Cooling and Hot water Mode (Hot water function as priority)
	Smart mode
	Powerful mode
	Silent mode
	Vacation mode
	Compressor working
	Water pump working
	Fan motor working

	Water tank heater working
	Electric heating working
	Defrosting
	Anti-freezing
	Auxiliary heat source
	(Heating+Hot Water Mode) Heating mode
	(Heating+Hot Water Mode) Hot water mode

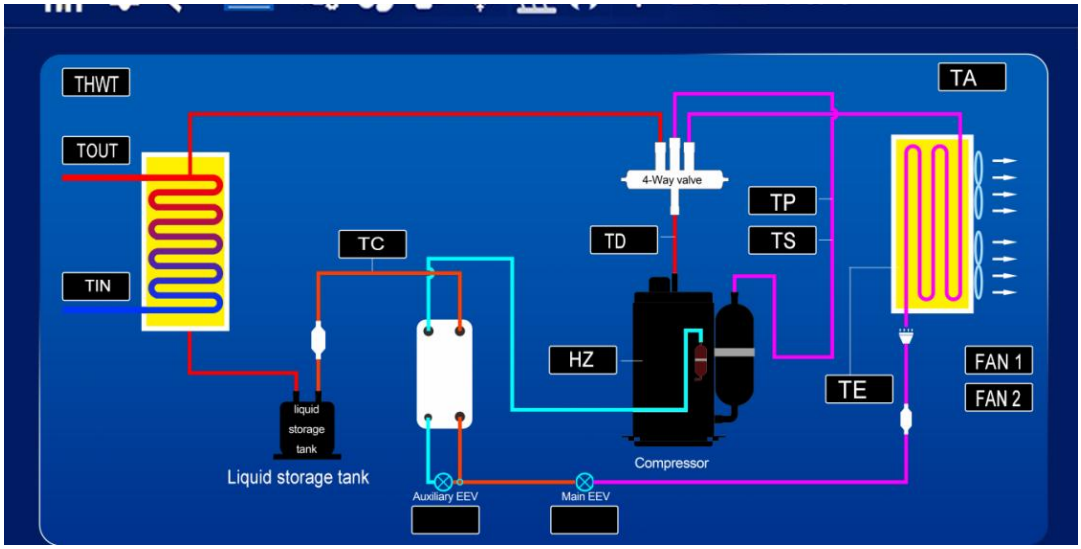
9.3 Definition of Buttons:

Button	Description	Function
OFF	On/off	turn on or turn off the heat pump.
MODE	Mode	switch the operating mode of the heat pump.
TIMER	Timer	set timer switch and working weekdays.
SETTING	Setting	query running parameters, check and set system parameters, error code records, Wifi connection, etc.
60℃	Temperature setting 1	Temperature setting for **only hot water, only heating and only cooling mode**(the interface displays the inlet water temperature and outlet water temperature)
60℃ + 26℃	Temperature setting 2	In **hot water+heating or hot water+cooling mode**, the left side is temperature setting for heating and cooling, and the right side is temperature setting for hot water (the main interface temperature display shows on the left side is inlet water temperature, and on the right side is water tank temperature)
Unit Status	Status	Check the running parameters of the heat pump

Fault Query	Faulty	Record the most recent error codes
Wi-Fi Configure	Wifi	Wifi setting
User Parameters	User parameters	Check and set the user parameters of the heat pump
Factory Parameters	Factory parameters	Check and set the factory parameters(Do not advise to amend the factory parameters.
Run the curve	Run the curve	Check the inlet water and outlet water operation curves and operation power curves.
System Parameters	System parameters	Check the version information of the system motherboard and the remote control program.
Language	Language	Language selection

9.4 Wire Controller Operation

Click the "" icon in the upper left corner of the main interface to enter Heat Pump Freon System Diagram. The meaning & explanation of the abbreviations as below:



THWT: Water tank temperature	TOUT: Outlet water temperature
TIN: Inlet water temperature	TC: Plate heat exchanger

TD: Exhaust gas temperature (of the compressor)	TP: Low pressure conversion temperature
TS: Return gas temperature(of the compressor)	TE: Evaporator coil temperature
TA: Ambient temperature	FAN 1: Wind speed of DC fan 1
HZ: Compressor frequency	FAN 2: Wind speed of DC fan 2
Main EEV: Opening steps of main expansion valve	Auxiliary EEV: Opening steps of assistant expansion valve(Reserved for EVI system)

9.5 Wire controller operation

10.5.1 START/STOP THE HEAT PUMP

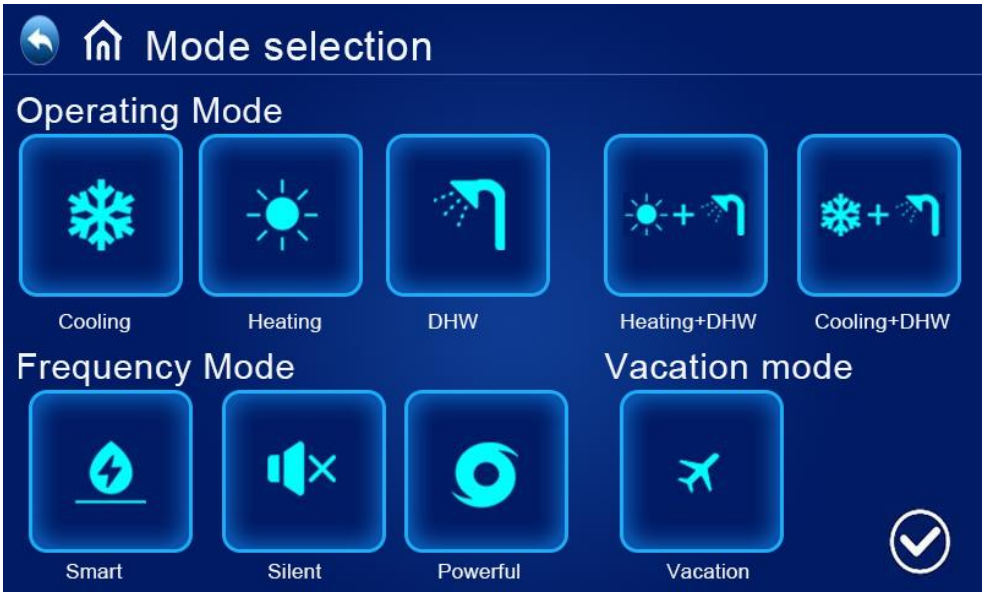
In the main interface, press the "ON/OFF" button for 1 second, and the "Startup Confirmation" window will pop up. Confirm startup, then the mode symbol is displayed in the startup status, but not in the shutdown status.

10.5.2 SET TARGET WATER TEMPERATURE

Under single-function modes (only cooling / only heating / only hot water mode), click "+" and "-" on the main interface to adjust the target water temperature; in dual-function modes (heating+hot water / cooling+hot water mode), click "+" and "-" on the left side of the main interface to adjust the target heating or cooling temperature; click "+" and "-" on the right side to adjust the target hot water temperature.

9.5.3 RUNNING MODE SETTING/OPERATING MODE SELECTION

In the main interface, press the "MODE" button for 1 second to enter the Mode Selection interface (Including operating mode, frequency mode and holiday mode selection), Choose the operating mode and frequency mode according to actual needs.



(1) Operating Mode description: Offer 5 modes for option: Heating, Cooling, DHW, Heating+DHW, Cooling+DHW.

(2) Operating mode description: In the normal mode, Heat pump has Smart, Powerful & Silent mode to choose from.

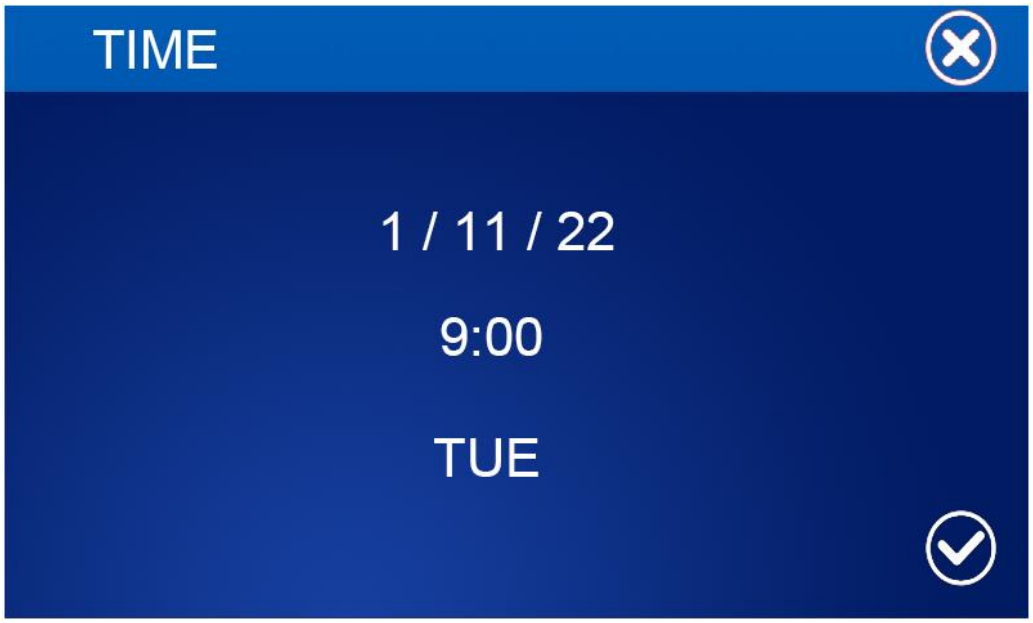
(3) Vacation mode description: when this mode is selected, the heat pump will run in heating mode only. When inlet water temperature ≤Vacation Set temperature - Temp difference of return water and cooling/heating target temperature (Parameter P01), the heat pump will perform heating function; when inelt water temperature ≥Vacation Set + 2℃, the heat pump will stop heating.

9.5.4 Clock setting

(1) In the main interface, press the time to enter system time setting.(2022/11/1 15:00 TUE for example in this manual)

(2) Enter the value of date (day / month / year) or hours (hours: minutes) with the keyboard, switch from Sunday to Monday.

(3) Press the confirmation button to save and exit, or press the cancel button not to save, and then exit.



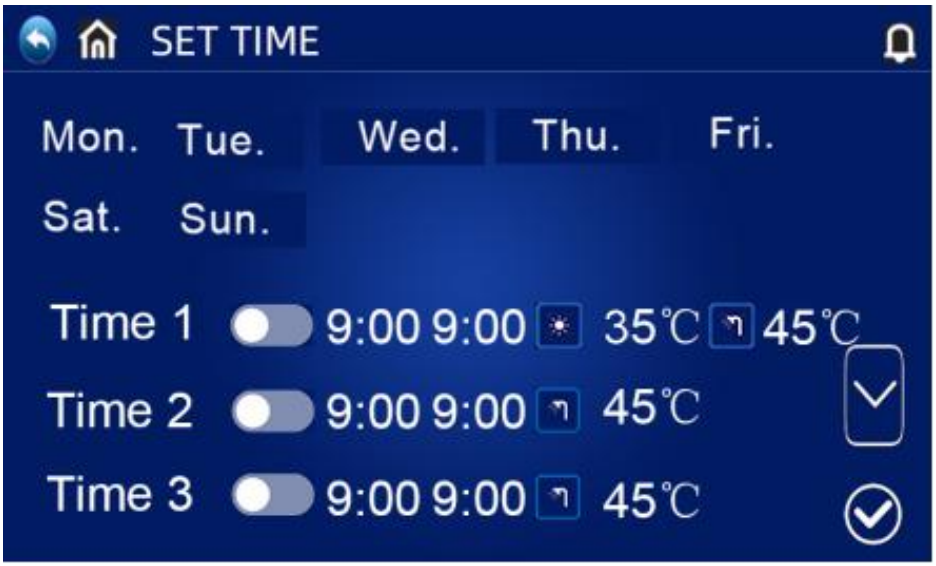
9.5.5 Timer settings

(1) In the main interface, press the "Timer" button to enter the timer setting interface.

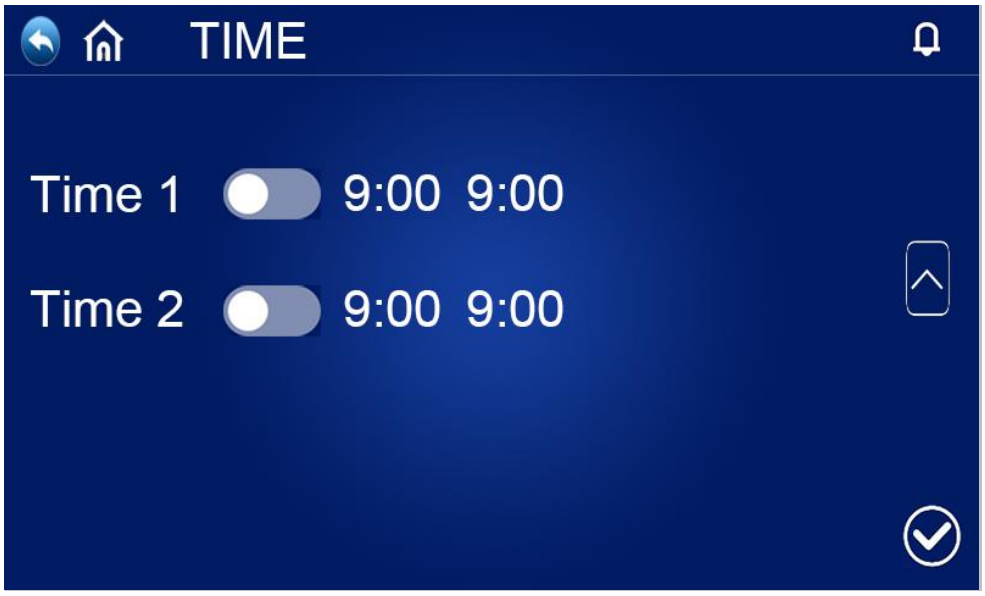
(2) In the week column, the user can choose which day to perform the timer. When the weekday button ("Mon." to "Sun.") turns white, the timer will be executed on the selected day(s). When the weekday button turns gray, the timer will not be executed.

(3) In the "Timer" column, the user can set up to 4 pairs of timers

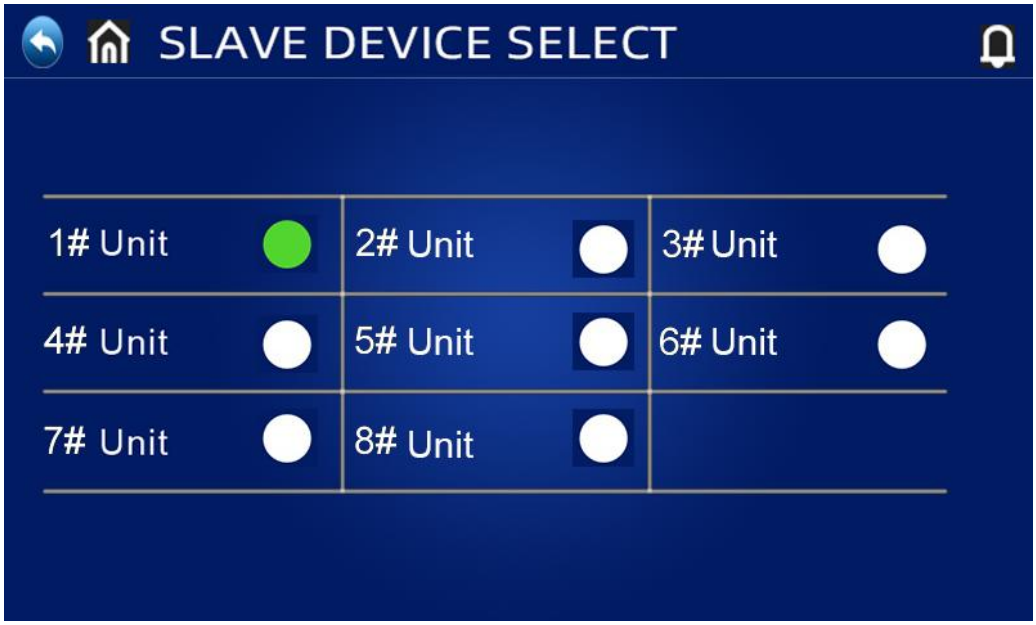
(4) In the same timer, when its start time equals to its end time, the timer is then invalid.



Silent time:
Click the "Close" button in the "Set Time" interface to enter the timing mute interface. The unit will operate in mute mode during the scheduled mute timers.

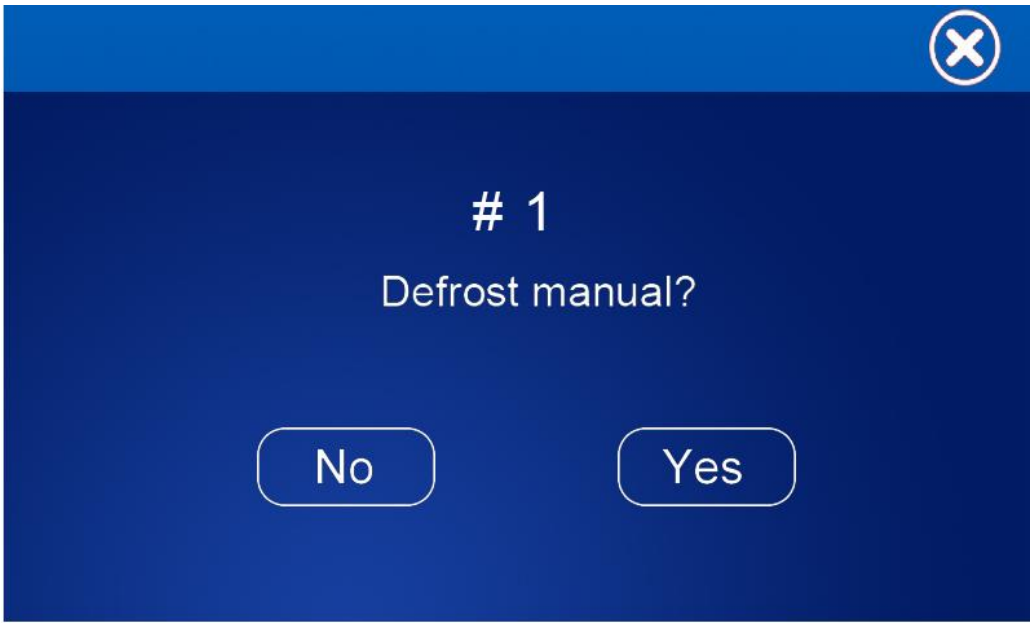


9.5.6 Query of operation parameters
In the main interface, press the "SETTING" setting button to enter the settings interface. Then press "Unit Status" button to enter the unit list interface, click the corresponding unit to query its running parameters. The status table is as follows:

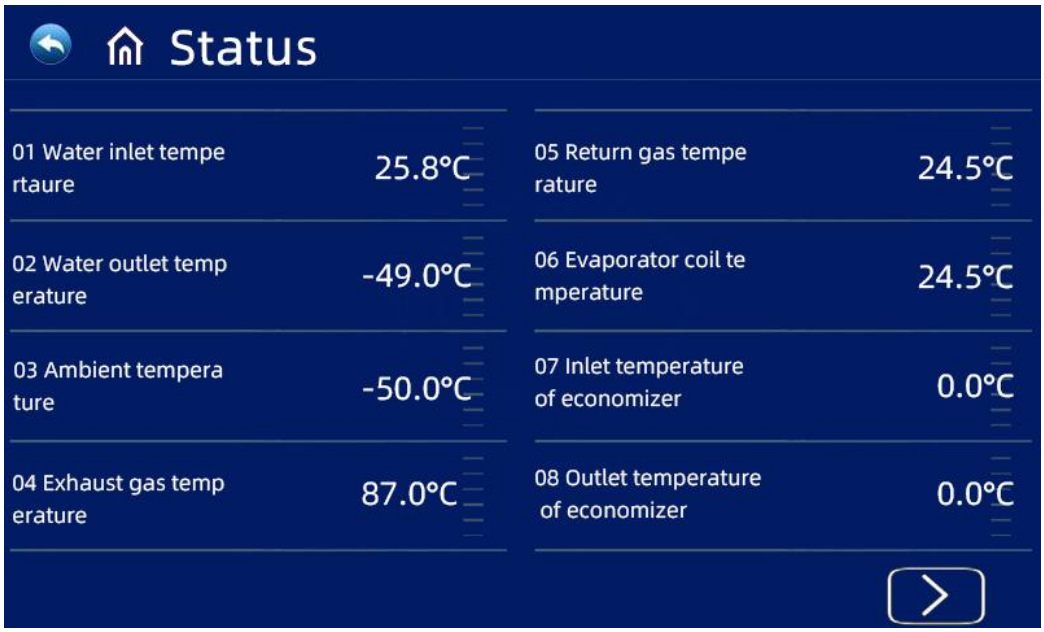


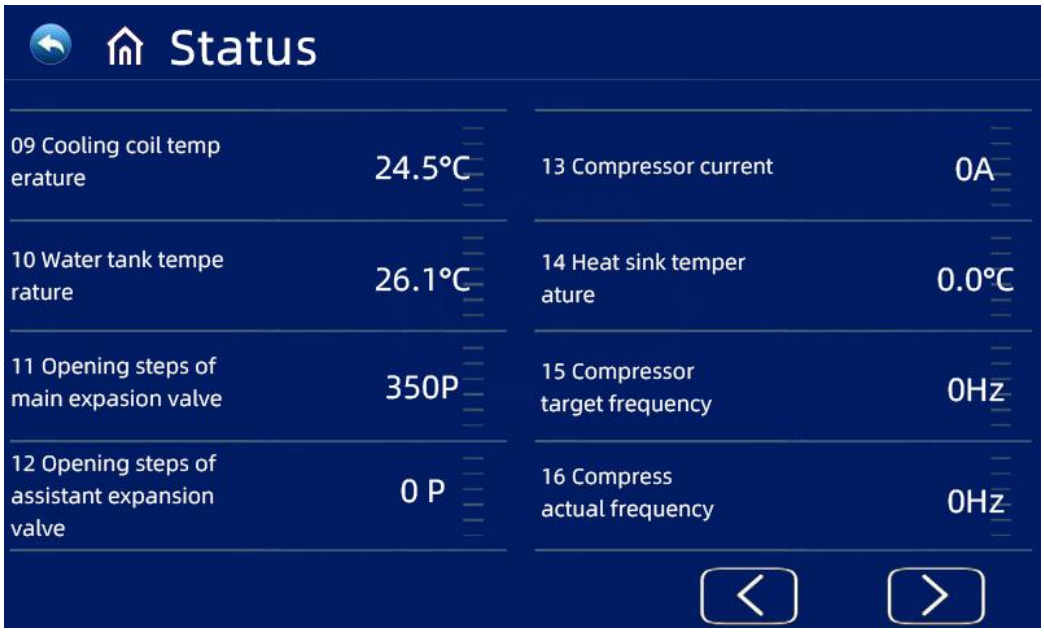
Remark: When a specific unit is connected to Cascade, the corresponding circle will turn green.

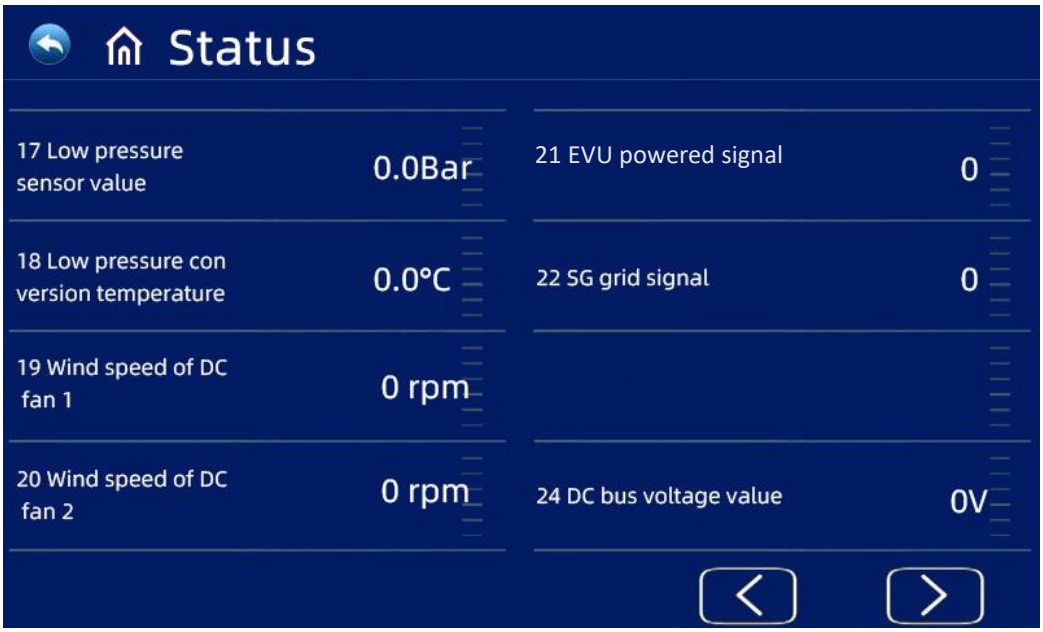
Forced defrosting: in the unit list interface, long press the corresponding unit number for about 8 seconds to enter forced defrosting. The "Defrost manual" interface will then pop up, click "Yes" and then the corresponding unit will enter the forced defrost condition.

