



Installation Guide

DHP-AT

Installation and service manual

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The English language is used for the original instructions.
Other languages are a translation of the original instructions.
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Table of Contents

1	About documents and decals	4
	1.1 Introduction	4
	1.2 Symbols in documents	4
	1.3 Symbols on decals	5
	1.4 Terminology	5
2	Important information	6
	2.1 General safety precautions	6
	2.2 Refrigerant	6
	2.3 Electrical connection	7
	2.4 Water quality	7
	2.5 Commissioning	7
3	Transport, delivery check and positioning	8
	3.1 Transporting heat pump	8
	3.2 Delivery check	8
	3.3 Positioning the heat pump	8
4	The heat pump	10
	4.1 Dimensions and connections	10
	4.2 Components	11
	4.3 Principle function description	12
	4.4 Check and safety functions	16
	4.5 Heating curves	17
5	System solution	19
	5.1 System solution	19
6	Piping installation	20
	6.1 Pipe connection	20
	6.2 Connecting cold and hot water lines	20
	6.3 Connecting supply and return lines	21
	6.4 Noise and vibrations	21
7	Electrical installation	23
	7.1 Connecting the operator panel	23
	7.2 Connecting circulation pump	24
	7.3 Connecting hot water tank electrical heater	24
	7.4 Connecting external electrical heater	25
	7.5 Connecting hot water sensor	25
	7.6 Connecting buffer tank sensor	25
	7.7 Connecting 3-way switching valve	25
	7.8 Connecting the power supply	26
8	Operator panel	27
9	Commissioning	28
	9.1 Checking piping installation and heating system	28
	9.2 Checking electrical installation	28
	9.3 Filling hot the water tank and heating system and bleeding excessive air	28
	9.4 Starting the unit	28
	9.5 Default settings	29
	9.6 Test Operation	30
	9.7 After start-up and tests	30
	9.8 Customer information	31
10	Troubleshooting	32
	10.1 Operational problems	32
11	Technical data	34
	11.1 Working range compressor operation	35
12	Circuit diagram	37
13	Connection diagram	40

1 About documents and decals

1.1 Introduction

The following documentation is available for this product:

- Installation and service instructions containing information on how to install and commission a DHP-AT heat pump.
- Information about accessories, technical data, troubleshooting and maintenance.
- User instructions on how to operate the unit (the User Guide).

The instructions are available for download at the following address:
www.documentation.heatpump.danfoss.com

1.2 Symbols in documents

The instructions contain different warning symbols. The symbols, together with text, indicate to the user that there are risks involved and that actions need to be taken to prevent personal injury or property damage.

The symbols are displayed to the left of the text and three different symbols are used to indicate the degree of danger:

Danger



Indicates an immediate danger that leads to fatal or serious injury if necessary measures are not taken.

Warning



Risk of personal injury! Indicates a possible danger that can lead to fatal or serious injury if necessary measures are not taken.

Caution



Risk of installation damage. Indicates a possible hazard that can lead to property damage if necessary measures are not taken.

A fourth symbol is used to give practical information or tips on how to perform a procedure.





Information on how to make the installation easier or indicating a possible operational or technical difficulty.

1.3 Symbols on decals

The following symbols can be found on different parts of the heat pump. Which symbols used depends on the heat pump model.

Warning symbols

	Warning, danger!
	Warning, hazardous electrical voltage!

1.4 Terminology

Term	Meaning
Heating system/Heat transfer fluid circuit	The circuit that generates heat to the property or to the domestic hot water tank.
Supply line	The supply line in the heating system with flow direction from the heat pump to radiators/under floor heating or domestic hot water tank.
Return line	The return line in the heating system with flow direction from radiators/under floor heating or domestic hot water tank back to the heat pump.
Circulation pump	Circulation pump for the heating system.
Refrigerant circuit	The energy carrying circuit between the outdoor air and heating system.
Refrigerant	The gas/liquid that circulates in the refrigerant circuit.
Domestic hot water	Domestic hot water is the water that you use around the house or office for everyday use, like showers, cleaning, laundry or dishes.
Buffer tank	Buffer tank is installed for equalisation of the temperature for the heating system and to guarantee sufficient energy when defrosting.

2 Important information

2.1 General safety precautions

Warning



Risk of personal injury! Children are not permitted to play with the product.

Caution



The heat pump must be installed by authorised installation engineers and the installation must adhere to local applicable rules and regulations as well as these installation instructions.

Caution



This product 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 instructions concerning the use of the product by a person responsible for their safety.

Caution



When using the cooling functionality, it is important to limit the lowest supply line temperature in order to prevent condensation.

2.2 Refrigerant

Fire risk

The refrigerant is not combustible or explosive in normal conditions.

Toxicity

In normal use and under normal conditions the refrigerant has low toxicity. However, although the toxicity of the refrigerant is low, it can cause personal injury (or be highly dangerous) under abnormal circumstances, or if the refrigerant is deliberately misused

Warning



Risk of personal injury! The refrigerant is heavier than air. Enclosed spaces where refrigerant can accumulate must be well ventilated. In the event of leakage, concentrations can arise which can cause suffocation due to lack of oxygen.

Warning



Risk of personal injury! Refrigerant exposed to a naked flame creates a poisonous irritating gas. The gas can be detected by its odour even at concentrations below its permitted levels. Evacuate the area until it has been sufficiently ventilated.

Work on the refrigerant unit

Caution



Work on the refrigerant circuit must only be carried out by a certified engineer!

Caution



When repairing the refrigerant circuit, the refrigerant must not be released from the heat pump - it must be dealt with in the appropriate way. Local rules and regulations must be obeyed.

Refilling must only be carried out using new refrigerant (for the amount and type of refrigerant see manufacturer's plate) through the service valves.

Caution



All Danfoss warranties are void if filling with refrigerant not specified by Danfoss A/S, unless there is written consent that the new refrigerant is an, by Danfoss A/S, approved replacement refrigerant.

Scrapping

Caution



When the heat pump is to be scrapped the refrigerant must be extracted for disposal. Local rules and regulations related to the disposal of refrigerant must be obeyed.

2.3 Electrical connection

Danger



Hazardous electrical voltage! The terminal blocks are live and can be highly dangerous due to the risk of electric shock.
All power supplies must be disconnected before the electrical installation is started. The heat pump is connected internally at the factory, so the electrical installation consists mainly of the connection of the power supply.

Warning



Electrical installation may only be carried out by an authorised electrician. Applicable local and national regulations must be obeyed.

Warning



The electrical installation must be carried out using permanently routed cables. It must be possible to disconnect the power supply using a multi-pole circuit breaker with a minimum contact gap of 3 mm.

2.4 Water quality

Caution



A normal heating system always contains a certain amount of corrosion particulate (rust) and sludge products from calcium oxide. This comes from acid that naturally occurs in the fresh water that the system is filled with. Normal filling should occur only once or twice a year. Filling the system more than twice a year can indicate leakage in the heating system and should be repaired immediately.
The water in the heating system should be as clean as possible. Position the dirt filter on the return line from the heating system to the heat pump as close to the heat pump as possible.

Caution



Hard water; Normally it is not a problem to install a heat pump in areas with hard water because the normal operating temperature for the hot water does not exceed 60°C.
In areas with exceptional water conditions, it can be necessary to install a softening filter. The filter softens the water, cleans any impurities and prevents the build up of calcification.

2.5 Commissioning

Caution



The installation may only be commissioned if the heating system is filled and all excessive air is bled. Otherwise the circulation pump may be damaged.

3 Transport, delivery check and positioning

3.1 Transporting heat pump

Caution



The heat pump must always be transported and stored in an upright position and in a dry environment. If the heat pump is laid on the incorrect side it may become seriously damaged as the oil in the compressor can run out in the pressure pipe.

Caution



Always secure the heat pump so that it can't tip over during transportation.

3.2 Delivery check

1. Check that there is no transport damage.
2. Remove the packaging and check that the delivery contains the following components.

Quantity	Name
1	Heat pump
1	Control unit with connection cord
1	Document set
1	Flexible hose for drainage of condensate water
1	Buffer tank sensor
1	Hot water tank sensor

3.3 Positioning the heat pump

When positioning the heat pump, note the following:

Caution



The heat pump must be installed outdoors and secured on a stable base, for example a cast foundation. All four mounting points must be secured to the base.

Caution



Incorrect positioning of the heat pump risks reduction of performance.

- Use M10 bolts for fastening the frame to the base.
- Select a position with good ventilation and with enough free space for installation and maintenance.
- Do not select a position that will block the air flow near the inlet or outlet areas.
- No barrier allowed closer than 30 cm behind the unit.
- Check with a spirit level that the heat pump is installed horizontally.
- Ensure that condensate water is well drained from the unit. A flexible hose is available as accessory for drainage. If there is a freezing risk, use a heat cable inside the hose.
- Make sure that condensate water is not drained out on a footway, which may become slippery or icy. This is important to avoid the risk of personal injury.

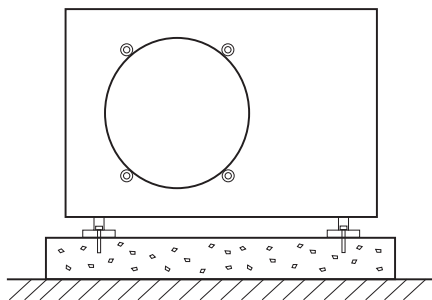


Fig. 1: Positioning heat pump



Avoid placing the heat pump near windows or walls to noise sensitive areas.



Ensure that there is sufficient distance to neighbouring properties so that they are not exposed to noise. Applicable local regulations must be followed.



The heat pump must not be built in into any cabinet or similar.



Keep the heat pump and its immediate area free of snow, ice, leaves etc.

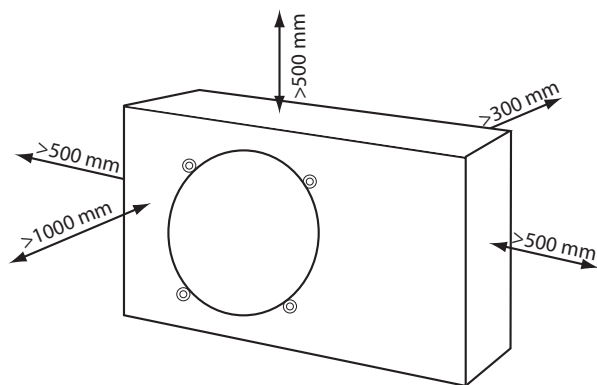


Fig. 2: Installation space



Remember that the heat pump must have a certain amount of space in order to function and for servicing. Otherwise there is a risk that the air will recirculate from exhaust to intake. Avoid this by following the dimensions given above.

