



KOMPLET
a.s.

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Heat pumps air-water Split systems



1. General – Application

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

The characteristic feature of the heat pump is its ability to transform - with the aid of electric energy – low-potential heat from 'natural' sources that cannot be utilized in common ways (for instance, heat from the ambient air, soil, or ground water) to heat suitable for heating. The principle of the heat pump implies that the heating output to electrical input ratio (so-called performance factor) is always greater than one, which means that heating output is always greater than electric input. The economical convenience of the heat pump – i.e. the greater the temperature of the low-potential heat and the lower the temperature of the heating medium, the greater the amount of the thermal energy produced from taken electric energy. The heat pump is therefore suitable especially in combination with low-temperature heating systems (for instance, under-floor heating or wall heating and large-surface radiators).

2. Characteristic Features – Heating System

Heat pumps HP3AW and HP1AW (hereinafter referred to as 'the heat pump' or 'the **HPAW** pump') are **designed** as 'air-water' pumps, i.e. the source of their low-potential heat is the ambient air. The heating output from the heat pump is removed through a circulation circuit filled with water that functions as a heating medium.

Considering the relation between the need for heat and energy consumption needed for heating during the heating season it is recommended that a **heating system with a heat pump** is designed as a **bivalent** system, i.e. that the heat pump alone is able to cover the need for the heat, or rather heating output, only up to a certain outside temperature, for instance, for instance 0°C (so-called bivalence temperature), whereas it cooperates with another heat source such as a direct-heating electro-boiler at lower temperatures. The so-designed heating system achieves an optimal ratio between acquisition and operational costs.

The heat pumps work with the **SCROLL compressors** and with an absolutely ecologically safe refrigerant called **R 404A**. The plus side of the heat pumps with these compressors and with this type of cooling agent is the fact that the decline of heating output and performance factor depending on the drop of the outside temperature is very mild, which is obvious from the attached tables of technical parameters.

3. 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**

Low-potential heat is supplied to the evaporator through the ambient air. The supplied heat causes the refrigerant to evaporate; the vapors of the refrigerant thus become the carrier of thermal energy, which they transport to the compressor. The air whose circulation through the evaporator is secured by an axial ventilator or ventilators is being cooled at the same time. The air path forms 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

The **HPAW heat pump** is a heating unit comprising two parts.

Outer part – the evaporator of the heat pump (that operates as an air cooler) is located in an open area. The circulation of the air through the evaporator is secured by an axial fan or fans. The evaporator also includes a thermostatic expansion (choke) valve.

Inside part - shall be located in a suitable interior area. The interior part contains remaining parts of the heat pump, especially the compressor and the plate condenser, other parts of the cooling circuit and the electric switchboard of the heat pump including the control panel.

Both parts of the heat pump are assembled in separate metal boxes. The box of the inside part is noise-proof.

Both parts of the heat pump are assembled together by means of copper piping and necessary cables.

The heat pumps are offered as **HP3AW** models for three-phase supply **3x400 V** or **HP1AW** models for single-phase supply **230 V**.

Heat pump models air-water and internal equipment:	Bivalence source regulation	Reg. mixing valve	Pump - secondary	Electric boiler	Three-way valve DHW
HP3AW 06 SB to HP3AW 18 SB	ON/OFF		●		
HP3AW 06 SC to HP3AW 18 SC	3 stages	●	●		
HP3AW 06 SE to HP3AW 18 SE	3 stages	●	●	●	●
HP3AW 22 SB to HP3AW 36 SB	ON/OFF				
HP3AW 22 SC to HP3AW 36 SC	3 stages	●			

Heat pump models air-water and internal equipment:	Bivalence source regulation	Reg. mixing valve	Pump - secondary	Electric boiler	Three-way valve DHW
HP1AW 06 SB to HP1AW 16 SB	ON/OFF		●		
HP1AW 06 SC to HP1AW 16 SC	3 stages	●	●		
HP1AW 06 SE to HP1AW 16 SE	3 stages	●	●	●	●

Design thermal loss of the building in HP failure need not to be 100% covered by performance of the **HPAW-SE** pump electric boiler!

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

5. Cooling circuit

The cooling circuit (read paragraph 3. 'Working principle') consists of a hermetic spiral compressor - SCROLL, plate condenser and a tubular evaporator; the supply of the coolant to the evaporator is controlled by a thermostatic expansion valve.

All of the parts of the circuit are interconnected with copper piping that is fitted with other necessary integrated components.

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.

Evaporator defrosting. When the air on the evaporator cools off, the humidity on its surface condenses. At low outside temperatures, the same humidity on the heat-exchange evaporator surface freezes and forms ice. The ice defrosted periodically. At a temperature greater than about 2 °C, the defrosting is secured by circulation through the evaporator or evaporators – by the 'running-out' of the fans after the heat pump's shutdown. At a lower temperature, the defrosting is induced by reversing the function of the heat pump – which is applicable to heat pumps with one evaporator or by exchanging the function of the evaporator - which is applicable to heat pumps of greater type sizes with two evaporators.

Defrosting by reversing the heat pump's function is achieved by means of a four-way electromagnetic valve that relays the paths at the compressor inlet and outlet so that the plate exchanger is connected to a compressor suction unit and functions as an evaporator; and the tubular exchanger is connected to a compressor delivery and functions as a condenser.

Defrosting by exchanging the function of the evaporator is achieved by two three-way valves that change the function of one of the two evaporators with the function of the condenser in cycles. The other evaporator retains its basic activity and the heat pump works only with the outside exchangers. The basic condenser in the inside part is automatically disengaged from operation. The flow of the coolant between both outside exchangers is secured by the bypasses thermostatic expansion valves fitted with reverse valves.

The cooling circuit is fitted with other components that secure the reliability and safety of its operation. These components are a receiver, filter drier, a liquid indicator and suction accumulator.

The proper operational conditions (suction and delivery pressure and temperature at the compressor delivery) follow the combined pressostat and the thermostat.

6. Heat pump primary circuit

The primary circuit secures the supply of low-potential heat to the heat pump.

Evaporator location shall be selected so that the length of the pipeline connecting the evaporator and the interior part will not be longer than ca. 10 m.

It has been said in this information that low-potential heat is obtained by cooling the ambient air. The cooling of the air leads to the condensation of humidity that gets frozen on the evaporator if the temperature is below +7 °C. The ice melts periodically and automatically as described above. The defrosted ice drips (runs) freely from the horizontally placed evaporator into the area under the evaporator. Because the defrosted evaporator works as a condenser when defrosting is achieved by reversing or by exchanging the evaporator's function, the heat is supplied and the ice is defrosted 'from within the inside'. In such a situation, the ice on the heat-exchanging surface usually does not melt completely, but moves down under the evaporator in smaller or bigger pieces.

