

Dimplex

Project engineering manual

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Foreword

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For the Dimplex specialist,

More efficiency, more climate protection, more independence, more quality of life: the heat pump is the heating of the future.

As a leading international manufacturer of efficient and convenient solutions for heating and ventilation, Dimplex will continue to be the perfect partner for heat pumps in the future.

Our experience and expertise is based on the requirement to constantly develop new ideas and drive innovations in technology and design. Our aim is to create products that work energy-efficiently, always keep pace with the times and make buildings a cozy home or a pleasant place to work.

Dimplex has been a driver of innovation for over 40 years. Long-lasting products and reliable service are our aim. We offer a broad portfolio in the areas of electrical heating, cooling, hot water and ventilation. The focus is not on new products, but above all on intelligent system solutions.

Sustainability is one of the defining pillars of our corporate philosophy. With our teams and the outstanding technological competence of our parent company, the Glen Dimplex Group, which is also a world leader in intelligent electrical heating, we will promote climate protection through sustainable system solutions. We are firmly convinced that the future belongs to electric heating and cooling, thanks to a steadily increasing share of green electricity from renewable sources.

We want to shape the future of heating together with you and be a strong service partner by your side - for system solutions in the field of new construction and renovation. As part of our extensive range of services, the first online version of the heat pump manual was created with the following innovations:

- Design of heat pumps with single-stage or stepless control
- Clear presentation of the areas of application and connection options for all available circulation pumps
- Additional information on the M / M Flex heat pump system and the air routing of the Air / water heat pump LI 16I-TUR etc.
- Notes on lightning protection
- Additional solutions for the condensate drain
- Updated integration schemes
- Update of the design tables for the heat source, brine and water, including pump assignments
- New assignment tables for hydraulic components including hot water preparation
- Water quality: Update VDI 2035 "Avoidance of damage in hot water heating systems" with regard to stone formation in heating systems

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Chapter 0 - Why a heat pump?

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introduction

This project planning manual (PHB) provides the most important information in connection with the planning, operation and construction of a heat pump system. It serves as a reference work for the planner and installer, but can also be used as a document for training or to prepare for a technical or advisory meeting. It cannot and should not replace technical expertise. It is the responsibility of each user to carefully check the information he uses, in particular to ensure that it is up-to-date, correct and complete.

Notes on use:

The illustrations and descriptions contained in this manual serve to develop an understanding of all components contained in a heat pump system. The illustrations and schemes are therefore concentrated on the essentials and are not to be understood as complete assembly instructions.

These can be found in the product documents of the respective heat pump or the system accessories, the device-related planning documents or the electrical or hydraulic integration schemes.

Furthermore, information on the manual implementation has only been included in this manual if specific features have to be observed when installing a heat pump system.

1.1 Why a Heat pump?

The high proportion of fossil fuels in our energy supply has serious consequences for our environment. When they are burned, in addition to large amounts of carbon dioxide, other pollutants such as carbon monoxide, unburned hydrocarbons, sulfur dioxide, particles e.g. soot and nitrogen oxides are released in large quantities.

Space heating with fossil fuels contributes significantly to the emission of pollutants, since complex exhaust gas cleaning measures - as in modern power plants - are not provided. Due to the limited supplies of oil and gas, the high proportion of fossil fuels in our energy supply is problematic.

In the course of the next few decades, the phase-out of the use of fossil fuels for the generation of electrical energy towards renewable energy generation will continue to be driven forward.

Since the **Heat pump** only a small amount of electricity is required to temper the heat obtained from air, water or earth so that it can be used for heating purposes, it has a significantly lower rate of loss than oil or gas heating.

A heat pump is more than just a heater. The advantages of a heat pump at a glance:

- more efficiency
 - EU energy label: Only heat pumps and heat pump systems consistently achieve the highest label classes.
 - Energy Saving Ordinance (EnEV): Houses with heat pumps meet the more stringent energy standards now and in the future.
 - The annual operating costs of a heat pump are extremely low. A small percentage of these are linked to electricity prices.
 - Special low-cost electricity tariffs are available.
- more climate protection
 - Heat pumps cause significantly fewer CO₂ emissions than a conventional boiler (up to 90 percent less than gas and oil heating).
 - Electricity is getting greener and greener - and with it the heat pump.
 - Energy supplier is environmentally friendly and almost inexhaustible.
- more independence
 - individual (PV self-consumption, power-to-heat / thermal storage)
 - for all of Germany through fewer oil and natural gas imports
 - Heat pumps are almost maintenance-free.
 - The operational safety of heat pumps is very high.
- more quality of life
 - cozy warmth and comfortable cooling in one device
 - clean energy source, space-saving technology
 - can be used for heating in almost any type of building

1.1.1 What does the heat pump do?

The heat pump is a "transport device" that brings the environmental heat, which is available free of charge, to a higher temperature level.

1.1.2 How does the heat pump convert low-temperature heat into high-temperature heat?

It extracts stored solar heat from the environment - soil, water (e.g. groundwater) and air (e.g. outside air) and transfers this to the heating and hot water circuit in addition to the drive energy in the form of heat.

Heat cannot pass from a colder body to a warmer one by itself. It always flows from a body with a high temperature to a body with a lower temperature (second law of thermodynamics). Therefore, the heat pump must bring the heat energy absorbed from the environment using high-quality energy - e.g. electricity for the drive motor - to the temperature level necessary for heating and hot water preparation.

The heat pump actually works like a refrigerator. That means with the same technology, but with the opposite benefit. It extracts heat from a cold environment, which can be used for heating and hot water.

1.2 Terms

1.2.1 Defrost

Control routine for removing frost and ice on evaporators of air / water heat pumps by supplying heat. Air / water heat pumps with reverse circulation are characterized by need-based, fast and energy-efficient defrosting.

1.2.2 Bivalent-parallel operation

The bivalent operating mode (nowadays usually bivalent-parallel operation) works with two heat generators (two energy sources), i.e. the heat pump covers the heat output requirement up to the determined limit temperature and is then supported in parallel by a second energy generator.

1.2.3 Bivalent-renewable operation

The bivalent regenerative mode of operation enables the integration of regenerative heat generators such as wood or thermal solar energy. If energy from renewable energies is available, the heat pump is blocked and the current heating, hot water or swimming pool requirement is served from the regenerative storage.

1.2.4 Carnot coefficient of performance

The ideal comparison process for all heat work processes is the Carnot process. This ideal (imaginary) process results in the theoretical efficiency or, in comparison with the heat pump, the theoretically highest coefficient of performance. The Carnot coefficient of performance only applies the pure temperature difference between the warm and the cold side.

1.2.5 CO₂-Equivalent (global warming potential - GWP)

The global warming potential (GWP) or CO₂-Equivalent to one [chemical compound](#) is a measure of their relative contribution to the [Greenhouse effect](#), so their mean warming effect is the [Earth atmosphere](#) over a certain period of time (usually 100 years). It indicates how much a certain [Dim ensions](#) one [Greenhouse gas](#) compared to the same mass of CO₂ to the [global warming](#) contributes.

For example, this is CO₂-Equivalent for [methane](#) with a time horizon of 100 years 28; This means that within the first 100 years after its release, one kilogram of methane contributes 28 times as much to the greenhouse effect as one kilogram of CO₂. at [Nitrous oxide](#) this value is 265.

1.2.6 D-A-CH seal of approval

Certificate for heat pumps in Germany (D), Austria (A) and Switzerland (CH) that meet certain technical requirements, have a 2-year guarantee, guarantee spare parts availability for 10 years and whose manufacturer has a comprehensive customer service network. In addition, the seal of approval certifies the seriality of a heat pump series.

1.2.7 EnEV

The Energy Saving Ordinance (EnEV) regulates measures for saving energy in buildings in Germany. In addition to the basic requirements for newly constructed buildings, deadlines are also set for the replacement of outdated heating technology.

1.2.8 Energy efficiency

Energy efficiency is a measure of the amount of energy used to achieve a specific benefit. A process is efficient when a certain benefit can be achieved with a minimal expenditure of energy. For heating technology, this means: "Comfortable room temperatures with minimal use of energy."

The energy efficiency of a building (heating and drinking water heating) is expressed in terms of "primary energy", as this is in contrast to the final energy requirement - i.e. the amount of energy (liters of heating oil / m³ Natural gas / kWh electricity) that you buy from your energy supplier - also takes the upstream process chain into account. The primary energy requirement also includes the energy that was required for the production, conversion and distribution of the energy source.

In order to make the energy demand and the energetic quality of different buildings comparable, the primary energy demand is allocated to the living space of a house. The Energy Saving Ordinance (EnEV) regulates the maximum amount of primary energy per square meter and year (kWh / (m²a)) a newly constructed building may use for heating and domestic hot water.

1.2.9 Energy label

In order to make a comparison of different heat generators that use different heating energy sources, the different room and combination heaters and water heaters are divided into the respective energy efficiency classes on the basis of the seasonal space heating energy efficiency or the water heating energy efficiency, the latter depending on the load profile.

To calculate the seasonal space heating or hot water heating energy efficiency, the heat requirement covered by the heater or the system is related to the annual energy requirement required for this. The resulting percentage value determines the efficiency class achieved.

In order to make the different heat generators comparable, they are divided into the respective energy efficiency classes on the basis of the seasonal space heating energy efficiency or the water heating energy efficiency.

With the EU energy label, only heat pumps and heat pump systems achieve the highest efficiency class. Even today, a heat pump with an annual coefficient of performance (JAZ) of 2.14 or better causes fewer CO₂ emissions than a conventional gas condensing boiler with an efficiency of 90%. And because the proportion of renewable electricity in our grids continues to increase, heat pumps will become even more climate-friendly over the years.

1.2.10 Energy label overview:

1.2.10.1 Product label and compound system label

A basic distinction is made between product labels issued exclusively by the manufacturer and composite system labels. Product labels are only available for pure heat generators, e.g. hot water heat pumps, heat pumps for space heating and DHW heating or condensing boilers. In a compound system, these are combined with one or more additional components. Compound system labels can be issued by manufacturers, wholesalers or craftsmen.

Due dates



Fig. 0.1: Summary table for adapting the energy label

1.2.10.2 Overview: compact EU energy label

There are three different reference dates for the mandatory use of the energy label, as a step-by-step tightening of the efficiency scales for the product labels of space heaters and water heaters is planned.

- From the **September 26, 2015** All space heating devices must have a product label with an efficiency scale ranging from A ++ to G. For the water heating energy efficiency of combination heaters and for pure water heaters, a scale with classes A to G is mandatory.
- From the **26th September 2017** A product label that includes efficiency classes A + to F becomes mandatory for pure water heaters.
- From the **26th September 2019** Space heating systems must also bear the "Label II", which includes classes A +++ to D. In addition, the scale for the water heating energy efficiency of combination heaters now also includes classes A + to F.
- The energy label classes for **Compound systems** include from **September 26, 2015** Classes A +++ to G for room and combination heaters as well as hot water heaters.

From the **Deadline September 26, 2015** Space heaters, combination heaters, pure water heaters and compound systems must bear an efficiency label. All space heaters must have efficiency classes A ++ to G from this date. From this day on, the labels for interconnected systems carry efficiency classes A +++ to G.

1.2.10.3 Which devices are affected by the energy label

So that a comparison of different technologies is possible, the EU directives on energy labeling and ecodesign summarize certain product groups in so-called "lots". With the amendment of the directives, not only energy-consuming, but also energy-related products (ErP) are considered.

Lot 1 concerns room and combination heaters as well as composite systems made up of these devices and other components. Devices and systems for space heating or for combined space heating and drinking water heating with a nominal heat output of up to 70 kW are affected by the labeling.

The regulations in lot 2 apply to water heaters with a nominal heat output of up to 70 kW and to hot water storage tanks with a storage volume of no more than 500 liters. In addition, the specifications also apply to combinations ("compound systems") of water heaters with a nominal heat output of up to 70 kW and solar devices.

In addition to heat pumps and low-temperature heat pumps, the scope of the two lots also includes fossil-fired boilers (natural gas / heating oil) and CHP (combined heat and power) systems. Solid fuel boilers (wood, pellets) are not covered by these regulations and therefore cannot be compared with the other technologies.

1.2.10.4 Compound system label

Compound systems are always a combination of the respective space heater, combination heater or water heater and one or more of the following components:

- Temperature controller
- thermal solar system
- Storage
- additional heat generator

Compound systems usually achieve higher efficiency values than are indicated by the product label of the pure heat generator. For example, a condensing boiler, which for physical reasons can achieve a maximum of efficiency class A on its own, in combination with a temperature controller and solar system, an efficiency class A + can be achieved. However, deterioration is also conceivable, for example in the case of a heat pump that is combined with fossil heating technology as an additional heat generator.

The labels for the compound systems can be issued by the manufacturers, wholesalers and the specialist trade. Information on the efficiency class is required when preparing the offer. The data required for the calculation must be provided by the manufacturers of the individual products or components.

There are a total of 14 different labels for the individual technologies and integrated systems for room and combination heaters alone. What can be seen on the individual labels is explained below using the example of the labels for heat pumps.

Because a heat pump with intelligent control is, by definition, a composite system, most heat pumps - even though they are optically a single device - are in practice supplied with two labels. For example, a heat pump with intelligent control is simultaneously marked with A + or A ++ on the product label and with A +++ on the composite system label.

1.2.10.5 Label for space heaters (product label)

In addition to information on the manufacturer and model, the product label must also contain the energy efficiency classes, the nominal heat output (for average, warmer and colder climates) and information on the sound power levels.



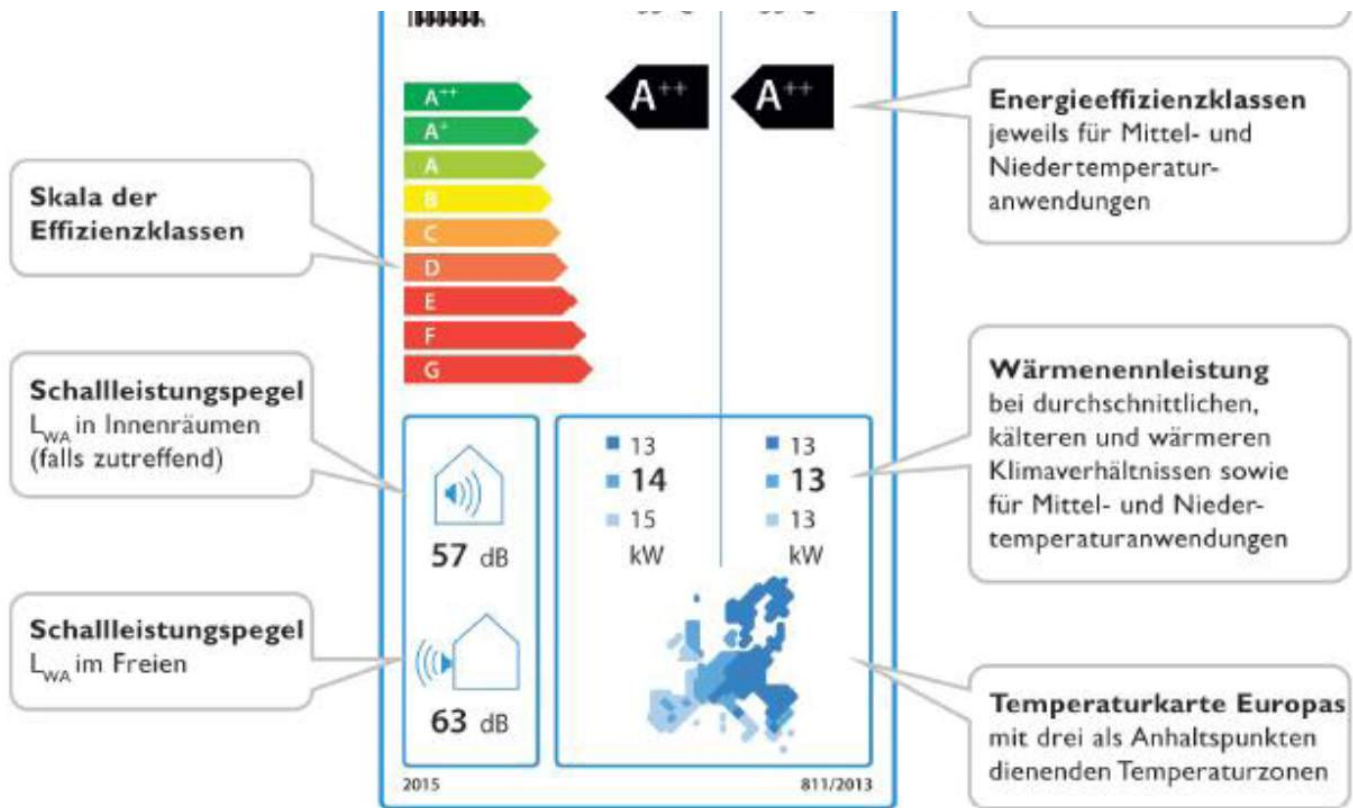


Fig.0.2: Product label (label I) for a space heater with heat pump (from September 2015)

1.2.10.6 Label for combination heaters (product label)

The labels for heat pumps for combined space heating and drinking water heating contain, in addition to the column for space heating energy efficiency, a column for water heating energy efficiency, which ranges from A to G for label I and from A+ to F for label II.