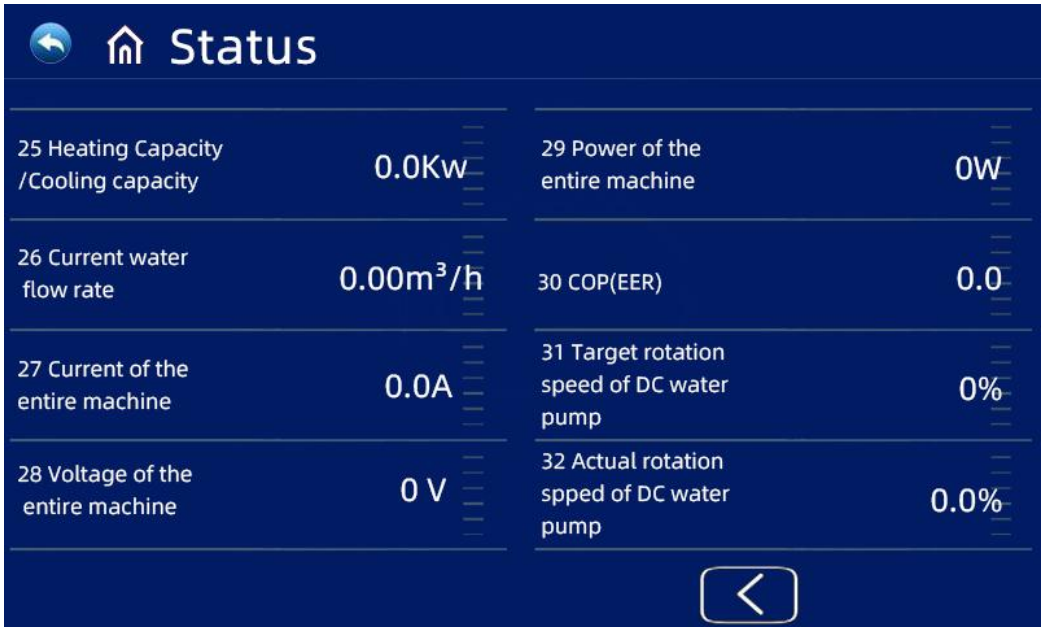


Interfaces of Status Parameters:




Status
09 Cooling coil temp erature
24.5°C
10 Water tank tempe rature
26.1°C
11 Opening steps of main expasion valve
350P
12 Opening steps of assistant expansion valve
0 P
13 Compressor current
0A
14 Heat sink temper ature
0.0°C
15 Compressor target frequency
0Hz
16 Compress actual frequency
0Hz


Status
17 Low pressure sensor value
0.0Bar
18 Low pressure con version temperature
0.0°C
19 Wind speed of DC fan 1
0 rpm
20 Wind speed of DC fan 2
0 rpm
21 EVU powered signal
0
22 SG grid signal
0
24 DC bus voltage value
0V

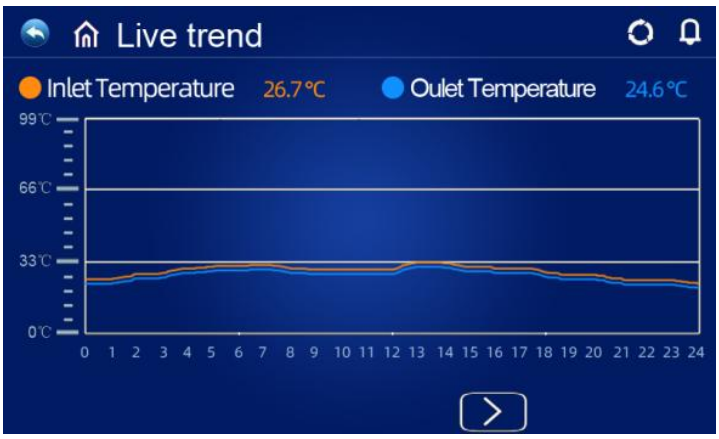

Status
25 Heating Capacity /Cooling capacity
0.0Kw
26 Current water flow rate
0.00m³/h
27 Current of the entire machine
0.0A
28 Voltage of the entire machine
0 V
29 Power of the entire machine
0W
30 COP(EER)
0.0
31 Target rotation speed of DC water pump
0%
32 Actual rotation spped of DC water pump
0.0%

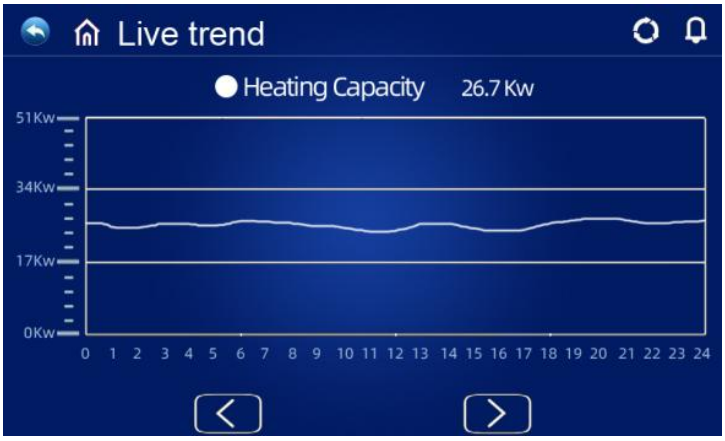
◎ List of operation parameters

Code	Description	Remarks:
01	Water inlet temperature	-30~99℃
02	Water outlet temperature	-30~99℃
03	Ambient temperature	-30~99℃
04	Exhaust gas temperature	0~125℃
05	Return gas temperature	-30~99℃
06	Evaporator coil temperature	-30~99℃
07	Inlet temperature of economizer	-30~99℃
08	Outlet temperature of economizer	-30~99℃
09	Cooling coil temperature	-30~99℃
10	Water tank temperature	-30~99℃
11	Opening steps of main expansion valve	
12	Opening steps of assistant expansion valve	
13	Compressor current	
14	Heat sink temperature	
15	Compressor target frequency	
16	Compress actual frequency	
17	Low pressure sensor value	Real-time data (Bar)
18	Low pressure conversion temperature	
19	Wind speed of DC fan 1	
20	Wind speed of DC fan 2	
21	EVU powered signal	
22	SG grid signal	
24	DC bus voltage value	
25	Heating Capacity/Cooling capacity	
26	Current water flow rate	
27	Current of the entire machine	
28	Voltage of the entire machine	
29	Power of the entire machine	
30	COP(EER)	
31	Target rotation speed of DC water pump	
32	Actual rotation speed of DC water pump	
33	Emergency switch	
34	Linkage switch	
35	Water flow switch	
36	Low pressure switch	
37	High pressure switch	
38	Heat pump billing costs	
39	Gas billing costs	

9.5.7 Check the energy consumption curve

In the main interface, press the "SETTING" button to enter the Settings interface. Then click "Run the curve" to enter the energy consumption curve interface, click "<" and ">" icons at the bottom of the interface to switch "temperature curve", "operating power curve", "heating capacity", "daily power consumption curve", "monthly power consumption curve", "annual power consumption curve".

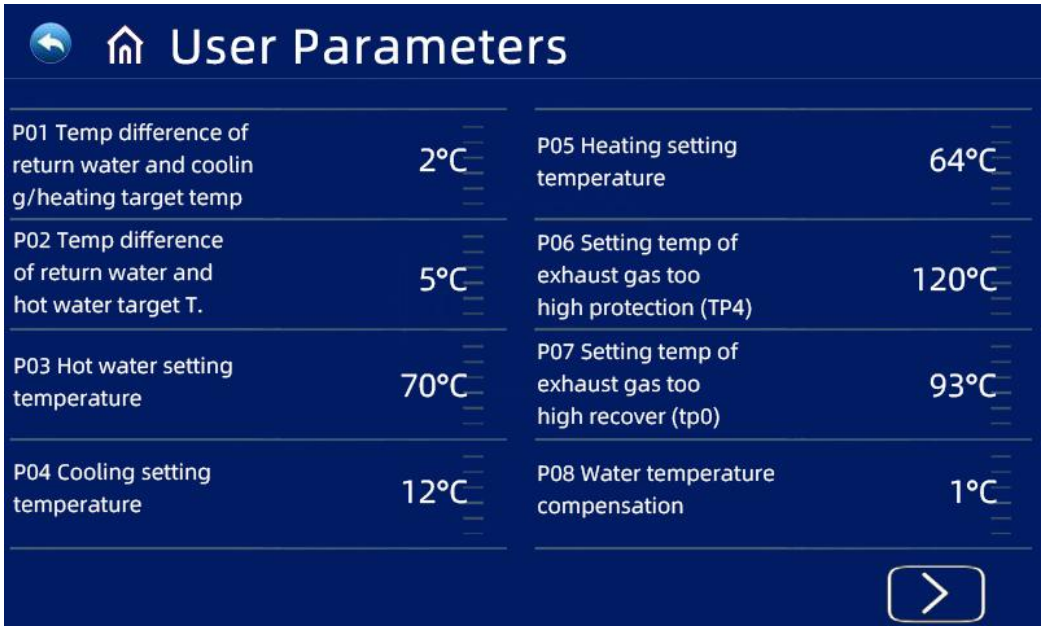




9.5.8 Query and setting of user parameters

In the main interface, press the "SETTINGS" button to enter the setting interface, and then press the "User Parameters" to enter the parameter query and setting. The following list shows the code, definitions, ranges, and defaults.

MENU
Unit Status
Fault Query
Wi-Fi Configure
User Parameters
Factory Parameters
Run the curve
System Parameters
Language


User Parameters
P01 Temp difference of return water and coolin g/heating target temp
2°C
P02 Temp difference of return water and hot water target T.
5°C
P03 Hot water setting temperature
70°C
P04 Cooling setting temperature
12°C
P05 Heating setting temperature
64°C
P06 Setting temp of exhaust gas too high protection (TP4)
120°C
P07 Setting temp of exhaust gas too high recover (tp0)
93°C
P08 Water temperature compensation
1°C

User Parameters

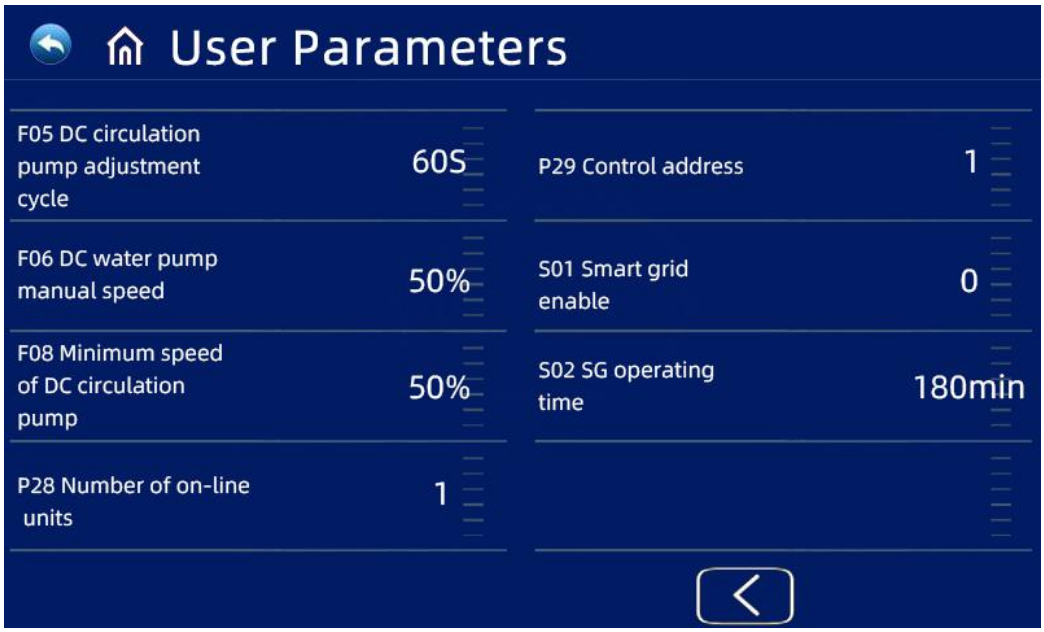
P09 Defrosting frequency	70Hz	P13 Defrost exit temperature	15°C
P10 Defrosting period	45min	P14 Def. environment and evaporator coil T. difference 1	5°C
P11 Defrosting enter temperature	-3 °C	P15 Def. environment and evaporator coil T. difference 2	5°C
P12 Defrosting time	8min	P16 Ambient temperature for defrosting	17°C

User Parameters

P17 High temperature disinfection cycle days	10 Day	P21 Heat pump's setting temperature for high T. disinfection	65°C
P18 High temperature disinfection start time	11 H	Fahrenheit/Celsius conversion	0
P19 High temperature disinfection sustaining time	50min	P22 Heating target Temp. automatic adjustment enable	0
P20 High temperature disinfection setting temperature	60°C	P23 Heating compensation Temp. point (ambient temp.)	23°C

User Parameters

P24 Target Temp. compensation coefficient	15	F01 Heat Pump Function	4
P25 Frequency operating mode after constant Temp.	0	F02 Circulation pump status after reaching target Temp.	1
P26 Ambient temperature for starting electric heating	0°C	F03 Circulation pump on-off cycle after reaching set Temp.	30min
P27 Start time for electric heating of water tank	30min	F04 DC circulation pump mode	1



◎ List of the user parameters

Code	Definition	Settable Range	Default
P01	Temp difference of return water and cooling target temp	2℃~18℃	2℃
P02	Temp difference of return water and hot water target temp	2℃~18℃	5℃
P03	Hot water setting temp.	28℃~70℃	50℃
P04	Cooling setting temp.	7℃~30℃	12℃
P05	Heating setting temp.	15℃~70℃	35℃

The user parameters P1-P5 can be set, and the remaining engineering parameters need to enter factory parameters page and require a password 666 to enter the settings. It is recommended that engineers use it.

Code	Definition	Settable Range	Default
P08	Water temp. compensation	-5°C~15°C	1
P09	Defrosting frequency	30-120HZ	70HZ
P10	Defrosting period	20MIN~90MIN	45MIN
P11	Defrosting enter temp.	-15°C~-1°C	-3°C
P12	Defrosting time	5MIN~20MIN	8MIN
P13	Defrost exit temp.	1°C~40°C	15°C
P14	Defrosting environment and evaporator coil temp. difference 1	0°C~15°C	5°C

P15	Defrosting environment and evaporator coil temp. difference 2	0℃~15℃	5℃
P16	Ambient temp. for defrosting	0℃~20℃	17℃
P17	High temperature disinfection cycle days	0~30 days Disinfection function is not executed when set to 0	0
P18	High temperature disinfection start time	0~23:00	23
P19	High temperature disinfection sustaining time	0~90min	30
P20	High temperature disinfection setting temperature	0~90℃	70℃
P21	Heat pump's setting temperature for high temperature disinfection	40~70℃	65℃
P22	Heating target temperature automatic adjustment enable	0~1 (0 is not enabled, 1 is enabled) (only applicable at heating mode)	0
P23	Heating compensation temperature point (ambient temperature)	0-40	23
P24	Target temperature compensation coefficient	1~30 (1 corresponds to actual 0.1)	6
P25	Compressor's Frequency operation mode after constant Temperature	0-Decrease Frequency after constant Temp. /1-Non Decrease Frequency after constant Temp.	0
P26	Ambient temperature for starting electric heating	-20-20℃	0
P27	Start time for electric heating of water tank	0-60 min	30
P28	On-line units	1~8	1
P29	Control address	1~255	1
P30	E-heater mode selection	0: disable 1: backup E-heater 2: water tank booster heater 3: backup e-heater + tank booster heater	0
P31	Water temperature control mode	0: Water inlet temperature 1: Water outlet temperature	0
P32	Temperature difference of compress full power operation	1~20℃	10
P33	Loading temperature difference	1~20℃	1
P34	Unloading temperature difference	1~20℃	1
P35	Cascade mode regulation cycle	10~2500S	60
P36	Automatic temperature control upper limit	20~80	70

F01	Heat Pump Function	1 Heating only 2 Heating+Cooling 3 Heating+DHW 4 Heating+Cooling+DHW	4
F02	Circulation pump status after reaching target temp.	0 Intermittent 1 All time 2 Stop at constant Temp.	0
F03	Circulation pump on-off cycle after reaching set temp.	1~120min	15 (OFF15min ON3min)
F04	DC circulation pump mode	0 No Start 1 Auto 2 Manual 3 Control water flow	3
F05	DC circulation pump adjustment cycle	10~100S	60
F06	DC water pump manual speed	10~100%	50
F08	Minimum speed of DC circulation pump	10~100%	60
S1	Smart grid capabilities	No、Yes	No
S2	Set DHW temp.increase value in SG mode	0-30℃	5℃
S3	Antifreeze on/off for hot water mode	0: three way valve is off and not active 1: three way valve is active	1
S4	Compressor stop time after 3 way valve switched	0-5min (0-comoressor keeps running)	3
H01	Auxiliary heat source	0 disable 1 heating 2 hot water 3 heating & hot water	0
H02	Auxiliary heat source operation mode	0-low carbon mode 1-Eco hybrid mode	1
H03	Eco hybrid mode	0 fixed pricing 1 peak-valley pricing 2 ambient temp judgment	0
H04	Ambient temp of auxiliary heat source operation	-30~30℃	-15℃
H05	Delay start time of auxiliary heat source	0~180min	30min
H06	Temperature difference to enter auxiliary heat source	2~18℃	5℃
H07	Standard unit price of electricity	0~2.5	0.08
H08	Low valley unit price of electricity	0~2.5	0.05

H09	Unit price of gas materials	0~2.5	0.25
H10	Work day low price electricity start time	0:00~23:00	0:00
H11	Work day low price electricity end time	0:00~23:00	7:00
H12	Rest day low price electricity start time	0:00~23:00	0:00
H13	Rest day low price electricity end time	0:00~23:00	23:00
H14	Ambient temp change of heat pump restart	-30~30℃	5℃
	Celsius/Fahrenheit switch	0 Celsius/1 Fahrenheit	0
H15	Compressor preheating	0-Disable 1-Enable	1
H16	Power off time for preheating detection	2-48	4
H17	Preheating time 1	10-100min	30
H18	Preheating time 2	10-150min	90
H19	Preheating time 3	10-250min	120
H20	Preheating time4	10-350min	180
H21	Preheating time5	10-500min	240

Note: When you need to change the address of the unit, you can enter the factory parameter and enter password 4180 to enter the settings. This operation is recommended for engineers to use.

R41	Control address	1~128	1

9.5.9 Factory settings reset

Entering the main interface to select the factory parameters, enter the password to enter the factory parameters interface, select the parameter R as below then will see the "factory data reset" button on right corner. Press this button and select yes then the factory settings reset is done.

9.6 High-temperature disinfection function (Only on hot water mode)

When selecting the hot water function, the high-temperature disinfection mode description is as follows:

(1) The high-temperature disinfection mode cycle is once for every 7 days (User parameter-P17);

(2) When entering the high temperature anti-corrosion, the water tank electric heater will be forced to open.

(3) During the disinfection process, if the tank temperature is> 65℃ (the maximum temperature can be set), the compressor does not start, only start electric heating; if the tank temperature is≤ 60℃, Both compressor and electric heater are started.

(4) When the temperature of the water tank is ≥70℃ (User parameter-P20) and lasting for 30 minutes (User parameter-P19), then exit the high temperature disinfection mode;

(5) After entering the high temperature disinfection mode, if the temperature of the hot water tank does not reach 70°C after 1 hour, the high temperature disinfection procedure is forced out.

9.7 Target temperature automatic adjustment logic (Only in heating mode)

(1) The target temperature in the heating mode can be automatically adjusted according to the ambient temperature.

Users can directly enter the temperature curve interface on the wired controller, set P23 and P24 parameters according to local environmental conditions, and the interface will automatically generate operating curves, as shown in the below figure.

(2) Entry conditions

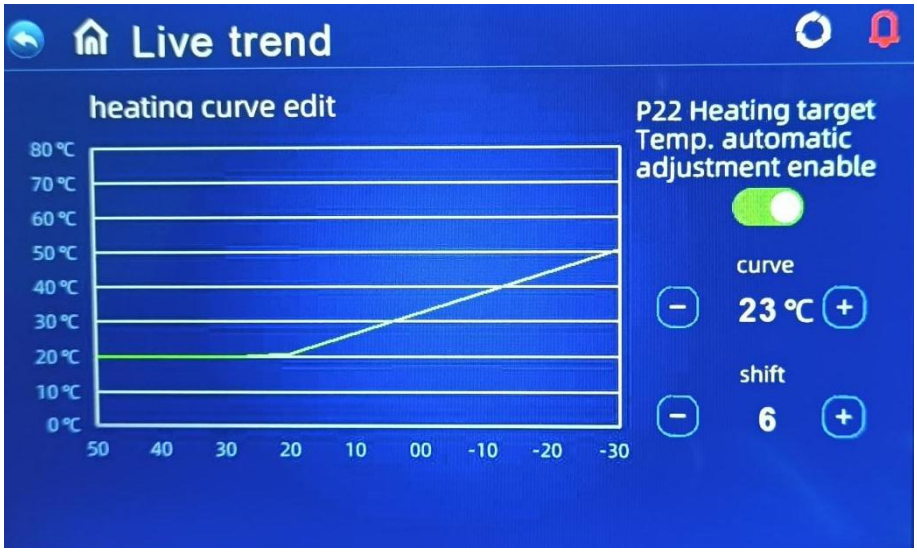
Click on the inlet water temperature on the main interface to enter, and the maximum set temperature can be adjusted using parameter P36.

When the user parameterP22=1 enables the automatic adjustment mode of the heating of the target temperature.

(3) Calculation formula of the heating target temperature

Pset (heating target temperature) =20 + (User parameterP24 / 10) * (User parameterP23-Current ambient temperature)

P23 is curve slope, P24 is shift.



◎ The different curves described above indicate the different values of user parameter-P24.

(Actual value is 0.1 when user parameter P24=1)

◎ The target temperature range for the automatic temperature regulation is 20-70℃

9.8 Auxiliary electric heater for water tank

(1) Starting conditions (All the following conditions must be met)

1) In the hot-water mode;

2) Compressor operation for user parameter P27 (30) minutes;

3) With hot water demand, the temp of the water tank is ≤ the set temp of hot water (P03) - the return difference of hot water (P02);

4) The pump is running;

5) Enable heater mode selection function (P30=2 or 3)

(2) Exit conditions (only one of the following needs be met)

1) When the heat pump works on cooling / heating mode;

2) When hot water or constant temperature control is not needed;

3) The water tank temperature sensor malfunctions and alarms.

◎ In the defrosting / forced defrosting / secondary antifreeze state, forced on water tank heater;

◎ When there is a high pressure/low pressure error, exhaust temp sensor fault, or high exhaust

temp protection, the unit will shutdown, if the compressor is locked and cannot be started for 5 mins, electric heating will be started to replace the compressor operation.

9.9 Auxiliary electric heater is used for space heating

(1) Enable conditions

1) In the heating mode;

2) Ambient temperature<user parameter P26 (-15℃) or ambient temperature sensor failure

3)There is a heating demand there, and the inlet water temperature ≤ setting temperature of heating(user parameter P05) -temp difference (user parameter P01);

4) The water pump is in the working condition;

5) The compressor runs for P27 (30) minutes;

6) Enable heater mode selection function (P30=2 or 3)

When all the above conditions are met, the electric heater will turn on.

(2) Exit conditions

1) In a cooling or hot water mode;

2) When there is no demand for heating or constant temperature control;

3) Inlet water temperature sensor fault or alarm;

4) Ambient temperature> -15℃ (user parameter P26) + 1;

5) Water flow failure;

6) Circulation pump is off.

When any of the above conditions is met, the external electric heater shall be turned off.

9.10 Auxiliary heat source control

The auxiliary heat source is set by parameter H01. When H01=1 operates in heating mode, the auxiliary heat source only operates in heating mode. When H01=2 operates in hot water mode, the auxiliary heat source can only be used to produce domestic hot water; When H01=3, the auxiliary heat source runs under heating & hot water mode.

When the above mode is running, the AHS will automatically turn on when the return water temperature is too low or the ambient temperature is too low, or the ambient temperature is too high(Exceeding the allowable working range of the heat pump).

When the auxiliary heat source H01 is turned on, there are two mode Settings: H02=1,operates low carbon mode; If H02=2, operates Eco hybrid mode.

9.10.1 Low carbon mode

low carbon mode refers to the calculation based on the COP with the heat pump as the priority, the auxiliary heat source as the auxiliary, and the heat pump will not stop.

Prerequisites for enabling:
1. The total outlet water temperature of the system <70℃
2. No water flow fault occurs
3. The total outlet water temperature sensor is set enabled

1) When AHS is set to only work for heating mode or heating & hot water (H01=1 or 3)

Open conditions :(all conditions are met)
1. The total outlet water temperature of the system < [P05]-[H06]
2. Ambient temperature TA< [H04]-2

3. Hot water electric heating off time > [H05]

Closing condition: (Meet one of the conditions)
1. Total outlet water temperature > [P05]
2. Heating mode is off

2) When AHS is set to hot water mode only or heating & hot water (H01=2 or 3)

Open conditions: (All conditions are met)
1. Hot water tank temperature < [P03]-[P02]
2. Hot water tank temperature <40℃
3. Water tank electric heating closing time ≥[H05]

Closing condition: (Meet one of the conditions)
1. Hot water tank temperature ≥[P03]
2. Total outlet water temperature >70℃
3. Hot water mode is off

9.10.2 Eco hybrid mode

Eco hybrid mode relies on the COP of the heat pump for calculation, prioritize the most cost-effective mode, and the heat pump will stop if it does not save money.

There are three Eco hybrid modes: H03=0 in fixed pricing mode, H03=1 in peak-valley pricing mode, and H03=2 basing on ambient temperature

1) Fixed pricing mode

The system calculates the price of heat pump and gas every hour. When the heat pump price is lower than the auxiliary heat source, the heat pump is turned on and the auxiliary heat source is turned off. When the heat pump price is higher than the auxiliary heat source, the auxiliary heat source is turned on and the heat pump is turned off.

H14 Ambient temp change of heat pump restart
Based on the ambient temperature when the auxiliary heat source is turned on for the first time, when the cumulative ambient temperature changes by H14 degrees (default is 5 degrees), the heat pump is restarted to run for one hour, and then calculate the electricity price and gas price comparison based on COP, and choose whether to operate heat pump or gas boiler.

2) Peak-valley pricing mode

Calculate the unit price of electricity by time, once per hour; The time is divided into working days and rest days, working days and rest days are divided into standard electricity prices and low Low valley electricity prices.
The low valley electricity price is H08 and the standard electricity price is H07.
The Work day low price electricity time is H10 to H11;
The rest day low price electricity time is H12 to H13;

Prerequisites for enabling: H03 = 1 (peak-valley pricing mode)

2.1 Heating opening conditions: (all conditions are met) Turn on the auxiliary heat source and turn off the compressor.

Open conditions :(all conditions are met)
1. The total water temperature of the system < [P05]-[H06]
2. Auxiliary heat source shutdown time >5min
3. Gas use cost < heat pump use cost

Closing condition: (Meet one of the conditions)
1. The total water temperature of the system > [P05] +2
2. Heating mode is off
3. Gas use cost ≥ heat pump use cost

2.2 Hot water starting conditions :(all conditions are met) Start the auxiliary heat source and shut down the compressor.