The location of the evaporator, or other measures must be chosen to prevent defrosted ice from causing inconvenience.

Recommendations concerning evaporator location and preparation of the ground under the evaporator can be found in the picture part of this document.

7. Secondary circuit

The secondary circuit secures the transfer of the heat pump's heating output to the 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.

The secondary circuit is not included in a heat pump delivery.

7.1 Circulation circuit proper

In order to secure the heat pump's parameters according to this documentation and operational safety, the secondary circuit must meet the following requirements:

- The circulation pump must (in the required flow rate) ensure the coverage of pressure losses of the whole circuit including HP internal pressure loss on the condenser side and 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 rate (heating medium) must be constant and must correspond with this documentation.
- In order to adjust a flow-rate amount a flow meter and appropriate regulation armatures must be installed within the circuit (at least for adjustment during commissioning).
- If no flow meter is permanently fitted, flow rate can be verified indirectly according to a change in HP medium temperature (the difference between inlet and outlet temperature of the heating medium).
- An efficient filter must be fitted in front of the heat pump's inlet socket; the filter captures impurities from the outside parts of the circulation circuit and prevents the possible contamination of the plate heat exchanger. The filter is mounted outside the heat pump to allow for easy inspection and cleaning.
- The circuit must be designed so that it can be vented perfectly.
- Measures must be taken inside the circuit to eliminate the volumetric changes of the working substance (heating medium) depending on temperature changes. HP comprises no expansion tank
- The circuit must be secured in accordance with valid standards. To hot water outlet(s) of HP, a safety valve must be fitted
- The connection of the outer circulation circuit must be completed with removable joints one side of which must be welded onto the neck of the HP.
- The dimension of the outer pipelines is calculated according to the 'flow rate – pressure loss' relation, it is not chosen according to the dimension of the heat pump neck.

7.2 Heat pump in a heating system

In order to ensure the reliability of the heat pump (i.e. of the 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.

Considering that the heating system works:

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

whereas both of these conditions are inappropriate for heat pumps, it is necessary to provide for the independent flow of the heating medium through the heat pump and the heating system.

This basic requirement is satisfied by securing the flow rate in both parts by means of independent circular pumps, i.e. by installing one independent circular pump for the heat pump and another one for the heating system. At the same time both pumps (i.e. also the pump used by the heating system) must be sized for a flow rate amount required by the heat pump and both parts must be interconnected either with a thermo hydraulic distributor or with an accumulation tank in order to make sure that there is an independent flow in both segments.

The heat pump's output within a heating system is controlled in a two-positional manner, i.e. 'on and off'. The frequency of switching depends mainly on the heating system's design, its regulation, total filling of the heating medium in the heating system, and the ability of such a filling to accumulate heat; whereas the frequency derives from the following facts:

Within a heating system the heat pump represents a heat source and a selected heating system represents heat consumption. Because the heat pump alone does not have output regulation, the disproportions between the source's output and consumption is resolved by heat accumulation in the heating system's filling, or rather in the heating system's active segment. 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 system filling that circulates in the heat pump under any working (regulation) status of the heating system. If the active filling of the system is not sufficient, it has to be secured by an accumulation tank.

If the heat pump's heating output is not fully utilized, the heat pump operates in working cycles when:

- During the first cycle part the heat pump is engaged in operation, heat accumulates in the system's filling, and the system is being 'charged' (by the surplus output of the source as opposed to the output of the consumption part);
- During the second cycle part the heat pump is disengaged, the accumulated heat is taken from the system's 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]:

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

The questions connected with the frequency of switching are considered when there are reduced requirements for heating output, i.e. at the higher temperatures of the outside air (above a bivalence temperature level). When higher requirements for heating output are in place, i.e. when the temperature of the outside air is lower (below a bivalence temperature level), the heat pump works permanently and its output is complemented by the other source.

In order not to exceed the frequency of switching, the control system of the heat pump is provided with so-called anticyclic regulation that prevents the repeated startups of the cooling circuit within short time intervals.

It is often the case in a heating system with poor heat accumulation that if there are lower requirements for heating output, the frequency of switching is not determined by controlling temperature by anticyclic regulation.

The proper solution of issues connected with the system's accumulation capacity has great importance for the full utilization of the heat pump.

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

7.3 Working substance

Water is considered the unquestionable working substance (heating medium) of the secondary circuit.

8. 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 fan (fans), the evaporator and circulation pumps of heating circuits as given in the electric wiring diagram. The electric distributor for HPs of the SC make used in types HP3AW 18 SC and HP1AW 16 SC contains an electric power terminal for three stages of the electric boiler

The electric switchboard is not provided with any main switch. It is assumed that it will be a part of individually protected HP supply line.

Electric switchboard provides for control and regulation of the whole heating system including a bivalence source.

8.1 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)

The detailed description of the control panel and of the heat pump's operation is not a part of these designing data and information.

The regulator monitors:

a) The following **operational statuses**

- Discharge (condensation) pressure,
- Suction (evaporation) pressure,
- Compressor discharge temperature,
- Correct phase sequence and full voltage on all phases, power supply to **HP3AW**, full voltage on the phase of **HP1AW**
- Correct progress of evaporator defrosting,
- Demand for heating system operation
- Heat pump operation release by CRC signal

In **HPAW-SE** model furthermore

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

b) Following **parameters**

- Temperature of (return) heating medium at the heat pump inlet;
This temperature is the controlling variable of the heat pump according to which the operation of the heat pump is controlled (on/off),
- Temperature of heating medium at the heat pump outlet (the condenser),
- Outside air temperature,
- Temperature of the surface of the heat-exchanging area of the evaporator,
- Compressor temperature,
- Operating hours of the compressor and the fans

In **HPAW-SC** and **HPAW-SE** 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;

- Anticyclic regulation that secure necessary delay between two compressor starts (min. 15 minutes);
- Regulation of a minimum compressor shutdown time (min. 5 minutes);
- Defrosting of the evaporator within a set time mode and depending on outside temperature and on the surface temperature of the evaporator.

In **HPAW-SB** model furthermore

- Switching of the supplementary bivalence heat source (programmable output)

In **HPAW-SC** and **HPAW-SE** 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

In **HPAW-SE** model furthermore

- 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.
- **Collective Remote Control** signal (neutral conductor of the CRC signal)

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

8.2 Power wiring

Electric power part contains:

- Connecting terminals for a fused lead of 3x400V, 50 Hz in **HP3AW** and 230V, 50 Hz in **HP1AW**
- Connecting terminals for circulation pumps (230V, 50 Hz) of heating circuits

9. Design of a heating system with a heat pump

A heating system with a heat pump must be designed by a qualified technical designer that suggests an optimal heating system solution for a specific heating system and integrates a heat pump in the system, considering the requirements formulated in this documentation and other PZP's designing data and information.