4 The heat pump

4.1 Dimensions and connections

The dimensions and connections of the heat pump is described in the pictures and tables below.

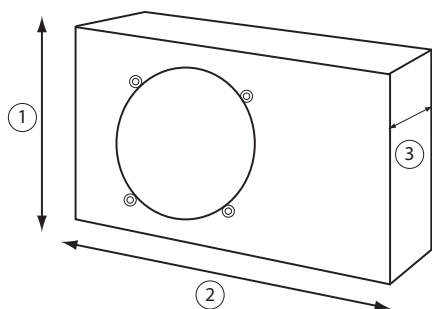


Fig. 3: Dimensions

Pos	Description	6kW	8kW
1	Height	660 mm	760 mm
2	Length	1028 mm	1028 mm
3	Width	460 mm	460 mm

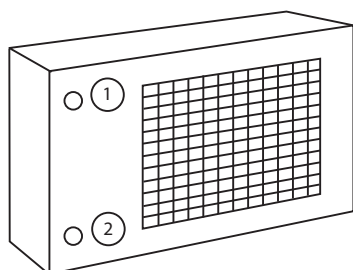


Fig. 4: Piping connections (rear side)

Pos	Description	6kW	8kW
1	Supply line pipe (red label)	DN 20	DN 25
2	Return line pipe (blue label)	DN 20	DN 25

4.2 Components

The principal components of the heat pump is shown in the picture below:

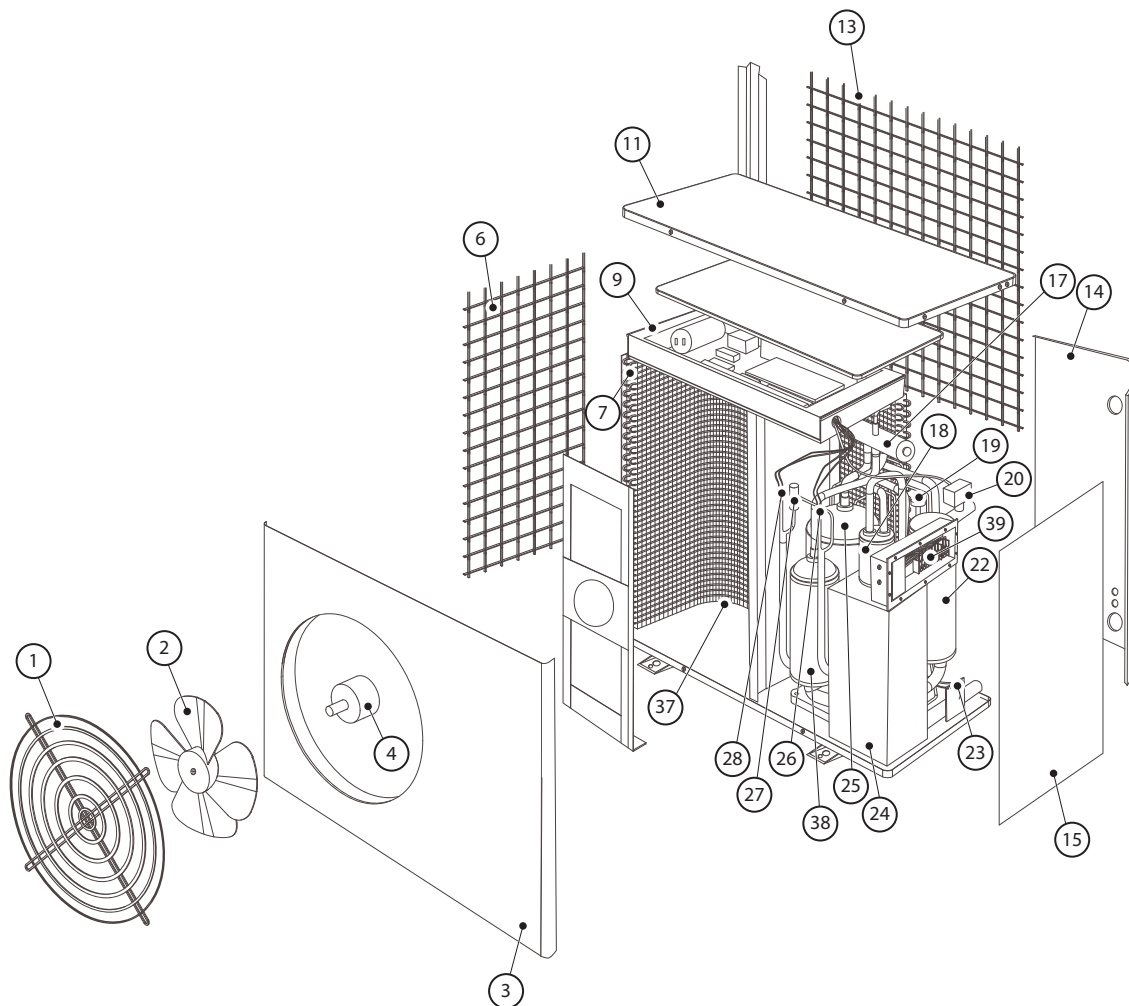


Fig. 5: Components, exploded view

- | | | | |
|----|---|----|--|
| 1 | Fan mesh | 19 | Expansion valve |
| 2 | Fan | 20 | Water flow switch |
| 3 | Front panel | 22 | Internal electrical heater |
| 4 | Fan motor | 23 | High/low pressure service connection valve |
| 6 | Left mesh | 24 | Heater exchanger |
| 7 | Evaporator | 25 | Compressor |
| 9 | Electrical cabinet (internal connections) | 26 | High pressure valve |
| 11 | Top cover | 27 | Pressure relief valve |
| 13 | Rear mesh | 28 | Low pressure valve |
| 14 | Rear panel | 37 | Evaporator heating belt |
| 15 | Right side panel | 38 | Gas and liquid separator |
| 17 | 4-way valve | 39 | Connection box (external connections) |
| 18 | Receiver (refrigerant storage tank) | | |

4.2.1 Accessories

The following accessories are available for the product:

- External electrical heater
- Circulation pump
- Reversing valve hot water

4.3 Principle function description

The heat pump can provide the following main functions:

- House heating
- Cooling
- Domestic Hot Water (DHW)
- Defrosting
- Legionella prevention
- Frost protection

To support these functions a suitable system solution, with the required components, is selected at installation. An example is shown in the System Solution illustration.

By default, the heat pump operation is house heating/DHW AUTO which is the recommended configuration. This means that DHW is prioritized before house heating or cooling. When the water tank temperature drops below the set point, the heat pump will switch to DHW and heat the tap water until the temperature in the tank has reached its setting again. The unit will then switch back to house heating or cooling.

The user can change the operation from AUTO to MANUAL mode and manually control some of the functions from the operator panel.

4.3.1 Operating heat pump in AUTO mode

House heating

In AUTO mode, the water temperature is adjusted by the control system according to the selected heat curve, the desired room temperature, and the outside air temperature (if it is within the heat pump's working range between -15°C to +43°C). The compressor stops when the water temperature has reached the set point in the control system.

The heat pump has an internal electrical heater (3kW) for backup in situations where the compressor has stopped for other reasons. According to the default settings in the control system, the internal electrical heater will start running in the following conditions:

- The control system discovers insufficient heating due to low outside air temperature (below -15°C).
- The heat pump stops working as a protective measure and at the same time, the water temperature has not reached its setpoint.
- The heat pump is defrosting.
- Freeze protection (step 2)

Start and stop conditions, internal electrical heater

The internal electrical heater will start in any of the following conditions:

- During defrosting cycle (assuming that the parameter value in **Menu 13** is set to 1= turned on).
- During freeze protection (step 2)

- During house heating:
 - When the air temperature is below 0°C, **and**
 - the system requests heating operation, **and**
 - the buffer tank temperature has dropped below the value set in **Menu 08** and 30 minutes after the compressor has started
 - After another 90 minutes;
 - If the air temperature is still below 0°C.
 - If the system still requests heating operation.
 - If the buffer tank temperature has dropped below the value set in **Menu 08**.
 - If the buffer tank temperature still has not reached the temperature measured at compressor startup.
- During house heating operation, if the heat pump has stopped as a protection due to a failure and the system does not reach the temperature setting, an automatic start of the internal electrical heater is triggered.

The internal electrical heater will stop in any of the following conditions:

- If the DHW electrical heater in the water tank starts.
- Water flow switch failure
- Standby (and not going into freeze protection, step 2)
- Non house heating mode (for example, cooling)
- Air temperature sensor failure
- Buffer tank temperature sensor failure
- Air temperature above 0°C
- The buffer tank temperature is above the temperature setting.

Drain heater

The drain heater starts if all of the following conditions are fulfilled:

- Power is on, and the operation is heating or domestic hot water.
- Compressor is started.
- The air temperature is below 1°C.

The drain heater stops in any of the following conditions:

- Non heating operation (for example, cooling)
- Compressor stopped for more than 30 minutes
- The air temperature is above 4°C

Cooling

The heat pump can be set to cooling within an outside air temperature range between 8-43°C. Beyond this range the heat pump will stop. Typically, in temperatures below 16°C, condensate problems may occur and which must be taken care of by drainage solutions as well as isolation of water tanks and piping. The set point range in cooling mode is 8-28°C. (Default cooling temperature is 12°C)

Domestic hot water

It is possible to produce Domestic Hot Water (DHW) by installing a heat system with a reversing valve and a hot water tank (if to be combined with house heating). If only DHW is required, this valve is not necessary.

When the operation is house heating/DHW AUTO mode and the water temperature in the water tank drops below the set temperature in the control system, the heat pump switches to produce hot water. When the temperature reaches the set point again, the heat pump returns to house heating.

Maximum DHW temperature setting is 60°C. (Default DHW temperature is 50°C). The maximum water temperature for DHW is 55°C running on compressor only. If the water temperature rises above 55°C, the heat pump will automatically go into protection mode and run the DHW tank electrical heater (if available) to reach the set point. Considering energy saving, it is recommended to set the DHW temperature below 55°C (60°C if there is an electrical heater installed inside the hot water tank).

