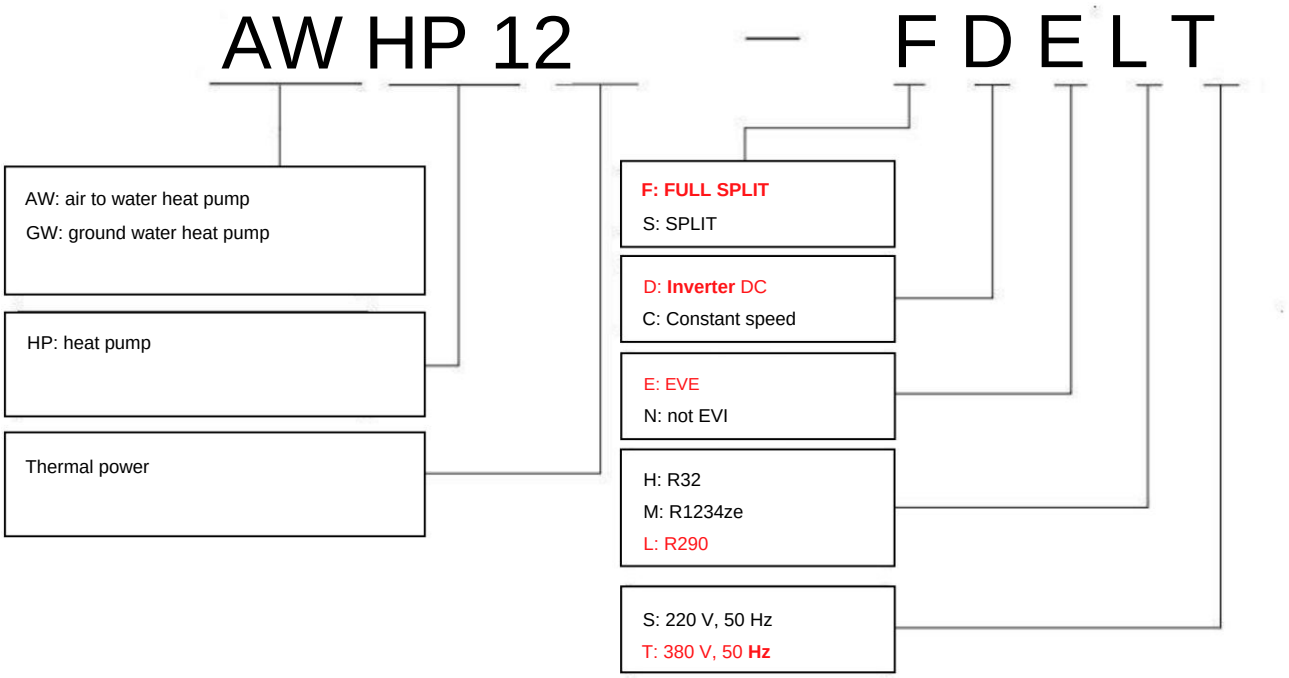
HEAT PUMP AIR WATER

DC Inverter, **Premium,** EVI

Installation of this appliance must comply with all local codes and building codes.

Table of contents

Nomenclature.



Specialized tools

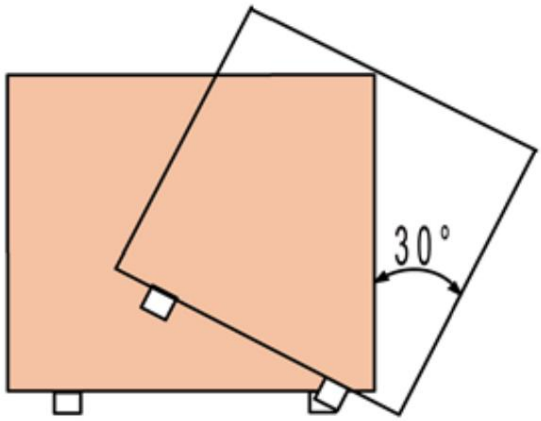
Specialized tools that can be used for installation, commissioning and maintenance. Tools as exclusive tools only for R410A, R32, R290 refrigerant. 1. Measuring manifold · R410A, R32, R290 only.

• Use the existing installation specifications (G1/4”). • Use the high-voltage side pressure of 5.3 MPa G or more. 2. Charging hose · R410A, R32, R290 only. Use the pressure specification of 5.09 MPa G or more. 3. Electronic scale. 4. Gas leak detector · Use the R410A, R32, R290 detector. 5. Vacuum pump (pump with backflow prevention function). 6. Refrigerant charging base. 7. Refrigerant cylinder · R410A only Cylinder top (pink) Siphon cylinder. 8. Refrigerant recovery equipment. 9. Wrench. 10. Multimeter. 11. Screwdrivers.

Installation

Moving and storage

The device must not be transported, moved or stored at an angle greater than 30° from the vertical position. Store the device in a dry place until it is needed.



The unit must be installed by a qualified dealer and all electrical work must be performed by an authorized electrical contractor in accordance with all local codes.

Safety

Installation must be carried out under the supervision of a qualified technician to avoid improper installation that may result in damage to the device or injury.

people. Any faults and/or leaks must be repaired immediately before the unit can continue to operate. If the unit has been repaired, the operation of the safety devices and parameters must be rechecked.

If a refrigerant leak occurs, remove the entire charge using a recovery unit and store the refrigerant in a portable container.

Note: Caution is required as the refrigerant may deteriorate due to high temperatures, these by-products of refrigerants After the leak has been repaired, refill the unit with the correct weight and fill type as indicated on the unit's nameplate.

dangerous.

Note: Make sure that the unit is refueled with

The correct refrigerant is used, as Do not use oxygen to purge pipes or pressurize the unit for any purpose. ***The wrong gas can damage the unit and cause danger.*** Oxygen gas reacts violently, oil, grease and other common substances. Use only refrigerant or dry nitrogen for testing. Traces of vapor must be replaced with dry nitrogen. Refrigerant will release toxic gases when exposed to an open flame.

Make sure the necessary safety equipment is available for maintenance. You have the correct fire extinguishers for the system.

Do not transfer refrigerant.

Avoid contact with skin and eyes. Wear goggles. Wash off any soap and skin. If liquid refrigerant gets into your eyes, rinse them immediately with plenty of water and consult a doctor.

Note: Never bring

open flame or jet to the container with Compressor oil type: 3MA POE.

refrigerant. This may result in dangerous overpressure and explosion. Note: Be careful not to let ***the refrigerant escape.***

caution, as the refrigerant may decompose due to high temperature, these refrigerant by-products are dangerous.

The heating system must be pressure tested and completely ventilated. Filling water and additional water must be of drinking quality (colourless, clear, without sediment). Filling water and additional water must be pre-filtered. (pore size max. 5 µm)

- The unit must be installed on a solid, level surface on a concrete foundation that is not connected to the foundation of the house. Rubber pads can be added if necessary to reduce vibration and noise.

- The unit should be located away from bedrooms or noise-sensitive areas, including at the edges of an adjacent unit. (The unit

The device must be aligned on both axes (tolerance less than 2 mm per meter).

will produce noise above the minimum rated value of 45 decibels).

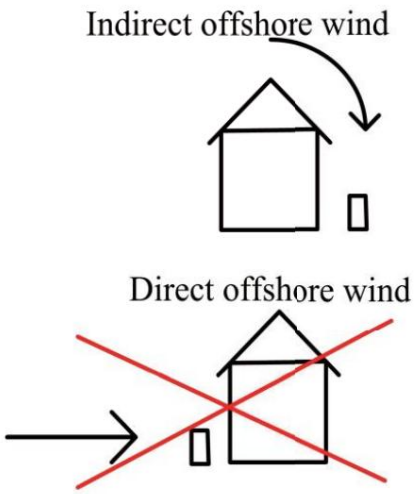
- The installation must be well ventilated, unobstructed and regularly maintained.

- Make sure there is space around the installation site there is good drainage and make sure that this water cannot run off the tracks as this can cause ice or mud to form, which is undesirable. (The unit can produce a lot of condensation when operating in high humidity areas. There is also a lot of leakage when the unit melts ice during the defrost cycle.)

- Avoid areas exposed to exposure to motor oil vapors, salt air, hot springs or other aggressive substances.

- When operating for a long time at temperatures below 0 °C or in areas where snow is possible, the unit should be raised at least 300 mm above the ground. This is necessary to prevent ice from forming on the unit chassis.

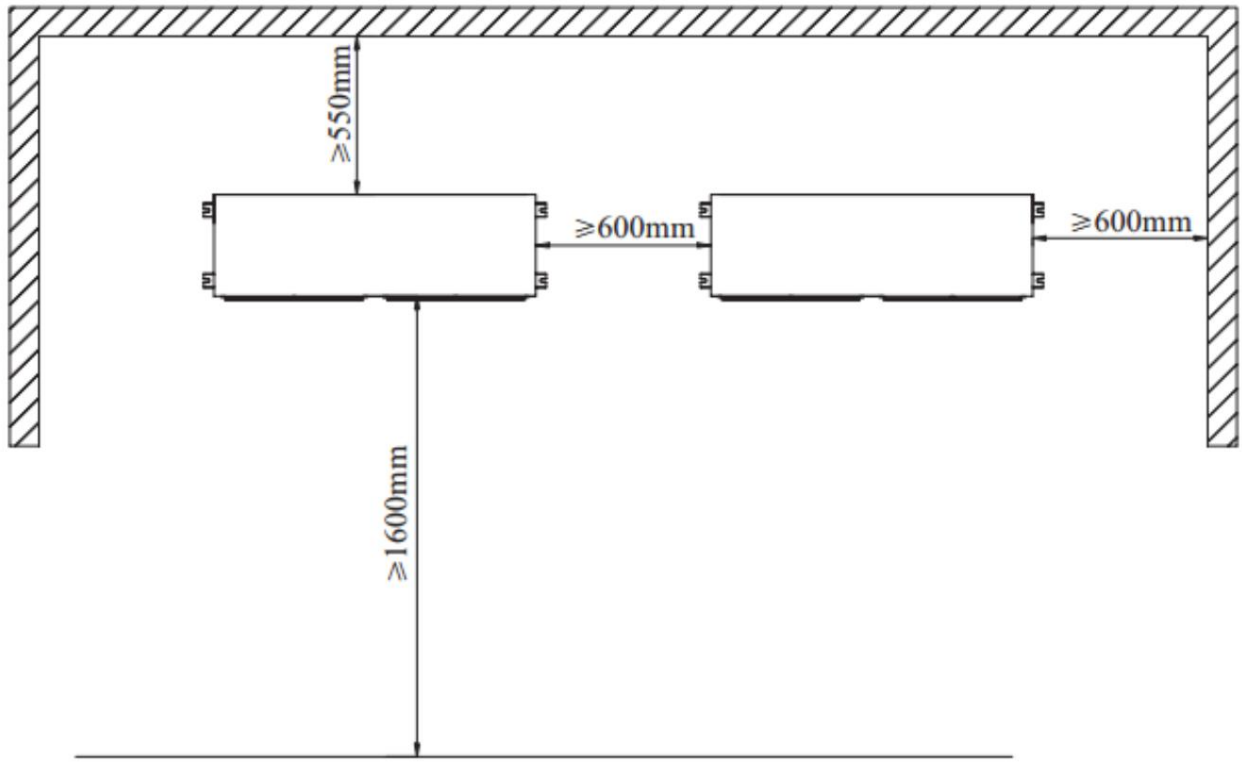
Locations exposed to strong winds should be avoided, otherwise deflectors may be required to deflect strong winds and prevent snow from blowing directly into the unit.

