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Heat pumps
Earth-water and water-water

1. General – Application

Heat pumps are primarily intended as heat sources for heating and water warming.

They are characterized by their ability to use electric energy to transform low-potential, most often 'natural' heat that cannot be utilized in standard ways (for instance, heat from the ambient air, soil, or ground water) into heat suitable for heating. The design principle of the heat pump implies that the heating output to power input ratio (so-called performance factor) is always greater than one, which means that heating output is always greater than power input. The economic convenience of heat pumps, i.e. the amount of thermal energy produced from purchased electric energy will increase in proportion to an increase in low-potential temperature and to a decrease in the temperature of the heating medium used. Heat pumps therefore prove suitable especially in connection with low-temperature heating systems (for instance, under-floor or wall heating and large-surface radiators).

2. Characteristic Features – Heating System

Heat pumps HP3BW and **HP1BW** (hereinafter referred to as 'the heat pump' or 'the **HPBW**') are **designed** as **'earth-water'** pumps, in which low-potential heat is transferred from earth, or rather from an earth collector (geothermal heat) through a circulation circuit by means of anti-freeze fluid;

- **Heat pumps HP3WW** and **HP1WW** (hereinafter referred to as 'the heat pump' or 'the **HPWW**') are **designed** as **„water-water",** in which low-potential heat is fed to a heat pump by means of flowing ground water whose temperature must be sufficiently high.

In either case, the heating output from the pump is taken away by a circulation circuit filled with water that works as a heating medium.

Considering the heating needs and energy consumption for the purposes of heating during a heating season, it is advised that a **heating system with a heat pump** be designed as **bivalent**, i.e. that a heat pump alone cover the need for heat, or rather heating capacity, only up to a certain level of the outside temperature, for instance, 0 °C (so-called bivalence temperature), and that it cooperate with another source of heat – such as direct heating electro-boiler – at lower temperatures. Such a heating system achieves an optimal ratio of acquisition and operational costs.

Heat pumps work together with **compressors SCROLL** and with ecologically safe refrigerant **R 407C.**

1. Working Principle

The working principle of the heat pump is a so-called cooling circuit with steam circulation. The heat pump, or rather the cooling circuit has four basic parts:

- **Evaporator**

  The evaporator is fed with low-potential heat by a working substance (cooled liquid). The supplied heat causes the refrigerant to evaporate. The vapors of the refrigerant become a thermal energy medium and transfer the same energy to the compressor. The working substance that may circulate ('earth-water' heat pump) or flow ('water-water' heat pump) and from which thermal energy was withdrawn is cooled and has to be reheated or the constant supply of this substance must be secured. This procedure is ensured by the **primary circuit of the heat pump**.

- **Compressor**

  The compressor absorbs vapors from the evaporator, compresses them and delivers them to the condenser. The part of work developed to drive the compressor is transformed into heat that is added to the heat supplied to the evaporator.

- **Condenser**

  The circulating working substance (heating medium) removes from the condenser the heat that was supplied to the same from the evaporator and the compressor by refrigerant vapors. The removal of the heat causes the vapors of the refrigerant to condense. The transferred heat warms up the working substance that is, once it has been warmed up, introduced into the

heating system. The required circulation of the working substance is secured by the **secondary circuit of the heat pump**.

- **Expansion valve**

The liquid refrigerant that condensed in the condenser at a greater (condensation) pressure is transferred (choked) into the evaporator to evaporate there again at a lower (evaporation) pressure.

4. Technical description and heat pump models

Heat pump HPBW and **HPWW** is a compact, heating unit containing a complete cooling circuit and the electric switchboard of the heat pump including the control panel. Heat pumps are delivered along with a refrigerant. Shall be located in a suitable interior area.

The heat pump is assembled in a self-supporting metal box, which is noise-proof.

The heat pumps are offered as **HP3BW** and **HP3WW** models for three-phase supply **3x400 V** or **HP1BW** and **HP1WW** models for single-phase supply **230 V**.

Heat pump models earth-water and internal equipment:	Monovalence HP	Bivalence HP	Primary circ. pump	Secondary circ. pump	Electric boiler	Three-way valve
HP3BW 05 G to HP3BW 15 G	●		●	●		
HP3BW 05 E to HP3BW 15 E		●	●	●	●	●
HP3BW 19 G to HP3BW 41 G	●					
HP1BW 07 E to HP1BW 15 E		●	●	●	●	●

Heat pump models water-water and internal equipment:	Monovalence HP	Bivalence HP	Primary circ. pump	Secondary circ. pump	Electric boiler	Three-way valve
HP3WW 08 G to HP3WW 14 G	●			●		
HP3WW 08 E to HP3WW 14 E		●		●	●	●
HP3WW 18 G to HP3WW 54 G	●					
HP1WW 10 E to HP1WW 14 E		●		●	●	●
HP1WW 20 E		●			●	

In HP drop out, performance of the electric boiler in-built in **HPBW-E** and **HPWW-E** pump need not to ensure 100% coverage of the design thermal loss of the building!

The most relevant requirements that are necessary for the parameters and for the operational reliability of the heat pump are indicated in highlighted paragraphs.

5. Cooling circuit

The cooling circuit (see paragraph 3 ‘Working Principle’) consists of a hermetic, spiral compressor - SCROLL, a plate condenser and a plate evaporator. The supply of the refrigerant to the evaporator is controlled by a thermostatic expansion valve.

All of the parts of the circuit are interconnected by copper piping in which other necessary components are integrated as well.

At rest, is crankcase the compressor’s heated with an electrical heater, which prevents the saturation of oil with the coolant. This ensures reliable operation and extends the compressor’s service life.

The cooling circuit is fitted with other components that secure reliable and safe operation: i.e. a filter drier and liquid indicator.

Correct operation conditions (suction and discharge pressure and temperature during the compressor’s discharge) are monitoring by a combined pressostat and a thermostat.

6. Primary and Secondary Circuits – Summary

- **The primary circuit** provides for the supply of low-pressure heat to a heat pump.
- **The secondary circuit** provides for the supply of heating output to a heating system.

The internal connections of HP secondary circuit pipelines are made of copper pipes and flexible hoses. The dimensions of connection necks of the secondary circuit are given in a table.

Recommendations concerning dimension design of the primary circuit and both primary and secondary circuit connections can be found in the picture part of this document.

The primary and secondary circuit are not included in a heat pump delivery.

In order to secure the parameters and reliable operation of a heat pump according to this documentation the following requirements must be complied with in both (circular) circuits:

- The circulation pumps must secure the coverage of pressure losses of the entire circuit at a required flow rate, including the inner pressure loss of the heat pump, i.e.
  - on the evaporator side in the primary circuit;
- - on the condenser side in the secondary circuit, the losses of the electric boiler and the change-over three-way valve, as the case may be. For that reason, the secondary circuit pressure loss must be lower than or equal to the circulation pump available pressure. HP internal pressure loss and the type of the used circulation pump are given in a table.
- The flow of a working substance (that is cooled in the primary circuit and heated in the secondary one) must be constant and must correspond with this documentation.
- In order to adjust a circulation amount, both circuits must be fitted with flow meters (at least for the purpose of adjustment during commissioning) and with appropriate regulation armatures.
- If no flow meters are permanently fitted, flow rate can be verified indirectly according to a change in HP medium temperature (the difference between inlet and outlet temperature).
- The piping in front of the inlet necks of both circuits must be provided with efficient filters to trap impurities from the outer part of the circulation circuits and to prevent the possible contamination of plate heat exchangers. The filters must be mounted outside the heat pump to allow for easy inspections and cleaning.
- The design of both circuits must allow for their complete venting.
- Both circuits (the primary circuit only during circulation) must be modified with special measures to eliminate the volume-related changes of working substances (heat-conveying and heating medium) due to temperature changes.
- The secondary circuit must be secured in compliance with valid standards.
- The connection of both outer circulation circuits must consist of dismountable joints whose one side will be welded onto the necks of the heat pump.
- The dimensions of the outer piping lines will be based on calculation according to the ‘flow rate-pressure loss’ relation; i.e. they are not selected according to the size of the heat pump’s necks.

6.1 Primary circuit

a) **Circuit function inspection**

Circulation pump functioning, - especially in the case of water-water HP, must be monitored by means of a suitable instrument, e.g. a flow sensor, which can block heat pump operation if the circulation pump drops out. No sensor is included in the HP delivery; but it may be delivered separately as a special accessory.

b) **Protection from the freezing of the evaporator**

Basic protection against the freezing of the evaporator resulting in the cooling circuit’s accident is:

- Ensuring a constant flow inside the primary circuit,
- Application of anti-freeze liquid in ‘earth-water’ heat pumps, read paragraph 11

The concentration of the anti-freeze liquid in 'earth-water' heat pumps is selected so that the initial temperature if crystallization is at least 5 °C below the lowest anticipated working temperature of this liquid.