Open conditions :(all conditions are met)
1. Water tank temperature < [P03]-[P02]
2. Auxiliary heat source shutdown time >5min
3. Gas use cost < heat pump use cost

Closing condition: (Meet one of the conditions)
1. Water tank temperature ≥[P03]
2. The total water outlet temperature of the system is ≥70℃
3. Hot water mode is off
4. Gas use cost≥heat pump use cost

3) Ambient temp judgment mode

3.1 Heating opening conditions: (all conditions are met) Turn on the auxiliary heat source and turn off the compressor.

Open conditions :(all conditions are met)
1. The total outlet water temperature of the system <[P05]-[H06]
2. Auxiliary heat source shutdown time >5min
3. Ambient temperature TA＜H04 - 2

Closing condition: (Meet one of the conditions)
1. The total outlet water temperature of the system >[P05] +2
2. Turn off the heating
3. Ambient temperature≥H04

3.2 Hot water starting conditions :(all conditions are met) Start the auxiliary heat source and turn off the compressor.

Open conditions :(all conditions are met)
1. Water tank temperature <[P03]-[P02]
2. Auxiliary heat source shutdown time >5min
3. Ambient temperature＜H04 - 2

Closing condition: (Meet one of the conditions)
1. Water tank temperature≥[P03]
2. Total outlet water temp≥70℃
3. Hot water mode is off
4. Ambient temperature≥H04

9.11 Preheating Function

WARNING: Please note that after the heat pump is powered off for more than 4 hours, if the ambient temperature is too low and the compressor is not preheated, starting the compressor directly may cause the compressor to get stuck, damage the compressor or main board, and other poor situations. Please pay attention to the preheating function.

To ensure compressor protection and prolong its operational lifespan, the heat pump is required to complete a preheating process upon power restoration following an extended power interruption before initiating normal operation.

1)When H15 is set to [Enabled], upon initial power-on, if the detected unit's "power-off

duration" exceeds the preheat detection power-off time of 4 hours (H16), the unit will enter the preheat state. During the preheat state, the compressor cannot be started, and the compressor icon will flash.

2) Preheating time

The warm-up time is set at the following intervals depending on the ambient temperature:

Ambient temperature >10℃, H17 preheating time 30 minutes;

10℃≥ Ambient temperature >0 ℃, H18 preheating time 90 minutes;

0℃≥ Ambient temperature >-10 ℃, H19 preheating time 120 minutes;

-10C≥ Ambient temperature >-20℃, H20 preheating time 180 minutes;

-20≥ Ambient temperature, H21 preheating time 240 minutes;

3) Forced exit preheating

During the system preheating process, you can use the wired control to press and hold the "" key for 8 seconds to forcefully exit this preheating.

9.12 General Operating Guide

Initial Start-up Precautions

First boot-strap and Running state checks

1. To ensure the power same as the product nameplate required power.
2. Unit electrical connections: Check if power supply wire track and connection is ok; if ground wire is properly connected; Check if water pump and other chain device is properly connected
3. Water pipe and pipe: water pipe and pipe must be washed two and three times, ensure clean and no any pollution.
4. Check water system: If the water is enough and no any air, ensure no leakage
5. First boot-strap or starting up again after long time stop, ensure power on ahead and heating at least 12 hours for crankcase (local loop temp. is zero). Water pump start up first, last a while, fan start up, compressor start up, unit regular work.
6. Running checks (according to the following data to check if the unit running is normal)
   After unit normal running, check the following item:
   a. Input and output water temp.
   b. cycle water flow of the side
   c. running electric current of compressor and fan
   d. High and low pressure value when heating running.

CAUTION — Refrain from using this heat pump if any electrical components have been in contact with water. Immediately call a qualified service technician to inspect the heat pump.

CAUTION — Keep all objects clear above the heat pump. Blocking air flow could damage the unit and may void the warranty.

9.13 Users' Guide

9.13.1 Rights and Responsibility

(1) To ensure you have the service in guarantee period, only the professional server and technology staff can install and repair the unit. If you infarct this request and cause any loss and damage, our company will not be claimed any responsibility.
(2) After receiving the unit, check if have damage on shipment and all parts are complete; any damage and lack of parts please notice the dealer in written.

9.13.2 User Guide

1. All safety protection device are set in unit before leaving factory, don't adjust by yourself.
2. Unit have enough refrigerant and lubricating oil, don't fill or replace them; if need fill owing to leak, please refer to the quantity on nameplate (if refill refrigerant, need re-vacuum).
3. External water pump must connect with the message of unit, or else easy show various water lack alarm.
4. Regular clean water system according to maintenance request.
5. Pay attention to antifreeze when the environment temp. is less than zero in winter.
6. Safety Precautions

A User can't self-install the unit, ensure agent or specialized install company to do, or else maybe cause safety accident and affect the use effect.

B When install or use the unit, please check if the power is corresponding with unit power.

C The main power switch of unit should install leakage protector; the power cord must meet unit power request and national standard and local Fire & Safety Regulations.

D Unit must have ground wire; don't use the unit if no ground wire; forbid connect the ground wire to null line or water pump.

E The main power switch of unit should set much higher 1.4 meter (child don't touch it), to prevent child play it and cause danger.

F More than 52℃ hot water can cause damage, hot/cold water must be mixed then use it.

G When unit is soaking, please contact the factory or maintain department, you can use it again after maintain.

H Forbid insert any tools into fan fence of unit, fan is dangerous. (child special care)

I Don't use the unit if turn off the fan fence.

J To avoid electric shock or cause fire, don't store and use fixture, oil paint and petrol etc. combustible gas or liquid around the unit; don't throw the water or other liquid on the unit and don't touch the unit by wet hand.

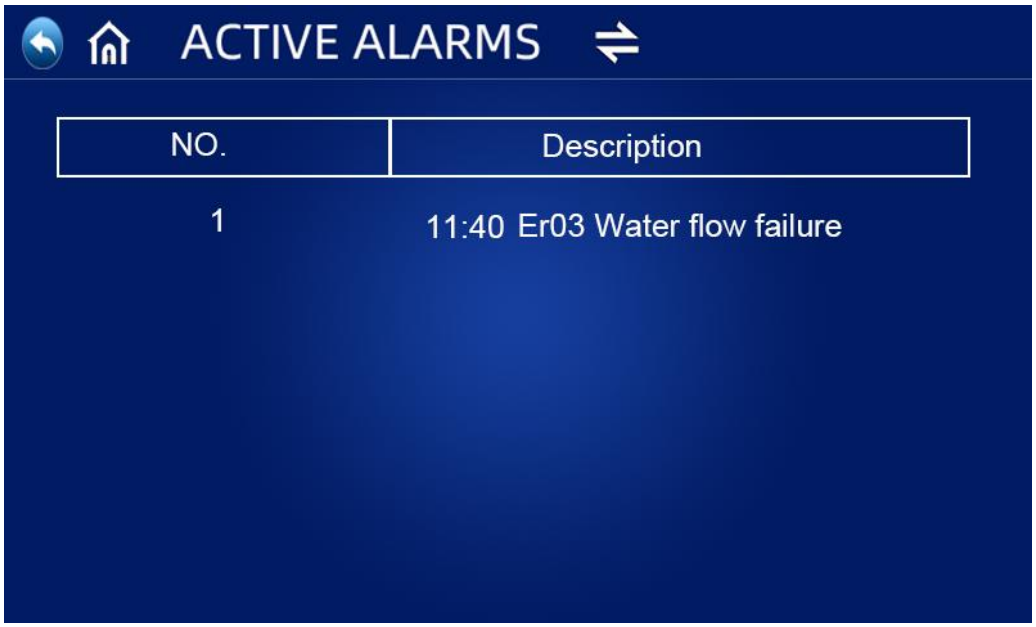
K Don't adjust the switch, valve, controller and internal data except company server or authorized staff.

L If safety protection device often start up, please contact factory or local dealer.

10.Fault list and trouble shooting

10.1 Controller fault code

(1) If the heat pump fails, the main interface will display the fault code and record them with details in the fault column in the setting interface.



(2) The following common fault codes will be appeared on the controller if happened

Fault code	Definition of a fault or a protection
Er 01	Power supply phase loss
Er 03	Water flow fault
Er 04	Antifreeze protection
Er 05	High voltage fault
Er 06	Low voltage fault
Er 09	Communication failure
Er 10	Communication fault of the frequency conversion module (alarm when the communication between the outer plate and the drive board is disconnected)
Er 12	Protection for too high exhaust gas temperature
Er 14	Tank temperature sensor fault
Er 15	Inlet water temperature sensor fault
Er 16	Evaporator coil temperature sensor fault
Er 18	Exhaust temperature sensor fault
Er 20	Protection for inverter module abnormality
Er 21	Ambient temperature sensor fault
Er 23	Protection for too low outlet water temperature
Er 26	Radiator temperature fault
Er 27	Water outlet temperature sensor fault
Er 29	Return gas temperature sensor fault
Er 32	Protection for too high outlet water temperature
Er 33	Evaporator coil temperature is too high
Er 34	Inverter module temperature is too high
Er 42	Internal coil temperature sensor fault
Er 46	DC fan motor failure

Er 62	Economizer inlet temperature sensor fault
Er 63	Economizer outlet temperature sensor fault
Er 64	DC fan 1 fault
Er 66	DC fan 2 fault
Er 67	Low pressure switch fault
Er 68	High pressure switch fault
Er 69	Pressure protection is too low
Er 70	Pressure protection is too high
Er 72	Fan drive board communication error
Er 73	Expansion board communication error
Er74	Total outlet water temp. Sensor failure
Er75	Refrigerant leakage protection
Er76	Refrigerant sensor malfunction

(3) When the system has an Er 20 fault, detailed fault codes ranging from 1 to 384 will be displayed. Where, 1~128 in the first category, when will be displayed as priority, 257 to 384 in the second category, only when failure 1 to 128 does not appear. If two or more faults occur in the same class, it displays the fault number and. For example, when both 16 and 32 are present, it will display the fault code 48 (16 + 32=48)

◎ Detailed fault code list for Er 20:

Fault code	Name	Description	Solution advice
1	IPM over current	The IPM module problem	Replace the frequency conversion module
2	Compressor synchronization is abnormal	Compressor failure	Replace the compressor
4	alternate code	alternate code	--
8	The compressor output phase is missing	Compressor wiring line break or poor contact	Check the compressor input circuit
16	DC bus with low voltage	Input voltage is too low or the PFC module failure,	Check the input voltage and replace the module
32	DC bus with high voltage	Input voltage is too high or PFC module failure	Replace the frequency converter module
64	The radiator temperature is too high	Host fan motor fails or air duct is blocked	Check the fan motor and air duct
128	Radiator temperature failure	Short circuit or open circuit of the radiator sensor	Replace the frequency conversion module
257	Communication failure	The frequency conversion module did not receive the command from the master control	Check the communication connection between the main control module and the

			frequency conversion module
258	The AC-input phase is missing	Missing input phase (the three-phase module is valid)	Check the input circuit
260	AC input over-current	Input three phase imbalance (three phase module valid)	Check the input three-phase phase voltage
264	The AC-input voltage is low	Low input voltage	Check input voltage
272	Compressor high-voltage fault	Compressor high-voltage fault (reserved)	
288	IPM hypermedia	Main fan motor fault and air duct is blocked	Check the fan motor and the air duct
320	The compressor peak current is too high	The compressor line current is too high and the driver program does not match the compressor	Replace the inverter module
384	The PFC module temperature is too high	The PFC module temperature is too high	

10.2 Owner Inspection

We recommend the householder to check the heat pump regularly, especially after abnormal weather conditions.

It is also recommended that you should follow the following basic guidelines to checking:

1. Ensure space is enough around the unit for maintenance or repair.
2. Keep the top and surrounding areas of the heat pump clean and good air flow
3. Ensure no plants close to the unit which may has the risk of leaves/branches drop into the inside from the Fan
4. Do not spray water on the unit when sprinkling plants to avoid corrosion and damage of the unit.
5. Keep the unit grounding well all the time.
6. Maintain the external filter regularly to ensure the cleanliness of the water to avoiding damage the internal components of the unit.
7. Check the wiring of the power supply and electrical components regularly to ensure their normal operation.
8. Do not change the settings by yourself after all safety guards have been installed. If any changes are required, please contact an authorized professional installer / agent.
9. If the unit is installed under a roof without a drain, please ensure that the necessary measures are taken to prevent excessive water from splashing directly or flowing into the unit.
10. If water flows into the unit and touches any electrical component, cut off the power supply and stop using the unit. Also, please contact an authorized professional installer / agent for inspection.
11. If power consumption from the unit increased too much not due to cold weather condition,

Please get in touch with local authorized installer agent for checking

12. When not in use for a long time, please close the unit, and cut off power supply to the unit.

10.3 Trouble shooting

The following troubleshooting information is used to resolve the problems encountered in the unit use.

Warning-Risk of electric shock

Ensure that all high voltage circuits are disconnected before opening the unit to starting installation. Contact with these circuits may cause death or serious injury to the user, installer, or other person, and possible property damage.

Non-professionals, do not turn on the heat pump anywhere to avoid electric shock.

1. Keep your hands and hair away from the fan blades to avoid injury.
2. If you are not familiar with your heat pump:

A) Be sure to consult your authorized installer / agent before attempting to adjust or repair the equipment.

B) Read the complete installation and user guide before trying to operate or adjust the heat pump.

Important: The main power of the heat pump must be turned off before repair.

10.3.1 Troubleshooting of fault codes

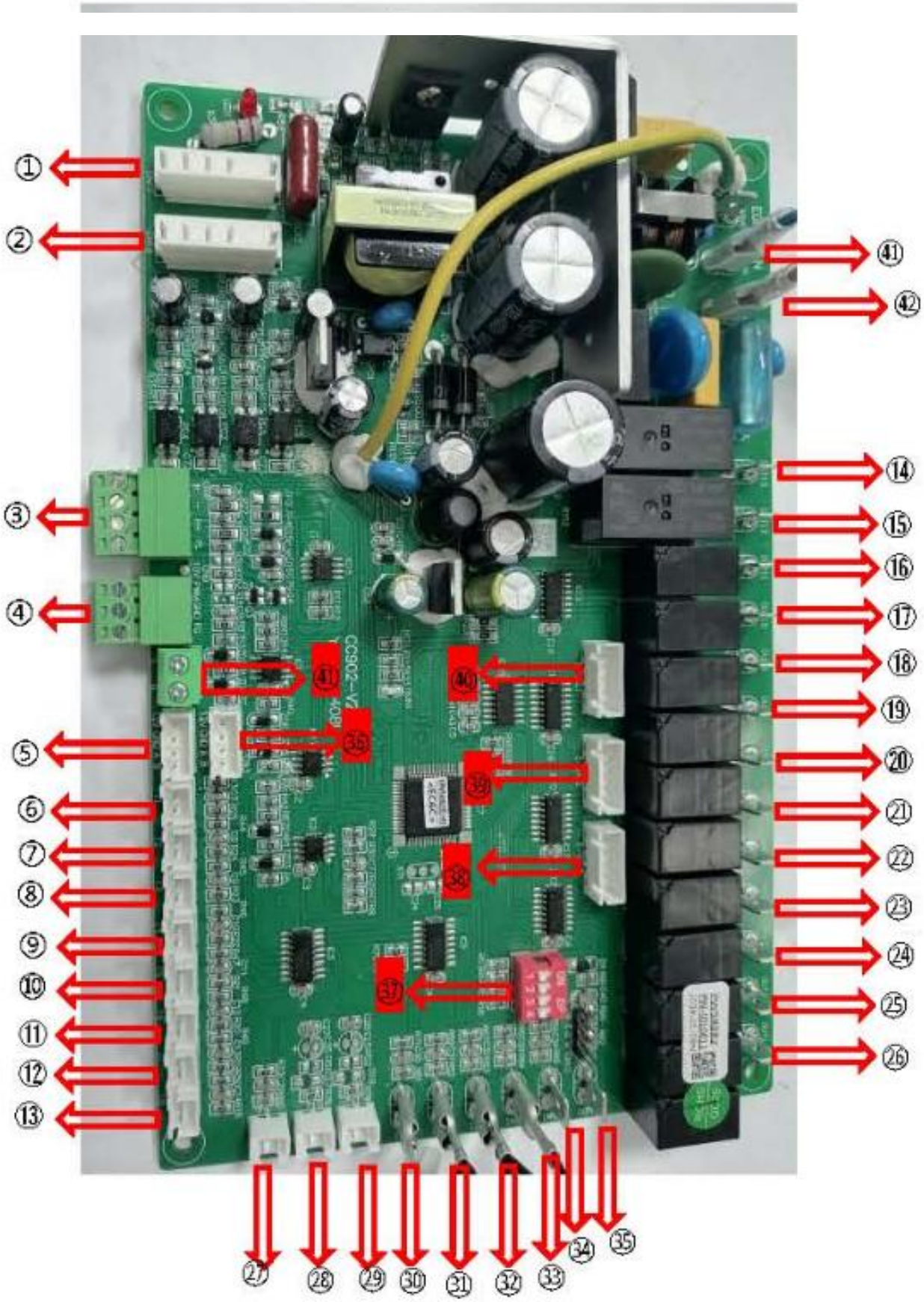
Fault code	name	description	Solution advice
Er 01	Wrong phase protection	The 380V heat pump power incoming line RST sequence fault	The RST sequence of 380V heat pump power incoming line is wrong, and the three RST wires are switched to the correct wiring position (power off first, then power on after the replacement, and the wrong phase fault will disappear)
Er 03	Water flow fault	**electronic control system:** Water flow switch failure	Check the water flow switch and replace if need
		water system: 1. The water flow is too small 2. wrong connected on inlet and outlet pipe 3. Has air inside the pipes system 4. Pipe block	1. Check the temperature difference between the inlet and outlet water temperature 2. Check whether the inlet and outlet water pipes are improperly connected 3. Discharge the air inside pipes (exhaust valve) 4. Clean the pipe (filter valve)
Er 04	Antifreeze protection	Ambient temperature is too low, non-abnormal fault	Normal protection shows that the host power can be automatically restored
Er 05	High pressure fault	1. Throttle switch is too small or blocked 2. Condenser fins are dirty or blocked with debris	1. Check the throttling device 2. Clean the condenser heat sink 3. Check whether the fan is abnormal

		3. Insufficient condensing air volume or fan failure 4. Too much refrigerants	4. Fill the refrigerant according to the volume on the nameplate
		electronic control system: High voltage switch failure	Reconnect the cable to the HP switch or replace the HP switch
		water system: 1. The water flow is too small 2. The water supply system has been blocked 3. The water side heat exchanger has scale 4. Inlet temperature probe drops (the actual water temperature is too high)	1. Check the temperature difference between the inlet valve and the inlet and outlet water 2. Replace the filter 3. Scaling 4. Reconnect the water inlet temperature probe
Er 06	Low pressure fault	1. The evaporator fin is dirty, dusty, and seriously blocked 2. Refrigerant leakage and dirty wing blockage lead to poor defrosting	1. Clean the fins of the evaporator 2. Find the leakage point, weld it well, and then fill in the refrigerant
		Electronic control system: low-voltage switch fault	Check the water flow switch and replace it if damaged
		water system: 1. water flow too weak 2. The return water temperature is too low	1. Check the temperature difference between water and outlet water and adjust the water flow 2. Check the actual water inlet and outlet temperature
Er 09	Communication fault	1. Poor contact or damage of the communication cables 2. The motherboard and control panel are damaged	1. Check and replace the communication cable 2. Replace the motherboard and the control panel
Er 10	Communication fault of the frequency conversion module (alarm when the communication between the outer plate and the drive board is disconnected)	1. The communication cable connector between the main board and the drive board has a bad contact or falls off 2. The communication cable is damaged 3. The motherboard or drive board is damaged	1. Reconnect the cable between the motherboard and the drive board 2. Replace the communication cable 3. Replace the motherboard or the drive control board
Er 12	The protective effect of the exhaust gas temperature is too high	1. System refrigerant leakage 2. The system is dirty and blocked 3. Insufficient cooling oil of the compressor 4. The resistance value of the exhaust probe is offset, and the water inlet temperature probe drops	1. Refrigerant supplement (should it be checked for any leakage points?） 2. Replace the filter 3. Add the cooling oil to the compressor 4. Replace the exhaust probe and reconnect the water inlet temperature probe
Er 14	Water tank temperature sensor fault	The sensor plug contact or fall off, the sensor is damaged	Check and replace the water tank temperature sensor if need
Er 15	Inlet water temperature sensor fault	The sensor plug contact or fall off, the sensor is damaged	Check and replace the inlet water temperature sensor if need
Er 16	Evaporator coil temperature sensor fault	The sensor plug contact or fall off, the sensor is damaged	Check and replace the external coil temperature sensor if need
Er 18	Exhaust temperature	The sensor plug contact or fall off, the sensor	Check and replace the exhaust gas

	sensor fault	is damaged	temperature sensor if need
Er 20	Abnormal protection of the frequency conversion module	Internal fault of IPM module is shown in the table below	/
Er 21	Ambient temperature sensor fault	The sensor plug contact or fall off, the sensor is damaged	Check and replace the ambient temperature sensor if need
Er 23	Cooling outlet water temperature is ultra-cold protection	1. If the effluent temperature is higher than the protection value of the system, and the water flow is small; 2. There is air or blockage in the pipe 3. The inlet water temperature probe is closed	1. Check whether the water valve or water pump has been started 2. Clean the pipe and discharge the air from the pipe 3. Reconnect the water outlet temperature probe
Er 26	Radiator temperature overheating fault	1. High temperature protection of the drive board or the main PCB board 2. Poor ventilation of the radiator.	1. Check whether the operating frequency of the compressor is normal 2. Check whether the fan rotates slowly, and check whether there is any foreign matter on the radiator or whether the air outlet is blocked
Er 27	Outlet water temperature sensor fault	The sensor plug contact or fall off, the sensor is damaged	Check and replace the outlet water temperature sensor
Er 29	Return gas temperature sensor fault	The sensor plug contact or fall off, the sensor is damaged	Check and replace the return air temperature sensor
Er 32	Heating outlet water temperature is too high protection	1. The effluent temperature is higher than the system protection value, the water flow is weak, and the pump body is abnormal 2. There is air or blockage in the pipe system 3. The inlet water temperature probe is closed	1. Check whether the water valve or water pump has been started 2. Clean the pipe and exhaust the air from the system 3. Reconnect the water outlet temperature probe
Er 33	The coil temperature is too high	The temperature of the condenser is higher than the set value, usually appear with Er32, priority display Er32	Solution as Er32
Er 34	The frequency conversion module temperature is too high	The temperature of the frequency conversion module is too high	Check whether the fan does not rotate; Check the installation position of the unit for the duct not circulating
Er 42	The temperature sensor of the cooling tube fault	The sensor plug contact or fall off, the sensor is damaged	Check and replace the cooling tube temperature sensor
Er 46	DC Fan motor failure	The phase of the fan motor wire is reverse The capacitor of the fan motor is fault	1. Use the multimeter to detect whether it's protected by reverse phase, if yes, please exchange the connection of the two neighboring wires incoming to the power supply of the unit. 2. Check if there is any fault to the capacitor, if yes, then replace it with a new one with same specification
Er 62	Economizer inlet temperature sensor fault	The sensor plug contact or fall off, the sensor is damaged	Check and replace the inlet temperature sensor for the economy device

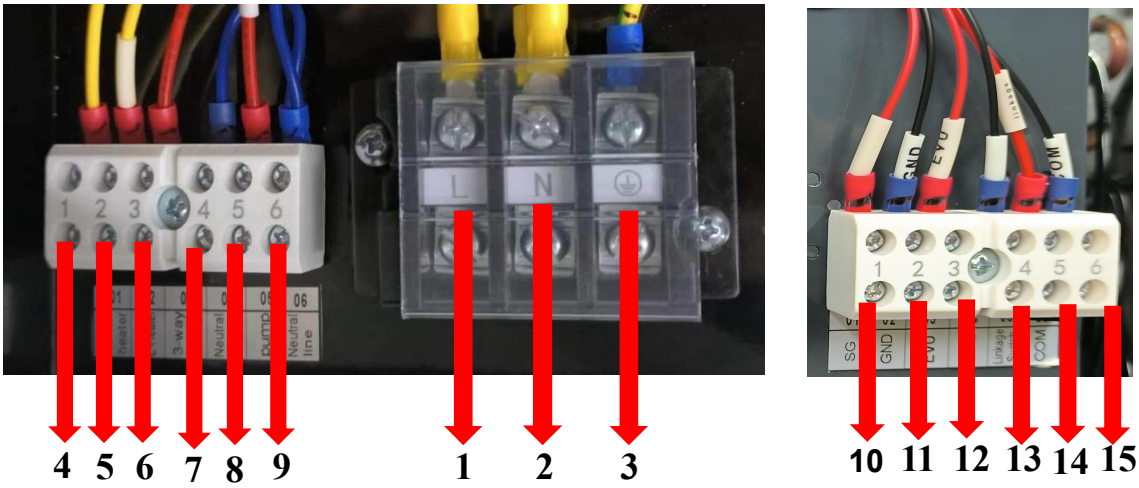
Er 63	Economizer outlet temperature sensor fault	The sensor plug contact or fall off, the sensor is damaged	Check and replace the outlet temperature sensor for the economy device
Er 64	DC fan 1 fault	DC fan, bad plug contact, or plug closed	Reattach the cable to the DC fan, and replace the DC fan
Er 66	DC fan 2 fault	DC fan, bad plug contact, or plug closed	Reattach the cable to the DC fan, and replace the DC fan
Er 67	Low pressure switch fault	Low-pressure switch broken, poor plug contact, or plug closed	Reconnect the low pressure switch or replace the low pressure switch
Er 68	High pressure switch fault	High pressure switch damage, poor plug contact, or plug closed	Reconnect the high pressure switch or replace the high pressure switch
Er 69	Pressure protection is too low	The operating pressure is below the set point and usually happened with a low pressure fault or only with a low pressure fault together	Solution as Er06
Er 70	Pressure protection is too high	The operating pressure is above the set point and usually happened with a high pressure fault or only with a high pressure fault together	Solution as Er05
Er 72	Fan drive board communication error	Failure of communication between the main board and the fan driver board	Test the communication cable from the main board to the fan driver board; Or check if the D01 fan parameters are correct.
Er 73	Expansion board communication error	Expansion board communication cable is connected incorrectly or not set the dial code	Check main board to expansion board communication cable, check expansion board dial code 2 dial up, check C07 parameter setting (with or without expansion board)
Er74	Total outlet water temp. Sensor failure	The sensor plug contact or fall off, the sensor is damaged	Check and replace the total outlet water temperature sensor if need