When the temperature is higher than the bivalence temperature the heating system works with a lower input temperature than designed, which is in accordance with a lower heating output required. Heating to a design-based input temperature below the bivalence temperature will be secured by a permanent second source.

This documentation does not replace a design solution prepared for specific projects!

The connection of a bivalent source other than an electro-boiler has to be agreed upon with the heat pump's manufacturer.

10. Heat pump assembly and commissioning

Heat pump outside part (evaporator or evaporators)

- To be placed outside (in an open area) either on a suitable surface or a base; if marginal movement due to the freezing of the subsoil, it is necessary to make sure that connecting piping will allow for required dilation;
- Location is selected with regard to the fact that the ventilator (ventilators) is (are) a source of certain noise;
- Location is selected so that
 - Neither the air inlet nor the outlet gets restricted;
 - Access is secured for the installation of parts to be connected with the internal part and for maintenance interventions;
 - Defrosting frost does not cause any problems;
- The distance between the outer and inner part of the heat pump should not be greater than 10 m (measured with the length of the connecting piping – not with the distance of location places).

Heat pump inside part

- To be placed in a suitable interior;
- Location is selected so that access is secured for the installation of parts to be connected with the outer part, eventually for the installation of an outer secondary circulation circuit, for the connection of power and controlling leads, and for the maintenance (servicing) of the mechanical and electric part. 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.
- HP is delivered with closed valves on the compressor suction and discharge sides; the valves must remain closed until the outdoor and the interior part are interconnected.

For the dispatch, both the outdoor and the interior part are filled with nitrogen under overpressure of 3 to 5 bar! It is necessary to take enhanced care when cutting off plugs.

Connecting distributions

- In the circumferential wall or possibly other walls, there are to be set bushings (PVC tubes) enabling pipelines getting through; bushing diameter is 110 mm for HP with one evaporator, 125 mm in the case of HP with two evaporators. After assembly, these bushings shall be packed with polyurethane foam;
- Connecting distributions are then laid in cable troughs, in channels, or on consoles; the distributions must be freely accessible, they should not be placed 'under plaster' or 'in concrete';
- Connecting steam line must be designed for the two-way flow of vapors;
- Connecting steam line and liquid line must be thermally insulated.

The installation of the secondary circuit and the integration of a heat pump in a heating system must comply with all requirements stated in this documentation (specified in the highlighted paragraphs).

After connecting both parts, after the installation of the outer secondary circulation circuit and of the entire heating system, after the connection of the heat pump to the mains supply and to a parent control system, the heat pump can be activated and commissioned.

The interconnection of both heat pump parts, their activation and commissioning can be carried out only by a company authorized by the manufacturer.

The activation and commissioning proceed in these steps:

- The secondary circuit is filled with a working medium, perfectly vented, and commissioned.
- The heat pump cooling circuit is tested for strength and tightness, then it is vacuumed and dried.
- Check supply line connection and phase configuration, the adjustment of protective devices and the regulator.
- While the heating system is on, the heat pump is commissioned and filled with a refrigerant.
- The function of the heat pump blocking elements is checked.

- The flow rate of the heat pump heating medium is adjusted according to this documentation and a respective design.
- The operation of the heating system and of the heat pump is tested.
- 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.

11. Data for inquiry (order)

An inquiry for a heat pump (order) must indicate the following information:

- Heat pump type marking according to this informative material
- the number of required heating circuits, standard make – 3 heating circuits with **HP3AW**, expansion to 4 heating circuits is possible within the HP internal part, further expansions are possible through the RTO auxiliary distributor for heating circuits, 2 heating circuits with **HP1AW**
- requirement for non-standard outlets of the cooling circuit - rear connection
- other possible requirements

Heat pumps are marked as follows:

HP3AW 10 SE-2AG		
Colour finish - outside part	G,H	... standard
	J	... non-standard
Colour finish - inside part	A,B	... standard
	C	... non-standard
Electric installations make	1	... Czech Republic
	2	... EU
Equipment degree	B	... basic
	C	... higher
	E	... maximum
Model	S	... Split
Nominal thermal performance		... ad table
Heat pump type	AW	... air-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 air-water			
Inside part		Front cover	Side covers
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
Outside part		Evaporator legs	Covers
Model	G - standard	dark grey, RAL 7045	light grey, RAL 7035
	H - standard	light green, RAL 7003	dark green, RAL 6005
	J - non-standard	light grey, RAL 7035	STAINLESS

12. Working conditions

Heat pumps can be used:

- As heat sources for heating and water warming
- Other applications are subject to an agreement with the manufacturer.

Heat pumps can be operated as follows:

Outside part:

- In stationary installations in a place that is not protected from weather conditions
- In climatic areas CT, WT, WDr – according to IEC 721-2-1 (under the conditions of 'Environment Classification')
- In this environment: hazardous – according to IEC 364-3

Inside part:

- In stationary installations in a place that is protected from weather conditions
- In climatic areas CT, WT, WDr – according to IEC 721-2-1 (under the conditions of 'Environment Classification')
- In this environment normal – according to IEC 364-3

Environment classification:

Outside part:

- During operation class 4K2/4Z8/4B1/4C2/4S2/4M4 – according to EN 60721-3-4
- During storage class 1K8/1Z6/1B2/1C2/1S3/1M3 – according to EN 60721-3-1
- During transport class 2K4/2B1/2C2/2S2/2M2 – according to EN 60721-3-2

Inside part:

- During 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 is 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 [m³] is larger than the filling of the refrigerant in [kg] divided by 0.48 (critical concentration in [kg/m³]).

Electrical equipment and its technical parameters:

- Rated feeding voltage 3 x 400/230 V ± 10 % for **HP3AW**
230 V ± 10 % for **HP1AW**
- Current type and frequency alternating, 50 Hz ± 1 %
- Maximal power input see tables
- Mains characteristics TN-C – according to IEC 364-3 for **HP3AW**
TN-S – according to IEC 364-3 for **HP1AW**
- Protection category I – according to EN 60335-1
- Degree of coverage protection
- Outside part IP54 – according to EN 60529 (applies to prescribed assembly and installation)
- Inside part IP40 – according to EN 60529 (applies to prescribed assembly and installation)

Limit values of the temperature of the outside air:

- Minimal air temperature - 25 °C (max. outlet temperature of water 40 °C)
- Maximal air temperature + 35 °C

Secondary circuit working substance (heating medium):

- Priority is given to non-corrosive water free of mechanical impurities
- Other substance can be used after an agreement with the manufacturer

The active part of the secondary circuit:

- Maximum working overpressure 250 kPa

- Minimal overpressure 25 kPa
- Maximum working temperature 55 °C
75 °C only on DHW warming by **HPAW-SE** model

Main power supply line:

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

13. Scope of delivery

The heat pump is delivered in two parts, without connecting material and without a refrigerant filling. Both parts are supplied blinded and in nitrogen overpressure. The equipment is supplied with a 'Quality and Completeness Certificate.'