The evaporator of the 'water-water' heat pump is designed for a temperature gradient of 10/6 °C, i.e. the application of water in the primary circuit is possible in the event that the lowest working initial temperature is not lower than 10 °C. A special evaporator for lower working temperatures can be designed after an agreement with the manufacturer.

If the following conditions are met, the evaporator is protected from freezing by these two measures:

- The temperature at the cooled liquid outlet is monitored by a control system. Whenever the monitored temperature drops below a set value, the system turns off the heat pump and signals a breakdown status. The manufacturer sets a turn-off temperature at a value corresponding with an applied working substance and its allowable minimal temperature.
- Evaporation temperature, or its corresponding evaporation pressure, is monitored in the evaporator by a low-pressure pressostat. When the evaporation pressure drops below a value at which the evaporator would be at risk of freezing, the pressostat turns off the heat pump and signals a breakdown status. The manufacturer sets a turn-off pressure at a value corresponding with an applied working substance and its allowable minimal temperature.

c) **Working substance**

The following substances are considered suitable working substances (heat conveying medium) in the primary circuit:

water or **appropriate anti-freeze liquid.**

When flowing water is used ('water-water' heat pump), the quality has to be considered and the inlet has to be fitted with appropriate filtration, or with water treatment equipment, if need be.

6.2 Secondary Circuit – Heat Pump in a Heating System

In order to secure the reliable performance of the heat pump (i.e. cooling circuit) in a heating system the following basic requirements must be met:

- Temperature in any part of the secondary circuit may not exceed 55°C. The only exception is DHW warming by the in-built electric boiler when the compressor is Off. Under this condition, the maximum water temperature may be 75 °C.
- The flow rate of a heating medium through the pump must be constant and the flow rates of the heating medium through the heat pump and the heating system must be absolutely independent of each other.
- The frequency of the switching of the heat pump must not be greater than 4 startups per hours.

With regard to the fact that a heating system uses:

- Either the variable flow rate of the heating medium (a system with thermoregulation valves or a system divided in zones),
- Or with a variable inlet temperature (a heating system whose inlet temperature is controlled by a mixing valve),

which are conditions that have negative impacts on heat pumps, it is necessary to make sure that the passage of the heating medium through the heat pump and the heating system is independent of any other factors.

This rudimentary requirement is met by securing the flow of liquids in both parts by means of independent circular pumps, i.e. by installing one independent circular pump for a heat pump and another one for a heating system. Meanwhile, both pumps (also the pump for the heating system) must be designed for flow rates required by the heat pump and both parts must be interconnected either by a thermo hydraulic distributor or by an accumulation tank so that unobstructed flow would be guaranteed in both parts.

The output of the heat pump within a heating system is controlled in an 'on-off', two-positional manner. The frequency of switching depends especially on the technical design of the heating system, its regulation, total filling of a heating medium in the heating system, and the ability of the same filling to accumulate heat. Furthermore, it ensues from the following facts:

A heat pump within a heating system represents a heat source and a chosen heating system represents heat consumption. Considering that the heat pump alone does not have its own output regulation, it is necessary to deal with the disproportions between the source's output and consumption in the form of heat accumulation in the heating system's filling, or rather in its active part.

The smaller the active filling and the heat accumulation of the system, the greater the frequency of switching. The term active filling means a minimal heating system filling that circulates in the heat pump alone under any working (regulation) conditions of the heating system. If the active filling of the system is not large enough, it must be provided for by an accumulation tank.

If the heating output of the heat pump alone is not utilized to the full, the heat pump operates at working cycles during which:

- The heat pump works during the first part of the cycle, heat is accumulated in the system filling, and the system is being 'charged' (with the surplus output of the source as compared to the output of the consumption side);
- The heat pump is shut down during the second stage of the cycle, the accumulated heat is taken from the system filling, and the system is being 'discharged'.

The following relation can be derived for a maximum of 4 activations of the heat pump per hour with regard to the minimal **active filling of the heating system** V_a [liters] in which the heat pump operates with **rated heating output Q_z** [kW]:

$$\mathbf{V_a\ [liters] = 15 \times Q_z\ [kW]}$$

Concerns regarding the frequency of switching become an issue when heating output is subject to less demanding requirements; i.e. during the higher temperatures of the outdoor air (greater than bivalence temperature). With greater requirements for heating output; i.e. at the lower temperatures of the outdoor air (below bivalence temperature), the heat pump operates permanently and its capacity is complemented with another source as need be.

In order not to exceed the required frequency of switching, the control system of the heat pump comprises a so-called anti-cyclic regulation that prevents the repeated activation of the cooling circuit at short intervals.

Therefore, the frequency of switching in a heating system with insufficient heat accumulation and with lower requirements for heating output is not based on a controlling temperature, but on anti-cyclic regulation.

The processing of issues connected with the accumulation capacity of a heating system is of great importance for the full utilization of heat pumps.

A heating system must be secured in accordance with valid standards.

6.3 Secondary Circuit – Working Substance

The only working substance (heating medium) considered for the use in the secondary circuit is

water.

7. Electric switchboard, control panel, control system

The electric switchboard incorporated in the HP interior part has both control function and power switchboard function. In the electric switchboard shall be connected external temperature probes, control signals actuating HP operation (CRC and external initiation) and protected power supply line. The electric switchboard furthermore contains a power output terminal for connection of the primary

circulation pump (if it is not a part of HP) and the circulation pump of the heating circuit as given in the electric wiring diagram.

The electric switchboard is not provided with any main switch. It is assumed, that such switch will be incorporated in the HP power supply line.

In **HPBW**-**E** and **HPWW-E** models, their electric switchboard provides for control and regulation of the whole heating system including a bivalence source.

7.1 Control system

The control of the heat pump and its automatic operation is secured by a **programmable microprocessor regulator** in connection with an operation panel that communicates with the operator, monitors the important parameters and operational statuses of the heat pump and shows the same on the display.

If the important operational values exceed limit values, the heat pump turns off and the display signals a respective 'failure', i.e. the reason for the heat pump's shutdown.

The operator panel of the heat pump contains:

- Equipment on/off button (introduction of an emergency status)
  (When the heat pump is turned off the heating of the compressor is not on.);
- Buttons for communication with heat pump operators;
- Display for the imaging of the parameters and operational statuses of the heat pump;
- Colour backlight of push buttons responding to operating conditions of the heat pump (heat pump On and Off, a fault).

A detailed description of the control panel and of heat pump attendance is not included in this design document.

The regulator monitors:

a) The following **operational statuses**

- Discharge (condensation) pressure,
- Suction (evaporation) pressure,
- Temperature during the compressor's discharge,
- Correct phase sequence and full voltage on all phases, power supply to **HP3BW** and **HP3WW,** full voltage on the phase of **HP1BW** and **HP1WW,**
- Working medium flow through the evaporator (flow sensor – is not a part of HP).

In **HPBW-E** end **HPWW-E** model furthermore

- Demand for DHW pre-warming by the heat pump,
- Safe temperature of the electric boiler exceeded.

b) The following **parameters**

- The temperature of (reversible) heating medium at the heat pump inlet;
  This temperature is the controlling variable of the heat pump and is used to control the operation of the heat pump (on/off),
- The temperature of the heating medium at the heat pump outlet (the condenser),
- Outdoor air temperature,
- The temperature of a heat-conveying medium (primary circuit) at the heat pump outlet,
- Compressor temperature,
- Operating hours of the compressor and the primary circuit circulation pump.

In **HPBW-E** and **HPWW-E** model furthermore

- Control temperature of heating medium (the temperature of heating medium returning from the heating system); according to this temperature, operation of the heat pump and the bivalence heat source is controlled,
- Heating medium temperature behind its mixing (if used),
- Operating hours of the electro-boiler.

If any of the statuses or parameters exceeds a limit value, the equipment is disengaged from operation and the display signals a respective 'failure'. A failure can also be signaled acoustically.

The regulator also secures the following:

- Delayed startup of the heat pump after connecting feeding voltage or after activating an emergency status (60 to 100s), this prevents undesirable repeated activations occurring during mains supply failures or improper handling of wiring,
- Anti-cyclic regulation that secures necessary delay between two repeated compressor startups (a minimum of 15 minutes),
- The regulation of a minimum compressor shutdown time (a minimum of 5 minutes),
- Switching of the supplementary bivalence heat source (programmable output).