10.3.2 Diagram of board for maintenance and trouble-shooting



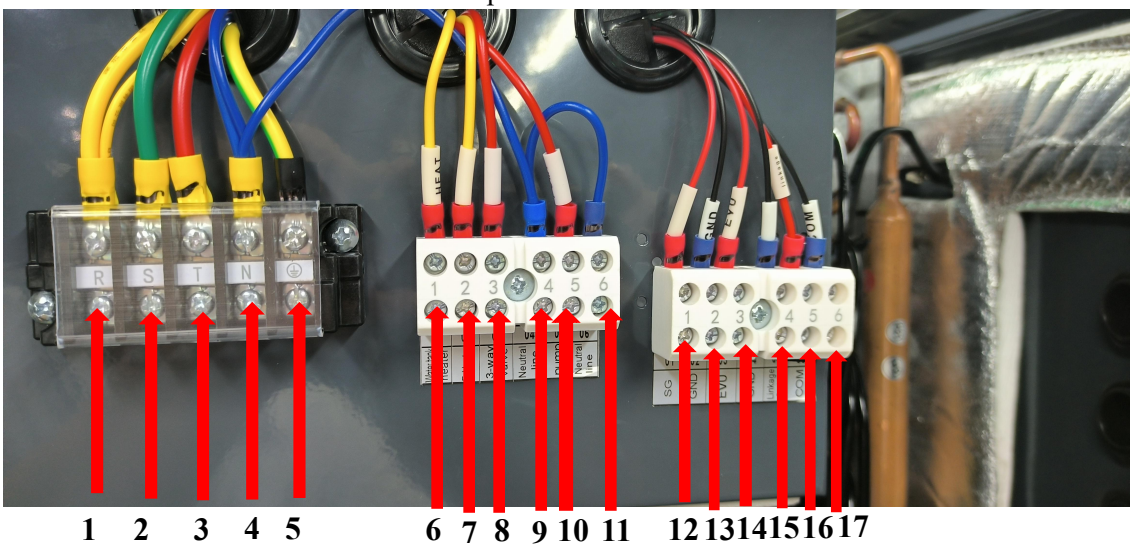
Item no.	Descriptions	Item no.	Descriptions
①	Fan 1#	㉒	Water tank electrical heater outlet connection
②	Fan 2#	㉓	Auxiliary heat source outlet connection
③	Low pressure sensor	㉔	This output connection is reserved
④	Variation frequency signal wire for Water pump	㉕	This output connection is reserved
⑤	Power detection board RS485 communication connection	㉖	This output connection is reserved
⑥	Outer coil temperature sensor	㉗	Total outlet water temperature sensor
⑥	Water tank temperature sensor	㉘	SG output connection
⑧	Inlet water temperature sensor	㉙	EVU output connection
⑨	Discharge gas temperature sensor	㉚	High pressure switch
⑩	Return gas temperature sensor	㉛	Low pressure switch
⑪	Cooling coil gas temperature sensor	㉜	Water flow switch
⑫	Ambient temperature sensor	㉝	The linkage switch output connection
⑬	Outlet water temperature sensor	㉞	Not available
⑭	Circulating water pump output connection	㉟	Common connection output
⑮	Electrical heater output connection	㊱	Controller display connection(One port of the communication cable is connected to the controller, and the other port is connected to RS485 communication or cascading)
⑯	4-way valve output connection	㊲	Code switch
⑰	This output connection is reserved	㊳	EEV of EVI gas circuit (if any)
⑱	3-way valve output connection	㊴	EEV of main gas circuit
⑲	Crankshaft electrical heater output connection	㊵	This EEV connection is reserved
⑳	Chassis electrical heater output connection	㊶	Drive board RS485 communication wire
㉑	This output connection is reserved		

10.3.2.1 User’s terminals for 220V single-phase units



No.	Descriptions	No.	Descriptions
1	Power cable live line L	9	Neutral wire
2	Power cable neutral line N	10	SG signal connection
3	Earth line ⏚	11	GND connection
4	Control line connection for pipeline water tank heater	12	EVU signal connection
5	Control line connection for E-heater	13	GND connection
6	Control line connection for 3-way valve	14	Linkage Switch connection
7	N connection for neutral line	15	COM connection
8	Auxiliary heat source control wire		

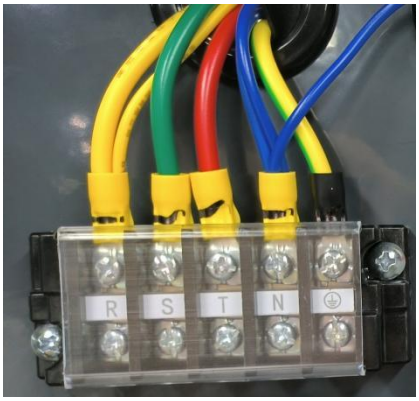
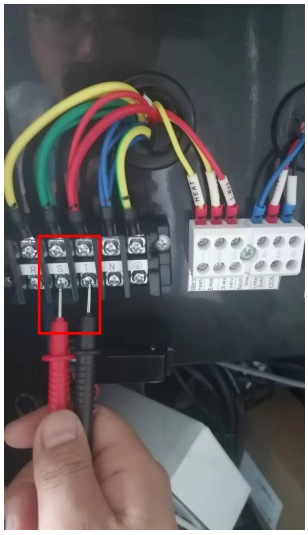
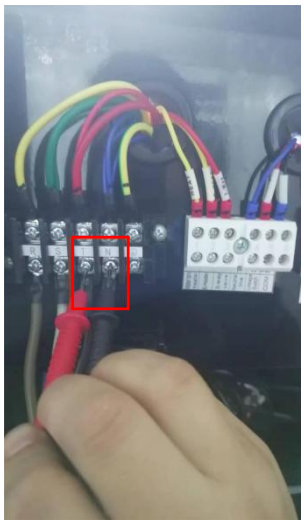
10.3.2.2 User’s terminals for 380V three-phase units

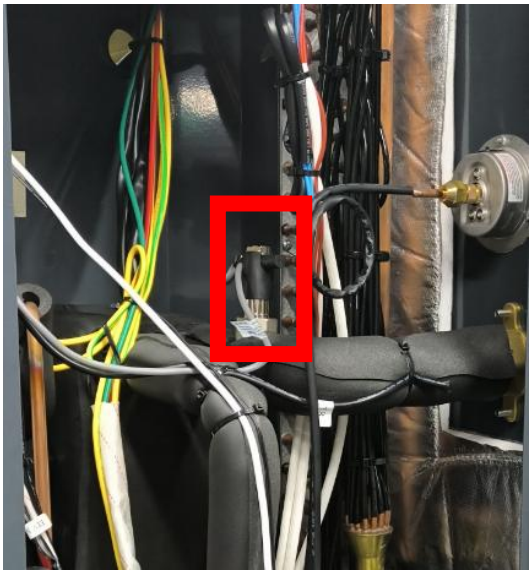
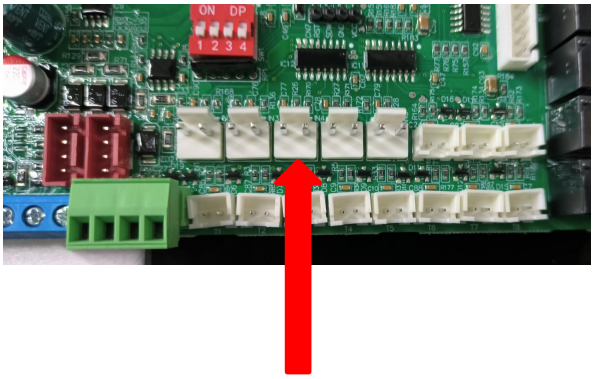


No.	Descriptions	No.	Descriptions
1	Power cable live line R	10	Auxiliary heat source control wire
2	Power cable live line S	11	N connection neutral line
3	Power cable live line T	12	SG signal connection
4	Power cable zero line N	13	GND connection
5	Earth line ⏚	14	EVU signal connection
6	Control line connection for pipeline water tank heater	15	GND connection
7	Control line connection for E-heater	16	Linkage Switch connection
8	Control line connection for 3-way valve	17	COM connection
9	N connection for neutral line		

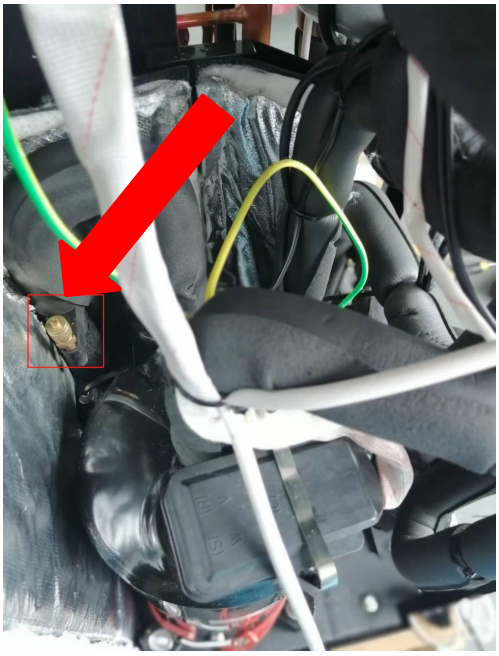
10.3.3. Troubleshooting and Maintenance of Common Fault Codes

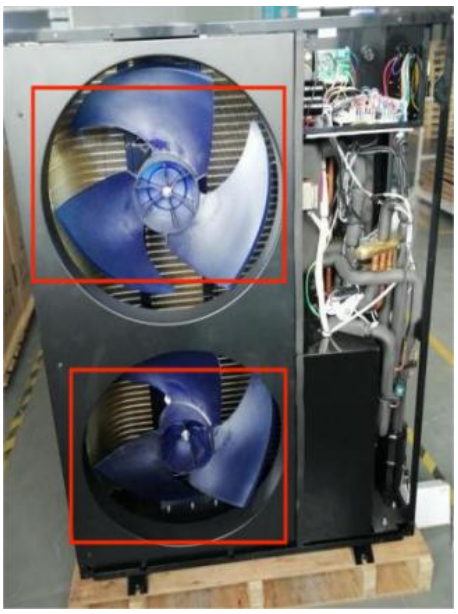
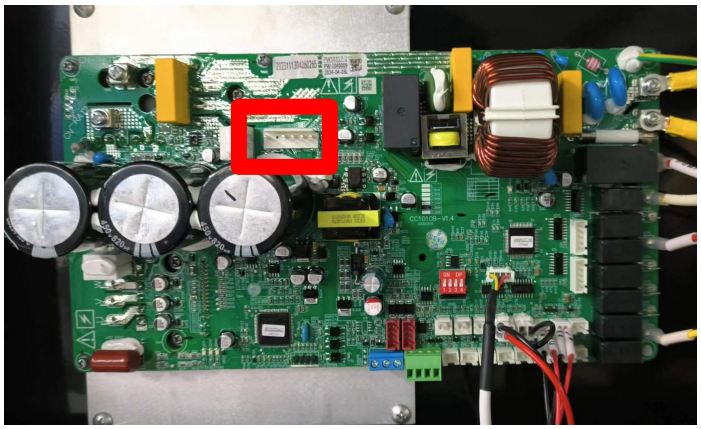
Note: When testing the resistance values of all temperature sensors, please refer to **Appendix D-Temperature Sensor Resistance.**

Er 01 Wrong phase protection		Maintenance method: RST three fire lines arbitrarily exchange two (after the exchange, re-power, adjust to the wrong phase fault disappeared); (This 220V heat pump will not cause this fault)
Er 20-258 Lack of phase failure	 	Service method: require measurement under power-on state 1. Check whether the power cord connection is fixed and firmly; 2. Use a multimeter to measure 380V voltage between three RST fire lines; if 380V voltage deviation ± 10%, check the power supply company. 3. Use a multimeter if there is 220V voltage between zero line and each RST; if 220V voltage deviation ± 7%, ask the power supply company to check.

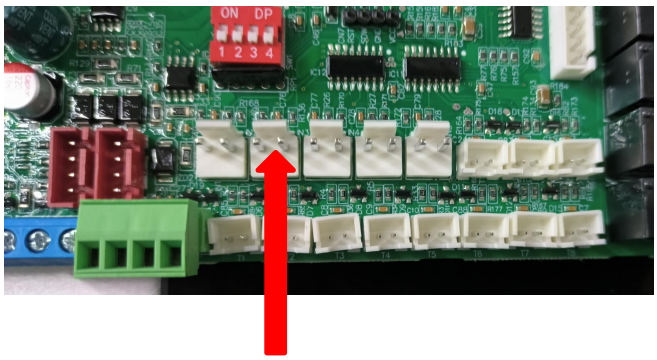
E03 Water flow switch failure or low water flow protection	  	Maintenance: Water pipe 1. Check whether the water pipe valve is fully open or not, ensure smooth water flow. 2. Check whether the temperature difference between the inlet and outlet water is within the range of 4~7 degrees Celsius or not. If the temperature difference between the inlet and outlet water is too large, it indicates that the water flow maybe too low due to unobstruction, and the heat of the heat exchanger cannot be taken away in time, so it is necessary to clean the water pipe or exhaust air (pipeline emptying and external water pump emptying). 3. Check whether the head and flow of the water pump, is enough or not. If the flow rate and the head is not enough, (1)the heat pump built-in water pump needs to add an user's end auxiliary pump, (2)the without water pump unit needs to be replaced with a suitable matching water pump. Pay attention to the installation position and direction of the water pump. The water pump must be installed at the inlet of the unit rather than outlet. Electronic control: Electric control: after shut down the unit, check the water flow switch. Find the water flow switch terminal on PCB main circuit board, pull out the terminal, and short the terminal instead. Turn on the heating mode of the unit again for 5 minutes and check whether the water temperature difference is between 4-7 degrees Celsius or not. If it is normal, determine the water flow switch installation is bad or fault, need to be installed or replaced;

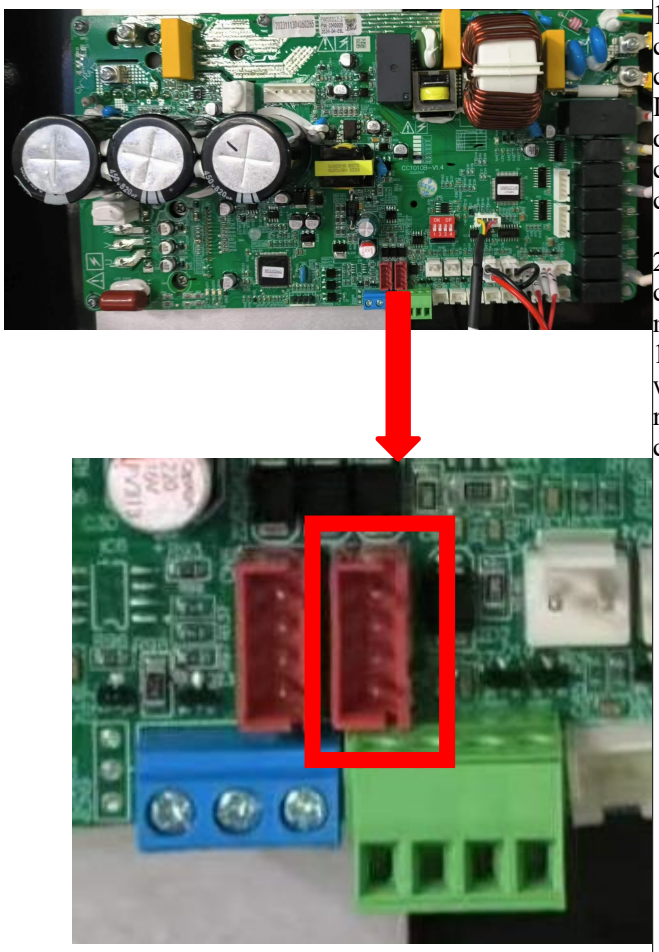
E05 High-pressure switch failure	 	**Electronic control:** First Steps: 1. Check whether the high pressure switch is damaged or the sensor wire is broken or not. Make sure the wiring terminals are connected correctly (Red IN1) 2. Check whether the position of the inlet temperature probe is correct or falls off (the inlet pipe of the unit). Make sure they are connected correctly;

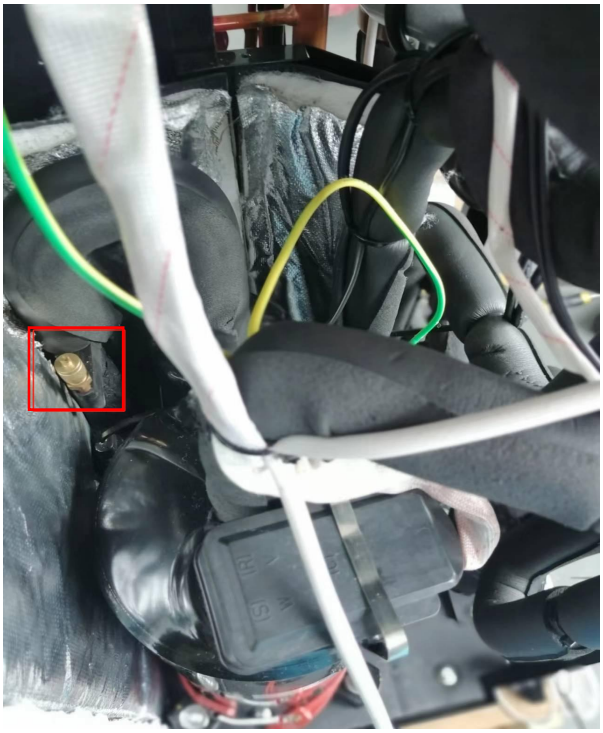
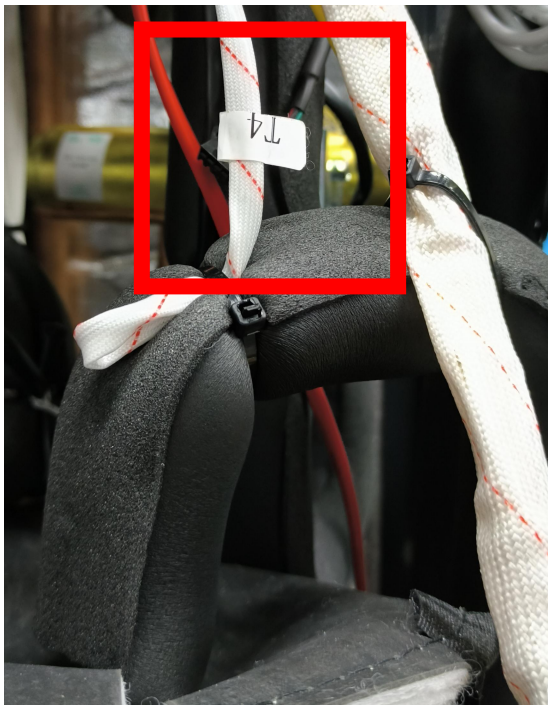
E05 High-pressure switch failure	 	**Systems:** Second Steps: After turning off the heat pump for 10 minutes, check whether the refrigerant pressure gauge parameters of the unit are normal, and connect to the low-pressure inspection port with pressure gauge to measure whether the refrigerant in the system is normal or not (operated by professionals). Danger warning: Since it will be in contact with R290 refrigerant, make sure there is no open flame, good ventilation, and operate in a safe environment.

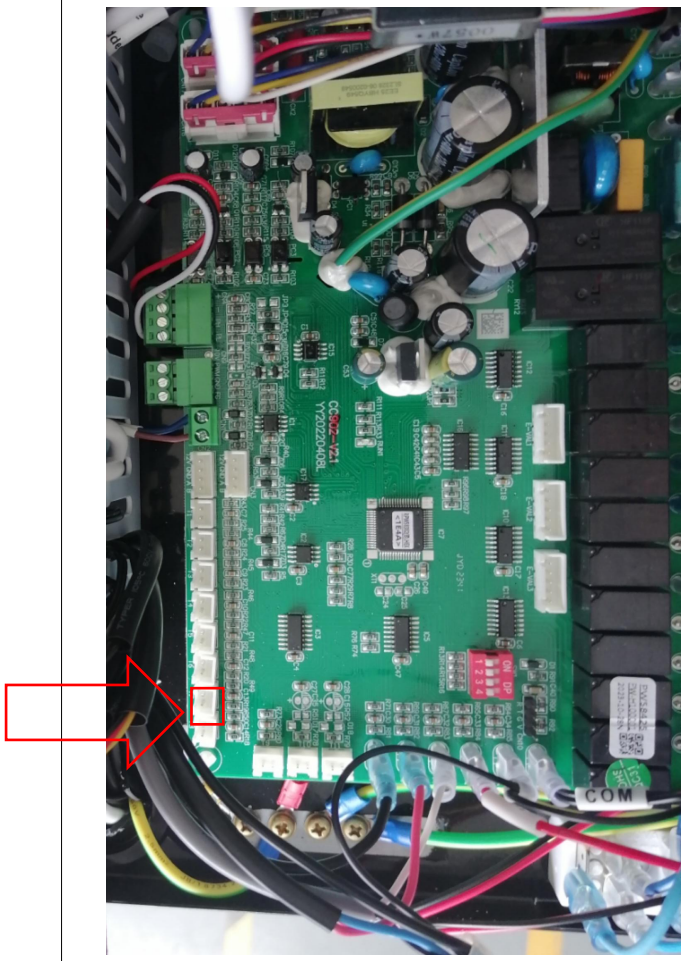
E05 High-pressure switch failure	 	The Third Steps: While the unit is running, check whether the fan is operating normally or not, or check the fan speed parameter through the controller. If the fan speed parameter is 0, check whether the fan terminal wiring is secure or not after power off.

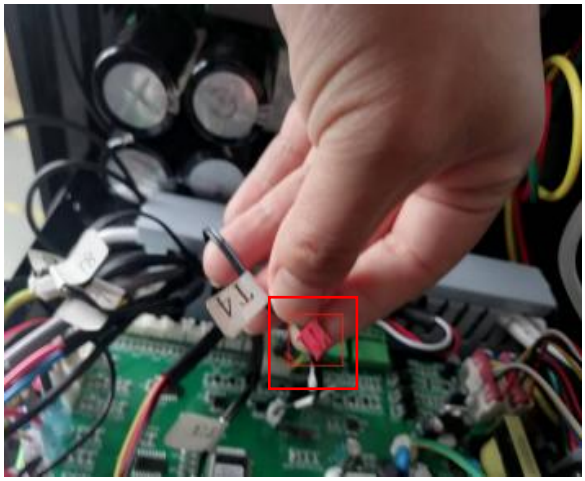
E05 High-pressure switch failure		Water Connection: The Fourth Steps: 1. After opening heating mode for 5 minutes, check whether the temperature difference between the inlet and outlet water is between 4 and 7 degrees Celsius. If the temperature difference too large, maybe the water is not smooth or the water flow is too small. 2. When the unit is on, check whether there is any abnormal noise or not when the water pump is running, and whether the water flow is sufficient or not. If the flow and head of water pump are not enough, (1) the built-in water pump unit needs to add a hot water auxiliary pump, (2)the without water pump unit needs to be replaced with a suitable matching water pump. Pay attention to the installation position and direction of the water pump: (1) the water pump must be installed at the inlet of the unit rather than outlet. 3. Check whether the diameter of the water pipe is too small or not (to avoid small water flow). Make sure the water pipe connection is fairly smooth.

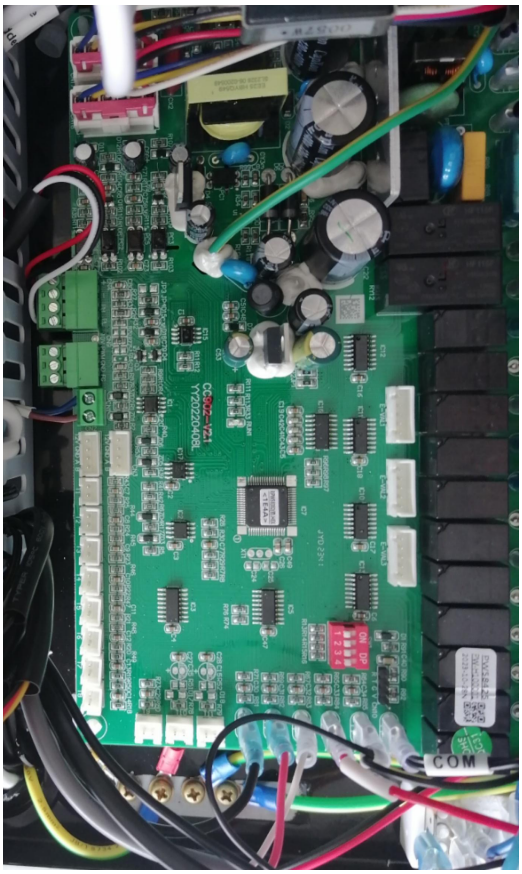
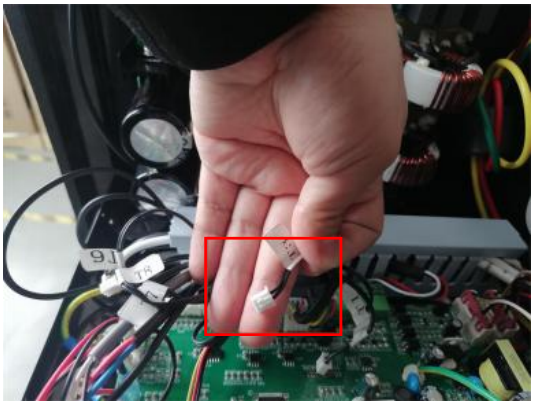
E06 Low-pressure switch failure	 	Electronic control First Steps: 1. Check whether the low pressure switch is damaged or the sensor wire is broken or not. Make sure the wiring terminals are connected correctly (Black IN2). System The Second Steps: After turning off the heat pump for 10 minutes, check whether the refrigerant pressure gauge parameters of the unit are normal, and connect to the low-pressure inspection port with pressure gauge to measure whether the refrigerant in the system is normal or not. If it is lower than normal, it indicates a refrigerant leak. Please find the location of the pipe leak, repair it and refill the refrigerant according to the maintenance instructions (operated by professionals). Danger warning: Since it will be in contact with R290 refrigerant, make sure there is no flame, good ventilation, and operate in a safe environment.