Defrosting

The heat pump has an automatic defrosting function that will start when required. The control system decides defrosting program depending on data collected from the temperature sensors. As an option, defrosting can also be activated manually by the user.




Auto defrosting

Auto defrosting is active when the air temperature is below 15°C and no failure is detected in the coil temperature sensor. In heating operation, when the coil temperature reaches the value set in **Menu 04**, the defrost starts and the compressor runs for the defrost cycle setting time in **Menu 03**. Accumulated running time will be cleared after the defrosting has stopped and a new cycle starts the next time defrosting is required.

Defrosting stops when the coil temp is more than the defrost stop temperature in **Menu 05** or when the defrost time reaches the maximum setting specified in **Menu 06**.


Manual defrosting

When the air temperature is below 15°C and the compressor has run for more than 10 minutes, manual defrosting can be activated using the key pad on the control unit. Manual defrosting should only be initiated when the automatic defrosting function is not sufficient (heavy icing on the outdoor unit).

To start a manual defrosting cycle, press  and  simultaneously for 5 seconds. If all defrost conditions are fulfilled, the defrost symbol  will be displayed in the information window. An air temperature below 15°C is required and the compressor must run for at least 10 minutes.



If the defrost symbol disappears almost immediately, the defrosting criteria are not met and defrosting will not start.

The defrosting sequence will stop when the defrost time setting or the defrost stop temperature has been reached. The symbol  will then disappear from the information window.

The defrosting sequence is as follows:

- Send out defrost signal and show symbol on operator panel.
- The three-way valve remains in the current position determined by the current active operation mode.
- Power on the 4-way valve switch.
- Stop the fan.
- The compressor is still running.
- The water pump runs as normal.
- The internal electrical heater starts according to the setting in **Menu 15** (if it is 0=Auto).
- Drain heater is turned on, but controlled by its own conditions.

When the defrosting stop conditions have been met, the heat pump will perform the following sequence:

- Defrost signal ends and the symbol on the operator panel will disappear.
- The compressor is still running.
- The fan starts.
- The 4-way valve switch is powered off after 30 seconds
- The three-way valve starts again if the domestic hot water function is active.
- Accumulated defrosting running time is cleared
- The heat pump goes back to normal heating

Timer defrosting (special condition, faulty coil sensor)

If the coil temperature sensor for the heat exchanger fails, and the air temperature is below the value set in **Menu 05**, then a timer controlled defrosting cycle will start.

The heat pump then starts defrosting in intervals of 40 minutes of compressor running time. The defrosting sequence stops after the defrosting time setting has been reached.

Defrosting abnormal termination

If the heat pump is switched off (on the operator panel) during the defrosting cycle, the defrosting will continue until the defrosting stop condition has been met and then the heat pump stops.

In case of a high pressure protection situation during defrosting, defrosting stops and the heat pump shuts down as a protection.

If there is a power failure during defrosting, when the power returns, the compressor will start testing the coil temperature after 10 minutes of operation. If the defrost conditions are met, the heat pump will start to defrost.



Low pressure protection is ignored during defrosting. After the defrosting has stopped and the normal heating operation has started again, it takes 1 minute before the low pressure switch is tested.

Legionella prevention

DHW tank with built-in electrical heater

There is an automatic legionella prevention when the heat pump function is set to DHW. The automatic legionella prevention runs at 00:00 every 7:th day of operation. The maximum water temperature for DHW is 55°C running on compressor only. The water in the hot water tank will be heated to 65 °C for 15 minutes, using the hot water tank electrical heater. This will kill any possible legionella bacteria inside the hot water tank.

DHW tank without built-in electrical heater

There is an automatic legionella prevention when the heat pump function is set to DHW. The automatic legionella prevention runs at 00:00 every 7:th day of operation. The water in the hot water tank will be heated to 55 °C for 3 hours then returns back to previous operating mode.

Freeze protection

There is an automatic freeze protection function in the unit that works in two steps.

Step 1: When there is a risk of freezing due to low temperatures, the unit will start the water pump to create a water flow in the system.

Step 2: To automatically start the heating operation.

Freeze protection, step 1

When the operational status of the heat pump is Standby or powered ON, and the outside ambient air temperature is below 2°C, and the return water temperature is below 8°C, the unit will automatically start operating in water pump mode.

The heat pump will exit the freeze protection mode when the ambient air temperature is above 3°C or the return water temperature is above 10°C. When this protective function is triggered, the operator panel will display "Err 19", but this is not a fault.

The unit will automatically recover once the conditions in the control system is met.

Freeze protection, step 2

When the return water temperature is below 6°C, the unit will automatically start the heating operation. It will exit step 2 protection when the ambient temperature is above 3°C or the return water temperature is above 15°C. When this protective function is triggered, the operator panel will display "Err 18", but this is not a fault.

The unit will automatically recover once the conditions in the control system is met. When the operational status of the heat pump is "ON", the machine will start the domestic hot water function compulsorily if the water tank temperature is below 13°C; then exit and return to previous status when the water temperature is above 16°C. The operator panel will display "Err 18", but this is not a fault. The unit will automatically recover once the conditions in the control system is met.

4.3.2 Operating heat pump in MANUAL mode

In MANUAL mode, the heat pump provides a constant water temperature according to the temperature settings in the control system.

The user can change the temperature settings for the supply line, which in turn affects the temperature in the house. Heat curves cannot be selected in manual mode. The user can start and stop house heating/cooling or production of DHW from the operator panel.

Caution



It is important to be aware of the freezing risk when running the system in MANUAL mode as certain control functions may have been turned off completely or set in a manual mode.

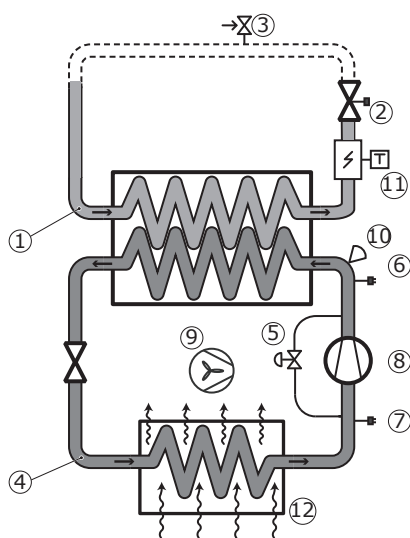
4.4 Check and safety functions

The heat pump has a number of safety functions to protect the heat pump and the installation against damage during abnormal operating conditions:

- Internal fuse for current limitation in electrical system
- Water flow switch protection in heat transfer fluid circuit
- Internal electrical heater overheat protection in heat transfer fluid circuit
- High pressure protection in refrigeration circuit
- Low pressure protection in refrigeration circuit
- Compressor exhaust gas temperature overheat protection in refrigeration circuit
- Fan motor temperature protection

Depending on the condition, the heat system will stop completely or electrical heaters will start and the system continues to work but with limited capacity. Error codes will be displayed to inform the user about the problem. When the abnormal condition ceases, it is detected by the control system and the heat pump begins to work according to the settings in the control system, unless a safety function is triggered that requires manual reset.

The diagram below shows the heat pump's three circuits with respective safety functions.



Position	Name
1	Heat transfer fluid circuit
2	Flow switch
3	Safety valve, heat transfer fluid circuit, externally mounted
4	Refrigerant circuit
5	Over-pressure bypass valve from high pressure side to low pressure side
6	High pressure switch
7	Low pressure switch
8	Compressor
9	Fan
10	Discharge pipe sensor
11	Internal electrical heater with overheating protection
12	Ambient air source

Fig. 6: Check and safety functions

Electrical system

The electrical cabinet inside the heat pump is fused with a 5A/250V AC fuse (dimension: 5*20; model: 522).

Heat transfer fluid circuit (1)

If the flow in the heat transfer fluid circuit is below the permitted value, detected by the flow switch (2), the heat pump's normal operation is blocked. An alarm indicator on the control unit control panel flashes and an error code appears in the control panel display. The alarm resets itself when the flow returns.

If the pressure in this circuit exceeds the opening pressure for the safety valve (3), the valve opens, releases the over-pressure and closes again. The safety valve overflow pipe must have an open connection to the drain and visibly flow into this in a frost-free environment. The safety valve (3) is not an integrated part of the product, but a required external protection function that must be installed at commissioning and in accordance with local regulations.

Refrigerant circuit (4)

The refrigerant circuit's high pressure side is equipped with a high pressure switch (6) and an over-pressure bypass valve (5). The high pressure switch activates when its break pressure is reached, whereupon the compressor stops and the heat pump's normal operation is blocked.

If the high pressure switch is activated an alarm indicator flashes on the control unit's control panel and an error code appears in the control panel display.

If the operating pressure reaches and exceeds the pressure level of the over-pressure bypass valve (5), the valve will unload the pressure to protect the compressor. No alarm is connected to this protector.

If the low pressure switch (7) registers too low pressure in the refrigerant circuit, the heat pump's normal operation is blocked, an alarm indicator on the heat pump's control panel flashes and an error code appears in the control panel display.

Compressor (8)

The compressor is equipped with an internal temperature protector that stops the compressor if there is a risk of overheating. The internal temperature protector cannot be reset manually, the compressor must cool down before it can be restarted. No alarm is connected to this protector.

The discharge pipe temperature sensor (10) stops the compressor at too high pressurised gas temperature. This is indicated by an error code in the control panel display. The stop is ceased when the temperature becomes normal.

Fan (9)

The fan motor is equipped with an internal overheating protection. The internal temperature protector can not be reset manually, the fan motor must cool down before it can be restarted. No alarm is connected to this protector. If this protector is triggered during operation and the fan stops, a high pressure or low pressure alarm may be triggered as a consequence.

Alarm mode

If an alarm that affects the heat pump's normal operation is activated, an error code is presented in the control panel display.

Internal electrical heater with overheating protection (11)

The internal electrical heater consists of an electric heating element mounted on the heating system supply line. It has an overheat protector that switches off the electric heating element if it is at risk of becoming overheated.

If the overheat protector is activated an alarm indicator flashes on the heat pump's control panel and an error code appears in the control panel display.

The overheat protector is reset by pushing the reset button, which is on the overheat protector inside the unit. This alarm is not automatically reset.