In **HPBW-E** and **HPWW-E** model furthermore

- Electric boiler blocking according to outdoor temperature (bivalence condition temperature) during automatic mode,
- Successive switching of regulation outputs according to control temperature of heating medium,
- The option of mixing circuit control by means of a three-point servo drive 24 VAC,
- Automatic turn of circulation pumps to prevent air pockets in the pumps,
- The option of start mode use to put floor heating into operation,
- DHW warming by HP including the option of Legionella killing function Control of the three-way valve at the HP outlet,
- The option to set priority for heating, DHW warming or DHW warming in pre-set time intervals.

Communication between the control system and a superior control system:

Communication is provided by external input signals:

- either an initiating signal (potential-free contact, e.g. a room thermostat),
- or a signal from an external controller (potentiometer) used for user's stepless setting of equithermic curve correction in the range of -10,0°C to +10,0°C,
  One of the above mentioned signals must be led into the switchboard;
- **C**ollective **R**emote **C**ontrol signal (neutral conductor of the CRC signal);
- The signal of flow sensor (flow switch) primary circuit.

In the HP switchboard there are prepared appropriate terminals for these signals.

7.2 Power wiring

Electric power part contains:

- Connecting terminals for a fused lead of 3x400V, 50 Hz in **HP3BW** and **HP3WW**; 230V, 50 Hz in **HP1BW** and **HP1WW**,
- Terminal clamps for connection of the primary circuit circulation pump (if it is not a part of HP)
- Terminal clamps for connection of the heating circuit circulation pumps (230V, 50 Hz)

8. Design of a Heating System With a Heat Pump

A heating system with a heat pump must be designed by a qualified project engineer who shall propose an optimal system solution for a selected heating system and integrate a heat pump in that same system, considering the requirement stipulated in this documentation and other PZP's design data and information.

When the temperature is higher than the bivalence temperature the heating system works with a lower input temperature than the temperature proposed in a design, which is in compliance with a lower heating output required. Heating to a proposed inlet temperature below a bivalence temperature value will be secured by the other source.

This documentation is not intended to replace the design solutions of specific projects!

Connection of a bivalent source other than an electro-boiler has to be approved by a heat pump manufacturer.

9. Heat Pump Assembly and Commissioning

A heat pump must be to placed outside. Location is selected so that it can be easily accessible when installing external (circular) circuits, connecting power and controlling electric wires, carrying out the maintenance (servicing) of the mechanical and electrical parts. Free and accessible space (min. 70 cm) must remain in front of the HP front face and furthermore free space (min. 50 cm) in front of one side face at least. The minimum distance between HP and a wall is 5 cm.

When HP is delivered, the valves on the compressor suction and discharge side are closed. They must be opened prior operation commencement.

The installation of outer primary and secondary circuits and the integration of the heat pump in a heating system must correspond with all of the requirements set out in this documentation (as specified in highlighted paragraphs).

Following the installation of the outer circular distribution lines and of the entire heating system, following the connection of the heat pump to the mains supply and to its parent control system, the heat pump can be activated and commissioned.

Activation and commissioning can be carried out only by a company authorized by the manufacturer.

The activation and commissioning proceed in these steps:

- The primary and secondary circuits are filled with a working medium, perfectly vented;
- Check supply line connection and phase configuration, the adjustment of protective devices and the regulator, whereas special attention is paid to the correspondence of settings with the working substance in the primary circuit;
- The heating system and the heat pump are commissioned and their performance is tested;
- The function of the heat pump blocking elements is checked;
- The flow rate in both circuits is adjusted according to this documentation and a specific project;
- In a bivalent system, an bivalence source is commissioned and its function is tested along with the blocking. Cooperation with the heat pump and with heating system is tested as well;
- The initial inspection of the wiring is carried out.

Once these steps have been completed, the heat pump can be introduced in permanent operation.

10. Data for Making an Inquiry (Order)

In an inquiry (order) the following shall be stated:

- Type marking of a heat pump according to the information given herein
- Working substance of the primary circuit and its lowest temperature at the HP inlet
- Demand for the delivery of a flow sensor
- Other requirements, if any

Heat pumps are marked as follows:

HP3BW 11 E-1A

Colour finish - outer part	A,B	... standard
	C	... non-standard
Electric installations make	1	... Czech Republic
	2	... EU
Equipment degree	G	... basic, monovalence HP
	E	... maximum, bivalence HP
Nominal thermal performance		... ad table
Heat pump type	BW	... earth-water
	WW	... water-water
Nominal supply voltage	1	... single-phase 230 V, 50 Hz
	3	... three-phase 3x400 V, 50 Hz
Heat pump marking		

Colour finish heat pumps earth-water and water-water			
Inside part		**Front cover**	**Side cover**
Model	A - standard	white, RAL 9003	light silver, RAL 9006
	B - standard	light silver, RAL 9006	dark silver, RAL 9007
	C - non-standard	light silver, RAL 9006	white, RAL 9003

11. Working Conditions

The heat pump can be used as:

- A heat source for heating and water warming;
- Other applications are subject to an agreement with the manufacturer.

The heat pump can be operated in the following conditions:

- If installed as stationary, it can be used in a place protected from weather conditions
- In these climatic areas CT, WT, WDr – according to IEC 721-2-1 (under the conditions according to 'Environment classification')
- In environment normal – according to IEC 364-3

Environment classification:

- In operation class 3K4/3Z9/3B1/3C2/3S2/3M2 – according to EN 60721-3-3
- During storage class 1K3/1B1/1C2/1S3/1M2 – according to EN 60721- 3-1
- During transport class 2K2/2B1/2C2/2S1/2M2 – according to EN 60721- 3-2

The heat pump must not be placed or operated in an environment with the risk of the explosion of flammable gases and vapors BE3N2 according to IEC 364-3.

The heat pump must be removed from operation (by turning off the main lead) before starting work that might result in the changes of the environment (such as gluing, varnishing, etc.) in the room in which the heat pump in installed.

Requirements for the location of the heat pump

As per EN 378-1, if the heat pump is located in a special machine room it is not subject to any restrictions regarding the volume of the space where the heat pump is placed with regard to the amount of a refrigerant. In the opposite case, the volume of the space where the heat pump is placed must meet the following rule: the volume of the space in [m^3] is larger that the filling of the refrigerant in [kg] divided by 0.31 (critical concentration in [kg/m^3]).

Electrical equipment and its technical parameters:

–	Rated feeding voltage	3 x 400/230 V ± 10 % for **HP3BW** and **HP3WW** 230 V ± 10 % for **HP1BW** and **HP1AWW**
–	Current type and frequency	alternating, 50 Hz ± 1 %
–	Maximal power input	see tables
–	Mains characteristics	TN-C – according to IEC 364-3 for **HP3BW** and **HP3WW** TN-S – according to IEC 364-3 for **HP1BW** and **HP1WW**
–	Protection category	I – according to EN 60335-1
–	Degree of coverage protecti	IP40 – according to EN 60529 (applies to prescribed assembly and installation)

Limit parameters of the working substance in the primary circuit (heating medium):

- Maximal input (operational) temperature of water + 20 °C
  (unless another temperature is agreed upon with the manufacturer)
- Minimal input temperature of water + 8 °C
  (unless another temperature is agreed upon with the manufacturer)
- Maximal input temperature of anti-freeze liquid + 10 °C
- Minimal input temperature of anti-freeze liquid - 10 °C

Working substance in the primary circuit (heating medium)**:**

- Preference is given to water or to the aqueous solution of water and ethanol (30 %), Non-corrosive, and without mechanical impurities
- The use of another working substance is subject to an agreement with the manufacturer

Working substance in the secondary circuit (heating medium)**:**

- Preference is given to non-corrosive water without mechanical impurities
- The use of another working substance is subject to an agreement with the manufacturer

The active part of the primary and secondary circuit:

–	Maximum working overpressure	250 kPa
–	Minimal overpressure	25 kPa
–	Maximum working temperature	60 °C 75 °C only on DHW warming by **HPBW-E** and **HPWW-E** model

Mains supply:

- Fixed; its dimension design and protection must comply with the standards applicable in the country of use.

12. Scope of Delivery

Theheat pump is delivered as fully assembled and tested cooling equipment with a ‘Quality and Completeness Certificate’.

Each heat pump is delivered along with the following:

- Technical documentation
- Thermal probes - 3 pieces for **E** model and 1 piece for **G** model
- Silent blocks – 4 pcs; intended for horizontal alignment of HP
- Inbus screw key 8 mm

The following is included in the Manual:

- Operating and installation manual
- Installation instructions and Instructions on putting into operation
- Design basic document
- Diagram of the cooling and the hydraulic circuit
- Electric wiring diagram
- Adjustment of protective and control elements
- Certificate of product quality and comprehensiveness
- Guarantee certificate
- Report on electric equipment initial inspection
- EC declaration on conformity
- Certificate of conformity CE
- Service record

The manufacturer reserves the right to modify this information depending on the further improvements of the heat pumps.