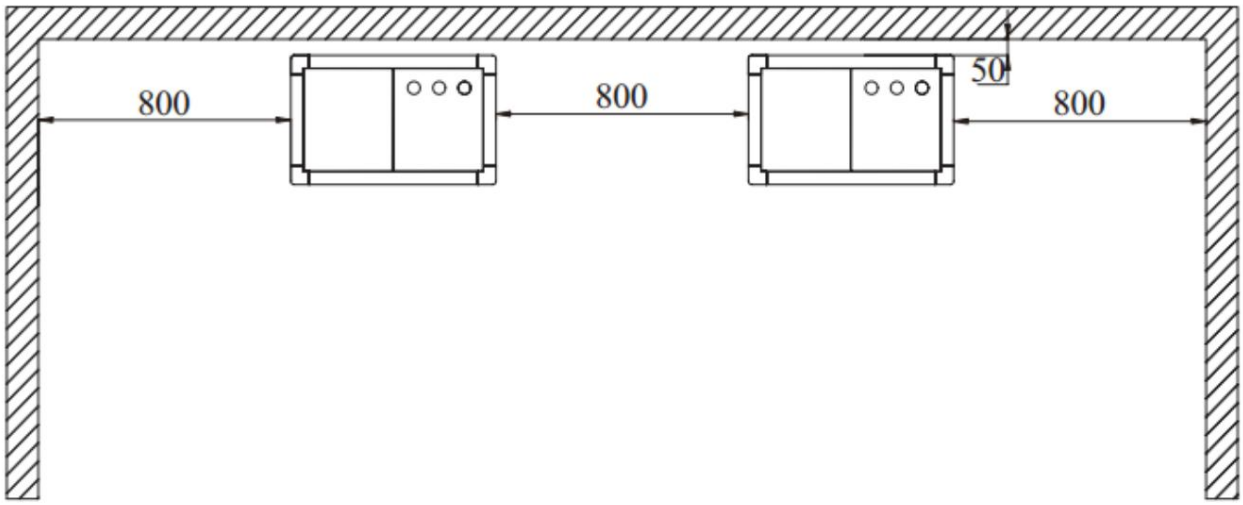


They must not restrict the air flow into the installation.

Maintain a suitable distance between the unit and the building to ensure normal operation of the unit and sufficient space for maintenance.

Location.

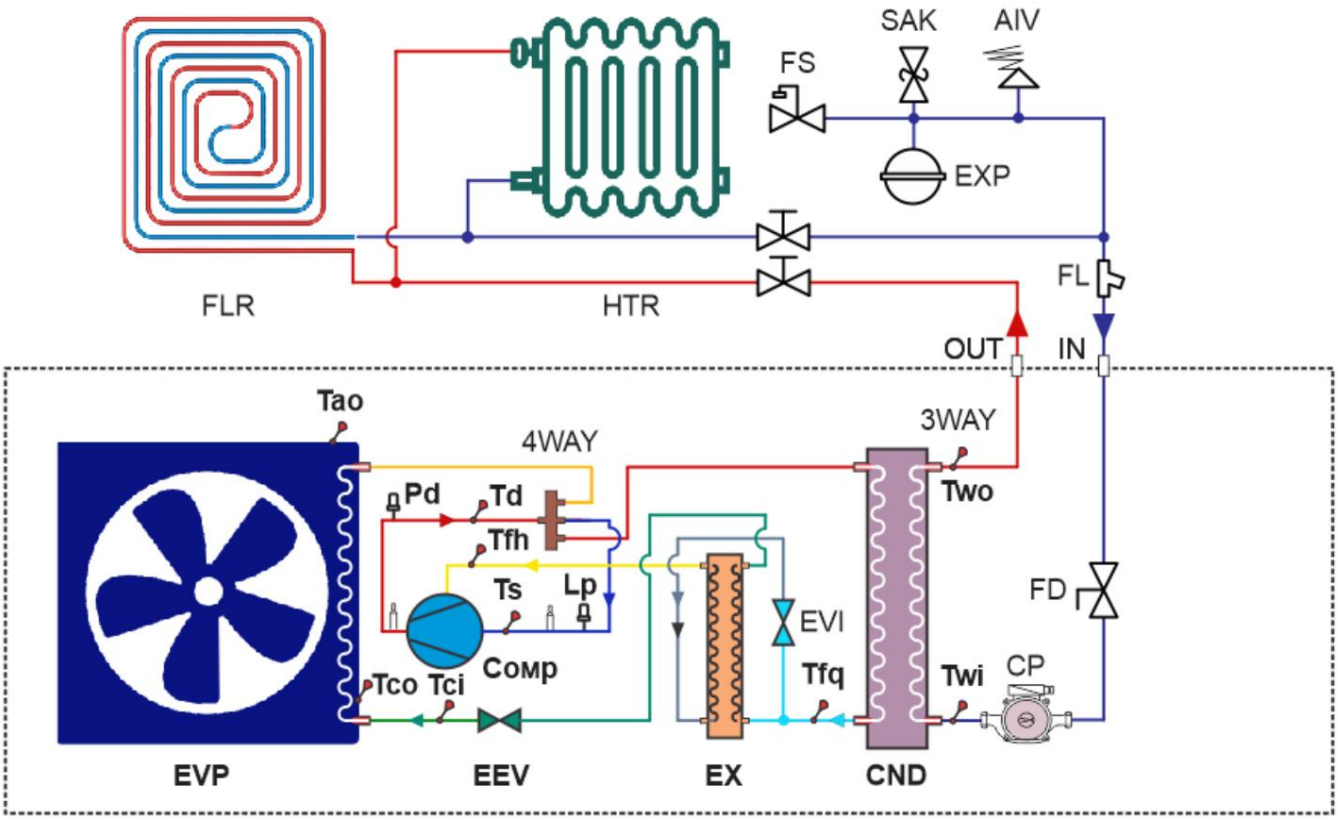




Description of the air water system

Heating and cooling

(without three-way valve and without electric heater).



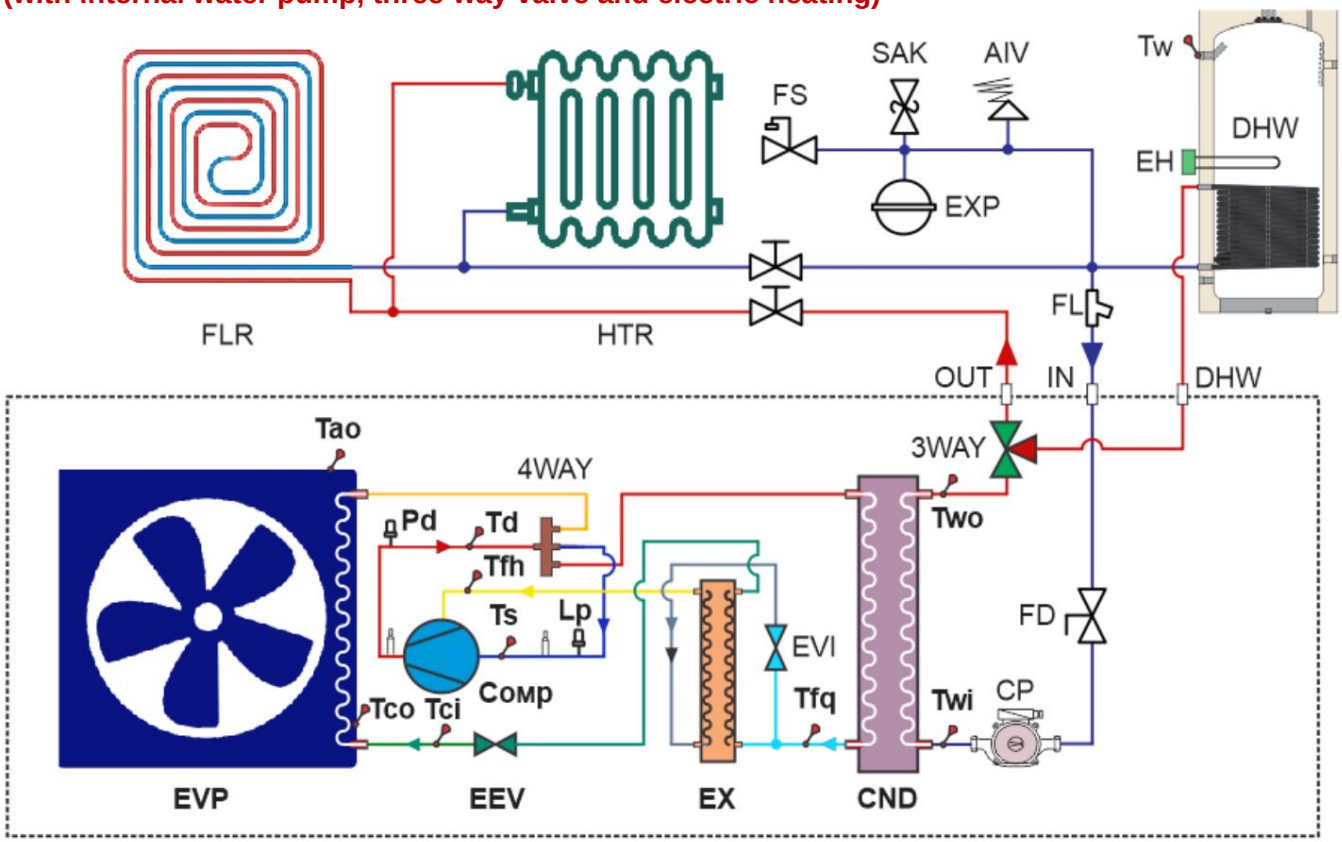
Name	Description	Port Name		Description	Port
Temperature Sensors					
Twÿ Heating supply		ADC	**Tfq** Temperature before economizer		ADC
Twi	Heating return		**Tfh** After economizer		
Person	Temperature outside		**Ts**	Suction temperature sensor	
Tci	Temperature after ERV		**Td**	Discharge temperature sensor	
Tw Temperature in tank					
Pressure sensors					
Ps	Low pressure sensor	Input **Pd**	High pressure sensor **Outputs for device**		Login
control					
CP	Circulation pump 220 V **EVI**			Steam injection valve	220 V
4WAY Reverse Valve **Somr**		220V **EEV**	Main EEV		220 V
Compressor		220 V			
Heat exchangers					
EVP Evaporator			**CND** Capacitor		
Hydraulic connection elements					
OF	Soft connection		**FL** Filter		
Person	Soft connection		**SAK** Safety valve		
FS	Filling valve		**FD** Water flow sensor		
AIV	Drain valve		**EXP** Expansion tank		

If inverter technology is not used, it is recommended to use a buffer tank to ensure smooth operation of the heat pump. A suitable buffer tank can prevent excessive cycling of the heat pump (start and stop). The buffer tank ensures hydraulic separation of the volume flow from the heat pump and the heating circuits. The volume flow in the heat pump circuit remains constant, even if the volume flow of the heating circuit is reduced by thermostatic valves. **If the total water volume in the system is less than 15 l/kW, a buffer tank should be installed to reduce the compressor load from the ON/OFF cycle.** This will extend the service life of the compressor. When installing a buffer tank, the heating system will first absorb energy from the buffer tank. To save energy, install an internal CP pump that only switches on when the compressor is switched on. This is done by changing the mode of the internal CP pump to "regulating operation".