4.5 Heating curves

The heat pump will automatically adjust the water temperature according to the following:

- Different ambient air temperatures
- Selected heat curve
- Desired room temperature setting

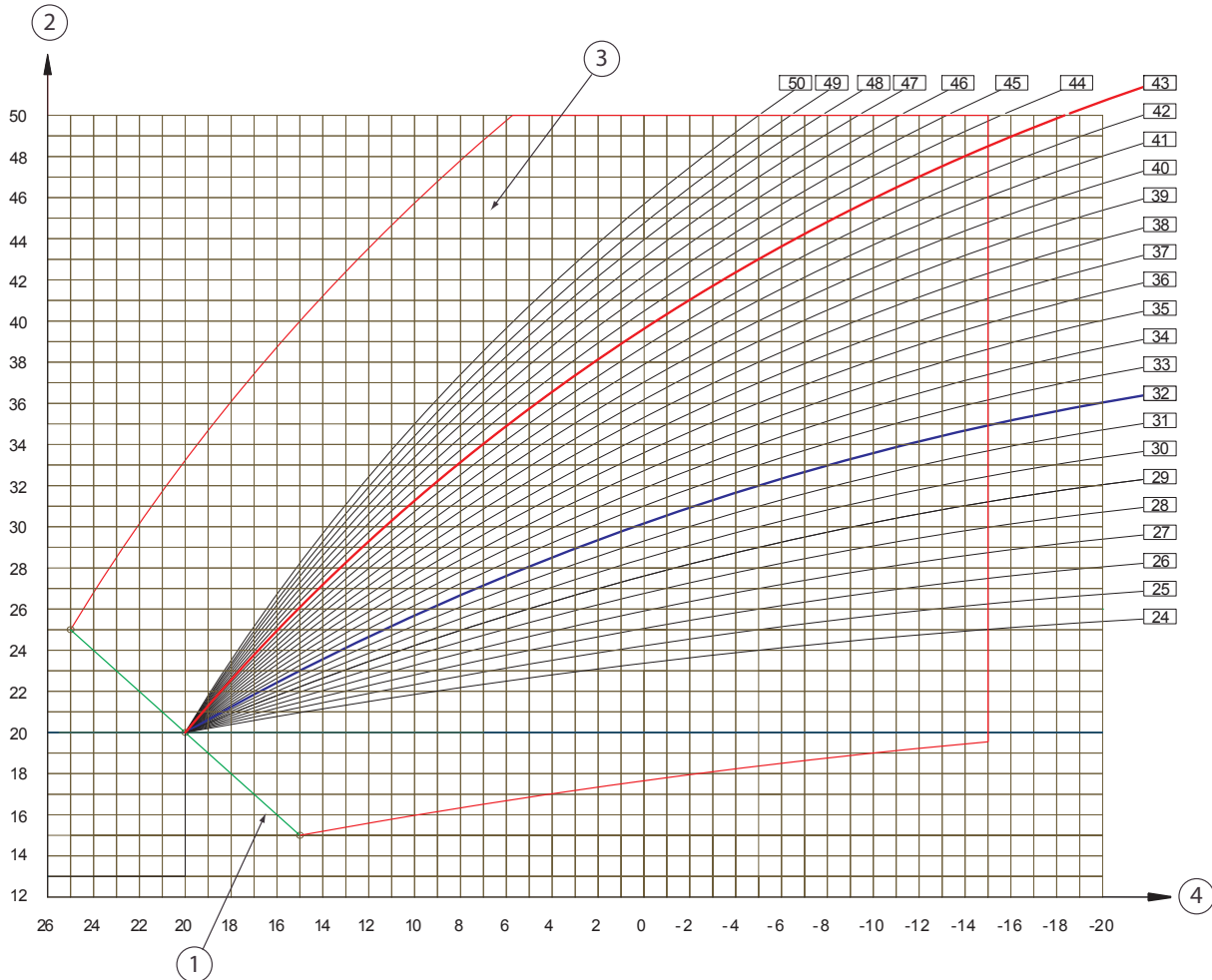


Fig. 7: Heat curves and heat pump working range in AUTO mode

- 1 Initial supply line temperature (°C)
- 2 Supply line water temperature (°C)
- 3 Working range in AUTO mode
- 4 Outdoor Air temperature (°C)



The outside air temperature reference point for the heat curves is -6 °C.

When the outside air temperature is -6°C, selecting heat curve 43 and AUTO mode means that the heat pump will adjust the water temperature to 43°C.

Heat curve 43 is suitable for radiator heating and heat curve 32 is for under-floor heating (considering any local conditions that may have impact on this recommendation).

5 System solution

5.1 System solution

An example of a system solution with heat pump, hot water tank, and buffer tank is shown in the picture below.

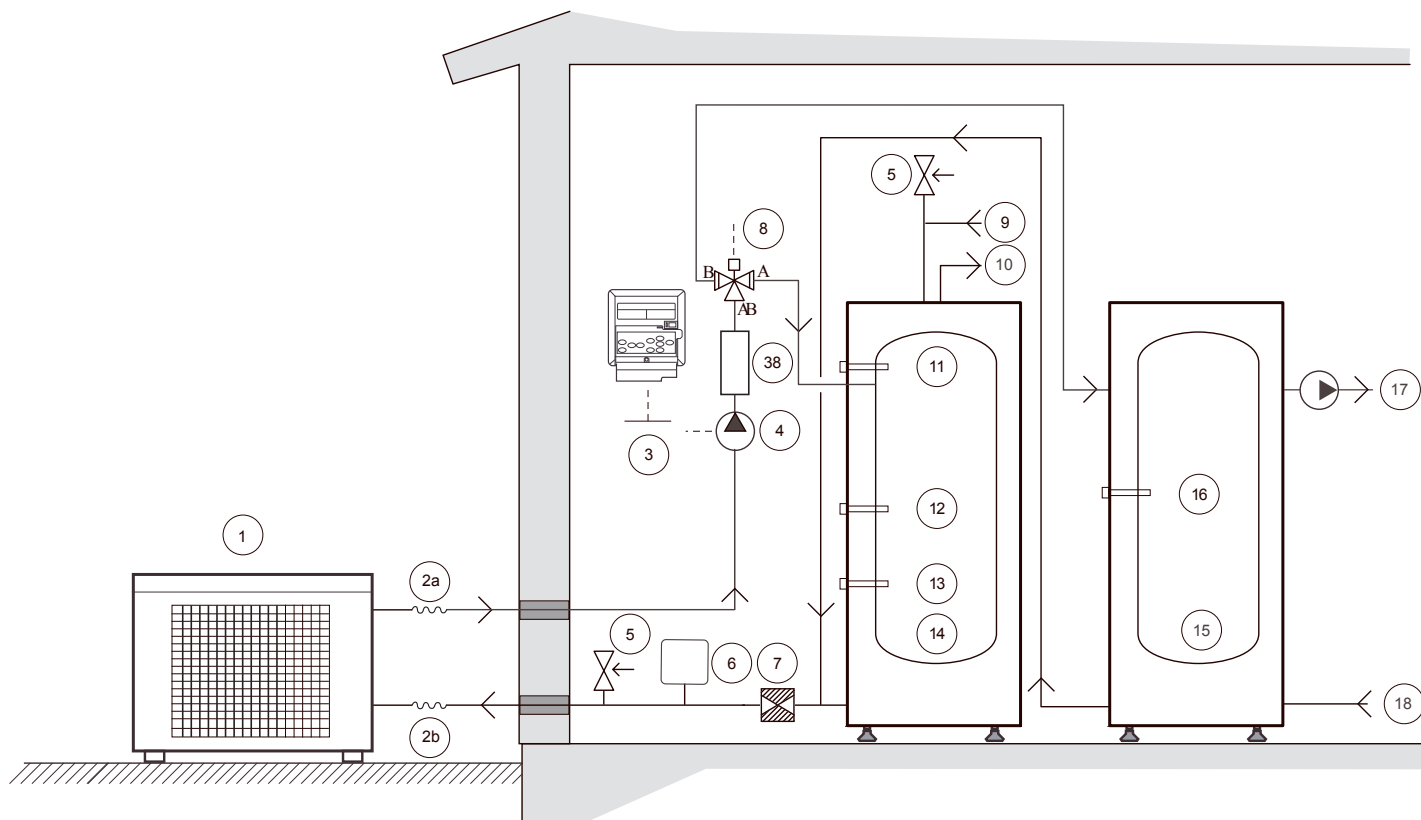


Fig. 8: Example, system solution

- | | | | |
|----|-------------------------------------|----|----------------------------------|
| 1 | Heat pump | 10 | Hot water |
| 2a | Flexible hose (supply line) | 11 | Temperature and pressure valve |
| 2b | Flexible hose (return line) | 12 | Temperature sensor |
| 3 | Control unit | 13 | Hot water tank electrical heater |
| 4 | Circulation pump | 14 | Hot water tank (optional) |
| 5 | Safety valve | 15 | Buffer tank (optional) |
| 6 | Expansion vessel | 16 | Temperature sensor |
| 7 | Strainer | 17 | Supply line |
| 8 | 3-way switching valve for hot water | 18 | Return line |
| 9 | Cold water | 38 | External electrical heater |

6 Piping installation

6.1 Pipe connection

Caution



There is a risk that the pipes to the heat pump freezes when water circulation through the heat pump stops and the outdoor temperatures drops below freezing. The integrated flow sensor will normally give an alarm if the water flow is low (provided that the heat pump is powered on), for example when the radiator pump has stopped. In the event of longer flow stops, for example in case of power failure or if the system is powered OFF, there is an obvious risk of freezing. Installing a drain plug indoors will make it possible to drain the part of the system that goes out to the heat pump if necessary. Another way to prevent freezing is to install an intermediate exchanger indoors. In such cases glycol intended for refrigerant applications must be used in the circuit to the heat pump unit and an extra circulation pump is required, see System solution intermediate exchanger. Another option is to fill the heating system with anti-freeze fluid.

Caution



To prevent leaks, ensure that there are no stresses in the connecting pipes!

Caution



It is important that the excessive air is bled from the heating system after installation. Bleed valves must be installed where necessary.

Caution



Heating systems with closed expansion tanks must also be supplied with approved pressure gauges and safety valves.

Caution



Cold and hot water pipes and overflow pipes from safety valves must be made of heat resistant and corrosion-resistant material, for example copper. The safety valve overflow pipes must have an open connection to a drain in a frost-free environment.