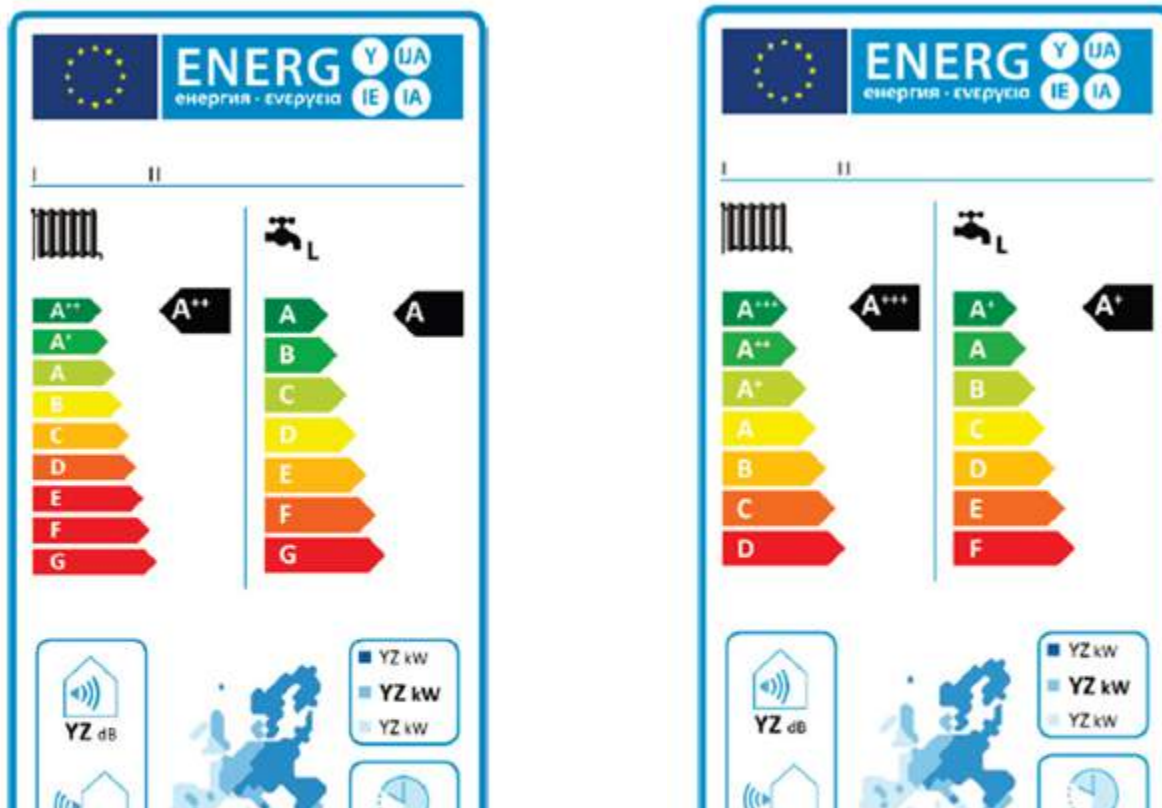




Fig. 0.3: Product label (label I) for combination heaters from September 2015



Fig.0.4: Product label (label II) from September 2019

1.2.10.7 Label for interconnected systems

In contrast to the product labels, the efficiency scales of the composite system labels for heating devices and water heaters already include classes A+++ to G from September 26, 2015. May contain storage and another space heater.

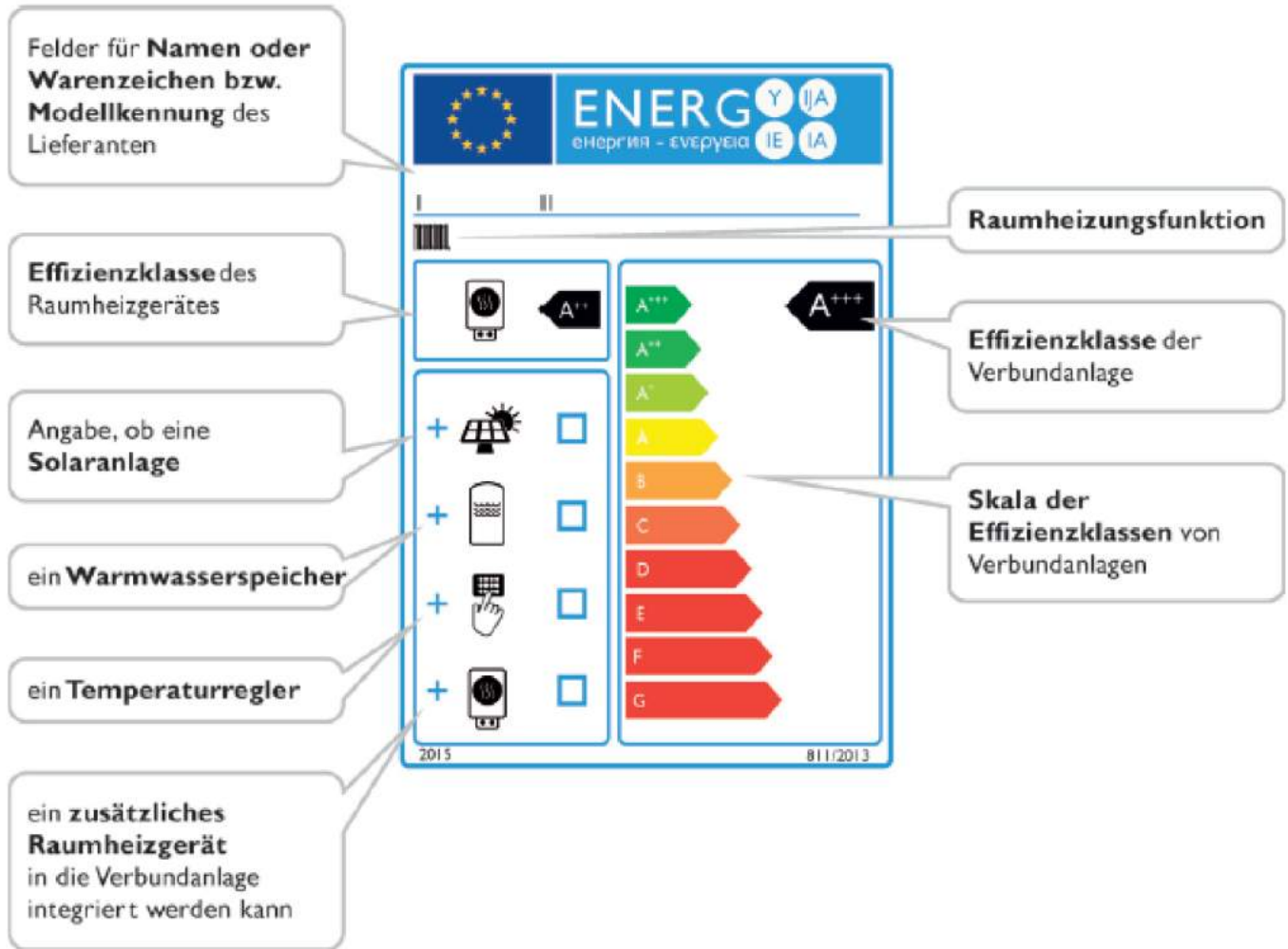
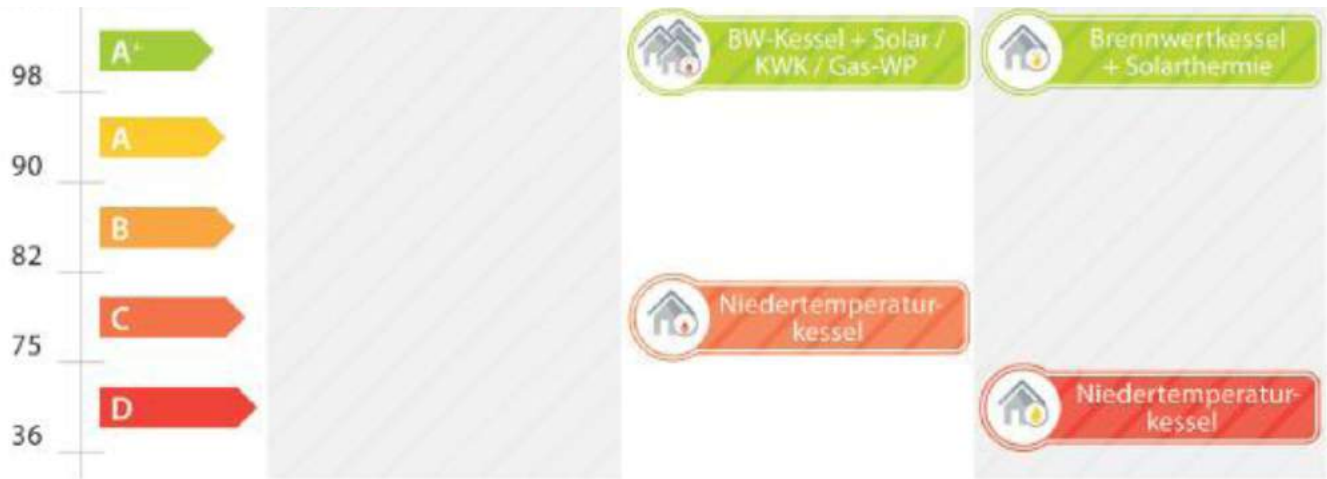


Fig. 0.5: Label for compound systems made up of space heaters and other components (from September 2015)

1.2.10.8 Comparison of the efficiency of systems and products





* Seasonal space heating energy efficiency for all space heaters in combination with temperature controller class VIII

Fig. 0.6: Comparison of the efficiency of different heat generators

1.2.11 EVU blocking times

The use of special heat pump tariffs of the respective local EVU requires a supply of electrical energy that can be switched off by the EVU. The power supply can be interrupted e.g. for 3 x 2 hours within 24 hours. Therefore, the daily heating work (daily heat quantity) must be applied within the time in which electrical energy is available.

1.2.12 Expansion valve

Component of the heat pump between the condenser and evaporator to lower the condensing pressure to the evaporation pressure corresponding to the evaporation temperature. In addition, the expansion valve regulates the amount of refrigerant injected depending on the evaporator output.

1.2.13 Limit temperature / equilibrium point

Outside temperature at which the 2nd heat generator in mono-energetic (electric immersion heater) and bivalent parallel operation (e.g. boiler) is switched on depending on demand and serves the heat demand of the house together.

1.2.14 Inverter

The inverter principle is based on the fact that the performance of the heat pump compressor is controlled by a frequency converter ("inverter"). This mode of operation is also [Modulation or heat pumps modulating the corresponding heat pumps](#) called.

Inverters are used in heat pumps for stepless power control depending on the heating requirement. The compressor motor rotates faster or slower by varying the alternating current frequency. As a result, output-controlled heat pumps always work at the optimal operating point and produce exactly as much heat as is required at any time.

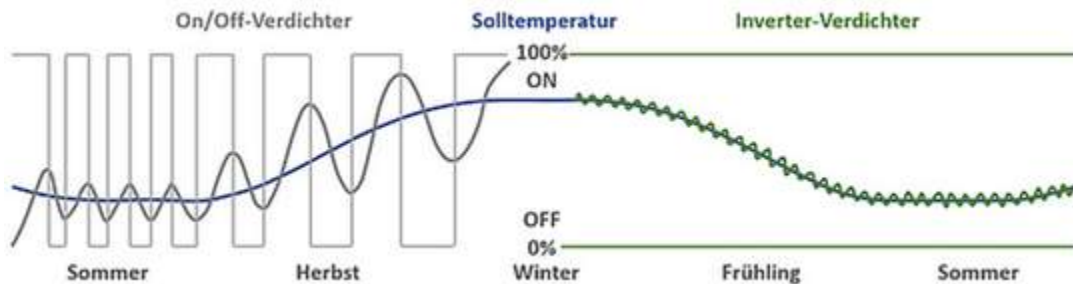


Fig. 0.7: Comparison of inverter and "on-off" heat pumps

Conventional heat pumps without frequency control or inverters (fix-speed heat pumps) switch on when heat is required and run at full load. Once the requirement has been reached or the desired amount of heat is produced, the heat pump switches itself off again. A heat pump with an inverter, on the other hand, continuously adapts its output to the demand, so that it does not work with the full heat pump output, but only with the output that is sufficient for the requirement level.

1.2.15 Annual work rate

The ratio between the amount of thermal energy released by the heat pump system within a year and the amount of electrical energy supplied corresponds to the annual coefficient of performance. It relates to a specific system, taking into account the design of the heating system (temperature level and temperature difference) and must not be equated with the coefficient of performance.

1.2.16 Annual expenditure figure

The effort figure corresponds to the reciprocal of the work figure. The annual expenditure figure indicates what expenditure (e.g. electrical energy) is necessary to achieve a certain benefit (e.g. heating energy). The annual expenditure figure also includes the energy for auxiliary drives. The VDI guideline VDI 4650 exists for calculating the annual expenditure figure.

1.2.17 Cooling capacity

Amount of heat that is extracted from the environment by the evaporator of a heat pump. The heating capacity of the compressor results from the electrical power consumption and the supplied cooling capacity.

1.2.18 refrigerant

The working substance of a refrigeration machine or heat pump is referred to as refrigerant. The refrigerant is characterized as a fluid that is used to transfer heat in a refrigeration system and that absorbs heat at low temperature and low pressure and gives off heat at higher temperature and pressure. Safety refrigerants are refrigerants that are non-toxic and non-flammable.

Replacement refrigerant	Security class	GWP _{PAR4}	NSP [° C]	Sliding [K]	Critical temperature [° C]	Replaces
R 32	A2L	675	-52	0	78	R 410A
R 290	A3	3	-42	0	97	R 404A
R 448A	A1	1387	-46	6.2	83	R 404A
R 417A	A1	2346	-39	5.6	87	R 22
R 449A	A1	1397	-46	4th	82	R 404A
R 450A	A1	603	-23	0.4	104	R 134a
R 452A	A1	2140	-47	3	75	R 404A
R 452B	A2L	676	-51	1	76	R 410A
R 454C	A2L	148	-46	6th	82	R 407C
R 513A	A1	631	-29	0	98	R134a
R 600a	A3	0	-12	0	135	R134a
R 1234ze	A2L	7th	-18	0	110	R134a

Table 0.1: Table of substances: Commercially available refrigerants for heat pumps

1.2.19 Performance figure (COP = Coefficient of Performance)

The ratio between the heat output by the heat pump and the electrical power consumed is expressed by the coefficient of performance, which is calculated under standardized conditions (e.g. for air A2 / W35, A2 = air inlet temperature +2 ° C, W35 = heating water flow temperature 35 ° C and proportional pump output) is measured in the laboratory according to EN 255 / EN 14511. A coefficient of performance of 3.2 therefore means that 3.2 times the electrical power used is available as usable heat output.

