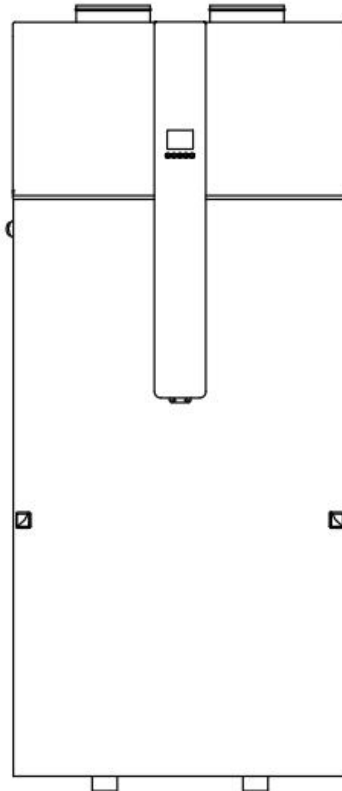




Operation & Installation Manual

For Sanity Hot Water Heat Pump



Suitable for model TWMB3500 K



READ THIS MANUAL CAREFULLY BEFORE STARTING UP THE UNIT. DO NOT THROW IT AWAY. KEEP IT IN YOUR FILES FOR FUTURE REFERENCE.



BEFORE OPERATING THE UNIT, MAKE SURE THE INSTALLATION HAS BEEN CARRIED OUT CORRECTLY BY A PROFESSIONAL DEALER. IF YOU FEEL UNSURE ABOUT OPERATION, CONTACT YOUR DEALER FOR ADVICE AND INFORMATION.

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1、 INTRODUCTION

1.1 This manual

This manual includes the necessary information about the unit. Please read this manual carefully before you use and maintain the unit.

1.2 The unit

The hot water heat pump is one of the most economical systems to heat the water for family domestic use. Using free renewable energy from the air, the unit is highly efficient with low running costs. Its efficiency can be up to 3~4 times more than conventional gas boilers or electrical heaters.

1.2.1 Waste Heat recovery

Units can be installed near the kitchen, in the boiler-room or the garage, basically in every room which has a large number of waste-heat so that the unit has the higher energy efficiency even with very low outside temperatures during the winter.

1.2.2 Hot water and dehumidification

Units can be placed in the laundry room or clothing room. When it produces hot water, it lowers the temperature and dehumidifies the room as well. The advantages can be experienced particularly in the humid season.

1.2.3 Storage room cooling

Units can be placed in the storage room as the low temperature keeps the food fresh.

1.2.4 Hot water and fresh air ventilation

Units can be placed in the garage, gym, basement etc. When it produces hot water, it cools the room and supplies fresh air.

1.2.5 Compatible with different energy sources

Units can be compatible with solar panels, external heat pumps, boilers or other different energy sources.

1.2.6 Ecological and Economical Heating

Units are the most efficient and economical alternative to both fossil fuel boilers and heating systems. By making use of the renewable source in the air, it consumes much less energy.

1.2.7 Compact design

Units are especially designed for offering sanitary hot water for family use. Its extremely compact structure and elegant design are suitable for indoor installation.

1.2.8 Multiple Functions

The special design of the air inlet and outlet makes the unit suitable for various ways of connections. With different ways of installation, the unit can work as just a heat pump but also as a fresh air blower, a dehumidifier, or an energy recovery device.

1.2.9 Other features

Stainless steel tank and a magnesium stick assure the durability of components and the tank. Highly efficient compressor with the R454C a refrigerant.

Electrical element available in the unit as a back-up, assuring constant hot water even in extreme cold winters.

2、 SAFETY INSTRUCTIONS

To prevent injury to the user, other people, or property damage, the following instructions must be followed. Incorrect operation due to ignoring of instructions may cause harm or damage.

Install the unit only when it complies with local regulations, by-laws and standards. Check the main voltage and frequency. This unit is only suitable for earthed sockets, connection voltage 220 - 240 V ~ / 50Hz.

The following safety precautions should always be taken into account:

- Be sure to read the following WARNING before installing the unit.
- Be sure to observe the cautions specified here as they include important items related to safety.
- After reading these instructions, be sure to keep it in a handy place for future reference.

2.1 Warning



2.1.1 Do not install the unit yourself.

Incorrect installation could cause injury due to fire, electric shock, the unit falling or leakage of water. Consult the dealer from whom you purchased the unit or a specialized installer.

2.1.2 Install the unit securely in a place.

When insufficiently installed, the unit could fall causing injury. The bearing surface should be flat to bear the weight of the unit and suitable for installing the unit without increasing noise or vibration.

When installing the unit in a small room, please take measures (like sufficient ventilation) to prevent the asphyxia caused by the leakage of refrigerant.

2.1.3 Use the specified electrical wires and attach the wires firmly to the terminal board (connection in such a way that the stress of the wires is not applied to these sections).

Incorrect connection and fixing could cause a fire.

2.1.4 Be sure to use the provided or specified parts for the installation work.

The use of defective parts could cause an injury due to possible fire, electric shocks, the unit falling etc.

2.1.5 Perform the installation securely and please refer to the installation instructions.

Incorrect installation could cause an injury due to possible fire, electric shocks, the unit falling, leakage of water etc.

2.1.6 Perform electrical work according to the installation manual and be sure to use a dedicated section, fused with 16A.

If the capacity of the power circuit is insufficient or there is an incomplete electrical circuit, it could result in a fire or an electric shock.

2.1.7 The unit must always have an earthed connection.

If the power supply is not earthed, you may not connect the unit.

2.1.8 Never use an extension cable to connect the unit to the electric power supply.

If there is no suitable, earthed wall socket available, have one installed by a recognized electrician.

2.1.9 Do not move/repair the unit yourself.

If the supply cord is damaged, it must be replaced by the manufacturer or its service agent or a similarly qualified person in order to avoid a hazard. Improper movement or repair on the unit could lead to water leakage, electrical shock, injury or fire.

2.1.10 The unit is no intended for use by children.

This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.

Children should be supervised to ensure that they do not play with the appliance.

2.1.11 Do not tear off the labels on the unit.

The labels are for the purpose of warning or reminding, keeping them can ensure your safe operations.

2.2 Caution



2.2.1 Do not install the unit in a place where there is a chance of flammable gas leaks.

If there is a gas leak and gas accumulate in the area surrounding the unit, it could cause an explosion.

2.2.2 Perform the drainage/piping work according to the installation instruction.

If there is a defect in the drainage/piping work, water could leak from the unit and household goods could get wet and be damaged.

2.2.3 Do not clean the unit when the power is 'ON'.

Always shut 'OFF' the power when cleaning or servicing the unit. If not, it could cause an injury due to the high-speed running fan or an electrical shock.

2.2.4 Do not continue to run the unit when there is something wrong or there is a strange smell.

The power supply needs to be shut 'OFF' to stop the unit; otherwise, this may cause an electrical shock or fire.

2.2.5 Do not put your fingers or others into the fan, or evaporator.

The inside parts of the heat pump may run at high speed or high temperature, they could cause serious injury. Do not remove the grills on the fan outlet and top cover.

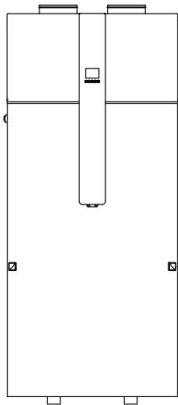
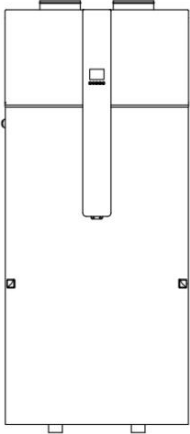
The hot water probable needs to mix with cold water for terminal usage, too hot water (over 50°C) in the heating unit may cause injury.

The installation height of power supply should be over 1.8m, if any water may spatter, the unit can be safe from water.

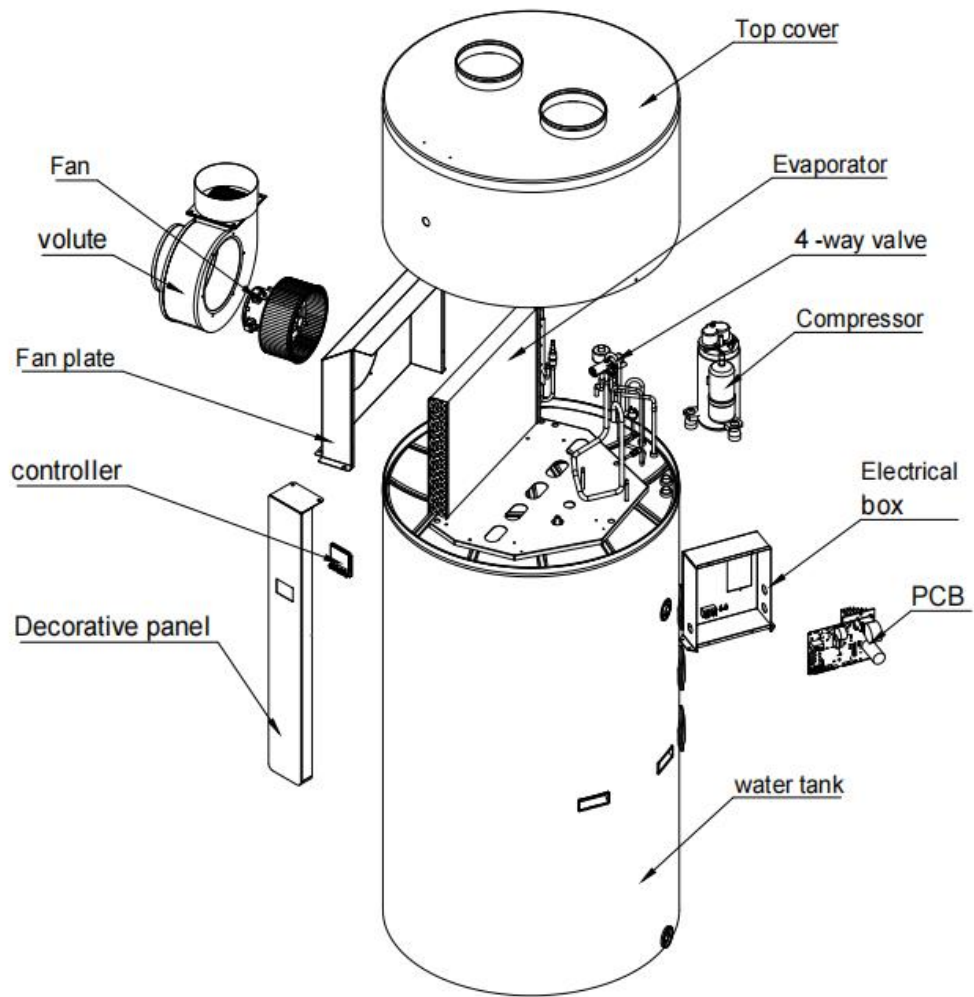
3、Product summary

3.1 Items inside product box

Before starting the installation, please make sure that all parts are found inside the box.