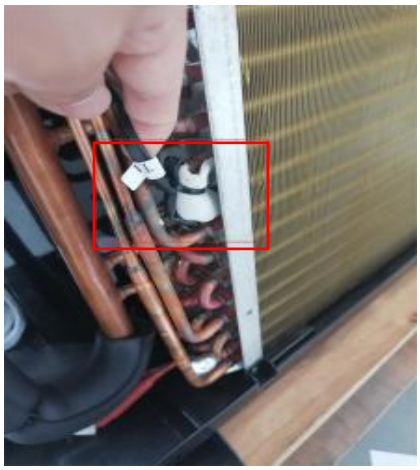
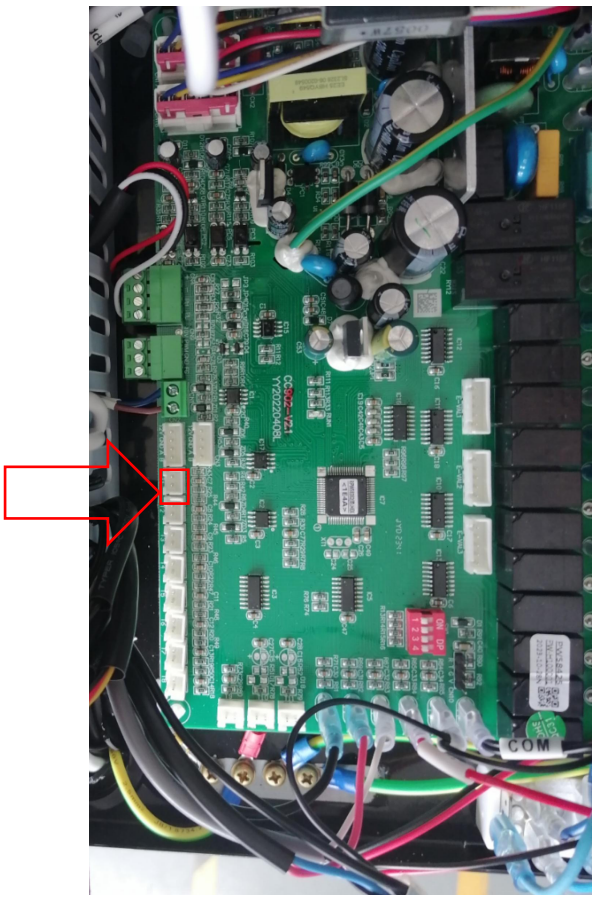
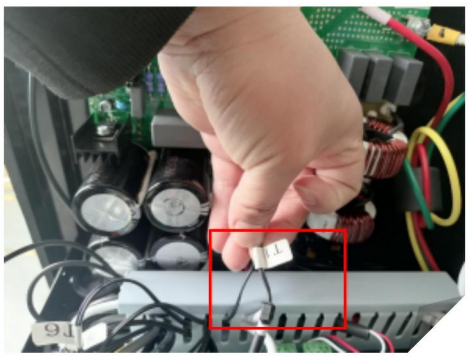
E09 Communication failure	 	1. Check the connection of the communication line between the wire controller and the main circuit board. If the communication line is damaged, the terminal falls off or the connection is bad, please replace the communication line and check again; 2. Measure the voltage between main circuit board and controller with multimeter. If the voltage output is 12V DC, recheck after replacing the wire controller; otherwise please recheck after replacing the main circuit board;

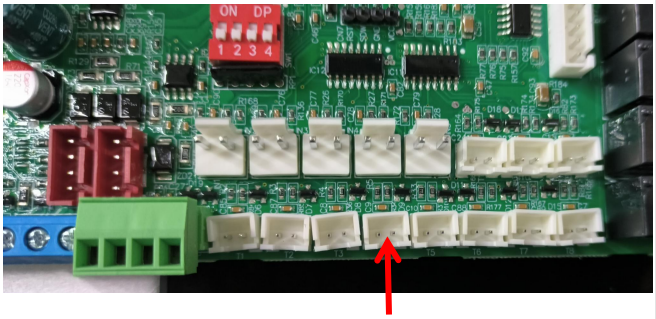
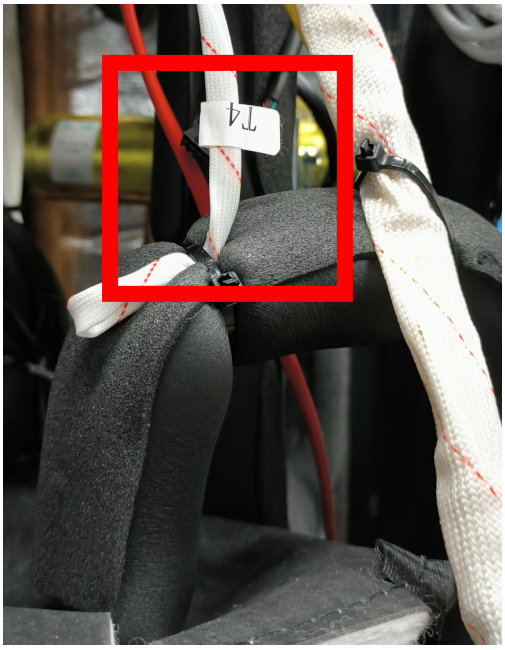
E12 Exhaust temperature too high protection	 	1. After turning off the machine for 10 minutes, check whether the refrigerant pressure gauge parameters of the unit are normal, and use the pressure gauge to measure whether the system refrigerant is normal.(If the refrigerant is below the normal value and the refrigerant is leaked, please check whether there are leakage points in each pipeline. The professional personnel are responsible for repairing the welding leakage point and recharging the refrigerant.) Caution: This operation involves handling R290 refrigerant. Prior to commencing the operation, ensure no open flames, adequate ventilation, and conduct inspections only after confirming environmental safety. 2. The refrigerant circuit of the heat pump cooling system is blocked, necessitating the replacement of the filter. (Professional personnel are responsible for the maintenance operation to replace the filter and recharge the refrigerant.) 3. Check whether the exhaust temperature sensor T4 probe is damaged or detached. After shutting down the unit and disconnecting the power supply, locate the T4 terminal on the mainboard and unplug it. Then, use a multimeter to measure the resistance value (normal resistance value is 50KΩ) to verify correctness. If the resistance value is abnormal, replace the exhaust temperature sensor.

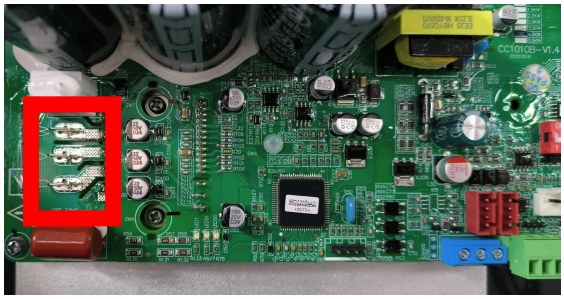
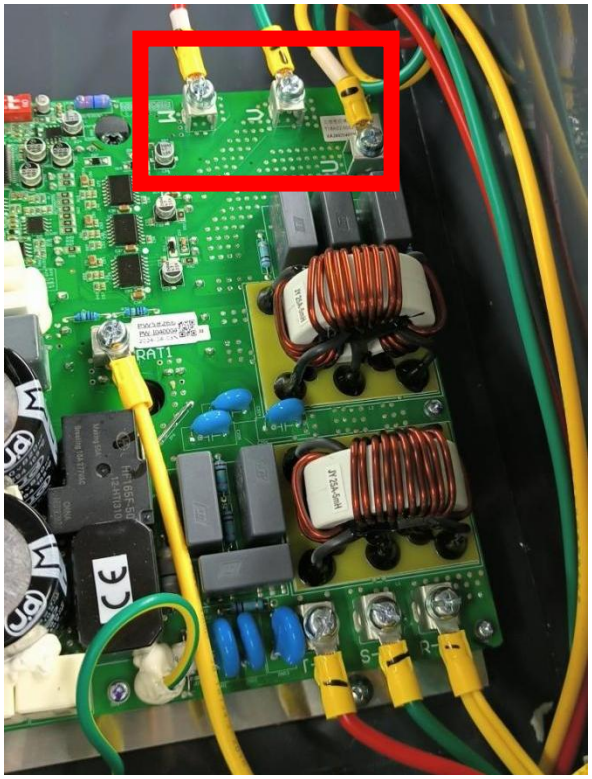

COM

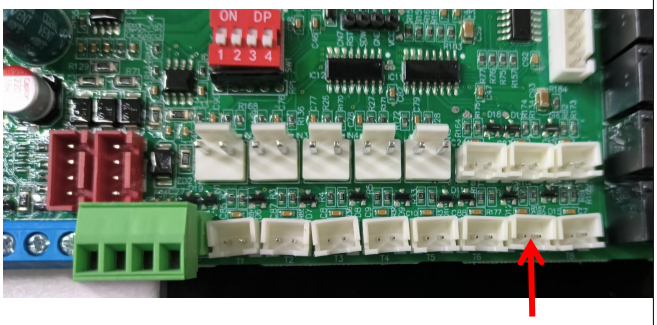

T1

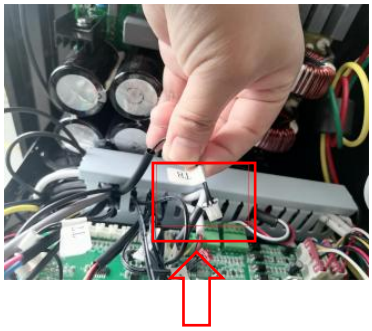
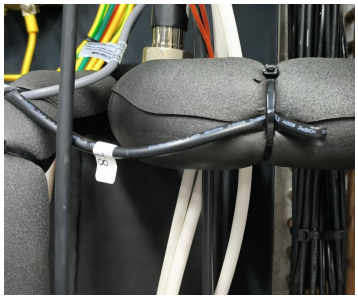
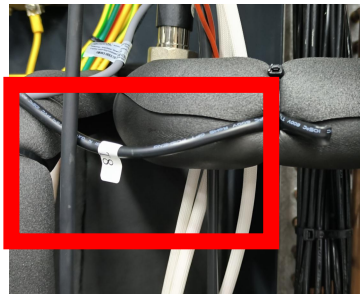
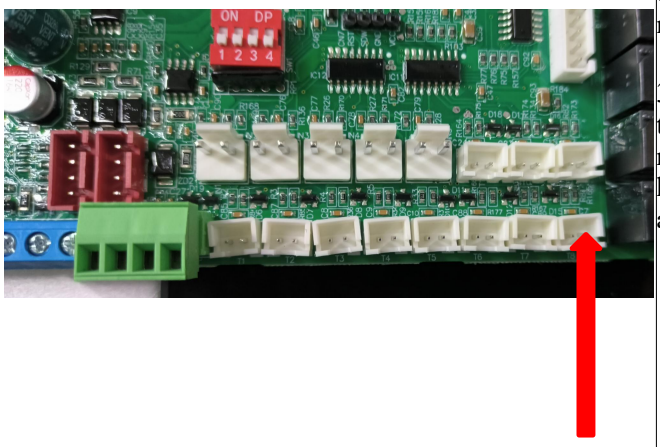
E15 Inlet water temperature sensor fault	  	1. Check if the probe wiring is damaged; 2. Check the connection between the temperature sensor and the main board; 3. Check the resistance value of the temperature sensor (5 KΩ). If the resistance value is too low or too high, it indicates that the sensor has a problem and needs to be replaced.

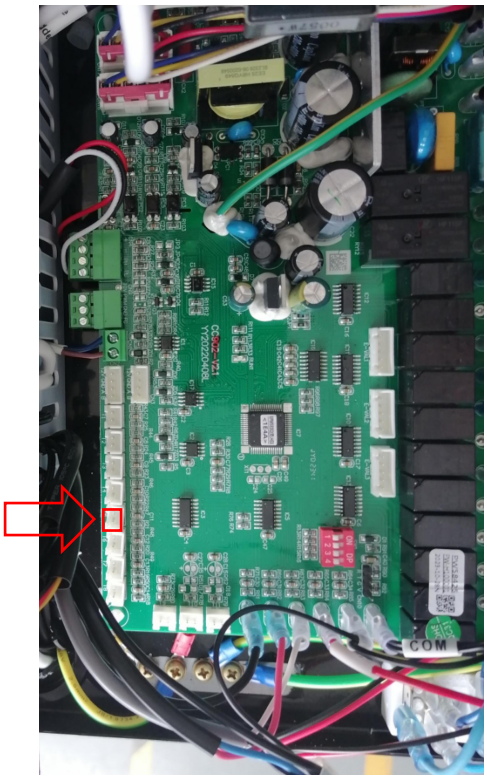
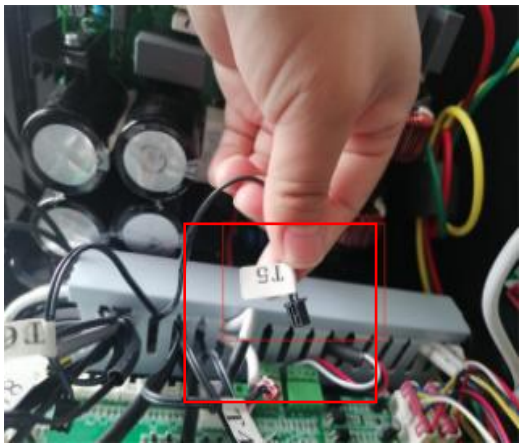
E16 Heating coil temperature sensor fault (Evaporator coil)	  	1.Check if the probe wiring is damaged; 2. Check the connection between the temperature sensor and the motherboard 3. Check the resistance value of the temperature sensor (5 KΩ). If the resistance value is too low or too high, it indicates that the sensor has a problem and needs to be replaced.

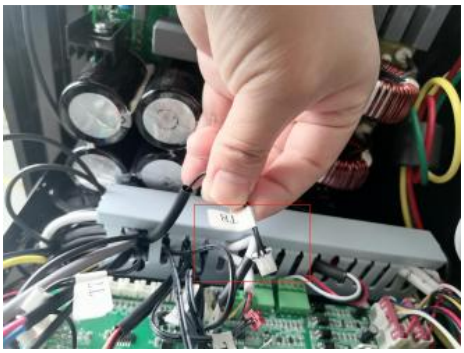
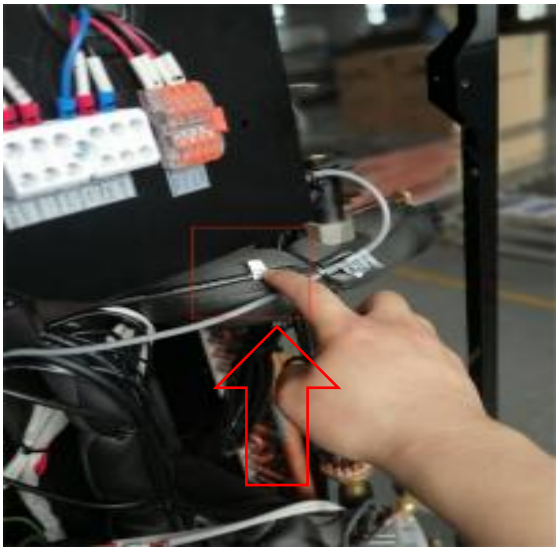
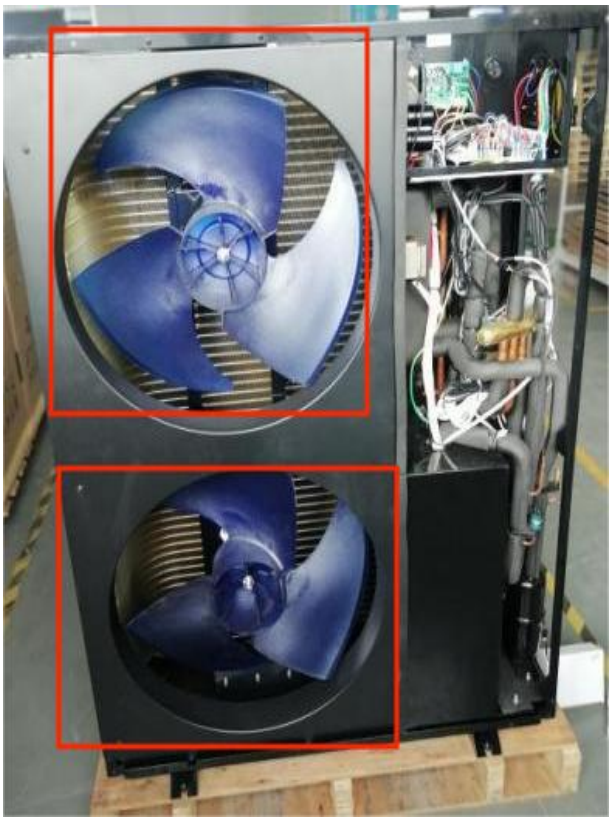
E18 The exhaust temperature sensor is faulty	 	1. Check if the probe wiring is damaged; 2. Check the connection between the temperature sensor and the motherboard 3. Check the resistance value of the temperature sensor (50 KΩ). If the resistance value is too low or too high, it indicates that the sensor has a problem and needs to be replaced.

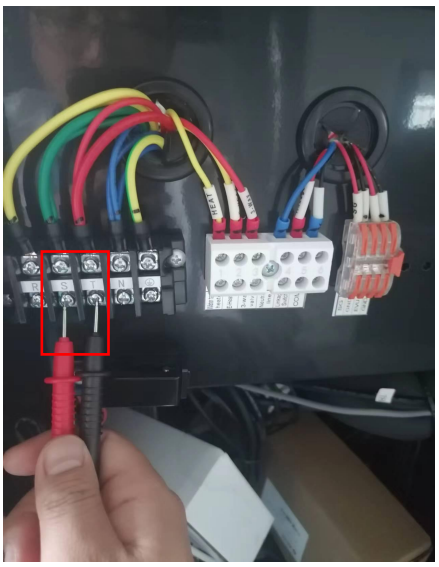
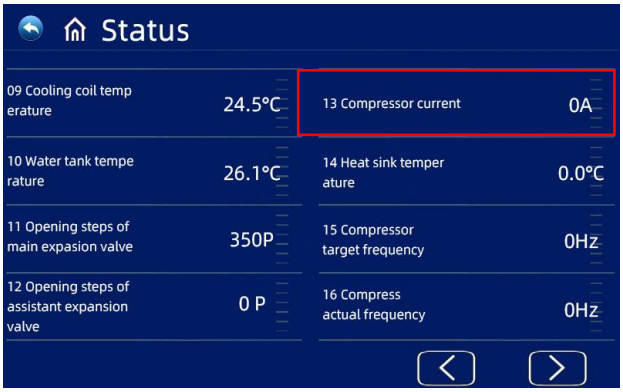
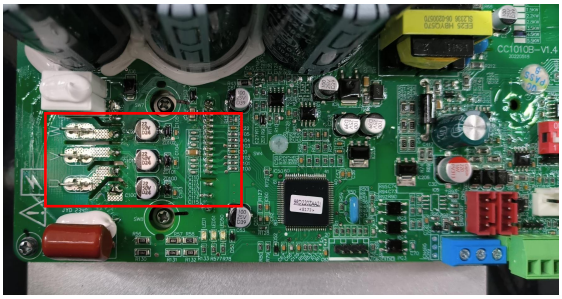
Er20 Abnormal protection of the inverter module	 	1. Check whether the inverter module is overheated 2. Check whether the inverter module is over-current 3. Check the fault code of the corresponding inverter module

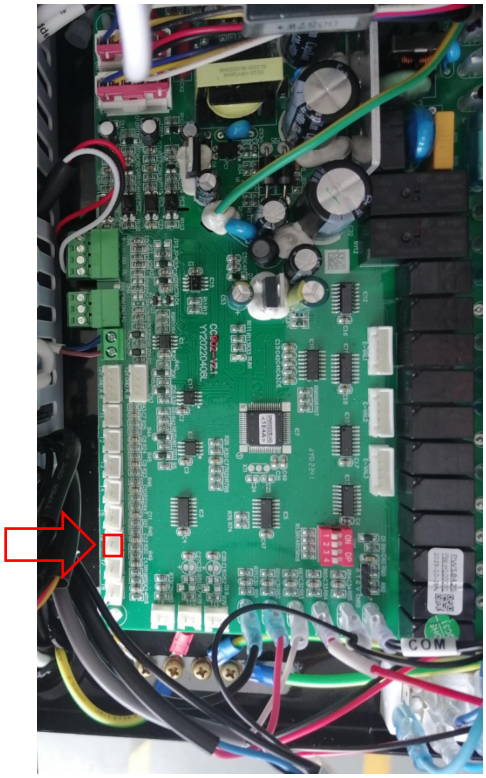
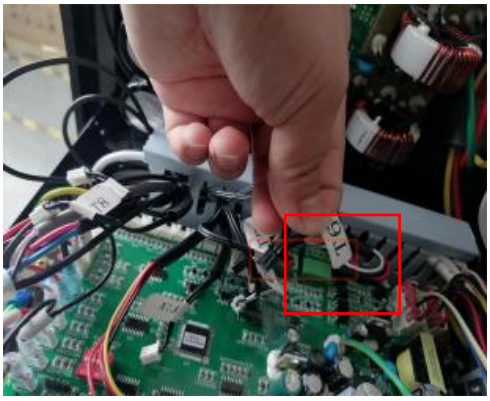
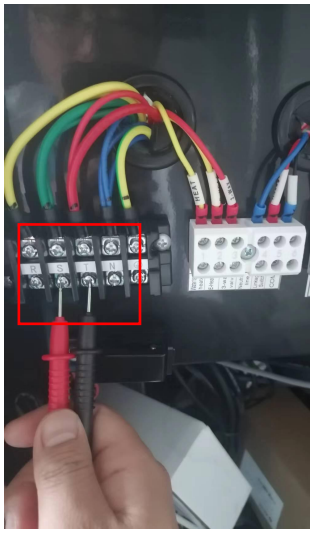
Er21 Ambient temperature sensor failure	 	1. Check if the probe wiring is damaged; 2. Check the connection between the temperature sensor and the motherboard 3. Check the resistance value of the temperature sensor (5 KΩ). If the resistance value is too low or too high, it indicates that the sensor has a problem and needs to be replaced.

Er23 Cooling Mode：low outlet water temperature protection (refer to Er27 treatment)	 	1.The outlet water temperature exceeds the system's protection threshold, low water flow rate, water pump anomaly. Check if the water valve or water pump is open. 2. The water pipeline has air or blockage, emptying and cleaning the blockage 3. Check the outlet water temperature probe
Er27 Outlet Water temperature sensor fault	  	1. Check if the probe wiring is damaged; 2. Check the connection between the temperature sensor and the motherboard 3. Check the resistance value of the temperature sensor (5 KΩ). If the resistance value is too low or too high, it indicates that the sensor has a problem and needs to be replaced.

Er29 Return gas temperature sensor failure	  	1. Check if the probe wiring is damaged 2. Check the connection between the temperature sensor and the motherboard 3. Check the resistance value of the temperature sensor (5 KΩ). If the resistance value is too low or too high, it indicates that the sensor has a problem and needs to be replaced.

Er32 Heating Mode: Outlet water temperature too high protection (Refer to the Er27 handling method)	 	1. The outlet water temperature exceeds the system's protection threshold, low water flow rate, water pump anomaly. Check if the water valve or water pump is open. 2. The water pipeline has air or blockage, emptying and cleaning the blockage 3. Check the inlet and outlet water temperature probe
Er34 The Inverter module : temperature is too high		1. Check if the fan is not rotating, inspect the heat sink behind the inverter drive board for any dirt or blockages, promptly clean it, and then restart the machine. 2. Examine the installation position of the unit to see if the air duct is obstructed.

Er35 Over-current protection of compressor	  	1. Make sure the power supply voltage is within the normal operating voltage range of the machine; 2. Check whether the compressor works normally, check the compressor current value from the controller display screen, and measure the current of the power line with a clamp multimeter; if the current value of the compressor does not correspond to the power line current value measured by the multimeter, the circuit of the compressor current is damaged and needs to be replaced.

Er42 Cooling coil temperature failure (Condenser pipe)	 	1. Check if there is any damage to the sensor and its wire 2. Check the connection between the temperature sensor and the main board 3. Check the resistance value of the temperature sensor (5 KΩ). If the resistance value is too small or too large, then the sensor has a problem and needs to be replaced.
Er46 DC fan motor failure		1. Use the multimeter to detect whether it's protected by reverse phase, if yes, please exchange the connection of the two neighboring wires incoming to the power supply of the unit 2. Check if there is any fault to the capacitor, if yes, then replace it with a new one with same specification

10.3.4 Er20 inverter module error code troubleshooting

⚠ **Safety precautions:** Ensure a safe testing environment and avoid electric shock or other safety issues.

1. Fault analysis

IPM module internal fault, the possible causes of the malfunction could be as follows:

The communication wire between the driver board and the main board is damaged;

The power supply is abnormal;

The IPM driver board is faulty;

The main control board is faulty;

The compressor power line is damaged;

The compressor is faulty.....

2. Main troubleshooting

For the above reasons, please focus on checking the **main board, driver board, compressor, filter board** etc. Please refer to the following inspection steps.

2.1 How to check if the main board is damaged?

① Observe whether there are black burn marks on the surface of the main board (power terminals, capacitors, fuses, relays, and all ports);

② Using a multi-meter to measure the L and N power ports on the main board to check if the voltage within a fluctuation range of ± 10% of rated power supply?

Single phase unit: 198V-242V Three phase unit: 342-418V

③ Check the circuit connection terminals and wiring on the main board to ensure that they are not loose or corroded(For single-phase -081HE4 integrated main board, it is also necessary to check the U V W on the main board). If the connector is loose or corroded, it may cause the circuit to be disconnected and needs to be reconnected or replaced.