1.2.20 log p-h diagram

Graphic representation of the thermodynamic properties (enthalpy, pressure, temperature) of working media.

1.2.21 Monoenergetic operation

In principle, the monoenergetic mode of operation is a bivalent-parallel mode of operation in which only one energy source is used, usually electricity. The heat pump covers a large part of the required heat output. On a few days when the outside temperature is low, an electric heating rod supplements the heat pump.

The dimensioning of the heat pump for air / water heat pumps is usually based on a limit temperature (also called the bivalence point) of approx. 5 ° C.

1.2.22 Monovalent operation

This operating mode covers the heating requirements of the building one hundred percent all year round. This type of application should be given preference as far as possible.

Usually, brine / water or water / water heat pumps are operated monovalently.

1.2.23 Buffer storage

The installation of a heating water buffer storage tank is generally recommended in order to extend the running times of the heat pump when there is little heat demand. A buffer storage tank is essential for air / water heat pumps in order to guarantee a minimum runtime of 10 minutes during defrosting (control routine to remove frost and ice on the evaporator).

1.2.24 SCOP

Abbreviation for "Seasonal Coefficient of Performance". The SCOP indicates the annual coefficient of performance of a heat pump within different operating states, which are weighted according to climate zones. Here, the outside temperatures of 12 °, 7 °, 2 ° and -7 ° Celsius are used for the measurement. The additional division into three climate zones, Northern, Central and Southern Europe, enables an even more precise assessment of the performance efficiency.

The SCOP can be converted using the following equation using the eta (s) value:

$$\text{eta (s)} = 1 / 2.5 \times \text{SCOP} \times 100^{-3}$$

1.2.25 SG Ready

The "SG Ready" label relates to the heat pump / series including the control technology used to control it, as well as interface-compatible system components. The label is awarded for Germany, Austria and Switzerland.

The SG Ready label helps to identify heat pumps that can be addressed via a defined interface for the purpose of load management for grid serviceability. This interface can be used, for example, by network operators to control the device. The interface can also be used, for example, for control with the aim of achieving the highest possible self-consumption in combination with a photovoltaic system.

Requirements for the SG Ready label

Heating heat pumps

Heating pumps must have a controller that covers four operating states:

Operating state 1 (1 switching state, with terminal solution: 1: 0): This operating state is downward compatible with the EVU blocking, which is often switched at fixed times, and comprises a maximum of 2 hours of "hard" blocking time.

Operating condition 2 (1 switching state, with terminal solutions: 0: 0): In this circuit, the heat pump runs in energy-efficient normal mode with a proportionate amount of heat storage tank filling for the maximum two-hour power company block.

Operating status 3 (1 switching state, with terminal solution 0: 1): In this operating state, the heat pump runs within the controller in increased operation for room heating and hot water generation. This is not a definitive start-up command, but a switch-on recommendation based on today's increase.

Operating status 4 (1 switching state, with terminal solution 1: 1): This is a definitive start-up command, insofar as this is possible within the framework of the control settings. For this operating state, different control models must be set on the controller for different tariff and usage models:

Variant 1: The heat pump (compressor) is actively switched on.

Variant 2: The heat pump (compressor and electrical auxiliary heating) is actively switched on, optional: higher temperature in the heat storage tanks. The room temperature can optionally be used as a reference variable for regulating the system temperatures (flow and return temperature). Blocking the heat pump with a room thermostat depending on the room temperature is not sufficient.

Domestic water heat pumps

Hot water heat pumps must have a controller which, by means of an automatic control, enables the target hot water temperature to be increased for the purpose of thermal storage.

1.2.26 sound

Essentially, a distinction is made between the two types of airborne sound and structure-borne sound. Airborne sound is sound that propagates through the air. Structure-borne sound spreads in solid substances or liquids and is partially emitted as air-borne sound. The audible range of the sound is between 16 and 16,000 Hz.

1.2.27 Sound pressure level

The sound pressure level, measured in the surrounding area, is not a machine-specific variable, but a variable that depends on the measuring distance and the measuring location.

1.2.28 Sound power level

The sound power level is a specific, machine-specific and comparable parameter for the radiated acoustic power of a heat pump. The sound immission level to be expected at certain distances and acoustic surroundings can be estimated. The standard provides for the sound power level as a noise characteristic value.

1.2.29 Brine / brine liquid

Frost-proof mixture of water and frost protection concentrate on a glycol basis for use in geothermal collectors or geothermal probes.

1.2.30 evaporator

Heat exchanger of a heat pump in which a heat flow is withdrawn from the heat source (air, groundwater, soil) by evaporation of a working medium at low temperature and low pressure.

1.2.31 Compressor (Compressor)

Machine for the mechanical conveyance and compression of gases. Compression increases the pressure and temperature of the refrigerant significantly.

1.2.32 Condenser

Heat exchanger of a heat pump in which a heat flow is given off by liquefying a working medium.

1.2.33 Heat demand calculation (heating load)

In the case of heat pump systems, precise dimensioning is essential, as an oversized system would cause increased energy costs and negatively affect efficiency. The determination of the heat requirement is based on country-specific standards.

The specific heat demand (W / m^2) is multiplied by the living space to be heated. The result is the total heat demand, which includes both the transmission and ventilation heat demand.

1.2.34 heat recovery system

The heat utilization system has a decisive influence on the efficiency of the heat pump heating system and should get by with the lowest possible flow temperatures. It consists of the device for transporting the heat transfer medium from the warm side of the heat pump to the heat consumers. In a single-family house, for example, it consists of the pipeline network for heat distribution, the low-temperature heating or the radiators including all additional equipment.

1.2.35 heat pump system

A heat pump system consists of the heat pump and the heat source system. In the case of brine and water / water heat pumps, the heat source system must be developed separately.

1.2.36 Heat pump heating system

Complete system, consisting of the heat source system, the heat pump and the heat utilization system.

1.2.37 heat source

Medium from which heat is extracted by the heat pump.

1.2.38 Heat source system (WQA)

Device for extracting heat from a heat source and transporting the heat carrier between the heat source and the heat pump, including all additional devices.

1.2.39 heat transfer medium

Liquid or gaseous medium (e.g. water, brine or air) with which heat is transported.

1.2.40 Wall heating

Wall heating with water flowing through it acts like a large radiator and has the same advantages as underfloor heating. As a rule, 25 ° C to 28 ° C is sufficient for heat transfer, which is mainly brought into the room as radiant heat.

1.3 Formula symbols

size	symbol	unit	Other units (definition)
Dimensions	m	kg	
density		kg / m ³	
Time	t	s H	1h = 3600s
Volume flow	V	m ³ /s	
Mass flow	m	kg / s	
force	F.	N	1 N = 1kg m / s ²
pressure	P	N / m ² ; Pa	1 Pa = 1 N / m ² 1 bar = 10 ⁵ Pa
Energy, work, heat (amount)	E, Q	J kWh	1 J = 1 Nm = 1 Ws = 1kg m ² /s ² 1 kWh = 3600 kJ = 3.6 MJ
Enthalpy	H	J	
(Heating capacity Heat flow	P.	W. kW	1 W = 1 J / s = 1 Nm / s
temperature	T	K °C	Absolute temperature, temperature difference, temperature in ° Celsius
Sound power	L _{WA}	dB (re 1pW)	Sound pressure level
Sound pressure	L _{PA}	dB (re 20 microPa)	Sound power level
Efficiency	η	-	
Performance figure	ϵ (COP)	-	Performance figure
Work rate	β	-	e.g. annual performance figure
spec. Heat content	c	J / (kg K) kWh / (m ³ K)	e.g. c _(Water) = 4182 J / (kg K) or 1.1617 kWh / (m ³ K)

Table 0.2: Table overview of important formula symbols

1.4 Greek letters

α	A	alpha	ι	I	Iota	ρ	P	Rho
β	B	beta	κ	K	Kappa	σ	Σ	Sigma
γ	Γ	gamma	λ	Λ	Lambda	τ	T	dew
δ	Δ	delta	μ	M	Mu	υ	Y	Ypsilon
ϵ	E	epsilon	ν	N	Nu	ϕ	Φ	Phi
ζ	Z	Zeta	ξ	Ξ	Xi	χ	X	Chi
η	H	Eta	\omicron	O	Omicron	ψ	Ψ	Psi

ϑ	θ	Theta	π	Π	pi	ω	Ω	omega
---	---	-------	---	---	----	---	---	-------

Table 0.3: Table overview of Greek letters

1.5 Energy content of different fuels

fuel	calorific value ¹ H _i (H _u)	Calorific value ² H _s (H _o)	max. CO ₂ Emission (kg / kWh) based on	
			calorific value	Calorific value
Hard coal	8.14 kWh / kg	8.41 kWh / kg	0.350	0.339
Heating oil EL	10.08 kWh / l	10.57 kWh / l	0.312	0.298
Heating oil S	10.61 kWh / l	11.27 kWh / l	0.290	0.273
Natural gas L	8.87 kWh / m _n ³	9.76 kWh / m _n ³	0.200	0.182
Natural gas H	10.42 kWh / m _n ³	11.42 kWh / m _n ³	0.200	0.182
Liquefied petroleum gas (propane) (r = 0.51 kg / l)	12.90 kWh / kg	14.00 kWh / kg	0.240	0.220
	6.58 kWh / l	7.14 kWh / l		
current	---	---	0.200	

1. Calorific value H_i (formerly H_u): The calorific value H_i (also known as the lower calorific value) is the amount of heat that is released during complete combustion, when the water vapor produced during combustion escapes unused
2. Calorific value H_s (formerly H_o): The calorific value H_s (also known as the upper calorific value) is the amount of heat that is released during complete combustion, when the water vapor generated during combustion is condensed and the heat of evaporation is thus usable.

Table 0.4: Energy content of various fuels

1.6 Conversion tables

1.6.1 Energy units

unit	J	kWh	kcal
1 J = 1 Nm = 1 Ws	1	2.778 * 10 ⁻⁷	2.39 * 10 ⁻⁴
1 kWh	3.6 * 10 ⁶	1	860
1 kcal	4.187 * 10 ³	1.163 * 10 ⁻³	1

Specific heat capacity of water: 1.163 Wh / kg K = 4.187J / kg K = 1 kcal / kg K

Table 0.5: Conversion table for energy units

1.6.2 Performance units

unit	kJ / h	W.	kcal / h
1 kJ / h	1	0.2778	0.239
1 w	3.6	1	0.86
1 kcal / h	4.187	1.163	1

Table 0.6: Conversion table for power units

1.6.3 Pressure

bar	Pascal	Torr	Water column
1	100,000	750 mm HG	10.2 m

Tab. 0.7: Conversion table for pressure units

1.6.4 length

meter	customs	foot	yard
1	39,370	3.281	1.094
0.0254	1	0.083	0.028

Table 0.8: Conversion table for length units

1.6.5 Powers

Intent	Abbreviations	meaning	Intent	Abbreviations	meaning
Deka	there	10^1	Deci	d	10^{-1}
Hecto	H	10^2	Centi	c	10^{-2}
kilo	k	10^3	Milli	m	10^{-3}
Mega	M.	10^{6th}	Micro	m	10^{-6}
Giga	G	10^9	Nano	n	10^{-9}
Tera	T	10^{12th}	Pico	p	10^{-12}
Peta	P.	10^{15th}	Femto	f	10^{-15}
Exa	E.	10^{18th}	Atto	a	10^{-18}

Tab. 0.9: Table overview of potencies

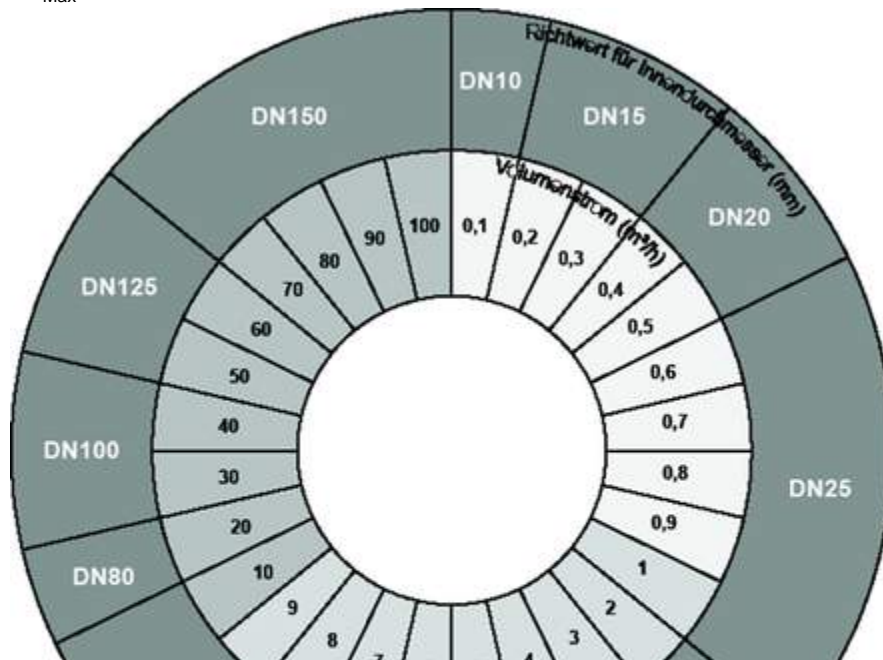
1.7 Planning and installation aids

1.7.1 Pipe dimensioner

In order to minimize pressure losses and thus the power requirement for circulation pumps, the pipe cross-sections must be dimensioned appropriately large. The specific pressure loss per meter of pipe and the flow velocity of the medium in the pipe, based on the nominal volume flow, are the design criteria for this.

The following guide values should not be exceeded:

- $dp_{Max} = 120 \text{ Pa / m}$
- of pipelines DN 10 to DN 65 $w_{Max} = 0.7 \text{ m / s}$
- from pipes DN 80 to DN 125 $w_{Max} = 1.2 \text{ m / s}$
- from pipes DN 150 $w_{Max} = 2.0 \text{ m / s}$



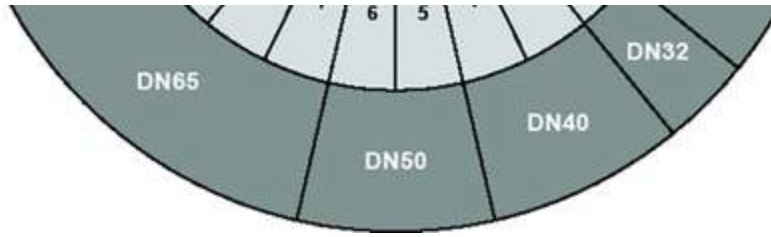


Fig. 0.8: Dimplex pipe dimensioner

ATTENTION

The approximate inside diameter of the pipe can be determined with the aid of the diagram. The rough layout does not replace a pipe network calculation. The pressure losses determined from the pipe network calculation are also required for the design of the circulation pump.

NOTE

When using water-glycol mixtures, the pressure loss in the system increases. This must be taken into account when designing the pump.

NOTE

When using composite pipes, increased pressure losses are to be expected due to the considerable cross-section reductions on the fittings. For pipe sections with a large number of fittings, the pipe diameter should be at least one dimension larger. When designing additional pipeline components (check valves, 2- and 3-way switch valves, etc.), the pressure loss should also be kept as low as possible.