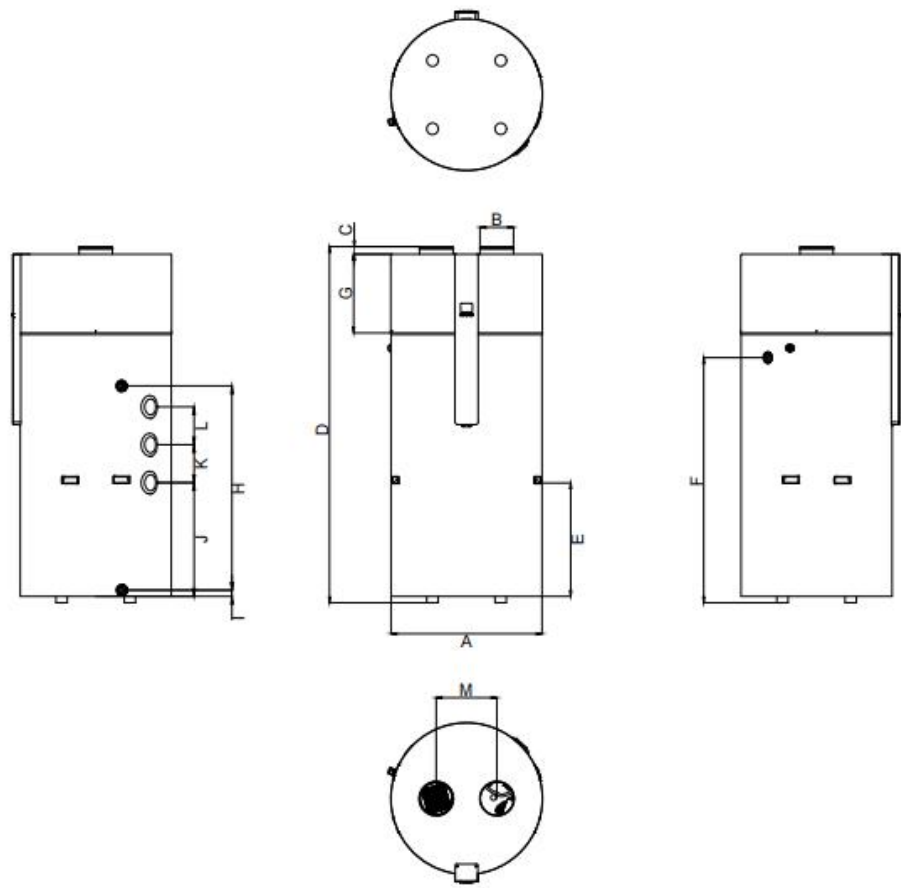
The Unit Box		
Item	Image	Quantity
Domestic hot water heat pump		1
Operation & Installation Manual	Operation & Installation Manual --For Sanity Hot Water Heat Pump 	1

3.2 Parts and descriptions



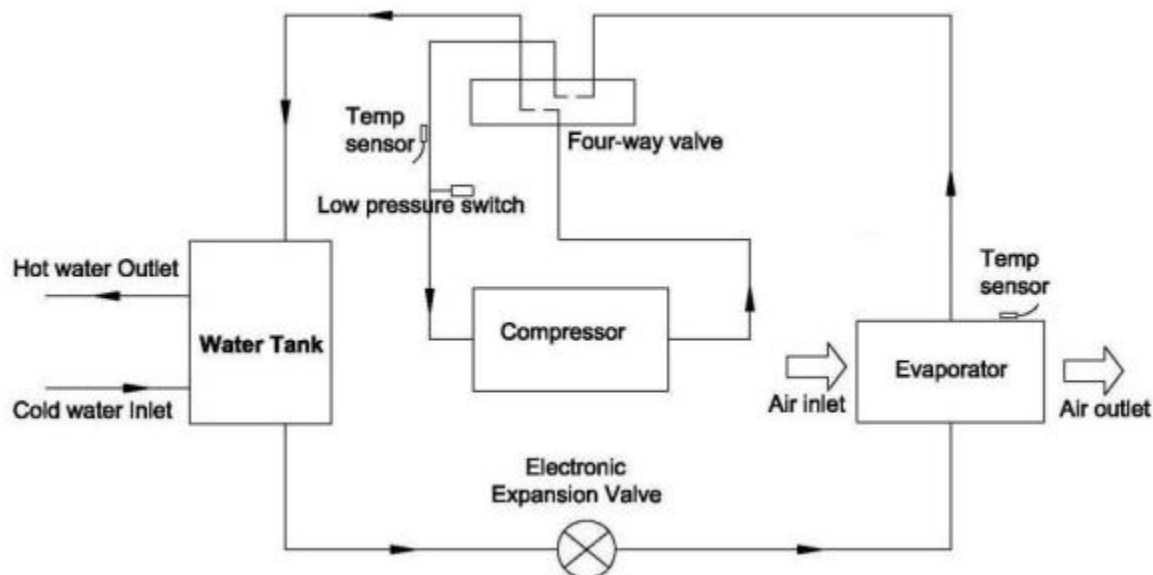
3.3 Dimensions

Model: TWMB5 3500 K (500lt.)



A	800
B	ϕ 177
C	40
D	1880
E	600
F	1295
G	415
H	1077
I	33
J	600
K	200
L	200
M	320

3.4 Schematic overview of the water and refrigeration circuit



4、INSTALLATION

⚠ WARNING

- Asked your supplier to install the unit. Incomplete installation performed by yourself may result in a water leakage, electric shock, or fire.
- Indoor installation is highly recommended. It is not allowed to install the unit at outdoor or rain achieving place.
- The installation place without direct sunlight and other heat supplies is recommended. If noway to avoid these, please install a covering.
- The unit must be securely fixed to avoid noise and shaking.
- Make sure that there's no remora around the unit.
- In the place where there is strong wind, fix the unit in the location protected from the wind.

4.1 Transportation

As a rule, the unit is to be stored and/or transported in its shipping container in upright position and without water charge. For a transport over short distance (provided that it is done with care), an inclination angle up to 30 degrees is permitted, both during transport and storage. Ambient temperatures of -20 to +70 degrees Celsius are permitted.

- Transport using a forklift

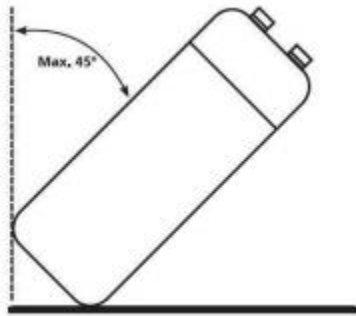
When transported by a forklift, the unit must remain mounted on the pallet. The lifting rate should be kept to a minimum. Due to its top-heaviness, the unit must be secured against tipping over.

To prevent any damage, the unit must be placed on a level surface.

- **Manual transport**

For the manual transport, a wooden/plastic pallet can be used. Using ropes or carrying straps, a second or third

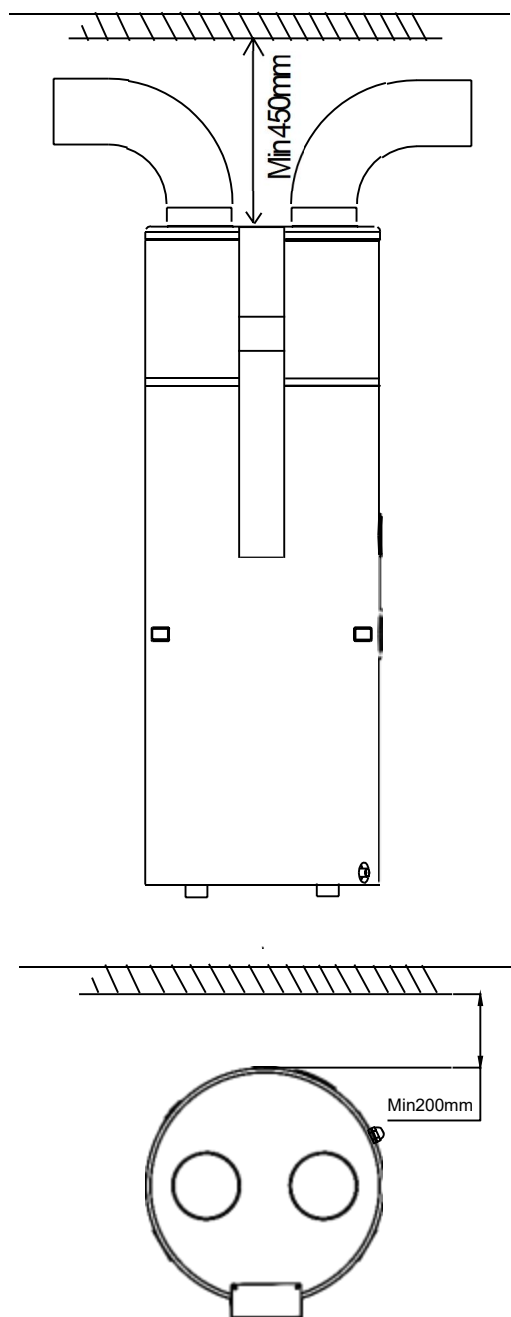
handling configuration is possible. With this type of handling, it is advised that the maximum permissible inclination angle of 45 degree is not exceeded. If transport in an inclined position cannot be avoided, the unit should be taken into operation one hour after it has been moved into final position.



ATTENTION: DUE TO THE HIGH CENTER OF GRAVITY, LOW OVERTURNING MOMENT, THE UNIT MUST BE SECURED AGAINST TIPPING OVER.

4.2 Required service space

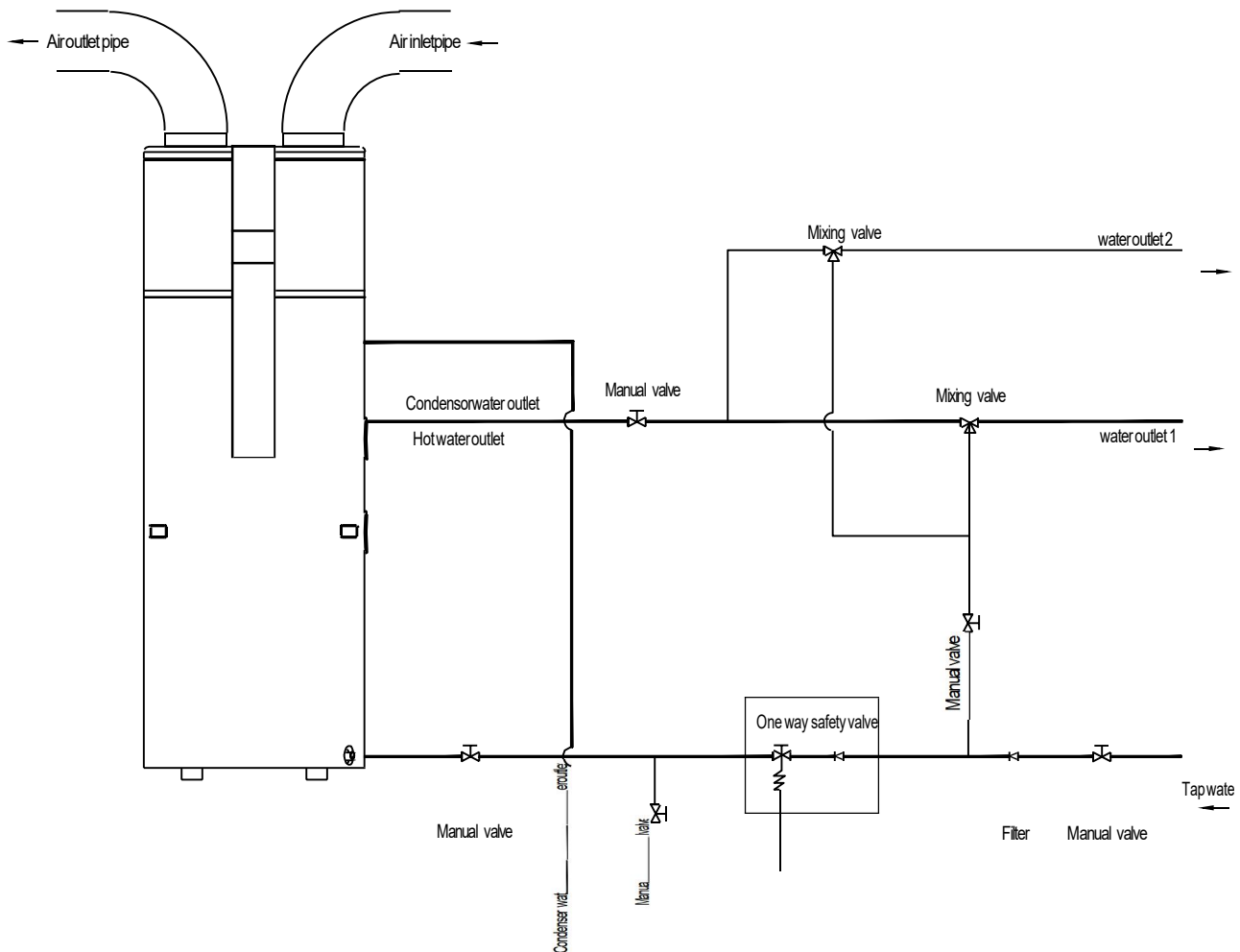
Below you will find the minimum space required to be able to complete service and maintenance tasks on the units.