Caution



The connecting pipe between the expansion tank and the safety valve must slope continuously upwards. This means that the pipe must not, at any point, slope downwards



The pipe installation must be carried out in accordance with the dimensions and connection diagrams.

Caution



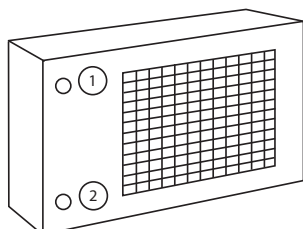
Safety valves must be installed in the system for both the heating circuits and DHW, according to local regulations.

6.2 Connecting cold and hot water lines

If necessary, connect the cold water (9) and hot water (10) pipes with all the necessary components to the hot water tank, see the system solution illustration.

6.3 Connecting supply and return lines

1. Connect the supply pipe (red label) with a flexible hose connection and with all other necessary components.
2. Connect the return pipe (blue label) with a flexible hose connection and with all the necessary components including a filter.
3. Insulate the supply and return lines all the way to the heat pump.



- 1 Supply line pipe (red)
- 2 Return line pipe (blue)

6.4 Noise and vibrations

Installation of the heat pump

To prevent disturbing noise from the heat pump, the following recommendations should be observed:

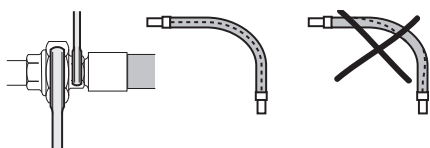
- In the event the heat pump is positioned on a vibration sensitive base, vibration dampers should be used. The vibration dampers must be correctly dimensioned with regards to the heat pump's weight so that static spring depression of at least 2 mm is obtained in all mounting components. Vibration dampers are available to purchase as accessories.
- The connection of the heat transfer fluid to the heat pump must be made using a flexible hose to prevent transmission of vibration to building construction and the pipe system.
- Ensure that pipes at lead-ins are not lying against the walls.

Flexible hoses

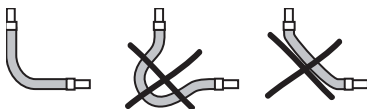
All pipes should be routed in such a way that vibrations cannot be transmitted from the heat pump through the piping and out into the building. This also applies to the expansion pipe.

We recommend that flexible hoses are used for all pipe connections to avoid the transmission of vibrations. Flexible hoses are available to purchase as accessories.

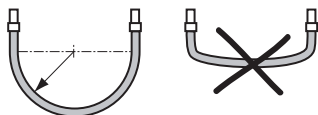
The figures below show how appropriate and inappropriate installations look using this type of hose:

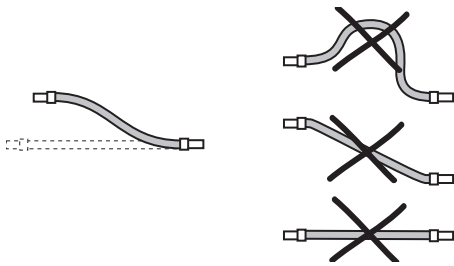


Do not twist the flexible hoses as they are installed.
At threaded connections, use a counterhold spanner

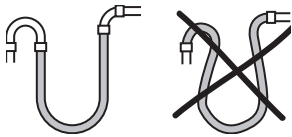


Cut the hose to the correct length to avoid excess bowing-out or stretching at bends





Cut the hose to the correct length to avoid excess bowing-out or stretching and offset the ends so that the hose is installed completely straight



Use fixed pipe bends to avoid excess stress on bends next to connections

7 Electrical installation

Danger



Hazardous electrical voltage! The terminal blocks are live and can be highly dangerous due to the risk of electric shock. All power supplies must be disconnected before the electrical installation is started. The heat pump is connected internally at the factory, so the electrical installation consists mainly of the connection of the power supply.

Warning



Electrical installation may only be carried out by an authorised electrician. Applicable local and national regulations must be obeyed.

Warning



The electrical installation must be carried out using permanently routed cables. It must be possible to disconnect the power supply using a multi-pole circuit breaker with a minimum contact gap of 3 mm.

The electrical installation includes connecting the following components to the heat pump:

- Operator panel/control unit
- Circulation pump
- Power supply
- Buffer tank sensor
- Hot water tank sensor



Buffer tank sensor and hot water tank sensor must be installed even if only heating or DHW function is provided in the system. Install both sensors at the same measurement point if only one function is used.

Optional components:

- Hot water tank electrical heater
- External electrical heater
- Reversing valve, hot water

For details, see the illustrations of the connection points and components.



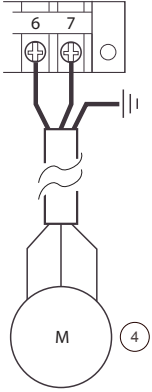
To install the provided sensors and connecting the cord to the external circulation pump etc., only the right gable needs to be removed. There is no need to take the top off to get inside the electrical connection box.

7.1 Connecting the operator panel

Connect the communication (signalling) cable from the operator panel to the connector marked **Operator panel** in the heat pump. The cable has prepared connectors that will fit only one way.

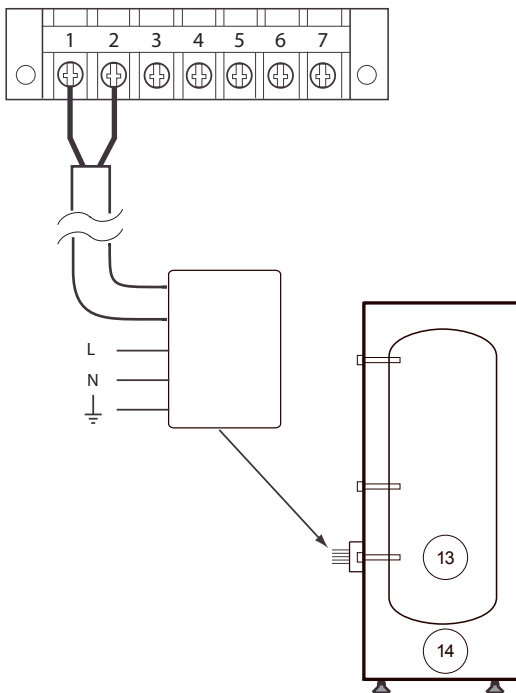
7.2 Connecting circulation pump

Connect the power cable between the circulation pump (4) and the heat pump (1) as shown in the picture below and the illustration with an exploded view of the heat pump. Also, see the diagram inside the connection box.



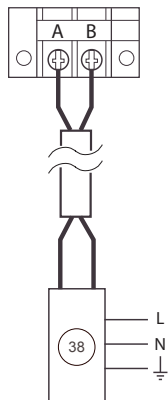
7.3 Connecting hot water tank electrical heater

Connect the signal cable and the power connection to the hot water tank electrical heater (13) according to the picture.



7.4 Connecting external electrical heater

Connect the signal cable and the power connection between the heat pump (1) and the optional external electrical heater (38).



7.5 Connecting hot water sensor

Connect the hot water tank sensor cable (12) to the connector in the heat pump marked **Hot water sensor**. Attach the sensor to the hot water tank.

Caution



The hot water tank sensor must be connected to the heat pump and attached to the system even though the hot water tank itself is excluded from the installation.

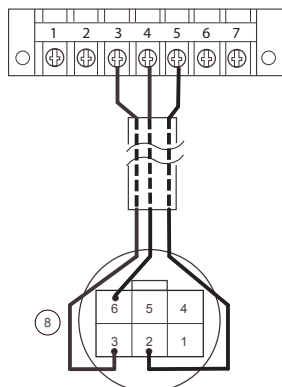
7.6 Connecting buffer tank sensor

Connect the buffer tank sensor cable (13) to the heat pump to the connector marked **Buffer tank sensor**.

If a buffer tank is used, attach the sensor in the applicable pocket in the buffer tank. If no buffer tank is present in the system, attach the sensor to the supply line piping and heat insulate it.

7.7 Connecting 3-way switching valve

Connect the cable between the heat pump and the 3-way switching valve for hot water (8). The picture below shows a connection example using the LK 3-way switching valve for hot water. The connection may be different if using other types of 3-way switching valves for hot water.



7.8 Connecting the power supply

Warning

Obey local and national rules and regulations regarding the specification of the power cable.

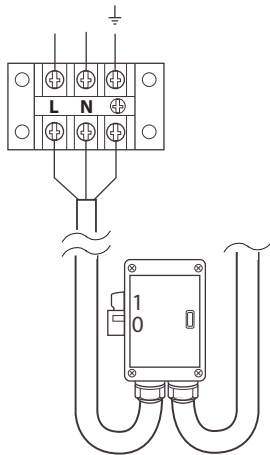


Fig. 9: Connect the power cable between the safety circuit breaker and the heat pump (1)

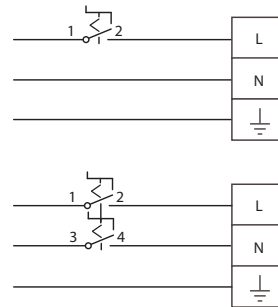


Fig. 10: Connection alternatives

8 Operator panel

The heat system is controlled by an operator panel with a display that shows operational information. A keypad is used for user interaction, that is selecting functions, navigating the menu system, and for parameter value settings. When the heat pump is turned on, the display shows the operational mode and the water temperatures. The default setting is house heating/DHW AUTO mode. For more information about the operator panel, see description in the user manual.

