CHS01 2150EN
17 December 2021

Installation and operation manual
ChillHeat S 180 – S 2000

Read these instructions carefully before installation, use, or maintenance

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1 Introduction

1.1 Safety precautions

Read these instructions carefully before installation, commissioning, operation or maintenance of the device. The given instructions must be followed. Throughout this manual, the following three symbols are used to point out very important information:

	Be careful. The DANGER symbol indicates a possible danger of bodily harm or lethal injury.
	Pay attention. The CAUTION sign indicates a possible danger of damage to the device, components or surroundings.
! Note	Note indicates tips, hints, and other essential information.

Keep these instructions as well as the electrical diagrams available near the device.

Oilon products are manufactured according to general product standards and directives, and based on our best knowledge about product design, and technologies. Operation safety is one of the leading principles in our product development. However, it is wise to be prepared, and think about safety. Read the following principal safety warnings and instructions:

	Installation, commissioning, or service of the appliance is to be carried out by a service provider authorized by Oilon, adhering to all local regulations and requirements.
	IN CASE OF FIRE OR OTHER EMERGENCY • Turn off power from the main switch. • Follow safety instructions. • Contact the safety supervisor.
	Connectors in control box are under voltage. Only authorized users may open safety cover.

	This device is not intended for use by children under 9 years of age or persons whose physical, perceptual or mental qualities are lowered, or those who have no experience or knowledge in the device‘s use, unless they do so under supervision or after receiving appropriate training from the person responsible for device-related safety. Children may not clean the device or perform any maintenance tasks without supervision. Children should be supervised to make sure that they do not play with the device.
	Wear proper hearing protection and personal protective equipment, such as protective footwear, gloves, and safety goggles when necessary.
	Installation may involve hot work, such as welding. Hot work may only be performed by authorized and trained personnel, adhering to all local regulations and requirements.
	Do not touch hot pipes or surfaces during operation or maintenance.
	Make sure that potential pressurized discharge from refrigerant circuit’s pressure relief valves does not cause danger to people or property.
	Do not mix the refrigerant with air above atmospheric pressure for leak testing or any other purpose.
	To avoid slipping, keep floor surfaces dry, and seal off or report any leaks that you detect.
	The heat pump can be loud when in operation. Wear hearing protection in the vicinity of the heat pump.
	The heat pump contains lubricating oil that may cause irritation.

Refrigerant safety notice

The refrigerants used in Oilon heat pumps are in normal working conditions non-toxic and non-flammable. Read the following information always before starting any work on the appliance. Follow the instructions and take care of preventive safety measures. For more detailed information, see the Material Safety Data Sheet of the refrigerant manufacturer.

Data	Description
Product name	R134A R410A R450A R513A R1234ze
Composition, R-134A Composition, R-410A	Tetrafluoroethane Difluoromethane Pentafluoroethane
Appearance	Clear, colorless liquid and vapor
Physical state	Gas at typical ambient temperatures
Classifications	• ANSI/ASHRAE 34 Safety Group – R-1234ze: A2L • HMIS Classification: Health – 1, Flammability – 1, Reactivity – 0 • NFPA Classification: Health – 2, Flammability – 1, Reactivity – 0 • US DOT HAZARD CLASS 2.2 • Canada – Listed on DSL • R-134A: EU – EINECS # 2065578 – HFC-125 • R-410A: EU - EINECS # 223770 • R-1234ze: A2L
Emergency overview	Colorless, volatile liquid with ethereal and faint sweetish odor. Non-flammable material. Overexposure may cause dizziness and loss of concentration. At higher levels, CNS depression and cardiac arrhythmia may result from exposure. Vapors displace air and can cause asphyxiation in confined spaces. At higher temperatures, (> 250 °C, 482 °F), decomposition products may include Hydrofluoric Acid (HF) and carbonyl halides.

Potential health hazards	First aid measures
SKIN Irritation would result from a defatting action on tissue. Liquid contact could cause frostbite.	Promptly flush skin with water until all chemical is removed. If there is evidence of frostbite, bathe with lukewarm water. Do not use hot water, and do not rub. If water is not available, cover with a clean, soft cloth or similar covering. Get medical attention if symptoms persist. Treatment of overexposure should be directed at the control of symptoms and the clinical conditions.
EYES Liquid contact can cause severe irritation and frostbite. Mist may cause irritation.	Immediately flush eyes with large amounts of water for at least 15 minutes. In case of frostbite, water should be lukewarm, not hot. Lift eyelids occasionally to facilitate irrigation. Get medical attention if symptoms persist.
INHALATION The refrigerant is low in acute toxicity in animals. When oxygen levels in air are reduced to 12–14% by displacement, symptoms of asphyxiation, loss of coordination, increased pulse rate and deeper respiration will occur. At high levels, cardiac arrhythmia may occur.	Immediately remove to fresh air. If breathing has stopped, give artificial respiration. Use oxygen as required, provided a qualified operator is available. Get medical attention immediately. DO NOT give epinephrine (adrenaline).
INGESTION Ingestion is unlikely because of the low boiling point of the material. Should it occur, discomfort in the gastrointestinal tract from rapid evaporation of the material and consequent evolution of gas would result. Some effects of inhalation and skin exposure would be expected.	Ingestion is unlikely because of the physical properties and is not expected to be hazardous. DO NOT induce vomiting unless instructed to do so by a physician.
DELAYED EFFECTS None known	Not applicable

Flammable properties	Fire fighting measures
Material itself is not flammable. Its autoignition temperature is 750 °C, 1,382 °F.	
UNUSUAL FIRE AND EXPLOSION HAZARDS The refrigerant is not flammable at ambient temperatures and atmospheric pressure. However, this material will become combustible when mixed with air under pressure and exposed to strong ignition sources. Contact with certain reactive metals may result in formation of explosive or exothermic reactions under specific conditions (for example very high temperatures and/or appropriate pressures).	SPECIAL FIRE FIGHTING PRECAUTIONS AND INSTRUCTIONS: Firefighters should wear self-contained, NIOSH-approved breathing apparatus for protection against possible toxic decomposition products. Proper eye and skin protection should be provided. Use water spray to keep fire-exposed containers cool.

Exposure controls, personal protection, and accidental release measures

Type	Preventive measures
GENERAL	Always wear recommended personal protective equipment. Where contact with liquid is likely, such as in a spill or leak, impervious boots and clothing should be worn.
ENGINEERING CONTROLS	Provide local ventilation at filling zones and areas where leakage is probable. Mechanical (general) ventilation may be adequate for other operating and storage areas. Equip the installation site with any gas alarms and/or gas protection required by local rules and regulations.
PERSONAL PROTECTIVE EQUIPMENT	SKIN PROTECTION: General work clothing and gloves (leather) should provide adequate protection. If prolonged contact with liquid or gas is anticipated, insulated gloves constructed of PVA, neoprene or butyl rubber should be used. Any contaminated clothing should be promptly removed and washed before reuse.
	EYE PROTECTION: or normal conditions, wear safety glasses. Where there is reasonable probability of liquid contact, wear chemical safety goggles.
DISPOSAL CONSIDERATIONS	Not a hazardous waste WARNING: DO NOT vent to the atmosphere. To comply with provisions of the U.S. Clean Air Act, any residual must be recovered. Contains greenhouse gas which may contribute to global warming.

The refrigerant should not be mixed with air above atmospheric pressure for leak testing or any other purpose.

IN CASE OF A SPILL OR OTHER RELEASE

- Always wear recommended personal protective equipment.
- Evacuate unprotected personnel.
- Protected personnel should remove ignition sources and shut off leak, if without risk, and provide ventilation.
- Unprotected personnel should not return until air has been tested and determined safe, including low-lying areas.
- Spills and releases may have to be reported to federal and/or local authorities.
  - Regarding reporting requirements refer to the Material Safety Data Sheet of the refrigerant manufacturer.

1.2 Transportation and storage

The heat pump is top-heavy and may tip over if not handled properly.

Transport and store the heat pump in a vertical position.

Be careful when lifting the heat pump. Use appropriate lifting tools.

Preparations for storage, transfer, and lifting

1. Check that the way is free from obstacles.
2. Use appropriate vehicle for transport.
3. At installation site check that you have proper means and resources for lifting and placing the pump.

Storage

Before transporting to the final installation site and commissioning phase, the heat pump must not be stored longer than needed. If the heat pump must be stored longer than one month, the manufacturer must be informed. The heat pump must be stored in a dry place where the temperature is at least +5 °C.

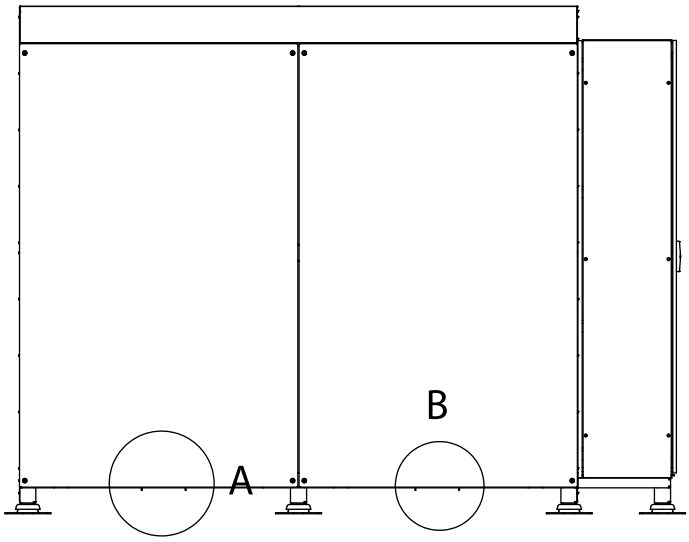
Transfer (models S, RE, P 220 - 450)

- Move the heat pump with a forklift or two pallet jacks.
- Keep the heat pump in a vertical position.
- When using pallet jacks, place one on each side of the pump.

Lifting

S 180 - S 580:

There are welded lifting supports in the pump frame, see illustration.



Lifting brackets ver. 1

A and B, lifting supports

Use a forklift or a pallet jack to lift the heat pump as indicated by the labels and markings on the device.

CAUTION	Do not transfer or lift the heat pump without any housing covers.

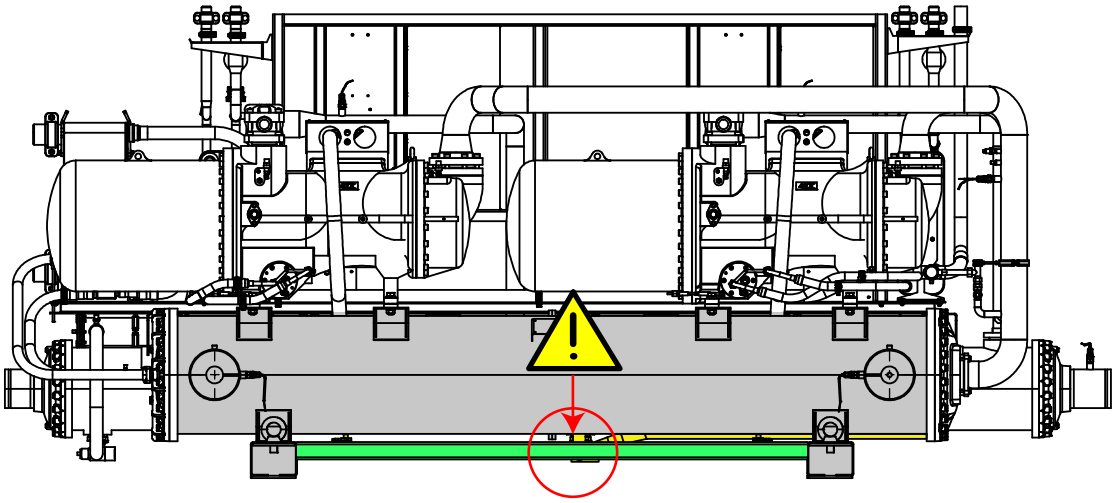
S 600 - S 2000:

Transferring the unit

DANGER!

Be careful not to damage the valves and pipes under the heat exchanger, see the figure above.

Lift the heat pump from the beams running along the length of the heat pump (marked in green in the figure below). Use a forklift or two pallet jacks to lift the heat pump as indicated by the labels and markings on the device.



Lifting S 600 - S 2000 ver. 1

Lifting the unit for transport

When lifting the unit onto a vehicle for transport, use the lifting lugs attached to the support frame under the unit, see the figure.

Hoisting S 600 - S 2000 ver. 2

Use a cruciform (cross-shaped) lifting beam for lifting the unit, see the figure below. This way the lifting straps or chains can be placed so that they cannot damage the equipment.

Crufiform lifting beam ver. 1

In some heat pumps, the bottom support frame is not wide enough for the lifting lugs to extend far enough from the sides of the unit. If this is the case, the unit will be delivered with an additional lifting support (beam) bolted onto the frame. This will provide sufficient clearance for lifting the unit without harming the equipment. The support can be removed after use.

CAUTION	If the delivery includes an additional lifting support, hoisting the unit without the support is not allowed. Doing so will cause damage to the equipment during lifting.

CAUTION	The lifting support is not intended for use in any other lifting applications or in continuous use.

1.3 Delivery content, optional equipment and accessories

Standard delivery content

A standard heat pump delivery includes the following:

- heat pump
- 1 flow switch with cable
- installation and operation manual, electrical drawings
- installation, commissioning and warranty records
- maintenance sheets
- PI-diagram or flow diagram for the pipe connections
- preliminary work form for commissioning.

1.4 Decommissioning

Heat pump systems must be decommissioned in accordance with applicable laws and regulations. Heat pumps include materials and substances that require special care, including:

- Refrigerant
- Oil
- Electrical components
- Batteries
- Other materials

The specific considerations for each substance or material are described in the following sub-sections.

Refrigerant
Depending on the model, the heat pump includes one of the refrigerants listed in table below.

Refrigerant	Details
R134a	Norfluorane / 1,1,1,2-Tetrafluoroethane
R1234ze(E)	trans-1,3,3,3-tetrafluoropropene
R513A	mix of R1234yf and R134a

Refrigerant	Details
R450A	mix of R1234ze and R134a
R410a	mix of difluoromethane and pentafluoroethane
R1233zd	Trans-1-chloro-3,3,3-trifluoropropene

Refrigerants should be recycled, or disposed if recycling is not possible, by a service provider duly authorized to do so pursuant to local laws and regulations. Depending on the refrigerant type, refrigerants can be flammable, toxic, or both. In addition, certain refrigerants have a high global warming potential (GWP) if released into the atmosphere.

Oil

Waste oil should be delivered to a service provider with the means for processing such materials in accordance with laws and regulations. Use appropriate precautions to prevent the oil for leaking or ending up in the environment.

Electrical components

Heat pumps include a wide range of electrical components, such as digital devices, electric circuits, sensors, and a variable frequency drive. Any such items should be handled and disposed of as indicated in the instructions given by their manufacturer or in accordance with local laws and regulations.

Batteries

Batteries can be hazardous for the environment. Consequently, if the heat pump includes an electronic device with an internal battery, the battery must be appropriately disposed of.

Other materials

In addition to the above, heat pumps have several components that are made of metals and plastics. If possible, any such components should be recycled, and if recycling is not an option, disposed of in accordance with local laws and regulations.

2 Technical data

2.1 Heat pump technical data

Dimensions and weight

Measurements without cover and extra feet	S 180	S 280	S 380	S 490	S 580	S 600
Height (mm)	2091	2091	2091	2091	2091	1900
Width (mm)	2876	2876	2876	2876	2876	4700
Depth (mm)	911	911	911	911	911	1000
Weight (kg)	2300	2900	3600	4000	4500	3200

Measurements without cover and extra feet	S 800	S 1000	S 1200	S 1500	S 2000
Height (mm)	1900	2100	2100	2190	2190
Width (mm)	4700	4700	4700	5500	5500
Depth (mm)	1000	1100	1100	1600	1600
Weight (kg)	4000	4500	5300	6500	7500

Connections

For information on pipe connections, see connection diagrams delivered with the heat pump.

	S 180	S 280	S 380	S 490	S 580	S 600
Electrical connections	3 L / PE / 400 VAC 50 Hz, ask for other alternatives					
Fuse size (A)	250	355	400	500	630	2x3x400
Protection degree, control cabinet	IP44					

	S 800	S 1000	S 1200	S 1500	S 2000
Electrical connections	3 L / PE / 400 VAC 50 Hz, ask for other alternatives				
Fuse size (A)	2x3x400	2x3x630	2x3x630	2x3x800	2x3x1000
Protection degree, control cabinet	IP44				

Refrigerant circuit

> **!** Note
>
> The refrigerant charge values presented here are baseline values. The actual refrigerant charge depends on the heat pump exchanger option, other accessories, and the local conditions.
> Always check the exact refrigerant charge from the heat pump's type plate.

	S 180	S 280	S 380	S 490	S 580	S 600
Refrigerant	R134A	R134A	R134A	R134A	R134A	R134A
Refrigerant charge (kg)	34	55	77	90	96	2 x 75

	S 800	S 1000	S 1200	S 1500	S 2000
Refrigerant	R134A	R134A	R134A	R134A	R134A
Refrigerant charge (kg)	2 x 100	2 x 135	2 x 170	2 x 240	2 x 350

Water or brine circuits: Minimum water/brine outlet temperature from the evaporator: –15 °C. Maximum water/brine inlet temperature to the evaporator: +50 °C.

Process water quality requirements for shell and tube heat exchangers

For quality requirements concerning process water as well as general instructions for shell and tube heat exchangers, refer to technical bulletin 0006 (TB-00006-External_ENG).

3 Installation

3.1 Installation site requirements

	Installation, commissioning, or service of the appliance is to be carried out by a service provider authorized by Oilon, adhering to all local regulations and requirements.
	Do not install the heat pump in an explosive environment.
	Install the heat pump in a location that is not accessible to the general public.
	The heat pump housing must be kept closed at all times. Only under maintenance and service occasions, to access the internal components, the heat pump housing can be opened.
	The heat pump must not be installed on flammable material.
	Follow local construction rules and regulations when installing the heat pump.

General site requirements:

- The installation site must have a sufficient structural capacity.
- The installation site must have a floor drain.
- Select the installation site so that noise and vibration from the apparatus causes no danger or discomfort to building users.
- For models with ON–OFF control, the maximum ambient operating temperature is +40 °C.
- For models equipped with variable frequency drives, the maximum ambient operating temperature is +30 °C. If the temperature is higher, separate ventilation must be arranged for the VFD units.
- The minimum ambient operating temperature is +10 °C.
- The heat pump must be installed on an completely level and even surface.
- Each of the heat pump's feet must be firmly placed on the floor, and the load must be evenly distributed on the feet.

- The heat pump must be properly protected from the rain and direct sunlight.
- The machine room needs to be properly lit and ventilated. Escape and access routes must be unobstructed and the site must have working emergency lighting.
- The maximum altitude for the installation site is 5,000 m.

Refrigerant circuit site requirements

Refrigerant circuits are equipped with pressure relief valves. In fault situations they will discharge any excess pressure in the circuits.

Make sure that potential pressurized discharge from refrigerant circuit's pressure relief valves does not cause danger to people or property.