The inlet water temperature sensor must be removed from the unit and placed in the sensor socket of the buffer tank. The inlet water temperature sensor is located on the water supply line. The inlet water temperature sensor Twi in the buffer tank will monitor the tank temperature, turning the compressor and pump on and off together as needed. When changing to "regulated", when the unit reaches the set temperature, the compressor stops, the **CP** pump turns off. stop accordingly due to the TI setting. "run according to the schedule". In this case, there is no water flow between the heat pump and the buffer tank. The inlet water temperature will maintain its temperature, not the temperature of the water in the buffer tank. The inlet water temperature sensor Twi cannot start the compressor and **CP pump,** even if the water in the buffer tank cools down. Replacing the inlet water temperature sensor to the buffer tank will avoid this problem.

Water heating and hot water preparation

(with internal water pump, three-way valve and electric heating)



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Tw Temperature in tank					
Pressure sensors					
Ps	Low pressure sensor	Input **Pd**	High pressure sensor **Outputs for device**		Login
control					
CP	Circulation pump	220 V **AC**		Electric heater	220 V
4WAY Reverse Valve **Somr**		220V **3WAY** DHW Valve			220 V
Compressor		220V **EEV** Main EEV			220 V
HOME	Steam injection valve	220 V			
Heat exchangers					
EVP Evaporator			**CND** Capacitor		
Hydraulic connection elements					
OF	Soft connection Soft		**IN**	Filter	
Person	connection Filling		**SAK** Safety valve		
FS	valve Drain valve		**FD** Water flow sensor		
AIV			**EXP** Expansion tank		
TNK Buffer tank					

Internal components: air-to-water heat pump, split.

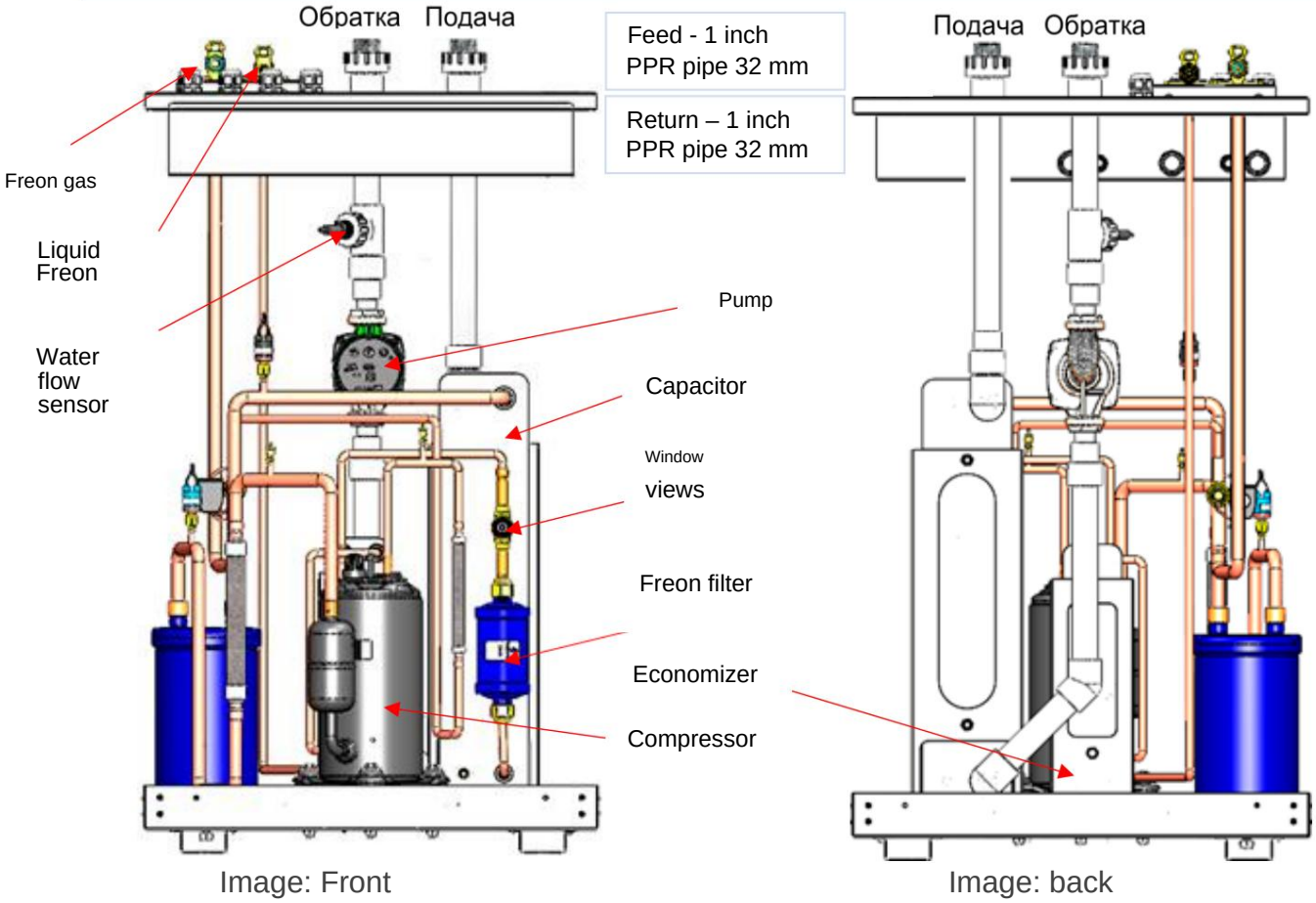
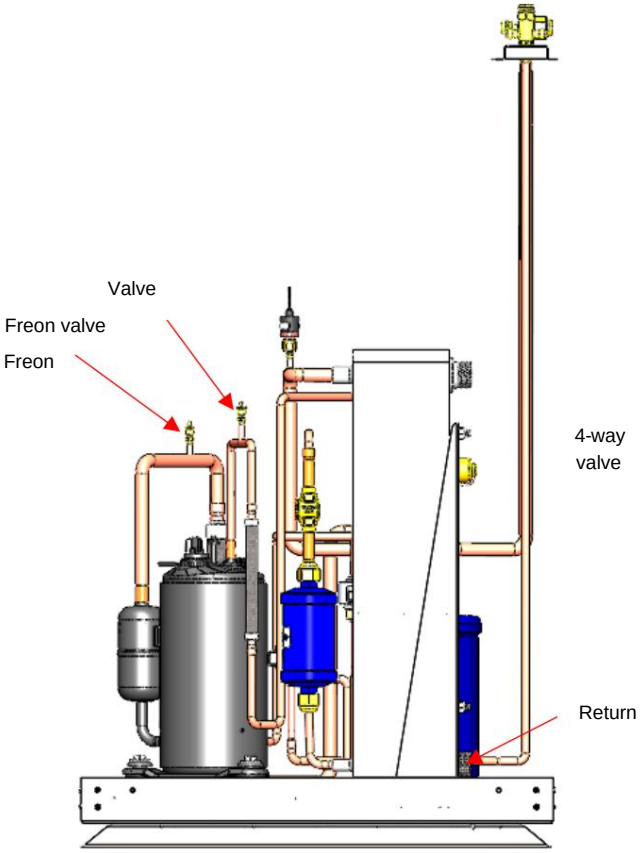


Image: Front

Image: back



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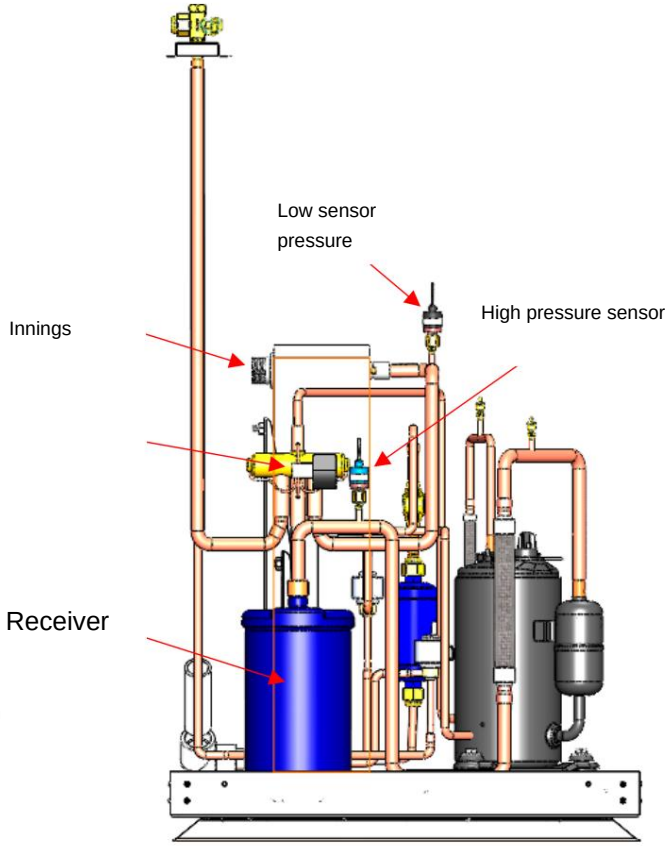


Image: left

Plumbing installation

1. The pipe installation must comply local building codes, standards and any local council requirements.

2. Make sure the water flow and return are correct and not reversed. Reversing the water flow will reduce the power of the unit; refer to the labels on the unit for the correct direction of water flow.

3. The water pipes should not transmit any radial or axial forces to the heat exchanger. A flexible pipe between the unit and the structure can be used to reduce any problems related to stress and vibration.

Water supplied to the system must be clean and free of heavy metals that may damage the installation.

4. Water must be treated with an approved inhibitor and tested annually to prevent corrosion, fouling and damage to pump fittings.

5. Protective devices shall be installed to protect the unit from operation outside its operating parameters, such as controls; shut-off valve, blow-off valves, relief valves and expansion tanks.

6. The pipe installation should be designed to have the least number of bends and joints as these reduce the flow. Install drains at low points so that water can be drained from the system if necessary.

7. Flexible connections should be used whenever possible to reduce vibration transmission.

8. Insulate all exposed pipes and areas to protect against heat loss and prevent condensation on cooled pipes.

9. When filling the system Use vents and flushing procedures to remove residual air pockets in the water supply.

10. The heat pump is not equipped with shut-off valves and therefore must be installed outside the heat pump to facilitate future servicing requirements.

Freon pipe connections

Connecting the refrigerant line

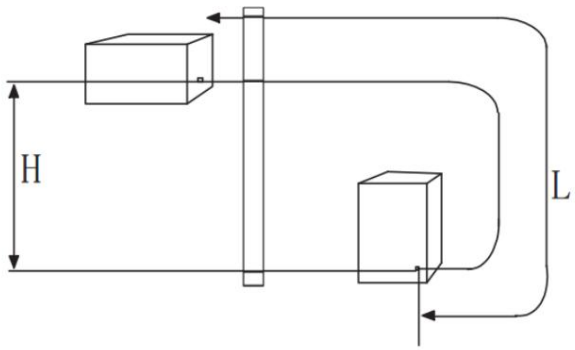
(not provided).

Install the refrigerant pipes between the outdoor unit and the indoor unit. Installation must be carried out in accordance with the applicable rules and directives.