Technical parameters heat pumps earth-water HP3BW

Type **HP3BW**		**05 E**	**07 E**	**09 E**	**11 E**	**13 E**	**15 E**	**19 G**	**23 G**	**27 G**	**33 G**	**41 G**
Data	Unit											
Energetic parameters **B0/W35** [1]												
- heating output	kW	5,3	7,3	9,1	10,5	13,1	15,4	19,7	23,3	27,8	34,0	41,5
- effective input	kW	1,3	1,7	2,1	2,4	3,0	3,5	4,8	5,5	6,4	7,9	9,6
- performance factor (COP)	-	4,1	4,2	4,3	4,4	4,4	4,4	4,1	4,2	4,4	4,3	4,3
B0/W50 [1]												
- heating output	kW	5,2	7,1	8,9	10,4	13,0	15,2	19,2	23,2	27,2	33,5	40,5
- effective input	kW	1,7	2,2	2,7	3,3	4,0	4,6	6,0	7,4	8,0	10,0	12,2
- performance factor (COP)	-	3,0	3,2	3,3	3,2	3,2	3,3	3,2	3,1	3,4	3,4	3,3
Electro-boiler												
- standard installed	kW	6	8	10	10	14	14	-	-	-	-	-
- maximal possible output	kW	14	14	14	14	14	14	-	-	-	-	-
Hydraulic parameters Primary circuit												
- flow rate	m^3/h	1,5	2,0	2,6	3,0	3,7	4,4	5,5	6,6	7,8	9,6	11,7
- pressure loss at HP	kPa	25	29	35	40	34	37	35	37	39	35	37
- built-in pump	-	Grundfos 25-80				Wilo TOP-S 30/10		-	-	-	-	-
Secondary circuit												
- flow rate recommended	m^3/h	0,9	1,3	1,6	1,8	2,3	2,7	3,4	4,0	4,8	5,9	7,2
- pressure loss at HP	kPa	9	13	15	18	25	31	14	13	16	11	14
- built-in pump	-	Grundfos 25-60				Grundfos 25-80		-	-	-	-	-
Electric parameters												
- feeding voltage	V / Hz	3x400 / 50										
- start up current compr.	A	13	20	23	26	32	37	50	61	63	83	99
- HP power lead fuse	A	C 16 A	C 25 A	C 25 A	C 25 A	C 40 A	C 40 A	C 20 A	C 25 A	C 25 A	C 32 A	C 40 A
Compressor	-	Scroll										
Refrigerant	-	R 407C										
Range temp. source	°C	anti-freeze -10 to +10										
Max. inlet temperature [2]	°C	55										
Piping dimension												
- primary circuit	mm	28 x 1				35 x 1,5		42 x 1,5			54 x 2	
- number of pipes	piece	2				2		2			2	
- secundary circuit	mm	28 x 1						35 x 1,5	42 x 1,5			
- number of pipes	piece	3						2	2			
Size and weight												
- width	mm	580						700				
- depth	mm	600						750				
- height	mm	1500						1500				
- weight	kg	155	165	170	180	190	195	270	280	290	320	340

1) For example B0/W35 means: The temperature of inlet medium at the primary side (brine) 0 °C, the temperature of water at the outlet of heat pump +35 °C.
2) The maximal temperature of water at the outlet of heat pump +55 °C at the temperature of inlet medium at the primary side (anti-freeze) -5 °C (B-5/W55). In HP3BW 23 heat pumps is this value at the temperature of inlet medium at the primary side(anti-freeze) 0 °C (B0/W55).

Technical parameters heat pumps water-water HP3WW

Type **HP3WW**		**08 E**	**10 E**	**12 E**	**14 E**	**18 G**	**22 G**	**26 G**	**32 G**	**36 G**	**44 G**	**54 G**
Data	Unit											
Energetic parameters **W10/W35**[1]												
- heating output	kW	7,3	9,9	12,4	14,3	17,8	20,8	25,8	31,1	35,8	44,4	53,8
- effective input	kW	1,5	1,9	2,3	2,6	3,3	3,9	4,5	5,5	6,2	7,8	9,3
- performance factor (COP)	-	5,0	5,3	5,3	5,5	5,5	5,4	5,7	5,7	5,8	5,7	5,8
W10/W50[1]												
- heating output	kW	6,7	9,0	11,3	13,1	16,3	19,0	23,8	28,8	33,3	40,9	50,0
- effective input	kW	1,9	2,4	3,0	3,5	4,3	5,0	6,5	7,7	8,8	11,0	13,2
- performance factor (COP)	-	3,6	3,7	3,8	3,8	3,8	3,8	3,7	3,7	3,8	3,7	3,8
Electro-boiler												
- standard installed	kW	8	10	14	14	-	-	-	-	-	-	-
- maximal possible output	kW	14	14	14	14	-	-	-	-	-	-	-
Hydraulic parameters Primary circuit												
- flow rate	m^3/h	1,3	1,7	2,2	2,5	3,2	3,7	4,6	5,5	6,4	7,9	9,6
- pressure loss at HP	kPa	10	12	15	21	18	20	18	19	21	17	19
- built-in pump	-	-	-	-	-	-	-	-	-	-	-	-
Secondary circuit												
- flow rate recommended	m^3/h	1,3	1,7	2,1	2,5	3,1	3,6	4,5	5,4	6,2	7,7	9,3
- pressure loss at HP	kPa	13	17	22	27	13	15	15	10	12	10	12
- built-in pump	-	Grundfos 25-60		Grundfos 25-80		-	-	-	-	-	-	-
Electric parameters												
- feeding voltage	V / Hz	3x400 / 50										
- start up current compr.	A	13	20	23	26	32	37	50	61	63	83	99
- HP power lead fuse	A	C 20 A	C 25 A	C 32 A	C 40 A	C 16 A	C 16 A	C 20 A	C 25 A	C 32 A	C 32 A	C 40 A
Compressor	-	Scroll										
Refrigerant	-	R 407C										
Range temp. source	°C	water +8 to +20										
Max. inlet temperature[2]	°C	55										
Piping dimension												
- primary circuit	mm	28 x 1				35 x 1,5		42 x 1,5			54 x 2	
- number of pipes	piece	2				2		2			2	
- secundary circuit	mm	28 x 1				35 x 1,5		42 x 1,5			54 x 2	
- number of pipes	piece	3				2		2			2	
Size and weight												
- width	mm	580				700						
- depth	mm	600				750						
- height	mm	1500				1500						
- weight	kg	150	160	165	175	205	210	270	290	300	330	355

1) For example W10/W50 means: The temperature of inlet medium at the primary side (water) +10 °C, he temperature of water at the outlet of heat pump +50 °C.
2) The maximal temperature of water at the outlet of heat pump +55 °C at the temperature of inlet medium at the primary side (water) in the range of temperature source.

Technical parameters heat pumps earth-water HP1BW and water-water HP1WW

Type **HP1BW**		**07 E**	**11 E**	**15 E**
Data	Unit			
Energetic parameters **B0/W35** [1]				
- heating output	kW	7,4	10,9	14,8
- effective input	kW	1,7	2,6	3,4
- performance factor (COP)	-	4,2	4,3	4,3
B0/W50 [1]				
- heating output	kW	7,0	10,4	14,5
- effective input	kW	2,3	3,4	4,9
- performance factor (COP)	-	3,1	3,1	3,0
Electro-boiler				
- standard installed	kW	6	8	10
- maximal possible output	kW	14	14	14
Hydraulic parameters Primary circuit				
- flow rate	m³/h	2,1	3,1	4,2
- pressure loss at HP	kPa	30	42	34
- built-in pump	-	Grundfos 25-80		Wilo 30/10
Secondary circuit				
- flow rate recommended	m³/h	1,3	1,9	2,6
- pressure loss at HP	kPa	13	20	29
- built-in pump	-	Grundfos 25-60		25-80
Electric parameters				
- feeding voltage	V / Hz	230 / 50		
- start up current compr.	A	76	108	150
- HP power lead fuse	A	C 32 A	C 40 A	C 50 A
Compressor	-	Scroll		
Refrigerant	-	R 407C		
Range temp. source	°C	anti-freeze -10 to +10		
Max. inlet temperature [2]	°C	55		
Piping dimension				
- primary circuit	mm	28 x 1		35 x 1,5
- number of pipes	piece	2		2
- secundary circuit	mm	28 x 1		
- number of pipes	piece	3		
Size and weight				
- width	mm	580		
- depth	mm	600		
- height	mm	1500		
- weight	kg	165	180	195