2.2 How to check if the inverter drive module is damaged?

① Observe whether there are any burnt black marks on the surface of the driver board (power terminals, capacitors,

fuses, reactance, and all ports)

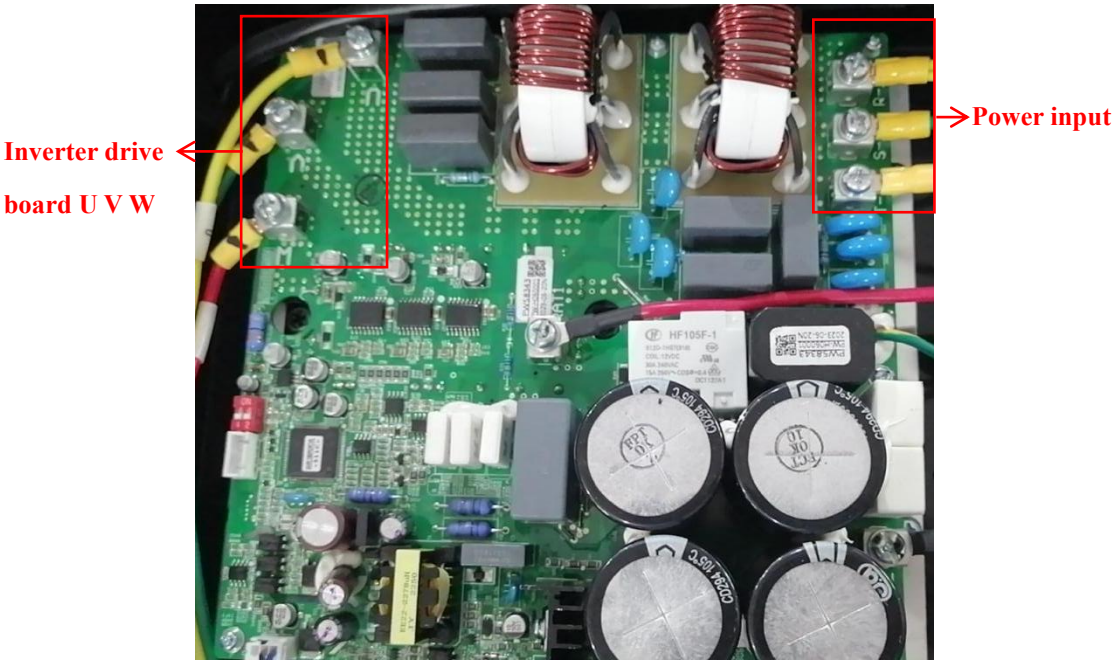
② Check the circuit connection terminals and wiring on the driver board to ensure they are not loose or corroded. If the connector is loose or corroded, it may cause the circuit to be disconnected and needs to be reconnected or replaced.

③Using a multi-meter to measure the power supply input ports(L N or R S T) on the main board to check if the voltage within the rated voltage fluctuation range of ± 10% as indicated on the nameplate?

④Use a multi-meter to measure whether the UVW port voltage on the driver board is normal. Too low or too high voltage will cause abnormal operation of the compressor.

Single phase unit: 311V ± 10%

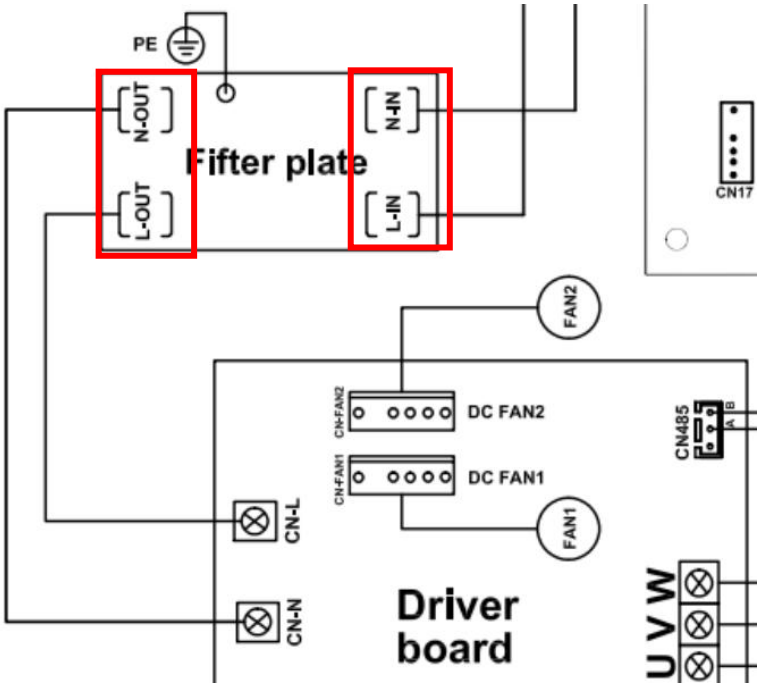
Three phase unit: 537V ± 10%



2.3 How to check if the filter board is damaged?

① Observe whether there are burnt black marks on the surface of the filter board, and whether the ports and wiring are loose.

② Measure resistance value: Turn the knob of the multi-meter to the resistance position, touch the test pen to both ends (L N) of the filter board, and record the resistance value. If the resistance value is infinite or close to infinite, it indicates that the filter board has failed and needs to be replaced.

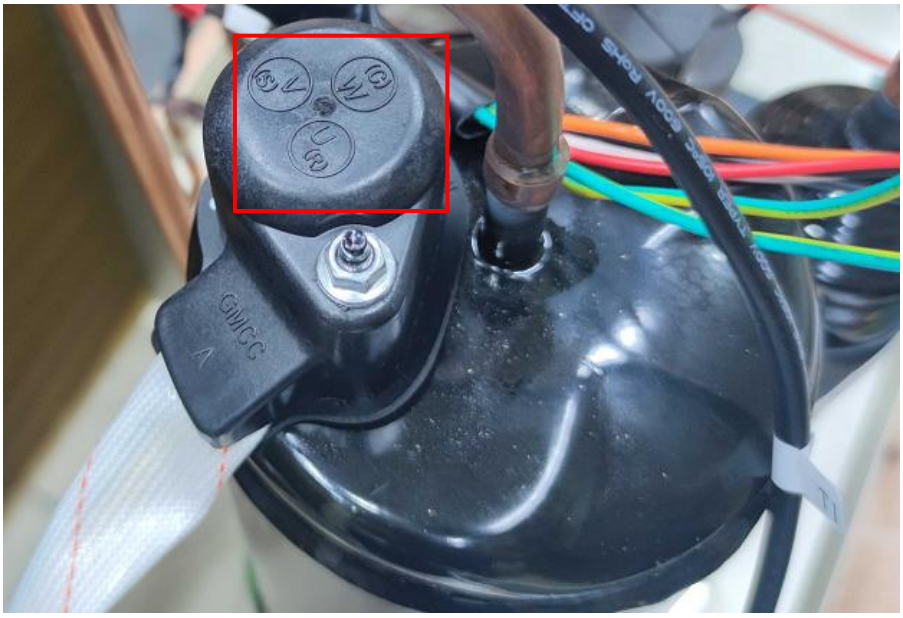


2.4 How to check if the compressor is damaged?

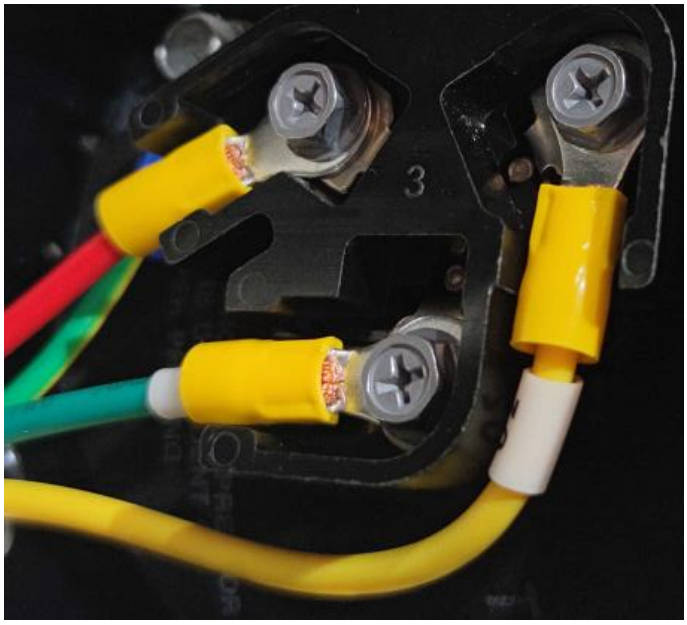
① Observe if there is any abnormal noise during the operation of the compressor? Observe if the power terminal on the top of the compressor is burnt black?

② Use a multi-meter to measure the U V W of the power control terminal on the top of the compressor. If the resistance values of any two terminals are close and not zero, the compressor power terminal control is normal; Then measure the resistance value of each terminal to ground, which should be above 10M Ω ; Otherwise, it can be determined that there is an internal abnormality in the compressor and the compressor is damaged.

Step 1: Remove the top control cover of the compressor



Step 2: Set the multi-meter to the Ω position and measure the resistance of U V W using method ②.



3.Detailed sub-error of Er20

For other detailed sub-error code and reasons, see the table below page.

Code	Meaning	Possible Reasons	Detecting Procedures	Solutions
1	IPM over current	1. External overload or overheating of IPM board 2. Short circuit of drive UVW 3. Fault of current detection device 4. Damage or failure of the IPM module.	1. Check whether the machine is stuck, for example, if the compressor cylinder is stuck 2. Check whether the feeding speed is too large 3. Check whether if there water inside the motor power cord plug which causes short circuit 4. Check if there is any problem with the current detection device	1. Make sure that the machine is not stuck 2. Appropriate feeding speed 3. Measure the motor UVW with the multimeter ohm gear to ensure that there is no short circuit 4. Replace the frequency conversion module
2	The compressor synchronization is abnormal	1. The compressor loading of the starting moment is too large 2. The compressor does not match with the program 3. The high and low voltage difference for starting the compressor is too large	1. If the internal and external fan motors work normally, check whether filters of indoor equipment are full of dust 2. Check if the external main board program and the compressor match or not 3. Check if the high and low voltage difference for start the compressor is too large or not	1. Clean the filters and Ensure that the air inlet of the internal and external machine is not blocked 2. Replace the correct main board and use the correct program 3. Ensure that the high and low voltage difference starts normally
8	Phase loss of the compress	1. The U, V and W wires of compressor are not or not well connected 2. The compressor and the	1. Check if the compressor U, V and W wires are connected in a good way or not 2. Check if the external main board	1. Ensure that the compressor U, V and W wires are well connected 2. Change the correct main

	or output	program do not match 3. The high and low voltage difference for start the compressor is too large 4. Failure of phase-loss inverse protector	program and the compressor match or not 3. Check if the high and low voltage difference for start the compressor is too large or not 4. Check the working status of the phase-loss inverse protector	board or update its program 3. Ensure that the high and low voltage difference starts normally 4. Replace the phase-loss inverse protector
16	DC bus voltage is low	1. Power supply is not stable 2. Mechanical failure 3.AC suddenly power off, the DC voltage will be too low when the remaining electricity supports the chips of the capacitor to work 4. PFC module failure	1. Check whether the instantaneous voltage is too low or the power supply voltage is too low 2. Check whether the transmission system of the motor is stuck 3. Check if the DC bus low voltage is caused by remaining electricity of the capacitor or not 4. Check the PFC module for any faults	1. Ensure the stable power supply 2. Ensure that the transmission shaft system is not stuck and there is no mechanical failure 3. Ensure that the electricity in capacitor is completely discharged first and then test it again 4. Replace the faulty frequency conversion module
32	DC bus voltage is high	1. Power supply voltage is too high. When the power supply voltage exceeds the rated voltage of the converter, the output voltage of the converter will also increase, which causes high DC bus voltage. 2. Failure of the capacitor 3. Overload 4. PFC module failure	1. Check whether the power supply voltage is normal 2. Check whether the capacitor fails 3. Check whether the load of the frequency converter is too large 4. Check the PFC module for any faults	1. Ensure that the power supply voltage is normal 2. Replace the capacitor 3. Reduce load 4. Replace the faulty frequency conversion module
64	The temperature of the heat sink is too high	1. Fan motor fault 2. The air outlet duct is blocked	1. Check whether the fan motor fails 2. Check whether the air outlet duct is blocked	1. Change the fan motor 2. Ensure that the air outlet duct is clean

128	Heat sink temperature failure	1. Temperature sensor failure of short circuit or open circuit 2. Heat sink scaling 3. The ambient temperature is too high	1. Check if there is short circuit or open circuit of heat sink sensor 2. Check if there is too much dust or scaling on the heat sink 3. Check if the ambient temperature is too high.	1. Replace the frequency conversion module 2. Clean up the dust and scaling from the heat sink 3. Reduce the ambient temperature
257	Communication failure	1. The wires are not well connected 2. Internal components of the heat pump are damaged 3. The output voltage of the power board in the module is abnormal or no output	1. Check the communication wires connection between main board and frequency conversion module 2. Check whether the internal components of the heat pump are damaged 3. Check whether the power board in the module is normal	1. Reconnect the wires and ensure stability 2. Replace the internal components 3. Replace the module power board
258	Phase-loss of AC input	1. Damage of current transformer during transportation 2. The direction of the current transformer is not inserted correctly during production 3. Compressors works without any load (no air compression) and with more than 40Hz, AC current is very small, leading to abnormal current transformer detection	1. Check whether the current transformer is damaged 2. Check whether the direction of current transformer is inserted correctly 3. Check AC current when compressor works without any load (no air compression) and with more than 40Hz frequency	1. Replace the good current transformer 2. Ensure that the current transformer is inserted correctly 3. Ensure that the AC current is moderate at a specific state and frequency
260	AC input over-current	1.AC over-current, the load suddenly goes too large, and the frequency cannot drop in time 2. The compressor is over-power, and the load suddenly goes too large, and the frequency cannot drop in time 3. The compressor is over-power, the compressor high and low voltage difference for starting is too large	1. Test whether the load is changed suddenly 2. Check whether the high and low pressure difference of the compressor for starting is too large	1. Make sure that the load is not too high suddenly 2. Ensure that the high and low voltage difference of the compressor for starting is moderate
264	The AC	1. The input voltage is too	1. Check whether the input voltage	1. Ensure that the input

	input voltage is low	low 2. Current transformer is damaged during transportation 3. The direction of the current transformer is not inserted correctly during production	is too low 2. Check the current transformer on the frequency converter for any damage 3. Check whether the direction of the current transformer is wrong	voltage is normal 2. Make sure that the current transformer is not broken 3. Ensure that the current transformer is inserted correctly
272	High voltage failure	1. Circulation system is blocked 2. Compressor failure, such as piston stuck or valve leakage 3. Excessive or insufficient refrigerant 4. The sensor fails	1. Check that if the refrigerant pipeline is free of impurities or ice 2. Check whether the compressor is faulty 3. Check whether the refrigerant is too much or too little 4. Check the pressure sensor or temperature sensor has failure	1. Ensure that the circulation system is not blocked 2. Replace the compressor 3. Fill or discharge it with the appropriate refrigerant 4. Replace the sensor
288	IPM temperature is too high	1. Failure of fan motor or the air outlet duct is blocked 2. The ambient temperature rises too fast, resulting to the over-temperature and frequency cannot drop in time 3. Power supply voltage and current are too high or too low	1. Check whether the fan motor fails, or the air duct is blocked 2. Check whether the around ambient temperature rises up too fast 3. Check whether the power supply voltage and current is too high or too low	1. Replace the fan motor, or ensure that the air outlet duct is clear 2. Reduce around ambient temperature 3. Ensure that the power supply voltage and current is normal
320	Compressor peak current is too high	1. Current of compressors wires is too large 2. The drive program and compressor do not match	1. Check whether the current of compressor wires is too large 2. Check whether the main board driver program matches with the compressor	1. Ensure that current of the compressor wires is appropriate 2. Update the program to ensure it matches with the compressor 3. Replace the frequency conversion module

258	Phase-loss of AC input	1. Damage of current transformer during transportation 2. The direction of the current transformer is not inserted correctly during production 3. Compressors works without any load (no air compression) and with more than 40Hz, AC current is very small, leading to abnormal current transformer detection	1. Check whether the current transformer is damaged 2. Check whether the direction of current transformer is inserted correctly 3. Check AC current when compressor works without any load (no air compression) and with more than 40Hz frequency	1. Replace the good current transformer 2. Ensure that the current transformer is inserted correctly 3. Ensure that the AC current is moderate at a specific state and frequency
260	AC input over-current	1.AC over-current, the load suddenly goes too large, and the frequency cannot drop in time 2. The compressor is over-power, and the load suddenly goes too large, and the frequency cannot drop in time 3. The compressor is over-power, the compressor high and low voltage difference for starting is too large	1. Test whether the load is changed suddently 2. Check whether the high and low pressure difference of the compressor for starting is too large	1. Make sure that the load is not too high suddenly 2. Ensure that the high and low voltage difference of the compressor for starting is moderate
264	The AC input voltage is low	1. The input voltage is too low 2. Current transformer is damaged during transportation 3. The direction of the current transformer is not inserted correctly during production	1. Check whether the input voltage is too low 2. Check the current transformer on the frequency converter for any damage 3. Check whether the direction of the current transformer is wrong	1. Ensure that the input voltage is normal 2. Make sure that the current transformer is not broken 3. Ensure that the current transformer is inserted correctly

272	High voltage failure	1. Circulation system is blocked 2. Compressor failure, such as piston stuck or valve leakage 3. Excessive or insufficient refrigerant 4. The sensor fails	1. Check that if the refrigerant pipeline is free of impurities or ice 2. Check whether the compressor is faulty 3. Check whether the refrigerant is too much or too little 4. Check the pressure sensor or temperature sensor has failure	1. Ensure that the circulation system is not blocked 2. Replace the compressor 3. Fill or discharge it with the appropriate refrigerant 4. Replace the sensor
288	IPM temperature is too high	1. Failure of fan motor or the air outlet duct is blocked 2. The ambient temperature rises too fast, resulting to the over-temperature and frequency cannot drop in time 3. Power supply voltage and current are too high or too low	1. Check whether the fan motor fails, or the air duct is blocked 2. Check whether the ambient temperature rises up too fast 3. Check whether the power supply voltage and current is too high or too low	1. Replace the fan motor, or ensure that the air outlet duct is clear 2. Reduce ambient temperature 3. Ensure that the power supply voltage and current is normal
320	Compressor peak current is too high	1. Current of compressors wires is too large 2. The drive program and compressor do not match	1. Check whether the current of compressor wires is too large 2. Check whether the main board driver program matches with the compressor	1. Ensure that current of the compressor wires is appropriate 2. Update the program to ensure it matches with the compressor 3. Replace the frequency conversion module

10.3.5 Common faults and debugging

◎ If users have any problems in the process of work, they must hire professional maintenance personnel for maintenance. Maintenance personnel may refer to the chart for debugging.

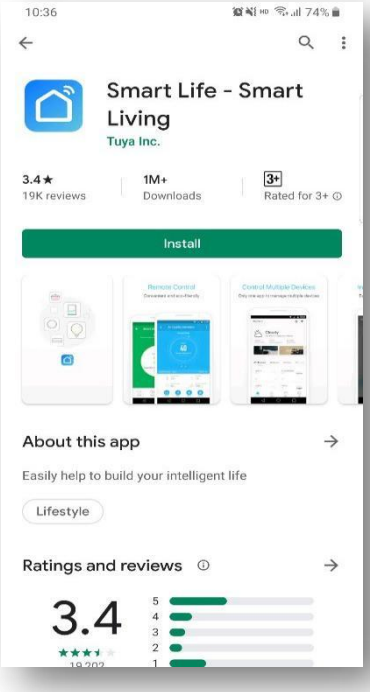
Fault	Possible Reasons	Solutions
The heat pump is not running	1. Power failure **2.** Loose wiring 3. blown fuse **4.** Low pressure is too low	**1.** Turn off the power supply switch and check the power supply condition **2.** Find out the cause and repair it **3.** Replace the fuse **4.** Test the voltage and the current
The water circulation pump is working but no water circulation or high noise of the water pump	**1.** Lack of water in the system **2.** There is air in the water system **3.** These valves are not all open **4.** The water filter is very dirty and blocked	**1.** Check the system supplement device, and complete the system **2.** Exhaust the air in the water system 3. Open the water supply system valve **4.** Clean the water filter

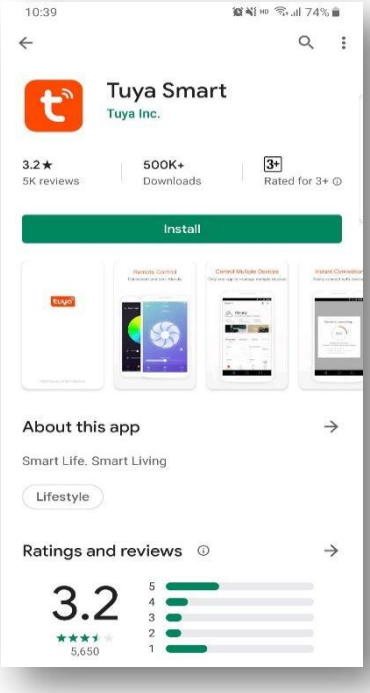
Low heating capacity	**1.** Lack of refrigerant **2.** Poor thermal insulation of the water system; **3.** Dry filter is blocked **4.** The air heat exchanger has poor heat dissipation **5.** Water is insufficient	**1.** Leakage detection and charge sufficient refrigerant **2.** Strengthen the thermal insulation of the water supply system **3.** Replace dry filter 4. Clean the air heat exchanger **5.** Clean the filter
The compressor does not work	**1.** Power supply failure **2.** Compressor contactor is damaged; **3.** The wiring is loose **4.** Compressor overheat protection 5. Water outlet temperature is too high **6.** Water flow is insufficient **7.** Compressor overload protector has tripping operation	**1.** Find out the cause, and solve the power supply failure problem **2.** Replace the compressor contactor **3.** Find out the loose point and repair it **4.** Check the unit pressure and the exhaust temperature. **5.** Reset the water temperature **6.** Clean the water filter and exhaust the air from the system **7.** Check the running current and check if the overload protector is damaged
The compressor operating noise is too high	**1.** The liquid refrigerant enters into the compressor **2.** Internal parts of the compressor are damaged **3.** Power voltage is too low	**1.** Check if the expansion valve has failure 2. Replace the compressor 3. Check the power voltage
The fan does not work	**1.** The fastening screw of the fan motor is loose **2.** The fan motor is damaged **3.** Contractor is damaged	**1.** Fix the screw **2.** Replace fan motor **3.** Replace the contractor
The compressor is working, but the heat pump does not provide heating	**1.** All the refrigerant leaks completely **2.** Compressor failure **3.** Compressor reversal	**1.** Check the leakage and fill with refrigerant **2.** Replace the compressor **3.** Exchange the phase sequence of the compressor
Low water flow protection	**1.** Insufficient water flow in the system **2.** Failure of water flow switch failure	**1.** Clean the water filter system and exhaust the air from the system **2.** Check and replace the water flow switch

11.WIFI connection and operation

11.1 Application download

Please go to "Google Game Store" or "Apple App Store," search for "Smart Life" or "Tuya Smart," and download it. See below.





11.2 WIFI connection mode: Bluetooth mode

1st step

(1) By default, it can be connected by touching icons after 10 seconds of the first startup (10s is the delay of wifi into low power).

(2) Manually enter the smart distribution mode: select "SMART Mode" or "AP MODE" on the WIFI interface, click "Add Device" to enter the smart distribution mode, when the icon on the main interface flashes, you can start the phone to configure the network.

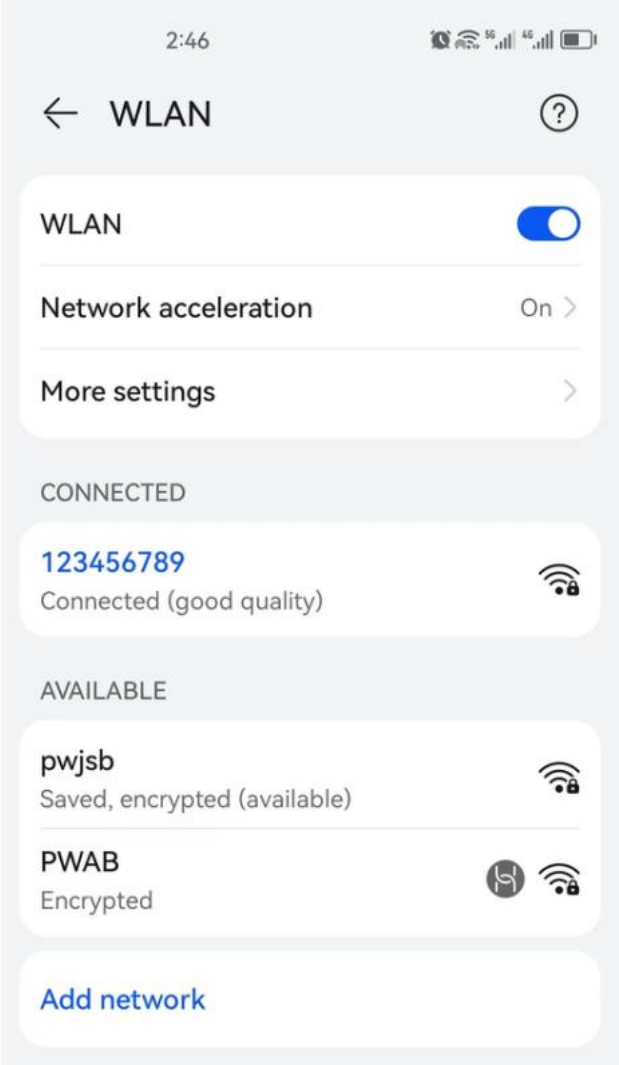
(3) After 3 minutes, it will exit the network configuration status, icon stop flashing, WIFI module

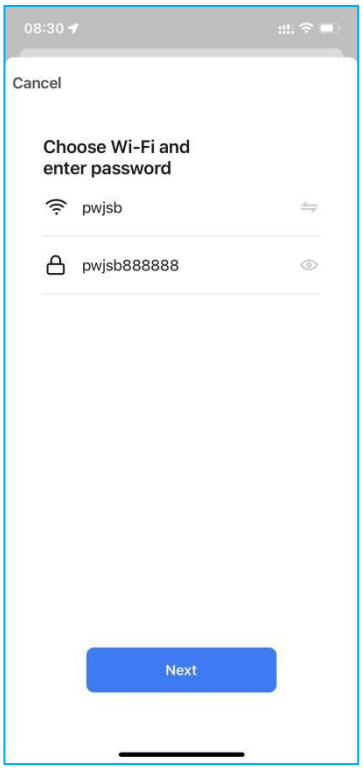
is no longer connected. If you want to configure the network again, you need to click the “Add Device” button on the WIFI interface again to confiture network.