Note:

- If air inlet and/or outlet pipes are connected, portion airflow and capacity in heat pump unit will lose.
- If the unit connects with air ducts it should be DN 180mm for pipes or 180mm internal diameter flexible hose. Total length of the ducts should not be longer than 8m or the maximum static pressure should not exceed than 45Pa. The wind pressure of each 90 elbow loses 3.6Pa, each 45 elbow wind pressure loses 2Pa, and the wind pressure loses 0.85Pa. Be in mind of bending site of the duct no more than 4m.

4.3 Installation overview



Note: Solar heat exchange coil is optional.



ATTENTION:

- **The one-way safety valve must be installed.** If not, it could cause damage to the unit, or even hurt people. The set point of this safety valve is 0.7 MPa. For the installation place please refer to the pipeline connection sketch.
- The discharge pipe connected to the one-way safety valve is to be installed in a continuously downward direction and in a frost-free environment.
- The water may drip from the discharge pipe of the one-way safety valve and that this pipe must be left open to the atmosphere.
- The one-way safety valve is to be operated regularly to remove lime deposits and to verify that it is not blocked. Please beware of burn, because of the high temperature of water.
- The tank water can be drained through the drainage hole on the bottom of the tank.
- After all the pipes installed turn on the cold-water inlet and hot water outlet to fill the tank. When there is water normally following out from water outlet, the tank is full. Turnoff all valves and check all pipes. If any leakage, please repair.
- If the inlet water pressure is less than 0.15MPa, a pressure pump should be installed at the water inlet. For ensure the long safety using age of tank at the condition of water supply hydraulic higher than 0.65MPa, a reducing valve should be mounted at the water inlet pipe.
- Filters are needed in the air inlet. If the unit is connected with ducts, filter in there must be put forward to the air inlet of duct.
- To fluently drain condensate water from evaporator, please install the unit at the horizontal floor. Otherwise, please make sure the drain vent is at the lowest place. Recommending the inclination angle of unit to be ground should no more than 2 degrees.

4.4 Installation positions

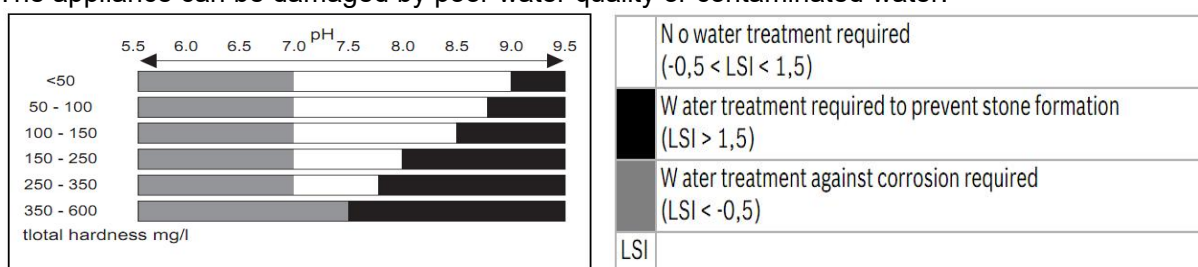
4.4.1 Installation conditions

When choosing the installation location, the following points should be considered:

- The device must be placed in a dry and frost-proof room. The higher the air temperature, the higher the efficiency of the unit up to the maximum operating limit of the refrigeration circuit. On the other hand, the refrigeration circuit stops working below the minimum operating temperature.
- The surface of the appliance must be firm and level enough.
- Air outlet and inlet must not be located in places where there is a risk of explosion due to gas, steam or dust.
- Ensure proper drainage of condensate.
- The surface on which the device stands must be firm enough (the weight of the device is approximately 400 kg with the tank full and distributed evenly over the four adjustable feet).

4.4.2 Water quality

The appliance can be damaged by poor water quality or contaminated water.



It should be noted that the Langelier saturation index depends on the water temperature and the above data takes into account two extreme values: 10 °C and 70 °C. While corrosion is higher at low water temperatures, stone formation is more important at higher water temperatures. For water hardness above 600 mg/l, the Langelier saturation index must be determined to assess the need for water treatment. Notify a certified specialist.

Water conductivity for protective anodes: 130 mS/cm-1500 mS/cm

Do not use demineralized, distilled or deionized water for this type of appliance.

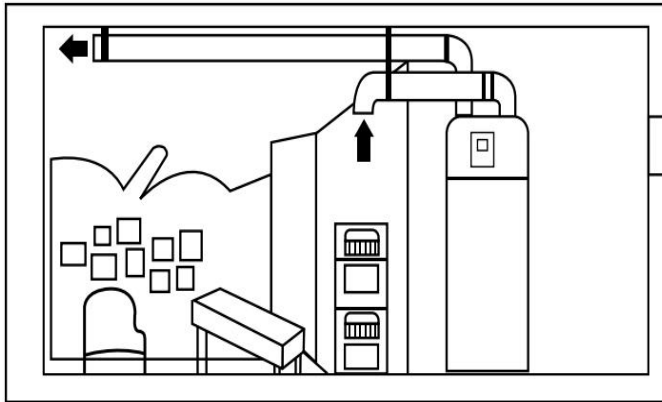
Remark:

1) The extra heat source is optional.

2) This unit is equipped with **Electronic Anode** that is an anti-corrosion element. It is assembled in the water tank to avoid the creation of fur around the inside tank and to protect the tank, and other components. It doesn't need servicing, just consider that in case the **Electronic Anode** doesn't work correctly, the error code E6 will appear in the Display of the Unit.

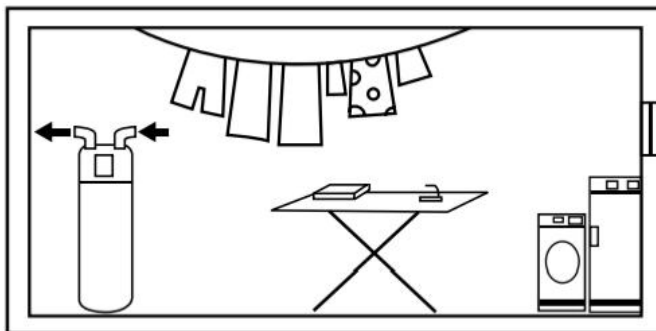
4.4.3 Waste heat can be useful heat

Units can be installed near the kitchen, in the boiler-room or the garage, basically in every room which has a large number of waste-heat so that the unit has the higher energy efficiency even with very low outside temperatures during the winter.



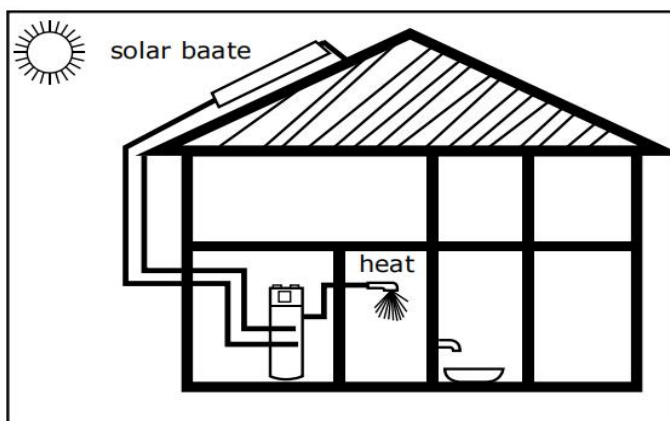
4.4.3 Hot water and dehumidification

Units can be placed in the laundry room or clothing room. When it produces hot water it lowers the temperature and dehumidifies the room as well. The advantages can be experienced particularly in the humid season.



4.4.4 Solar panel or external heat pump could be the second heat source

Units can work with solar panel, external heat pump, boiler or other different energy source.



NOTE:

- Choose the right path to move the unit.
- This unit complies with the relevant technical standards of electrical equipment.

4.5 Water loop connection

Please pay attention to the below points when connecting the water loop pipe:

1. Try to reduce the water loop resistance
2. Make sure there is nothing in the pipe and the water loop is smooth, check the pipe carefully to see if there is any leak, and then pack the pipe with the insulation.
3. Install the one-way valve and safety valve in the water circulation system.
4. The nominal pipe wide of the field- installed sanitary installations must be selected on the basis of the available water pressure and the expected pressure drop within the piping system.
5. The water pipes may be of the flexible type. To prevent corrosion damage, make sure that the materials used in the piping system are compatible.
6. When installing the pipe-work on the customers' site, any contamination of the piping system must be avoided.

4.6 Water affusion and water emptying

4.6.1 Water Affusion:

If the unit is used for the first time or used again after emptying the tank, please make sure that the tank is full of water before turning on the power.

- Open the cold-water inlet and hot water outlet.
- Start the water affusion. When there is water normally flowing out from the hot water outlet, the tank is full.
- Turn off the hot water outlet valve and water affusion is finished.



ATTENTION: Operation without water in water tank may result in damage of auxiliary e-heater!

4.6.2 Water emptying:

If the unit needs cleaning, moving etc, the tank should be emptied.

- Close the cold-water inlet
- Open the hot water outlet and open the manual valve of drainpipe
- Start the water emptying.
- After emptying, close the manual valve.

4.7 Wire connection

- The specification of the power supply wire is 3*1.5 mm².
- Fuse specification is T 3.15A 250V
- There must be a switch when connecting the unit to the power system. The current of the switch is 10A.
- The unit must be installed a Creepage Breaker near the power supply and must be effectively earthed. The specification of the creepage breaker is 30mA, less than 0.1sec.