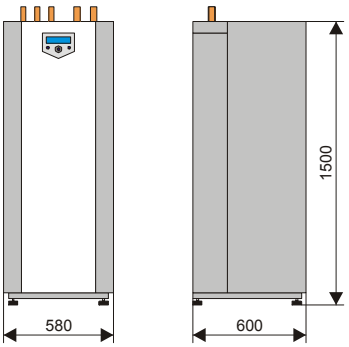
Type **HP1WW**		**10 E**	**14 E**	**20 E**
Data	Unit			
Energetic parameters **W10/W35** [1]				
- heating output	kW	9,9	14,4	19,4
- effective input	kW	2,0	2,9	3,6
- performance factor (COP)	-	5,0	5,0	5,4
W10/W50 [1]				
- heating output	kW	9,0	13,2	18,1
- effective input	kW	2,6	3,8	5,2
- performance factor (COP)	-	3,5	3,5	3,5
Electro-boiler				
- standard installed	kW	8	10	8
- maximal possible output	kW	14	14	14
Hydraulic parameters Primary circuit				
- flow rate	m³/h	1,7	2,5	3,5
- pressure loss at HP	kPa	12	21	18
- built-in pump	-	-	-	-
Secondary circuit				
- flow rate recommended	m³/h	1,7	2,5	3,4
- pressure loss at HP	kPa	17	28	15
- built-in pump	-	G 25-60	G 25-80	-
Electric parameters				
- feeding voltage	V / Hz	230 / 50		
- start up current compr.	A	76	108	150
- HP power lead fuse	A	C 40 A	C 50 A	C 50 A
Compressor	-	Scroll		
Refrigerant	-	R 407C		
Range temp. source	°C	water +8 to +20		
Max. inlet temperature [2]	°C	55		
Piping dimension				
- primary circuit	mm	28 x 1		35 x 1,5
- number of pipes	piece	2		2
- secundary circuit	mm	28 x 1		35 x 1,5
- number of pipes	piece	3		2
Size and weight				
- width	mm	580		700
- depth	mm	600		750
- height	mm	1500		1500
- weight	kg	160	175	205

1) For example B0/W35 means: The temperature of inlet medium at the primary side (brine) 0 °C, the temperature of water at the outlet of heat pump +35 °C.
For example W10/W50 means: The temperature of inlet medium at the primary side (water) +10 °C, the temperature of water at the outlet of heat pump +50 °C.

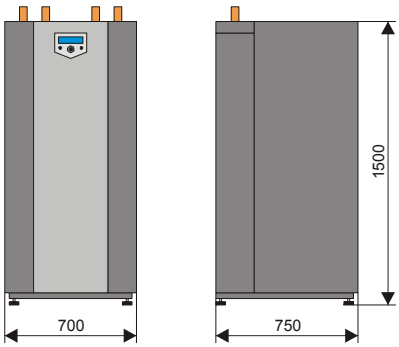
2) The maximal temperature of water at the outlet of heat pump +55 °C at the temperature of inlet medium at the primary side (anti-freeze) -5 °C (B-5/W55).
In HP1BW 15 heat pump is this value at the temperature of inlet medium at the primary side (anti-freeze) 0 °C (B0/W55).
The maximal temperature of water at the outlet of heat pump+55 °C at the temperature of inlet medium at the primary side (water) in the range of temperature source.

Dimensional sketches of HP3BW, HP3WW, HP1BW and HP1WW heat pumps

HP3BW 05 E - HP3BW 15 E
HP3WW 08 E - HP3WW 14 E
HP1BW 07 E - HP1BW 15 E
HP1WW 10 E - HP1WW 14 E



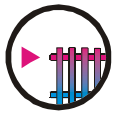
HP3BW 19 G - HP3BW 41 G
HP3WW 18 G - HP3WW 54 G
HP1WW 20 E



Pipeline - meaning of the symbols - earth-water and water-water heat pumps

Liquid outlet into the primary circuit

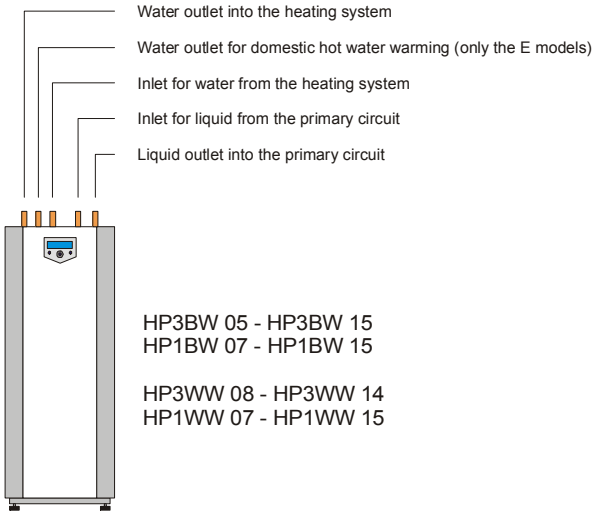
Inlet for liquid from the primary circuit



Water outlet into the heating system

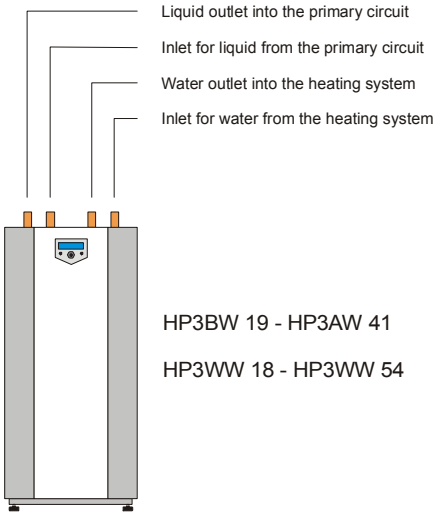
Inlet for water from the heating system

Water outlet for domestic hot water warming
(only the E models)



HP3BW 05 - HP3BW 15
HP1BW 07 - HP1BW 15

HP3WW 08 - HP3WW 14
HP1WW 07 - HP1WW 15



HP3BW 19 - HP3AW 41

HP3WW 18 - HP3WW 54

Recommended dimension design of the primary circuits of earth-water heat pumps

Heat pump PZP			**Vertical bore hole**					
Type	Size	Flow rate	Total length	Length of loop	No. of loops	Diameter	Min. distance	Pressure loss
		m^3/h	m	m	piece	mm	m	kPa
HP3BW	05	1,5	90	90	1	2 x 40	x	12,0
	07	2,0	112	112	1	2 x 40	x	20,0
	09	2,6	140	70	2	2 x 32	10	19,5
	11	3,0	160	80	2	2 x 32	10	25,0
	13	3,7	200	100	2	2 x 40	10	18,0
	15	4,4	240	80	3	2 x 32	10	25,0
	19	5,5	300	100	3	2 x 40	10	17,0
	23	6,6	360	90	4	2 x 32	10	30,0
	27	7,8	400	100	4	2 x 40	10	18,0
	33	9,6	500	100	5	2 x 40	10	18,0
	41	11,7	630	90	7	2 x 32	10	33,0
HP1BW	07	2,1	112	112	1	2 x 40	x	22,0
	11	3,1	160	80	2	2 x 32	10	26,5
	15	4,2	240	80	3	2 x 32	10	23,0

Heat pump PZP			**Horizontal ground collector**				
Type	Size	Flow rate	Length of loop	No. of loops	Diameter	Min. distance	Pressure loss
		m^3/h	m	piece	mm	m	kPa
HP3BW	05	1,5	100	3	32	0,7	11,0
	07	2,0	100	4	32	0,7	14,0
	09	2,6	100	5	32	0,7	10,0
	11	3,0	100	6	32	0,7	10,0
	13	3,7	100	7	32	0,7	12,0
	15	4,4	100	8	32	0,7	13,0
	19	5,5	100	10	32	0,7	11,0
	23	6,6	100	12	32	0,7	11,0
	27	7,8	100	14	32	0,7	11,0
	33	9,6	100	17	32	0,7	12,0
	41	11,7	100	20	32	0,7	12,0
HP1BW	07	2,1	100	4	32	0,7	15,5
	11	3,1	100	6	32	0,7	10,5
	15	4,2	100	8	32	0,7	12,0

Remark: In the stated loss are included losses of the backbone pipelines of a length of 12 m and local losses in the distributor.
In geothermal wells is used a double-circuit probe.