Refrigerant circuit safety valves

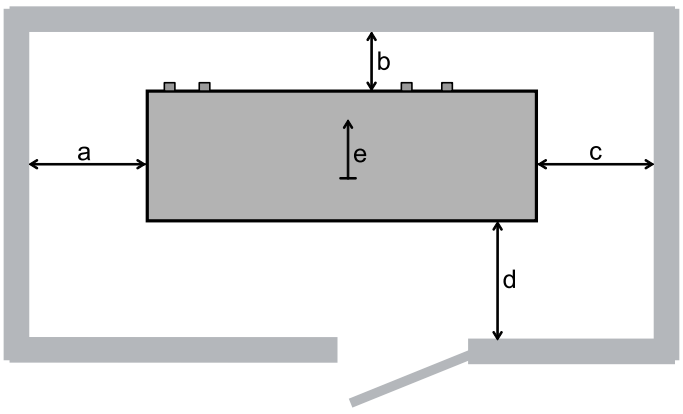
It is recommended to draw the safety valves' blow-off pipes to outside the building in a location wher a refrigerant discharge does not pose a risk. Also check the requirements of local standards, laws, and other regulations concerning blow-off pipe locations.

The blow-off pipe must be approximately 5 meters long (measured from the valve's blow-off port). If the pipe length exceeds 5 meters, calculate the diameter of the blow-off pipe according to standard EN 13136.

Space requirements

For installation, operating and maintenance purposes, leave enough space on each side of the heat pump. The minimum space requirements are listed in the following.

By default, the control cabinet is attached to the right side of the heat pump. On request, the control cabinet can be moved to the left side of the heat pump.

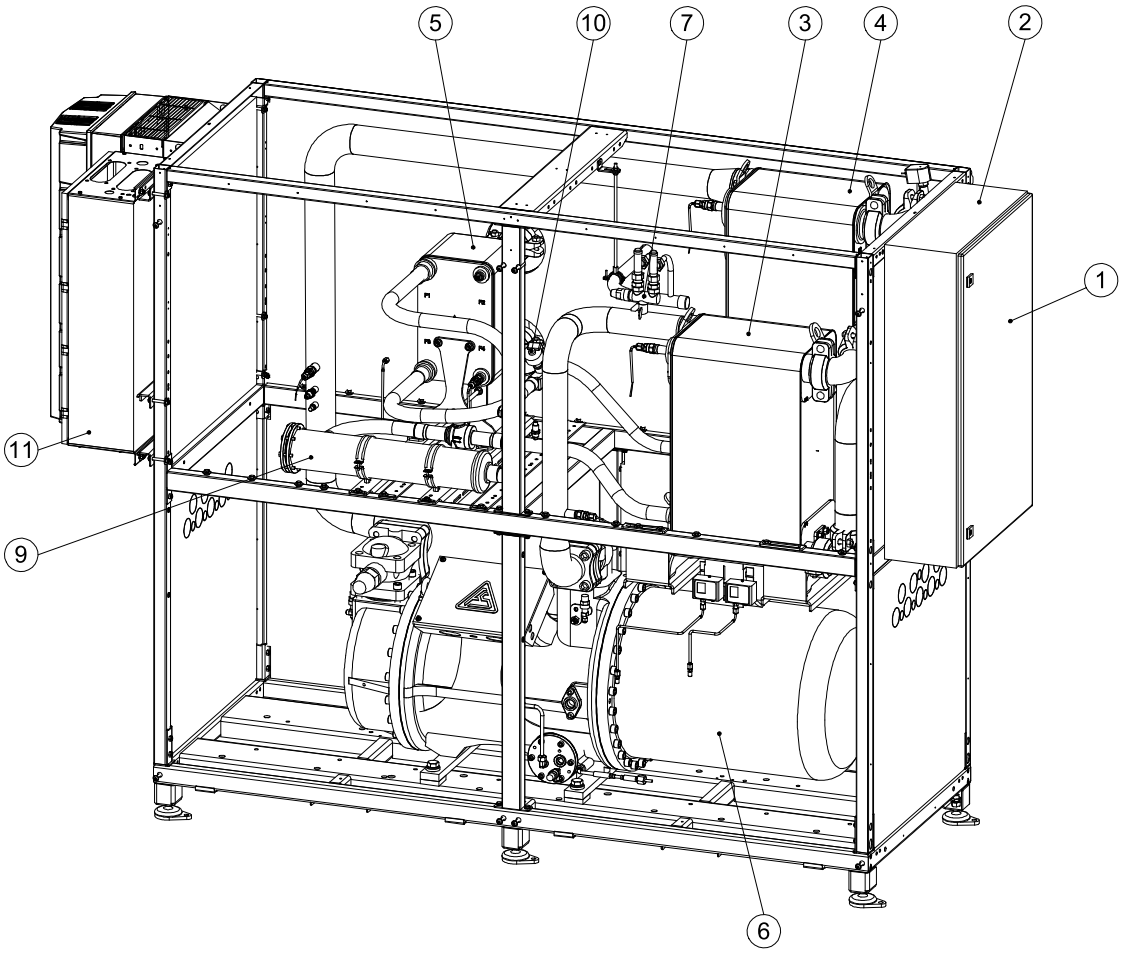


Space requirements ver. 1

Legend	mm
a (left)	800
b (back)	400
c (right)	800
d (front)	800
e (top)	400

3.2 Main parts

S 180 – S 580 main parts

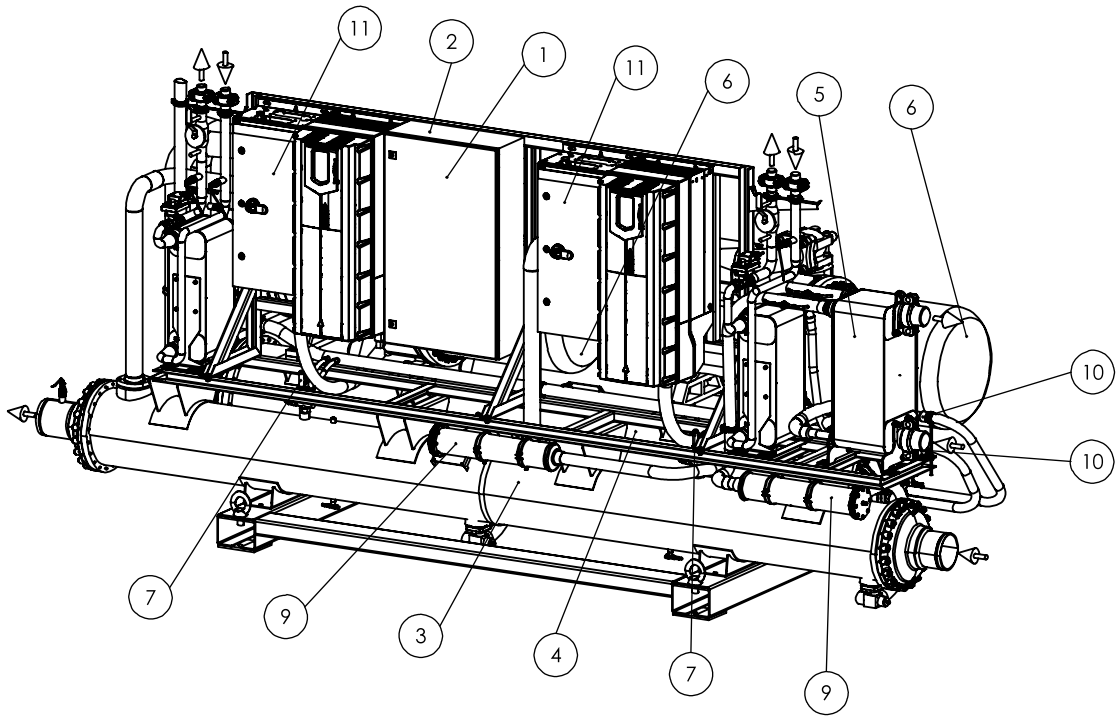


d068643 ver. 1

> **Note** The assembly may vary depending on the scope of delivery.

Pos.	Part	Pos.	Part
1	Control panel	7	Double safety relief valve with changeover valve
2	Control cabin	9	Filter drier
3	Condenser	10	Expansion valve
4	Evaporator	11	Main switch and either variable frequency drive, star-delta starter or soft starter
5	Subcooler		
6	Compressor		

S 600 – S 2000 main parts



D080678 ver. 1

> **Note** The assembly may vary depending on the scope of delivery.

Pos.	Part	Pos.	Part
1	Control panel	7	Double safety relief valve with changeover valve
2	Control cabin	9	Filter drier
3	Condenser	10	Expansion valve
4	Evaporator	11	Main switch and either variable frequency drive, star-delta starter or soft starter
5	Subcooler		
6	Compressor		

3.3 System design and sizing the heat pump

Heat pump or pumps must be selected and configured based on the actual capacity required and the operating conditions specific to the site. These parameters are specified by the customer.

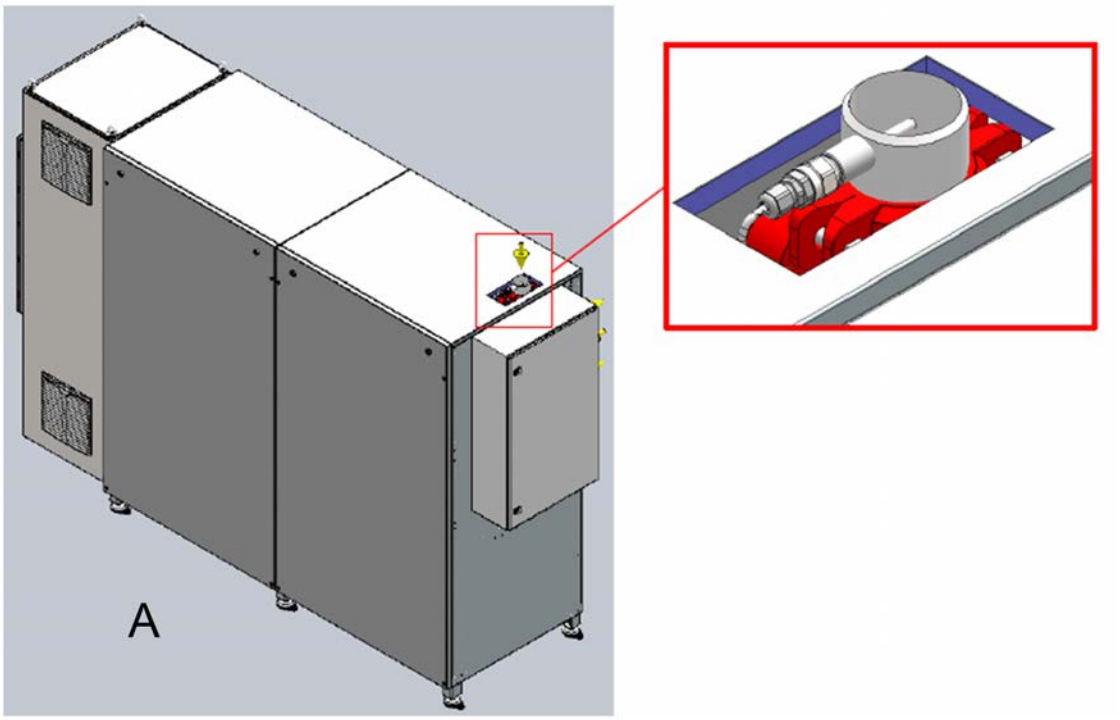
If there is a change in operating conditions, the original heat pump settings are no longer valid and need to be checked.

3.4 Connections and dimensions

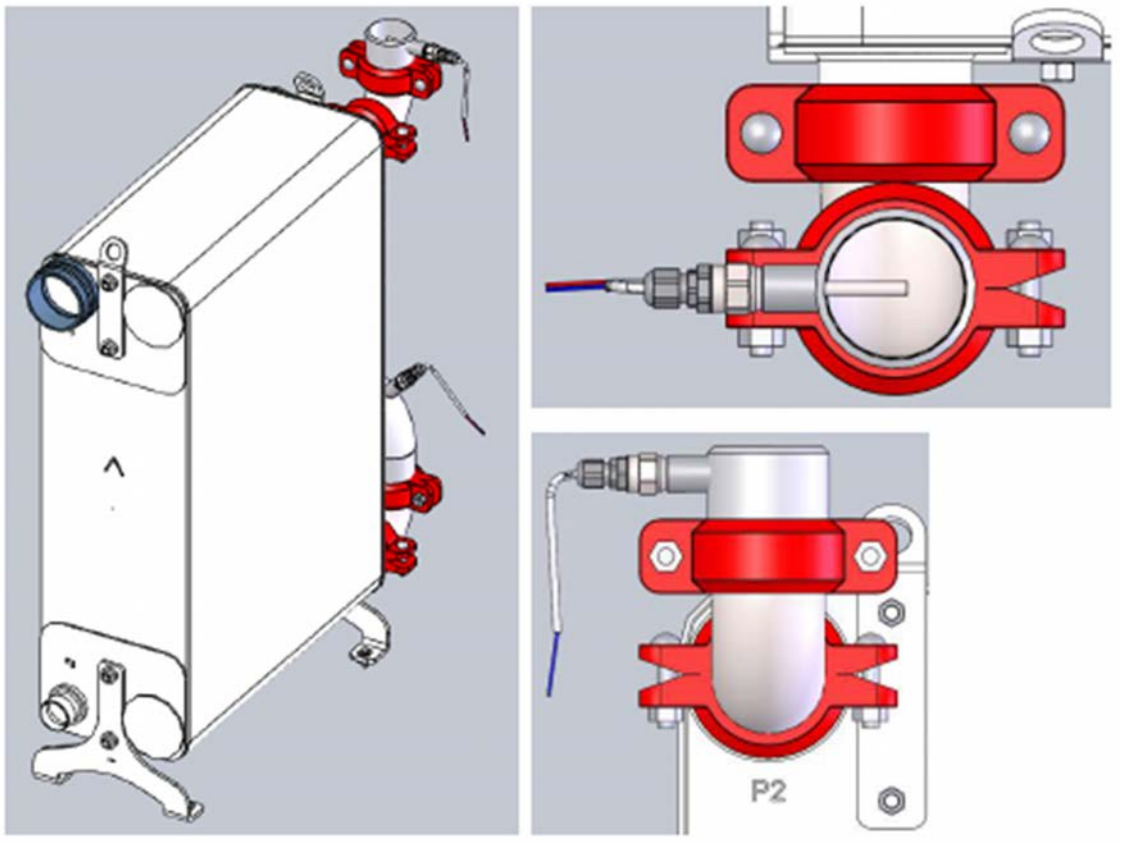
For information on connection positions and sizes, refer to the diagrams delivered with the unit.

3.5 S380 HC+, S490 HC, S490 HC+ and S580 HC evaporator inlet temperature sensor

The evaporator fluid inlet temperature sensor used in heat pump models S380 HC+, S490 HC, S490 HC+, and S580 HC is delivered loose. A Victaulic pipe fitting is also included. Align the Victaulic fitting so that the temperature sensor coupling is directed towards the service side of the heat pump as shown on the pictures 1 and 2 below. The temperature sensor must be attached to the provided Victaulic pipe fitting as shown in pictures 1 and 2 below.



HP service side ver. 1

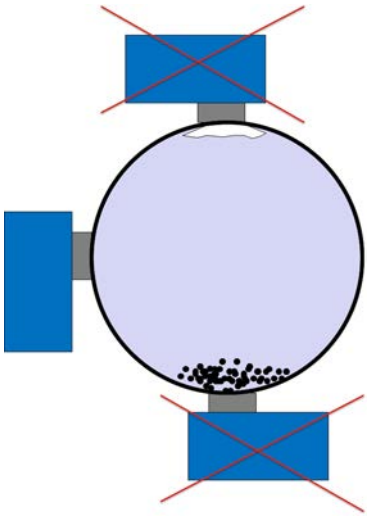


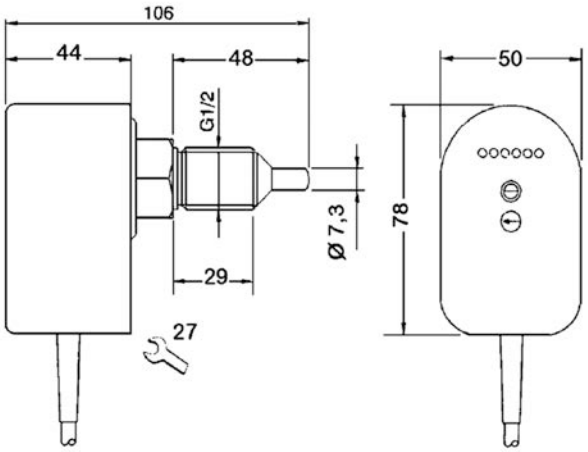
HP sensor installation ver. 1

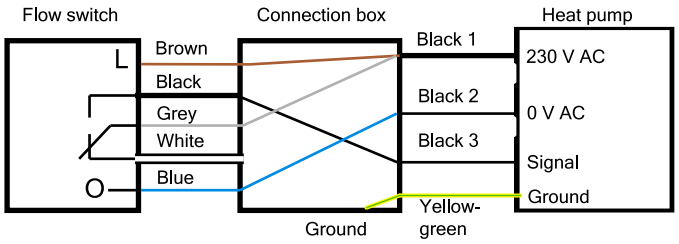
3.6 Installing flow switch

- Install the flow switch in the inlet pipe on the cold side.
- Make sure that there is a straight section of pipe before the flow switch (minimum length: 4 x pipe diameter).
- Place the switch on the side of the pipe, not on the bottom due to dirt, nor on the top due to air.
- Install the flow switch in a G1/2 sleeve (max. length: 29 mm).
- For electrical connections, refer to the heat pump's wiring diagrams.
- Water flow adjustment range: 1–150 cm/s, adjust according to the minimum flow of the site.
- With normal flow rates, all green LEDs should be active.
- Alarm delay adjustment range: 1–40 s. Adjust to minimum (~1 s).

Electrical connection 230 VAC. Note that the white wire has to be insulated.







3.7 Flow diagrams

Examples of flow diagrams

DANGER!	Appliance installation is to be carried out by authorized and trained personnel only.