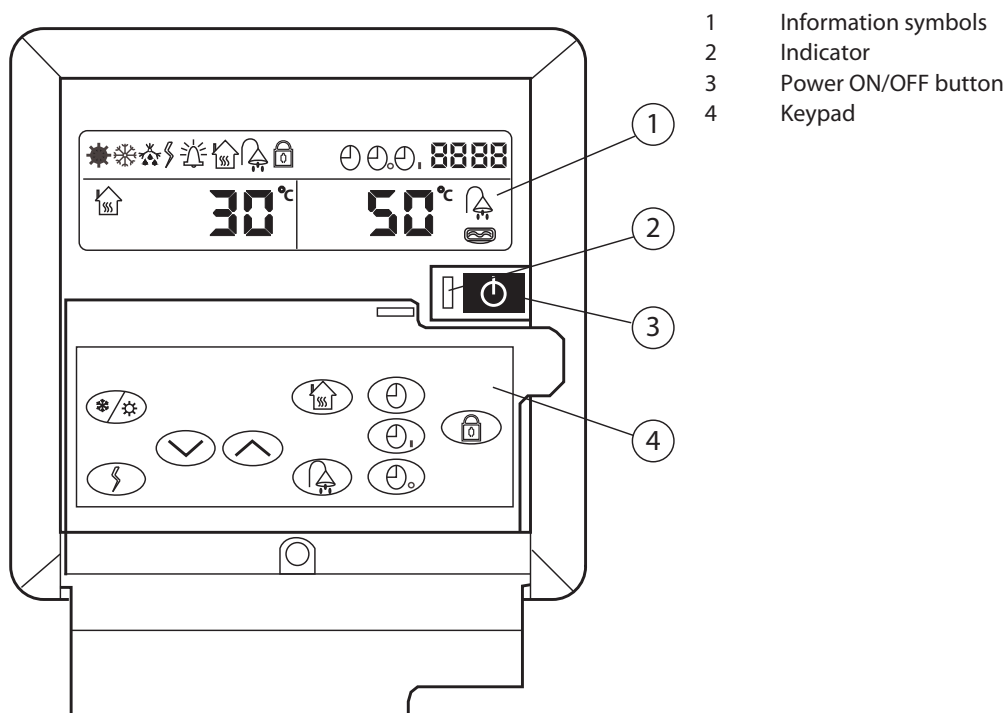


Fig. 11: Layout of operator panel

9 Commissioning



Read the safety instructions!

Before filling water in the heating system or turning on the power, the installation must be checked for safety and functional capability.

9.1 Checking piping installation and heating system

Pipe connections in accordance with the system solution.

- Flexible hoses on the supply and return lines
- Pipe insulation
- Strainer on return line
- All excessive air has been bled from the heating system
- All radiator valves fully open
- Expansion tank heating system (not included in the delivery)
- Safety valve for expansion tank
- Filler valve with non-return valve heating system (not included in the delivery)
- Safety valve for cold water (not included in the delivery)
- If the solution supports both heating and domestic hot water, also check:
 - 3-way switching valve
 - Bleed valve (not included in the delivery)


9.2 Checking electrical installation

- Circuit-breaker (not included in the delivery)
- Fuse protection
- Communication cable between heat pump and operator panel

9.3 Filling hot the water tank and heating system and bleeding excessive air

1. Fill the water heater/hot water tank with cold water by opening the filler valve that is on the valve pipe.
2. Bleed all excessive air by opening one of the hot water taps.
3. Fill the water heater coil and the heating system with water through the filling valve to a pressure of approximately 1 bar.
4. Open all radiator valves fully.
5. Bleed all excessive air from the radiators.
6. Refill the heating system to a pressure of approximately 1 bar.
7. Repeat the procedure until all air has been bled.
8. Check the system for leakage.
9. Leave the radiator valves fully open.

9.4 Starting the unit

1. Set the main power switch to ON.
2. Press  on the keypad.

The display shows the current status of the heat system.

After the power has been turned on to the heat pump, the system starts in house heating/DHW AUTO mode with a desired room temperature as set in **MENU 02**. The default values can be modified as required, this is done by navigating through the menu system.



There is no reset function. If the default factory settings (parameter values) are changed, the only way to return to the default settings is to manually set the values presented in section Default settings.

9.5 Default settings

The default DHW temperature is set to 50°C.

The following table shows the other default settings in the control system:

Menu	Description	Default value	Range
00	Auto heating curve (value 43 relates to the number of the curve and has no units of measure, A indicates that it is in automatic mode only)	A43	A24—50
01	Initial (desired) room temperature	20 °C	15—25 °C
02	House heating mode	1	1=Auto 0=Manual
03	Defrosting cycle	40 min	30—90 min
04	Coil temperature threshold for starting defrosting	-6 °C	From -20 °C to +5 °C
05	Coil temperature threshold for stopping defrosting	13 °C	1—30 °C
06	Maximum defrosting period	12 min	1—12 min
07	Domestic hot water hysteresis setting (i.e. number of degrees below set point where the DHW will start again)	5 °C	1—20 °C
08	Heating hysteresis setting (i.e number of degrees below set point where the heating will start again)	2 °C	1—20 °C
09	Overheating of electronic expansion valve in heating mode	2 °C	From -20 °C to +20 °C
10	Overheating of electronic expansion valve in cooling mode	3 °C	From -20 °C to + 20 °C
11	Time delay for compressor start-up after power-up (for example, after a power cut-off)	1 min*	1—10 min
12	Circulation pump operation mode	1	1=Switched off when heating temperature has been reached. 0=Continuous operation
13	Internal electrical heater operation during defrosting	1	1= Turned on 0=Turned off
14	Automatic legionella protection function	1	1=Activated 0=Deactivated
15	Internal electrical heater start option	0	0=Auto 1=Air-temperature condition set in menu 16 2=Water temperature condition set in menu 17 3= Conditions 1 and 2 must be met
16	Air temperature restriction for when internal electrical heater can manually be started, that is, must be lower than this value.	-5 °C	From -15 °C to +7 °C
17	Additional hysteresis in relation to menu 08 for when internal electrical heater can manually be started.	2 °C	0—13 °C
18	Additional temperature hysteresis for hot water tank electrical heater in relation to menu 07 for when the electrical heater will start.	5 °C	0—20 °C
19	Hot water tank electrical heater startup delay	30 min	30—90 min
20	Return water temperature	Measured value	From -30 °C to +99 °C
21	Supply water temperature	Measured value	From -30 °C to +99 °C
22	Coil temperature in heating mode (T7)	Measured value	From -30 °C to +99 °C
23	Coil temperature in cooling mode (T8)	Measured value	From -30 °C to +99 °C
24	Air temperature (T1)	Measured value	From -30 °C to +99 °C
25	Hot water tank temperature (T3)	Measured value	From -30 °C to +99 °C
26	Buffer tank temperature (T2)	Measured value	From -30 °C to +99 °C
27	Return gas temperature of compressor (T5)	Measured value	From -30 °C to +99 °C
28	Exhaust gas temperature of compressor (T4)	Measured value	From -30 °C to +99 °C
29	Shows the number of the operation steps for the expansion valve	Measured value	100—480 steps

* Should not be modified.

9.6 Test Operation

Caution



The installation may only be commissioned if the heating system and water heater have been filled and excessive air bled from the system. Otherwise the circulation pump can be damaged.

Caution



Any alarms that may occur in connection with the installation must be fault-traced.

Test operate and, at the same time, check the following functions of the components in the heat system:

- Flows and actuators
- Circulation pump is running
- Compressor is running
- Reversing valve, hot water switches from house heating/cooling to DHW
- External electrical heater starts as required
- Hot water tank electrical heater starts as required
- Fan
- Internal electrical heater starts as required

9.7 After start-up and tests



Remember that it takes time for the heat pump to heat up a cold house. It is best to let the heat pump work at its own pace and NOT alter any values in the control system to try to heat up the house more rapidly.

Caution



If there is an alarm in conjunction with the installation, it usually means that there is air in the system.

Caution



In the event of longer periods of downtime and risk of freezing in the system, the heat pump must be drained of water.

Adaptation of the heating system

The delta temperature (the difference between the supply line and return line) should be 7–10°C. If this is not reached, the flow of the circulation pump may need adjusting depending on the applicable heating system.

Change operating mode

How to change the operating mode and other parameter values is described in the User manual.

Noise check

During transportation and installation there is a certain risk that the heat pump can be damaged, components may move or get bent and this can cause noise. Because of this it is important to check the heat pump when it has been installed and is ready to be commissioned to ensure that everything is in order. Test operate the heat pump in both heating and hot water modes to ensure that there is no abnormal noise. Whilst doing this, check that there is no abnormal noise in other parts of the house because unwanted noise can occur in rooms other than the one where the heat pump is located.

Tuning the heating system

To obtain a heating system balance and obtain an even and comfortable indoor temperature, the heating system must be adjusted according to the example below.



Adjust the heating system during the winter to obtain the greatest possible output.



Tuning must be carried out over a few days as the inertia in the heating system causes the indoor temperature to change slowly.

1. Choose one of the rooms in the house as a reference room for the indoor temperature, use the room where the highest temperature is wanted, 20-21°C.
2. Place a thermometer in the room.
3. Open all radiator valves in the heating system fully.
4. Set the room temperature on the heat pump to 20°C.
5. Note the temperature in the reference room at different points in time over a 24 hour period.
6. Adjust the room temperature so that the reference room reaches your required indoor temperature of 20-21°C. Remember that the other rooms will have different temperatures during tuning, but these are adjusted later.
7. When the reference room has an even temperature of 20 - 21°C over a 24 hour period, you can adjust the radiator valves in the other rooms so that their indoor temperatures are the same temperature or lower than the reference room.

9.8 Customer information

After installation and test operation, the customer must be informed about their new heat pump installation. It is important that the customer understands the behaviour of the heat pump and the result of any changes made to the default settings in the control system. See the checklist and Installation Protocol in the user guide regarding the information that the installer must give the customer.



The serial number must always be given for warranty matters. The serial number is found on the exterior of the heat pump cabinet. The serial number must be noted in the Installation Protocol.

10 Troubleshooting

10.1 Operational problems

Operational problems can be solved by troubleshooting the following areas:

- Alarms
- Leakage (fluid side)
- Abnormal noise in the heat pump or radiator system
- Hot water
- Heating
- Other issues

There may be more than one way of troubleshooting a cause.