NOTE

Special planning information for the energy-efficient operation of heat pump systems and the Dimplex pipe dimensioner can be downloaded from: www.dimplex.de/professional/online-planer/hydraulische-einbindungen

1.7.2 Master copy for the experimental determination of the actually required system temperature

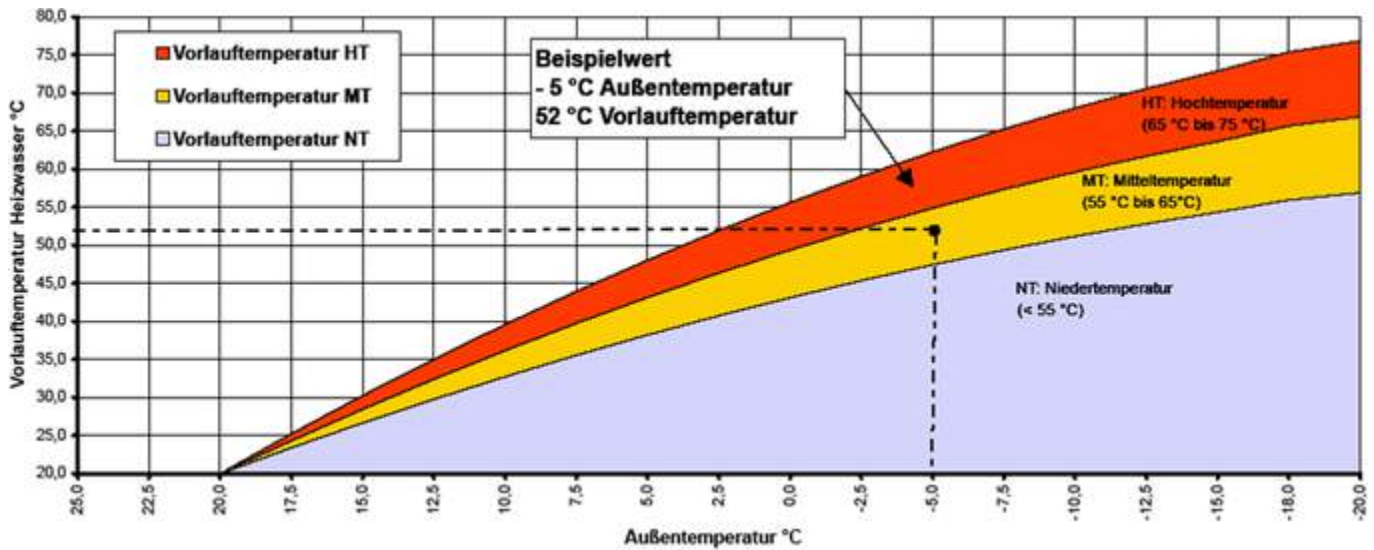


Fig. 0.9: Diagram for the experimental determination of the system temperature actually required

Measured values [° C]	example	1	2	3	4th	5	6th	7th	8th	9
Outside temperature	-5 ° C									
Flow temperature	52 ° C									
Return temperature	42 ° C									
Temperature difference	10 ° C									

Perform the following steps during the heating season at different outside temperatures:

1. Set the room thermostats in rooms with high heat requirements (e.g. bathroom and living room) to the highest level (valves fully open!).
2. Reduce the flow temperature on the boiler or the mixer valve until the desired room temperature of approx. 20-22 ° C is reached (note the inertia of the heating system!).

- 3. Note the flow and return temperatures as well as the outside temperature in the table.
- 4. Transfer the measured values to the diagram.

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Chapter 1 - Selection and dimensioning of heat pumps

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1 Selection and dimensioning of heat pumps

1.1 Heat pumps for the renovation market - dimensioning for an existing heating system

1.1.1 Heat requirement of the house to be heated

In the case of existing heating systems, the heat demand of the building to be heated must be redefined, since the heating output of the existing boiler is not a measure of the heat demand. Boilers are usually oversized and would therefore lead to oversized heat pumps. The exact calculation of the heat requirement is based on country-specific standards (e.g. EN 12831). A rough determination can be made from the previous energy consumption, the living space to be heated and the specific heat requirement. The heat demand can be roughly determined as follows:

Calculation for oil:

$$B_a \cdot \eta \cdot H_u \cdot Q_N = \dots \dots \dots B_{vh} \quad \text{Calculation for gas:}$$

$$B_a \cdot \eta \cdot Q_N = \dots \dots \dots B_{vh} \quad \text{Simplified calculation:}$$

$$B_a \cdot Q_N = \dots \dots \dots 250 \text{ with:}$$

- Q_N = Building heat demand
- B_a = Annual gas consumption (in kWh) or oil (in l)
- η = efficiency of gas or oil heating
- B_{vh} = Annual full hours of use
- H_u = Calorific value of heating oil (in kWh / l)

The annual full hours of use depend on the type of building and the climatic region. The following table shows annual full-use hours according to VDI 2067 for various types of building.

Building type	Full hours of use (h / a)
---------------	---------------------------

detached house	2100
Apartment building	2000
Office building	1700
hospital	2400
School (one-shift operation)	1100
School (multi-shift operation)	1300

Tab. 1.1: Annual full hours of use for different types of buildings

The specific heat requirement for single and two-family houses built between 1980 and 1994 is approx. 80 W / m^2 . For houses that were built before 1980 and no additional thermal insulation measures have yet been taken, it is 100 W / m^2 up to 120 W / m^2 . In the case of existing systems, the current state of the system must be taken into account.

NOTE The building's heat requirement for selecting a heat pump must be calculated according to the country-specific standard (e.g. EN 12831). The selection of a heat pump on the basis of previous energy consumption or reference values for the building's heating requirement is not permitted. In this case, the heat pump can be greatly oversized or undersized.

1.1.2 Determination of the required flow temperature

In most oil and gas boiler systems, the boiler thermostat is set to a temperature of 70°C to 75°C . This high temperature is usually only required for hot water preparation. Downstream control systems of the heating system such as mixing valves and thermostatic valves prevent the building from overheating. If a heat pump is retrofitted, it is imperative that the flow and return temperatures actually required are determined in order to be able to determine the correct renovation measures.

There are two different ways of doing this:

- **The heat demand calculation and heat demand of each room are known.**

In the heating output tables of the radiators, the output is specified as a function of the flow and return temperature (see Tab. 1.2). The room for which the highest temperature is required is then decisive for the maximum flow temperature in the heating system.

Cast radiators										
Construction height	mm	980			580			430		280
Construction depth	mm	70	160	220	110	160	220	160	220	250
Thermal output per link in W, at average water temperature T_m	50°C	45	83	106	37	51	66	38	50	37
	60°C	67	120	153	54	74	97	55	71	55
	70°C	90	162	206	74	99	129	75	96	74
	80°C	111	204	260	92	126	162	93	122	92

Steel radiators										
Construction height	mm	1000			600			450		300
Construction depth	mm	110	160	220	110	160	220	160	220	250
Thermal output per link in W, at average water temperature T_m	50°C	50	64	84	30th	41	52	30th	41	32
	60°C	71	95	120	42	58	75	44	58	45
	70°C	96	127	162	56	77	102	59	77	61
	80°C	122	157	204	73	99	128	74	99	77

Table 1.2: Heat output of radiator sections (at room air temperature $t_r = 20^\circ \text{C}$, according to DIN 4703)

- **Experimental determination in the heating season (see Fig. 1.1)**

During the heating season, the flow and return temperatures are reduced when the thermostat valves are fully open until a room temperature of approx. $20\text{--}22^\circ \text{C}$ is reached. Once the desired room temperature has been reached, the current flow and return temperatures as well as the outside temperature are noted and entered in the diagram below. With the aid of the diagram, the **In fact** required temperature level (low, medium, high temperature) can be read off.

NOTE Performing hydraulic balancing can reduce the maximum required flow temperature!



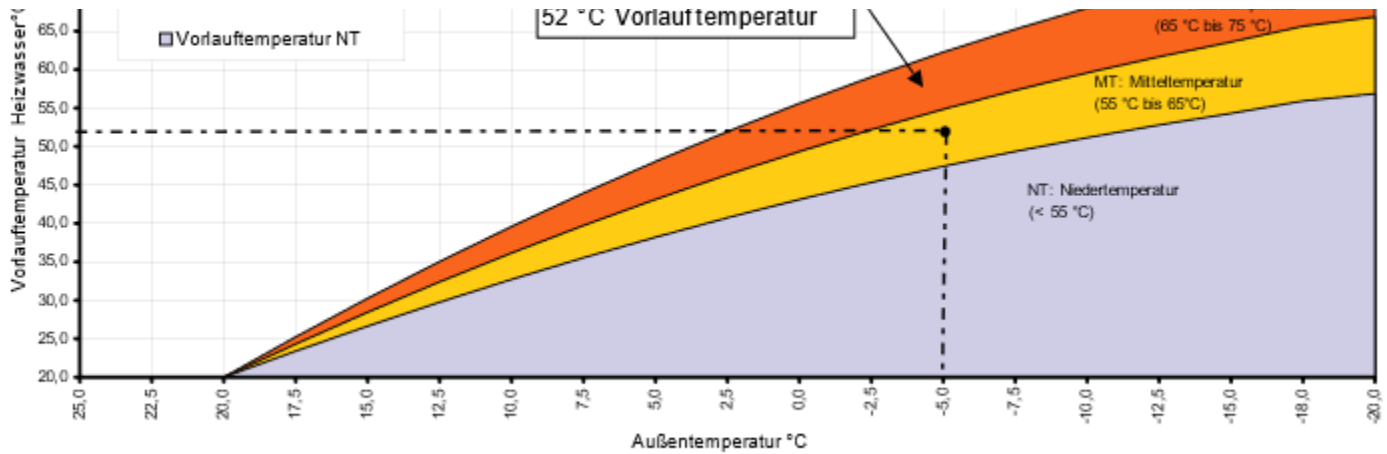


Fig. 1.1: Diagram for the experimental determination of the actually required system temperatures

1.1.3 Which renovation measures have to be taken for an energy-saving heat pump operation?

Low temperature

Flow temperature for all rooms max. 55 ° C

If the required flow temperature is below 55 ° C, no additional measures are required. Any low-temperature heat pump can be used for flow temperatures of up to 55 ° C.

Mean temperature

Flow temperature in some rooms over 55 ° C

If the required flow temperature is above 55 ° C only in some rooms, measures should be taken to reduce the required flow temperature. To do this, only the radiators in the affected rooms are replaced in order to enable the use of a low-temperature heat pump.

Mean temperature

Flow temperatures in almost all rooms between 55 ° C and 65 ° C

If temperatures between 55 ° C and 65 ° C are required in almost all rooms, the radiators in almost all rooms have to be replaced or a medium-temperature heat pump can be used.

High temperature

Flow temperatures in almost all rooms between 65 ° C and 75 ° C If flow temperatures of 65 ° C to 75 ° C are required, the entire heating system must be converted or adapted. If this changeover is not possible or not wanted, a high-temperature heat pump must be used.

A reduction in heat demand through

- Exchange of windows
- Reduction of ventilation losses
- Insulation of storey ceilings, roof trusses or facades

brings savings in four different ways when renovating a heating system with a heat pump.

- By reducing the heat requirement, a smaller and therefore cheaper heat pump can be installed.
- A lower heat requirement leads to a reduction in the annual heating energy requirement that has to be supplied by the heat pump.
- The lower heat requirement can be covered with lower flow temperatures and thus improves the annual coefficient of performance.
- Better thermal insulation leads to an increase in the mean surface temperatures of the areas surrounding the room. As a result, the same level of comfort is achieved at lower room air temperatures.

Example:

A house with a heating requirement of 20 kW and an annual heating energy requirement of approx. 40,000 kWh is heated with a hot water heater with a flow temperature of 65 ° C (return 50 ° C). Subsequent thermal insulation measures reduce the heat requirement by 25% to 15 kW and the annual heating energy requirement to 30,000 kWh. As a result, the average flow temperature can be reduced by approx. 10 K, which lowers energy consumption by a further 20-25%. The total energy cost saving for a heat pump heating system is then approx. 44%.

i NOTE

In principle, the following applies to heat pump heating systems: Every degree of temperature reduction in the flow temperature results in a saving in energy consumption of approx. 2.5%.

1.1.4 Selection of the heat source (renovation)

In the renovation market for existing houses and landscaped gardens, it is rarely possible to build a geothermal collector, geothermal probe or well system. In most cases, the only possible source of heat remains the outside air. Air as a heat source is available everywhere and can always be used without a permit. The expected annual performance factors are lower than for water and ground systems, but the effort for developing the heat source system is lower. How the heat source system is dimensioned for brine and water / water heat pumps, please refer to the corresponding chapters.

1.2 Heat pumps for new systems to be built

1.2.1 Determination of the building heat requirement

The exact calculation of the maximum hourly heat requirement is based on country-specific standards. An approximate determination of the heat requirement is to be made using the living space to be heated A (m^2) possible:

Heat requirement [kW] = heated area [m^2] * spec. Heat demand [kW / m^2]

= 0.01kW / m^2	Passive house
= 0.025kW / m^2	EnEV 2012
= 0.03 kW / m^2	EnEV 2009
= 0.05 kW / m^2	according to thermal insulation ordinance 95 or Minimum insulation standard EnEV
= 0.08 kW / m^2	with normal thermal insulation of the house (from approx. 1980)
= 0.12 kW / m^2	with older masonry without special thermal insulation.

Table 1.3: Approximate specific heat demand values for single-family houses

1.2.2 Design of the flow temperatures

When designing the heat distribution system of heat pump heating systems, it must be ensured that the required heat is transferred at the lowest possible flow temperatures, since every degree of temperature reduction in the flow temperature results in a saving in energy consumption of approx. 2.5%. Large heating surfaces such as underfloor heating are ideal. In general, the required flow temperature should not exceed 55 °C in order to enable the use of low-temperature heat pumps. If higher flow temperatures are required, medium or high temperature heat pumps must be used (Section 1.1.3). In order to heat buildings with the lowest possible flow temperature (low-temperature heating system) and thus energy-efficiently, the consumer circuit must be designed for these system temperatures. The following heat sinks, for example, are suitable for operation with low flow temperatures:

- Underfloor heating
- Fan coil units
- Radiant ceiling panels
- Ventilation register (with large heat exchanger surface)
- Concrete core activation

A weather-dependent setting of the control is preferred in order to avoid unnecessarily high heating water temperatures during the partial load operation of the heat pump. By lowering the flow temperature when the outside temperature rises, an increase in energy efficiency is achieved. The fixed value control of the heat pump, which is also possible, should be set for brine / water heat pumps with a probe system, since the heat source has the same temperature level all year round.

1.2.3 Selection of the heat source

The decision as to whether the heat source air, brine (geothermal heat collector, geothermal probe) or water (well system) is used should be made depending on the following influencing variables.

- **Investment costs** In addition to the costs for the heat pump and the heat recovery system, the investment costs are decisively influenced by the development costs of the heat source.
- **operating cost** The expected annual performance factors of the heat pump heating system have a decisive influence on the operating costs. These are primarily influenced by the type of heat pump, the average heat source temperature and the required heating flow temperatures.

NOTE The building's heat requirement for selecting a heat pump must be calculated according to the country-specific standard (e.g. EN 12831). The selection of a heat pump on the basis of previous energy consumption or reference values for the building's heating requirement is not permitted. In this case, the heat pump can be greatly oversized or undersized.



NOTE

The expected annual performance factors for air / water heat pumps are lower than for water and ground systems, but the effort for developing the heat source system is lower.

1.3 Additional power requirements

1.3.1 RU blocking times

Most energy supply companies (EVU) offer a special agreement with a cheaper electricity price for heat pumps. According to the Federal Tariff Ordinance, the power supply company must be able to switch off and block heat pumps in the event of load peaks in the supply network. The heat pump system for generating heat in the house is not available during the off-times. Therefore, energy must be added in the heat pump enable times, which means that the heat pump or the second heat generator must be dimensioned correspondingly larger.

Dimensioning The calculated heat demand values for heating and hot water preparation must be added. In the case of monovalent operation without a setpoint, an additional 2nd heat generator is not switched on during the blocking period, the sum of the heat demand values must be multiplied by the dimensioning factor f and the heat pump designed accordingly larger. In the case of mono-energetic or bivalent systems, the second heat generator can also provide the additional power required.

Calculation basis:

$$f = \frac{24h}{\text{Freigabedauer}} = \frac{24h}{24h - \text{Sperrdauer}}$$

Lock period (total)	Dimensioning factor
2 h	1.1
4 h	1.2
6 h	1.3

Table 1.4: Dimensioning factor f for taking blocking times into account

Due to the large number of network operators, the EVU block is used very differently. The bandwidth ranges from fixed daily locks to sporadic, load-dependent locks that are only used sporadically during load peaks in the network.