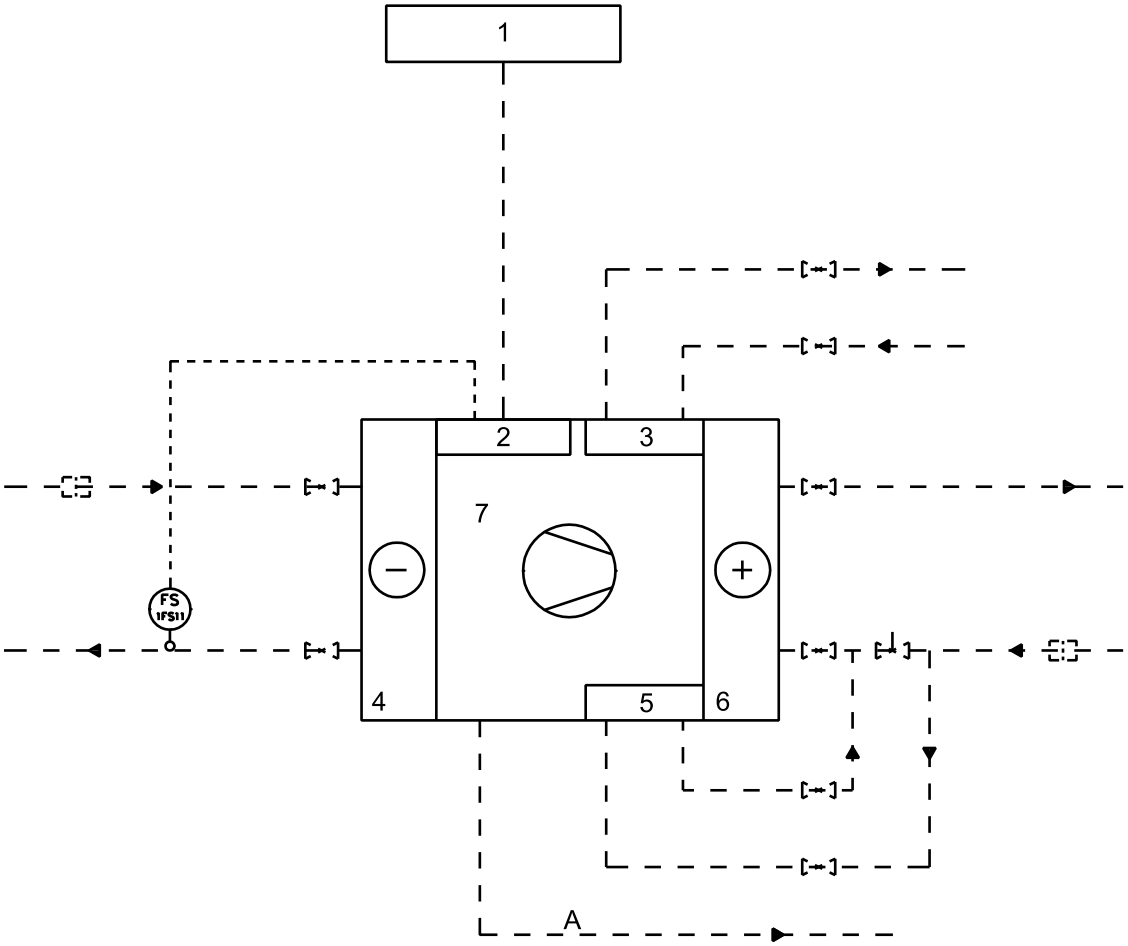
DANGER!	Before performing any work on pressurized components, make sure that the system is depressurized.

! Note	The following flow diagrams are only examples of various connection principles. Always check the final connections from the diagrams delivered with the heat pump.

Legend

A	Safety valve blow-off pipe (to outside the building)
- – – – -	Customer delivery scope
- - - - - - - - -	Oilon delivery scope
	Recommended to use a filter.
	Balancing valve, in customer delivery scope

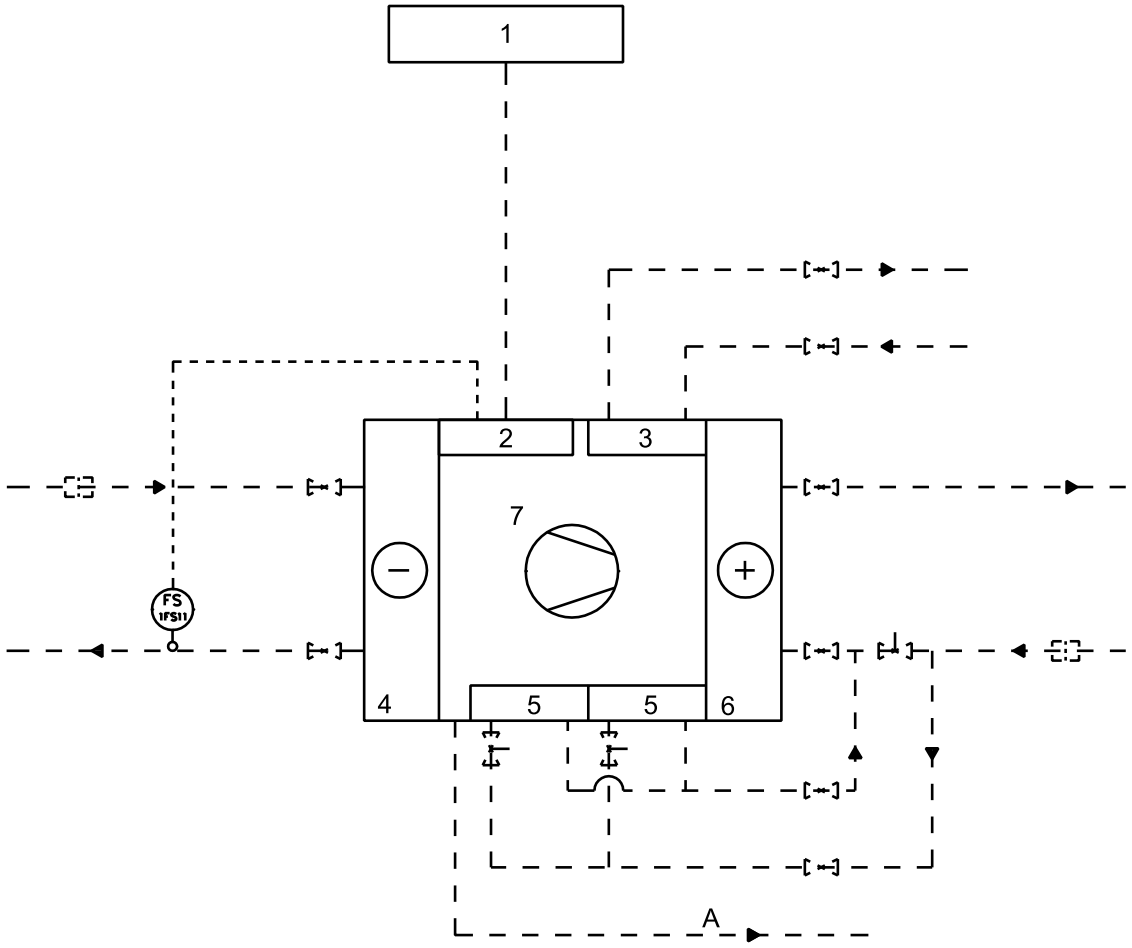
One heat pump with one refrigerant circuit



Flow diagram example 1xHP 1xref circuits ver. 2

Position	Description
1	Customer LV. switchgear
2	Control cabinet
3	Desuperheater
4	Evaporator
5	Subcooler
6	Condenser
7	Compressor
1FS11	Flow switch

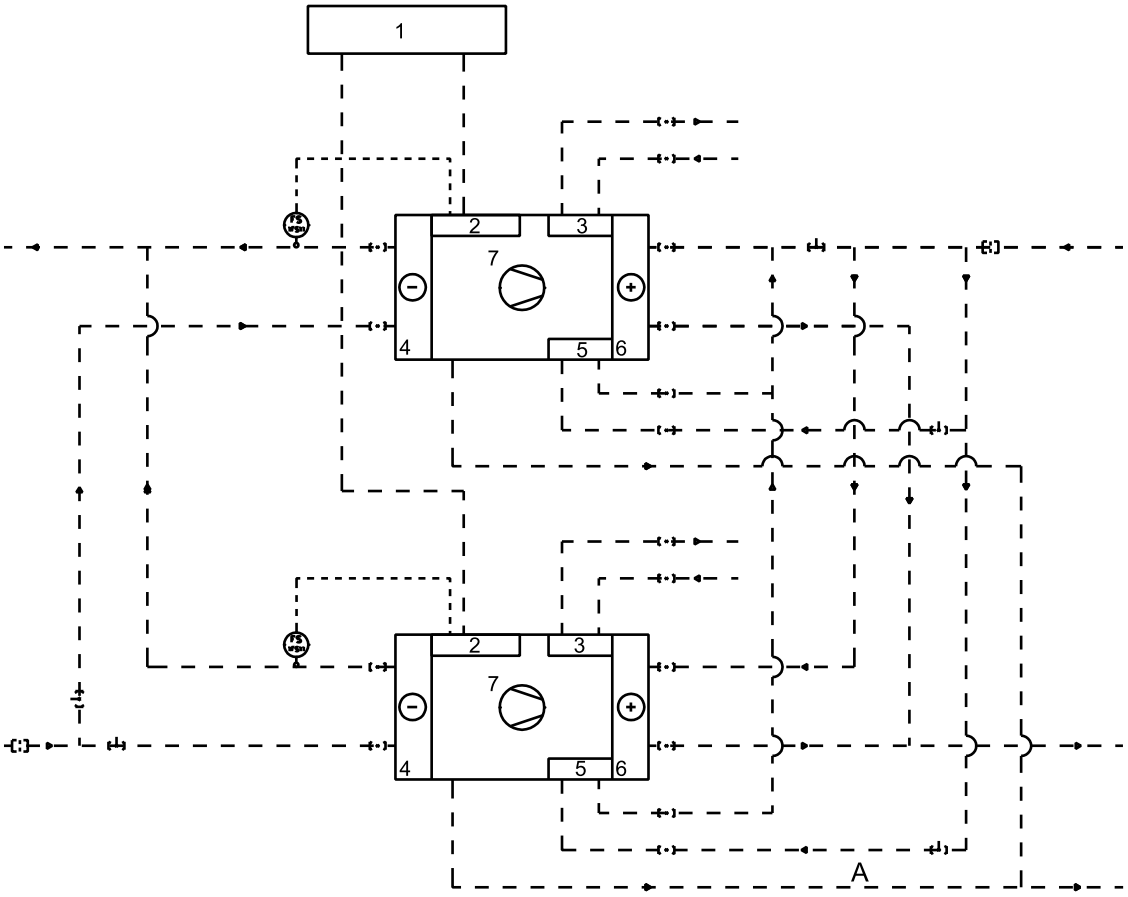
One heat pump with two refrigerant circuits



Flow diagram example 1xHP 2xref circuits ver. 1

Position	Description
1	Customer LV. switchgear
2	Control cabinet
3	Desuperheater
4	Evaporator
5	Subcooler
6	Condenser
7	Compressor
1FS11	Flow switch

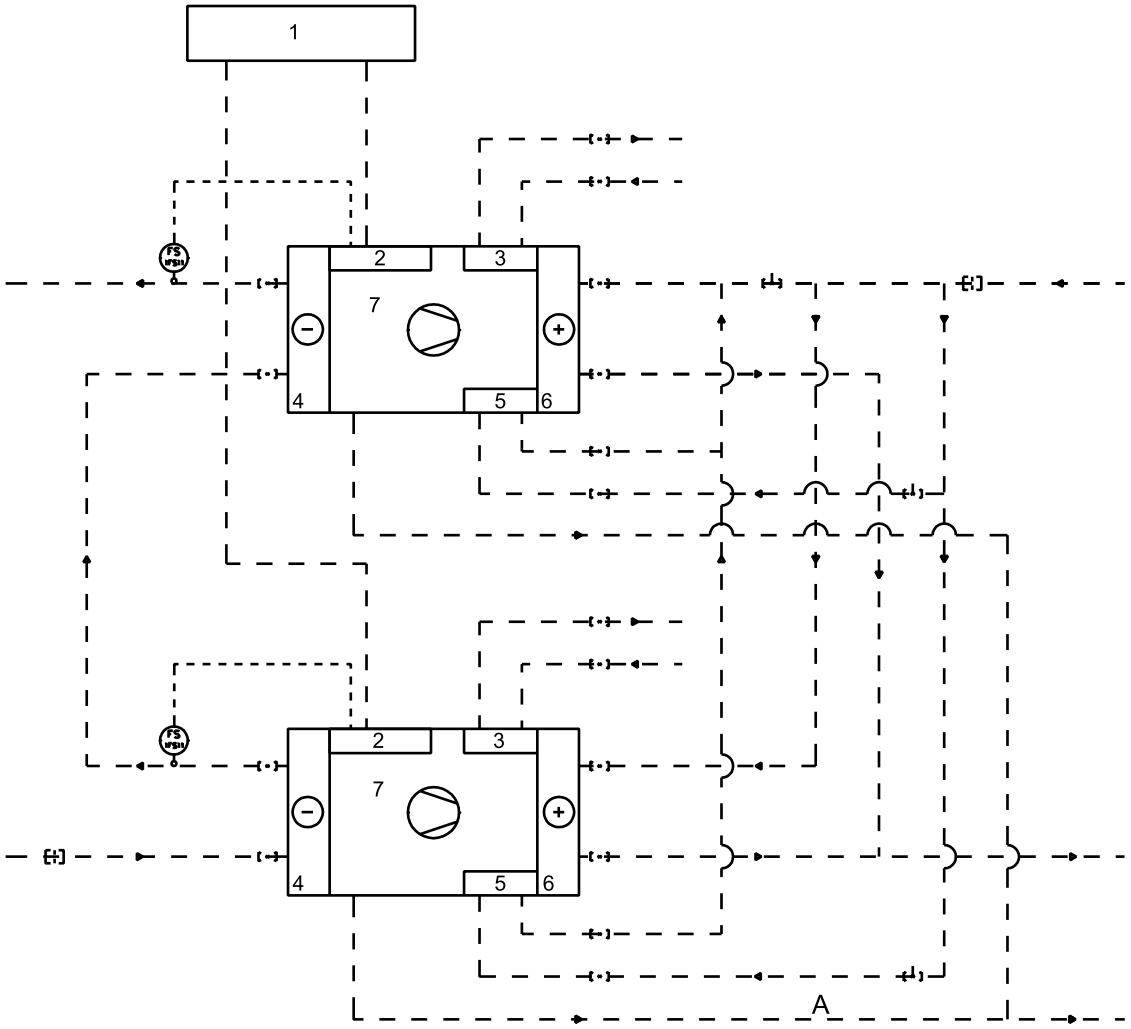
Two heat pumps, evaporators in parallel, and condensers in parallel



Flow diagram example 2xHP con_p eva_p ver. 2

Position	Description
1	Customer LV. switchgear
2	Control cabinet
3	Desuperheater
4	Evaporator
5	Subcooler
6	Condenser
7	Compressor
1FS11	Flow switch

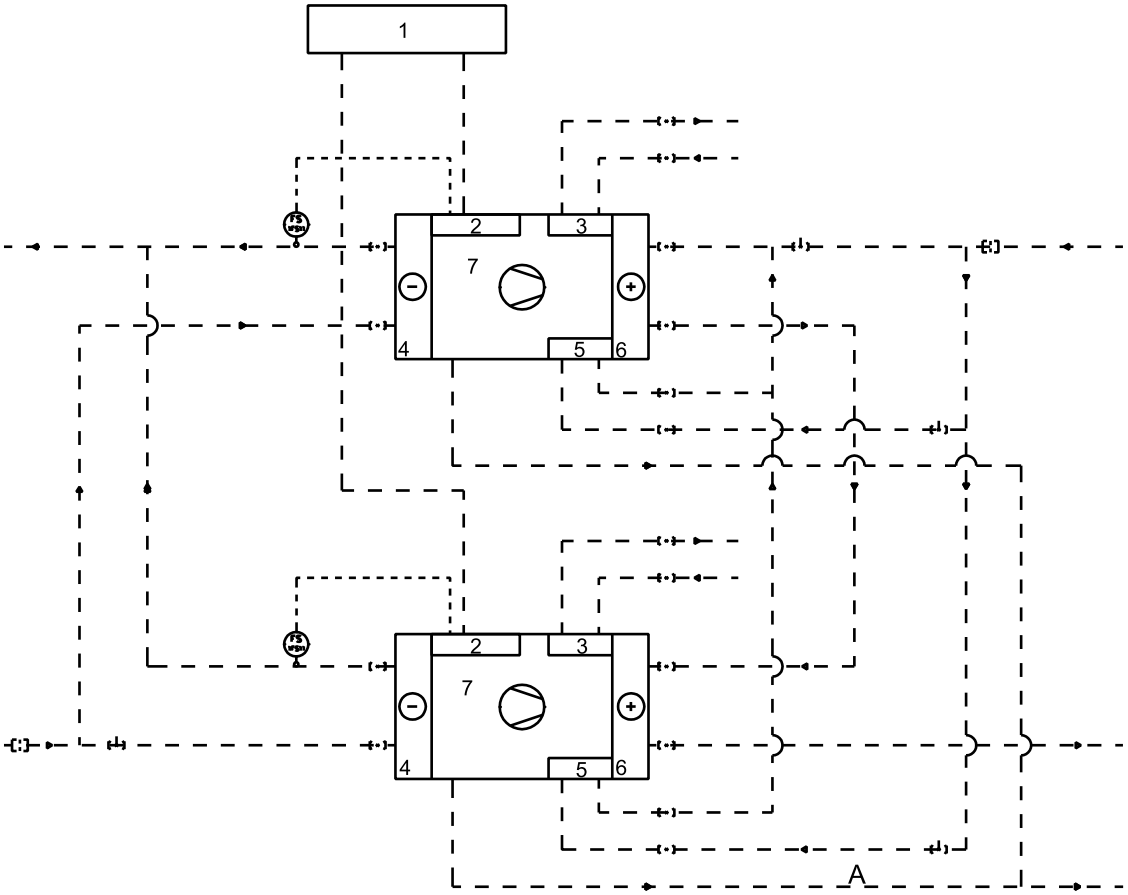
Two heat pumps, condensers in parallel, and evaporators in series



Flow diagram example 2xHP con_p eva_s ver. 2

Position	Description
1	Customer LV. switchgear
2	Control cabinet
3	Desuperheater
4	Evaporator
5	Subcooler
6	Condenser
7	Compressor
1FS11	Flow switch