THE APPLIANCE SHALL BE INSTALLED IN ACCORDANCE WITH NATIONAL WIRING REGULATIONS.

4.8 Trial running

Checks before trial running

- Check both the water in the tank as well as the water pipe connection.
 - Check the power system, make sure that the power supply is normal and the wire connection is ok.
- Check the inlet water pressure, and make sure that the pressure is sufficient (above 0.15Mpa).
- Check if any water flows out from the hot water outlet, and make sure that the tank is full of water before turning on the power.
- Check the unit; make sure everything is ok before turning 'ON' the power of the unit, check the light on the wire controller when the unit runs.
- Use the wire controller to start the unit.
- Listen to the unit carefully when turning 'ON' the power of the unit. Turn the power 'OFF' when you hear an abnormal sound.
- Measure the water temperature, to check the undulation of the water temperature.
- Once the parameters have been set, the user cannot change the parameters optionally. Please use a qualified service person to do this.

5、 Other installation methods

5.1 Solarkollektoreinbindung

The planning and installation of the solar circuit with all its elements (Fig. 1), must be carried out by a qualified specialist.

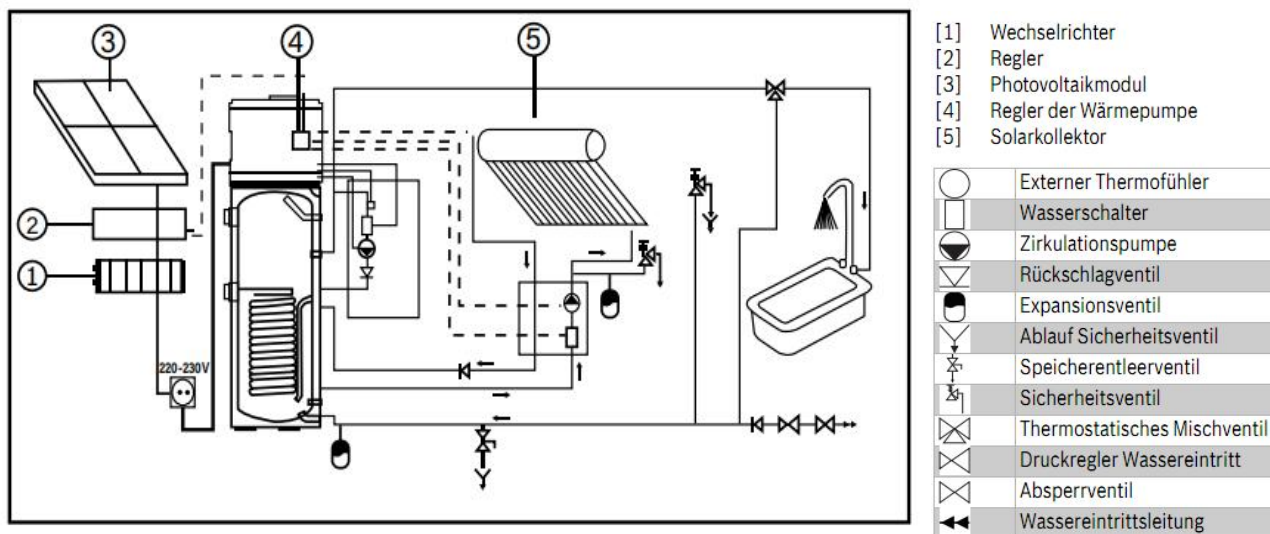


Fig. 1

The parameters described in this chapter can be found in Chapter 7.1, page 26.

The following steps are required to connect and adjust the control device:

- ▶ Configure parameters 24 (2 = solar water circuit)
- ▶ Connect the solar circuit pump and solar sensor (T6) The water switch connection is optional.

If the water switch is not present:

- ▶ Short circuit the water switch

If the water switch signal is turned off for five seconds after the pump has been running for 30 seconds, the pump will stop, the error code E5 will appear in the Display of the Unit. After three minutes, the pump starts again. If this fault occurs three times within 30 minutes, the pump cannot start again until it has been switched

off and on again. the error code E5 will appear in the Display of the Unit. Only the pump stops, the device remains active.

The pump starts when the following conditions are met:

- Device is switched on
- $T_6 \geq T_1 + \text{Parameter 27}$
- $T_1 \leq 78\text{ }^{\circ}\text{C}$

The pump stops when one of the following conditions is met:

- Device is switched off
- $T_6 \leq T_1 + \text{Parameter 28}$
- $T_1 \geq 83\text{ }^{\circ}\text{C}$

While the solar thermal function is active, the compressor of the heat pump is running.

Note: Damage to the device!

The solar heat exchanger is designed for use with circulating clean water as well as a mixture of water and propylene glycol in liquid state. The presence of anti-corrosion additives is mandatory. The use of other liquids as well as liquids in a different state will result in a breach of warranty.

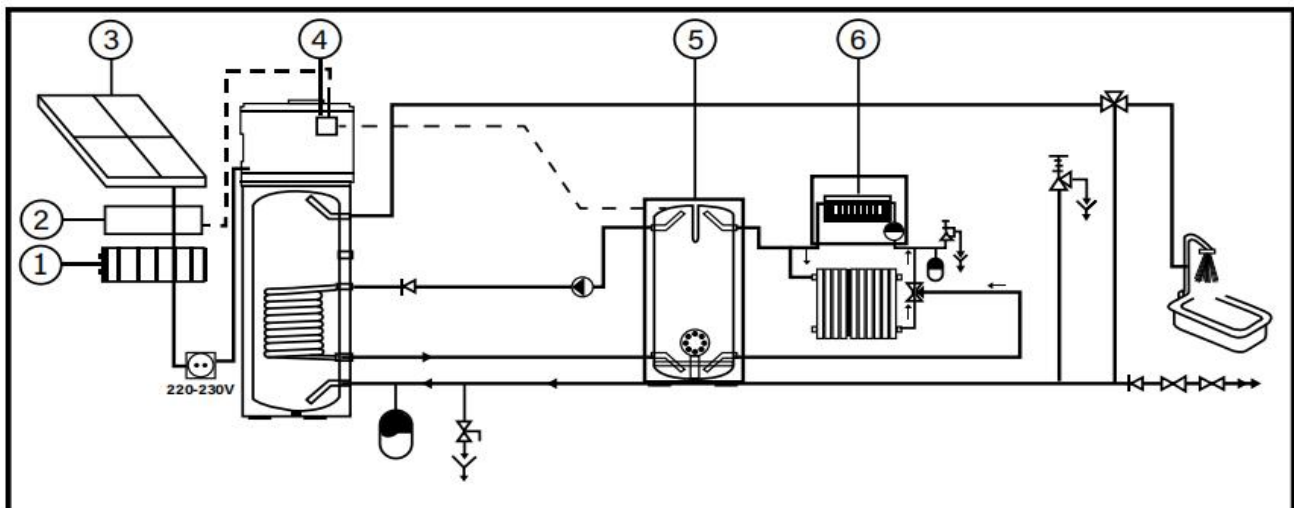
5.2 Connection of boiler and heat pump

There are two ways to connect the boiler to the heat pump: via a controller integrated into the heat pump or via an external controller.

5.2.1 centralized control

The parameters described in this chapter can be found in Chapter 7.1, page 26.

Integrated controller As an alternative to the solar connection, an integrated controller (Fig. 2,) can be connected.



① Inverter ② Controller ③ Photovoltaic module ④ Heat pump controller ⑤ Buffer tank ⑥ Boiler

Fig. 2

The pump starts when the following conditions are met:

- $T_6 > T_1 + P27$ (P27 is an adjustable parameter. The standard temperature is set to $5\text{ }^{\circ}\text{C}$, and the temperature range is between $5\text{ }^{\circ}\text{C}$ and $20\text{ }^{\circ}\text{C}$)

$T_1 < 78\text{ }^{\circ}\text{C}$

- $T_6 > T_1 + P28$ (P28 is an adjustable parameter. The standard temperature is set to $2\text{ }^{\circ}\text{C}$, and the temperature range is between $1\text{ }^{\circ}\text{C}$ and $4\text{ }^{\circ}\text{C}$)

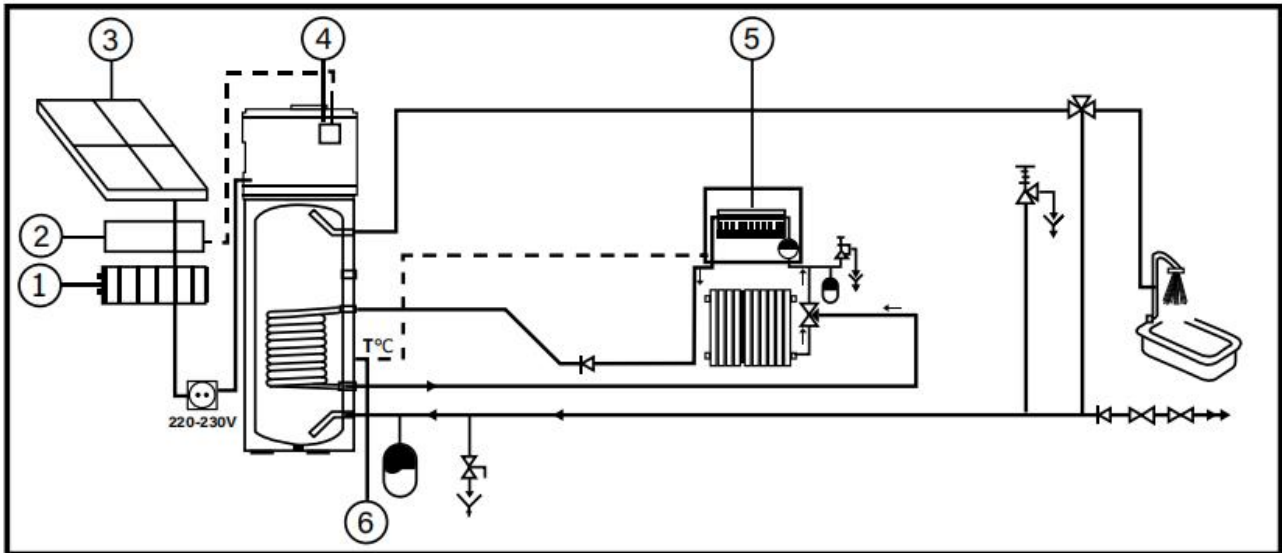
$T_1 > 83\text{ }^{\circ}\text{C}$

Parameter 24 must be set to value 2 (solar water pump).

The maximum temperature of the heat pump is $83\text{ }^{\circ}\text{C}$, even if the temperature of the buffer tank is, for example, $90\text{ }^{\circ}\text{C}$.

5.2.2 External controller

Connection via an external controller (Fig. 3) does not require any adjustments on the heat pump.