NOTE

In practice, oversized heat pumps with short running times often produce poorer performance factors. Therefore, it makes sense to cover the higher theoretical power requirement at least partially with the second heat generator through EVU locks. The heat pump can cover the additional heat demand for a large part of the year, since the heat pump only needs to be supported by a second heat generator when the outside temperature is low and the heat demand is high at the same time.

NOTE

As soon as a signal for locking the heat pump is set, the signal must be active for at least 10 minutes. After the signal has dropped, it must not be activated again until after 10 minutes at the earliest.

In general, in solidly built houses, especially with underfloor heating, the existing heat storage capacity is sufficient to bridge the maximum blocking period of two hours with only a slight loss of comfort, so that the second heat generator (e.g. boiler) does not need to be switched on during the blocking period. However, the increase in output of the heat pump or the second heat generator is necessary because of the required reheating of the storage masses.

1.3.2 DHW heating

The demand for hot water in buildings is heavily dependent on usage behavior.

With normal comfort requirements, a rough average daily hot water requirement of 1.45 kWh per person can be assumed. At a storage temperature of 60 °C, this corresponds to an amount of water of 25 l per person. In this case, an additional heat pump output of 0.2 kW per person for the hot water must be taken into account.

Simplified process

In the one- and two-family house area with standard sanitary equipment, the required storage tank size and the required heating power can be determined with the help of a simplified procedure.

This value is doubled for storage capacity up to approx. 10 people - thus the required minimum storage volume is obtained. This minimum volume is converted to the actual storage temperature.

NOTE When dimensioning, one should start from the maximum possible number of people and also take into account special user habits (e.g. whirlpool).

If the hot water preparation takes place at the design point of the heat pump by means of a flange heater, it is not necessary to add the additional energy requirement for hot water preparation to the heating requirement.

Circulation lines

Circulation lines increase the heat requirement for hot water heating on the system side. The additional requirement depends on the length of the circulation line and the quality of the line insulation and must be taken into account accordingly. If circulation cannot be dispensed with due to the long pipeline routes, a circulation pump should be used that is activated by a flow sensor if required. The heat requirement for the circulation line can be considerable.

NOTE According to the Energy Saving Ordinance §12 (4), circulation pumps in hot water systems must be equipped with automatic devices for switching them on and off.

The area-related heat loss of the drinking water distribution depends on the usable area and the type and location of the circulation used. With a usable area of 100 to 150 m² and a distribution within the thermal envelope results in area-related heat losses according to EnEV of:

$$n \text{ (with circulation)} = 9.8 \text{ [kWh / m}^2\text{a]}$$

$$n \text{ (without circulation)} = 4.2 \text{ [kWh / m}^2\text{a]}$$

1.3.3 Swimming pool water heating

outdoor pool The heat requirement for pool water heating in the outdoor pool depends heavily on usage habits. In terms of magnitude, it can correspond to the heat demand of a residential building and must be calculated separately in such cases. However, if there is only occasional heating in summer (heating-free time), the heat demand may not need to be taken into account. The approximate determination of the heat requirement depends on the wind position of the pool, the pool temperature, the climatic conditions, the period of use and whether the pool surface is covered.

	Water temperature		
	20 ° C	24 ° C	28 ° C
with cover ¹	100 W / m ²	150 W / m ²	200 W / m ²
without cover Protected location	200 W / m ²	400 W / m ²	600 W / m ²
without cover Partially protected location	300 W / m ²	500 W / m ²	700 W / m ²
without cover unprotected (strong wind)	450 W / m ²	800 W / m ²	1000 W / m ²

¹ Reduced values for pools with a cover only apply to private swimming pools when used for up to 2 hours per day

Tab. 1.5: Reference values for the heat demand of outdoor pools when used from May to September

For the initial heating of the pool to a temperature of over 20 ° C, a heat quantity of approx. 12 kWh / m is required³ Pool content required. Depending on the size of the pool and the installed heating capacity, heating times of one to three days are required.

Indoor swimming pool

- Space heating
The room is generally heated via radiator or underfloor heating and / or a heating register in the dehumidification / ventilation system. In both cases, a heat demand calculation is necessary - depending on the technical solution.
- Swimming pool water heating
The heat requirement depends on the pool water temperature, the temperature difference between pool water and room temperature and the use of the swimming pool.

Room temperature	Water temperature		
	20 ° C	24 ° C	28 ° C
23 ° C	90 W / m ²	165 W / m ²	265 W / m ²
25 ° C	65 W / m ²	140 W / m ²	240 W / m ²
28 ° C	20 W / m ²	100 W / m ²	195 W / m ²

Tab. 1.6: Reference values for the heat requirement of indoor swimming pools

In the case of private swimming pools with a pool cover and use of a maximum of 2 hours per day, these services can be reduced by up to 50%.

NOTE When using a brine / water heat pump for swimming pool preparation, the heat source must be designed for the higher number of full annual hours of use.

NOTE If a swimming pool is heated all year round, a separate swimming pool heat pump is recommended when there is a high heat demand.

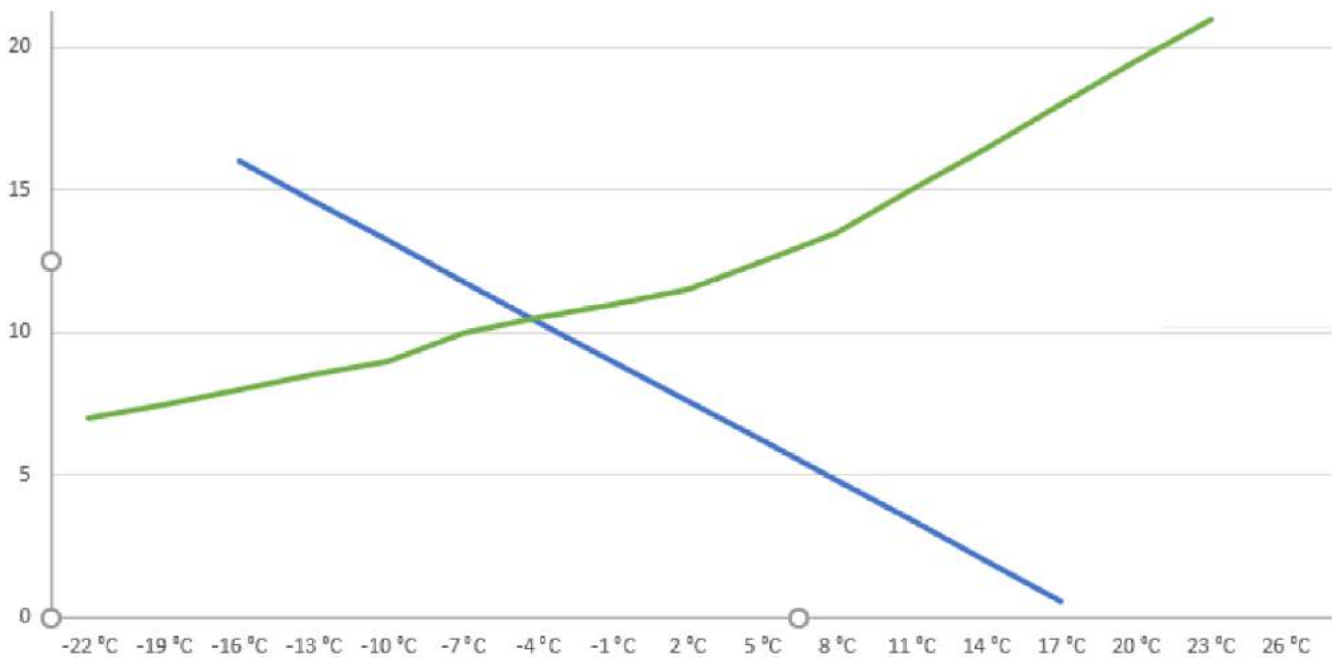
1.3.4 Determination of the heat pump output

1.3.4.1 Heat pump with one output level (Fix-Speed)

Fix-Speed heat pumps are controlled by switching the compressor on and off. The cooling circuit including the heat exchanger surfaces is optimized for the full performance of the compressor. Operating advantages are particularly evident in systems that have a high heat requirement at approx. 2 °C, e.g. in bivalent systems or systems with high storage masses, e.g. open underfloor heating systems, since the compressor is operated with maximum efficiency even when there is a high heat requirement.

Overdimensioning in connection with a lack of storage mass leads to short runtimes, the machine clocks. This behavior occurs more intensely in the transition period.

Heating capacity in kW



Outside temperature in °C

- heating power characteristic

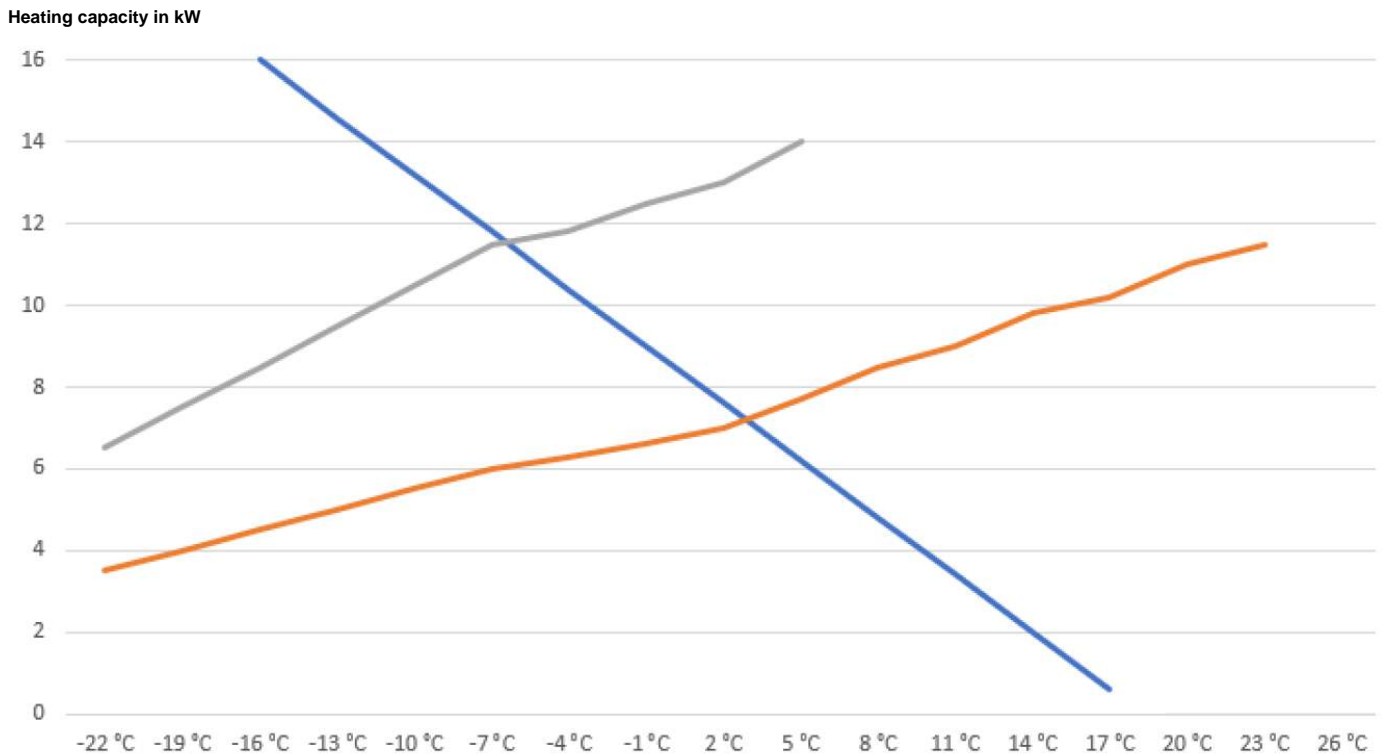
- Fixed-speed characteristic

Fig. 1.2: Heating output curve, heat pump with one output level (fixed speed)

1.3.4.2 Output-controlled heat pumps with two output levels (stepped control)

Step-controlled heat pumps are controlled by switching two compressors on and off. The cooling circuit including the heat exchanger surfaces is optimized for operation with one compressor, as one compressor can often cover over 80% of the annual heating work. When the outside temperature is low, additional power is available by switching on the second compressor. At higher outside temperatures, only the capacity of one compressor is available.

Over sizing (e.g. monovalent design) is less critical, as this simply increases the proportion of more efficient single-compressor operation. Ideally, the heat pump covers the building's heat demand with an outside temperature of approx. 2 °C with the output of a compressor. In bivalent systems, the bivalence point should be below 0 °C.



Outside temperature in ° C

- heating power characteristic

- Performance level 1 (2-level)

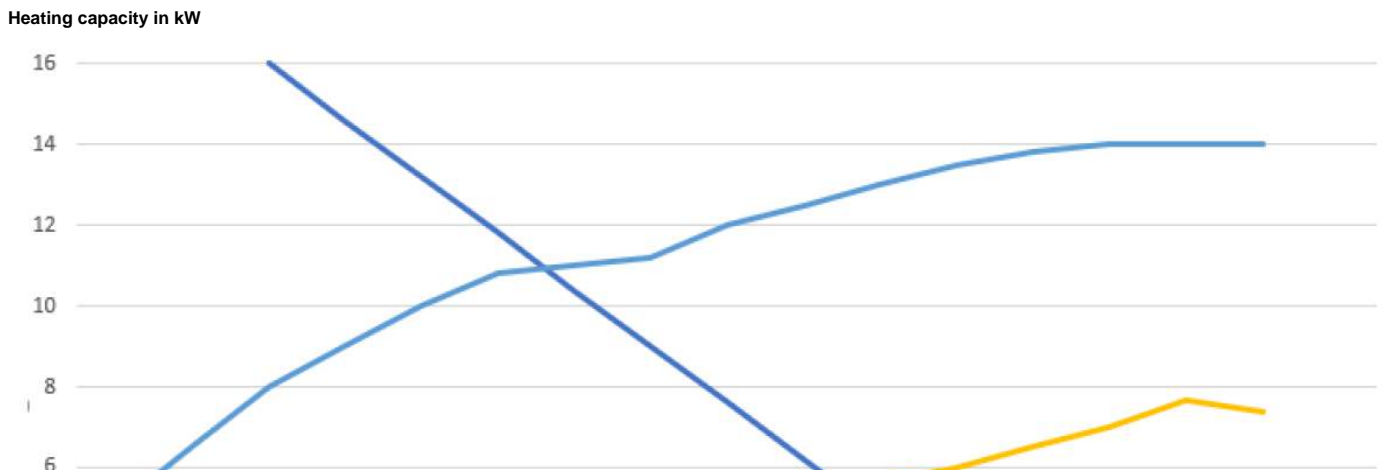
- Performance level 2 (2-level)

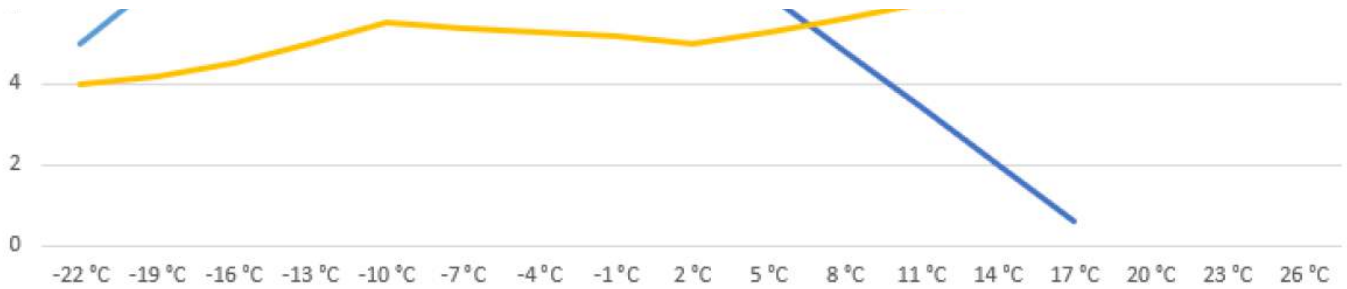
Fig.1.3: Heating output curves for heat pumps with two output levels (stepped control)

1.3.4.3 Output-controlled heat pumps with inverters

In the case of steplessly controlled inverter heat pumps, the output of the compressor is controlled via the frequency. The cooling circuit including the heat exchanger surfaces is optimized for partial load operation with the aim of achieving a high annual coefficient of performance. Ideally, the system is dimensioned so that the control range of the inverter is sufficient to enable continuous operation of the heat pump between approx. -7 ° C and + 7 ° C outside temperature. The heat pump only needs to be supported by a second heat generator when the outside temperature is lower. At higher outside temperatures, outside the control range, the control takes place by switching off the compressor (analogous to Fix-Speed).