The heat pump is delivered along with the following:

- Heat pump operating and installation manual
- Thermal probes - 2 pieces for **SE, SC** models and 1 piece for **SB** 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.

HP3AW-S heat pump technical parameters air-water

Type	HP3AW		06 SE	08 SE	10 SE	12 SE	14 SE	18 SE	22 SB	30 SB	36 SB
Data		Unit									
Energetic parameters	A15/W35¹⁾										
	- heating output	kW	8,6	11,0	13,4	15,7	19,4	23,2	28,5	39,7	48,2
	- effective input	kW	2,1	2,6	3,1	3,7	4,5	5,3	6,7	9,1	11,0
	- performance factor (COP)	-	4,1	4,2	4,2	4,2	4,3	4,4	4,2	4,3	4,4
	A7/W35¹⁾										
	- heating output	kW	7,1	9,3	11,1	13,2	16,4	19,6	24,1	33,6	40,8
	- effective input	kW	1,9	2,5	3,0	3,5	4,3	5,1	6,4	8,7	10,4
	- performance factor (COP)	-	3,7	3,8	3,8	3,8	3,9	3,9	3,8	3,9	3,9
	A2/W35¹⁾										
	- heating output	kW	6,2	8,3	9,8	11,8	14,6	17,5	21,5	29,9	36,4
	- effective input	kW	1,8	2,4	2,9	3,4	4,1	4,9	6,2	8,4	10,0
	- performance factor (COP)	-	3,4	3,5	3,4	3,5	3,6	3,6	3,5	3,6	3,6
	A-7/W35¹⁾										
	- heating output	kW	4,8	6,6	7,8	9,4	11,7	14,0	17,1	23,9	29,0
	- effective input	kW	1,7	2,2	2,7	3,2	3,9	4,6	5,8	7,8	9,3
	- performance factor (COP)	-	2,9	3,0	3,0	3,0	3,0	3,1	3,0	3,0	3,1
	A15/W50¹⁾										
	- heating output	kW	7,6	9,9	12,1	14,1	17,5	20,8	25,6	35,7	43,5
	- effective input	kW	2,5	3,2	3,8	4,5	5,5	6,5	8,2	11,2	13,3
	- performance factor (COP)	-	3,1	3,1	3,2	3,2	3,2	3,2	3,1	3,2	3,3
	A7/W50¹⁾										
	- heating output	kW	6,3	8,4	10,3	11,9	14,8	17,7	21,7	30,3	36,9
	- effective input	kW	2,3	3,0	3,7	4,3	5,2	6,2	7,8	10,7	12,7
	- performance factor (COP)	-	2,7	2,8	2,8	2,8	2,8	2,8	2,8	2,8	2,9
A2/W50¹⁾											
- heating output	kW	5,6	7,5	9,2	10,7	13,3	15,8	19,4	27,1	33,0	
- effective input	kW	2,2	2,9	3,5	4,1	5,1	6,0	7,6	10,4	12,3	
- performance factor (COP)	-	2,5	2,6	2,6	2,6	2,6	2,6	2,6	2,6	2,7	
A-7/W50¹⁾											
- heating output	kW	4,3	6,0	7,4	8,6	10,7	12,7	15,6	21,8	26,5	
- effective input	kW	2,1	2,7	3,3	3,9	4,7	5,6	7,1	9,7	11,5	
- performance factor (COP)	-	2,1	2,2	2,2	2,2	2,2	2,3	2,2	2,2	2,3	
Electro-boiler	- standard installed	kW	8	10	10	10	14	14	-	-	-
	- maximal possible output	kW	14	14	14	14	14	14	-	-	-
Hydraulic parameters	Secondary circuit										
	- flow rate recommended	m ³ /h	0,9	1,3	1,6	1,9	2,4	2,8	3,4	4,8	5,8
	- pressure loss at HP	kPa	15	18	21	25	31	37	15	17	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	63	83
	- HP power lead fuse	A	C 20 A	C 25 A	C 25 A	C 32 A	C 40 A	C 40 A	C 20 A	C 32 A	D 32 A
Other parameters	- number of compressors	piece	1	1	1	1	1	1	1	1	1
	- total number of the fans	piece	1	1	1	2	2	2	4	4	4
Kompressor	-	Scroll									
Refrigerant	-	R 404A									
Range temp. of the primary heat source (air)	°C	-25 to +35									
Maximal inlet temperature ²⁾	°C	52									
Piping dimension	- suction number of pipes	de x t mm piece	18 x 1 1	18 x 1 1	22 x 1 1	22 x 1 1	28 x 1 1	28 x 1 1	22 x 1 2	28 x 1 2	28 x 1 2
	- liquid number of pipes	de x t mm piece	10 x 1 1	10 x 1 1	12 x 1 1	12 x 1 1	16 x 1 1	16 x 1 1	18 x 1 1	18 x 1 1	22 x 1 1
	- heating water number of pipes	de x t mm piece	28 x 1 3			28 x 1 3			42 x 1,5 2		
Size and weight	Inside part										
	- width	mm	580						700		
	- depth	mm	600						750		
	- height	mm	1500						1500		
	- weight	kg	150	155	160	175	175	180	265	275	290
	Outside part										
	- number of pieces	piece	1			1			2		
	- width	mm	950			800			800		
	- length	mm	1236			1842			1842		
	- height	mm	1260			1295			1295		
- anchor openings	mm	870 x 1045			720 x 1645			870 x 1945			
- weight (1 piece)	kg	110	120	120	150	180	205	150	180	205	

1) For example A2/W50 means: The temperature of primary source of energy (air) +2°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 +52 °C in the temperature inlet of primary source of energy (air) -15 °C (A-15/W52).

Note: The dimension of the piping applies to a standard distance between the inside and outside part of the heat pump of up to 10 m.