① Inverter ② Controller ③ Photovoltaic module ④ Heat pump controller ⑤ Boiler ⑥ Boiler sensor

Fig. 3

Note

Damage to the device! The installer must:

- ▶ Limit the maximum temperature to 83 °C
- ▶ Set the maximum storage temperature to 83 °C

5.3 Integration of the photovoltaic system

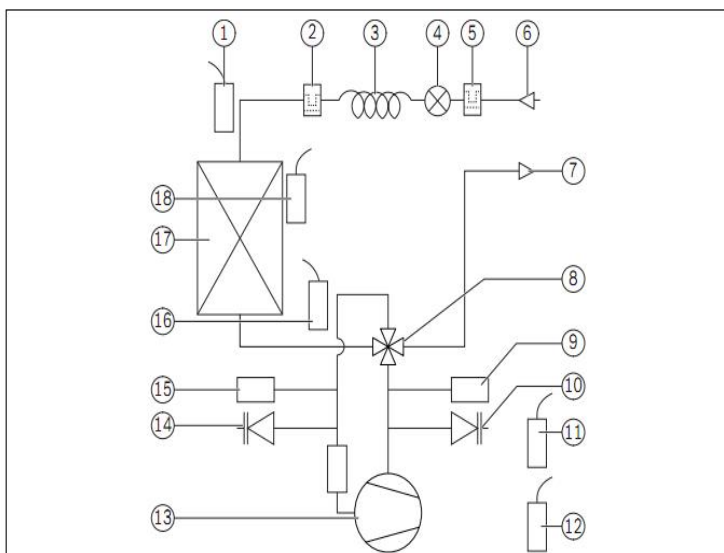
Caution

The planning and installation of the photovoltaic system must be carried out by a qualified specialist.

The parameters described in this chapter can be found in Chapter 7.1, page 26.

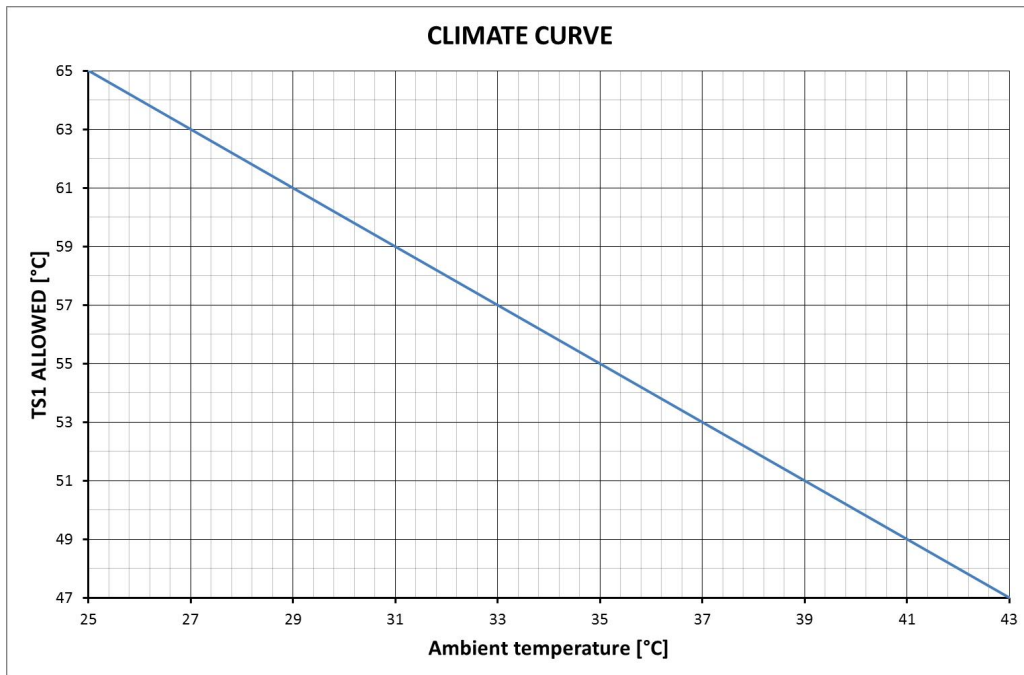
If the generated power of the photovoltaic system is high enough to keep the heat pump running, the heat pump or the electric auxiliary heater can be requested via an on/off contact. The heat pump then increases the target water temperature to obtain more hot water.

The photovoltaic on/off switch must be connected to the photovoltaic system (Fig.4)



1. Evaporator temperature sensor - T3
2. Refrigerant filter
3. Capillary tube
4. Expansion valve
5. Refrigerant filter
6. Condenser outlet
7. Condenser inlet
8. 4-way valve
9. High-pressure switch
10. Service valve
11. Lower storage temperature sensor - T1
12. Upper storage temperature sensor - T2
13. Compressor
14. Service valve
15. Low-pressure switch
16. Return gas temperature - T4
17. Evaporator
18. Ambient temperature sensor - T5

Fig.4



When parameter 17 = 1, i.e., the photovoltaic linkage switch is selected, the water tank temperature setpoint TS1 is controlled as follows:

- When parameter 20 = 0 and the switch terminal is closed:
 - If TS1 manual < TS1 allowed (check TS1 allowed temperature based on ambient temperature using the above diagram), TS1 manual is automatically adjusted to TS1 allowed temperature, and if TS1 allowed > 65°C, it is adjusted to 65°C. If TS1 manual ≥ TS1 allowed, the water tank temperature setpoint TS1 takes the manual value.
 - When the switch terminal is open, if TS1 manual < TS1 allowed, the manual value is selected; if TS1 manual ≥ TS1 allowed, the allowed value is selected.
- When parameter 20 = 1 and the switch terminal is closed:
 - If TS1 manual < 65°C, TS1 manual is automatically adjusted to 65°C.
- When the switch terminal is open, the manually set TS1 temperature reverts to the original manual set value.

5.4 On/off connection for PV inverter

Caution

The planning and installation of the on/off system must be carried out by a qualified professional.

The parameters described in this chapter can be found in Chapter 7.1, page 26.

Parameter 17 must be set to "0". If the ON/OFF contact is closed but the controller is on, the device can work, and the operating mode is determined by the controller setting.

- If the ON/OFF contact is opened but the controller is off, the appliance cannot operate-except for the external pump.
- When the control is turned on and the ON/OFF status is changed from OPEN to CLOSED, the device will work with the previous settings of the control (auto-restart).
- If the device was previously in standby mode and the ON/OFF status is changed from OPEN to CLOSED, the device remains in standby mode.
- In case of a remote off signal (contact open), a signal/warning is displayed. So the customer can understand why the device is not working.

5.5 External circulation pump and water switch

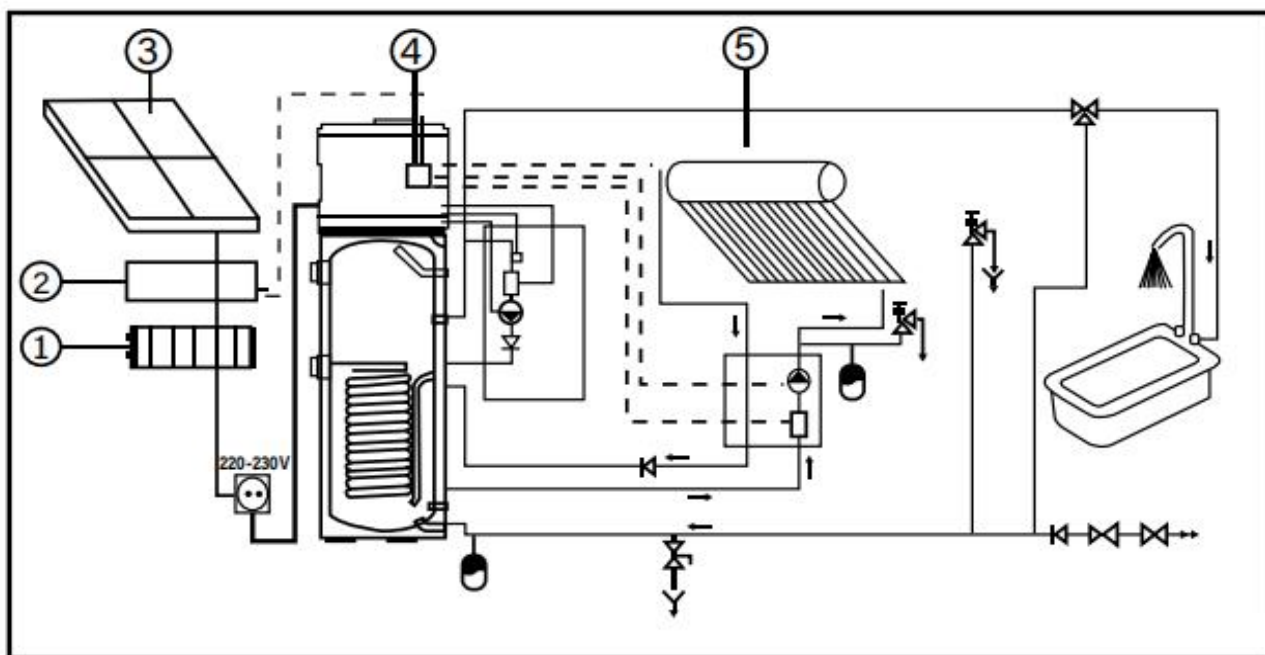
The parameters described in this chapter can be found in Chapter 7.1, page 26.

If there is the possibility of circulating solar water or hot sanitary water, an external pump and a water switch must be connected and installed hydraulically and electrically (Fig. 1, page 16). The installer must carry out the following steps:

- ▶ Short circuit FS 17 if the water switch is not present (WIRING DIAGRAM, Chapter 9.1, page 32)

The maximum available output for the pump has a load capacity of 5 A.

- ▶ Connect the optional sensor to the controller and attach it properly to the hydraulic system (Fig. 5).
- ▶ Parameter 24 must be configured (1 = circulation of warm sanitary water)



① Inverter ② Controller ③ Photovoltaic module ④ Heat pump controller ⑤ Solar collector

Fig. 5

The circulation prevents the water in the sanitary circuit from becoming cold if it is not used for a longer period of time. This way, hot water is always available when needed.