2nd step

(1) Turn on Bluetooth function of the mobile phone

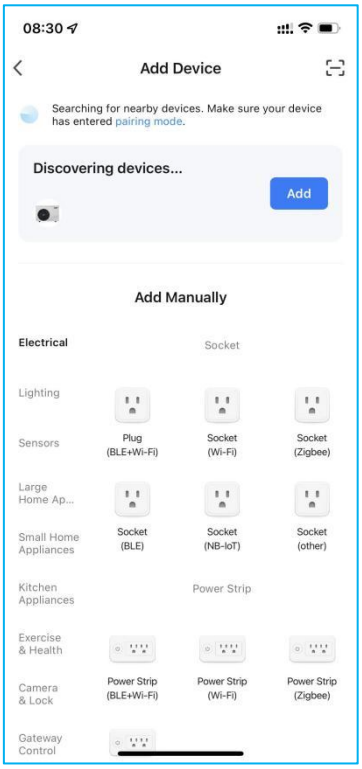
(2) Turn on phone's WIFI connectivity function, and connect to WIFI hotspot. WIFI hotspots must be able to connect to Internet, as shown in below picture, Connect WIFI hotspots "123456789".

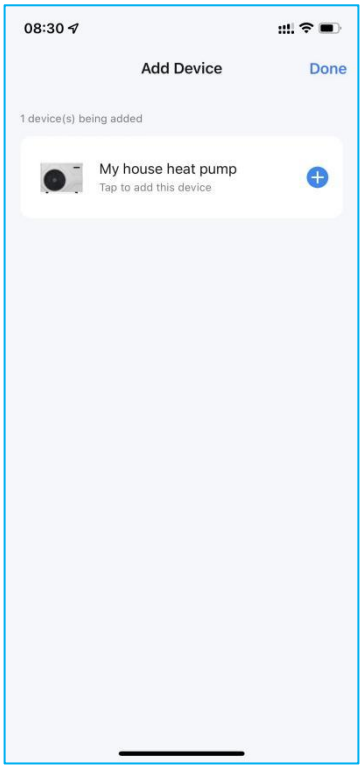




3rd step

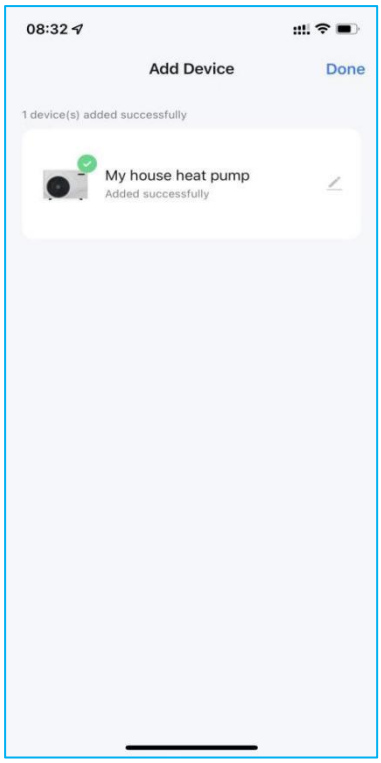
(1) Open "Smart Life" application, log in to main interface, click "+" in the upper right corner or "Add Device" in the interface to display "Discovering Devices", Click "Add" to enter "Add Device" interface, click "+", choose the network selection interface to enter and confirm with correct WIFI password, then, click "Next" to start connecting “My house heat pump” to WIFI.





4thstep

The WIFI network configuration of heat pump will be completed when the WIFI connection is done and system shows “add device” successfully. Click "Completed" to enter WIFI application interface.

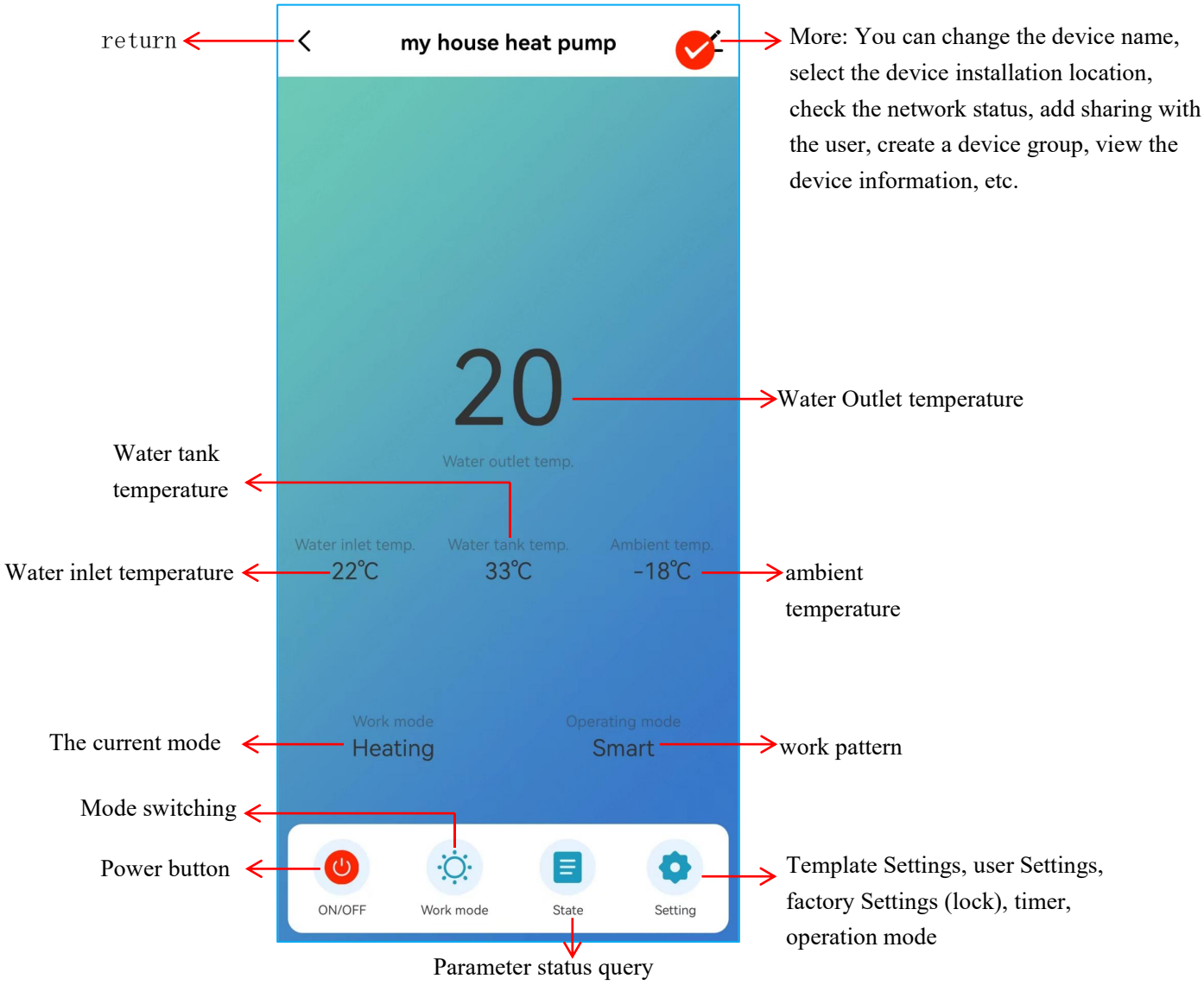


11.3 Software function operation

11.3.1 The interface introduction

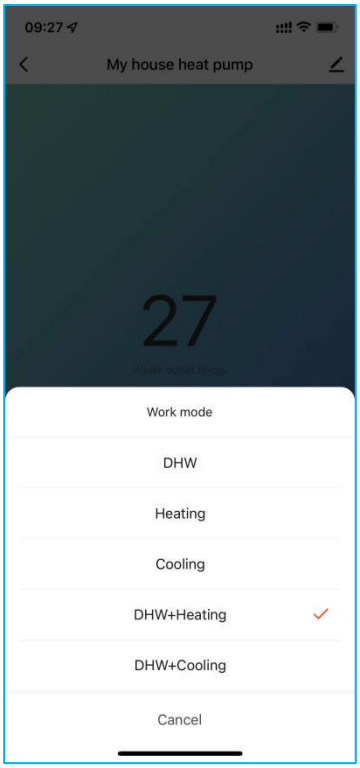
(1) After the heat pump is successfully connected to WIFI, enter to interface of "my house heat pump" (the name of heat pmp can be modified).

(2) Click "My Home Heat Pump" in the main interface of "All Devices" on "Smart Life" APP, enter the operation page of the "My Home Heat Pump" interface.



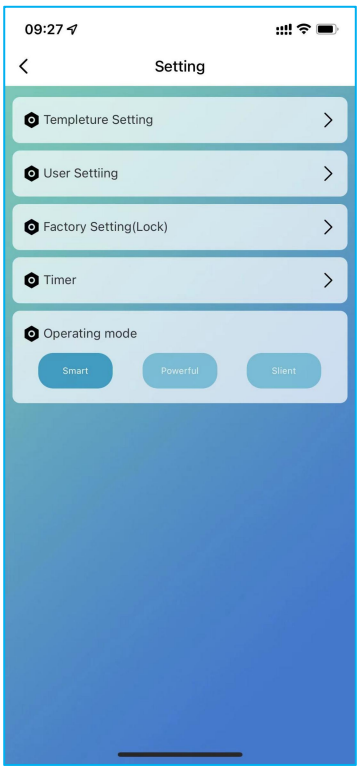
11.3.2 Mode setting

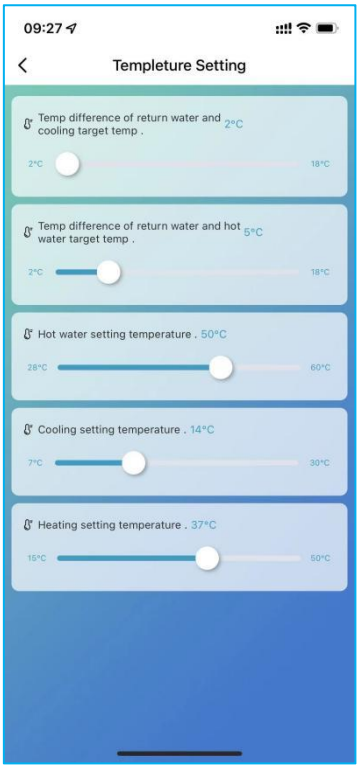
Click "working mode" on menu of main interface, choose the mode you want heat pump to work.



11.3.3 Water temperature setting

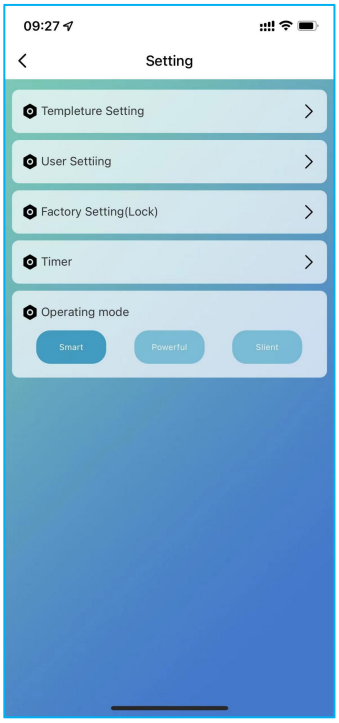
In the Settings interface, click "Water Temperature Settings" to set the required temperature and return water temperature difference.





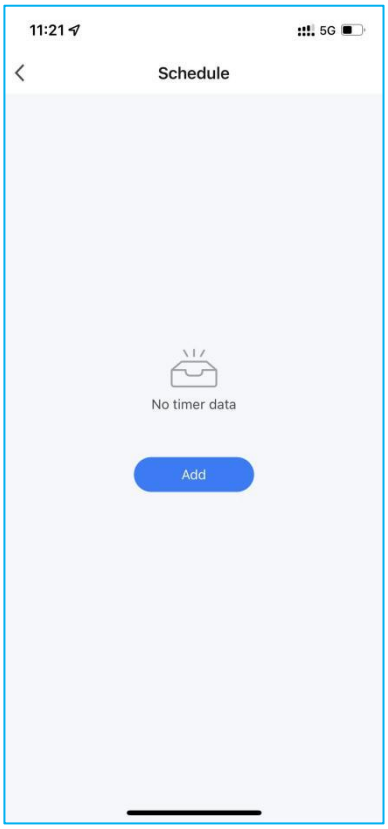
11.3.4 User Settings

In the setting interface, click "User Settings" to set the parameters.

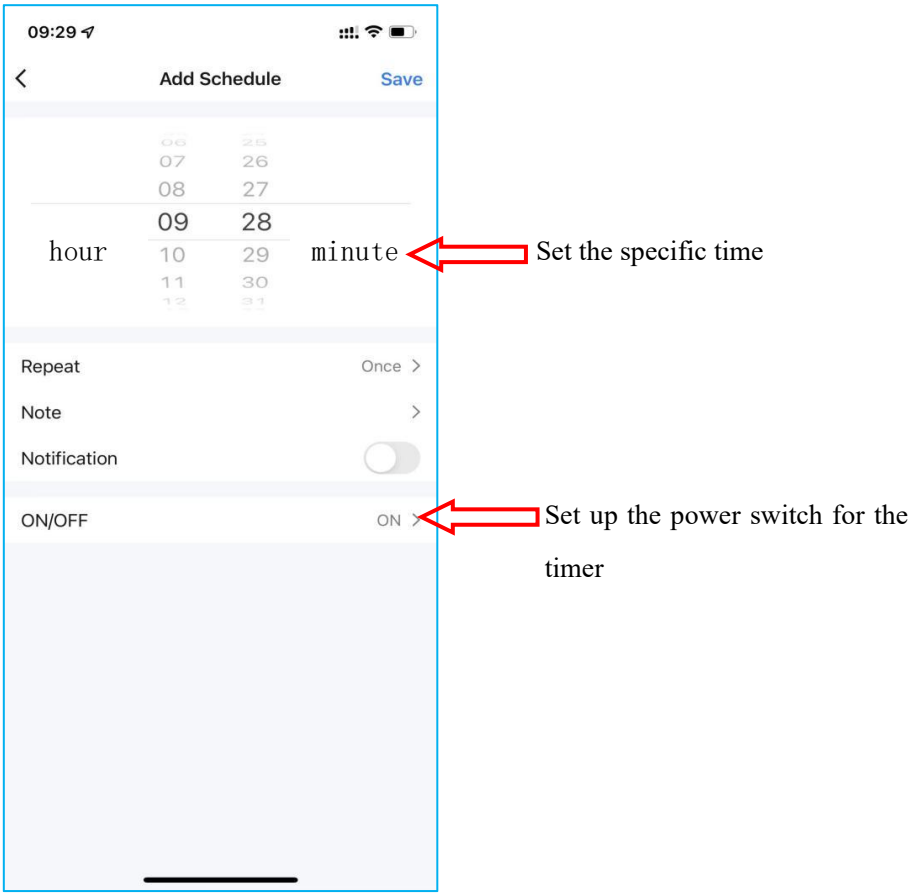


11.3.5 Timer settings

In the setting interface, click "timing" to enter the timer schedule setting, and click to add a timer.

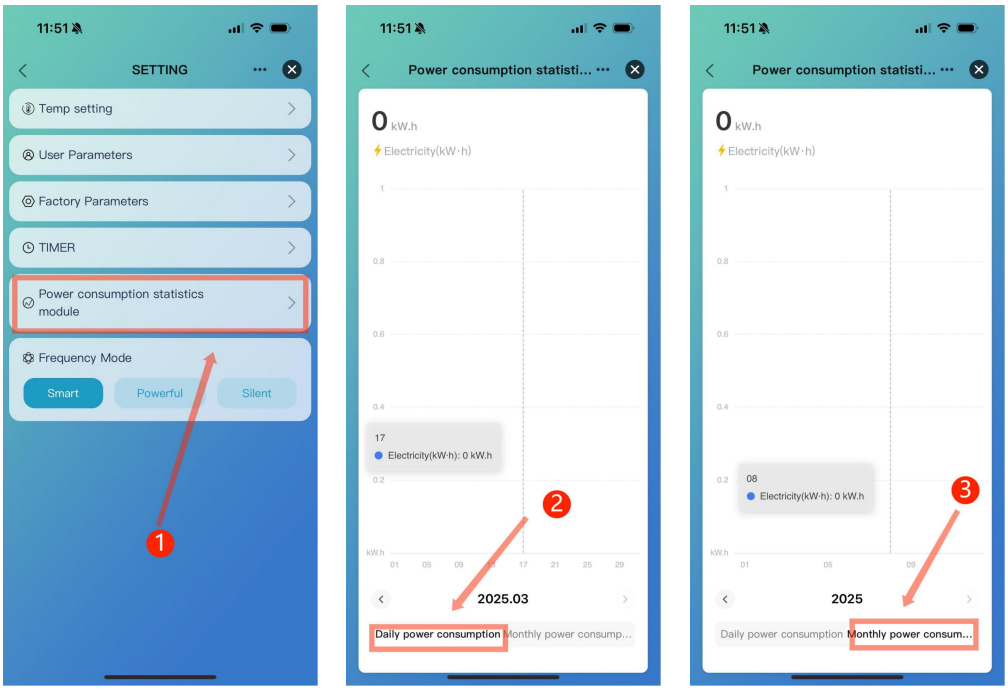


In the timer setting, slide up and down the hour / minute, set the timer time, set the repeat cycle and on / off, press the upper right corner to save, as shown in the below picture.



11.3.6 Power consumption curve view

Click on " " in the main interface of the device operation to enter the "Settings" menu. Find the "Electricity Statistics Module" and enter the interface to view "Daily Electricity Consumption" and "Monthly Electricity Consumption";



11.3.7 Equipment sharing

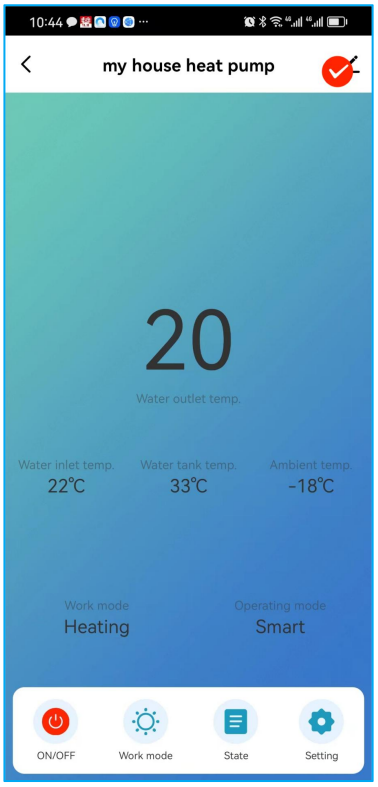
(1) For the shared bound devices, the sharer shall operate in the following order.

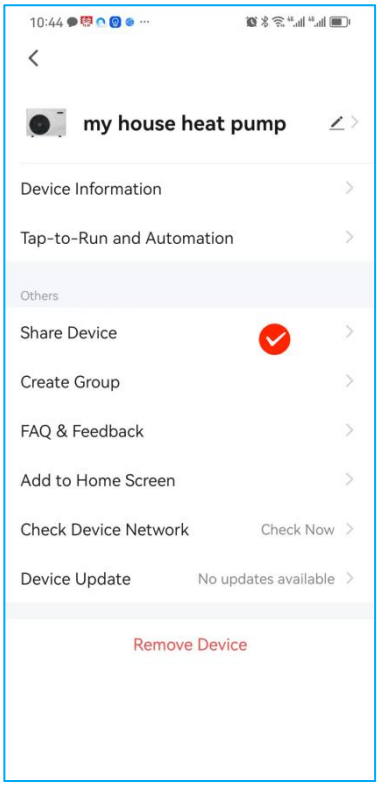
(2) After successful sharing, a list will be added and the shared people will be displayed.

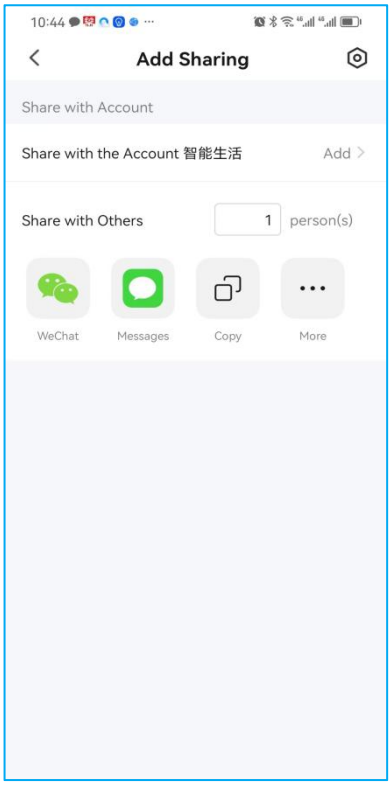
(3) To delete the shared person, long press the selected user, the delete interface will pop up, and click "Delete".

(4) The operation of the shared interface is as follows:

(5) Enter the “share device” account and click "Finish". The list of successful sharing will display the account of the newly added users. Shared person displays the received shared device, click operate and control the device.







11.3.8 Device deletion

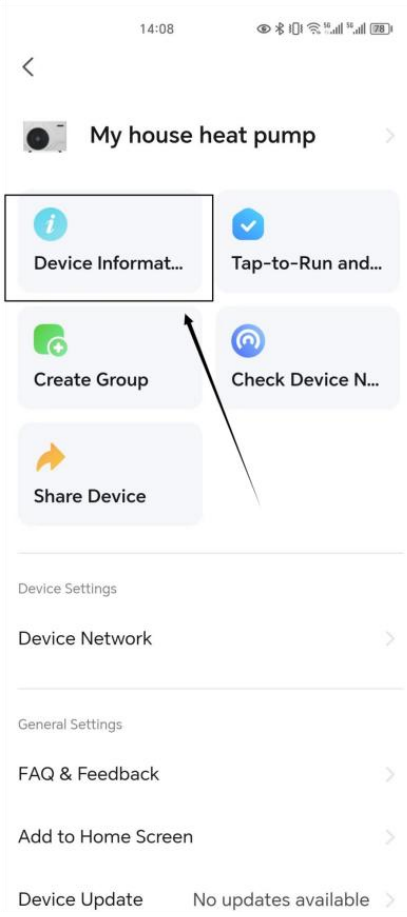
APP remove

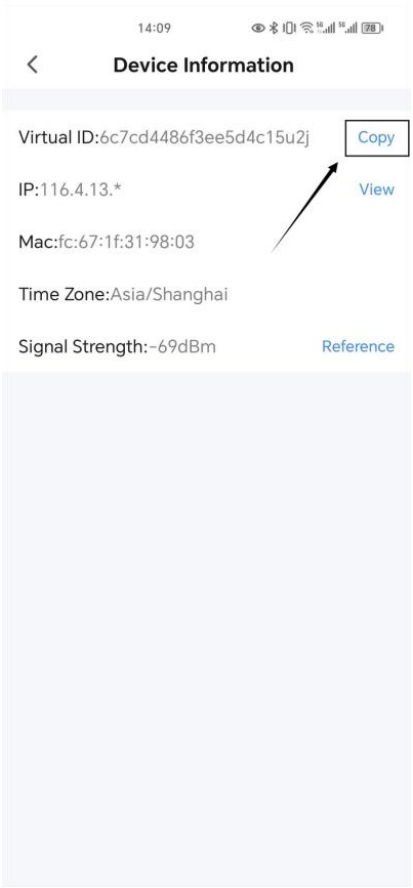
Click the upper right corner of device operation main interface to enter the device details interface, and click the "Delete device" interface to enter the intelligent network configuration mode. While the corresponding indicator light does not flash, the network can be reconfigured within 3 minutes. If it takes more than 3 minutes, it will exit the distribution network.

11.3.9 Virtual ID

Click the icon in the upper right corner of main interface, and then click the device information, the first behavior virtual ID listed in the device information interface, then click Copy to copy the virtual ID information.