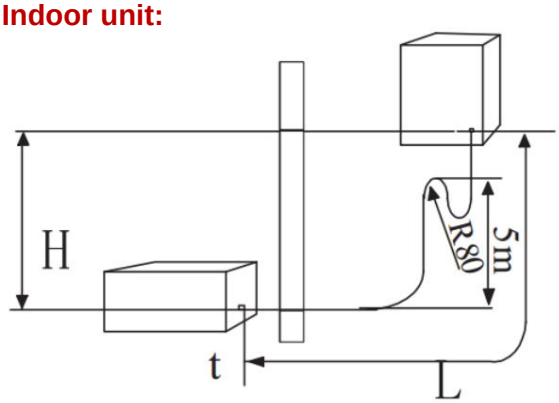
If the indoor unit is more than 5m higher than the outdoor unit, the oil return curve should be plotted every 5m.

Max. height difference between indoor and outdoor unit (H): 10 m
Max. pipe length (L): 9 m

Outdoor unit:

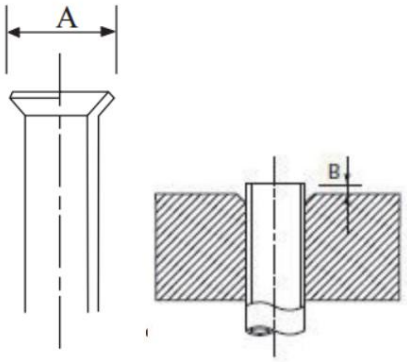


Indoor unit:



	Liquid pipe	Gas pipeline
Pipe size	ÿ9.52mm (3/8 inch)	ÿ15.88 mm (5/8 inch)
Connection	Socket (3/8 inch)	Socket (5/8 inch)
Minimum copper pipe thickness	1.0 mm	0.8 mm
Maximum pressure	4.5 MPa	

Socket joints. Expansion:



Copper tube outer diameter (mm) (8 kW) ÿ9.52	m
	13.2
ÿ15.88	19,7
Copper tube outer diameter (mm) (18 kW)	**m**
ÿ12.5	15,8
ÿ19.5	24,6

Copper pipe diameter (mm)	R, with R410A tool (mm)	R, with normal tool (mm
f9	0-0,5	0,7-1,3
ÿ15		
ÿ12.5		
ÿ19.5		

The service valves on the inner/outer pipe connector must be closed when the pipes are connected. The inner/outer pipe connector refers to the "Components" chapter.

Make sure that water and dirt do not get into the pipes.

Bend the pipes as wide as possible (east R100 ÿ R150). Do not bend the pipe again. Use a bending tool.

Connect the flare connector and tighten to the following torque: 3/8" (ÿ9.52 mm) 35-40 (N m), 3/8" (ÿ12.5 mm) 55-65 (N m), 5/8" (ÿ15.88 mm) 60-65 (N m),

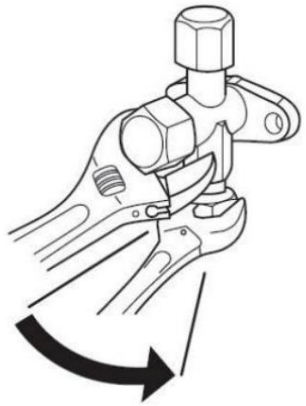
5/8” (ÿ15.88 mm) 70-75 (N·m).

- Direct the flared

Connect the copper coil to the center of the heat pump threaded connection, and tighten the flare nut by hand as much as possible.

- Tighten the flange nut to the required

torque using a torque wrench.



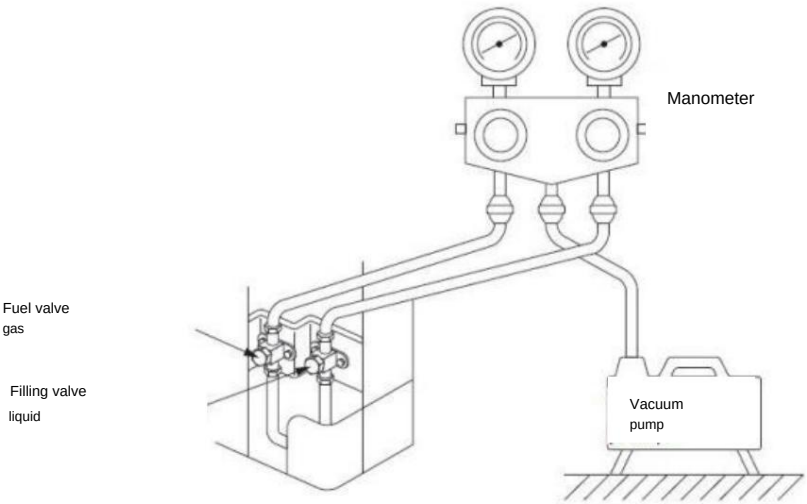
Pressure test and leak test.

The pipe connection between the indoor and outdoor units should be pressure tested and checked for leaks after installation.

Only nitrogen can be used to increase pressure and flush the system.

Use a vacuum pump to remove all air. Vacuum for at least one hour, and the final pressure after release should be 1 bar absolute pressure.

If there is moisture left in the system or there is leak, vacuum pressure will increase after complete vacuuming.



NOTE!

The pipe must be flushed before connecting the heat pump to prevent any contamination from damaging the components.

The water pressure in the heat exchanger cannot exceed 0.5 MPa.

Refrigerant charging:

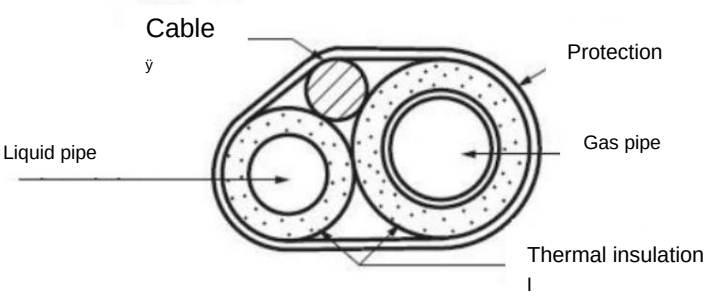
After completing the pipe connections, pressure testing, leak testing and vacuum testing, the service valves can be opened.

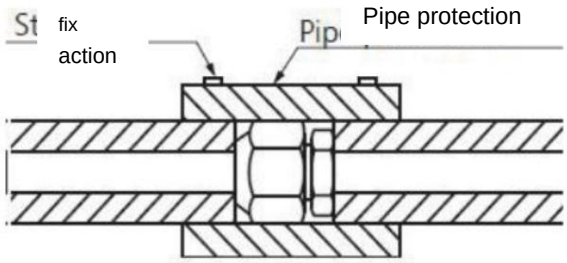
The gas inside the indoor unit is enough for 5m of pipe. If the connecting pipe is longer than 5m, it is necessary to add R410A with a small amount of refrigerant. The filler weight is 50g per additional meter.

Insulation of refrigerant pipes.

Insulate refrigerant pipes for thermal insulation and to prevent condensation.

Use insulation that can withstand temperatures of at least 120 ÿ. The insulation must be at least 13 mm.





Electrical connections

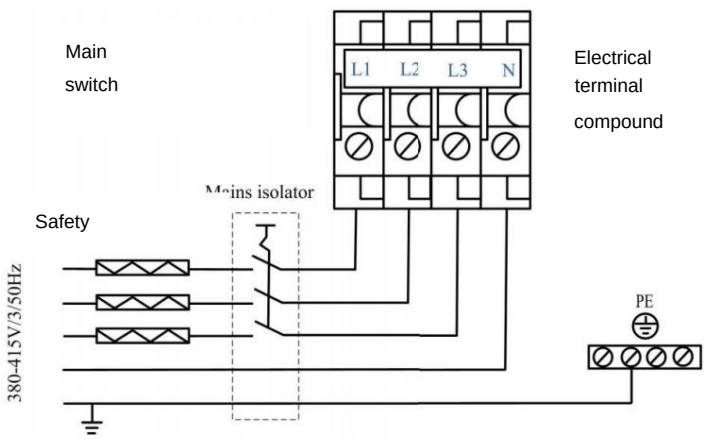
Connecting to a power source Before connecting the power source, make sure that the device matches the power source.

• Circuit breaker protection must be set to the maximum value indicated on the nameplate attached to the unit inside the front panel.

• The equipment must be installed with disconnector with a minimum breaking distance of 3 mm.

• The power source must match the nameplate. The supply voltage must be within the range specified in the electrical data table. For wiring connection information, refer to the electrical diagram on the inside panel of the unit.

• When the building is equipped with an RCD, the heat pump must be equipped with a separate RCD.



IMPORTANT:

When installing the unit, first connect the water supply and then connect the electricity supply.

If the unit needs to be removed, disconnect the electrical connections first and then the water connections to reduce the risk of electric shock.

WARNING:
Turn off the main power switch before touching any internal components of the device.

In case of serious malfunction, turn off the unit, disconnect the power source and contact a qualified service engineer.

Connecting the indoor and outdoor units. Using a cable (at least 1.5 mm2) **(not included) ,** connect the indoor and outdoor units to the terminal on the control board.

Note:

- The outdoor unit must be grounded before connecting the wires before the unit can be powered.
- The wiring must be secured so that The terminal block was not subject to load.

Internal return temperature sensor Twi:

The water return sensor (Twi) is placed on the water inlet line of the heating circuit (in the heat exchanger pocket). If a buffer tank is installed, the water inlet temperature sensor Twi can be moved to the input pocket of the buffer tank temperature sensor, and the value of the parameters **c5 and c15** (see Table 1. Heat pump parameters) can be set to 2, "tank". This method

stops the pump when the compressor is switched off. If the Twi inlet water temperature sensor cannot be moved to the buffer tank temperature sensor input, the **c5 and c15** parameters must be set to 1 "heating input" (factory default setting). This allows the pump to continue to operate so that the Twi inlet water temperature sensor readings match the buffer tank water temperature.

External ambient temperature sensor Tao (6m).

The **Tao** sensor is located in the outdoor unit.
The **Tao** sensor is connected to the indoor unit controller.
Connect the two sections of the **Tao** sensor to its connector.

Hot water temperature sensor:

The hot water sensor **Tw** is connected to the contacts on the main board, if necessary, another contact must be inserted into the input pocket of the tank temperature sensor. If the water tank sensor cable runs near the power cords, a shielded cable must be used. If a pipe is used, it must be sealed to prevent condensation from forming in the sensor probe.

temperature.

Important:

The temperature sensor must be separated (at least 20 cm) from high voltage power cables to avoid interference that may cause fluctuations in the read temperature and prevent the thermal sensor from operating normally.

pump.

If a duct is used, it must be sealed to prevent condensation from forming in the outside temperature sensor probe.

Important:

All temperature sensors must be separated (minimum 200 mm) from high voltage power cables to avoid interference that could lead to fluctuations in the read temperature and malfunction of the heat pump.

Electric hot water heater **(EH)**

There is a connection port **(OUTA)** used to turn on and off the electric hot water tank heater. **The maximum current is 1 Amp, so an external contactor must be used to control the electric water heater.**

User parameters **c05, c06, c07** set the temperature, time interval for switching on
water heater and heating the water to the value set in **c02** or settings **c161-c165**
to destroy bacteria. After the hot water temperature **(DHW)** reaches the set water temperature **c02,** the boiler

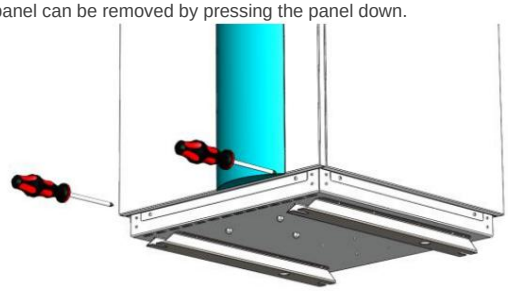
turns off.