Oversizing leads to the fact that the inverter is operated more and more outside its control range, which in turn leads to increased clocking and thus to a control behavior similar to a fix-speed heat pump, control by switching on and off.





Outside temperature in ° C

- heating power characteristic

- performance curve minimal (variable)

- Maximum performance curve (variable)

Fig. 1.4: Heating output curves for output-controlled heat pumps with inverters

1.3.4.4 Air / water heat pump (monoenergetic operation)

Air / water heat pumps are mainly operated as mono-energetic systems. Depending on the climate zone, the heat pump should completely cover the heat demand from -2°C to approx. -5°C outside temperature (equilibrium point). At low temperatures and high heat requirements, an electrically operated heat generator is switched on as required. The dimensioning of the heat pump output influences the level of investment and the annual heating costs, particularly in the case of monoenergetic systems. The higher the output of the heat pump, the higher the investment in the heat pump and the lower the annual heating costs. Experience has shown that the aim is to achieve a heat pump output that intersects the heating curve at a limit temperature (or equilibrium point) of approx. -5°C . With this design, according to VDI 4650 DIN 4701 T10, a bivalent-parallel operated system results in a share of the 2nd heat generator (e.g. heating element) of 2%. The following Fig. 1.5 shows, for example, the annual characteristic curve for the outside temperature in Essen. According to this, there are fewer than 10 days a year with an outside temperature of below -5°C .

- A monovalent design of air / water heat pumps is permitted
- The system should be hydraulically optimized in such a way that there is no permanent cyclical operation (buffer tank size, hydraulic balancing, heating curve setting, ...)
- Overdimensioning for security reasons or due to EVU blocks should be avoided

In the case of a monovalent heat pump, it must be ensured that sufficient storage masses prevent the heat pump from cycling. This can be done by increasing the buffer volume or by using the storage mass of the underfloor heating. Hydraulic balancing and the correct setting of the heating curve are essential. The ideal combination with the intelligent room temperature control, which adapts the system temperature to the actual heat demand and thus contributes to longer running times of the heat pump, among other things.

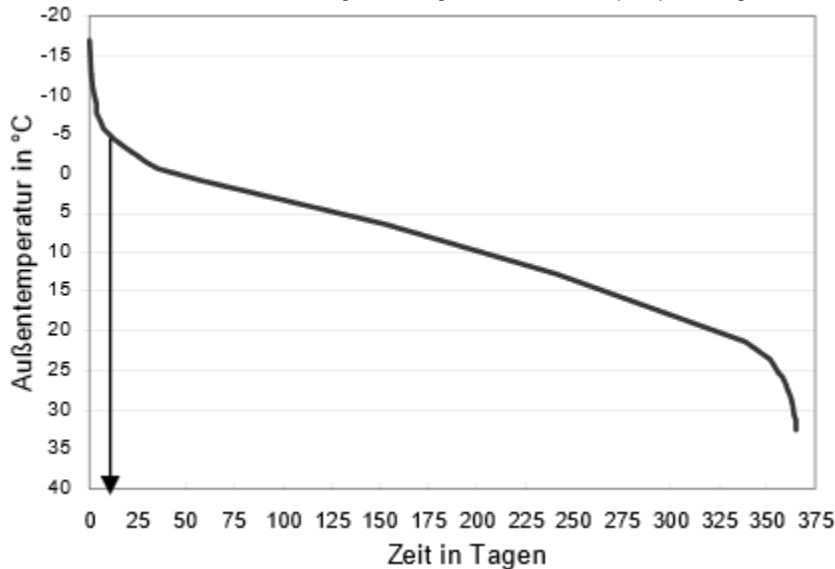


Fig. 1.5.: Annual characteristic curve: Number of days on which the outside temperature is below the specified value

Example for Tab. 1.7: With a bivalence point of 5°C , a heat pump share of approx. 98% results in bivalent-parallel operation.

Equilibrium point [° C]	-10	-9	-8th	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4th	5
Coverage [-] for biv.-parallel operation	1.00	0.99	0.99	0.99	0.99	0.98	0.97	0.96	0.95	0.93	0.90	0.87	0.83	0.77	0.70	0.61

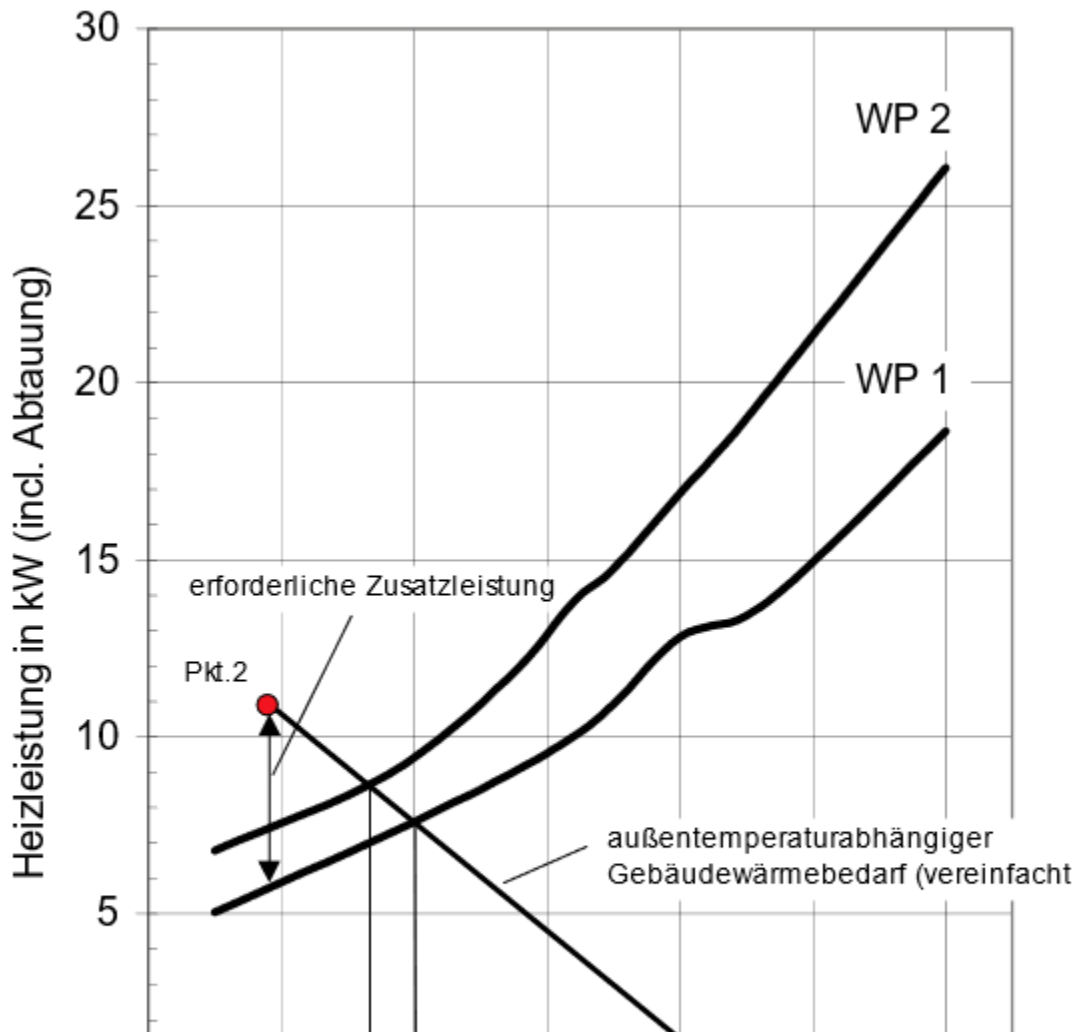
Coverage share [-] for biv.-alternative operation	0.96	0.96	0.95	0.94	0.93	0.91	0.87	0.83	0.78	0.71	0.64	0.55	0.46	0.37	0.28	0.19
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Tab.1.7: Coverage share of the heat pump in a mono-energetic or bivalent-operated system depending on the bivalence point and the operating mode (source: Table 5.3-4 DIN 4701 T10)

1.3.4.5 Design example for an air / water heat pump

The heat pump is dimensioned using the outside temperature-dependent building heat demand (simplified as a straight line) in the heat output diagram and the heat output curves of the heat pumps. The outside temperature-dependent building heat demand is entered from the selected room temperature (corresponding outside temperature point 1) on the abscissa (x-axis) to the calculated heat output (point 2) at standard outside temperature according to country-specific standards.

Building data:		
• Monoenergetic mode of operation (heat pump with electric heating element)		
• Heating system with maximum flow temperatures of 35 ° C		
• Locking time 2 h (factor f from Tab.1.4)		
• Heat demand for heating		9.0 kW
• Heat demand for hot water preparation		1.0 kW
Calculation:		
necessary heat output of the heat pump		
= (Heat demand heating + heat demand hot water preparation) x factor f		
= (9.0 kW + 1.0 kW) x 1.1 =		11.0 kW



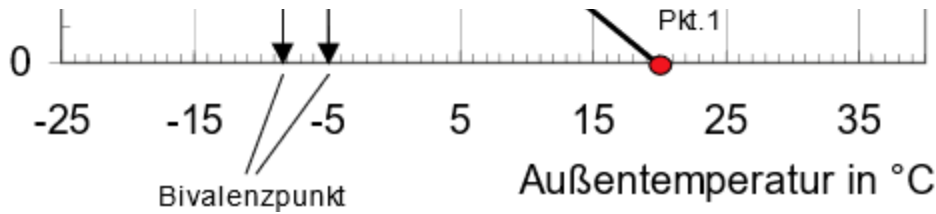


Fig. 1.6: Heating output curves of two air / water heat pumps with different heating outputs for flow temperatures of 35 ° C and outside temperature-dependent building heating requirements

The example from Fig. 1.6 with a total heating requirement of the house of 11.0 kW at a standard outside temperature of 16 ° C and a selected room temperature of +20 ° C illustrates the procedure. The diagram shows the heating output curves of two heat pumps for a heating water flow temperature of 35 ° C. The points of intersection (limit temperature or bivalence points) from the straight line of the outside temperature-dependent building heat demand and the heating output curves of the heat pumps are approx. -5 ° C for HP 1 and approx. -9 ° C for HP 2. For the selected example is to use the WP 1. So that year-round heating can take place, the difference between the outside temperature-dependent building heat requirement and the heating output of the heat pump at the corresponding air inlet temperature must be compensated for by an additional electrical heater.

Design of the electrical auxiliary heating:

	Total heat demand on the coldest day
-	Heat output of the heat pump on the coldest day
=	Power of the heating elements

Example:

$$11 \text{ kW} - 5,5 \text{ kW} = 5,5 \text{ kW}$$

Wärmebedarf des Hauses bei -16 °C
 Wärmeleistung der WP bei -16 °C
 Leistung der Heizstäbe

For the selected example, HP 1 is to be dimensioned with an electrical output of the heating elements of 6.0 kW.

1.3.4.6 Design of brine / water and water / water heat pumps (monovalent operation)

Fig. 1.7 shows the heating output curves of brine / water heat pumps. The heat pump whose heating output is above the intersection of the required total heat demand and the available heat source temperature is to be selected.

Building data:		
• Monovalent mode of operation (only heat pump)		
• Heating system with maximum flow temperatures of 35 ° C		
• Blocking time 6 h (factor f from Table 1.3)		
• Heat demand for heating		10.6 kW
Calculation:		
necessary heat output of the heat pump		
= Heat demand heating x factor f		
= 10.6 kW x 1.3 =		13.8 kW



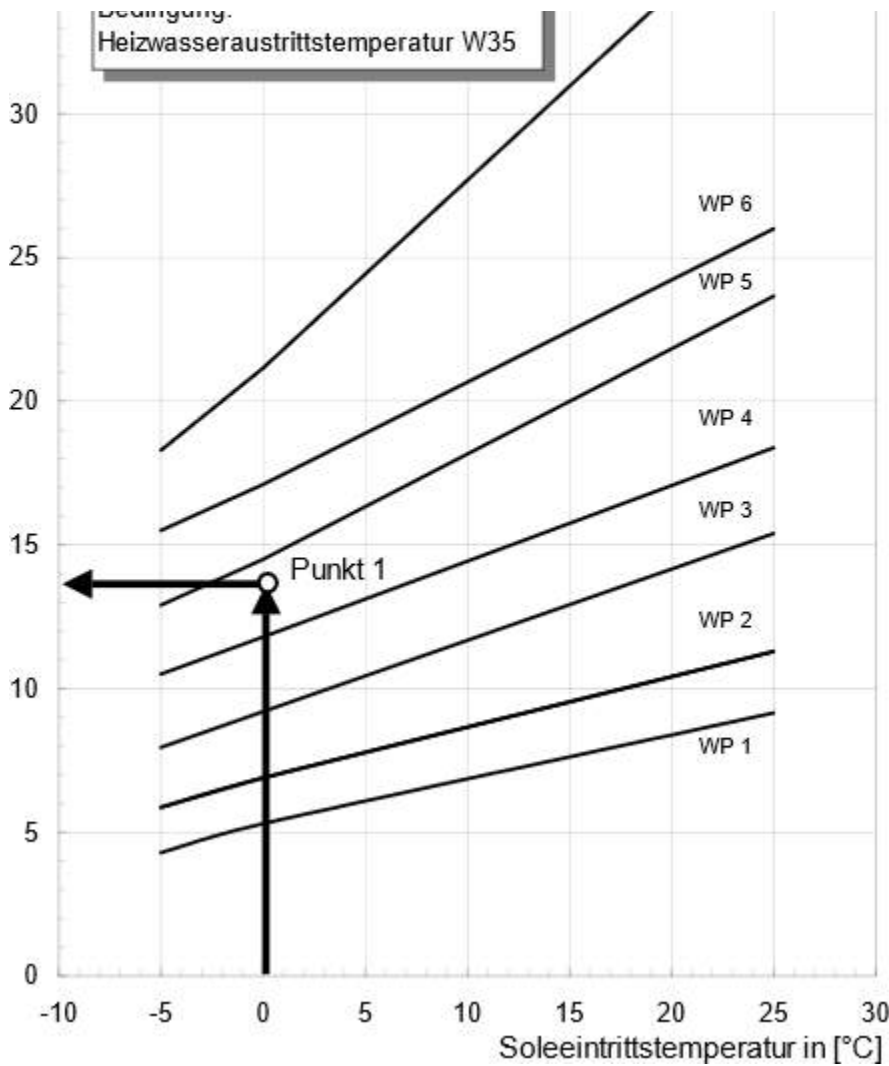


Fig. 1.7: Heating capacity curves of brine // water heat pumps with different heating capacities for flow temperatures of 35 ° C.

With a total heat requirement of 13.8 kW and a minimum brine temperature of 0 ° C, the performance curve of WP 5 must be selected with a maximum required flow temperature of 35 ° C. Under the above-mentioned boundary conditions, this delivers a heat output of 14.5 kW.