09:26
My house heat pump
27
Water outlet temp.
Water inlet temp.
38°C
Water tank temp.
26°C
Ambient temp.
24°C
Work mode
DHW+Heating
Operating mode
Smart
ON/OFF
Work mode
State
Setting


14:08
My house heat pump
Device Informat...
Tap-to-Run and...
Create Group
Check Device N...
Share Device
Device Settings
Device Network
General Settings
FAQ & Feedback
Add to Home Screen
Device Update
No updates available


14:09
Device Information
Virtual ID:6c7cd4486f3ee5d4c15u2j
Copy
IP:116.4.13.*
View
Mac:fc:67:1f:31:98:03
Time Zone:Asia/Shanghai
Signal Strength:-69dBm
Reference

Appendix

A.User Parameters Explanation

Code	Definition	Adjustment range	Factory value	Explanation
P01	Temp difference of return water and cooling/heating target temp	2℃~18℃	2℃	The difference between the set temperature of cooling/heating and the return water temperature in heating/cooling mode.
P02	Temp difference of return water and hot water target temp	2℃~18℃	5℃	The difference between the set temperature of hot water and the return water temperature of the water tank in hot water mode.
P03	Hot water setting temperature	28℃~70℃	50℃	Hot water setting temperature
P04	Cooling setting temperature	7℃~30℃	12℃	Cooling setting temperature
P05	Heating setting temperature	15℃~70℃	35℃	Heating setting temperature
The user parameters P1-P5 can be set, and the remaining engineering parameters need to enter factory parameters page and require a password 666 to enter the settings. It is recommended that engineers use it.				
P06	Setting temp of exhaust gas too high protection (TP4)	50℃~125℃	120℃	After the compressor is turned on for 1 minute, the exhaust temperature is detected. When the exhaust temperature is detected to be ≥ 120 ℃ (parameter P06), it enters the exhaust high temp protection and the system shuts down
P07	Setting temp of exhaust gas too high recover (tp0)	50℃~125℃	93℃	When the exhaust temperature is detected to be ＜ 93 ℃ (parameter P07), it exits the exhaust high protection mode and the system start working
P08	Water temperature compensation	-5℃~15℃	1℃ (Water inlet, water outlet, water tank)	The compensation value is designed based on factors such as probe detection accuracy, probe distance, and user experience. It's determined by the factory based on system design, and it is not recommended for customers to make changes.
P09	Defrosting frequency	30-120HZ	70HZ	Indicates the adjustable operating frequency of the compressor in defrost mode
P10	Defrosting period	20MIN~90MIN	45MIN	It indicates that the interval between defrosting cycles is 45 minutes
P11	Defrosting enter temperature	-15℃~-1℃	-3℃	It indicates that the evaporator coil temp ＜-3℃ when the system enter defrost
P12	Defrosting time	5MIN~20MIN	8MIN	It indicates that the continuous defrosting time of the heat pump after entering defrosting mode is 8 minutes
P13	Defrosting exit temperature	1~40℃	15℃	When detecting the evaporator coil temp≥20℃, it will exit defrost mode

P14	Defrosting environment and evaporator coil temperature difference 1	0℃~15℃	5℃	Indicates the difference between the ambient temperature and the evaporator coil temperature when -7 ℃ ≤ ambient temperature ≤ 17 ℃ (P16)
P15	Defrosting environment and evaporator coil temperature difference 2	0℃~15℃	5℃	Indicates the difference between the ambient temperature and the evaporator coil temperature when ambient temperature ＜ -7 ℃
P16	Ambient temperature for defrosting	0℃~20℃	17℃	The ambient temperature limit（P14） when entering defrost mode is set at 17 ℃
P17	High temperature disinfection cycle days	0~30 天	0	When set to 0, do not perform disinfection function
		0 means no function		The general high-temperature disinfection cycle is once every 7 days
P18	High temperature disinfection start time	0~23:00	23	It indicates that when selecting the hot water mode, the unit will activate the high-temperature disinfection function at 23:00
P19	High temperature disinfection sustaining time	0~90min	30	Continusly 30mins for high temperature disinfection
P20	High temperature disinfection setting temperature	0~90℃	70℃	When the temperature of the water tank reaches 70 ℃, start high-temperature disinfection
P21	Heat pump’s setting temperature for high temperature disinfection	40~65℃	65℃	65 ℃ represents the operating temperature of the heat pump. When the high-temperature disinfection function is activated, the heat pump forcibly turns on the hot water mode, and the target temperature of the water tank hot water reaches a maximum of 70 ℃. (Because the difference between the operating temperature of the heat pump and the set temperature of the hot water is 5 ℃)
P22	Heating target temperature automatic adjustment enable	0-Disable 1-Enable	0	Only applicable in heating mode, heating+hot water mode. The system automatically adjusts the heating target temperature based on the ambient temperature
P23	Heating compensation temperature point (ambient temperature)	0-40	23	Calculation formula of heating target temperature: Pset (heating target temperature) = 20 + (P24/10) * (P23 - current ambient temp) The target temperature range of automatic temperature adjustment is 20-70℃
P24	Target temperature compensation coefficient	1~30 (1 corresponds to actual 0.1）	6	

P25	Frequency operating mode after constant temperature	0-Reduce frequency 1-No reduce frequency	0	0-The compressor runs for a period of time, and before reaching the target temperature, it will automatically reduce the frequency based on the difference inlet and outlet water temperature and the set temperature, and maintain continuous operation until a constant temperature is reached. 1-The compressor runs continuously at the target frequency until the target water temperature is met, and then stops.
P26	Ambient temperature for starting electric heating	-20-20℃	0	When the ambient temperature ≤0 ℃, the electric heating will be automatically turned on
P27	Start time for electric heating	0-60min	30min	When the compressor runs for 30 minutes and the water tank temp or the heating temp has not yet reached the set temp, the electric heating will be turned on
P28	on-line cascade units	1~8	1	Set the quantity of the cascading units
P29	Control address	1-255	1	Set the address of the cascading units
P30	E-heater mode selection	0: disable 1: backup E-heater 2: water tank booster heater 3: backup e-heater + tank booster heater	0	Only for backup electric heating E-heater and water tank electric heating
P31	Water temperature control mode	0: Water inlet temperature 1: Water outlet temperature	0	
P32	Temperature difference of compress full power operation	1~20℃	10	The temperature difference between the current total outlet water temperature and the set temperature when all cascade machines are turned on
P33	Loading temperature difference	1~20℃	1	For every 1 ℃ increase in the temperature difference between the set temperature and the current total outlet water temperature, start one more unit(select the compressor with the shortest cumulative operating time to start)
P34	Unloading temperature difference	1~20℃	1	When the temperature difference between the set temperature and the current total outlet water temperature decreases by 1 ℃, the system will shut down one unit (select the compressor with the longest cumulative operating time to shut down)
P35	Cascade mode regulation cycle	10~2500S	60	Refers to adjusting the cycle of cascade machines, detecting loading or unloading deviations every 60 seconds

P36	Automatic temperature control upper limit	20~80	70	The maxi temp for automatic temperature control function
	Celsius/Fahrenheit switch	0 Celsius 1 Fahrenheit	0	
F01	Heat Pump Function	1 Heating only 2Heating+Cooling 3 Heating+DHW 4 Heating+Cooling+DHW	4	
F02	Circulation pump status after reaching target temp.	0-intermitent run 1 一 keep running 2-stop running	0	1 means after reaching the set temperature, the water pump continues to operate to ensure water circulation and prevent freezing.
F03	Circulation pump on-off cycle after reaching set temp.	1~120min	15（stop 15mins, then working for 3min）	When F02 mode is selected as 0, the water pump runs for 3 minutes every 15 minutes cycle
F04	DC circulation pump mode	0-disable 1-automatically run 2-manually set 3-control water flow	3	Indicates the water pump will adjust its operating speed according to the preset target water flow.
F05	DC circulation pump adjustment cycle	10~120s	60	The water pump has a cycle every 60 seconds, and users can set these settings as F02/03/04/06/08
F06	DC water pump manual speed	10~100%	50	When F04 mode is set to 2, users can manually set the speed of the water pump by wired controller
F08	Minimum speed of DC circulation pump automatically running	10~100%	60	When F04 mode is set to 1, user can set the water pump automatically running speed
S1	Smart grid capabilities	No、Yes	No	Yes indicates access to SG function and activation No indicates no SG function
S2	Set DHW temp.increase value in SG mod	0-30℃	5℃	Used to adjust the target water temperature for hot water mode in SG control modes 3 and 4
S3	Antifreeze on/off for hot water mode	0: three way valve is off and not active 1: three way valve is active	1	Add anti freezing function to the hot water side water tank pipeline, the three-way valve will be powered on, and the water pump will drive the hot water side water circulation
S4	Compressor stop time after 3 way valve switch	0-5min （0-comoressor keeps running)	3	When selecting hot water+heating, hot water+cooling, the delayed start time of the compressor when switching between hot water and heating or cooling modes

H01	Auxiliary heat source	0 disable 1 heating 2 hot water 3 heating & hot water	0	Applicable modes for external heat sources
H02	Auxiliary heat source operation mode	0-low carbon mode 1-Eco hybrid mode	1	
H03	Eco hybrid mode	0 fixed pricing 1 peak-valley pricing 2 ambient temp judgment	1	The fixed pricing and peak valley pricing of the Eco hybrid model are mainly applicable to gas boilers; If the electric boiler is connected, it needs to be set to 2. Environmental temperature judgment, or select H02 as the 0-low carbon mode
H04	Ambient temp of auxiliary heat source operation	-30℃~30℃	-15℃	
H05	Delay start time of auxiliary heat source	0~180min	30min	If the water electric heating or water tank electric heating off time is greater than 30 minutes, the system will automatically detect the conditions for entering the auxiliary heat source
H06	Temperature difference to enter auxiliary heat source	2~18℃	5℃	The temperature difference between the heating target temperature and the total outlet water temperature
H07	Standard unit price of electricity	0~2.5	0.08	Corresponding to H03- Fixed Pricing Mode
H08	Low valley unit price of electricity	0~2.5	0.05	Corresponding to H03-1 peak and valley pricing, input the H07 and H08 for calculation. Set parameters H10~H13 on weekdays and rest days, calculate the electricity unit price once per hour, and compare the gas cost and heat pump electricity consumption cost.
H09	Unit price of gas materials	0~2.5	0.25	Just code input for calculation, not necessarily referring to actual unit price
H10	Work day low price electricity start time	0:00~23:00	0:00	
H11	Work day low price electricity end time	0:00~23:00	7:00	
H12	Rest day low price electricity start time	0:00~23:00	0:00	
H13	Rest day low price electricity end time	0:00~23:00	23:00	

H14	Ambient temp change of heat pump restart	-30~30℃	5℃	Based on the ambient temperature when the auxiliary heat source is turned on for the first time, when the cumulative ambient temperature changes by H14 degrees (default is 5 degrees), the heat pump is restarted to run for one hour, and then calculate the electricity price and gas price comparison based on COP, and choose whether to operate heat pump or gas boiler.
H15	Compressor preheating	2-Disable 3-Enable	1	Indicate whether the preheating function is enabled or not.
H16	Power off time for preheating detection	2-48	4	After a continuous power outage of 4 hours, the detection unit will automatically enter the preheating function when restarted.
H17	Preheating time 1	10-100min	30	Ambient temperature >10℃, H17 preheating time 30 minutes;
H18	Preheating time 2	10-150min	90	10℃≥ Ambient temperature >0 ℃, H18 preheating time 90 minutes;
H19	Preheating time 3	10-250min	120	0℃≥ Ambient temperature >-10 ℃, H19 preheating time 120 minutes;
H20	Preheating time4	10-350min	180	-10C≥ Ambient temperature >-20℃, H20 preheating time 180 minutes;
H21	Preheating time5	10-500min	240	-20≥ Ambient temperature, H21 preheating time 240 minutes;

B.Commissioning Checklist

Installer name			Install engineer/Telephone		
User's basic information	Name/Telephone				
	Install address				
	Area	m	Building insulation		
	User's end device	Radiator□ Floor heating□ Fan coil□ Domestic hot water□ Swimming pool heat pump□ Others□ Remarks:			
	Actual input voltage	V	Actual water pressure	MPa	
Heat pump model/Input power				Heat pump pressure gauge	MPa

		value	

Heat pump install position	Outdoor□ In the yard□ Rooftop□ Wall split□ Others□	Install base bracket	Concrete□ Steel structure□ Rubber Shock Pad□

Heat pump installation and commissioning steps

1	Measure the user's power supply voltage with a multi-meter, check the tap water pressure, and check if the installation position is appropriate;(Water pressure of tap water ≥ 0.2MPa, 0.25~0.4MPa is normal)	Conclusion	Qualified□ Abnormal:
2	Wear gloves and unpack to inspect the appearance of the heat pump for any damage; If the heat pump has a pressure gauge, check the pressure value(With the **ambient temp 10~25℃, the normal Static pressure within 0.6-1.0MPA**); Some heat pumps don't have a pressure gauge. Open the front panel to check the needle valve welded on the copper pipe, unscrew the needle valve port and connect a refrigerant gauge to check the pressure value, or press the top pin inside the needle valve to check	Conclusion	Qualified□ Abnormal:
3	Install the heat pump on a solid foundation, install shock rubber pads to fix the device, fix the water tank, and reserve the installation position of the water pump and valves; Reserve heat pump floor drainage; Reserve the position of the heat pump power supply	Conclusion	Qualified□ Abnormal:
4	According to the installation diagram, check the connection of pipeline joints for accessories such as heat pumps, water tanks, valves, filters, and water pumps; Determine	Conclusion	Qualified□
5	According to the installation diagram, check if the installed pipeline accessories are correct, conduct water pressure and leakage testing, empty the water pump, and empty the water tank; (Water pressure of tap water ≥ 0.2MPa); **Water pump exhaust air:** First, turn off the water pump, close the inlet and outlet valves, open the exhaust valve on the water pump circulation pipe, and patiently wait for a few minutes to completely discharge the air; **Water tank exhaust air:** Simply open the exhaust valve at the top of the water tank and let it out for a few minutes; Or open the valve reserved on the circulating pipe of the heat pump and exhaust for a few minutes. **Water pipeline exhaust air:** Open the exhaust port at the terminal (such as radiators, underfloor heaters, etc.) and exhaust directly until no creaking gas sound, indicating that	Conclusion	Qualified□ Abnormal:
6	According to the wiring diagram of the heat pump, connect the power wires of the heat pump, install the water tank sensor, install the operation panel, connect the power wire of	Conclusion	Qualified□
7	According to the wiring diagram of the heat pump, check whether the power cord is tightened, whether the sensor position is correct, and whether the wiring position is fixed to ensure the protection of the circuit;	Conclusion	Qualified□ Abnormal:

8	After the above checks are normal, open all water valves; Power on inspection, first use a multi-meter to check if the power supply voltage is normal (The voltage fluctuation range of the inverter unit is ± **10%**);	Conclusion	Qualified□ Abnormal:
9	According to the instructions in the manual, use the operation panel to start up and run, check the operation of the water pump, and recheck whether there is any water leakage problem in the pipeline; No water leakage, insulation should be applied to all pipelines;	Conclusion	Qualified□ Abnormal:
10	Check if the drainage of the heat pump chassis is reasonable and smooth without water accumulation (if the weather is dry and does not produce condensation, tap water can be used to simulate the drainage situation);	Conclusion	Qualified□ Abnormal:
11	According to the heat pump manual, check the temperature status and pressure gauge values of the heat pump after ten minutes of normal operation; Checking if the water outlet temp, water inlet temp, exhaust temp, high pressure and the voltage are reasonable.	Conclusion	Qualified□ Abnormal:
12	After installation and commissioning, the customer can operate the heat pump control panel according to the instructions, such as adjusting the temperature, checking the temperature status of the heat pump, daily maintenance and protection of the heat pump, and regular maintenance and inspection.	Conclusion	Qualified□ Abnormal:
Installation engineer's master rechecks and confirms/notes			
User's confirmation		Date	

C.Reference parameters of the operation state for the heat pump

Note: This parameter is only a **theoretical value and is for reference only.** Please note that there are differences among different units. In addition, in low-temperature heating mode, the parameters for different states such as frost formation, slight frost formation, and severe frost formation are also different. If there are significant differences, please consult the supplier for advice.

R290 Heat Pump Judgement Table (for reference only)					
Heating					
Ambient temperature 30~43℃	Outlet water temperature ℃	Exhaust gas temperature ℃	Return gas temperature ℃	Evaporator Coil temperature ℃	Pressure MPa
	25	30~60	22~37	20~35	0.8~1.4
	30	35~65	22~37	20~35	0.9~1.6
	35	40~70	22~37	20~35	1.0~1.7
	40	45~75	23~38	21~36	1.1~1.8

	45	50~80	23~38	21~36	1.3~2.0
	50	55~85	23~40	22~38	1.5~2.2
	55	60~90	23~40	22~38	1.6~2.3
	60	65~95	23~40	22~38	1.7~2.4

Heating					
Ambient temperature 20~30℃	Outlet water temperature ℃	Exhaust gas temperature ℃	Return gas temperature ℃	Evaporator Coil temperature ℃	Pressure MPa
	25	30~60	12~26	10~24	0.8~1.4
	30	35~65	12~26	10~24	0.9~1.6
	35	40~70	12~26	10~24	1.0~1.7
	40	45~75	13~27	11~25	1.1~1.8
	45	50~80	13~27	11~25	1.3~2.0
	50	55~85	14~28	12~26	1.5~2.2
	55	60~90	14~28	12~26	1.6~2.3
	60	65~95	14~28	12~26	1.7~2.4

Heating					
Ambient temperature 10~20℃	Outlet water temperature ℃	Exhaust gas temperature ℃	Return gas temperature ℃	Evaporator Coil temperature ℃	Pressure MPa
	25	30~60	2~16	0~14	0.8~1.4
	30	35~65	2~16	0~14	0.9~1.6
	35	40~70	2~16	0~14	1.0~1.7
	40	45~75	3~17	1~15	1.1~1.8
	45	50~80	3~17	1~15	1.3~2.0
	50	55~85	4~18	2~16	1.5~2.2
	55	60~90	4~18	2~16	1.6~2.3
	60	65~95	4~18	2~16	1.7~2.4

Heating					
Ambient temperature 0~10℃	Outlet water temperature ℃	Exhaust gas temperature ℃	Return gas temperature ℃	Evaporator Coil temperature ℃	Pressure MPa
	25	30~60	-10~8	-12~8	0.8~1.4
	30	35~65	-10~8	-12~8	0.9~1.6
	35	40~70	-10~8	-12~8	1.0~1.7
	40	45~75	-10~8	-12~8	1.1~1.8

	45	50~80	-10~8	-12~8	1.3~2.0
	50	55~85	-10~8	-12~8	1.5~2.2
	55	60~90	-10~8	-12~8	1.6~2.3
	60	65~95	-10~8	-12~8	1.7~2.4

Heating					
Ambient temperature -10~0℃	Outlet water temperature ℃	Exhaust gas temperature ℃	Return gas temperature ℃	Evaporator Coil temperature ℃	Pressure MPa
	25	30~60	-20~-2	-22~-2	0.8~1.4
	30	35~65	-20~-2	-22~-2	0.9~1.6
	35	40~70	-20~-2	-22~-2	1.0~1.7
	40	45~75	-20~-2	-22~-2	1.1~1.8
	45	50~80	-20~-2	-22~-2	1.3~2.0
	50	55~85	-20~-2	-22~-2	1.5~2.2
	55	60~90	-20~-2	-22~-2	1.6~2.3
	60	65~95	-20~-2	-22~-2	1.7~2.4

Heating					
Ambient temperature -20~-10℃	Outlet water temperature ℃	Exhaust gas temperature ℃	Return gas temperature ℃	Evaporator Coil temperature ℃	Pressure MPa
	25	30~60	-30~-12	-32~-12	0.8~1.4
	30	35~65	-30~-12	-32~-12	0.9~1.6
	35	40~70	-30~-12	-32~-12	1.0~1.7
	40	45~75	-30~-12	-32~-12	1.1~1.8
	45	50~80	-30~-12	-32~-12	1.3~2.0
	50	55~85	-30~-12	-32~-12	1.5~2.2
	55	60~90	-30~-12	-32~-12	1.6~2.3
	60	65~95	-30~-12	-32~-12	1.7~2.4

Cooling					
Ambient temperature 30~43℃	Outlet water temperature ℃	Exhaust gas temperature ℃	Return gas temperature ℃	Evaporator Coil temperature ℃	Pressure MPa
	15	60~95	12~17	30~58	1.2~2.1
	20	60~95	17~22	30~58	1.2~2.1
	30	60~95	25~32	30~60	1.2~2.2

Cooling					
Ambient temperature 20~30℃	Outlet water temperature ℃	Exhaust gas temperature ℃	Return gas temperature ℃	Evaporator Coil temperature ℃	Pressure MPa
	15	55~80	12~17	30~50	1.0~1.8
	20	55~80	17~22	30~50	1.0~1.8
	30	55~80	25~32	30~50	1.0~1.8
	40	55~80	35~42	30~50	1.0~1.8

Cooling					
Ambient temperature 10~20℃	Outlet water temperature ℃	Exhaust gas temperature ℃	Return gas temperature ℃	Evaporator Coil temperature ℃	Pressure MPa
	15	50~75	12~17	25~42	0.8~1.6
	20	50~75	17~22	25~42	0.8~1.6
	30	50~75	25~32	25~45	0.8~1.6
	40	50~75	35~42	25~45	0.8~1.6

D.Temperature sensor resistance with different ambient temp.

5K Sensor Resistance(T1/T2/T3/T5/T6/T7/T8/T9)

Temp(℃)	Resistance(KΩ)	Temp(℃)	Resistance(KΩ)	Temp(℃)	Resistance(KΩ)
-30	63.7306	14	7.7643	58	1.5636
-29	60.3223	15	7.4506	59	1.5142
-28	57.1180	16	7.1813	60	1.4856
-27	54.1043	17	6.8658	61	1.4206
-26	51.2686	18	6.5934	62	1.3763
-25	48.5994	19	6.3333	63	1.3336
-24	46.0860	20	6.0850	64	1.2923
-23	43.7182	21	5.8479	65	1.2526
-22	41.4868	22	5.6213	66	1.2142
-21	39.3833	23	5.4048	67	1.1771
-20	37.3992	24	5.1978	68	1.1413
-19	35.5274	25	5.0000	69	1.1008
-18	33.7607	26	4.8108	70	1.0734
-17	32.0927	27	4.6298	71	1.0412
-16	30.5172	28	4.4586	72	1.0100
-15	29.0286	29	4.2909	73	0.9800
-14	27.6216	30	4.1323	74	0.9508
-13	26.2913	31	3.9804	75	0.9228
-12	25.0330	32	3.8349	76	0.8957
-11	23.8424	33	3.6955	77	0.8695
-10	22.7155	34	3.5620	78	0.8441
-9	21.6486	35	3.4340	79	0.8196
-8	20.6380	36	3.3119	80	0.7959
-7	19.6806	37	3.1937	81	0.7730
-6	18.7732	38	3.0809	82	0.7508
-5	17.9129	39	2.9727	83	0.7295
-4	17.0970	40	2.8688	84	0.7086
-3	16.3230	41	2.7692	85	0.6885
-2	15.5886	42	2.6735	86	0.6690
-1	14.8713	43	2.5816	87	0.6502
0	14.2293	44	2.4936	88	0.6320

1	13.6017	45	2.4097	89	0.6144
2	13.0057	46	2.3276	90	0.5973
3	12.4390	47	2.2491	91	0.5808
4	11.9011	48	2.1739	92	0.5647
5	11.3894	49	2.1016	93	0.5492
6	10.9028	50	2.0321	94	0.5342
7	10.4399	51	1.9656	95	0.5196
8	9.9995	52	1.9016	96	0.5088
9	9.5802	53	1.8399	97	0.4919
10	9.1810	54	1.7804	98	0.4786
11	8.8008	55	1.7232	99	0.4650
12	8.4395	56	1.6680	100	0.4533
13	8.0934	57	1.6140		

50K Sensor Resistance(T4)

Temp(℃)	Resistance (KΩ)	Temp(℃)	Resistance (KΩ)	Temp(℃)	Resistance (KΩ)	Temp(℃)	Resistance (KΩ)
-30	866.96	12	90.426	54	15.41	96	3.7351
-29	815.7	13	86.262	55	14.844	97	3.6238
-28	767.71	14	82.312	56	14.302	98	3.5162
-27	722.87	15	78.561	57	13.782	99	3.4123
-26	680.87	16	75.001	58	13.284	100	3.312
-25	641.59	17	71.625	59	12.807	101	3.215
-24	604.82	18	68.416	60	12.348	102	3.1214
-23	570.34	19	65.368	61	11.909	103	3.031
-22	538.03	20	62.474	62	11.487	104	2.9435
-21	507.74	21	59.719	63	11.083	105	2.8589
-20	479.34	22	57.104	64	10.694	106	2.7772
-19	452.68	23	54.62	65	10.321	107	2.6982
-18	427.67	24	52.253	66	9.9628	108	2.6218
-17	404.17	25	50	67	9.6187	109	2.5479
-16	382.11	26	47.857	68	9.2882	110	2.4764
-15	361.35	27	45.817	69	8.9706	111	2.4072
-14	341.86	28	43.877	70	8.6655	112	2.3403
-13	323.53	29	42.027	71	8.3723	113	2.2755
-12	306.29	30	40.265	72	8.0903	114	2.2128
-11	290.06	31	38.585	73	7.8193	115	2.1522
-10	274.78	32	36.987	74	7.5586	116	2.0934
-9	260.4	33	35.462	75	7.3077	117	2.0365
-8	246.85	34	34.007	76	7.0667	118	1.9814
-7	234.08	35	32.619	77	6.8345	119	1.928
-6	222.02	36	31.297	78	6.6109	120	1.8764
-5	210.69	37	30.034	79	6.396	121	1.8263
-4	199.98	38	28.827	80	6.189	122	1.7778
-3	189.86	39	27.677	81	5.9894	123	1.7308
-2	180.34	40	26.578	82	5.7976	124	1.6852
-1	171.33	41	25.528	83	5.6126	125	1.6411
0	162.81	42	24.524	84	5.4346	126	1.5983
1	154.78	43	23.566	85	5.2629	127	1.5567

2	147.19	44	22.648	86	5.0974	128	1.5165
3	140	45	21.773	87	4.9379	129	1.4774
4	133.21	46	20.935	88	4.7842	130	1.4396
5	126.79	47	20.134	89	4.6359	131	1.4028
6	120.72	48	19.368	90	4.4931	132	1.3672
7	114.96	49	18.635	91	4.3552	133	1.3327
8	109.51	50	17.932	92	4.2222	134	1.2991
9	104.34	51	17.26	93	4.0939	135	1.2665
10	99.456	52	16.616	94	3.97	136	1.2349
11	94.826	53	16.001	95	3.8506	137	1.2042

Temp(℃)	Resistance(KΩ)	Temp(℃)	Resistance(KΩ)	Temp(℃)	Resistance(KΩ)
138	1.1744	180	0.4496	222	0.2004
139	1.1455	181	0.4403	223	0.1969
140	1.1174	182	0.4313	224	0.1934
141	1.0901	183	0.4225	225	0.1901
142	1.0636	184	0.4138	226	0.1868
143	1.0379	185	0.4054	227	0.1836
144	1.0128	186	0.3972	228	0.1804
145	0.9886	187	0.3892	229	0.1773
146	0.9649	188	0.3814	230	0.1743
147	0.942	189	0.3738	231	0.1713
148	0.9197	190	0.3664	232	0.1684
149	0.898	191	0.3591	233	0.1656
150	0.8769	192	0.352	234	0.1628
151	0.8564	193	0.3451	235	0.1601
152	0.8364	194	0.3383	236	0.1574
153	0.817	195	0.3317	237	0.1548
154	0.7982	196	0.3253	238	0.1522
155	0.7798	197	0.319	239	0.1497
156	0.762	198	0.3128	240	0.1472
157	0.7446	199	0.3068	241	0.1448
158	0.7277	200	0.3009	242	0.1425
159	0.7112	201	0.2952	243	0.1401
160	0.6952	202	0.2896	244	0.1379

161	0.6796	203	0.2841	245	0.1356
162	0.6645	204	0.2787	246	0.1335
163	0.6497	205	0.2735	247	0.1313
164	0.6353	206	0.2684	248	0.1292
165	0.6213	207	0.2634	249	0.1272
166	0.6077	208	0.2585	250	0.1252
167	0.5944	209	0.2537		
168	0.5814	210	0.2491		
169	0.5688	211	0.2445		
170	0.5566	212	0.24		
171	0.5446	213	0.2357		
172	0.5329	214	0.2314		
173	0.5216	215	0.2272		
174	0.5105	216	0.2231		
175	0.4997	217	0.2191		
176	0.4892	218	0.2152		
177	0.4789	219	0.2114		
178	0.4689	220	0.2076		
179	0.4591	221	0.204		