Service Manual

Steps to open cabinets:

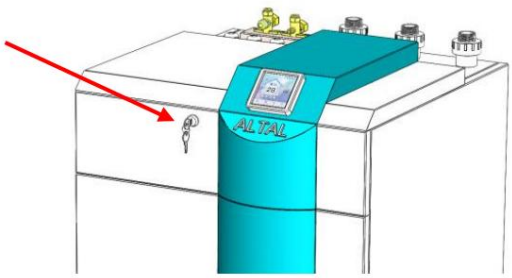
The panels must be removed in the following order: front panel - left panel - right panel. The rear panel opens separately and is independent of the other panels.

1. Unscrew the two screws at the bottom of the front panel as shown below, then remove the front
The panel can be removed by pressing the panel down.

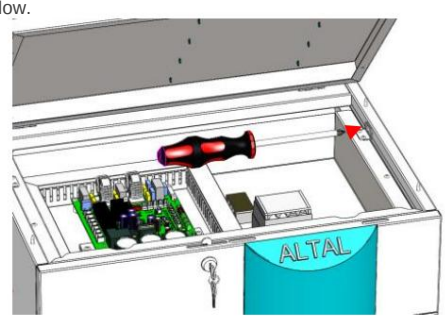


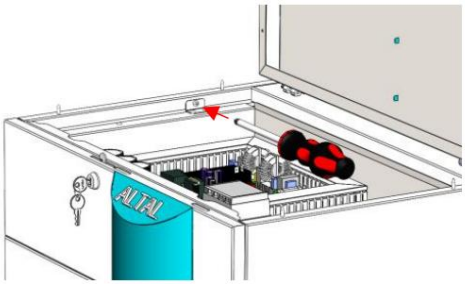
After this procedure, access to the internal section is sufficient.

2. To gain access from the side, open the lock on the electrical compartment key. Lift the cover up.

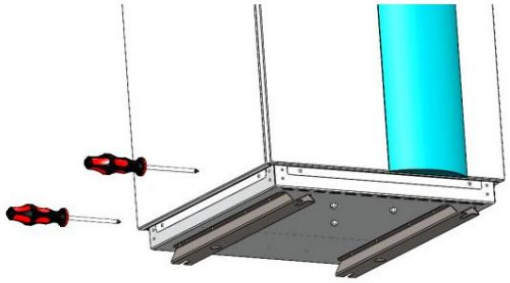


3. Unscrew the two screws on the top side of the left or right panel as shown below.

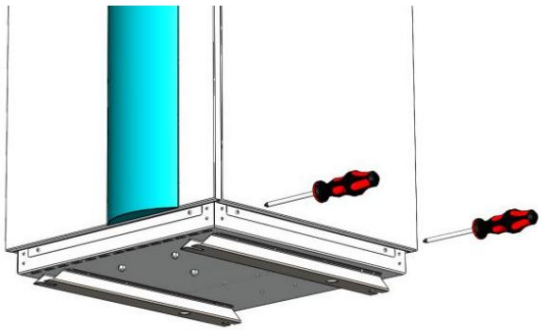




4. Unscrew the two screws on the bottom side (left or right) of the left or right panel as follows
shown below and then you can remove the right or left panel by pressing the panel down.

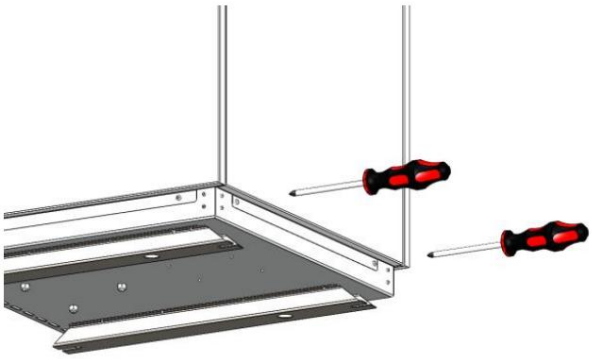


(Left)



(Right)

4. To open the back panel, unscrew the two screws at the bottom of the back panel as shown
shown below, then the panel can be removed,
by clicking on the panel.



Information about the system operation

Control scheme

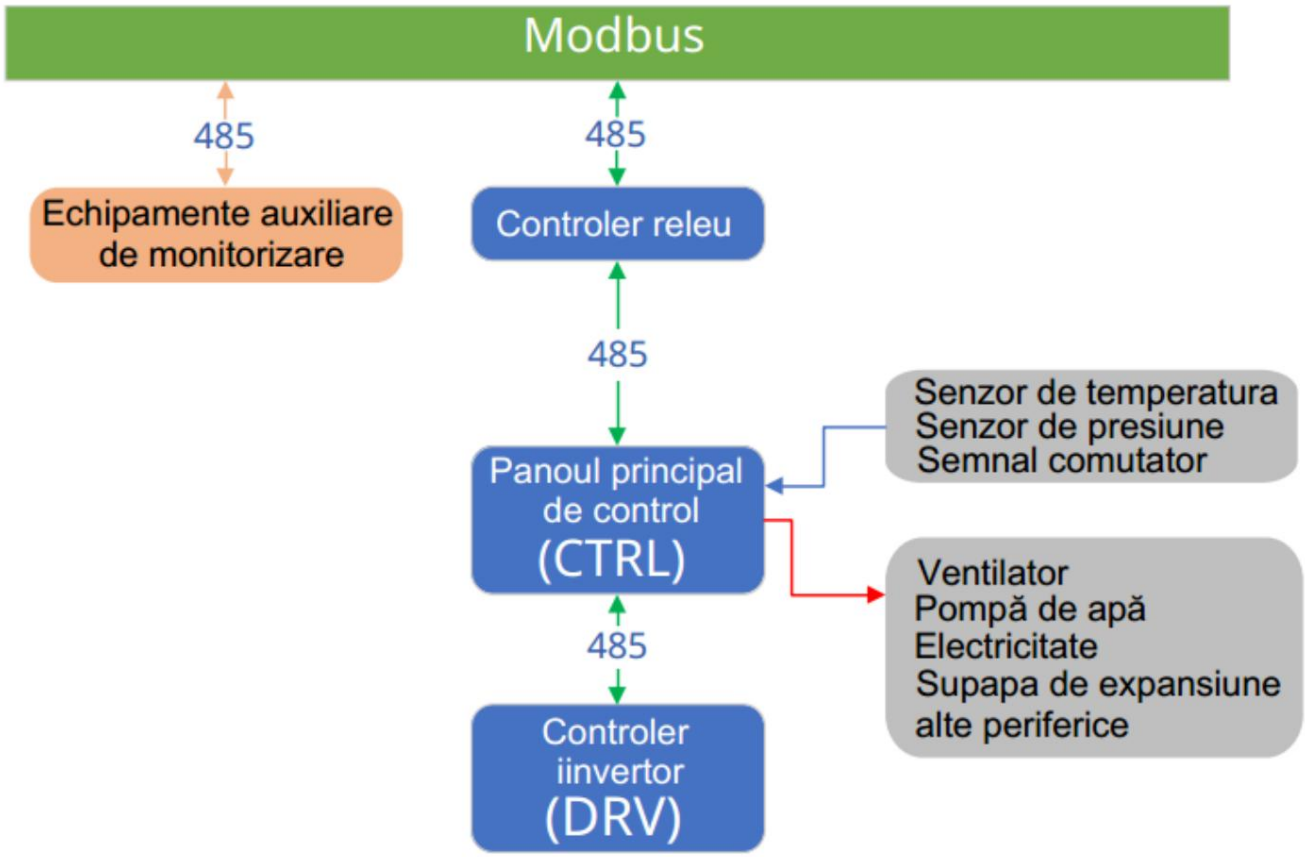


Figure 1: Setting up the management interface.

System diagram. Operating principle.

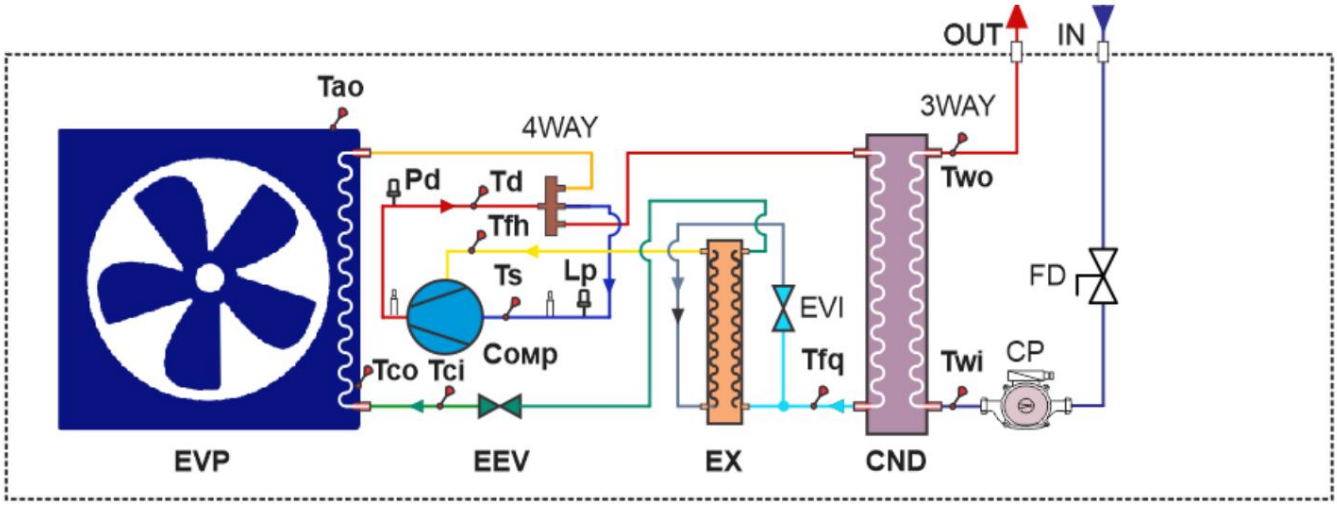


Figure 2: Factory system configuration. Cooling and heating only.