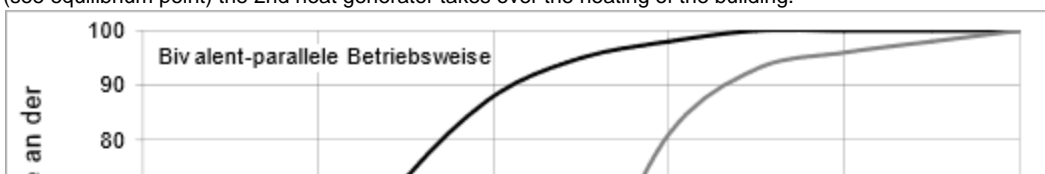
1.3.4.7 Design of brine / water and water / water heat pumps (monoenergetic operation)

Monoenergetic brine / water or water / water heat pump systems are equipped with a second, also electrically operated heat generator, e.g. a buffer storage tank with an electric immersion heater. The planning of mono-energetic brine / water or water / water heat pump systems should only be carried out in exceptional cases, if a very high performance surcharge is necessary due to blocking times or a heat pump with a significantly higher performance compared to the total heat requirement would have to be selected due to the range. In addition, mono-energetic operation is ideal for the first heating season when the building dries out in autumn or winter.

1.3.4.8 Design of air / water heat pumps (bivalent operation - hybrid systems)

At a **bivalent-parallel** In operation (old building and / or hybrid systems), a second heat generator (fossil: oil or gas boiler; regenerative: pellet stove, solar thermal) supports the heat pump from the bivalence point. Below the bivalence point **can** both heat generators be operated in parallel.

In existing buildings with classic (cast) radiators as a heat distribution system, heating flow temperatures of 50 ° C and more are sometimes possible. If an optimization of the heat distribution system is not possible, a **bivalent-alternative** Operation of heat pumps and boilers, as air / water heat pumps in particular have significantly better coefficients of performance at higher outside temperatures. At low outside temperatures (see equilibrium point) the 2nd heat generator takes over the heating of the building.



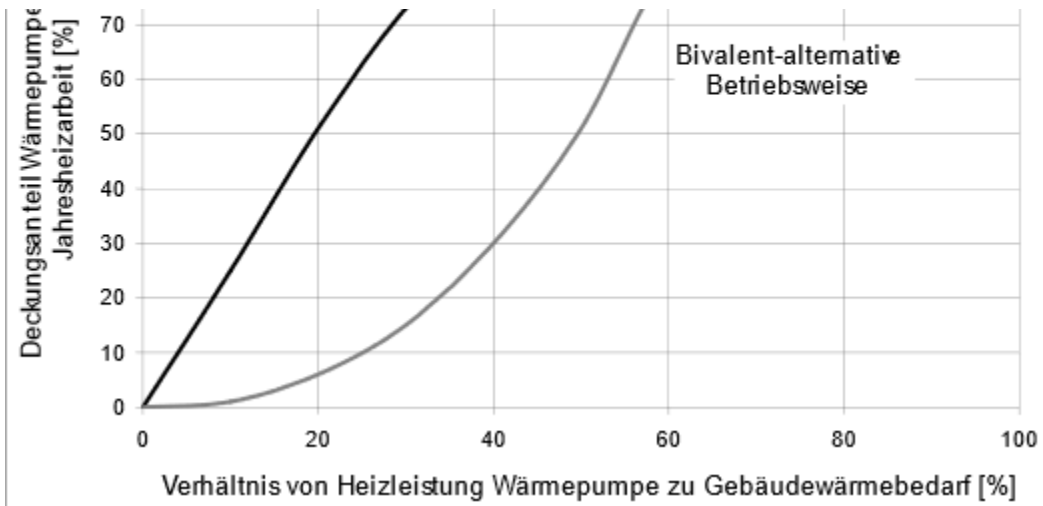


Fig. 1.8: Coverage share of a heat pump in different operating modes

The diagram shows the share of coverage of a heat pump for the operating modes bivalent-parallel and bivalent-alternative depending on the building's heat demand for an example building.

NOTE Experience shows that with bivalent systems in the renovation area, the existing oil or gas boiler is taken out of service for a wide variety of reasons after a few years. The design should therefore always be analogous to the mono-energetic system (equilibrium point - 2 ° C to approx. -5 ° C) and the buffer storage should be integrated into the heating flow.

1.3.4.9 Design of brine / water and water / water heat pumps (bivalent operation)

In the case of bivalent operation of water / water and brine / water heat pumps, the same relationships apply in principle as for air / water heat pumps. Depending on the system of the heat source system, the other dimensioning factors of the heat source (extraction capacity of the heat pump, hours of full use) must be taken into account and adjusted.

1.3.4.10 Building drying / screed drying

When building a house, depending on the construction method, a certain amount of water is used for mortar, plaster, plaster and wallpaper, which only slowly evaporates from the structure. In addition, rain can increase the moisture in the building. Due to the high level of humidity in the entire building, the heating requirement of the house is increased in the first two heating seasons.

The building should be dried out with special, on-site devices. If the heating output of the heat pump is limited and the building dries out in autumn or winter, an additional electric immersion heater or a replacement heater must be installed in accordance with VDI 4645. This must be taken into account, especially with brine / water heat pumps, in order to compensate for the increased heat demand and to relieve the heat source.

NOTE In the case of brine / water heat pumps, the increased compressor run times can lead to undercooling of the heat source and thus to a safety shutdown of the heat pump.

1.3.5 General information on the hydraulic connection of heat pumps

Connection on the heating side

The connection on the heating side must be carried out by qualified personnel using personal protective equipment. The respective connection sizes and thread types can be found in the device information for the heat pump. When connecting to the heat pump, the transitions must be held in place with a key. Empty pipes must be sealed after installation on the heat pump.

Before the heat pump is connected on the heating water side, the heating system must be flushed in order to remove any impurities, residues of sealing material or the like. An accumulation of residues in the condenser can lead to total failure of the heat pump.

After the installation on the heating side has been completed, the heating system must be filled, vented and pumped off.

Please note the following when filling the system:

- the fill and top-up water must be of drinking water quality (colorless, clear, without deposits) and be pre-filtered (pore size max. 5 µm). For more information, see Chapter 8.9 - Stone Formations ...
- Furthermore, the installation and operating instructions for components used on site (e.g. pumps, valves, storage tanks ...) must be observed.

1.3.6 General information on the electrical connection of heat pumps

1.3.6.1 Miniature circuit breaker and residual current circuit breaker (RCD)

The size and type of the required circuit breaker can be found in the documents supplied (electrical documentation, device information, instructions) or on the nameplate of the respective heat pump. The use of a circuit breaker with a different trigger characteristic or a higher trigger value is not permitted.

Depending on the conditions of use and the installation environment, the use of an upstream RCD is necessary. The information and boundary conditions for the use of a residual current circuit breaker include: can be found in the generally applicable VDE regulations. If a residual current circuit breaker is installed, it must at least correspond to the RCD type specified in the device information or the electrical documentation for the heat pump.

1.3.6.2 Cable laying

The environmental conditions (e.g. indoor or outdoor installation, wet room, ...) are decisive for the correct execution of the electrical installation. In accordance with these requirements, a suitable cable type must be used and the cables must be routed in accordance with regulations.

NOTE In the electrical documentation of the heat pump, recommendations for cable selection are given, which may be in accordance with the above. Boundary conditions have to be adapted.

1.3.6.3 Design, project planning and installation of surge protection / lightning protection

In times of digitalization, living comfort and networked building technology, the lightning and surge protection of residential buildings is also of immense importance. In all new residential buildings as well as in the event of changes and extensions to the electrical installation, attention must be paid to the use of overvoltage protection measures. The design, planning and installation of the surge protection / lightning protection is the responsibility of the planner or installer.

The following parts of the DIN VDE 0100 standard regulate:

-443: WHEN overvoltage protection measures are to be provided in systems and buildings.

-534: HOW the arrester is to be selected, installed and installed in the electrical system.

According to the technical interpretation of these standards, it is possible to differentiate between mandatory and recommended measures for overvoltage protection in residential buildings.

Measures for the power supply lines introduced into the residential building are currently mandatory. For Internet, telephone and broadband cable lines, DIN VDE 0100-443 cannot require surge protection measures, but only recommend them. However, a safe and effective surge protection concept can only be achieved if surge arresters are used for all electrical lines that are introduced, and thus also for communication lines.

A surge arrester is therefore required at the entrance to the building for each of these lines (power supply, telephone line and broadband cable). In the case of high-quality, sensitive end devices or if the system part needs special protection (e.g. heat pump), it is necessary to check whether further overvoltage protection measures are required. Because despite a surge arrester already installed at the building entrance, coupling can cause damage to end devices or system parts that are more than 10 meters away from the last surge protection device due to their cable length. The installation of additional overvoltage protection devices ensures that the voltage is limited in accordance with the insulation strength of the electrical or electronic devices and that damage to sensitive devices is avoided.

The aspect of the cable length can also be found in DIN VDE 0100-534. The standard speaks of the so-called "effective protection area of overvoltage protection devices". As in other standards, this was specified as 10 meters. This means that the effectiveness of the overvoltage protection device in the feed may no longer be sufficient after 10 meters.

It is therefore advisable to check whether further protective measures are required. These must be installed as close as possible to the device to be protected (e.g. heat pump) or in the last upstream sub-distribution. Additional overvoltage protection is therefore particularly recommended for components of a heat pump if

- the cable length to sensitive end devices or system parts is more than 10 meters,
- Cables extending beyond the building to external system components (e.g. external unit heat pump) are available,
- Loops are set up in the installation (e.g. when laying high / low current, WLAN routers),
- there are other or tall buildings (e.g. churches or skyscrapers) nearby.

Coordinate the measures for downstream surge arresters with the owner and adapt them to the individual protection needs of the building or the owner. These requirements / recommendations apply exclusively to buildings without an external lightning protection system. A possible lightning and surge protection concept to protect all components of a heat pump system is shown in Figure 1.6.



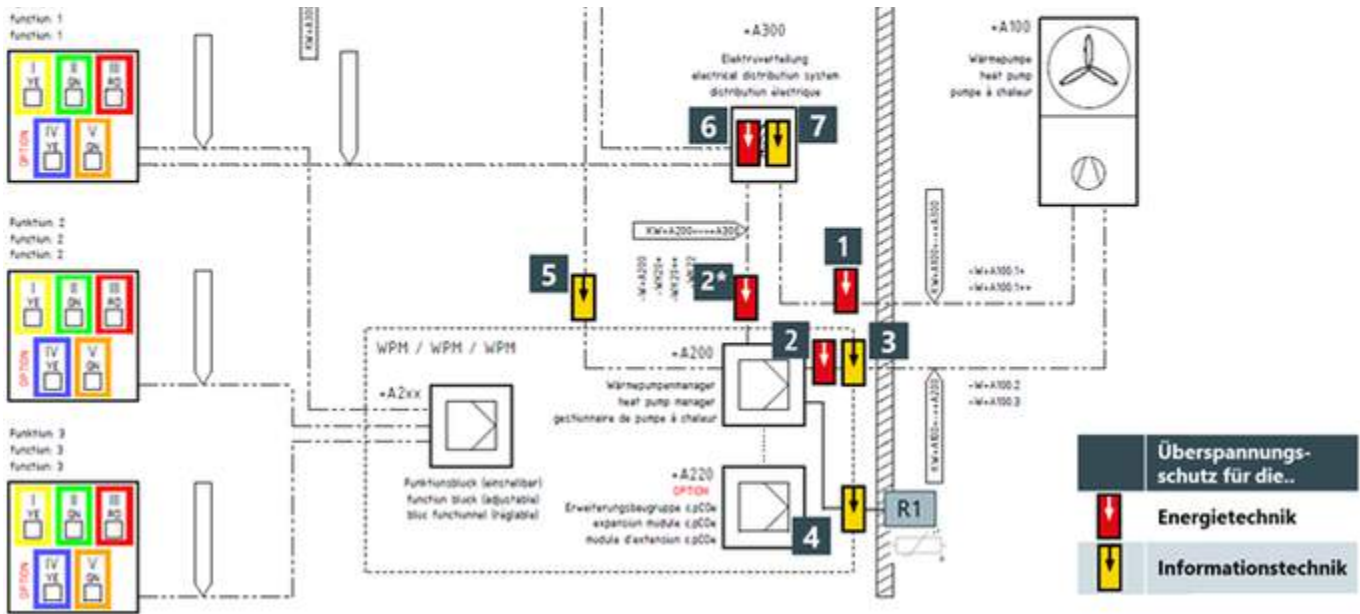


Fig. 1.9 Lightning and surge protection concept using the M / M Flex system as an example

Legend to Fig. 1.9

Nr.	Plan / Bezeichnung	Überspannungsschutz für ...
1	-W+A100.1* oder W+A100.1**	Versorgungsleitungskabel 230/400V
2	-W+A100.2	Steuersp.-Kabel (Außenbereich)
2*	-W+A200	Steuersp.-Kabel (Innenbereich) – bei Leitungslängen > 10m
3	-W+A100.3	Kom.-Kabel
4	R1	Außentemperatur-fühler NTC
5	z.B. +WN24.2 (oder andere)	Ethernetschnittstellen / RJ45-Technik (z.B. Regler, App, etc.)
6	+A300	Hauptverteiler / Zählerfeld 400VAC
7	+A300	Hauptverteiler / Telefon / Telekom

Empfehlung*1 (1-5) (indicated on the left side of the table)

Pflicht*2 (indicated on the left side of the table, covering rows 6 and 7)

*1 gemäß DIN VDE 0100-443/ -534 soll bei Leitungslängen > 10m ein zusätzlicher Überspannungsschutz installiert werden
 *2 gemäß DIN VDE 0100-443 / - 534 ist 6 & 7 ein Überspannungsschutz Pflicht – fällt nicht in das Handlungsfeld des Installateurs / Kälteanlagenbauers

Additional information, data sheets and planning documents on the subject of lightning protection can be found e.g. under www.dehn.de.

1.3.6.4 Electrical connection of heat pumps (general)

The power connection of the heat pump is made using a standard 5-core cable. The cable must be provided by the customer and the line cross-section selected according to the power consumption of the heat pump (see device information appendix) and the relevant VDE (EN) and VNB regulations.

In the power supply for the heat pump, an all-pole disconnection with at least 3 mm contact gap (e.g. EVU blocking contactor, power contactor), as well as a 3-pole automatic circuit breaker with common tripping of all outer conductors, must be provided (tripping current according to the device information of the respective heat pump).

The relevant components in the heat pump contain internal overload protection.

When connecting, the clockwise rotating field of the load feed must be ensured.

Phase sequence: L1, L2, L3.

⚠ ATTENTION

When connecting the load lines, ensure that the rotating field is clockwise (if the rotating field is incorrect, the heat pump will not perform well, it will be very loud and the compressor may be damaged).

- The control voltage is supplied via the heat pump manager. To do this, a 3-pole cable is to be laid based on the electrical documentation. Further information on the wiring of the heat pump manager can be found in the operating instructions.
- A shielded communication line (J-Y (ST) Y ..LG) (provided by the customer - not included in the scope of delivery of the heat pump) connects the heat pump manager with the WPIO controller built into the heat pump. More detailed instructions can be found in the instructions for use of the heat pump manager and the electrical documentation.

NOTE

The communication cable is essential for the function of air-to-water heat pumps installed outdoors. It must be shielded and laid separately from the load line.

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Chapter 2 - Air-to-Water Heat Pump

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2 air / water heat pumps

2.1 Air as a heat source

Area of application of the air / water heat pump The compact device or the outdoor part of a split heat pump is set up outdoors on a solid substructure (e.g. foundation, pavement slabs) taking into account the nature of the ground and connected to the heating system or the indoor part via thermally insulated district heating pipes or refrigerant pipes in accordance with the specifications of the EnEV. Please note the following:

- Take space requirements into account
- Direction of air flow, prevent air short circuit
- Take icing into account in the discharge direction (paths, terraces)
- Ensure condensate drainage even in frosty conditions
- Take sound propagation into account
- Safety clearances and assembly space for maintenance access according to the instructions for use
- Take wind loads into account
- When installed on the roof, load-bearing capacity of the building and sound decoupling (structure-borne sound)

A general statement on the application limits of air / water heat pumps is not possible. These can differ due to different components in the heat pump or different refrigerants. Areas of application related to the heat source temperature of different heat pumps are, e.g.:

- LA ..S-TU (R) from -22 ° C to +35 ° C
- LAW ..IMR / ITR from -20 ° C to +30 ° C

Availability of the heat source outside air

- Unrestricted

ATTENTION The air drawn in must not contain ammonia. The use of exhaust air from animal stalls is therefore not permitted.