HP1AW-SE heat pump technical parameters air-water

Type	HP1AW		06 SE	10 SE	16 SE
Data		Unit			
Energetic parameters	A15/W35¹⁾				
	- heating output	kW	8,0	12,2	21,2
	- effective input	kW	1,6	2,6	4,4
	- performance factor (COP)	-	4,9	4,7	4,8
	A7/W35¹⁾				
	- heating output	kW	6,7	10,3	17,8
	- effective input	kW	1,6	2,6	4,4
	- performance factor (COP)	-	4,1	3,9	4,0
	A2/W35¹⁾				
	- heating output	kW	5,9	8,9	15,9
	- effective input	kW	1,6	2,6	4,4
	- performance factor (COP)	-	3,6	3,4	3,6
	A-7/W35¹⁾				
	- heating output	kW	4,6	6,8	12,8
	- effective input	kW	1,6	2,6	4,4
	- performance factor (COP)	-	2,8	2,6	2,9
	A15/W50¹⁾				
	- heating output	kW	7,3	11,3	19,6
	- effective input	kW	2,1	3,5	5,9
	- performance factor (COP)	-	3,4	3,2	3,3
	A7/W50¹⁾				
	- heating output	kW	6,1	9,2	16,6
	- effective input	kW	2,1	3,5	6,0
	- performance factor (COP)	-	2,8	2,6	2,8
A2/W50¹⁾					
- heating output	kW	5,3	8,1	14,8	
- effective input	kW	2,1	3,5	6,0	
- performance factor (COP)	-	2,5	2,3	2,5	
A-7/W50¹⁾					
- heating output	kW	4,2	6,4	11,9	
- effective input	kW	2,1	3,6	6,1	
- performance factor (COP)	-	2,0	1,8	2,0	
Electro-boiler	- standard installed	kW	6	8	10
	- maximal possible output	kW	14	14	14
Hydraulic parameters	Secondary circuit				
	- flow rate recommended	m ³ /h	0,9	1,5	2,6
	- pressure loss at HP	kPa	12	17	31
	- built-in pump	-	Grundfos 25-60		25-80
Electric parameters	- feeding voltage	V / Hz	230 / 50		
	- start up current compr.	A	27	42	45
	- HP power lead fuse	A	C 32 A	C 40 A	C 50 A
Other parameters	- number of compressors	piece	1	1	1
	- total number of the fans	piece	1	2	2
Compressor	-	-	Scroll		
Refrigerant	-	-	R 404A		
Range temp. of the primary heat source (air)	-	°C	-25 to +35		
Maximal inlet temperature ²⁾	-	°C	52		
Piping dimension	- suction de x t	mm	18 x 1	22 x 1	28 x 1
	number of pipes	piece	1	1	1
	- liquid de x t	mm	10 x 1	12 x 1	16 x 1
	number of pipes	piece	1	1	1
	- heating water de x t	mm	28 x 1		
	number of pipes	piece	3		
Size and weight	Inside part				
	- width	mm	580		
	- depth	mm	600		
	- height	mm	1500		
	- weight	kg	150	160	175
	Outside part				
	- number of pieces	piece	1	1	1
	- width	mm	950	800	950
	- length	mm	1236	1842	2140
	- height	mm	1260	1295	1295
	- anchor openings	mm	870 x 1045	720 x 1645	870 x 1945
	- weight (1 piece)	kg	120	150	180

1) For example A2/W50 means: The temperature of primary source of energy (air) +2°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 +52 °C in the temperature inlet of primary source of energy (air) -15 °C (A-15/W52).

Note: The dimension of the piping applies to a standard distance between the inside and outside part of the heat pump of up to 10 m.

Noise level of air water heat pumps

Equivalent noise level $L_{Aeq,T}$ value of the external part evaporator. Data apply to one evaporator.

Type HP3AW			06 S	08 S	10 S	12 S	14 S	18 S	22 S	30 S	36 S
Mode	Distance	Unit									
Standard fan speed	1 m	dB(A)	50	54	54	53	53	57	53	53	57
	3 m	dB(A)	41	45	45	44	44	47	44	44	47
	5 m	dB(A)	36	40	40	39	39	43	39	39	43
	10 m	dB(A)	30	34	34	33	33	37	33	33	37
Reduced fan speed	1 m	dB(A)	43	50	50	47	47	52	47	47	52
	3 m	dB(A)	34	40	40	37	37	43	37	37	43
	5 m	dB(A)	29	36	36	33	33	38	33	33	38
	10 m	dB(A)	23	30	30	27	27	32	27	27	32

Equivalent noise level $L_{Aeq,T}$ value of the external part evaporator.

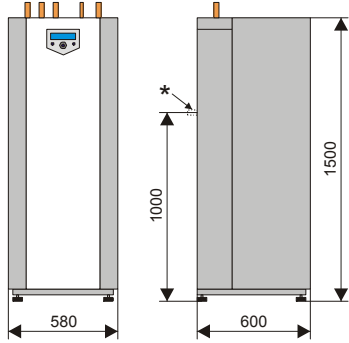
Type HP1AW			06 S	10 S	16 S
Mode	Distance	Unit			
Standard fan speed	1 m	dB(A)	48	51	51
	3 m	dB(A)	38	41	41
	5 m	dB(A)	34	37	37
	10 m	dB(A)	28	31	31

The data are valid under the condition of sound propagation in free space without reflecting surfaces.

HP3AW-S and HP1AW-S heat pump technical parameters

Inside part:

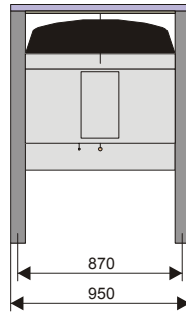
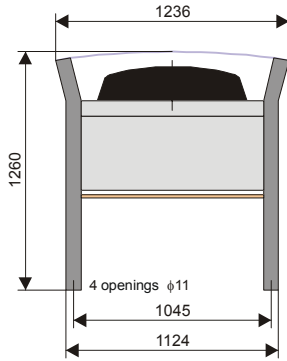
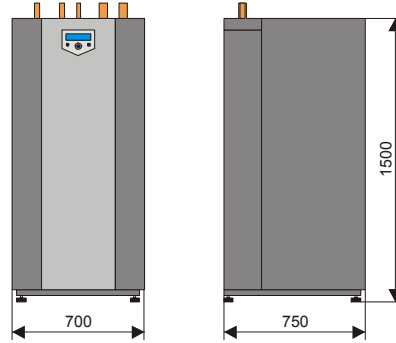
HP3AW 06 S - HP3AW 18 S
HP1AW 06 S - HP1AW 16 S



* ... Non-standard make of cooling circuit outlets

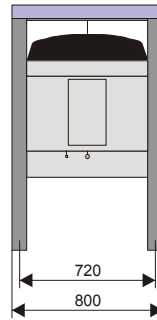
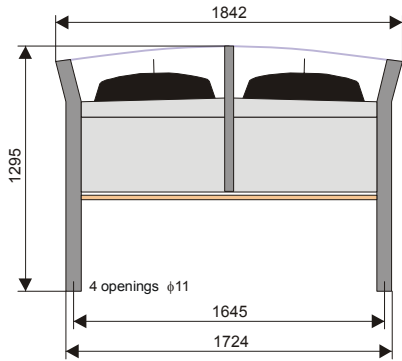
Inside part:

HP3AW 22 SB - HP3AW 36 SB



Outside part:

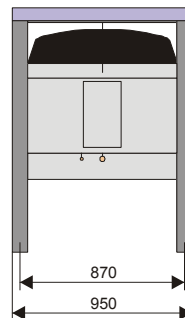
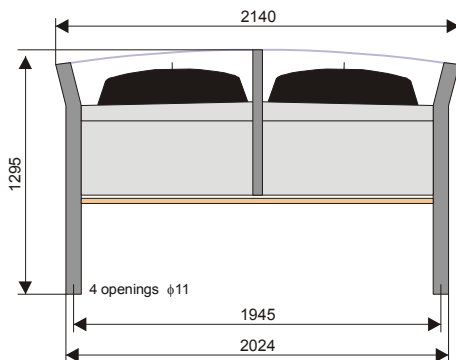
HP3AW 06 S
HP3AW 08 S
HP3AW 10 S
HP1AW 06 S



Outside part:

HP3AW 12 S
HP1AW 10 S

2 pieces for
HP3AW 22 SB



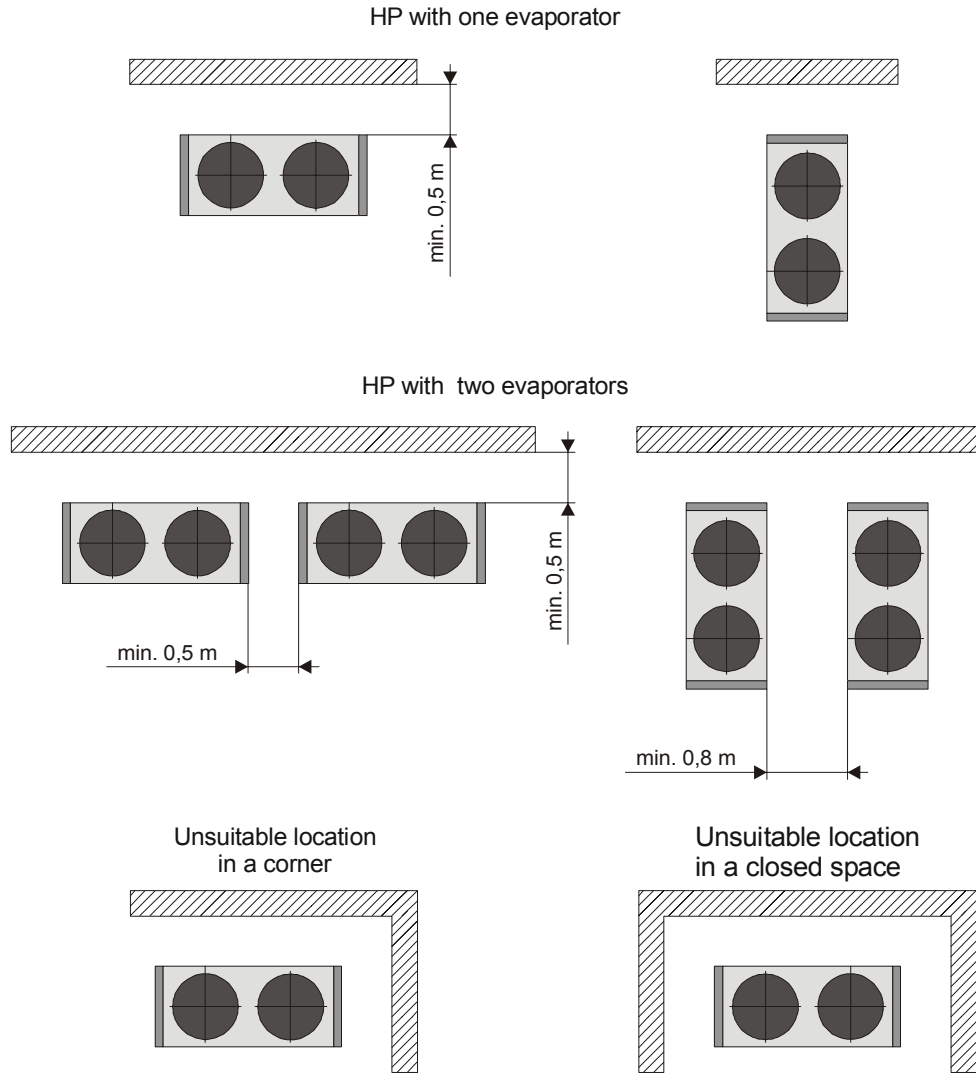
Outside part:

HP3AW 14 S
HP3AW 18 S
HP1AW 16 S

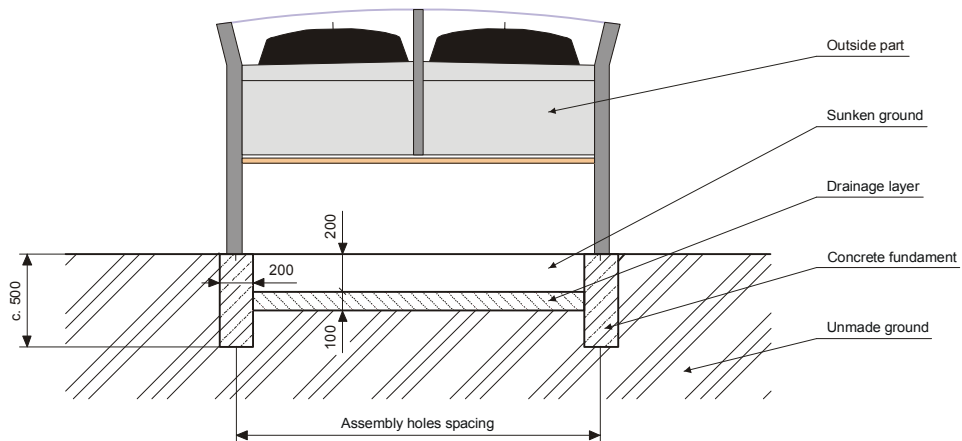
2 pieces for
HP3AW 30 SB
HP3AW 36 SB

Recommendations concerning evaporators of air-water heat pumps

Evaporator location in an outdoor area



Preparation of the ground under the evaporator



Pipelines - meaning of the symbols - air-water heat pumps



Refrigerant outlet into the evaporator - liquid pipeline



Inlet for the refrigerant from the evaporator - suction pipeline



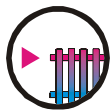
1

Inlet for the refrigerant from the evaporator No.1 - suction pipeline
(only HP3AW 22 to HP3AW 36)



2

Inlet for the refrigerant from the evaporator No.2 - suction pipeline
(only HP3AW 22 to HP3AW 36)