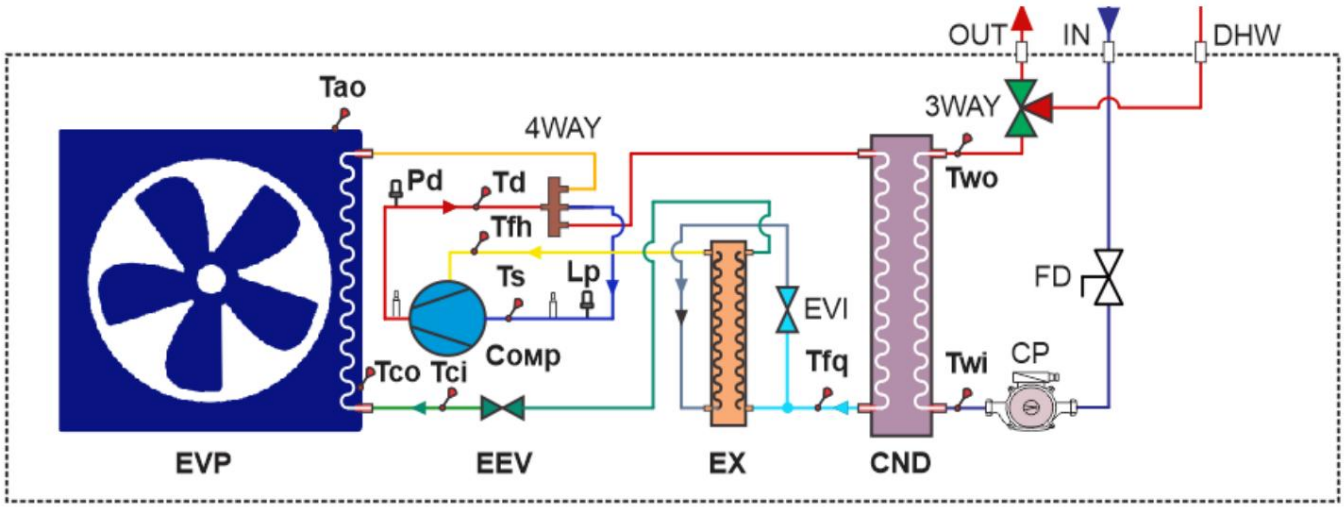


Figure 3: Custom configuration. Three-way valve version (with DHW). Cooling, heating and DHW.

1. The low pressure and low temperature liquid refrigerant exiting the expansion valve takes heat from the air through the heat exchanger and evaporates into a gaseous state.

2. Gas refrigerant is sucked into the compressor. The compressor compresses the gas, resulting in high pressure and high temperature.

3. The high-pressure, high-temperature gas released by the compressor gives up its thermal energy to the water in the plate heat exchanger. The freon cools and condenses into a liquid state.

4. The liquid refrigerant expands in the electronic expansion valve (EVI) . becomes a low-grade liquid refrigerant pressure and low temperature.

5. The cycle repeats.

6. When the EVI condition (the start of the vapor injection process is set to +7) is satisfied, the expansion valve will open and part of the liquefied gas will expand and be discharged into the center section of the compressor after absorbing the heat from the main branch of the liquefied gas into the EVI economizer. With this EVI function, the heating capacity of the heat pump and COP will be increased, and the discharge temperature of the compressor can be controlled within the safe limit, and the functional ambient temperature of the heat pump can be increased to -25 °C .

Input and output ports.

#	Digital input	Signal exit	Analog input	Digital exit
1	Low pressure sensor (reserve)	Compressor, **Summer**	Water tank temperature **(Tw)**	Electronic expansion valve 1 (main valve), **EEV**
2	High pressure sensor (reserve)	Four **4WAY** directional valve	Evaporator Temperature Sensor **(Tco)**	Electronic expansion valve 2, **EVI**
3	Water flow sensor, FD	Electric heater GVS, **EH**	Compressor discharge temperature **(Td)**	Electronic expansion valve 3 (reserve)
4	Compressor protection	Constant current fan current	Gas temperature at compressor inlet **(Ts)**	Variable Frequency Pump PWM
5	Remote switch	Circulation pump	Ambient temperature **(Tao)**	High pressure sensor, **Pd**
6		Electric heater on the chassis	Outlet water temperature **(Two)**	Low pressure sensor, **Lÿ**
7		External heater	Inlet water temperature sensor **(Twi)**	
8		Three-way valve (DHW)	Before the economizer temperature sensor **(Tfq)**	
9		Add solenoid enthalpy	After the economizer temperature sensor **(Tfh)**	
10		Terminal water pump	After main valve **(Tci)**	

Technical descriptions.

1. Temperature control and measurement accuracy: 1 °C .
2. In this document, (E) indicates that the data is stored in EEPROM and (D) indicates that The data is stored in the inverter driver.
3. Advanced features: Modbus-independent communication interface that can remotely monitor the working status of the system through PC or data terminal in the material network.

4. Provides stop memory function (automatic start after starting).
5. Inlet water temperature: temperature sensor, coolant outside (flow to module heat pump);
6. Outlet water temperature: coolant temperature sensor (return from the heating module) pump).
7. Ambient temperature refers to the external ambient temperature.
8. EVI stands for Enhanced Vapor Injection.
9. Compressor frequency actually refers to the speed at which the compressor rotates. Lower frequency refers to slowing down, higher frequency refers to speeding up, and the unit of speed is RPS (revolutions per second).
10. The controller has various protection and error indication functions.

General protections.

#	Security functions	Introduction
1	Temperature Exceeded injection	1. When the exhaust gas temperature is 95 ÿ ~120 ÿ, Compressor frequency control is combined to determine the exhaust gas temperature. 2. When **Td** ÿ120 ÿ, the compressor will stop. 3. If the error occurs three times within 60 minutes, the error will be blocked. It can be recovered no later than 25 minutes later **([p114]** Error recovery time).
2	Evaporator overtemperature protection in cooling mode	1. **Tcoÿ** 60 ÿ, the compressor reduces its frequency; 2. **Tco** <57 ÿ, the compressor increases its frequency; 3. **Tco** > 63 ÿ, the compressor stops; 4. When the downtime meets a certain condition and **Tco** <52 ÿ, compressor recovers from error.
3	Frost protection maintains its water circuit in cooling mode	1. Determine the saturation temperature at low pressure: **Tps** (1 ÿ, which corresponds to approximately 8.2 bar of **Tps);** 2. **Tpsÿ** 1 ÿ (E), the compressor reduces its frequency to 0.1r/s; 3. Tps starts to increase and 1ÿ **<Tpsÿ4** ÿ(E), compressor frequency; 4. 4ÿ <*Tpsÿ7* ÿ(E), the compressor increases its frequency at a speed of 0.1r/s; 5. **Tps** ÿ-3ÿ **[c57]** for 30sec **[c61** *10S], compressor stops; 6. When the compressor stops for more than 170 seconds and **Tps** ÿ 6 ÿ, it is recovering.
4	Exceeding the value of current consumption	1. When Iÿ stop setting value (D), the compressor is protected by frequency limitation and reduction. 2. When I ÿ stop setting value (D), the compressor stops; 3. If the error occurs three times within 60 minutes, the system will be blocked. It can be restored no later than 25 minutes later **([c114]** Error recovery time).
5	Compressor start protection	1. The minimum stop time of the press is 3 minutes, i.e. the machine must be switched off for 3 minutes before each start. Defrosting is not limited by this condition; 2. Mutual switching between cooling and heating modes requires a downtime of 3 minutes; 3. It will not be displayed at the first startup, but startup is only allowed after the electronic expansion valve is initialized; 4. The compressor and external fan start simultaneously, but after the compressor stops, the outdoor fan delays its shutdown.
6	Power-off protection compressors	1. Protection against shutdown: immediate shutdown at current operating frequency; 2. Temperature shutdown: turn off after decreasing to a certain frequency.
7	Protection against excess high pressure	1. Once the high pressure switch trip is detected, the system enters high pressure protection mode and turns off the compressor; 2. Error detection is masked during defrosting; 3. If the error occurs three times within 60 minutes, the system will be blocked. It can be restored only after 25 minutes. (E) (the first two times it can be restored automatically).

8	Low pressure protection	1. When the low pressure switch switches off or It is detected that the suction gas temperature is lower than -5 ÿ for 10s [c57] in cooling mode, the system turns on low pressure protection and stops the compressor. 2. Error detection is masked during defrosting; 3. If the error occurs three times within 60 minutes, the error will be blocked. It can only be restored after 25 minutes. (E) (the first two times it can be restored automatically).
9	Protection against lack of coolant flow in heating circuit	1. After receiving the start request, the water flow switch is checked 30 seconds after the water pump is turned on. If it is found that there is flow, the compressor can start. If there is no flow, the pump will be stopped and an error will be displayed. After 5 seconds, the pump will start again, and after 30 seconds, the water flow switch is checked. If it is found that the water flow meter is short-circuited within 5 seconds, the system will start the compressor. The check will be repeated three times. If the water flow switch is not short-circuited again, the system will turn off and display the water flow protection error code. It can be restored after 25 minutes; 2. If there is no water flow signal within 10 seconds during normal operation of the water pump, all heating loads (compressor and electric heater) will be stopped, water flow error will be displayed, and the water flow relay will be checked as above; 3. All these alarms have shut off the water pump. After the alarm is reset, the pump will start to detect the water flow before starting the compressor.
10	Protection of the electric heater of the DHW tank	Continuous detection of this breaker tripping causes the protection to trip;
11	Evaporator Temperature Sensor Error, **Tco**	1. If short circuit or open circuit of evaporator coil temperature sensor is detected at any time, it will be considered as evaporator coil temperature sensor error and the system will activate shutdown protection; 2. Error detection is masked during defrosting; 3. In heating mode, if the ambient temperature is lower than -10 ÿ, the shutdown detection will be masked for the first 8 minutes after the compressor starts; 4. This error can be corrected automatically.
12	Coolant inlet temperature sensor error, **Twi**	1. If a short circuit is detected at any time or break in the water inlet temperature sensor circuit, this will be considered as the water inlet temperature sensor input, and the system will turn on the shutdown protection; 2. This error can be corrected automatically.
13	Coolant outlet temperature sensor error, **Twÿ**	1. If a short circuit is detected at any time or a break in the circuit of the outlet water temperature sensor, this will be considered a malfunction of the outlet water temperature sensor, and the system will turn on the shutdown protection; 2. This error can be corrected automatically.
14	Suction temperature sensor error, **Ts**	1. If a short circuit or open circuit is detected suction temperature sensor, this will be considered a suction temperature sensor error and the system will start protection; 2. Detection of mask errors during defrosting; 3. In heating mode, if the ambient temperature is below -10°C, the shutdown detection will be masked in the first 8 minutes after the compressor starts; 4. This error can be corrected automatically.

15	Pressure sensor error, **Td**	1. If at any time a discharge temperature short circuit is detected or an open circuit is detected within 4 minutes after the compressor starts, it will be considered a discharge temperature sensor error and the system will shut down the system; 2. This error can be corrected automatically; 3. When an error occurs, the wired controller reports improper maintenance and displays an error code.
16	Environment sensor error, **Person**	1. If a short circuit or open circuit of the ambient temperature sensor is detected at any time, it will be considered an ambient temperature sensor error and the system will activate shutdown protection; 2. This error can be corrected automatically; 3. When an error occurs, the wired controller reports improper maintenance and displays an error code.
17	Protection against freezing of water in the system winter time	1. Water temperature at the outlet Twi and ambient temperature Tao environments are defined in standby mode; 2. When **Tao** ÿ 2 °C and **Twi** ÿ4 °C, the system enters the state primary frost protection and the circulation water pump starts to operate; Only after **Twi** ÿ6 °C or **Tao** ÿ4 °C can it exit frost protection and return to the mode expectations; 3. When **Tao** ÿ 2 °C and **Twi** ÿ2 °C, the system enters the state secondary frost protection and automatically operates in the heating state; If not up to **Twi** ÿ15 °C or **Tao** > 4 °C, the system may exit frost protection and be in standby mode; 4. In case of error **Tao,** the only criterion for protection against freezing is **Twi;** 5. In case of error **Twi,** the only criterion for protection against freezing is frost is **Tao;** 6. If the system encounters other errors that prevent the compressor from starting within this time, it may enter only primary freeze protection instead of secondary freeze protection; 7. In case of simultaneous failure of the **Twi** and **Tao** sensors The system can only enter the primary freeze protection mode and the water pump will operate automatically.
18	standby mode; from freezing or 2. In starts, the heating mode system will turn on the	1. In cooling mode, if the outlet water temperature is detected to be <5°C after the compressor starts, the system will turn on the outlet water temperature anti-freeze protection and stop the compressor. No sooner than the outlet temperature rises to ÿ8°C, the system can exit the , when the outlet water temperature overheating exceeds 70°C after the compressor outlet water overheating protection and turn off the compressor. Not earlier than the outlet temperature ÿ65°C can the system go out of protection.
19	Temperature sensor before economizer (model with steam injection)	1. If at any time during the operation of the system it is detected short circuit or open circuit of the temperature sensor before the economizer, this will be considered a temperature sensor error, and the system will turn on the protection; 2. This error can be corrected automatically.
20	Temperature sensor after economizer, (model with steam injection)	1. If at any time a short circuit or open circuit of the temperature sensor after the economizer is detected, it will be considered a temperature sensor error and the system will turn on; 2. This error can be corrected automatically.