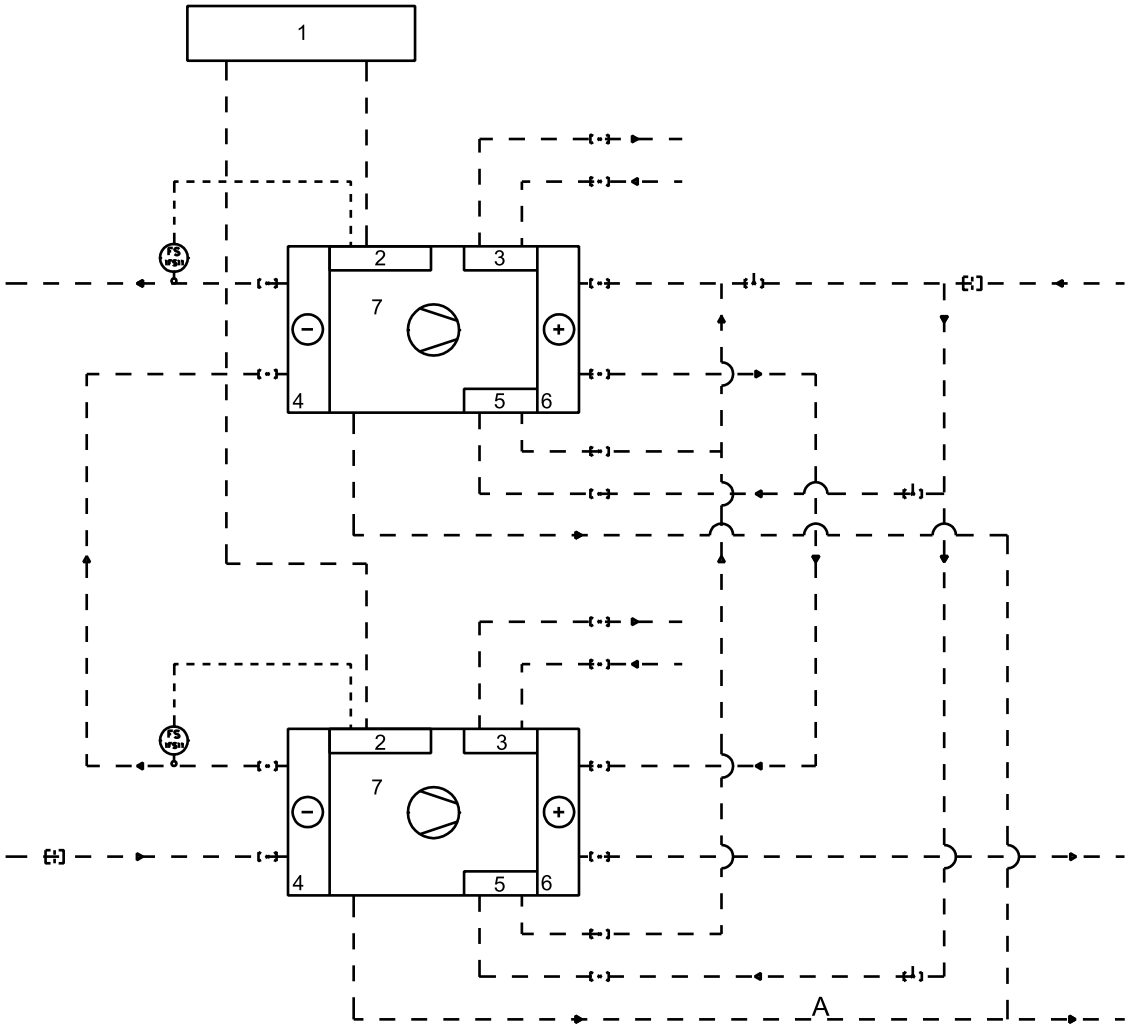
Two heat pumps, condensers in series, and evaporators in parallel



Flow diagram for 2xHP con_s eva_p ver. 2

Position	Description
1	Customer LV. switchgear
2	Control cabinet
3	Desuperheater
4	Evaporator
5	Subcooler
6	Condenser
7	Compressor
1FS11	Flow switch

Two heat pumps, evaporators in series, and condensers in series



Flow diagram f2xHP con_s eva_s ver. 2

Position	Description
1	Customer LV. switchgear
2	Control cabinet
3	Desuperheater
4	Evaporator
5	Subcooler
6	Condenser
7	Compressor
1FS11	Flow switch

! Note	The customer determines final pipe sizes.

! Note	Flow switch is in Oilon delivery scope, but customer takes care of installation.

3.8 Electrical connections

A general description of the needed electrical connections is given in this section. The actual connections should be made according to the wiring diagrams delivered with the heat pump.

Electrical installation is to be carried out by authorized and trained personnel only.

Before performing any work on electrical components, make sure that there is no voltage present.

Do not connect devices that draw over 2 A of current directly to the controller. Use a contactor instead.

Recommended cable sizes

Model	Cable size	Model	Cable size
S 180	2 x (3 x 95Cu/50Cu) 1 x (3 x 185Cu/70Cu)	S 800	2 x [2 x (3 x 120+PE Cu)]
S 280	2 x (3 x 120Cu/70Cu) 1 x (3 x 240Cu/95Cu)	S 1000	2 x [2 x (3 x 185+PE Cu)]
S 380	2 x (3 x 120Cu/70Cu) 1 x (3 x 240Cu/95Cu)	S 1200	2 x [2 x (3 x 185+PE Cu)]
S 490	2 x (3 x 150 Cu/70Cu)	S 1500	2 x [2 x (3 x 185+PE Cu)]
S 580	2 x (3 x 185+PE Cu)	S 2000	2 x [2 x (3 x 240+PE Cu)]
S 600	2 x [2 x (3 x 70+PE Cu)]		

Control voltage connection

The S series heat pumps require a separate control voltage connection along with the main power connection. The control voltage connection specifications are: Ölflex 100 3G1.5, 240VAC 50Hz 10A.

4 Commissioning

4.1 Prerequisites for commissioning

Installation, commissioning, or service of the appliance is to be carried out by a service provider authorized by Oilon, adhering to all local regulations and requirements.

Do not touch any liquid without protection. Contact with operating liquids may cause frostbite. Always immediately inform operating staff about leaks.

Before performing any work on components with hot surfaces, make sure that the component has cooled down.

The removable front panels of the heat pump are heavy and bulky. Use caution when detaching and lifting the panels.

The person commissioning the system must:
- have qualification and competence for installing high pressure devices
- have expert knowledge about heating and cooling systems
- be familiar with the heat pump control system

! Note — It is recommended that an Oilon expert performs commissioning.

Tasks to be completed before commissioning:
- Connect the electrical supply to the heat pump
- Fill and bleed the pipe lines
- Connect the feed cables and sensors
- Connect the safety valve blow-off pipe to outside air.
- Check the refrigerant level.
- Connect all pipes as indicated in the PI diagram or according to the instructions in section *Installation site requirements*.
- Check that the shut-off valve of the liquid line open.

Considerations for low ambient temperatures

To avoid freezing, protect liquid systems with insulation tap and trace heating cables and by using a suitable antifreeze. Ensure that the liquid circulates by keeping the pumps running. Insulate heat exchanger nozzles.

CAUTION

Do not start any circulation pumps before the circuits have been filled. Otherwise pump shaft seal gets damaged.

Note

Before commissioning, check that the shut-off valve of the liquid line is open.

4.2 Checking hot circuit

1. Check that condensers and subcoolers are correctly connected. Make sure that the flow direction is correct.
   Use the latest PI or flow diagram for reference.
2. Make sure that all transmitters in the hot water system are installed and connected.
3. Check that the component identification labels correspond to the PI diagram and component tag list.
   Mark off with green in the PI diagram.
4. Check that pressure relief valves have been installed in both condensers' and subcoolers' liquid circuits to prevent increasing pressure when trapped liquid is heated.
5. Check that all valves and other components displayed in the PI diagram have been correctly installed.
   Make sure that the valves can be operated at 0 – 100 %.
6. Check and note selected filter mesh size.
   The recommended mesh size is 0.8 mm in closed circuits, and 0.08 mm in open circuits.
7. Check that all threaded, flange, and/or welded connections to the heat pump are properly made and tightened.
8. Check the pipe insulation.
9. Make sure that all pipes are properly supported.
   Check that no stress is transferred to the heat exchanger connections of the heat pump.
10. Make sure that the pipes are vented.

4.3 Checking cold circuit

1. Check that the evaporators are correctly connected. Make sure that the flow direction is correct.
   Use the latest PI or flow diagram for reference.
2. Make sure that all transmitters in cold water system are installed and connected.
3. Check that the component identification labels correspond to the PI diagram and component tag list.
   Mark off with green in the PI diagram.
4. Check that all valves and other components displayed in the PI diagram have been correctly installed.
   Make sure that the valves can be operated at 0 – 100 %.
5. Check and note selected filter mesh size.
   The recommended mesh size is 0.8 mm in closed circuits, and 0.08 mm in open circuits.
6. Check that all threaded, flange, and/or welded connections to the heat pump are properly made and tightened.
7. Check the pipe insulation.
8. Make sure that all pipes are properly supported.

Check that no stress is transferred to the heat exchanger connections of the heat pump.

9. Start the circulation pump and adjust the possible flow switch limit to approximately 50 % of the nominal flow.
   If several heat pumps are connected, adjust the valves to achieve the specified flow distribution.
10. Make sure that the pipes are vented.

4.4 Checking safety valve blow-off pipe

1. Make sure that the blow-off pipe terminates outdoors. The opening at the end of the pipe must:
   - be located above the roof level
   - be located away from ventilation intake and exhaust vents
   - point downwards or be otherwise protected against water entering the pipe.
2. Check that the pipe is correctly sized.
3. Check that the pipe assembly is in accordance with local and national rules and regulations. Pay special attention to blow-off pipe size.
4. Make sure that condensate cannot enter the safety valves.
   It is recommended to place a drain valve in the lowest section of the pipe (below the pipe's connection at the heat pump).
5. Make sure that the blow-off pipe is properly supported.
   No stress must be transferred to the heat pump connections.

4.5 Checking refrigerant circuit

1. Make sure that nothing was damaged or loosened during transport.
2. Check screws and flange connections.
3. Check oil and refrigerant levels and make sure that there are no leaking connections.
   Use an electronic sniffer, but note that they usually react on all kinds of chemicals.
4. To ensure that no moisture is inside the system, check the sight glass.
   Green indicates a dry and healthy system.
5. Check the set pressures on the high and low pressure switches.

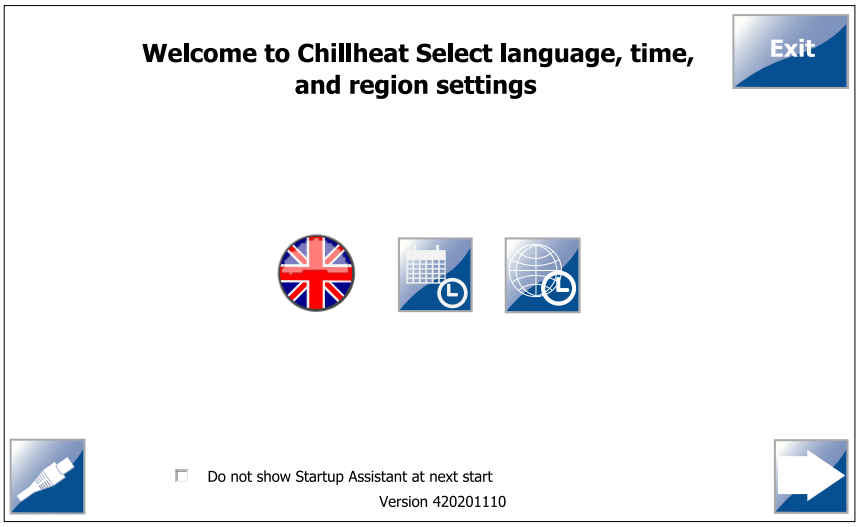
4.6 Checking electrical connections and the control cabinet

1. Turn all switches, fuses, and breakers into the **OFF** position.
   Secure breakers with adequate padlocks. This improves occupational safety and prevents unrelated personnel from accidentally switching the power on during work.
2. Refer to the electrical diagrams and visually inspect the electrical cabinets and connection cables.
3. To check that the cables are firmly connected, pull them randomly. Use a screwdriver to Check that the connections are properly secured.
   Verify that all components are correctly installed, tagged, and without damage.
   Mark any checked items with a green marker in the circuit diagram.
4. Check and retighten the compressor cables. Tightening torque: 40 Nm.
5. Check conductor protection circuit.
6. Verify the correct phase sequence of the electrical supply.
7. Check the power supply voltage, and compare to the measured values marked in the *Pre-commissioning certificate*.

8. Switch on the power.
9. Check the DC supply voltage.
10. Check the cooling fans and filters in the control cabinet. Check the variable frequency drives' fans and filters (if present). You can start the cooling fans by lowering the cabinet's internal temperature setpoint. Note down the original setting and reset after testing.
11. To start the cooling fan, change the temperature set point inside the cabinet. Reset and note down the initial setting.
12. Check that the communication interface is connected and correctly set up. Refer to the instructions and settings in the Modbus communication list.
13. Check the settings of any overcurrent protective devices.

4.7 First start-up

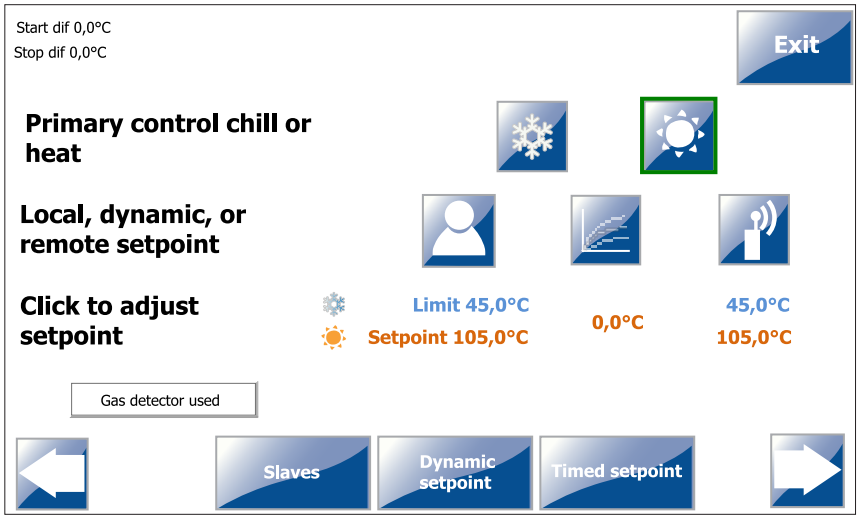
! Note	The screens shown below are discussed in further detail in chapter *Operation.*



Set the language, time, and time zone.

Tap the right arrow to continue.

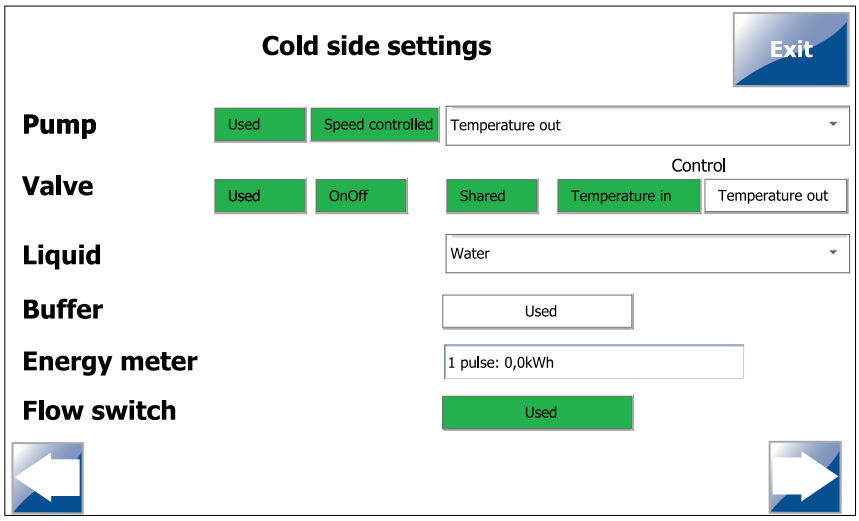
Control settings



Set the power control options.

Green = in use, white = not in use.

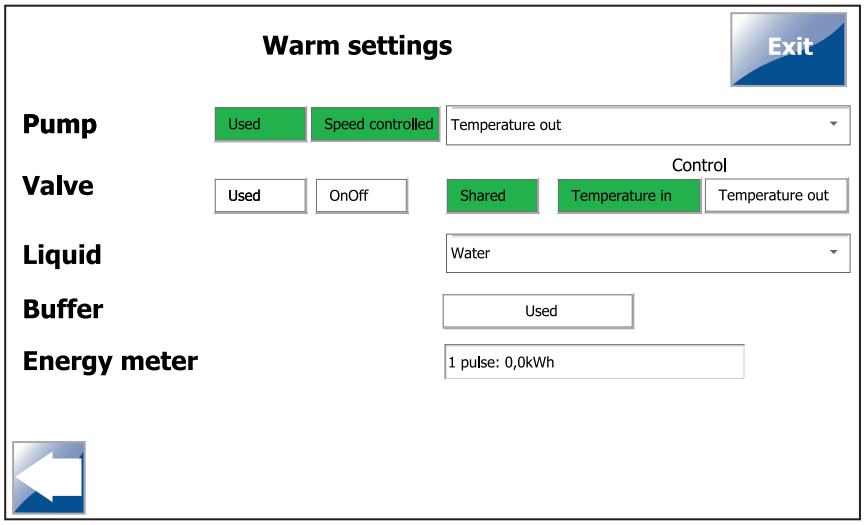
Cold side settings



Set the options for the cooling side of the heat pump.

Green = in use, white = not in use.

Warm side settings

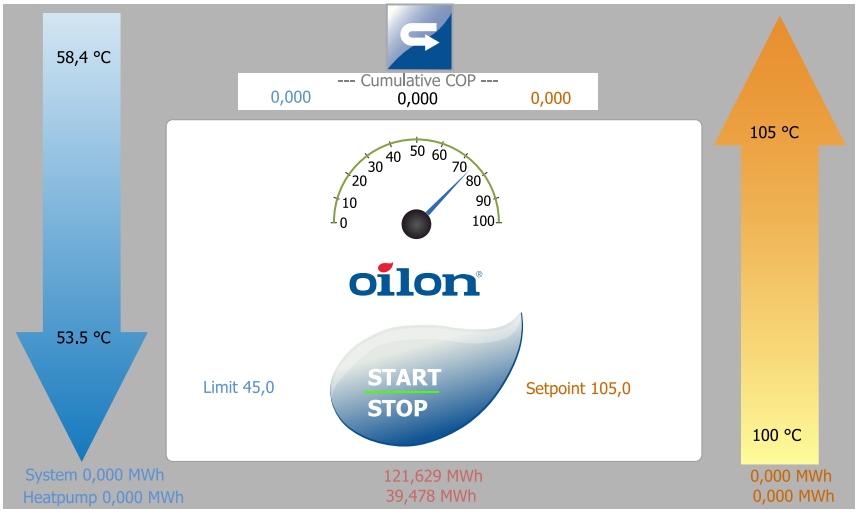


Set the options for the heating side of the heat pump.

Green = in use, white = not in use.

Home view

Finally, open the **Home** screen, and tap on the **Start** button to permit the heat pump to start. Once the line on the **Start** button turns green, the heat pump is permitted to start.



4.8 Commissioning the system

Carry out commissioning tasks according to this check list. Pay special attention to the leakage test.

- Measure compressor current.
- Control superheating temperature.
- Check and trim expansion valve functionality.
- Define overcurrent protection device settings.
- Perform thermal protection device functional test.