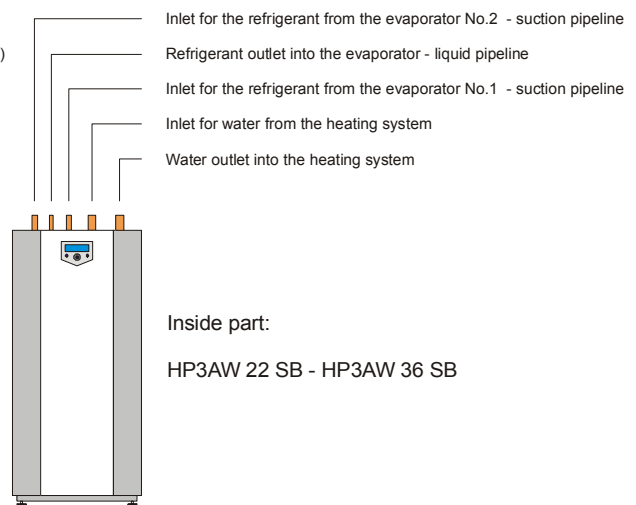
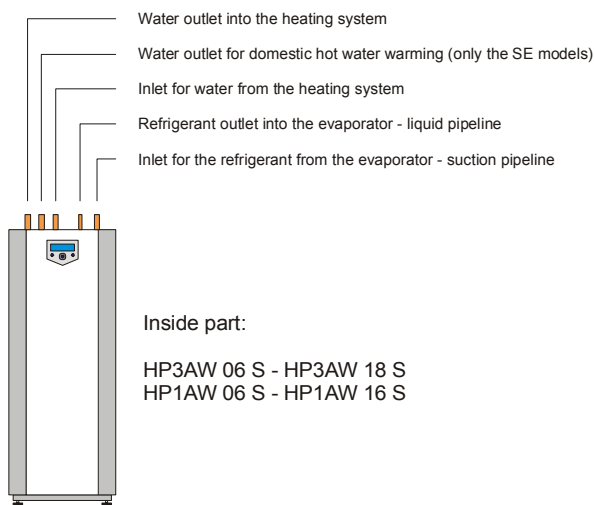
Water outlet into the heating system



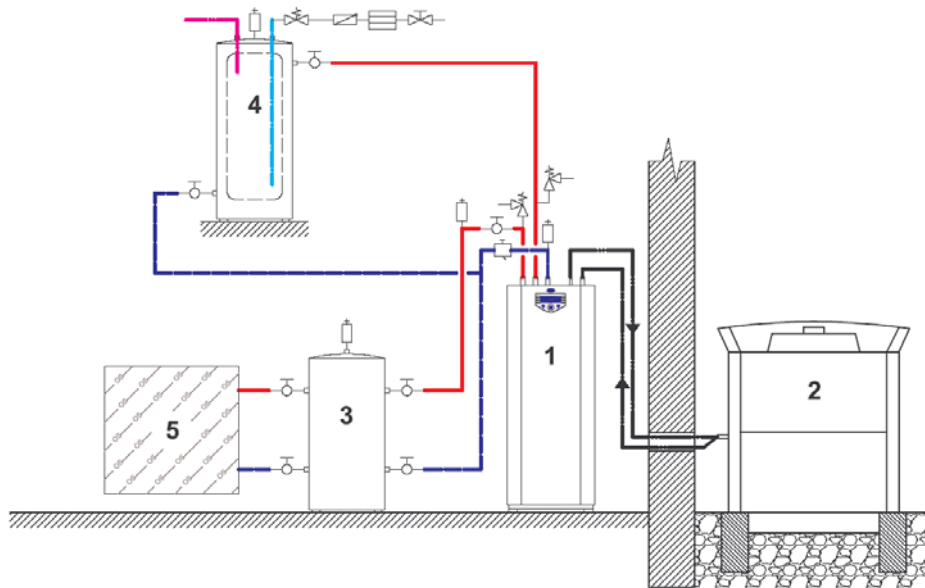
Inlet for water from the heating system



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

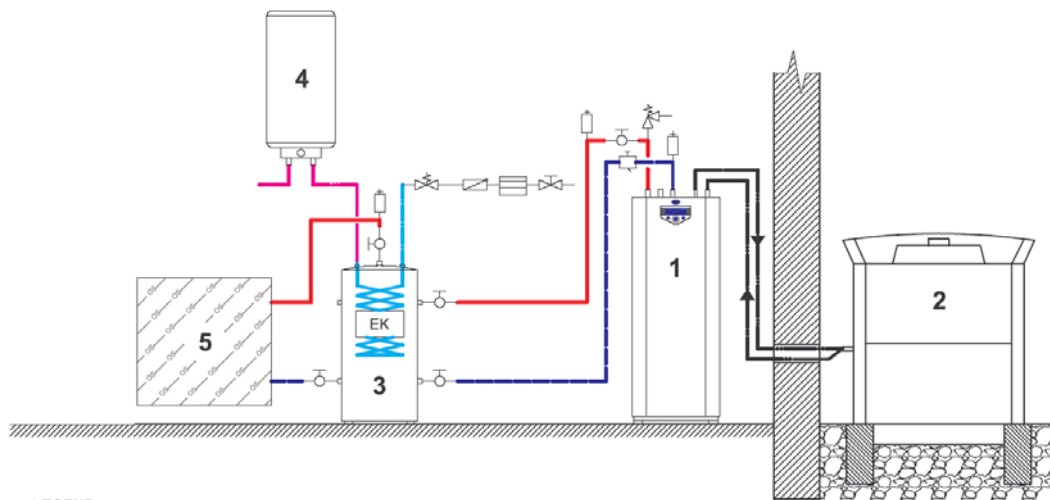


Connection diagram for the Split models of air-water heat pumps



LEGEND :

- 1. HEAT PUMP - INTERNAL PART
- 2. HEAT PUMP - EXTERNAL PART
- 3. BUFFER TANK
- 4. CYLINDER
- 5. HEATING SYSTEM



LEGEND :

- 1. HEAT PUMP - INTERNAL PART
- 2. HEAT PUMP - EXTERNAL PART
- 3. BUFFER TANK WITH HEAT EXCHANGER AND ELECTRIC COIL
- 4. CYLINDER
- 5. HEATING SYSTEM

LEGEND OF PIPES :