21	Excessive difference water temperatures between inlet and outlet	The protection against excessive difference in water temperature between inlet and outlet is detected only in cooling or heating mode. This error can be cleared automatically. Entry conditions: 1. In cooling mode, the inlet water temperature is – outlet water temperature ÿ parameter [c29]; 2. In heating mode, the outlet water temperature is the temperature water at the inlet ÿ parameter [c29]; 3. After 2 minutes of switching off, the temperature difference <(parameter [c29] -1°C).
22	DHW tank temperature sensor error	1. If short circuit or open circuit of water tank temperature sensor is detected at any time, it will be considered as water tank temperature sensor error and the system will start protection mode; 2. This error can be corrected automatically.
2. 3	Temperature sensor error after the main ERV	1. If at any time after the adjustment there is a short circuit or open circuit of the temperature sensor is detected, this will be considered an error of the temperature sensor after the ERV, and the system will turn on the protection; 2. This error can be corrected automatically.
24	Starting Limits at Ambient Temperature	1. When the ambient temperature ÿ parameter [c13] (adjustable: - 40 ~ 2°C , default setting: 30°C), the system stops; 2. Recovery: If the temperature is 2°C higher than Setting the stop condition [c13]; for example: [c13] = -25°C, the recovery temperature is 2 + (- 25) = - 23°C . If this condition is met and the waiting period exceeds 3 minutes, the device can be turned on again.
25	Control sensor 2. This Compressor overheating 3. If the (E) later separately, in installed)	1. If the overheat protection circuit at the **K4** terminal of the controller is detected to be open at any time, it will be considered as an overheat fault and the system will initiate shutdown protection; error can be corrected automatically; error occurs three times within 60 minutes, the error (set will be locked. Cannot be restored until 25 minutes models not (the first two times it can be restored automatically); 4. When an error occurs, the wired controller reports improper maintenance and displays the emergency error code system shutdown.
26	External control of system start and stop	1. If the signal on terminal **K5** is open, it will be considered as an external stop signal and the system will be switched off. The system start signal is a short-circuited contact; 2. This is a stop signal, not a fault, and can be cleared automatically;
27	Low sensor pressure (Optional)	1. If a short circuit is detected at any time or a break in the low pressure sensor circuit, this will be considered a low pressure sensor error and the system will turn on protection; 2. Errors are masked during defrosting and in the first 3 minutes after launch; 3. This error can be corrected automatically; When an error occurs, the wired controller reports 4. incorrect operation and displays an error code.

Operating mode of the system.

Working mode.

Operating modes include heating mode, high heating mode and cooling mode.
The actual available working mode can be reduced and adjusted in the following three cases according to the system configuration.

1. Cooling mode;
2. Heating mode, high heating mode;
3. Automatic cooling and heating mode;
4. Automatic cooling and hot water supply mode;
5. Automatic heating and hot water supply mode;
6. Hot water preparation mode (DHW).

Setting up temperature control.

1. For cooling or heating mode, the temperature sensor can control the system based on parameter [c05] (selection of main temperature sensor) when selecting control from the temperature of the outlet water, inlet water or water tank.
2. In cooling mode, the temperature setting parameter is [c03]; In heating mode, the temperature setting parameter is [c01];
3. “Water temperature control” and “Water temperature setting” below correspond to the actual water temperature and the set temperature of the outlet water, inlet water or water tank, which are determined by parameter [c05].

Heating mode.

The compressor and additional electric water tank heater can be used together. The need for the heating element to operate together with the compressor is determined by the system depending on the conditions and the set parameters.

Compressor on/off control:

a. Water temperature control ÿ set water temperature - set return temperature difference [c04], compressor and fan start, the system works in heating mode;
b) When selecting temperature reaching control (parameter [c12] as shown below) = 0 (the compressor does not reduce the frequency but stops after reaching the temperature), if the control water temperature ÿ setting water temperature + 1°C (can be changed depending on the model type), the compressor will stop;

c. When parameter [c12] = 1, if control water temperature ÿ set water temperature - 1.5°C, the compressor will reduce its frequency. In this situation, when the frequency > 40 r/s (minimum value 40 r/s), the compressor stops until the controlled water temperature ÿ set water temperature + 1.0.°C;

d. Water temperature control ÿ set water temperature – difference set return temperature [c04], but not at set water temperature, the system remains in the previous operating mode (off/heating).

Control of the buffer tank electric heater:

When the compressor runs for 5 minutes and the following three conditions are met, the electric heater starts immediately:

A. The switch of the electric water heater of the water tank [c27] is enabled, i.e. parameter [c27] = 1;
b) ambient temperature ÿ set temperature (parameter [c06], as shown below);
c) The water temperature does not rise continuously for the period of time set by parameter [c07] (electric heater start-up compensation time, as shown below);
g. The control water temperature is lower than (set water temperature – return temperature difference at start-up).

That is, when the ambient temperature ÿ the set temperature (parameter [c06]) and the water temperature does not increase continuously for the period of time set by parameter [c07], the electric heater is turned on.

Temperature achievement control selection:

When parameter [c12] = 1:
A. When the electric heater is turned on, it turns off 1.5ÿ earlier;
b) taking the water temperature as the target, the compressor begins to reduce the frequency with a gradient of 1.5 ÿ in advance;
c. When checking the water temperature - set the water temperature ÿ 1.0 ÿ, the compressor stop;

When parameter [c12] = 0:
When the water temperature ÿ set water temperature +1ÿ, the compressor, electric heater and fan turn off.

Powerful heating mode.

In high heating mode, the operating frequency will increase depending on the mode. heating, while other logical controls are the same as in heating mode.

Cooling mode.

Compressor on/off control:

A. Water temperature control ÿ set water temperature + set return temperature difference [c04], compressor and fan start, system works in cooling mode
b) When parameter [c12] = 0, if the control water temperature ÿ set water temperature - 1ÿ, the compressor will stop;
C. When parameter [c12]=1, if the control water temperature ÿ set water temperature +1.5ÿ, the compressor will reduce its frequency. In this situation, when the frequency>40r/s, the compressor will stop until the control water temperature ÿ set water temperature - 1.0ÿ;

g. Water temperature control ÿ set water temperature + set return temperature difference [c04], but not at set water temperature, the system remains in the previous operating mode (off/cooling).

Operating frequency regulator:

A. The operating frequency is adjusted by the ambient temperature according to the “Compressor Operating Frequency Display Table” - cooling mode;
B. It is set to the temperature control selection setting [c12]. If you need to enter the frequency reduction mode: refer to the description of "Temperature Reaching Control Selection".
c. For maximum and minimum operating frequency limits, see Compressor Frequency Limits and Cooling Limits.

Control of the buffer tank electric heater:

The electric water heater is turned off.

Temperature achievement control selection:

When parameter [c12] = 1:
A. When the electric heater is turned on, it turns off 1.5ÿ earlier;
b) taking the water temperature as the target, the compressor begins to reduce the frequency with a gradient of 1.5 ÿ in advance;
c. When checking the water temperature - set the water temperature ÿ 1.0 ÿ, the compressor stop;
When parameter [c12] = 0:

When you check the water temperature ÿ setting water temperature +1ÿ, the compressor, electric heater and fan will turn off.
down.

Frequency control.

Table of correspondence of compressor operating frequencies.

According to the ambient temperature and the water temperature to be controlled, a target frequency matching table is made.
Detailed correspondence will be provided separately.

Compressor frequency limits.

Compressor operating frequency range (E).

FACING	TAÿ41°C	TAÿ43°C
Minimum frequency cooling	28 rpm	28 rpm

TA	TAÿ18°C	20°C ÿTAÿ26°C	28°C ÿTAÿ36°C	TAÿ38°C
Maximum frequency coolers	90 RPS	100 RPS	110 rpm	100 RPS

FACING	TAÿ22°C	TAÿ24°C
Minimum frequency heating	28 rpm	28 rpm

FACING	TAÿ10°C	11°C ÿTAÿ15°C	17°C ÿTAÿ20°C	TAÿ22°C
Maximum frequency heating	120 rpm	110 rpm	100 RPS	90 RPS

Defrosting frequency	80 RPS

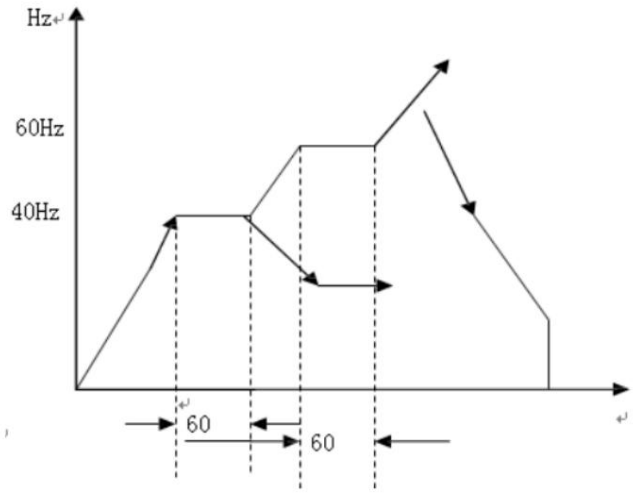
The above maximum and minimum frequencies are also limited by the maximum and minimum frequencies of the driver module. When performing multiple qualifications at the same time, the minimum qualification value is calculated.

Compressor braking.

By default, frequency slowdown is performed at the following speed:
Fast frequency up and down ---------- 1RPS
Slowly increase speed and decrease frequency ---------- 0.1 RPS
Normal high and low frequency ---------- 1RPS

Slow starting point and jump point of the frequency increase process compressor frequencies.

When the compressor starts, if the target frequency is higher than the soft start point frequency [40r/s(E) and 60r/s(E)], it will stay at the starting point for a little while for 60s(E) before running at the target frequency. .;



Compressor frequency jump point:
There are five points that can be set in Eeprom: 0RPS, 0RPS, 0RPS, 0RPS, 0RPS (0 means cancel).

Defrost mode.

Defrost mode

Defrosting conditions:

Category A Condition 1: (If all of the following conditions are met):
a) if the compressor continues to operate in heating mode for at least 10 minutes and the accumulated operating time exceeds the set defrost period [A10];
b) When the evaporator sensor temperature ÿ the set defrost temperature [A08], the system enters defrost mode;

C. Evaporator coil temperature is below ambient temperature -8°C (parameter [A36]) or -30°C.

If condition A is met, the system will turn on the evaporator defrost mode.