10.1.1 Alarms

Error code	Description
00	Communication failure
01	Return water sensor (T9) failure
02	Supply water sensor (T8) failure
03	Water flow switch protection
04	Phase sequence error (only applies to 3-phase models)
05	Excessive temperature difference between supply and return water (>13°C)
06	Internal electrical heater overheat protection (>85°C)
07	Condenser overheat protection
08	Hot water tank sensor (T3) failure
09	Buffer tank sensor (T2) failure
10	High pressure protection
11	Low pressure protection
12	Supply water temperature too high
13	Supply water temperature too low (cooling mode only)
14	Return gas temperature sensor (T5) failure
15	Exhaust gas temperature sensor (T4) failure
16	Exhaust gas temperature overheat protection
17	Null
18	Frost protection, step 2 (non-fault)
19	Frost protection, step 1 (non-fault)
20	Air temperature sensor (T1) failure
21	Heating coil sensor (T7) failure
22	Cooling coil sensor (T6) failure
23	Exceeded operation range warning (non-fault)

10.1.2 Temperature sensor locations

The location of the internal temperature sensors are shown in the principal diagram below:

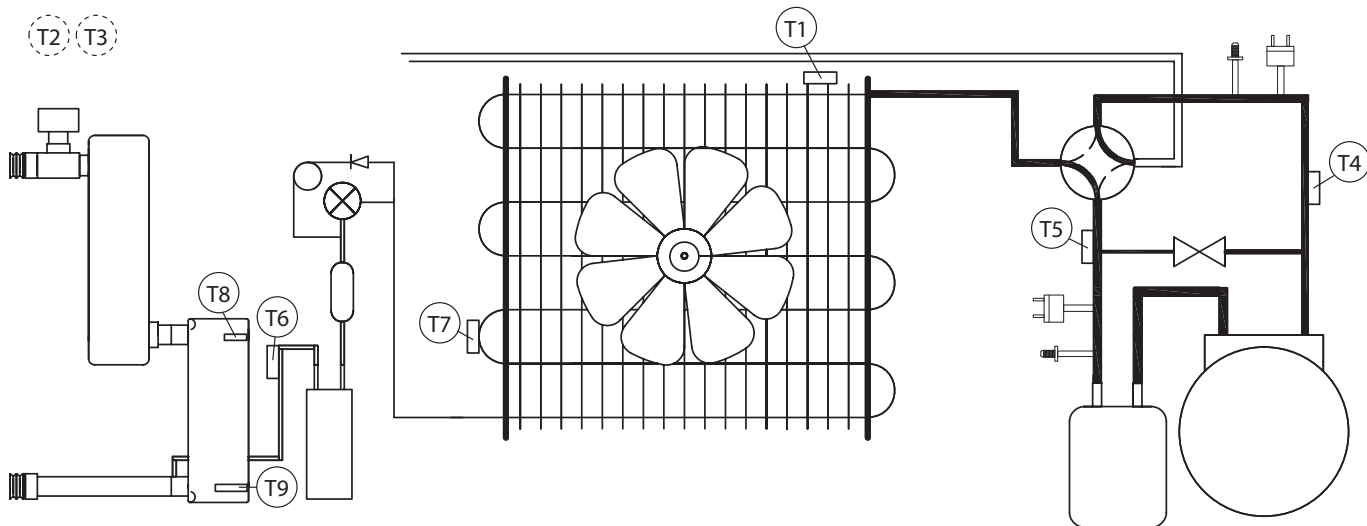


Fig. 12: Sensor locations

- | | | | |
|----|-------------------------|----|--------------------------------|
| T1 | Air temperature | T6 | Cooling coil (external sensor) |
| T2 | Buffer tank | T7 | Heating coil |
| T3 | Hot water tank | T8 | Supply line |
| T4 | Exhaust gas temperature | T9 | Return line |
| T5 | Return gas temperature | | |

11 Technical data

DHP-AT		Unit	6 kW	8 kW
Type			Air/water (monoblock/standalone)	
Refrigerant	Type		R410A	
	Amount	Kg	2.2	2.5
	Test pressurization	MPa	3.1	
	Design pressure	Mpa	4.2	
Compressor	Type		Rotary	
	Oil		HAF68D1 / 68HES-H	
Electrical data 1-N 50Hz heat pump	Mains power supply	V	220 – 240	
	Rated power, compressor	kW	1.7	2.5
	Rated power, fan	kW	0.044	0.044
	Rated power, internal electrical heater	kW	3	3
	Start current, heat pump ¹	A	30	28
	Fuse	A	25	25
Performance (new heat pump with clean heat exchanger)	COP ²		3.0	2.9
	Heating capacity ²	kW	4.0	5.8
	Power input ²	kW	1.4	2.0
	Operating current ²	A	6.6	9.3
	COP ³		4.0	4.0
	Heating capacity ³	kW	5.7	8.3
	Power input ³	kW	1.4	2.0
	Operating current ³	A	6.4	9.1
	COP ⁴		4.3	4.3
	Heating capacity ⁴	kW	6.0	8.5
	Power input ⁴	kW	1.4	2.0
	Operating current ⁴	A	6.3	8.8
	EER ⁵		2.7	2.6
	Cooling capacity ⁵	kW	4.4	6.2
	Power input ⁵	kW	1.6	2.4
	Operating current ⁵	A	7.2	10.6
	EER ⁶		3.7	3.2
	Cooling capacity ⁶	kW	6.3	8.2
	Power input ⁶	kW	1.7	2.6
Operating current ⁶	A	7.5	11.2	
Nominal flow ⁷	Heating circuit	l/s	0.142	0.205
Ambient air operating range (outdoor unit)		°C	-15 – +43	
Max temperatures ⁸	Heating circuit	°C	50	
	Hot water heating	°C	55	
Pressure switches	Low pressure	MPa	0.14	0.14
	High pressure	MPa	4.2	4.2
Fan speed ⁹	Low speed	rpm	600	600
	High speed	rpm	700	700
Water volume	Condenser	l	1.15	1.40
Noise	Sound power at normal operation ¹⁰	dB(A)	64.9	64.5
	Sound pressure at normal operation, 1 metre ¹¹	dB(A)	53.3	52.8

DHP-AT		Unit	6 kW	8 kW
Number of units			2	
Heat pump (outdoor unit)	Dimensions L x W x H	mm	1028 x 460 x 660	1028 x 460 x 760
	Weight (empty)	kg	90	101
	Pipe connections (supply line and return line)		DN 20	DN 25
Control unit (indoor unit)	Dimensions L x W x H	mm	120 x 20 x 120	
	Weight	kg	0.2	
Installation distance restrictions	Heat pump, minimum free distance from wall directly behind evaporator inlet	cm	30	30
	Maximum distance between outdoor and indoor unit	m	10	10

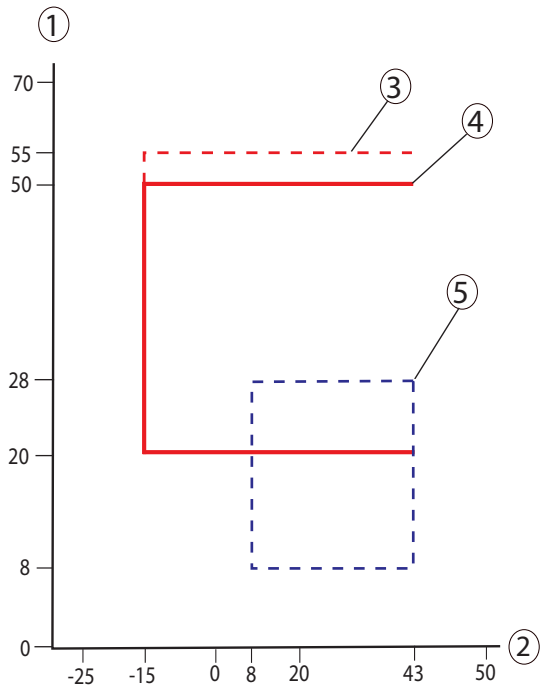
Measurements are carried out on a limited number of circulation pumps, which can give variations in results. Tolerances in the measurement methods can also give variations.

- 1) Measured according to IEC61000
- 2) At operating point A2/W35 in accordance with EN14511, including fan, defrost and correction for external circulation pump
- 3) At operating point A7/W35 in accordance with EN14511, including fan, defrost and correction for external circulation pump
- 4) At operating point A7/W35 Δ 10K hot side in accordance with EN255
- 5) At operating point A35/W7 according to EN14511
- 6) At operating point A35/W18 according to EN14511
- 7) Nominal flow, for heat circuit Δ 10K between supply line and return line, in operating point A7W25 in accordance with EN255
- 8) Heat pump operation only, at 0 °C outdoor temperature
- 9) Fan operating on low speed: Heating mode and ambient temp > 26°C; Cooling mode and ambient temp < 18°C
- 10) Outdoor unit, sound power level measured according to EN ISO 3741 at A7W35 and frost-free evaporator, high fan speed.
- 11) Outdoor unit, sound pressure level measured according to ISO 11203, cuboid-shaped measuring surface, high fan speed.

11.1 Working range compressor operation

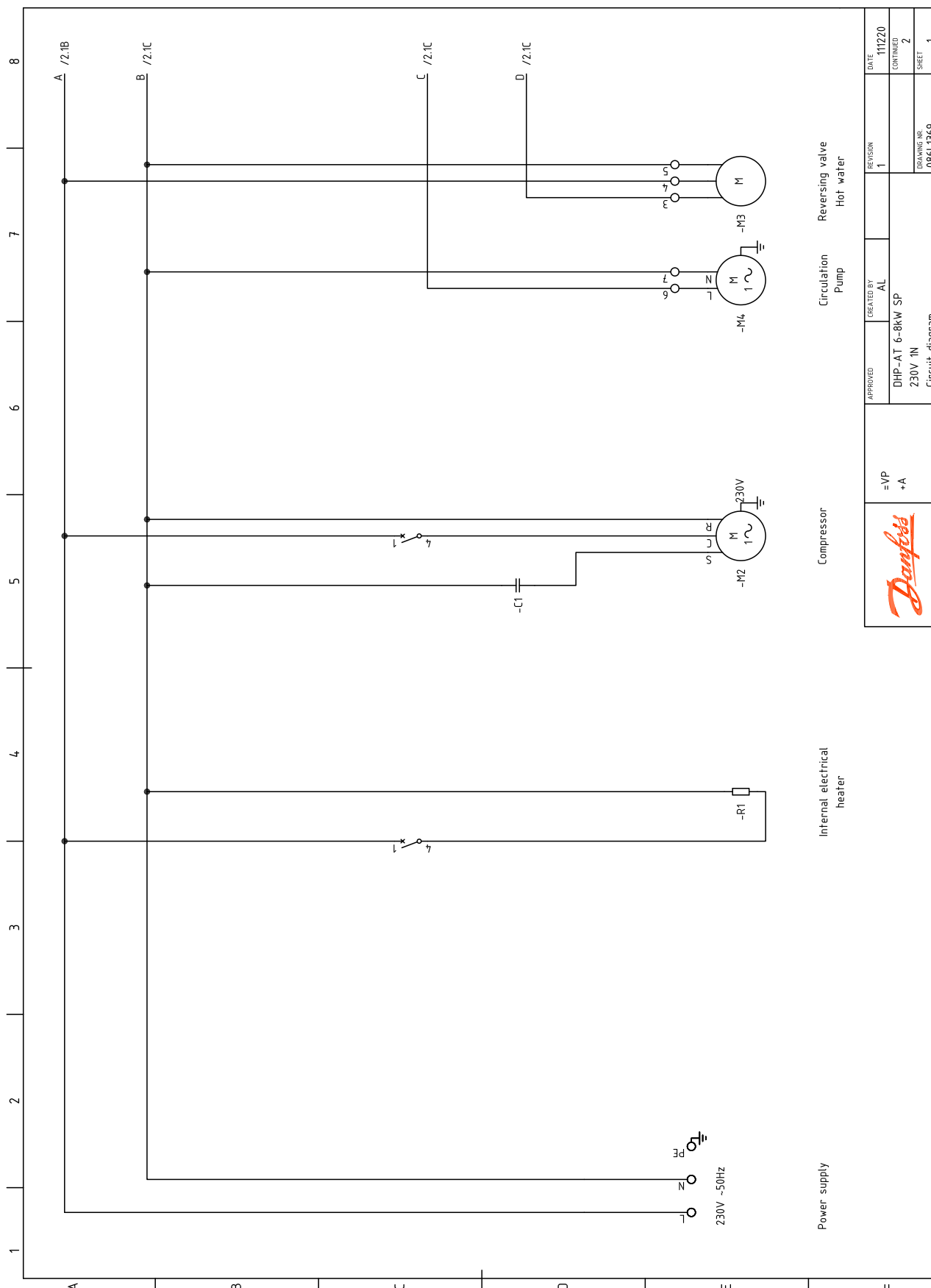
Lowest and highest temperatures for production of hot water, heating and cooling.