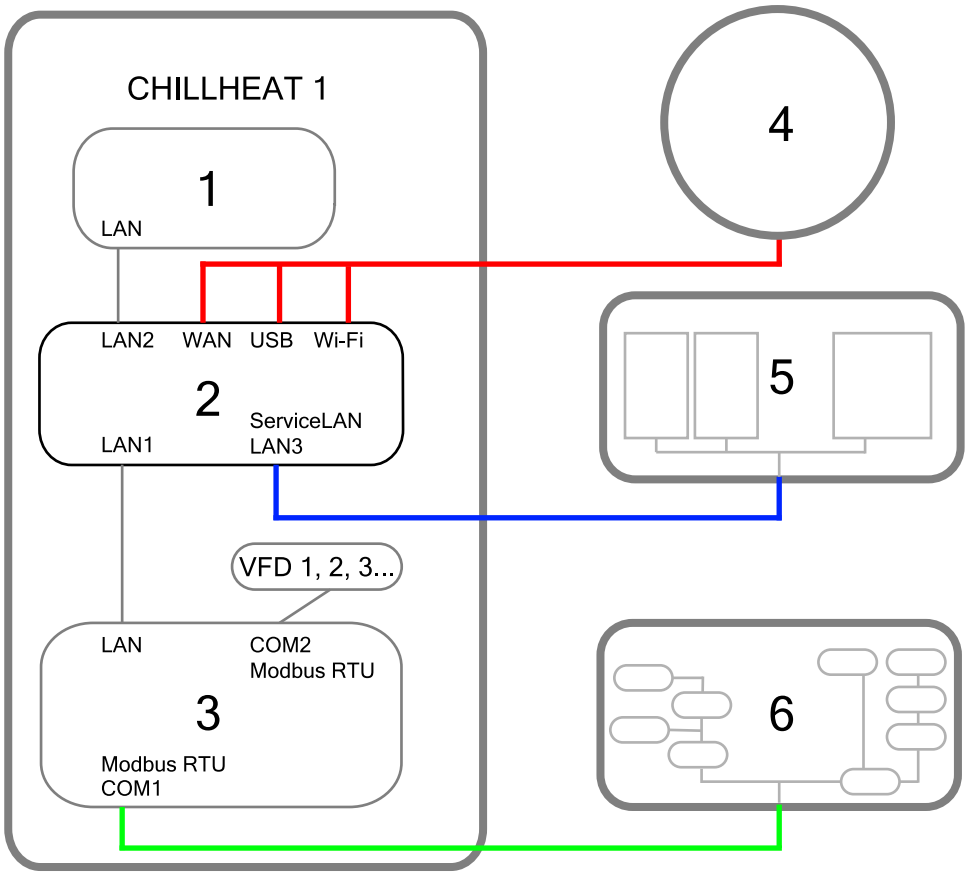
- Inspect running restrictions, evaporator and condenser side temperature settings, and delays in restart.
- Inspect suction and discharge pressure switch, bars.
- Perform compressor load control functional test.
- Test electrical cabin fan and filter, also for possible variable frequency drives.
- Check refrigerant and oil quantity.
- Perform moisture check.
- Check compressor and piping installation.
- Inspect cable shoe and terminal block connections also with a thermal camera.
- Perform leakage test and repair possible leakages. Perform the leakage test according to the *Heat pump leakage check* list of the *Commissioning report*.

Verifying certificates, documents, and approvals

- Make sure that the pre-commissioning certificate is completely filled and signed by the person responsible for the installation.
- All required control documents regarding the installation are in order, including leak and pressure test of water piping, and electrical supply certificate.
- Electrical feed approved by the customer to be taken into operation.
- Hot and cold water systems approved by the customer for operation.
- Ethernet communication, if any, approved to be used.
- Site manager/customer approval for start of commissioning.

! Note	Once installation and commissioning are complete, fill out the installation and warranty reports.

4.9 Network and internet connections



CH network connections ver. 2

1	Control panel, Beijer	4	Internet
2	Tosibox	5	Other heat pumps
3	PLC, ABB	6	Customer's system

VFD Variable frequency drive

As shown in the figure above, Tosibox supports a range of options for connecting to different systems. To access Tosibox's network settings, connect to your Tosibox either with your laptop or a mobile device.

- Connecting through Wi-Fi: establish a Wi-Fi connection as you would with any other device. The network ID is **Chillheat** and the password **0il0nm0bile**. Open a web browser. In the address bar, enter **http://10.20.30.1**.
- Connecting with a LAN cable: Connect a LAN cable to your device and plug the cable into the Tosibox unit's service port. Open a web browser. In the address bar, enter **http://172.17.17.17**.
- Sign in using the Admin password **qw56pomz**.

Establishing an internet connection

There are three ways to connect the heat pump to the internet: a direct wired connection, a mobile USB modem connection and connecting through Wi-Fi.

- Wired connection: Plug a network cable into the Tosibox unit's WAN port and the other end into your internet connection port. Note that the local network connected to the Tosibox WAN port cannot be accessed through Tosibox.
- Mobile USB modem: A mobile USB modem is required.* Plug the modem in the Tosibox unit's USB port. Either disable the modem's PIN code query, set the PIN to 1234, or enter the modem's PIN code in the Tosibox unit's settings. Note that the USB modem's APN settings might need to be changed to meet your ISP's requirements.
- Wi-Fi connection: Open the Tosibox unit's network settings (see the instructions above). Select a Wi-Fi network, and enter the network's password. Note that after this, Tosibox can no longer be accessed through its own Wi-Fi network, and its settings can be changed only using a LAN cable.

* The modem can be obtained from us or from an external supplier. For a list of compatible modems, see https://helpdesk.tosibox.com/support/solutions/articles/2100033964-which-usb-modems-are-supported.

4.10 Master–Slave operation: setting up parallel units

Physical configuration

1. Start the circulation and open up all throttling valves to the fully open position.
   a. If the circuit is capacity-controlled, make sure the system is running at the maximum flow.
2. Measure the individual flows and compare to the specified flows.
   a. If the flow notably deviates from the specified flow, search for the reason for this deviation. Possible reasons can be the pump, filter, valves, pipe length, air, gas, or dirt in the system.
3. To distribute the flow, start by reducing the flow, where necessary.
   a. Measure and adjust all individual flows until correct distribution is achieved.
   a. Keep at least one throttling valve fully open, unless the pressure drop is required to feed a subcooler or other equipment.

! Note	Note down all set and measured flows into a copy of the PI diagram.

Basic Master–Slave control can be activated through the heat pump user interface. For a more thorough setup, use the **Oilon Heat Pump Configurator**.

Activating Master–Slave control through the user interface

To activate master and slave control:

In the master heat pump, open **Control settings** and select **Slaves** (see section *Control settings*).

*The **Slaves** view.*

In the **Number of slaves** field, enter the number of heat pumps being controlled (in addition to the master heat pump).

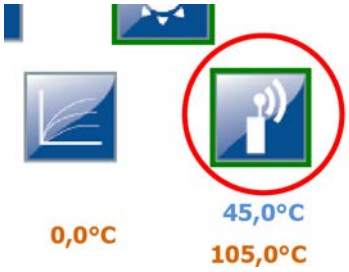
In the address fields, enter the last two numbers of each slave heat pump's IP address. Default addresses: Master: 11, Slave 1: 21, Slave 2: 31, Slave 3: 41, etc.

The **Max. power** field indicates the maximum allowable power for the heat pumps being controlled.

The **First to start** menu has the following options:

- Alternates = the start order is rotated; the first heat pump to start is changed between each start.
- 0 = master heat pump
- 1 = Slave 1; 2 = Slave 2; 3 = Slave 3, etc.

Each of the slave heat pumps must be set under remote control. Open the slave heat pump's **Control settings** view (see section **Control settings**). Press the remote setpoint button, see the figure below.



Master–Slave operation

In a Master–Slave configuration, a number of slave heat pumps are controlled by a master heat pump's controller. The heat pumps are started and stopped one at a time, each after a start or stop delay. Once the start delay has elapsed, the next heat pump in the starting order starts. The rest of the heat pumps will run at a lower capacity to prevent a spike in the overall capacity. Correspondingly, once the stop delay has elapsed, one of the heat pumps will be switched off, and the rest will run at a higher capacity to prevent a sharp fall in the overall capacity.

The overall heat pump capacity is controlled based on the highest Condenser Out and the lowest Evaporator Out temperature. The heat pumps will be permitted to start, if any of the heat pumps is requesting a heat pump to start.

The valves in the system can be set up to influence only a specific heat pump's flow or the entire heat pump group's flow. If the valve controls the entire group's flow, the valve will be opened whenever any of the heat pumps is sending out a flow request.

If the connection with the master heat pump is lost, the affected heat pump will operate in local control mode. However, once the connection returns, the heat pump will automatically revert to remote control.

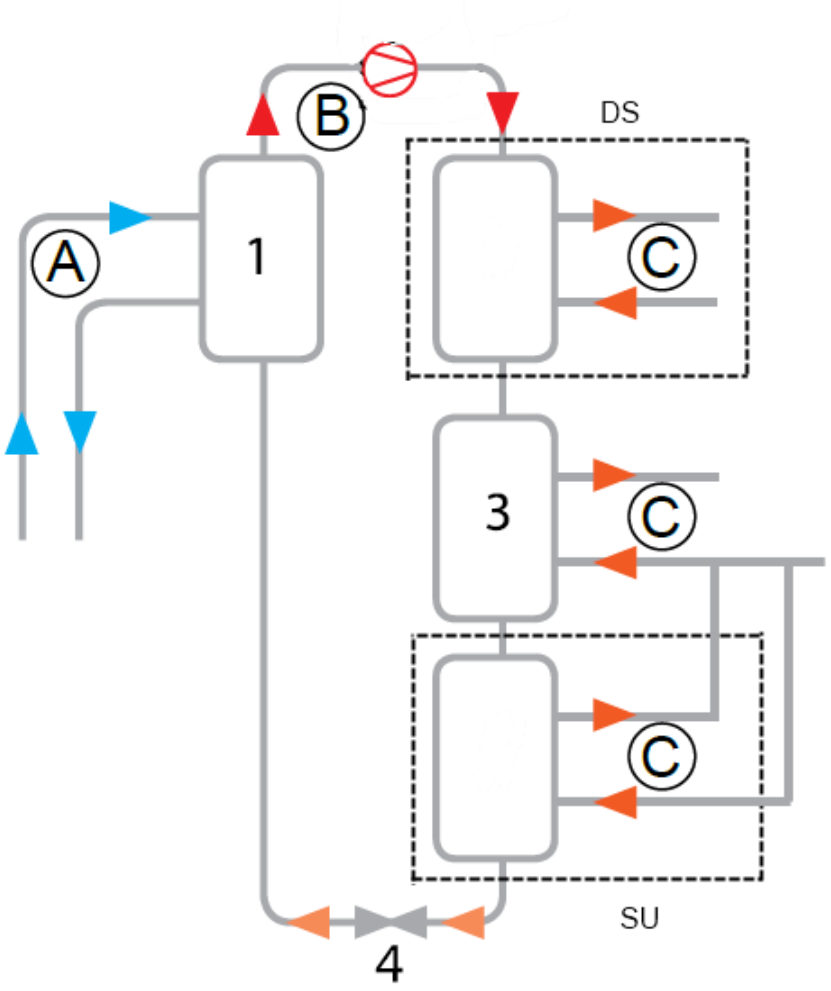
4.11 Setting up distribution condenser/subcooler

1. Start the circulation and open up all throttling valves to the fully open position.
   If the circuit is capacity controlled, make sure the system is running at the maximum flow.
2. Measure the individual flows and compare to the specified flows.
   Measured total flow: m3/h or kg/s
   If the flow notably deviates from the specified flow, search for the reason for this deviation. Possible reasons can be pump, filter, valves, pipe length, air, gas, or dirt in the system.
3. If the system has several condensers in parallel, follow the steps in section *Master—Slave operation: setting up parallel units* to distribute the water correctly between all condensers.
   Keep the throttling valve for the subcoolers fully open.
4. Measure the flow through the subcoolers and throttle the inlet valves to the condensers until the specified flow is reached to each subcooler.
5. For several parallel units, check again the distribution.
   Follow the steps in section *Master–Slave operation: setting up parallel units*.
6. Repeat until the specified flow is reached.
7. In case of higher flow than specified, throttle the condenser inlet more to increase the flow in subcooler.

Note down all set and measured flows into a copy of the PI diagram.

5 Operation

5.1 Main features



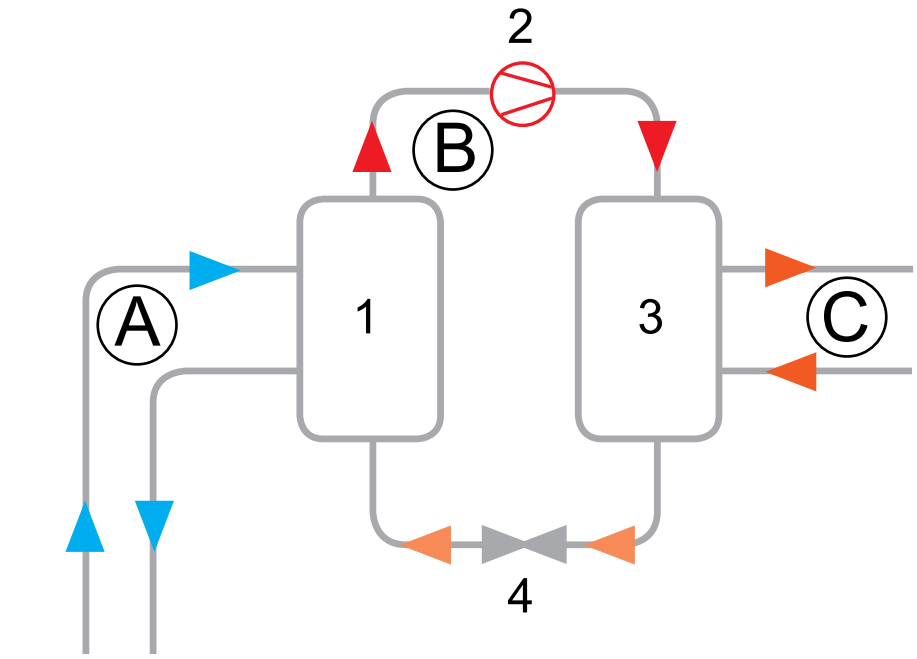
Main features ver. 2

1	Evaporator	A	Cooling circuit
3	Condenser	B	Refrigerant circuit
4	Expansion valve	C	Condenser circuit
		DS	Desuperheater, optional
		SU	Subcooler, optional

One of the main principles of our heat pump concept is to use a single machine both for cooling and heating. Our heat pumps are well suited for heating and cooling applications, either as dedicated cooling or heating solutions or as a combined solution.

It is possible to connect several heat pumps in series for an even higher capacity heating or cooling solution. Automation is a key component in the system, as it allows the unit to produce chill and heat with high energy efficiency and minimum user involvement.

5.2 Operating principle



GSHP19 ver. 3

1	Evaporator	A	Cooling circuit
2	Compressor	B	Refrigerant circuit
3	Condenser	C	Heating circuit
4	Expansion valve		

There are three closed circuits running within or through the heat pump:

- cooling circuit
- refrigerant circuit
- heating circuit.

The heat pump's operation is based on vaporization and condensation of refrigerant circulating within the pump.

The cooling circuit is used for collecting heat energy. As the fluid travels along the circuit, it collects heat energy, which causes the temperature in the fluid to rise. The fluid completes its circuit by returning to the evaporator and releasing the heat energy into the refrigerant, which circulates between the evaporator and the condenser.

When the refrigerant is in the evaporator, it is colder than the fluid in the cooling circuit, allowing he heat energy to be transferred transfer from the fluid into the refrigerant. This transfer of heat raises the temperature of the refrigerant, until it vaporizes.

The gaseous refrigerant is led to a compressor, which compresses it to a high pressure. As the pressure of the gaseous refrigerant increases, so does its temperature.

The high-pressure gaseous refrigerant is led into a condenser, where it releases its heat energy into the water that circulates between the heat pump and a heat sink (such as a storage tank, heating circuit, or other heating consumer). As the refrigerant releases its heat energy and its temperature drops, it condenses into a liquid.

The liquid refrigerant is then led into an expansion valve, where the pressure and temperature are lowered further. The refrigerant completes its circuit by returning back to the evaporator, where it receives heat energy from the cooling circuit.

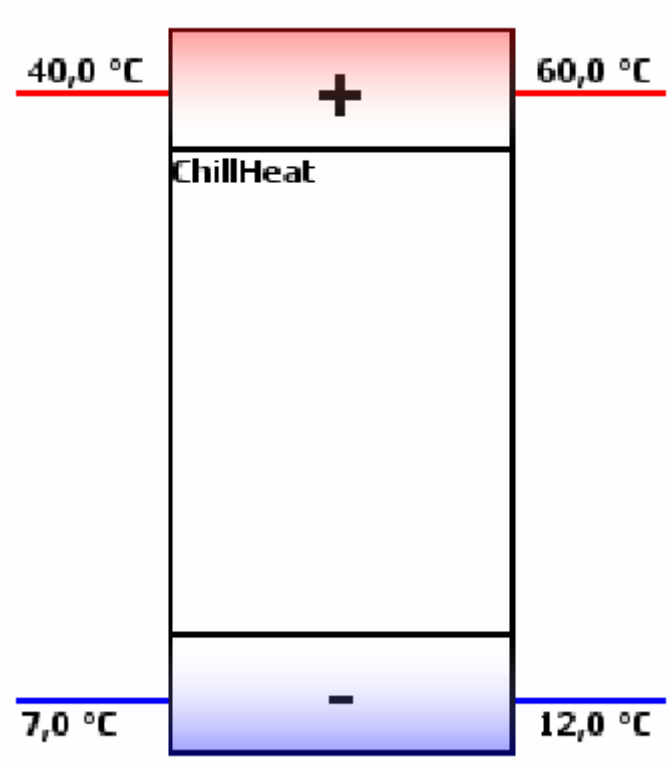
5.3 Heating and cooling

A single heat pump can be used for both heating and cooling at the same time, without any extra machinery involved. When using the heat pump to cool down one part of a process, heat is generated as a by-product. The generated heat can be used effectively in another process which requires heat. The typical coefficient of performance (COP) in these applications can vary between 5 and 8.

Example of a combined solution

An example of a combined solution is a data center. A data center usually consists of an office area and a large server room. The server room requires powerful air conditioning to keep the temperature down at an acceptable level.

At the same time, especially in countries with a colder climate, the office area of the data center requires heating. Both of these – air conditioning and heating – can be handled with a single heat pump. In the following figure, a single unit is used to produce cold water used in air conditioning while at the same time the unit produces hot water used for heating the office area.



Heating and cooling ver. 1

In this example, water is cooled down to 7 °C, and the energy taken from the water is used to heat the water in the heating system to 60 °C.