Circulation pumps recommended for PZP heat pumps with geothermal wells GERO*top*

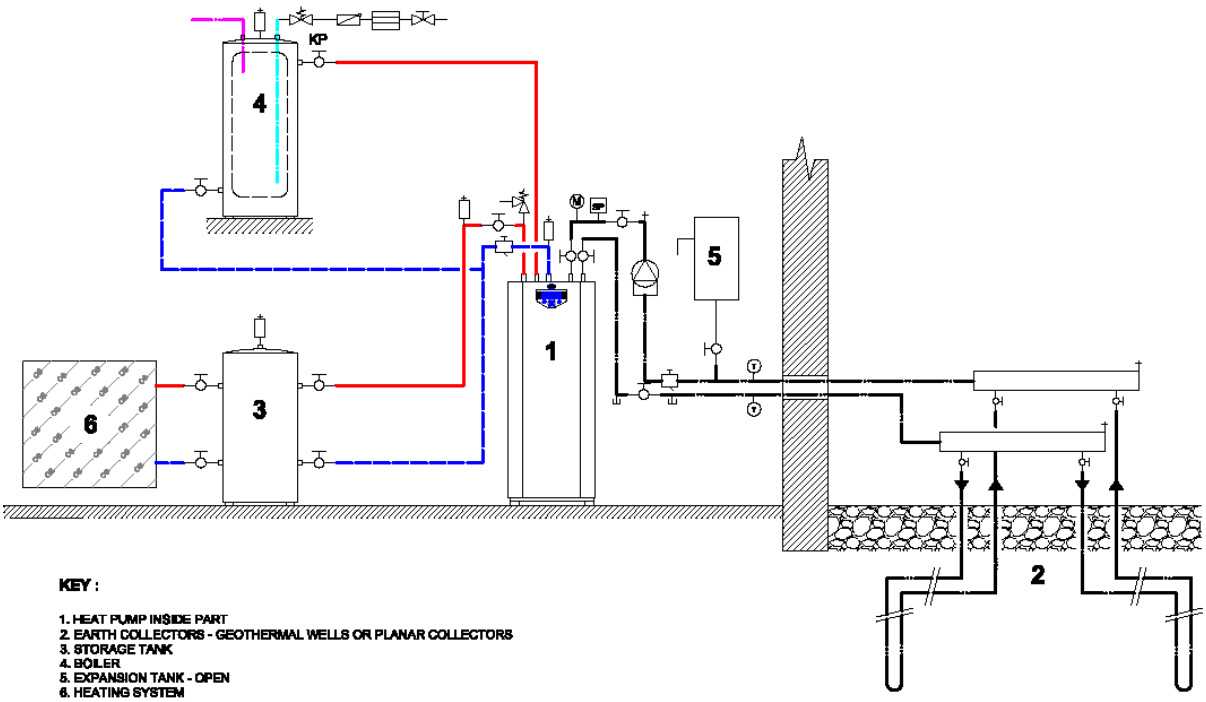
GRUNDFOS 1-phase pump				
Type	**Size**	**Type**	**Power supply**	**Order code**
HP3BW	**05 to 11**	UP 25-80 KU PN6/10	1x230-240V, 50Hz	52004413
		UPS 25-80 PN6/10	1x230-240V, 50Hz	52001110
	13 and 15	UPS 32-120 F PN6/10	1x230-240V, 50Hz	96401837
	19	UPS 32-120 F PN6/10	1x230-240V, 50Hz	96401837
		TP 32-90/2 R A-O-A-GQQE 0,25kW	1x220-240V, 50Hz	96465385
	23	UPS 40-120 F PN6/10	1x230-240V, 50Hz	96401942
		TP 32-180/2 A-F-A-RUUE PN6/10 0,55kW	1x220-240V, 50Hz	96463707
	27	UPS 32-120 F PN6/10	1x230-240V, 50Hz	96401837
		TP 32-120/2 A-F-A-RUUE PN6/10 0,37kW	1x220-240V, 50Hz	96438817
	33	UPS 40-120 F PN6/10	1x230-240V, 50Hz	96401942
		TP 40-120/2 A-F-A-RUUE PN6/10 0,37kW	1x220-240V, 50Hz	96438822
	41	UPS 40-180 F PN6/10	1x230-240V, 50Hz	96401977
		TP 40-180/2 A-F-A-RUUE PN6/10 0,55kW	1x220-240V, 50Hz	96438823
HP1BW	**05 and 11**	UPS 25-80 PN6/10	1x230-240V, 50Hz	52001110
	15	UPS 32-120 F PN6/10	1x230-240V, 50Hz	96401837

GRUNDFOS 3-phase pump				
Type	**Size**	**Type**	**Power supply**	**Order code**
HP3BW	**05 to 11**			
	13 and 15	UPS 32-120 F PN6/10	3x400-415V, 50Hz	96401839
	19	UPS 32-120 F PN6/10	3x400-415V, 50Hz	96401839
		TP 32-90/2 R A-O-A-GQQE 0,25kW	3x220-240D/380-415YV, 50Hz	96465393
	23	UPS 40-120 F PN6/10	3x400-415V, 50Hz	96401944
		TP 32-180/2 A-F-A-RUUEPN6/10 0,55kW	3x220-240D/380-415YV, 50Hz	96463708
		TP 32-120/2 A-F-A-RUUE PN6/10 0,37kW	3x220-240D/380-415YV, 50Hz	96438865
	27	UPS 32-120 F PN6/10	3x400-415V, 50Hz	96401839
		TP 32-120/2 A-F-A-RUUE PN6/10 0,37kW	3x220-240D/380-415YV, 50Hz	96438865
	33	UPS 40-120 F PN6/10	3x400-415V, 50Hz	96401944
		TP 40-120/2 A-F-A-RUUE PN6/10 0,37kW	3x220-240D/380-415YV, 50Hz	96438869
	41	UPS 40-180 F PN6/10	3x400-415V, 50Hz	96401979
		TP 40-180/2 A-F-A-RUUE PN6/10 0,55kW	3x220-240D/380-415YV, 50Hz	96438870

WILO 1-phase pump				
Type	**Size**	**Type**	**Power supply**	**Order code**
HP3BW	**05 to 11**	TOP-S 25/7 1~ PN6/10	1x230V, 50Hz	2006930
	13 and 15	TOP-S 30/10 1~ PN6/10	1x230V, 50Hz	2001350
	19	TOP-S 40/7 1~ PN6/10	1x230V, 50Hz	2046602
	23 to 41			
HP1BW	**05 and 11**	TOP-S 25/7 1~ PN6/10	1x230V, 50Hz	2006930
	15	TOP-S 30/10 1~ PN6/10	1x230V, 50Hz	2001350

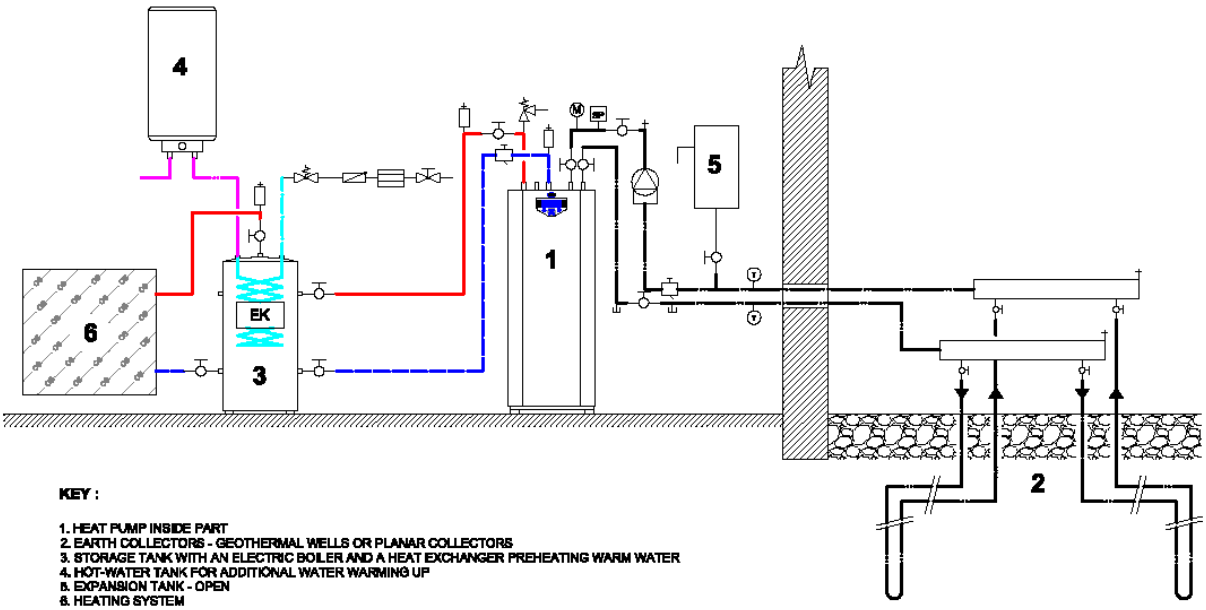
WILO 3-phase pump				
Type	**Size**	**Type**	**Power supply**	**Order code**
HP3BW	**05 to 11**	TOP-S 25/7 3~ PN6/10	3x400V, 50Hz	2006931
	13 and 15	TOP-S 30/10 3~ PN6/10	3x400V, 50Hz	2001351
	19	TOP-S 40/7 3~ PN6/10	3x400V, 50Hz	2046603
		TOP-S 40/10 3~ PN6/10	3x400V, 50Hz	2046604
	23 to 33	TOP-S 40/10 3~ PN6/10	3x400V, 50Hz	2046604
	41	TOP-S 50/10 3~ PN6/10	3x400V, 50Hz	2046608