When the parameter 24 is selected as 1, the circulating pump function is enabled:

Function of the circulation pump The pump starts when the following conditions are met simultaneously:

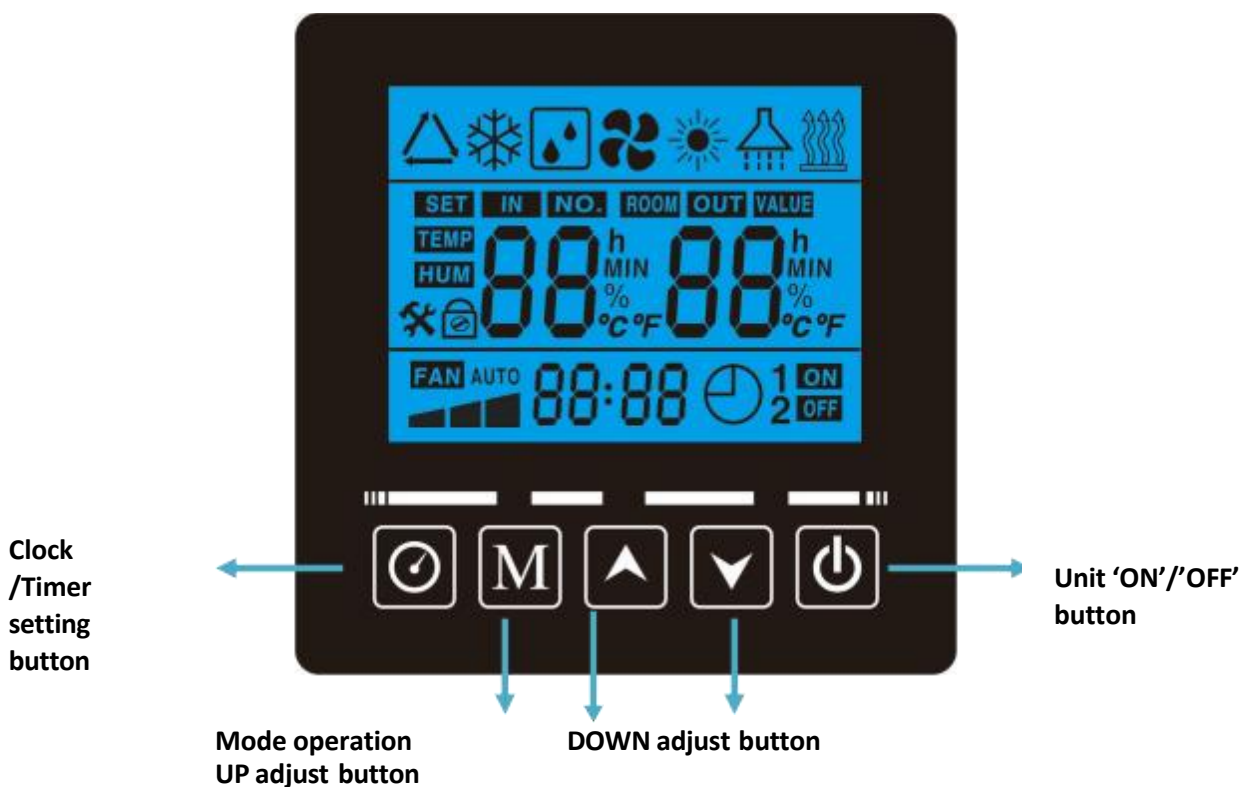
- Device is switched on
- $T_2 \geq \text{Parameter 25} + \text{Parameter 26}$ (2°C by default);
- $T_6 \leq \text{Parameter 25} - 5^\circ\text{C}$

The pump stops when one of the following conditions is met:

- Device is switched off
- $T_2 \leq \text{Parameter 25} - 2^\circ\text{C}$
- $T_6 \geq \text{Parameter 25}$

6、OPERATION THE UNIT

6.1 User interface and operation



Operations

1. Power 'ON'

When turning 'ON' the power, whole icons are displayed on the controller screen for 3 seconds. After checking if everything is ok, the unit enters into the standby mode.



2. button

Press this button and keep for 3 seconds when the unit is standby, the unit can be turned 'ON'. Press this button and keep for 3 seconds when the unit is running, the unit can be turned 'OFF'. Short press this button to exit the parameter setting or checking.(When in the unlocked state)



3. ▲ And ▼ buttons

- These are the multi-purpose buttons. They are used for the temp setting, parameter setting, parameter checking, clock adjustment and adjustment of the timer.
- During running status, press ▲ or ▼ button to adjust the setting temperature directly.
- Press these buttons when the unit is on clock setting status, the hour(s) and the minute(s) of the clock time can be adjusted.
- Press these buttons when the unit is on timer setting status, the hour(s) and the minute(s) of the timer 'ON'/'OFF' can be adjusted.

4. button

Clock setting:

- Long press  3s to unlock the screen;
 - After screen is light, short press  to entry the clock setting interface, hour icon "88:" flash, press the ▲ and ▼ buttons to set the exact hour(s);
- After hour setting, short press  button to switch to minute setting, minute ":88" flash, press the ▲ and ▼ buttons to set the exact minute(s);
- Press  button again to confirm and exit.

Timer setting:

Press and hold  the time button 3S to enter the timed on/off setting state. When entering the time setting, press the time button to set the clock and minute of the timed on/off (when the clock or minute flashes, combine ▲ and ▼ . The clock and minutes can be adjusted). The timed on/off can be set independently. When the timed "ON" flashes, it means to cancel the timed start function. At this time, press the  button "ON" does not flash to indicate that the timed start function is on, then press the  button, "ON" flashes to cancel. Timed start function; continue to press the time button. When "OFF" appears, you can set the timed shutdown. When "OFF" flashes, it means to cancel the timed shutdown function. At this time, press the  button, "OFF" does not flash to indicate that the timed shutdown function is on, then Click the  button, and "OFF" flashes to cancel the timed shutdown function.

In the case of lock screen, tap any button to light up the screen. After lighting the screen, press and hold the timer button for 3 seconds to unlock.

If no operation for 30 seconds, the monitor automatically exits to the main interface and locks the screen.

NOTE:

- 1) The timer 'ON' and timer 'OFF' functions can be set at the same time.
- 2) The timer settings are repeating.
- 3) The timer settings are still valid after a sudden power cut.

5. button

- When the screen is unlocked,

1) Short press , the mode can be adjusted operating mode ;

Press and hold the "" key and the "▼" key simultaneously for 3 seconds to activate the ventilation mode. When activated, the fan will start and the "FAN" icon will remain lit. Press and hold this combination of keys again to exit the ventilation mode.

-- AUTO Mode (heat pump +E-heater)

-- GREEN Mode (only heat pump will work at normal working situation)

-- Boost Mode (heat pump +E-heater work at the same time)

-- E-heater Mode (only E-heater will work)

-- Ventilation mode (only fans work):

2) Check the system parameters

-Press this button and hold for 5 seconds, enter the system status and system parameter query interface.

After entering the parameter query interface ,press the "" key again to modify the value of the parameter. At this time, the "VALUE" icon will remain lit.-Press the ▲ and ▼ buttons to check the system parameters.

3) Adjust the system parameters

- Press  for 3 seconds, entry the parameter checking interface.

- Press ▲ or ▼ button to select the parameter (parameter A-F can't be adjusted), andthen press  to confirm it.

- Press the ▲ and ▼ buttons to adjust the selecting parameter, and then press  to confirm the setting.
If no operation for 30 seconds, the controller will exit and save the setting automatically.

NOTE: The parameters have been set; the user cannot change the parameters optionally. Please ask a qualified service person to do this when required.

7、PARAMETER CHECKING AND ADJUSTMENT

7.1Parameter list

Some parameters can be checked and adjusted by the controller. Below is the parameter list.

Parameter nr.	Description	Range	Default	Notes
A01	Lower tank temperature sensor T1	-30~100℃	In case of lower tank temp. sensor failure, the error code“P01”will be displayed.	
A02	Upper tank temperature sensor T2	-30~100℃	In case of upper tank temp. sensor failure, the error code“P02”will be displayed.	
A03	Evaporation temperature sensor T3	-30~100℃	In case of evaporation temp. sensor failure, the error code“P03”will be displayed.	
A04	Compressor suction temperature sensor T4	-30~100℃	In case of compressor suction temperature sensor failure, the error code“P04”will be displayed.	
A05	Room temperature sensor T5	-30~100℃	In case of room temperature sensor failure, the error code“P05”will be displayed.	
A06	Return water temperature / Solar temperature	-30~100℃	In case of room temperature sensor failure, the error code“P07”will be displayed.	
A07	EXV open steps	0~48 step	Measured value N * 10	
A08	Actual set value (calculated water temperature)	35~70		
A09	Electrical current of the compressor		Measured value	
A10	Heat sink temperature	0~115	N/10	
A11	DC bus voltage value		Measured value	
A12	Actual frequency of the press machine	0~90	Measured value	
A13	Fan speed	0~150	Measured value N*10	
A14	Number of compressor startups	0~999	N/20	
A15	The operating duration of the compressor	0~999	N/24	
A16	Number of electric heating start-ups	0~999	N/20	
A17	Duration of electric heating operation	0~999	N/24	
A18	Number of defrosting operations	0~999	N/20	
A19	Total input current of the machine	0~150	N/10	
A20	power consumption	0~999	Measured value /100	
A21	Reserved	0~99	Measured value	
00	Set temperature TS1 of water tank water temperature	35℃~70℃	55℃	Adjustable
01	Heating differential temperature setting TS6	2℃~15℃	5℃	Adjustable
02	Electric auxiliary heating for starting the water tank water temperature TS2	10~70℃	65℃	Adjustable
03	Electric auxiliary heating startup delay t1	0~90min	6min	Adjustable (Actual time = Set value × 5 times)
04	Electric auxiliary heating high-temperature disinfection stop temperature TS3 (corresponding to the upper temperature of the water tank)	50~65℃	65℃	Adjustable
05	Duration of high-temperature disinfection: t2	0~90min	30min	Adjustable
06	Heating and defrosting cycle t3	30~90min	45min	Adjustable
07	Heating and defrosting enter the temperature point TS4	-30~0℃	-7℃	Adjustable
08	Heating exit from defrosting temperature condition TS5	2~30℃	20℃	Adjustable

Parameter nr.	Description	Range	Default	Notes
09	Heating exit defrosting time t4	1~18min	18min	Adjustable
10	The adjustment of the electronic expansion valve	0 (manual) 1 (auto)	1	Adjustable
11	Target superheat	-90~90	15	Adjustable
12	Manually adjust the number of steps of the electronic expansion valve	10~47	35	N*10
13	High-temperature disinfection start time	0~23hour	23hour	Under uninterrupted power supply, start it once every week at the set time.
14	Selection of pump attributes	0/1/2	0	0: No water pump / 1: Return water pump / 2: Solar water pump
15	Return water temperature setting	15~50℃	35℃	Adjustable
16	Backflow pump startup temperature difference	1-15℃	2℃	Adjustable
17	Solar water pump startup temperature difference	5-20℃	5℃	Adjustable
18	Solar water pump shut-off lag	1-4℃	2℃	Adjustable
19	Low-temperature electric heating instead of heat pumps	0/1	1	0 indicates no replacement by electric heating / 1 indicates replacement by electric heating
20	Electric heating starts during defrosting.	0/1	1	0. During defrosting, the electric heating does not start. / 1. During defrosting, the electric heating starts.
21	Disinfection cycle	1-30天	14	Adjustable
22	The opening degree of the expansion valve during defrosting	10~48	48	N*10
23	Heat pump temperature setting control	0-1	0	0: TS1 = Actual value; 1: TS1 = Manual value
24	compensation temperature	-10-10℃	0℃	Adjustable
25	Environmental temperature sampling frequency	2-120min	15min	Adjustable
26	Electric heating control after the heat pump reaches the set temperature	0-1	1	Adjustable
27	Electric heating startup hysteresis	1-10℃	3℃	Adjustable
28	Maximum set temperature for electric heating	65-85℃	75℃	Adjustable
29	Switch port application	0-1	0	Adjustable
30	Minimum operating environment for the compressor	-10~20℃	-10℃	Adjustable
31	Minimum opening degree of the electronic expansion valve	40~480	80	Adjustable
32	Target superheat degree 2	-90~90	25	Adjustable (N/10) Actual = Display / 10 (Unit: °C)
33	Target superheat degree 3	-90~90	40	Adjustable (N/10) Actual = Display / 10 (Unit: °C)
34	Fan speed 1	40~150	40	Adjustable (N*10)
35	Fan speed 2	40~150	60	Adjustable (N*10)
36	Fan speed 3	40~150	80	Adjustable (N*10)
37	Fan speed 4	40~150	90	Adjustable (N*10)
38	Fan speed 5	40~150	95	Adjustable (N*10)