- FLOW WATER
- RETURN WATER
- PIPES OF PRIMARY CIRCUIT
- COLD WATER
- HOT WATER

Protection and dimension design of the supply line of air-water heat pumps HP3AW

Table 1

Type	HP3AW		06 SE	08 SE	10 SE	12 SE	14 SE	18 SE
Data		Unit						
COMPRESSOR:	- start up current (Soft starter)	A	13	20	23	26	32	37
	- operating current ¹⁾	A	3,5	5,5	6,4	6,7	8,7	9,7
ELECTRIC BOILER:	- 1. phase (L1)	A	11,6	14,5	14,5	14,5	20,3	20,3
	- 2. phase (L2)	A	11,6	14,5	14,5	14,5	20,3	20,3
	- 3. phase (L3)	A	11,6	14,5	14,5	14,5	20,3	20,3
	- Total performance	kW	3x2,7(8)	3x3,3(10)	3x3,3(10)	3x3,3(10)	3x4,7(14)	3x4,7(14)
CURRENT TAKE-OFF:	- bivalence mode (compr. + 2. stages EB)	A	15,1	20,0	20,9	21,2	29,0	30,0
	- fan / fans outside part - evaporator	A	0,5	0,5	0,5	1,0	1,0	0,9
	- secondary circulation pump	A	0,4	0,4	0,4	0,8	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	17,5	22,3	23,2	24,5	32,3	33,2
	DIMENSION DESIGN:	- main supply line (breaker)	A	C20/3	C25/3	C25/3	C32/3	C40/3

Table 2

Type	HP3AW		06 SC	08 SC	10 SC	12 SC	14 SC	18 SC	22SC	30 SC	36 SC
Data		Unit									
COMPRESSOR:	- start up current (Soft starter)	A	13	20	23	26	32	37	50	63	83
	- operating current ¹⁾	A	3,5	5,5	6,4	6,7	8,7	9,7	15,4	21,7	25,1
ELECTRIC BOILER:	- 1. EB stage	A	4,4	6,5	6,5	8,7	8,7	17,4	----	----	----
	- 2. EB stage	A	4,4	6,5	6,5	8,7	8,7	8,7	----	----	----
	- 3. EB stage	A	4,4	6,5	6,5	8,7	8,7	8,7	----	----	----
	- Total performance	kW	3x3(9)	3x4,5(13,5)	3x4,5(13,5)	3x6(18)	3x6(18)	1x12 2x6 (24)	----	----	----
CURRENT TAKE-OFF:	- bivalence mode (compr. + 2. stages EB)	A	12,3	18,5	19,4	24,1	26,1	35,8	----	----	----
	- fan / fans outside part - evaporator	A	0,5	0,5	0,5	1,0	1,0	0,9	2,0	2,0	1,8
	- secondary circulation pump	A	0,4	0,4	0,4	0,8	0,8	0,8	0,8	2,0	2,0
	- heating system circulation pump 3 circuits	A	1,2	1,2	1,2	1,2	1,2	1,2	2,5	2,5	2,5
	- heat pump control system	A	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2
	- Total current take-off	A	14,7	20,8	21,7	27,4	29,4	39,0	21,0	28,5	31,7
	DIMENSION DESIGN:	- main supply line (breaker)	A	C16/3	C25/3	C25/3	C32/3	C32/3	C40/3	C25/3	C32/3

Table 3

Type	HP3AW		06 SB	08 SB	10 SB	12 SB	14 SB	18 SB	22SB	30 SB	36 SB
Data		Unit									
COMPRESSOR:	- start up current (Soft starter)	A	13	20	23	26	32	37	50	63	83
	- operating current ¹⁾	A	4,0	6,0	7,0	8,0	10,0	12,0	15,4	21,7	25,1
ELECTRIC BOILER:	- 1. EB stage	A	----	----	----	----	----	----	----	----	----
	- 2. EB stage	A	----	----	----	----	----	----	----	----	----
	- 3. EB stage	A	----	----	----	----	----	----	----	----	----
	- Total performance	kW	----	----	----	----	----	----	----	----	----
CURRENT TAKE-OFF:	- bivalence mode (compr. + 2. stages EB)	A	----	----	----	----	----	----	----	----	----
	- fan / fans outside part - evaporator	A	0,5	0,5	0,5	1,0	1,0	0,9	2,0	2,0	1,8
	- secondary circulation pump	A	0,4	0,4	0,4	0,8	0,8	0,8	0,8	2,0	2,0
	- circulation pump of the heating system 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
	- Total current take-off	A	6,4	8,3	9,3	11,3	13,3	15,2	18,5	26,0	29,2
DIMENSION DESIGN:	- main supply line (breaker)	A	C10/3	C10/3	C13/3	C13/3	C16/3	C16/3	C20/3	C32/3	D32/3

Protection and dimension design of the supply line of air-water heat pumps HP1AW

Table 1

Type	HP1AW		06 SE	10 SE	16 SE	06 SC	10 SC	16 SC	06 SB	10 SB	16 SB
Data		Unit									
COMPRESSOR:	- start up current (Soft starter)	A	27	42	45	27	42	45	27	42	45
	- operating current ¹⁾	A	9,5	15,0	27,8	9,5	15,0	27,8	12,8	16,4	29,8
ELECTRIC BOILER:	- 1. EB stage	A	8,6	11,6	14,5	8,6	10,4	13,0	----	----	----
	- 2. EB stage	A	8,6	11,6	14,5	8,6	10,4	13,0	----	----	----
	- 3. EB stage	A	8,6	11,6	14,5	8,6	10,4	13,0	----	----	----
	- Total performance	kW	3x2(6)	3x2,7(8)	3x3,3(10)	3x2(6)	3x2,4(7,2)	3x3(9)	----	----	----
CURRENT TAKE-OFF:	- bivalence mode (compr. + 1. stage EB)	A	18,1	26,6	42,3	18,1	25,4	40,8	----	----	----
	- fan / fans outside part - evaporator	A	1,2	2,4	2,4	1,2	2,4	2,4	1,2	2,4	2,4
	- secondary circulation pump	A	0,4	0,4	0,8	0,4	0,4	0,8	0,4	0,4	0,8
	- circulation pump of the heating system 2 circuits	A	0,8	0,8	1,7	0,8	0,8	1,7	0,8	0,8	1,7
	- heat pump control system	A	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2
	- Total current take-off	A	20,8	30,5	47,4	20,8	29,3	45,9	15,4	20,2	34,9
DIMENSION DESIGN:	- main supply line (breaker)	A	C32/1	C40/1	C50/1	C32/1	C40/1	C50/1	C20/1	C25/1	C40/1

1) In HPAW - SE and SC models ... the value of compressor operating current under A2/W52 condition
 HPAW - SB ... the value of compressor maximum operating current in the range of application .

Note: In HP3AW heat pumps of all SB model types, no electric boiler is fitted and connected. Here is led out one control contact for bivalence source switching. Heating circuits are not fitted in HP3AW heat pumps of HP3AW 22 SB, 30 SB, 36 SB types. Three control (not power) contacts for electric boiler control are led out in the HP3AW heat pumps of 22 SC, 30 SC and 36 SC types.