Connection diagram for earth-water heat pumps



KEY :

1. HEAT PUMP INSIDE PART
2. EARTH COLLECTORS - GEOTHERMAL WELLS OR PLANAR COLLECTORS
3. STORAGE TANK
4. BOILER
5. EXPANSION TANK - OPEN
6. HEATING SYSTEM



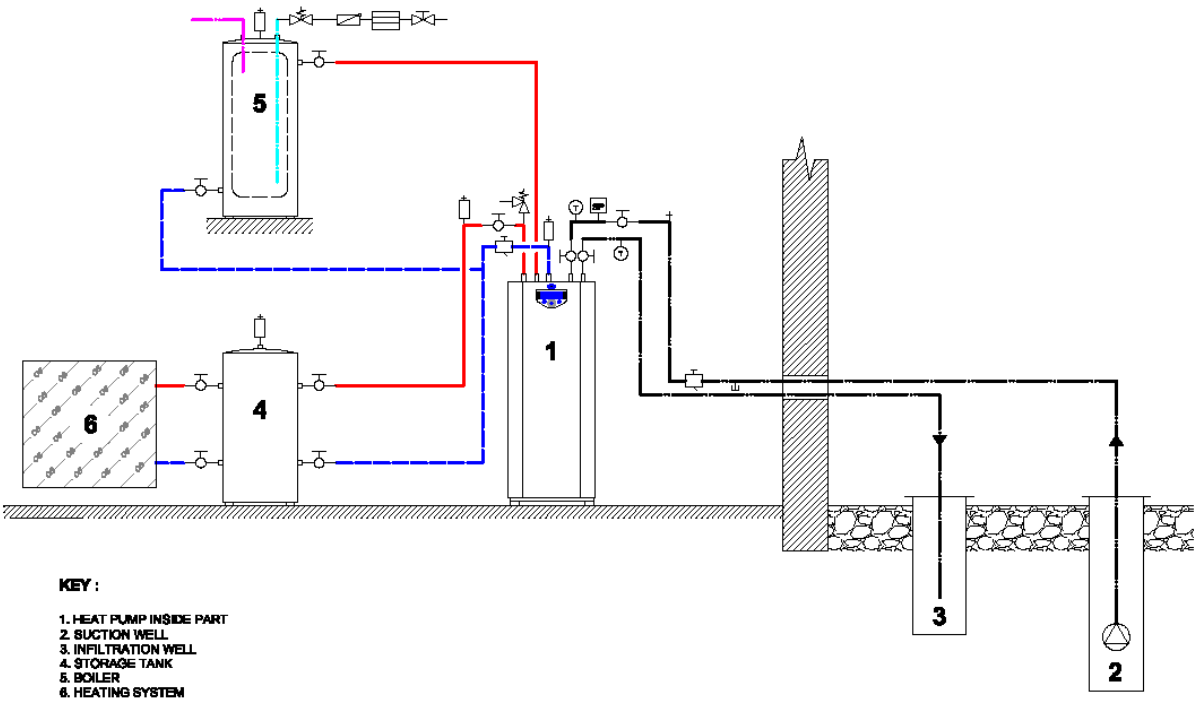
KEY :

1. HEAT PUMP INSIDE PART
2. EARTH COLLECTORS - GEOTHERMAL WELLS OR PLANAR COLLECTORS
3. STORAGE TANK WITH AN ELECTRIC BOILER AND A HEAT EXCHANGER PREHEATING WARM WATER
4. HOT-WATER TANK FOR ADDITIONAL WATER WARMING UP
5. EXPANSION TANK - OPEN
6. HEATING SYSTEM

KEY TO PIPELINES :

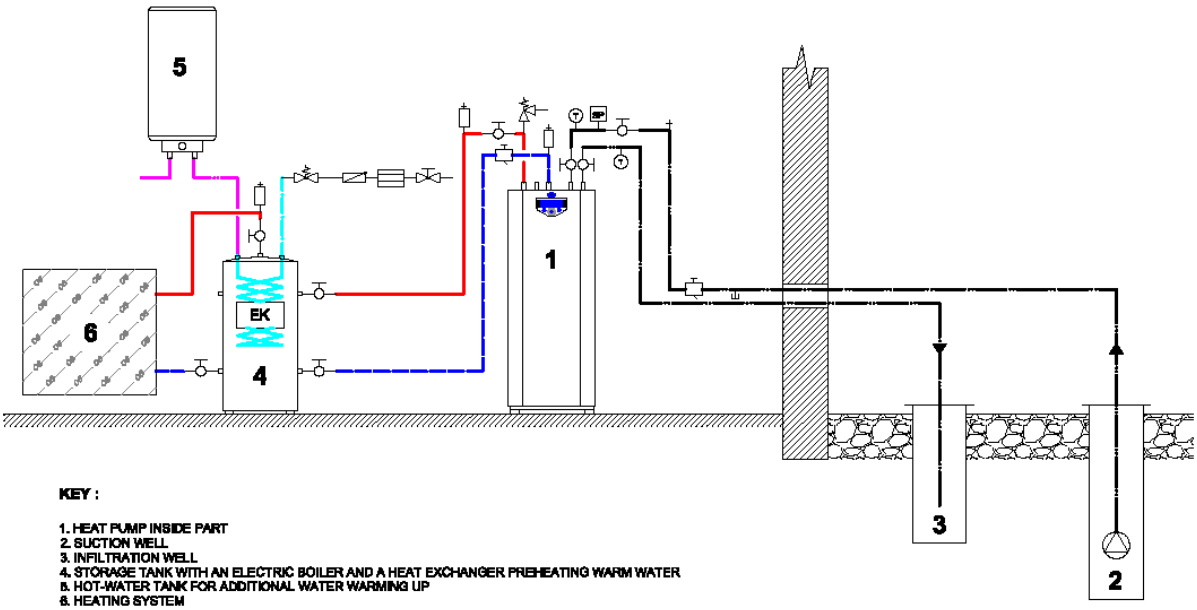
- HEATING WATER - SUPPLY
- RETURN HEATING WATER
- PRIMARY CIRCUIT PIPELINES
- COLD SERVICE WATER
- WARM SERVICE WATER

Connection diagram for water-water heat pumps



KEY :

1. HEAT PUMP INSIDE PART
2. SUCTION WELL
3. INFILTRATION WELL
4. STORAGE TANK
5. BOILER
6. HEATING SYSTEM



KEY :

1. HEAT PUMP INSIDE PART
2. SUCTION WELL
3. INFILTRATION WELL
4. STORAGE TANK WITH AN ELECTRIC BOILER AND A HEAT EXCHANGER PREHEATING WARM WATER
5. HOT-WATER TANK FOR ADDITIONAL WATER WARMING UP
6. HEATING SYSTEM

KEY TO PIPELINES :

- HEATING WATER - SUPPLY
- RETURN HEATING WATER
- PRIMARY CIRCUIT PIPELINES
- COLD SERVICE WATER
- WARM SERVICE WATER

Protection and dimension design of the supply line of earth-water heat pumps HP3BW

Table 1

Type	HP3BW		05 E	07 E	09 E	11 E	13 E	15 E
Data		Unit						
COMPRESSOR:	- start up current (Soft starter)	A	13	20	23	26	32	37
	- operating current[1)]	A	3,8	5,0	5,9	6,8	8,2	9,6
ELECTRIC BOILER:	- 1. phase (L1)	A	8,7	11,6	14,5	14,5	20,3	20,3
	- 2. phase (L2)	A	8,7	11,6	14,5	14,5	20,3	20,3
	- 3. phase (L3)	A	8,7	11,6	14,5	14,5	20,3	20,3
	- Total performance	**kW**	**3x2(6)**	**3x2,7(8)**	**3x3,3(10)**	**3x3,3(10)**	**3x4,7(14)**	**3x4,7(14)**
CURRENT TAKE-OFF:	- bivalence mode (compr. + 2. stages EB)	A	12,5	16,6	20,4	21,3	28,5	29,9
	- primary circulation pump	A	0,8	0,8	0,8	0,8	2,0	2,0
	- secondary circulation pump	A	0,4	0,4	0,4	0,4	0,8	0,8
	- heating system circulation pump 3 circuits	A	1,2	1,2	1,2	1,2	1,2	1,2
	- heat pump control system	A	0,2	0,2	0,2	0,2	0,2	0,2
	- total current take-off	**A**	**15,2**	**19,3**	**23,1**	**24,0**	**32,8**	**34,2**
DIMENSION DESIGN:	- main supply line (breaker)	A	C16/3	C25/3	C25/3	C25/3	C40/3	C40/3