Collecting heat

The heat pumps can use various heat sources for collecting heat, for example:

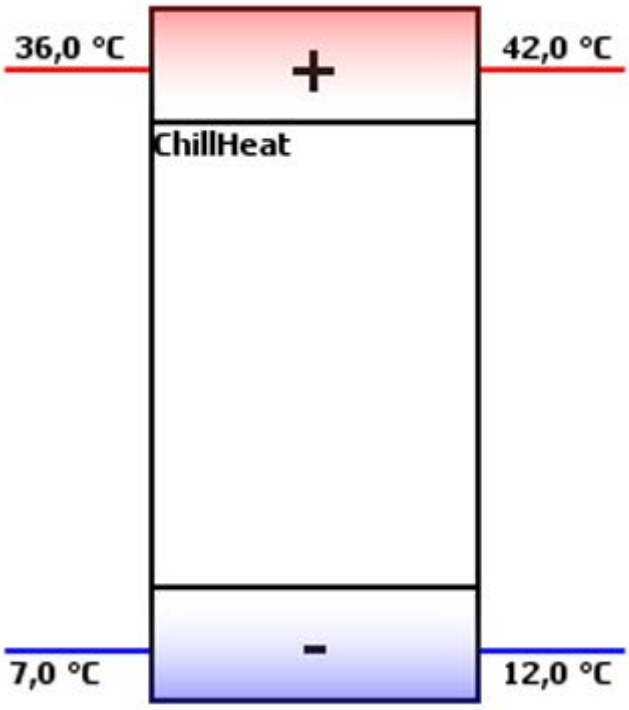
- recovered waste heat at refrigeration plants to generate hot water, thereby substituting valuable primary energy
- outdoor air, together with an outdoor cooling unit
- recovered waste heat from municipal or industrial waste waters
- industrial process waters
- flue gases from power plant and central heating plant boilers
- heat from ground or waters.

The recovered heat can, for example, be channelled into the district heating network, improving the efficiency of the plant and increasing the total heat output. The free heat sources can be put to use for heating spaces and producing hot water, among other things. The heat pumps can utilize these heat sources and produce valuable heating energy for industrial processes or to be sold out.

Under the operation period, the heat source circuit fluid warms up during circulation. The collected heat is used to vaporize the refrigerant in the heat pump unit.

Cooling

Our heat pumps provide an energy-efficient cooling solution for air conditioning, for cooling computer server rooms, and in industrial processes. They can provide energy-efficient refrigeration for industrial applications, ice rinks, or supermarkets.



Cooling ver. 1

5.4 Coefficient of performance

Heat pump efficiency ratios are measured by the coefficient of performance (COP) and cooling coefficient of performance (COPc) values.

COP indicates the amount of heat energy produced by the heat pump divided by the energy consumed by the heat pump.

COP depends largely on heat source and heating network temperatures. The higher the heat source temperature and the lower the supply water temperature, the better the efficiency ratio.

5.5 Control system

The heat pump is equipped with an automatic control system. The system manages the heat pump's operation, allowing the heat pump to generate both heating and cooling either separately or concurrently.

The control system includes a built-in automation system, sensors attached to it, and a control panel. The control panel is used for monitoring and changing system settings as well as browsing and resetting error notifications.

The automation system supports the most common field bus protocols. The control system has the following features:

- Clear, easy-to-use graphical user interface and reliable, programmable industrial controller with support for controlling multiple units.
- Modbus and Profibus protocols available
- Remote monitoring and programming

Control system user interface

The user interface has a number of different views for operating the system and changing its settings. The views can be browsed through the touch screen panel. As a normal user, you can access most features (such as changing setpoint values, starting and stopping the heat pump, acknowledging alarms, and viewing trends) without logging in. Certain screens, usually popup windows, will require logging in as an **Expert**. In such cases, the login screen will appear automatically.

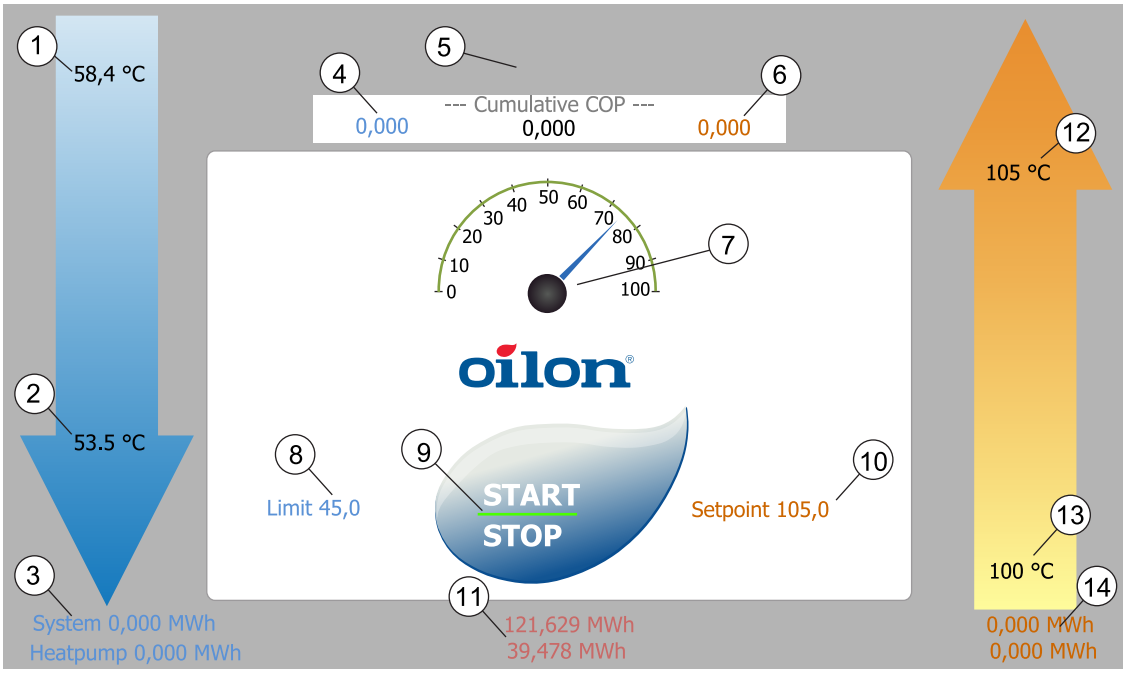
In the following sections, the different views and functions are described in more detail.

5.6 Control panel

Home view

The **Home** view is the main view of the heat pump user interface. It enables you to have an overview of the heat pump, and to turn it on or off. The limit and the setpoint value can be edited directly by tapping on the respective value.

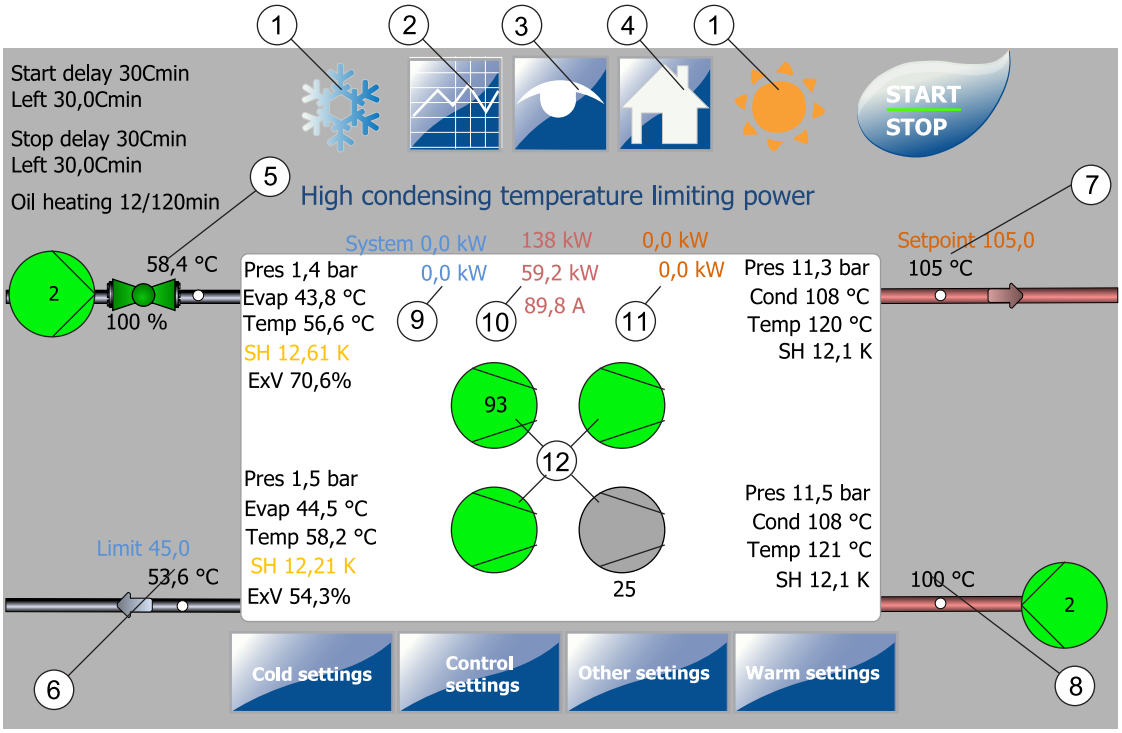
To open the **Process** view, tap on the process view button (Pos. 5 in the figure below).



Pos.	Item	Pos.	Item
1	Cooled water in	8	Cooled water temperature limit, tap to change.
2	Cooled water out	9	Start button. Green line = permitted to start, tap to change.
3	Energy collected	10	Heating setpoint, tap to change.
4	Cooling COP	11	Power consumption
5	Switch to the **Process** view	12	Heated water out
6	Heating COP	13	Heated water in
7	Power, 0–100%	14	Heat energy produced

Process view

The **Process** view allows you to view key process values and access different views and settings. To view detailed information about a specific device (such as a pump or a valve) and to change its settings, tap on the device's icon. To change a setpoint or limit value, tap on the value.



Pos.	Item	Pos.	Item
1	Current heating/cooling mode • Sun = heating • Snowflake = cooling	7	Warm water out
2	Trends	8	Warm water in
3	Alarms	9	Power: cooling*
4	Home view	10	Power consumed by the system's compressors* • The lowest value is the current taken by the compressor or compressors.
5	Cold water in	11	Power: heating*
6	Cold water out	12	Compressors

*The values for each circuit are shown on separate lines.

If the system has a buffer tank on the cold or the warm side, the tank will be displayed along the left or the right edge of the screen. The tank's temperature measurements will also be displayed. Note that these buffer tanks must be enabled in the **Warm settings** or the **Cold settings** view (see section *Cold side and warm side settings*) before they are displayed.

Start delay, stop delay, and oil heating delay

The start delay and stop delay are shown in the top left corner as degree minutes. These values can be changed. For example, if the stop delay value is 30Cmin and the temperature is 1 degree below the setpoint, the heat pump will start to ramp down in 30 minutes. If the temperature is 10 degrees below the setpoint, the heat pump will start to ramp down after 3 minutes. This can be speeded up by changing the **Left** values (time left).

If the oil heating delay is active, the delay is displayed in minutes.

Compressors

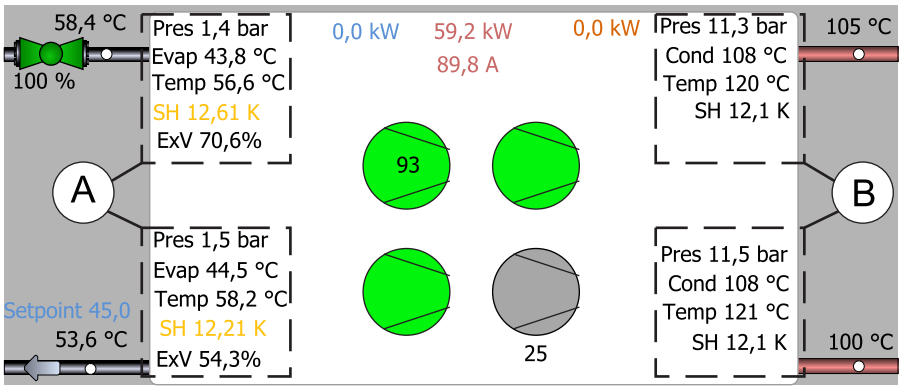
Each compressor's current power is expressed as a percentage (shown as a number inside the compressor's icon). The compressor color codes are shown in the table below.

Color	Status
Grey	Not ready to start
White	Ready to start
Green	Running
Blinking red	Alarm

If a compressor has a restart delay (greater than 0), the delay is displayed under the compressor's icon.

To view a compressor's motor status, tap on the compressor's icon. The **Motor status** popup will be discussed in section *Viewing motor status*.

Key process values



Process screen center ver. 3

A number of key process values are shown in the center of the process view.

A	Cold side values		B	Warm side values
Pres	Suction pressure		Pres	Discharge pressure
Evap	Evaporating pressure		Cond	Condensating temperature
Temp	Suction temperature		Temp	Discharge temperature
SH	Suction superheat		SH	Discharge superheat
ExV	Expansion valve opening, %			

Accessing setting views

To access different settings views, open the **Process** view and tap on one of the buttons in the bottom button row (see the figure below). These views are also displayed when the Startup Assistant is active (during the first start-up, for example). The views will be discussed in following chapters.

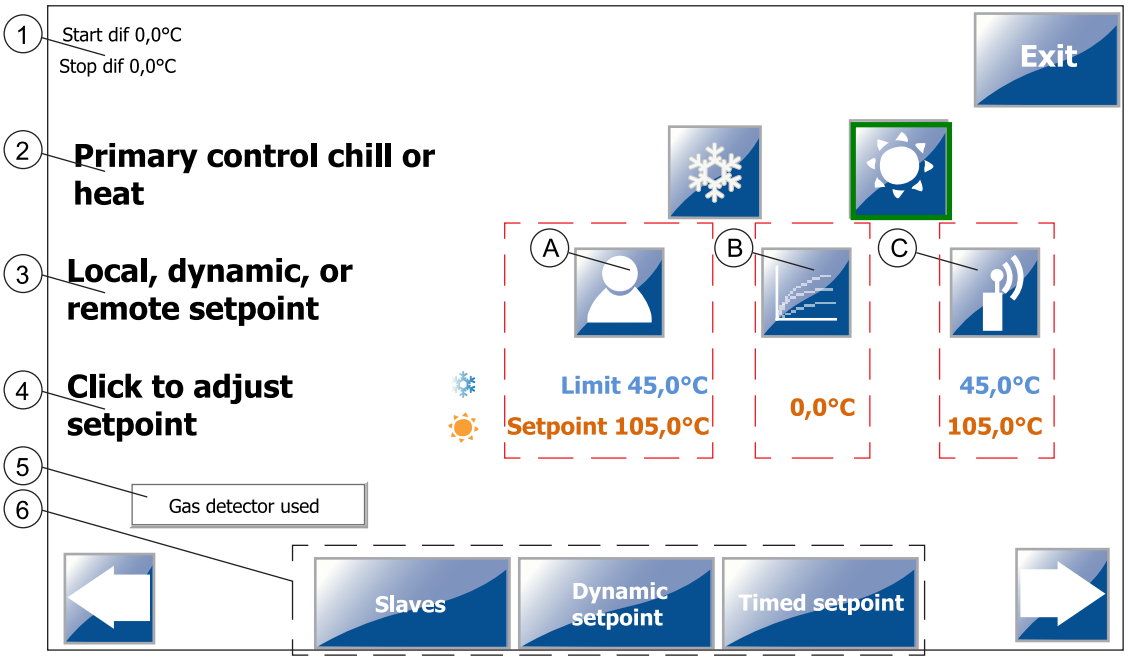
Process view button row ver. 2

5.7 Control settings

Control settings

The **Control settings** view allows you to toggle between different modes and specify setpoints. The view can be accessed from the **Process** view. An active selection is indicated in green.

To change a setpoint, tap on the setpoint value.



Pos.	Item	Description
1	Start difference and stop difference	These values specify how much the temperature must exceed or fall below the setpoint before the unit will be started or stopped (for example, when heating is no longer required). The unit will be stopped with a delay.
2	Primary control mode selection	Switch between two modes: **Chill** (snowflake button) or **Heat** (sun button).
3	Setpoint control method	Select the method with which the setpoint is determined (see the table below).

Pos.	Item	Description
4	Setpoint adjustment	Adjust the setpoint and limit value for each control method by tapping the value.
5	Gas detector	Toggle the unit's gas detector (optional) on or off. You will be prompted to sign in to the Expert level.
6	Additional settings buttons	Each button will open its own settings view. • The **Slaves** view is discussed in section *Master—Slave operation: setting up parallel units.* • The **Dynamic setpoint** and the **Timed setpoint** view are discussed below.

Setpoint control method

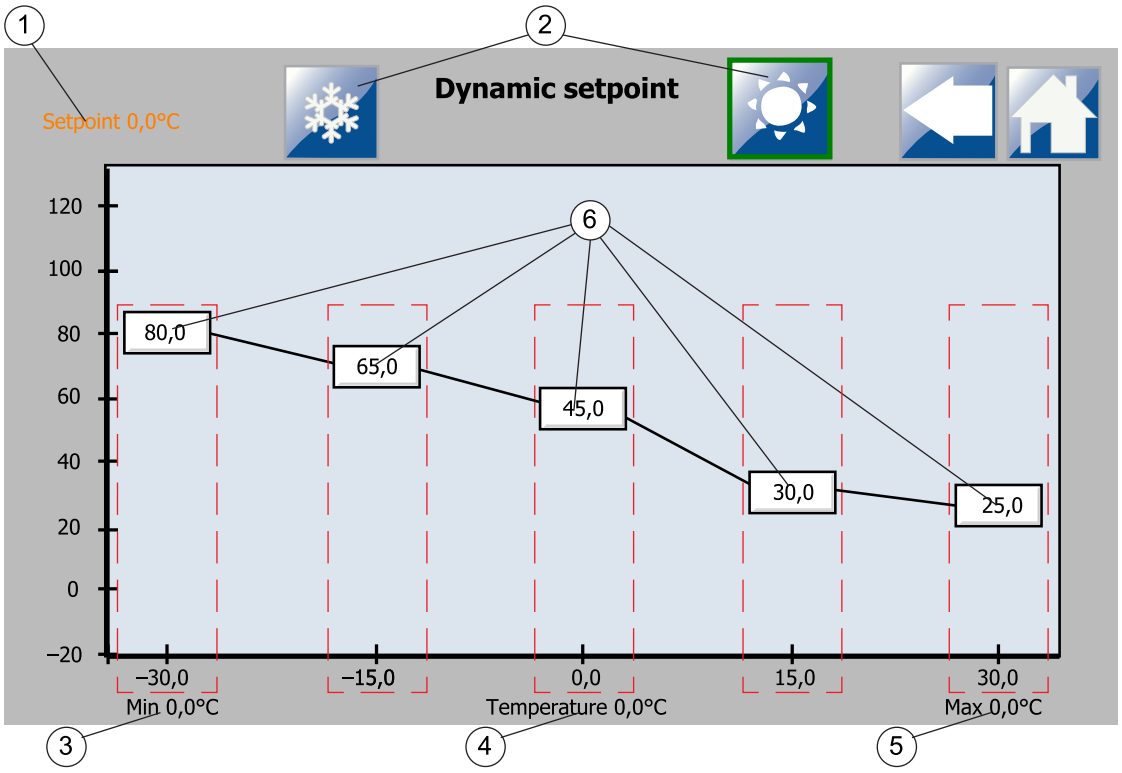
Pos.	Item	Description
A	Local	A locally-specified setpoint will be used. The setpoint can be specified either in the **Home** view or by tapping on the setpoint values in the **Control settings** view.
B	Dynamic	The setpoint will calculated based on current outdoor temperature and a temperature curve. A temperature curve can be set up in the **Dynamic setpoint** view.
C	Remote	A remote setpoint (through a bus connection) will be used.