Parameter nr.	Description	Range	Default	Notes
39	Fan speed 6	40~150	100	Adjustable (N*10)
40	Throttle valve superheat ratio coefficient Kp	0~100	8	Adjustable
41	Expansion valve superheat differential coefficient Kd	0~100	5	Adjustable
42	Exhaust setting TP0 (Exhaust over-temperature recovery set temperature)	50~125℃	95℃	Adjustable
43	Exhaust setting TP1	50~125℃	100℃	Adjustable
44	Exhaust setting TP2	50~125℃	105℃	Adjustable
45	Exhaust setting TP3	50~125℃	110℃	Adjustable
46	Exhaust setting TP4 (Exhaust Over-temperature Protection Setting Temperature)	50~125℃	115℃	Adjustable
47	Automatic control scheme	1-2	2	Adjustable
48	The ambient temperature for defrosting and the temperature of the coil	0℃-15℃	2℃	Adjustable
49	Defrosting environment temperature	0℃-20℃	17℃	Adjustable
50	Expansion valve operation cycle	20S~90S	45S	Adjustable
51	The exhaust temperature regulated by the expansion valve	70℃~125℃	102℃	Adjustable
52	Constant temperature shutdown pump stop time	1min-99min	45min	Adjustable
53	Constant temperature shutdown pump operation time	0min-99min	5min	Adjustable
54	The working mode of the water pump	0 = Constant temperature stop / 1 = Constant temperature not stop	1	Adjustable
55	Enable the set frequency operation	0 - Manual 1 - Automatic	1	Adjustable
56	Manual frequency setting	10-100	50	Adjustable
57	The maximum frequency of the compressor	0-90	80	Adjustable
58	Minimum frequency of the compressor	0-90	30	Adjustable
59	Compressor prohibited from increasing frequency current	10-100	45	Adjustable (N/10)
60	Compressor reduced-frequency current	10-100	55	Adjustable (N/10)
61	Compressor shutdown current	10-100	65	Adjustable (N/10)
62	Manual control enablement for the fan	0 - Manual 1 - Automatic	1	Adjustable
63	Manual setting of output for the fan	40-150	60	Adjustable (N*10)
64	PSG1	0 - Off; Any other number - On	0	Adjustable
65	PSG2	0 - Not enabled; 0 - 65 (enabled if not 0)	0	Adjustable
66	PSG3	0 - Not enabled; 0 - 65 (enabled if not 0)	0	Adjustable
67	PSG4	0: Heat pump + electric auxiliary heating mode; 1: Single electric auxiliary heating mode; 2: Single heat pump mode	0	Adjustable
68	SG1 Switch Status	0: Off; 1: On	0	Adjustable
69	Status of SG2 switch	0: Off; 1: On	0	Adjustable
70	F1	30-90	40	Adjustable

Parameter nr.	Description	Range	Default	Notes
71	F2	30-90	46	Adjustable
72	F3	30-90	52	Adjustable
73	F4	30-90	56	Adjustable
74	F5	30-90	58	Adjustable
75	F6	30-90	60	Adjustable
76	F7	30-90	64	Adjustable
77	The rising temperature at the lower part of the water tank	0~20℃	2℃	Adjustable
78	reserved	40%~70%	65%	Adjustable

Procedure for changing the parameters values that are allowed to the user/installer:

- Press the clock and down arrow buttons (⏸+↓) simultaneously for 3 seconds.
- "00" will flash on the right side of the display.
- Press the button M, the only the first zero "00" will start flashing; use the up/down buttons to select the first value.
- Press again the button M, the other zero "00" will start flashing and select the next value, use the button M to confirm.
- The first parameter with the relative value will flash. At this point, only the parameters defined as "Editable" in the reported table of parameters will be displayed and can be selected.
- Use the up and down arrow buttons to go to the parameter you want to modify and press the button "M" again to enter the mode of changing the value. Only its proper value will start to flash. Change the value with the up and down arrow buttons and press rge button M to confirm the new value.
- Quit the edit mode by pressing the ON/OFF button [⏸].
- The password used view the editable parameters is 24.

7.2 Malfunctioning of the unit and error codes

When an error occurs or the protection mode is set automatically, the circuit board and the wired controller will both display the error message.

Protection/ Malfunction	Error code	Possible reasons	Corrective actions
Standby			
Normal running			
Lower tank water temp. sensor failure	P1	1) The sensor open circuit 2) The sensor short circuit	1) Check the sensor connection 2) Replace the sensor
Upper tank water temp. sensor failure	P2	1) The sensor open circuit 2) The sensor short circuit	1) Check the sensor connection 2) Replace the sensor
Evaporator coil temp. sensor failure	P3	1) The sensor open circuit 2) The sensor short circuit	1) Check the sensor connection 2) Replace the sensor
Return air temp sensor failure	P4	1) The sensor open circuit 2) The sensor short circuit	1) Check the sensor connection 2) Replace the sensor
Ambient temp. sensor failure	P5	1) The sensor open circuit 2) The sensor short circuit	1) Check the sensor connection 2) Replace the sensor
Anti-freeze protection	P6	1) Lower water tank temp too low	The unit will be auto anti-freeze
Backflow temperature fault / Solar water tank temperature fault	P7	1) The sensor open circuit 2) The sensor short circuit	1) Check the sensor connection 2) Replace the sensor
Ackflow/Solar Water Tank Temperature Over-temperature Protection	P8		1) Check the sensor connection 2) Replace the sensor

Low pressure protection (LP Switch)	E2	1) Too low air inlet temp 2) The electronic expansion valve assembly blocked 3) Too less refrigerant 4) The switch damaged 5) The fan assembly cannot work	1) Check if the air inlet temp is over the working limited 2) Replace the electronic expansion valve assembly 3) Charge some refrigerant 4) Replace a new switch 5) Check if the fan working when the compressor working. If not, some problems with the fan assembly
Over heat protection (HTP Switch)	E3	1) Too high tank water temp 2) The switch damaged	1) If the tank water temp is over 85C, the switch will open and the unit will stop for protection. After the water comes to normal temp, 2) Replace a new switch
Electric titanium anodes	<u>E6</u>	1)Control panel failure 2)Not installed or grounded correctly	1)Check if the power indicator light is functioning properly 2)Check the grounding and the connection of the lines 3)Measure the working current
Communication failure	E8	1)The communication line is not plugged into the socket.	1)Check if the socket of the communication line is plugged in.
Fan drive failure	E 09	1) The control signal for the fan sent by the main control board is abnormal. 2) Fault of the driver board	1) Check if the socket of the communication line is plugged in. 2) Replace the driver board
Communication failure of the frequency conversion module (alarm when the outer panel and the driver board lose communication connection)	E 10	1) Poor contact of the circuit 2) Main control board power failure: This causes the control signals it sends out to be unstable. 3) The frequency conversion power module is damaged.	1) Check if the wiring is loose. 2) Check if the voltage is normal 3) Replace the frequency conversion module
Water flow failure	E 15	1) System water shortage 2) Flow switch/sensor failure 3) Pump failure	1) Check if the water supply of the system is insufficient. 2) Replace the water flow switch/sensor 3) Replace the water pump
Humidity sensor failure	E 16	1) line fault 2) sensor fault	1) Check the connection of the lines 2) Replace the sensor

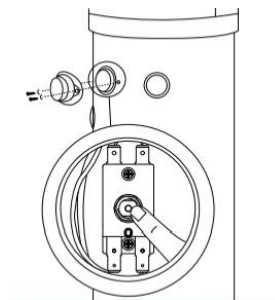
Frequency conversion module abnormal protection	E 20	1) Compressor failure 2) Connection line issue 3) The module is damaged itself. 4) Drive signal issue	1) Check if the compressor is functioning properly 2) Check whether the wiring is properly connected. 3) Replace with a new frequency conversion module
Upper part temperature overcooling protection of the water tank	E 23	1) The upper part is too cold.	1) The problem of mixing water and circulation, with a large amount of cold water "spilling" to the upper part 2) Fault of the upper temperature sensor or position deviation
The temperature at the bottom of the water tank is too high.	E 27	1) The temperature sensor at the bottom of the water tank detected a temperature that exceeded the safety limit.	1) Fault of the lower temperature sensor 2) Controller failure
Overheating protection for the coil	E 33	1) Insufficient air circulation 2) Excessive system pressure	1) Clean the fins of the evaporator 2) Reduce refrigerant
DC fan motor failure	E 64	1) The motherboard fails to receive the speed feedback from the fan. 2) Fan motor damage	1) Check motor wire 2) Replace the fan motor

8、 MAINTENANCE

8.1 Maintenance activities

In order to ensure an optimum operation of the unit, a number of checks and inspections on the unit and the field wiring have to be carried out at regular intervals, preferably yearly.

- Check the water supply and air vent frequently, to avoid lack of water or air in the water loop.
- Clean the water filter to keep a good water quality. Lack of water and dirty water can damage the unit.
- Keep the unit in a place where it is dry and clean, and which has good ventilation. Clean the heat exchanger every one to two months.
- Check each part of the unit and the pressure of the system. Replace the defect part if there is any, and recharge the refrigerant if it is required.
- Check the power supply and the electrical system, make sure the electrical components are good, and the wiring is well. If there is a damaged part or a strange smell, please replace it in time.
- If the heat pump is not used for a long time, please drain out all the water from the unit and seal the unit to keep it good. Please drain the water from the lowest point of the boiler to avoid freezing in winter. Water recharge and full inspection on the heat pump is required before it is restarted.
- Do not turn the power 'OFF' when you use the unit continuously, or the water in the pipe will freeze and split the pipe.
- Keep the unit clean by means of soft damp cloth, no maintenance is required by the operator.
- It is recommended to clean the tank and e-heater regularly to keep an efficient performance.
- It is recommended to set a lower temperature to decrease the heat release, prevent scale and save energy if the outlet water is sufficient.
- Clean the air filter regularly to keep an efficient performance.
- Open the safety valve at least once a month to ensure its functionality.
- When the water temperature exceeds 85 °C, the temperature protection switch will be disconnected and the machine will stop running. If the water tank temperature drops, manually open the temperature protector cover and press the reset switch, as shown in the figure below.



8.2 Troubleshooting

This section provides useful information for diagnosing and correcting certain troubles which may occur. Before starting the troubleshooting procedure, carry out a thorough visual inspection of the unit and look for obvious defects such as loose connections or defective wiring.

Before contacting your local dealer, read this chapter carefully, it will save you time and money.



WHEN CARRYING OUT AN INSPECTION ON THE SWITCH BOX OF THE UNIT, ALWAYS MAKE SURE THAT THE MAIN SWITCH OF THE UNIT IS SWITCHED 'OFF'.

The guidelines below might help to solve your problem. If you cannot solve the problem, consult your installer/local dealer.

- No image on the controller (blank display). Check if the main power is still connected.
- One of the error codes appears, consult your local dealer.
- The scheduled timer does work but the programmed actions are executed at the wrong time (e.g. 1 hour too late or too early). Check if the clock and the day of the week are set correctly, adjust if necessary.

8.3 Environmental information

This equipment contains fluorinated greenhouse gases covered by the Kyoto Protocol. It should only be serviced or dismantled by professional trained personnel.

This equipment contains R454C refrigerant in the amount as stated in the specification. Do not vent R454C into the atmosphere: it is a fluorinated greenhouse gas with a Global Warming Potential (GWP) = 146

8.4 Disposal requirements

Dismantling of the unit, treatment of the refrigerant, of oil and of other parts must be done in accordance with relevant local and national legislation.