Table 2

Type	HP3BW		05 G	07 G	09 G	11 G	13 G	15 G	19 G	23 G	27 G	33 G	41 G
Data		Unit											
COMPRESSOR:	- start up current (Soft starter)	A	13	20	23	26	32	37	50	61	63	83	99
	- operating current[1)]	A	3,8	5,0	5,9	6,8	8,2	9,6	13,7	16,6	17,0	20,3	25,4
ELECTRIC BOILER:	- 1. phase (L1)	A	----	----	----	----	----	----	----	----	----	----	----
	- 2. phase (L2)	A	----	----	----	----	----	----	----	----	----	----	----
	- 3. phase (L3)	A	----	----	----	----	----	----	----	----	----	----	----
	- Total performance	**kW**	**----**	**----**	**----**	**----**	**----**	**----**	**----**	**----**	**----**	**----**	**----**
CURRENT TAKE-OFF:	- bivalence mode (compr. + 2. stages EB)	A	----	----	----	----	----	----	----	----	----	----	----
	- primary circulation pump	A	0,8	0,8	0,8	0,8	2,0	2,0	2,5	2,5	2,5	4,5	4,5
	- secondary circulation pump	A	0,4	0,4	0,4	0,4	0,8	0,8	0,8	0,8	0,8	0,8	2,0
	- heating system circulation pump 3 circuits	A	1,2	1,2	1,2	1,2	1,2	1,2	----	----	----	----	----
	- heat pump control system	A	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2
	- total current take-off	**A**	**6,5**	**7,7**	**8,6**	**9,5**	**12,5**	**13,9**	**17,3**	**20,2**	**20,6**	**25,9**	**32,2**
DIMENSION DESIGN:	- main supply line (breaker)	A	C10/3	C13/3	C13/3	C16/3	C16/3	C16/3	C20/3	C25/3	C25/3	C32/3	C40/3

1) The value of compressor operating current under B10/W55 condition.

Remark: In HP3BW heat pumps of all G model types no electric boiler is fitted and connected.
Heating circuits are not fitted in HP3BW heat pumps of 19 G, 23 G, 27 G, 33 G, 41 G types.

Protection and dimension design of the supply line of water-water heat pumps HP3WW

Table 1

Type	HP3WW		08 E	10 E	12 E	14 E
Data		Unit				
COMPRESSOR:	- start up current (Soft starter)	A	13	20	23	26
	- operating current[1)]	A	4,0	5,1	6,2	7,0
ELECTRIC BOILER:	- 1. phase (L1)	A	11,6	14,5	20,3	20,3
	- 2. phase (L2)	A	11,6	14,5	20,3	20,3
	- 3. phase (L3)	A	11,6	14,5	20,3	20,3
	- Total performance	**kW**	**3x2,7(8)**	**3x3,3(10)**	**3x4,7(14)**	**3x4,7(14)**
CURRENT TAKE-OFF:	- bivalence mode (compr. + 2. stages EB)	A	15,6	19,6	26,5	27,3
	- primary circulation pump	A	1,0	1,0	2,2	2,2
	- secondary circulation pump	A	0,4	0,4	0,8	0,8
	- heating system circulation pump 3 circuits	A	1,2	1,2	1,2	1,2
	- heat pump control system	A	0,2	0,2	0,2	0,2
	- total current take-off	**A**	**18,5**	**22,5**	**31,0**	**31,8**
DIMENSION DESIGN:	- main supply line (breaker)	A	C20/3	C25/3	C32/3	C40/3

Table 2

Type	HP3WW		08 G	10 G	12 G	14 G	18 G	22 G	26 G	32 G	36 G	44 G	54 G
Data		Unit											
KOMPRESOR:	- start up current (Soft starter)	A	13	20	23	26	32	37	50	61	63	83	99
	- operating current[1)]	A	4,0	5,1	6,2	7,0	8,6	10,2	14,1	16,6	18,0	21,4	26,0
ELECTRIC BOILER:	- 1. phase (L1)	A	----	----	----	----	----	----	----	----	----	----	----
	- 2. phase (L2)	A	----	----	----	----	----	----	----	----	----	----	----
	- 3. phase (L3)	A	----	----	----	----	----	----	----	----	----	----	----
	- Total performance	**kW**	**----**	**----**	**----**	**----**	**----**	**----**	**----**	**----**	**----**	**----**	**----**
CURRENT TAKE-OFF:	- bivalence mode (compr. + 2. stages EB)	A	----	----	----	----	----	----	----	----	----	----	----
	- primary circulation pump	A	1,0	1,0	2,2	2,2	2,2	2,2	2,7	2,7	2,7	4,6	6,0
	- secondary circulation pump	A	0,4	0,4	0,8	0,8	0,8	0,8	0,8	2,0	2,0	2,0	1,2
	- heating system circulation pump 3 circuits	A	1,2	1,2	1,2	1,2	----	----	----	----	----	----	----
	- heat pump control system	A	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2
	- total current take-off	**A**	**6,9**	**8,0**	**10,7**	**11,5**	**11,9**	**13,5**	**17,9**	**21,6**	**23,0**	**28,3**	**33,5**
DIMENSION DESIGN:	- main supply line (breaker)	A	C10/3	C13/3	C13/3	C16/3	C16/3	C16/3	C20/3	C25/3	C32/3	C32/3	C40/3

1) The value of compressor operating current under W20/W55 condition.

Remark: In HP3WW heat pumps of all G model types no electric boiler is fitted and connected.
Heating circuits are not fitted in HP3WW heat pumps of 18 G, 22 G, 26 G, 32 G, 36 G, 44 G, 54 G types.

Protection and dimension design of the supply line of earth-water heat pumps HP1BW

Table 1

Type	**HP1BW**		**07 E**	**11 E**	**15 E**
Data		Unit			
COMPRESSOR:	- start up current	A	76	108	150
	- operating current[1)]	A	18,5	25,0	29,8
ELECTRIC BOILER:	- 1. EB stage	A	8,6	11,6	14,5
	- 2. EB stage	A	8,6	11,6	14,5
	- 3. EB stage	A	8,6	11,6	14,5
	- Total performance	**kW**	**3x2(6)**	**3x2,7(8)**	**3x3,3(10)**
CURRENT TAKE-OFF:	- bivalence mode (compr. + 1. stage EB)	A	27,1	36,6	44,3
	- primary cirkulation pump	A	0,8	0,8	2,0
	- secondary circulation pump	A	0,4	0,4	0,8
	- circulation pump of the heating system 2 circuits	A	0,8	0,8	0,8
	- heat pump control system	A	0,2	0,2	0,2
	- total current take-off	**A**	**29,4**	**38,9**	**48,2**
DIMENSION DESIGN:	- main supply line (breaker)	A	C32/1	C40/1	C50/1

Protection and dimension design of the supply line of water-water heat pumps HP1WW

Table 1

Type	**HP1WW**		**10 E**	**14 E**	**20 E**
Data		Unit			
COMPRESSOR:	- start up current	A	76	108	150
	- operating current[1)]	A	18,5	25,0	29,8
ELECTRIC BOILER:	- 1. EB stage	A	11,6	14,5	11,6
	- 2. EB stage	A	11,6	14,5	11,6
	- 3. EB stage	A	11,6	14,5	11,6
	- Total performance	**kW**	**3x2,7(8)**	**3x3,3(10)**	**3x2,7(8)**
CURRENT TAKE-OFF:	- bivalence mode (compr. + 1. stage EB)	A	30,1	39,5	41,4
	- primary cirkulation pump	A	2,5	3,8	4,2
	- secondary circulation pump	A	0,4	0,8	0,8
	- circulation pump of the heating system 2 circuits	A	0,8	0,8	0,8
	- heat pump control system	A	0,2	0,2	0,2
	- total current take-off	**A**	**34,1**	**45,2**	**47,4**
DIMENSION DESIGN:	- main supply line (breaker)	A	C40/1	C50/1	C50/1

1) The value of compressor maximum operating current in the range of application.