The control unit controls the heat pump operating range.

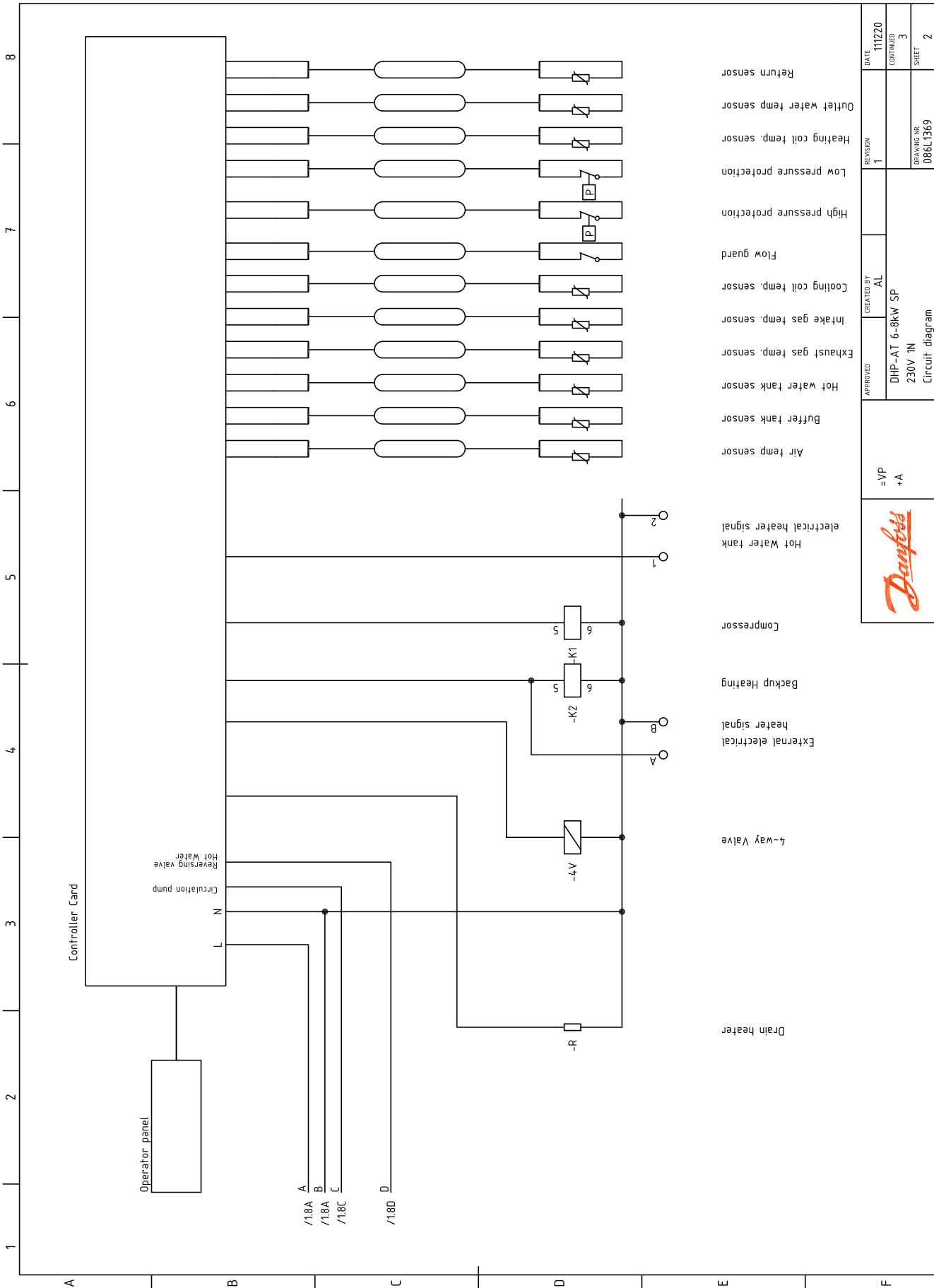


- 1. Supply line water temperature °C
- 2. Air temperature °C
- 3. Hot water production only
- 4. Heating
- 5. Cooling

12 Circuit diagram

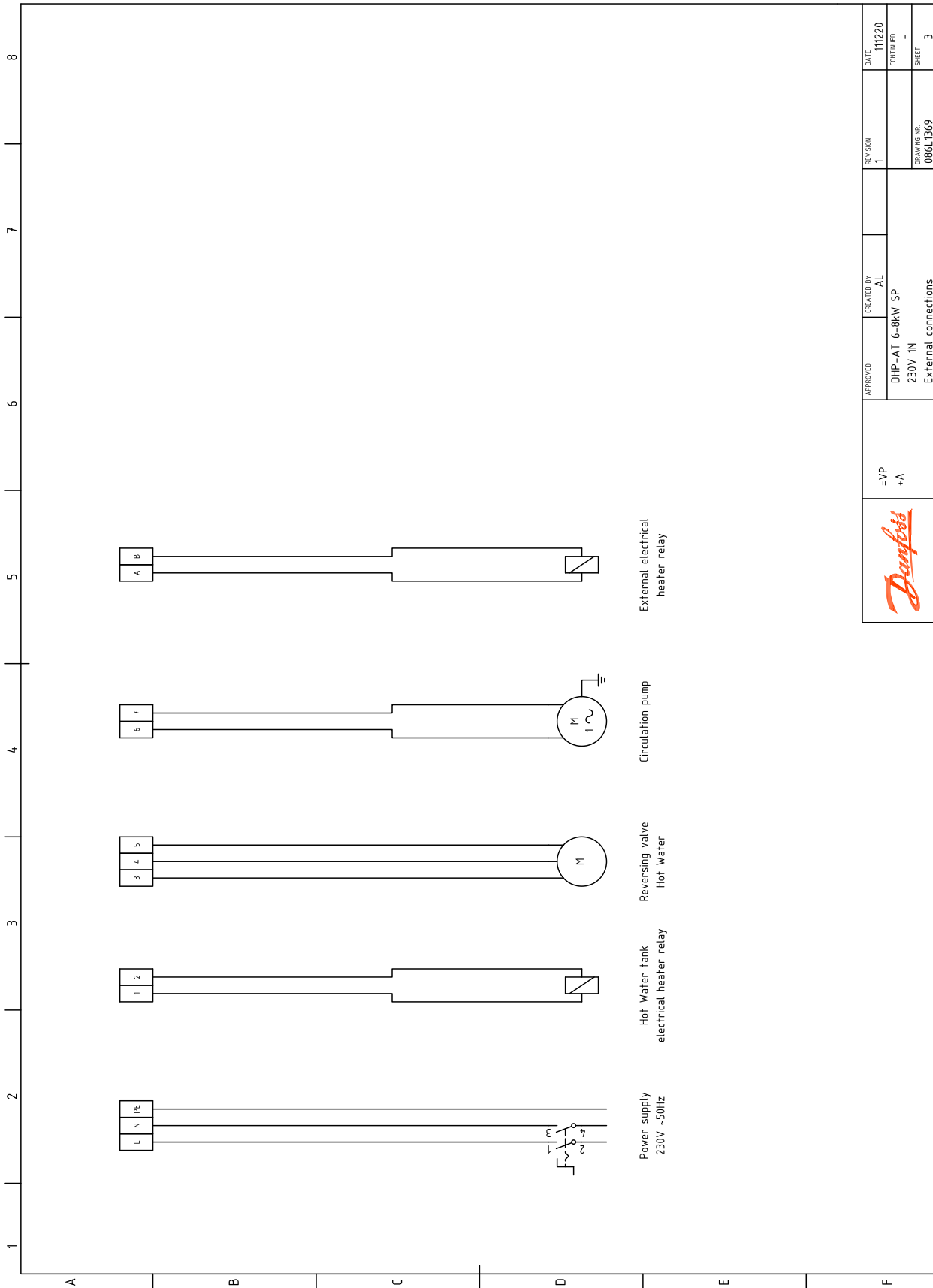


APPROVED	CREATED BY	REVISION	DATE
DHP-AT 6-8kW SP 230V 1N Circuit diagram	AL	1	11/20
			CONTINUED
			2
			SHEET
			1



DATE	111220
	CONFIRMED
REVISION	1
	DRAWING NR. 086L1369
APPROVED	DHP-AT 6-8kW SP 230V 1N Circuit diagram
CREATED BY	AL
=VP +A	
DATE	111220
CONFIRMED	3
SHEET	2

13 Connection diagram



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