Your product is marked with this symbol. This means that electrical and electronic products shall not be mixed with unsorted household waste.

Do not try to dismantle the system yourself: the dismantling of the system, treatment of the refrigerant, of oil and other parts must be done by a qualified installer in accordance with relevant local and national legislation.

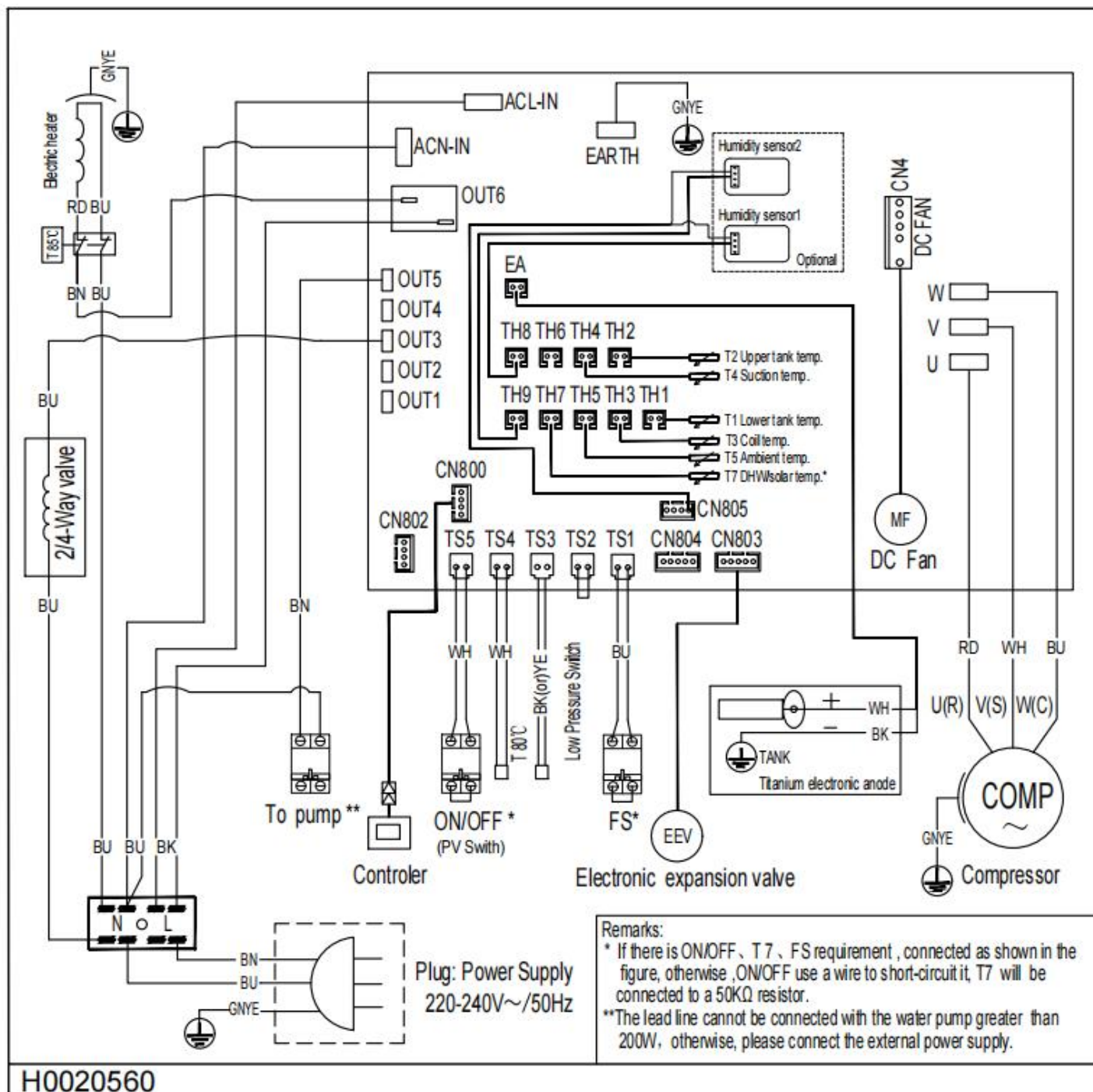
Units must be treated at a specialized treatment facility for re-use, recycling and recovery. By ensuring that this product is disposed of correctly, you will help to prevent potential negative consequences for the

environment and human health. Please contact the installer or local authority for more information.

9、ADDENDUM

9.1 Wiring Diagram

Please refer to the wiring diagram on the electric box.



9.2 Technical specification

TECHNICAL DATA		TWMBS 3500 K
Power supply	V/Ph/Hz	220-240/1/50
Water tank Volume	L	460
Heating capacity	kW	4.0* (+1.5**)
Max power input	W	960+1500(e-heater)
Max current	A	3.5*+6.5(e-heater)
Max.outlet water temperature range(without using E-heater)	°C	65
Max. Water temperature	°C	70
Min. Water temperature	°C	35
Ambient working temp.	°C	-10-43
Max. discharge pressure	bar	32
Min. suction pressure	bar	0.2
Refrigerant (type-QTY-GWP-tons of CO2)		R454C - 0,65Kg - 146 - 0,09t
Compressor	Type	Rotary
Fan motor	Type	DC Fan
Air flow	m3/h	650
Duct diameter	mm	177 (Fit flexible 180/200mm duct)
Max allowed pressure of tank	bar	10
Inside body material of tank		Stainless steel \ Duplex steel
Auxiliary electrical heater	kW	1.5
Electronic expansion valve		yes
Electronic anode		yes
Hot water outlet	inch	G 3 / 4
Cold water inlet	inch	G 3 / 4
Solar energy inlet and outlet	inch	/
Condensed water outlet	inch	G 1 / 2
Heat pump heat exchanger material		Microchannel

Net Dimensions	mm	Φ800x1880
Packing Dimensions	mm	850x850x2015
Net Weight	Kg	125
Weight with full water	Kg	615
Gross Weight	Kg	138
Noise level	dB (A)	51

9.3 Temperature sensor R-T conversion table

R25= 5.0KΩ±1.0% B 25-50 = 3470K±1.0%

℃	Rmin /KΩ	KΩ	Rmax/ KΩ	℃	Rmin /KΩ	KΩ	Rmax/ KΩ	℃	Rmin /KΩ	KΩ	Rmax/ KΩ
-20	36.195	37.303	38.441	21	5.779	5.847	5.914	62	1.343	1.374	1.406
-19	34.402	35.437	36.499	22	5.558	5.62	5.683	63	1.301	1.331	1.362
-18	32.709	33.676	34.668	23	5.346	5.404	5.463	64	1.26	1.29	1.321
-17	31.109	32.012	32.939	24	5.144	5.198	5.252	65	1.221	1.25	1.28
-16	29.597	30.441	31.306	25	4.95	5	5.05	66	1.183	1.212	1.242
-15	28.168	28.957	29.765	26	4.761	4.811	4.861	67	1.147	1.175	1.204
-14	26.816	27.554	28.308	27	4.58	4.63	4.68	68	1.111	1.139	1.168
-13	25.538	26.227	26.932	28	4.408	4.457	4.507	69	1.077	1.105	1.133
-12	24.328	24.972	25.631	29	4.242	4.292	4.341	70	1.045	1.072	1.099
-11	23.183	23.785	24.4	30	4.084	4.133	4.182	71	1.013	1.04	1.067
-10	22.098	22.661	23.236	31	3.933	3.981	4.03	72	0.983	1.009	1.035
-9	21.071	21.598	22.135	32	3.788	3.836	3.885	73	0.953	0.979	1.005
-8	20.098	20.59	21.093	33	3.649	3.697	3.745	74	0.925	0.95	0.975
-7	19.176	19.636	20.106	34	3.516	3.563	3.611	75	0.897	0.922	0.947
-6	18.301	18.732	19.171	35	3.388	3.435	3.483	76	0.871	0.895	0.919
-5	17.472	17.875	18.285	36	3.266	3.313	3.36	77	0.845	0.869	0.893
-4	16.686	17.063	17.446	37	3.149	3.195	3.241	78	0.82	0.843	0.867
-3	15.94	16.292	16.65	38	3.037	3.082	3.128	79	0.796	0.819	0.842
-2	15.231	15.561	15.896	39	2.929	2.974	3.019	80	0.773	0.795	0.818
-1	14.559	14.867	15.18	40	2.826	2.87	2.915	81	0.751	0.773	0.795
0	13.92	14.208	14.501	41	2.726	2.77	2.815	82	0.729	0.751	0.773
1	13.313	13.582	13.856	42	2.631	2.675	2.718	83	0.708	0.729	0.751
2	12.736	12.988	13.244	43	2.54	2.583	2.626	84	0.688	0.709	0.73
3	12.188	12.423	12.662	44	2.452	2.494	2.537	85	0.668	0.689	0.709
4	11.666	11.887	12.11	45	2.368	2.409	2.451	86	0.649	0.669	0.69
5	11.17	11.376	11.585	46	2.287	2.328	2.369	87	0.631	0.651	0.671
6	10.698	10.891	11.086	47	2.209	2.25	2.29	88	0.613	0.632	0.652
7	10.249	10.429	10.611	48	2.135	2.174	2.214	89	0.596	0.615	0.634
8	9.822	9.99	10.16	49	2.063	2.102	2.141	90	0.579	0.598	0.617
9	9.414	9.572	9.73	50	1.994	2.032	2.071	91	0.563	0.581	0.6
10	9.027	9.173	9.321	51	1.927	1.965	2.003	92	0.548	0.566	0.584
11	8.657	8.794	8.932	52	1.863	1.901	1.938	93	0.533	0.55	0.568
12	8.305	8.432	8.561	53	1.802	1.839	1.876	94	0.518	0.535	0.553
13	7.969	8.088	8.208	54	1.743	1.779	1.815	95	0.504	0.521	0.538
14	7.648	7.76	7.872	55	1.686	1.721	1.757	96	0.49	0.507	0.524
15	7.343	7.446	7.551	56	1.631	1.666	1.701	97	0.477	0.493	0.51
16	7.051	7.148	7.245	57	1.579	1.613	1.647	98	0.464	0.48	0.496
17	6.773	6.863	6.953	58	1.528	1.561	1.595	99	0.452	0.467	0.483
18	6.507	6.5911	6.675	59	1.479	1.512	1.545	100	0.439	0.455	0.47
19	6.253	6.331	6.41	60	1.432	1.464	1.497				
20	6.011	6.083	6.156	61	1.386	1.418	1.451				

NOTE

[illegible]

Due to on-going technological development of the products by the manufacturer, we reserve the right to vary the technical specifications at any time without notice.

A causa della continua evoluzione tecnologica dei prodotti, ci riserviamo il diritto di variare le specifiche tecniche in qualsiasi momento e senza darne preavviso.

Avec le souci d'améliorer sa production, le constructeur se réserve le droit de modifier les spécifications techniques des produits sans préavis.

Aufgrund der ständigen technologischen Weiterentwicklung der Produkte durch den Hersteller behalten wir uns das Recht vor, die technischen Spezifikationen jederzeit ohne vorherige Ankündigung zu ändern.

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