Category 2 B Condition: (If all of the following conditions are met):
a) if the compressor continues to operate in heating mode for at least 10 minutes and the accumulated operating time exceeds the set defrost period [A10];
b. Ambient temperature <5°C and evaporator coil temperature ÿ -4°C;
c) The total working time exceeds 2 hours.

CAUTION! Setting the defrost mode for some models. When the defrost mode is automatic ([c34] = 0), only condition A is fulfilled. And if it matches the settings and the evaporator temperature, the system enters the defrost mode. When the defrost mode is fixed ([c34] = 1), conditions A and B are evaluated. And depending on the execution of

one of them, the system goes into defrosting mode. Some models may only have a fixed mode, i.e. one of conditions A and B may be met.

Defrosting conditions:

When evaporator sensor temperature ÿ defrost outlet set temperature [c09] or time defrosting reaches the set defrosting time at the outlet [c11], defrosting occurs;

In the following special cases, the defrost mode is also switched off automatically:
A. During the defrosting process, it will automatically shut down when high pressure error occurs or the discharge temperature is too high, and there is no high pressure or discharge temperature error reported;

b. Defrost automatically when the outlet water temperature is less than 6°C.

Parameter	Default value Setting range	

Temperature difference between the evaporator and the ambient temperature (parameter c36 (in °C))	1	0-40
Defrost inlet temperature c08 (in °C) Defrost outlet	- 1	0--30
temperature c09 (in °C) Defrost interval c10 (in min)	13	2-20
Maximum defrost time c11 (in min)	55	20-200
	8	1-20

Performing the defrosting process:

1. Before entering the defrosting mode, the compressor begins to reduce its frequency. 2. When the frequency drops to 30 Hz, the compressor stops. 3. The reversing valve switches to the reverse mode after 5 seconds.
4. The fan stops after 55 seconds. 5. The electronic expansion valve operates according to the defrost mode [c42] and [p43].
6. 60 seconds after switching off, the compressor starts and reaches the defrost frequency. [p38].
7. After defrosting is complete, the compressor frequency drops to 30Hz before stopping. 8. 5 seconds after the compressor stops, the reversing valve switches. 9. 40 seconds after the fan turns on. 10. 60 seconds after turning off, the compressor starts running again at 40Hz for 1 minute, entering normal heating mode with the electronic expansion valve.

Electronic expansion valve control.

The maximum opening of the electronic expansion valve MAX_VAL is 500.

The parameters in the following control logic may vary from model to model.

Main Electronic Expansion Valve Control Rules

• Adjust the opening of electronic expansion valve according to the ambient temperature, controlled water temperature and exhaust vapor temperature, and set two opening tables for heating and cooling mode (detailed parameters will be provided separately);

• In cooling and heating mode, after the compressor starts, the electronic expansion valve will be opened to the initial opening of each mode and should be maintained for 2 minutes (not set for 2 minutes). After 2 minutes, the initial opening will be adjusted again according to the ambient temperature. After adjusting the initial opening, the opening of the electronic expansion valve will remain unchanged for 3 minutes.

• Initial opening in cooling mode is determined by the ambient temperature and can be changed depending on the main valve compensation cooling mode parameter [c146].

• Initial opening in heating mode is determined by the ambient temperature and can be changed depending on the main heating valve compensation mode parameter [c147].

• The initial opening of the high heat mode is determined by the ambient temperature, and the high heat compensation opening [c59] is added to the initial opening of the high heat mode valve.

• After the compressor is switched off, the electronic expansion valve opens to the maximum opening MAX_VAL;

• During defrosting, the opening of the electronic expansion valve is 470 steps [c42], and opening of auxiliary valve is 0 steps [c43];

• The target superheat during cooling is set to TSH, which is determined by the following table: [c131 ~ c135] (adjustable).

Surrounding temperature	All <26°C	26°C <ÿÿÿÿ30°C 30°C	<ÿÿÿÿ33°C 33°C <ÿÿÿÿ38°C		All°C 38°C
Overheat	2	2	2	2	2

• The target superheat during heating is set to TSH, which is determined by the following table: [c136 ~ c145] (adjustable).

Temp. Ambient environment	All <- 22°C	- 22°C <ÿÿÿÿ - 15°C	- 15°C <ÿÿÿÿ - 9°C	- 9°C <ÿÿÿÿ - 3°C	- 3°C <All ÿ4°C	4°C °C All11 °C	11°C °C ÿÿÿÿ18 °C	18°C °C Tÿÿÿÿ26 °C	26°C °C All35 °C	All °C 35°C
Overheated V	- 1	- 1	- 1	1	1	1	1	1	1	1

When the exhaust gas temperature is above 100°C [c76], open the main valve; For type with addition low temperature enthalpy ([c116] = 1) it is preferable to install an auxiliary valve.

When the exhaust gas overheating orifice control takes effect, exhaust regulation has priority over overheating regulation.

In cooling and heating mode, the minimum opening of the electronic expansion valve should not be less than the minimum opening value.

Minimum heating opening: [c149~c158 adjustable], minimum cooling opening: [c49~c53 adjustable].

To match different types of electronic expansion valves, compensation values The main valves ([c146], [c147]) are set for cooling and heating mode. The offset value is added to the initial opening value based on the value obtained from the table lookup.

Auxiliary Electronic Expansion Valve Control Rules valve (EVI).

- In cooling and stop state, auxiliary electronic expansion valve is closed (step 0) In defrost mode, defrost opening will follow, step 0 [c43];
- At ambient temperature > 7°C [c45] + 2°C, the additional electronic expansion valve does not open;
- The opening conditions of the auxiliary electronic expansion valve must match the opening conditions of the enthalpy addition valve. For details, see Enthalpy addition valve;
- If the opening of the calculated electronic expansion valve> MAX_VAL, the opening of the electronic expansion valve = MAX_VAL;

Within 4 minutes after the auxiliary electronic expansion valve opens, an initial opening will be given based on the ambient temperature; It can be changed according to the auxiliary heating valve compensation parameter [c148]. The initial opening of the auxiliary valve in high heating mode is determined by the ambient temperature.

- Depending on the heating mode, a compensatory opening of a powerful one has been added auxiliary valve [c60] to make the initial opening of the auxiliary valve in the powerful heating mode;
- The electronic expansion valve with enthalpy addition is adjusted according to the superheat before and after the auxiliary valve. The target superheat of the TSH before and after the valve is set to [c118] and [c119];
- When the exhaust gas temperature is above 100°C [c76], it is desirable that the auxiliary valve be open;

- To adapt to different types of electronic expansion valves,

The auxiliary valve for heating mode is set with a compensation value ([c148]). The offset value is added to the initial opening value based on the value obtained from the table lookup.

Oil return control.

Entry conditions.

a. In cooling mode, the compressor speed in total is less than 30 r/s (E) for 1 hour;

b. During the time accumulation process, if the frequency exceeds 60 r/s and the duration exceeds 10 minutes, the oil return time will be erased;

c. If condition a is met, then enter the oil return **action ;**

g. When entering the defrost mode, the oil return time will be cleared;

Oil return.

- The compressor increases its frequency to 70 rpm (E) and it takes 3 minutes for the oil to return, then the compressor decreases its frequency to 30 rpm (E), after 30 seconds the system returns to normal operation.
- The opening of the main valve is the same as the defrost hole, 480 [c42] (fully open).

Digital output interfaces.

Four-way valve.

ÿ Note: Parameter [c74] is four-way valve option.

Parameter control	Module	Four-way valve status
[p74] = 0	Cooling	Activated
	Heating	Switched off
	defrost	On (see defrosting process)
[p74] = 1	Cooling	Switched off
	Heating	Activated
	defrost	Off (see defrosting process)
Note: Fixed mode is not available for some models.		

Constant speed water circulation pump and water PWM variable speed pump.

ÿ Note: Parameter [c15] is how the water pump works.

Constant speed water circulation pump.

• When a start command is received, the pump starts 30 seconds before the compressor starts;
• Check the flow meter 30 seconds after turning on the water pump (see flow meter protection);

• Consult on freeze protection;
• When the machine reaches the set water temperature, it operates according to parameter [c15];
A. When [c15]=0, if the set temperature is reached, the water pump will keep working;

b) When [c15] = 1, if the set temperature is reached, the water pump will turn off 60 seconds after the compressor stops;

• If the water temperature is too low or too high or is under protection from overheating. The water pump is forced to start.
• Temperature control conditions when starting is required (regardless of whether stall protection is present): (i.e. non-stop mode)
A. Water temperature>=overheat protection point, pump start.
B. Water temperature <= overheat protection point - return difference, pump stops.
C. Correct the error, follow the normal logic of the water pump.

PWM variable speed water pump.

Depending on the temperature difference, the speed of the water pump is adjusted with variable frequency in accordance with the control program.

High/low speed control of AC fan and direct current.

Automatically adjust the fan speed according to the environment, evaporator coil and frequency.

The fan type can be selected according to parameter [c26]:
A. [c26] = 1, select DC fan. When the speed is less than 200 rpm, the fan runs at 200 rpm;

b) [c26] = 0, select two-speed AC fan;
c) [c26] = 2, select single speed AC fan. Output wind speed is strong wind when the fan is on.

AC Fan Control.

AC Fan Speed Control Table in Heating Mode.

Compressor frequency		°C 25 RPS	25RPS ~ 45RPS	ÿ45RPS
Person (sensor Middle A)	°C 15°C	Slowly Slowly	Big	Big
	15°C ~ 20°C		Slowly	Big
	°C 20°C	Slowly		

DC Fan Control.

Wind speed steps are divided into 6 degrees as follows.

Speed table:

	Speed 1	Speed 2 Speed 3 Speed 4 Speed 5 Speed 6				
Speed (rpm)	520°C c92°C 580°C c93°C 600 °C c94°C 640° C c95°C 700°C c96°C 800°C c97°C					

Electric chassis heating (external).

In the error state, the start state or stop state to reach the temperature:

1. First, to turn on the chassis heater, the switch must be
   available (parameter [c28] = 1);
2. Otherwise, the chassis electric heater will be switched off regardless of any of the
   the following temperature conditions;

- When the ambient temperature is below 6 ÿ, the chassis electric heater is switched on;
- When 6ÿ ÿ ambient temperature ÿ 8ÿ, remains in the original state;
- When the ambient temperature is above 8 ÿ, the electric chassis heater
  turns off.

Electric compressor heating.

In the off state:

When the ambient temperature is below 6ÿ, the compressor electric heater will turn on;

- When 6ÿ ÿ ambient temperature ÿ 8ÿ, remains in the original state;
- When the ambient temperature is above 8 ÿ, the compressor electric heater
  turns off.

Solenoid valve (enthalpy regulating valve / EVI).

In the nageva mode, the electromagnetic valve EVI (may be absent) is allowed to start only when the compressor starts;

In cooling mode, defrost mode or shutdown state, the EVI solenoid valve is closed.

1. When the ambient temperature. Tao < parameter [A45], the solenoid valve EVI starts; When the ambient temperature. Tao > parameter [A45]+2ÿ, the EVI solenoid valve stops;

2. When [A45] < ambient temperature. Tao < [A45]+2ÿ, the solenoid valve EVI will remain in its original state;

3. When the discharge temperature ÿ 60 ÿ and the discharge temperature is the water temperature at output ÿ parameter [A46], the EVI solenoid valve is allowed to start;

4. The EVI solenoid valve will turn off if the return difference exceeds 10ÿ.