Slaves

The Slaves view is discussed in section *Master–Slave operation: setting up parallel units.*

Dynamic setpoint

The **Dynamic setpoint** view allows you to specify outlet (flow) temperature values that will apply at specific outdoor temperatures. The actual setpoint will be calculated based on the current outdoor temperature (or process temperature) and these outlet temperature values (Pos. 6 in the figure).



Dynamic setpoint ver. 2

The dynamic setpoint view. X-axis: outdoor temperature, Y-axis: flow temperature.

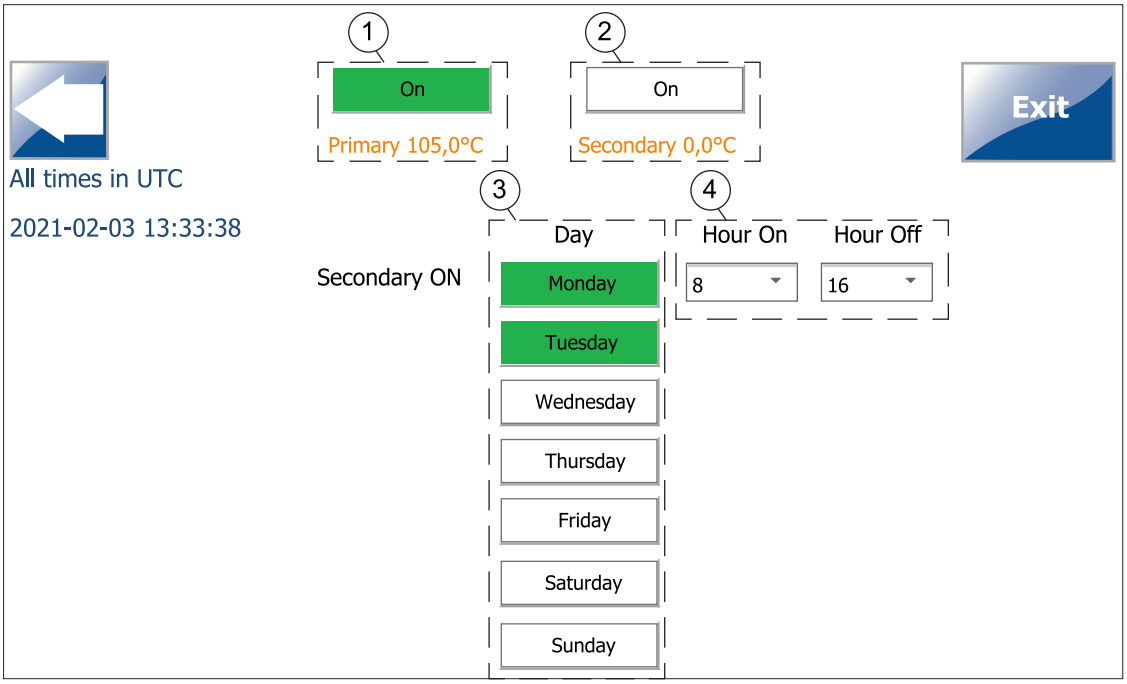
Pos.	Item	Description
1	Setpoint	Setpoint calculated based on the current outdoor temperature (or process temperature) and curve point values
2	Operating mode curve selection	Select which side's (in the figure: primary/Heat or secondary/ Chill) values to change.
3	Minimum outdoor temperature	Minimum outdoor temperature limit (can be adjusted)
4	Current temperature	Current measured outdoor temperature
5	Maximum outdoor temperature	Maximum outdoor temperature limit (can be adjusted)
6	Outlet temperature values for each outdoor temperature	Tap to adjust each value.

The values along the X-axis each indicate a specific outdoor temperature point. To specify an outlet (flow) temperature for a given outdoor (or process) temperature point, tap on the white box above the temperature point (Pos. 6 in the figure.)

The applicable temperature range can be changed by changing the temperature values along the X-axis. To change a temperature value (temperature point), tap on the value.

Timed setpoint

The **Timed setpoint** view allows users to temporarily force a setpoint for either side for a specific day and duration. Additionally, the **On** buttons along the top edge of the screen can be used to apply a (temporary) setpoint for the primary side, the secondary side, or both.



Timed setpoint ver. 2

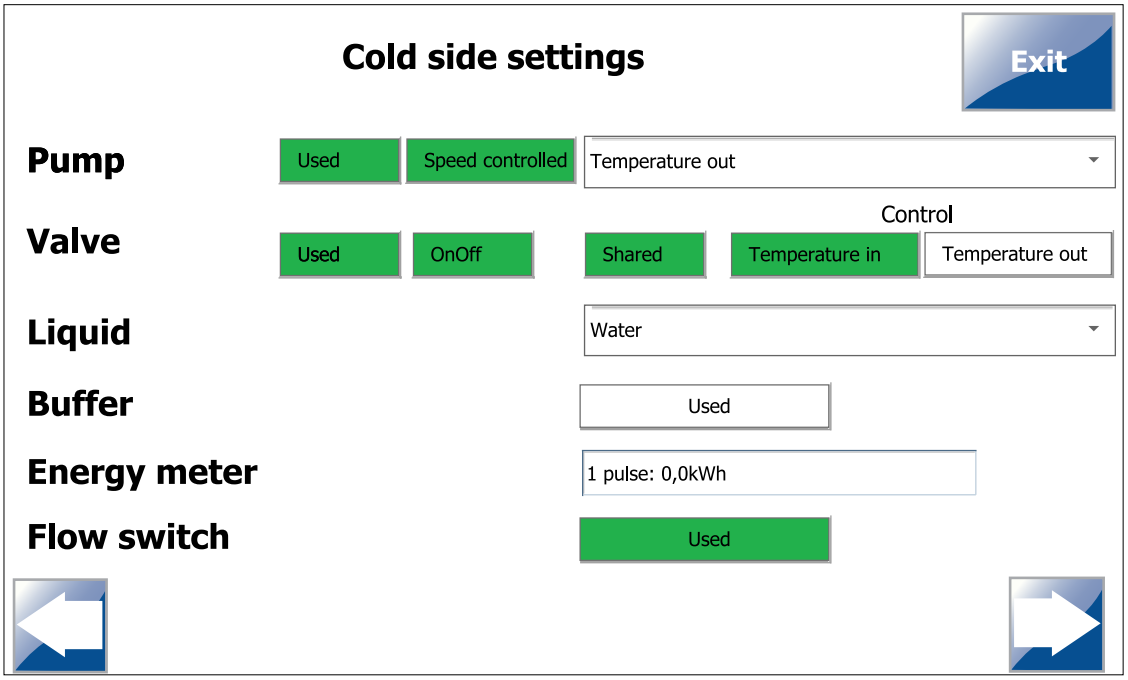
Pos.	Item	Description
1	Primary side button and setpoint	When the setpoint is active, the button is shown in green. To activate and deactivate the setpoint, tap the button. Change the setpoint by tapping the setpoint value.
2	Secondary side button and setpoint	
3	Day selection buttons	Select the days on which the timed setpoint will be applied. The selected days are shown in green.
4	Hour on and Hour off	Select the time of day at which the timed setpoint will be activated (Hour on) and deactivated (Hour off).

To set up a weekly schedule, select the days on which the timed setpoint should apply. Then, specify the hours between which the temporary setpoint will be active. In the figure above, the setpoint will be used on Mondays and Tuesdays between 8 AM and 4 PM.

5.8 Cold side settings and warm side settings

The **Cold side settings** and the **Warm side settings** view are nearly identical. These views will be used to specify the control method for the system's external circuits as well as the medium used in the circuits. These control settings need to be selected for optimal heat pump operation and to avoid the heat pump from operating outside its operating envelope.

The views include a number of on/off buttons. Active buttons are shown in green.



Cold side settings ver. 3

Settings presents in both views

Pump

- *Used:* there is a pump in the circuit on the cold or warm side.
- *Speed controlled:* if the button is active, the pump is a speed-controlled (VFD) pump. If the button is not active, the circuit has an on/off pump instead.

The drop-down menu allows you to select the control method for the pump. The menu includes the following options:

- *Temperature out:* outlet temperature will be used as the setpoint
- *Temperature difference:* temperature difference will be used as the setpoint
- *Constant speed:* the pump will run at constant speed
- *Temperature out, always on:* outlet temperature will be used as the setpoint, and the pump will run even if the heat pump is off.
- *Temperature difference, always on:* temperature difference will be used as the setpoint, and the pump will run even if the heat pump is off.
- *Constant speed, always on:* the pump will run at constant speed, and the pump will run even if the heat pump is off.

Valve

- *Used:* there is a valve in the circuit on the cold or warm side.
- *On/Off:* the valve can be either fully open or fully closed; otherwise, the valve is a flow control valve.
- *Shared:* the valve is shared between two or more heat pumps.
- *Control:* the valve can be controlled based on inlet temperature or outlet temperature.

Temperature in, Temperature out

The relevant circuit can be controlled based on either the heat pump inlet temperature or outlet temperature.

Liquid

The drop-down menu allows you to select the medium used in the cold or warm circuit.

Buffer

If there is a buffer tank in the circuit, activate the buffer by pressing this button. The buffer along with the associated temperature measurements will be displayed in the **Process** view (see the figure below). Note also that the heat pump's setpoint will be used for the buffer, not the circuit's outlet temperature.

Buffer tank ver. 1

Energy meter

To edit the kilowatt hours per pulse value, tap the value field.

Settings present only in the Cold side view

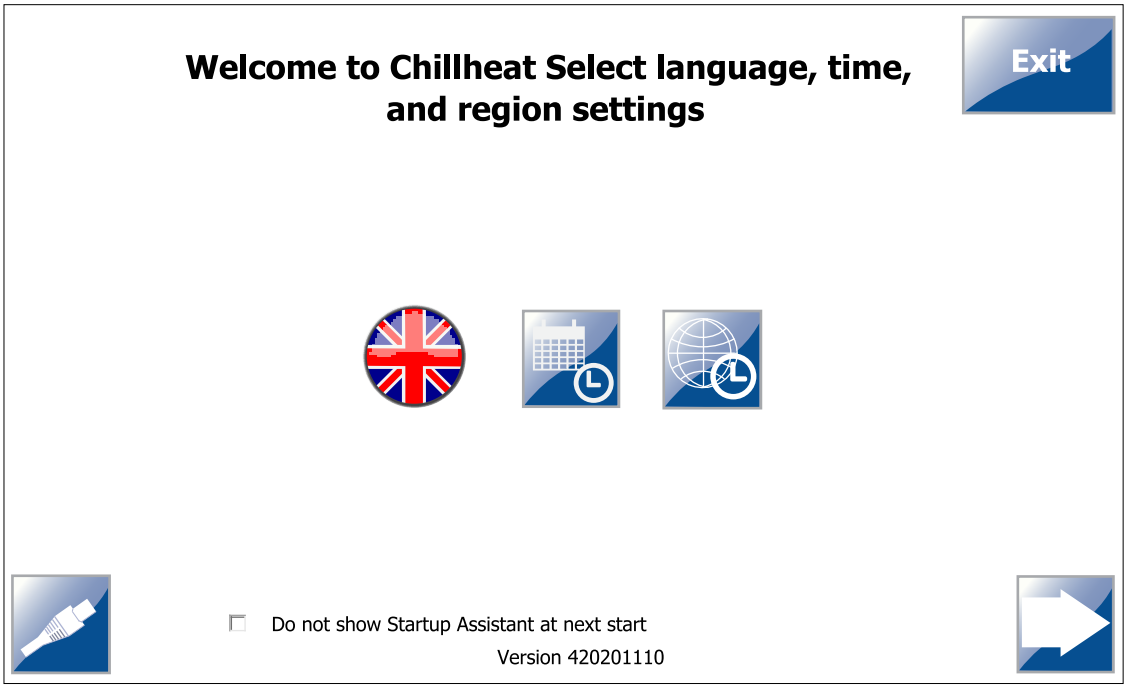
Flow switch

CAUTION	Deactivating the flow switch can result in damage to the heat pump or the system.

The flow switch is delivered as standard in all heat pumps, and shown active in the **Cold side** view. This setting should not be changed.

5.9 Language, Date and Time, and Ethernet settings

The **Other settings** view allows users to edit general user interface and heat pump settings. This view is also shown first during the first start-up.



Welcome screen ver. 3

Settings buttons

Button	Description
	Change the display language. The flag button will change to match the selected language.
	Set the current date and time.
	Set the time zone.
	Adjust Ethernet settings.

Setting language

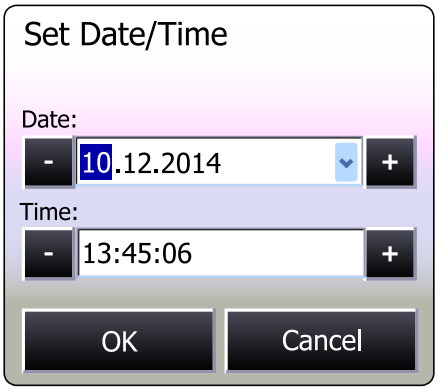
In the **Other settings** view, tap on the flag button. The language selection pop-up window appears.

Language screen ver. 3

Select the language by tapping the corresponding flag button.

Setting the time and date

In the **Other settings** view, tap on the calendar button. The **Set Date/Time** pop-up appears.



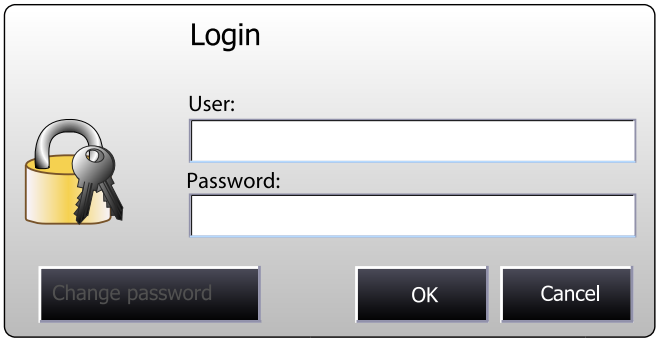
To set the date, select the date from the drop-down list or use the minus and plus buttons.

To set the time, enter the time or use the minus and plus buttons.

To save the settings, press **OK**.

5.10 Changing user level

Some functions require logging in as an **Expert** user. When trying to access such functions, you will be asked to log in. The **Login** dialog box appears:



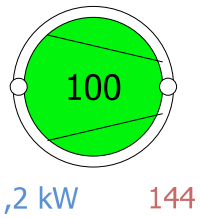
Login screen ver. 4

1. From the **User** drop-down list, select **Expert.**
2. Enter password in the **Password** field, and press **OK**.

You will be automatically logged out from the **Expert** level after 30 minutes of inactivity.

5.11 Viewing motor status

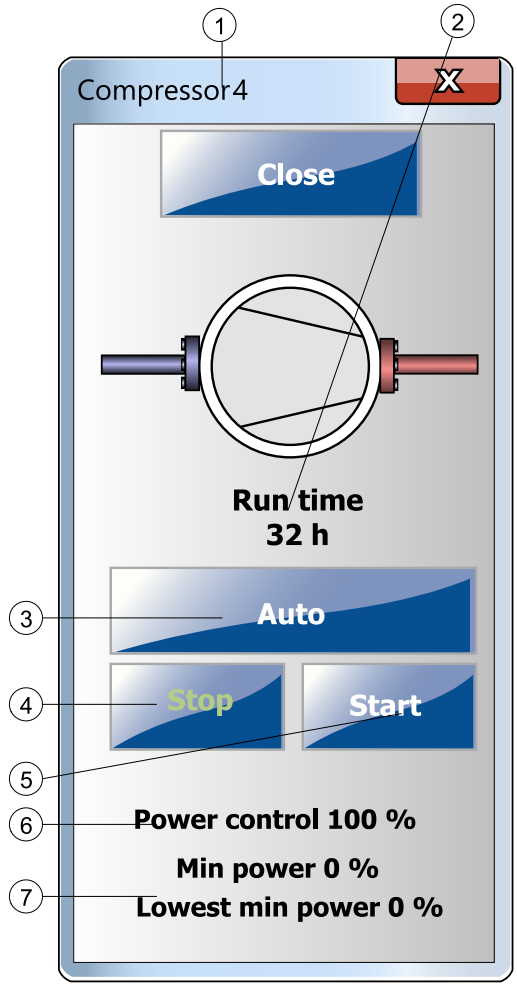
To view a compressor's or other motor's status, tap on the device's icon in the **Process** view. This will open the **Motor status** pop-up window.



The **Motor status** pop-up window allows you to view the motor's status, operate the pump manually, and access PID settings (if applicable).

Viewing on/off-controlled motor

To view an on/off-controlled motor's details, tap the relevant compressor's or pump's icon in the **Process** view.



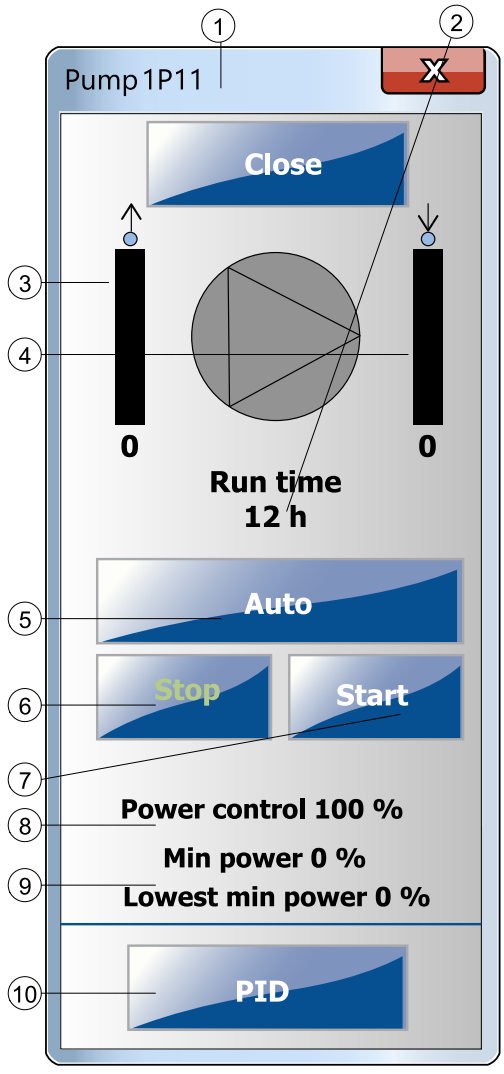
Viewing on/off-controlled motor ver. 4

Pos.	Item	Description
1	Motor status pop-up window	Pop-up window for on/off-controlled motors. Displays the current motor status.
2	Run time value	Displays the running hours for the motor.
3	Auto/manual toggle button	Toggle the motor between automatic and manual mode. • Green: automatic • White: manual
4	Stop	Stop the pump (when under manual control)

Pos.	Item	Description
5	Start	Start the pump (when under manual control)
6	Power control	Displays the control value input when under manual control. Tap to change the value. Grayed out when not in use.
7	Minimum power	Minimum power level setting; the user can change the lowest minimum power value.

Viewing speed-controlled motor

To view an speed controlled motor's details, tap the relevant compressor's or pump's icon in the **Process** view. Speed-controlled motors often have additional PID-related settings.



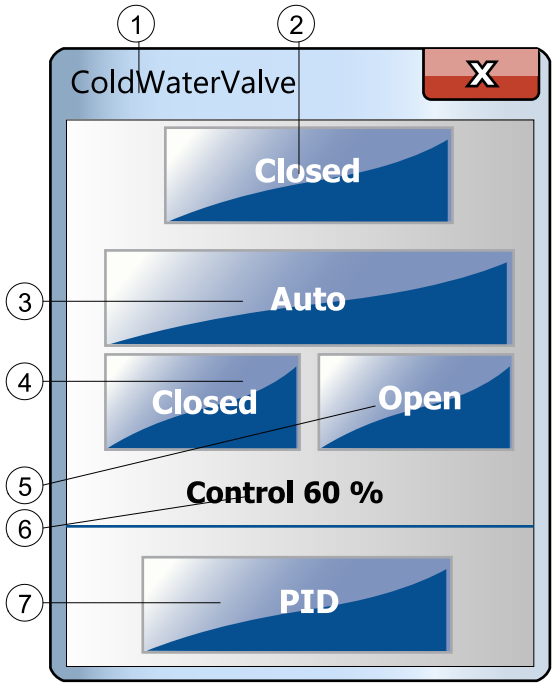
Viewing speed controlled motor ver. 5

Pos.	Item	Description
1	Motor status pop-up window	Pop-up window for speed-controlled motors. Displays the current motor status.
2	Run time value	Displays the running hours for the motor.
3	Control value	Displays the control value.
4	Measured value	Displays the measured value.
5	Auto/manual toggle button	Toggle the motor between automatic and manual mode. • Green: automatic • White: manual

Pos.	Item	Description
6	Stop	Stop the pump (when under manual control)
7	Start	Start the pump (when under manual control)
8	Power control	Displays the control value input when under manual control. Tap to change the value. Grayed out when not in use.
9	Minimum power	Minimum power level setting; the user can change the lowest minimum power value.
10	Open PID display	Tap to open the PID popup, see section *Viewing PID controller values.*

5.12 Controlling actuators

To control a valve manually and change its PID settings (if applicable), tap on the valve's icon in the **Process screen.**



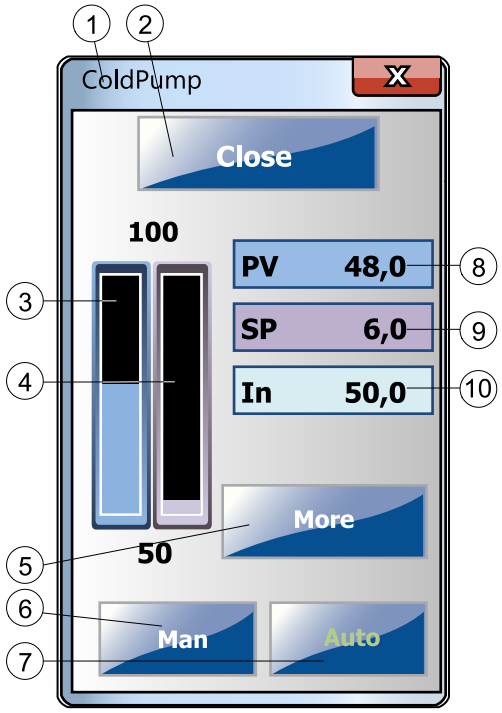
Actuator popup ver. 2

Pos.	Item	Description
1	Actuator popup window	Pop-up window for actuators. Allows the valve actuator to be controlled manually if required.
2	Close button	Closes the pop-up window.
3	Auto/Manual toggle button	Toggle between automatic and manual mode. • Green: automatic • White: manual
4	Closed button	Close the valve/run the actuator to the closed position (when under manual control).
5	Open button	Open the valve/run the actuator to the open position (when under manual control).
6	Control value	Displays the control value input (valve opening) when under manual control. Tap to change the value. Grayed out when not in use.
7	PID button	Tap on the PID button to view and adjust the device's PID values, see section *Viewing PID controller values.* Not available for all actuator types.

5.13 Viewing PID controller values

If a device has PID options, the device's popup window will include a **PID** button. Typical examples are speed-controlled pumps and some valve actuators. To open the device's PID options, tap on the **PID** button. This will open the **PID** popup window.

This popup window allows you to view and edit process values, setpoint values, and control values directly as well as toggle between manual and automatic operation. For more PID options, tap on the **More** button.



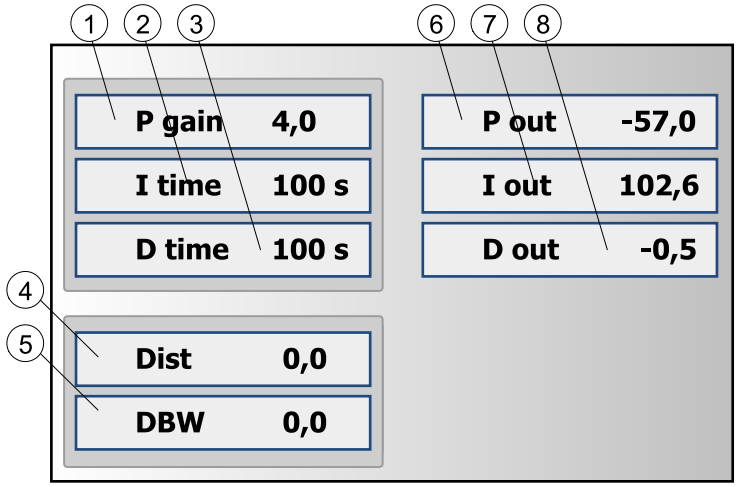
PID ver. 5

Pos.	Item	Description
1	PID pop-up window	PID (proportional integral derivative) pop-up window.
2	Close button	Closes the popup.
3	PV value	A bar display of the process variable value.*
4	SP value	A bar display of the setpoint value.*
5	More options	Expand the view to display advanced options.
6	Manual	Manual control
7	Automatic	Automatic control
8	PV value	Displays the process variable value.
9	SP value	Displays the setpoint value. Tap to change.
10	Control value	Displays the current control value as a percentage. • Out: current control value • In: manual control value (when under manual control). Tap to change.

*The minimum and maximum value are indicated above and below the two bars.

Expanded view

To expand the PID popup window, tap on the **More** button. The expanded view provides access to the following:

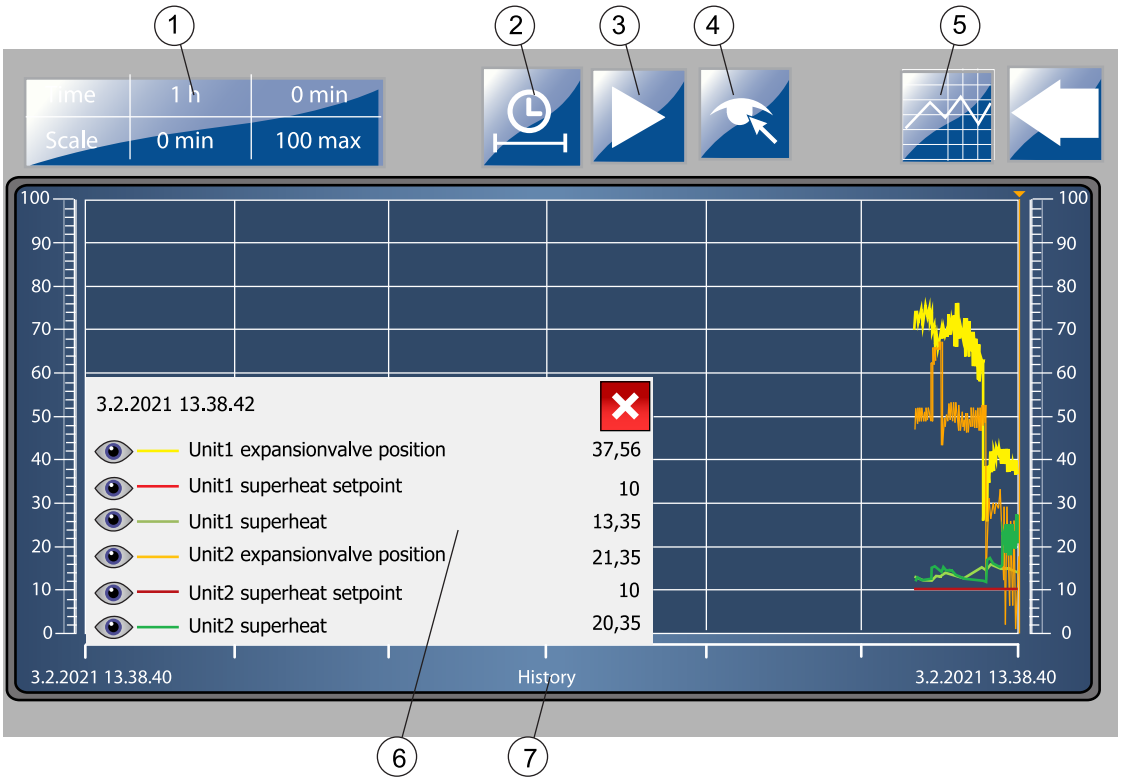


PID expanded view ver. 1

Pos.	Item	Description
1	Proportional gain	Displays the gain value for the PID controller.
2	Integration time	Displays the integration value for the PID controller.
3	Derivation time	Displays the derivation value for the PID controller.
4	Disturbance	An additional measurement that also influences the controller; Dist out=distance–average distance*P. gain.
5	Deadbandwidth	The area around the setpoint where control does not move.
6	P out	Difference*P gain.
7	I out	I out + (difference*P. gain)/I Time. Example: I out at the start = 0, difference = constant. After 1*I. time, I out will be equal to P out. After 2*I. time, I out will be 2*P out.
8	D out	Change in the difference within D. time*P. gain. Example: if D. time is 10 s, the past difference (from 10 s ago) is 1 and the current difference is 3, D out will be (3–1)*P. gain.

5.14 Trends view

The **Trends** view allows users to view both real-time and historical data about the heat pump's operation. To access the view, open the **Process** view and tap on the Trends button:



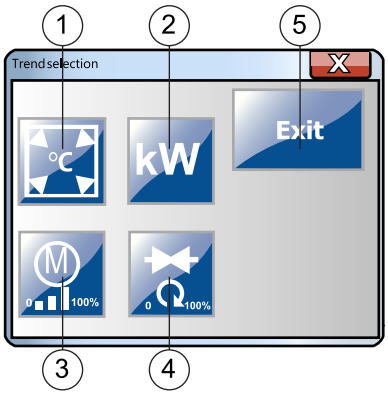
Trend history mode ver. 5

*The **Trends** view. X-Axis: time; the values along the Y-axis depend on the trend selected.*

Position	Item	Description
1	Displayed time and scale selection	Tap the values to change them.
2	Time selection	Select the period of time displayed on the time axis.
3	Play/Pause button	Toggle between real-time and history mode. • Play: view the trends in real time. • Pause: view the trends as a static screen.
4	Open trend legend	Display the trend legend (see below).
5	Trend selection	Open the **Trend Selection** dialog box.
6	Trend legend	Show and hide individual trend curves (see below).
7	Mode	Displays the trend mode (History; shown only when in History mode).

Trend selection

To open the **Trend selection** dialog box, tap on the **Trend selection** button (see above). This allows you to select the trend type.

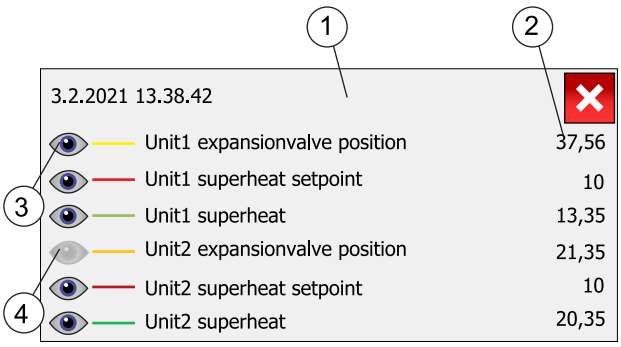


Trend Selection ver. 5

Pos.	Item
1	Temperature measurements
2	Power consumed by the heat pump
3	Motor speed (%)
4	Valve positions and setpoints (%)
5	Close the **Trend selection** popup

Trend legend

To open the trend legend dialog box, tap on the **Open trend legend** button (see above). The trend legend allows you to display and hide individual trend curves.



Trend view legend ver. 5

Position	Item	Description
1	Trend legend	The trend legend dialog box.
2	Current value	Real-time value of the measurement.
3	Show/hide trend: trend shown	Hides or shows the selected measurement or value curve.
4	Show/hide trend: trend hidden	

6.2 Troubleshooting

Before performing any troubleshooting steps on electrical components, check the appliance's operating status from the control panel screen.

Failure codes

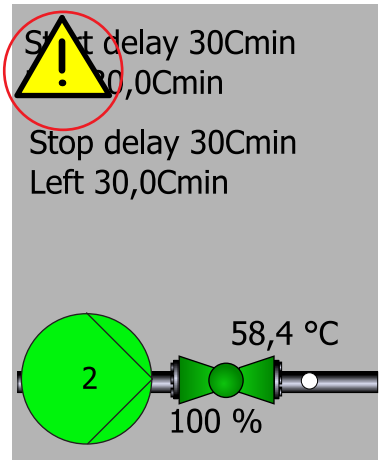
Device failures are displayed in the control panel's **Alarms** view.

Failure	Probable cause	Recommended actions
Refrigerant gas detected	Gas leak indicator has detected gas. The unit leaks refrigerant or there is external gas in the machinery space (for example due to painting work).	Try resetting the alarm. If the alarm resets and the heat pump starts again, there is no leak. If the alarm persists and there is no outside cause, contact Oilon Service.
No cold water flow	Problem with pump, a closed valve, air in pipes, lack of water, flow switch adjusted incorrectly.	Check.
Electrical supply phase fault	Wrong phase order in electricity supply, wire loose, or blown fuse.	Check fuses. If ok, contact Oilon Service.
Suction pressure low	Cooling water too cold or too low flow causing ice in evaporator, problem with expansion valve, or some refrigerant has leaked out.	Check operating conditions. If not near freezing point, contact Oilon Service.
evaporator temperature low	Cooling water too cold or too low flow causing ice in evaporator, problem with expansion valve, or some refrigerant has leaked out. If enough refrigerant, evaporating and condensing temperatures should be within 10 °C of water temperatures 10 min. after stop.	Check operating conditions. If not near freezing point, contact Oilon Service.
Discharge pressure high	Heating water too hot or too low flow in condenser, or too high refrigerant charge level. If refrigerant charge is correct, condensing temperature should be within 5 °C of temperature of water out when running (unless very low or very high flow).	Check warm water flow, check warm water temperature (compared to maximum).
Condensing temperature high	Heating water too hot or too low flow in condenser, or too high refrigerant charge level. If refrigerant charge is correct, condensing temperature should be within 5 °C of temperature of water out when running (unless very low or very high flow).	Check warm water flow, check warm water temperature (compared to maximum).
Hot gas temperature high	Compressor overheated, too high difference between evaporating and condensing temperature and too low power in compressor.	If the compressor's minimum power is set lower than 60%, try raising it, otherwise contact Oilon Service.
Suction superheat low	Expansion valve control problem.	Contact Oilon Service.
Motor starter tripped	Too high current.	If VFD, check VFD for alarms, otherwise check motor overcurrent protection device in electrical cabinet.
Communication lost to VFD	Fieldbus communication problem between controller and VFD.	Check wiring, contact Oilon Service.
Discharge pressure high, pressure switch	Heating water too hot or too low flow in condenser.	Check warm water flow, check warm water temperature compared to maximum.

Failure	Probable cause	Recommended actions
Protection device alarm	If the device resets automatically within an hour, then compressor motor overheating protection has tripped (motor gets hotter when warm water temperature is higher and cold water temperature lower). If not, then oil alarm.	Reset by pressing the button in the oil alarm device attached to the compressor. Try increasing compressor minimum power to improve oil flow.
Not starting	The heat pump controller is giving a start signal, but the heat pump does not start or the motor's ON signal does not reach the controller. Electrical problem, either contactor or wiring.	Check wiring, contact Oilon Service.
Not stopping	The heat pump controller is giving a stop signal, but the heat pump does not stop or the motor's OFF signal does not reach the controller. Electrical problem, either contactor or wiring.	Check wiring, contact Oilon Service.

Monitoring alarms

If there are active alarms in the system, the **Alarm** icon will be displayed on the control panel's screen. In the figure below, the alarm icon is displayed in the **Process** view.



Alarm active ver. 2

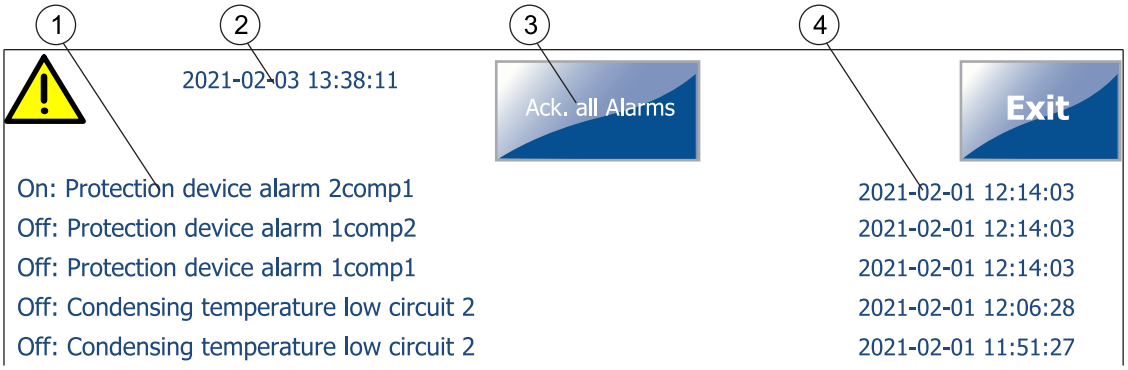
To view the alarm or fault, access the **Alarms** view by tapping on the **Alarm** icon. Alternatively, open the **Process** view and tap on the **Alarms** button (marked in red in the figure below).

Alarms button ver. 1

Alarms view

CAUTION	Before resetting any alarms that have caused the heat pump to stop, investigate the cause of the alarm and address the root cause of the issue.

Both active alarms and historical alarms are displayed in the **Alarms** view.



Alarms view ver. 2

Pos.	Item
1	List of alarms in the system
2	Current date and time
3	**Acknowledge all alarms** button
4	Alarm date and time

Active alarms are indicated with the text *On*, while historical alarms are indicated with the text *Off*. For example, in the image, the alarm *On: Protection device alarm 2comp1* is active, whereas the alarm *Off: Protection device alarm 1comp2* has been reset. Certain alarms will be automatically reset once the system recovers from alarm state, while others will remain active and need to be acknowledged manually.

To acknowledge all alarms, tap the **Ack all alarms** button.

In case of increased pressure drop in shell and tube heat exchangers

If there is a clear increase in the pressure drop across a heat exchanger's external circulation, refer to technical bulletin 0006 (TB-00006-External_ENG) for additional instructions and guidance.

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