NOTE

When using heat pumps near the sea, the high salt content of the air can lead to increased corrosion. Using the heat pump in dusty and corrosive air is not recommended. This also applies to use in the vicinity of exhaust air ducts or in the vicinity of flammable substances.

ATTENTION

The intake and exhaust area must not be restricted or blocked. Installation in hollows or inner courtyards is not permitted

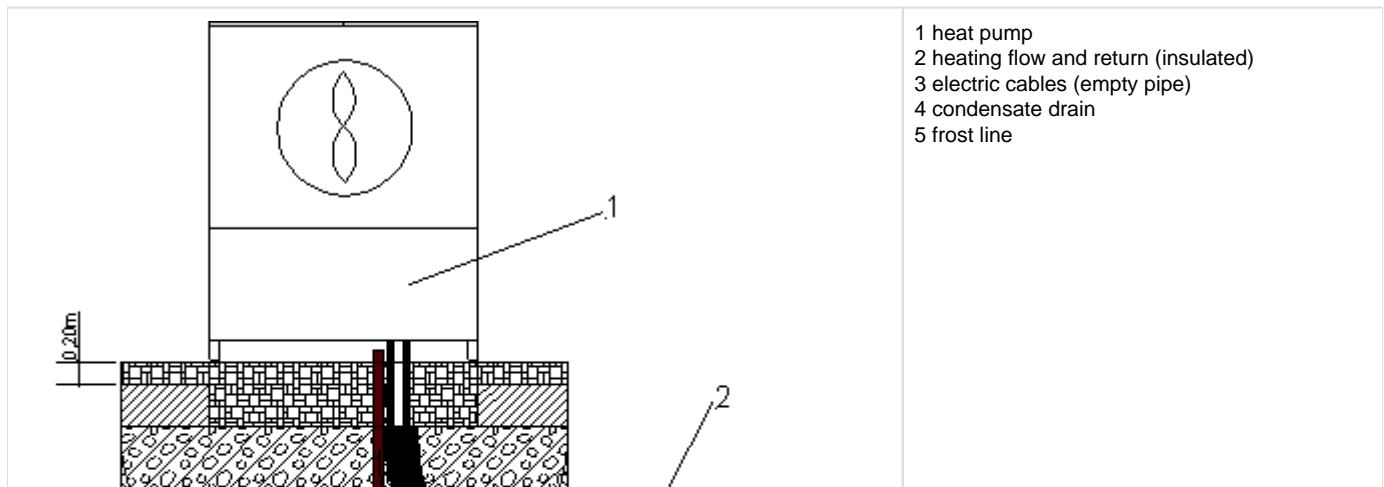
Uses

- monoenergetic
- bivalent parallel (or partially parallel)
- bivalent alternative
- bivalent regenerative

Buffer storage The integration of the air / water heat pump requires a series buffer storage tank in the heat pump flow to ensure that the evaporator (lamellar heat exchanger) is defrosted by reversing the cycle. In addition, the installation of an in-line buffer storage tank extends the runtimes of the heat pump when there is little heat demand (see Section 8.6).

2.1.1 Condensate drain (general information)

The condensation water that occurs during the defrosting phase must be drained off in a short, direct way and protected from frost. To ensure proper drainage, the heat pump must be in a horizontal position. The diameter of the drain pipe for the accumulating condensate must have a diameter of at least 50 mm and must be drained away in a frost-proof manner. Defrosting takes place several times a day as required. Per defrosting process, up to 1.5 liters of condensate can accumulate per kilowatt of heating output (heat pump foundation plan with condensate drain). In some cases, it may be necessary to use a pipe heating system / condensate drain heating system, especially when installing the heat pump on the roof of a building. In order to keep the power requirement of the pipe trace heating as low as possible, the pipe section laid in the frost area should be planned as short as possible. Ideally, the pipe heating is connected to the electrical system of the heat pump (parallel to the nozzle ring heating or directly to the heat pump manager - special accessory KAH 150), but an on-site connection using a self-regulating heating tape with frost protection thermostat is also possible.



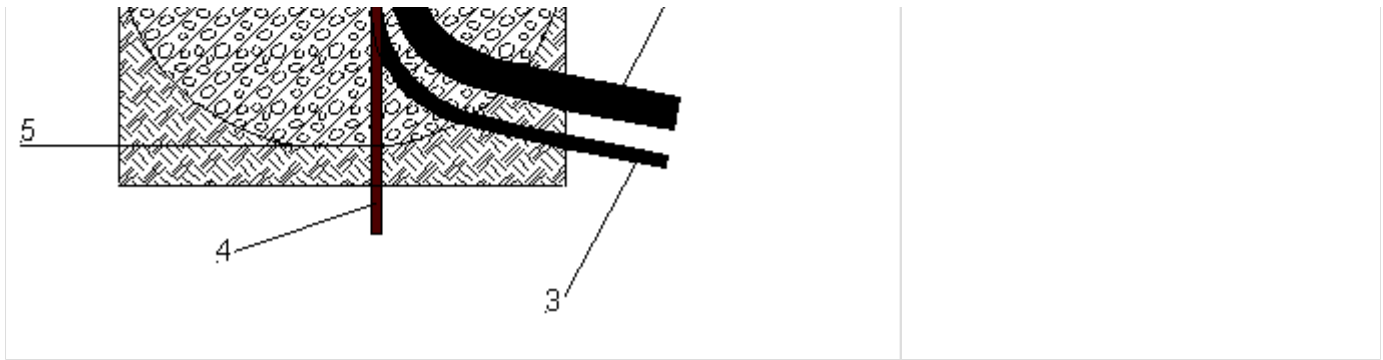


Fig. 2.1: Heat pump foundation plan with condensate drain

2.1.2 Variants of the condensate drain

A frost-free condensate drain line must be guaranteed. To ensure proper drainage, the heat pump must be in a horizontal position.

2.1.2.1 Gravel fill

The condensate that occurs during operation must be drained vertically into a foundation with a gravel bed. A daily infiltration capacity of at least 1.5 liters per kW heating output of the heat pump must be provided, whereby the diameter of the drain pipe for the condensate should be at least 50 mm.

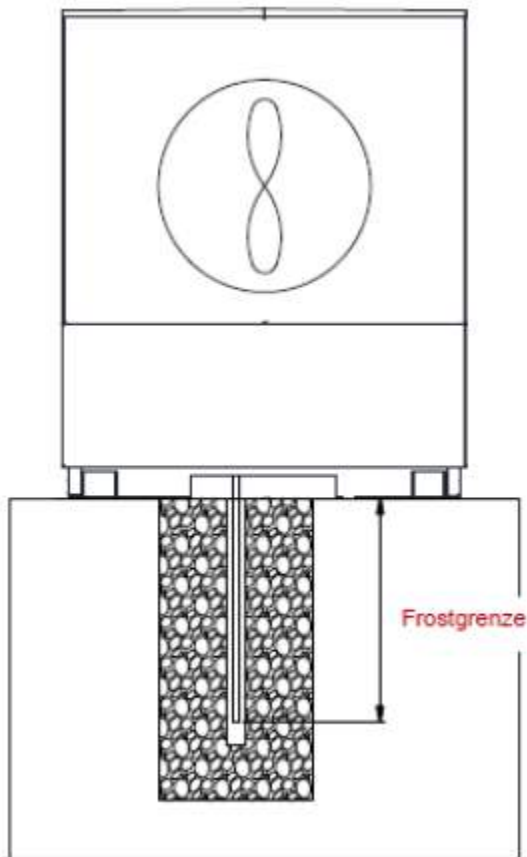


Fig. 2.1.1 Condensate drain in a gravel bed

2.1.2.2 Dirt, rain or drainage channel (not for heat pumps with flammable refrigerants - e.g. R290, R32)

The condensate is fed into a dirt, rain or drainage channel via a condensate pipe laid in the ground. If the condensate is to be discharged into sewers in which fermentation gases can occur, the evaporator must be protected from fermentation gases with the aid of a siphon (observe frost protection). The siphon must be designed with a minimum height of the barrier liquid of 300 mm. The tightness and correct functioning of the condensate drain must be checked and ensured as part of maintenance work. Lifting systems are not permitted.

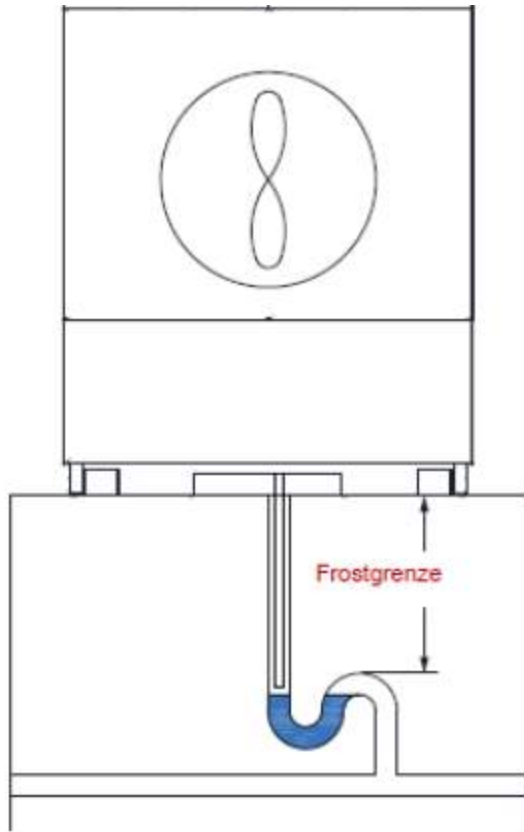


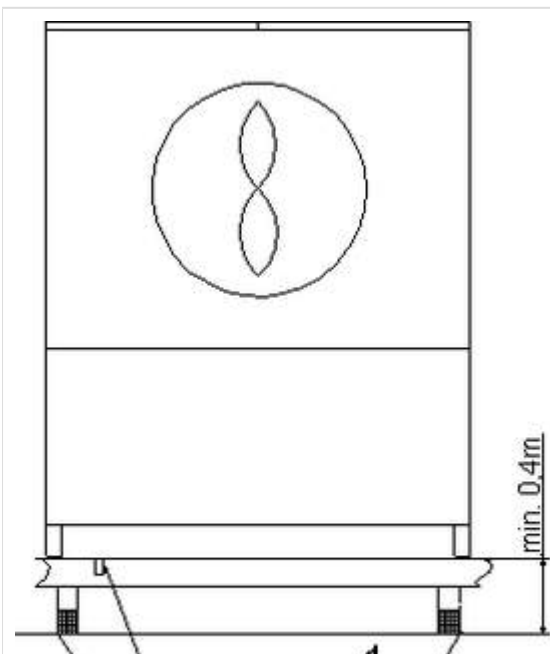
Fig. 2.1.2 Condensate drain in the sewer (shown with siphon)

⚠ ATTENTION

A siphon must be provided for the discharge of condensate into clarifiers and sewers to protect the heat pump's evaporator from aggressive vapors.

2.1.2.3 Free discharge (elevation)

Free drainage is only recommended in areas with short periods of frost. In colder regions at risk of frost, the condensate line must be equipped with appropriately sized and regulated electrical trace heating on an insulated condensate line. The resulting condensate must be led into a frost-free or heated drain.



- 1 free drainage downwards
- 2 Vibration decoupling if necessary

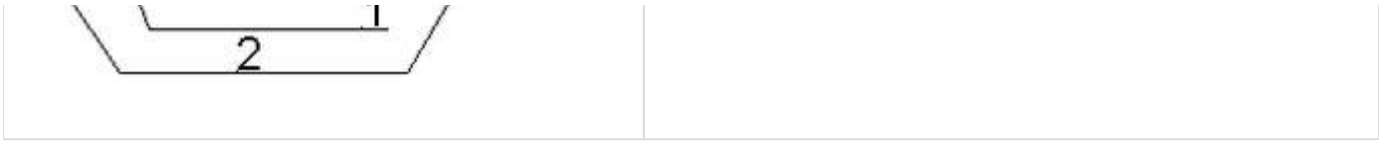


Fig. 2.1.3 Free condensate drainage on an elevation (e.g. building roof)

NOTE The frost limit can vary depending on the climatic region. The regulations of the respective countries must be taken into account.

ATTENTION
When discharging condensate into clarifiers and sewage systems, a siphon must be provided to protect the evaporator from aggressive vapors.

ATTENTION
The district heating pipe must be laid in such a way that no condensate or rainwater can penetrate the pipe via the foundation of the external unit. To do this, the entire district heating pipe must be routed at least 2 - 3 cm out of the foundation.

Frost protection

If a heat pump system cannot be guaranteed free of frost, a drainage facility (see Fig. 2.1.4) should be provided. As long as the heat pump manager and heating circulation pump are ready for operation, the frost protection function of the heat pump manager works. If the heat pump is shut down or if there is a power failure over a longer period of time, the system must be emptied at three points (see Fig. 2.1.4) and, if necessary, blown out.

In heat pump systems where a power failure cannot be detected (e.g. weekend house), the heating circuit must be operated with a suitable antifreeze (e.g. monoethylene glycol without inhibitors). The pump design and hydraulics of the system must be considered separately. These precautions can lead to lower plant efficiency.

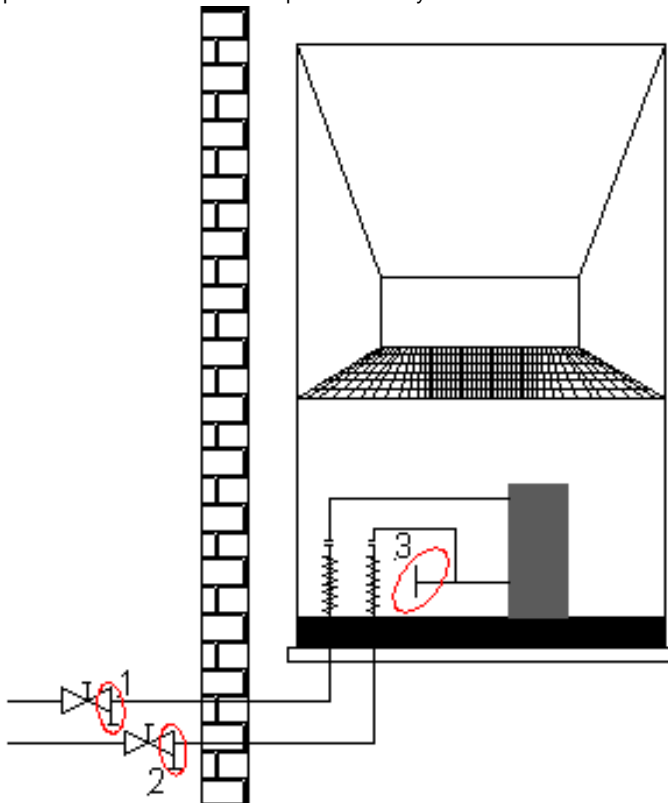


Fig. 2.1.4: Emptying points for air / water heat pumps

Freeze protection

If required, the heating circulation pump is activated automatically via a built-in frost protection sensor in order to prevent the heat pump from freezing up during its idle time (Section 8.2). A permanent power supply to the heat pump is essential to ensure this function.

Maintenance instructions

Heat pumps require maintenance. Regular checks are required by law, depending on the refrigerant and the charge. The following work can also be carried out without special training:

- Cleaning the condensate pan, checking the continuity of the condensate drain
- Checking and, if necessary, cleaning of the fins on the evaporator
- Checking and, if necessary, cleaning the interior of the heat pump
- Checking and, if necessary, cleaning of the air ducts (air inlet and outlet)

In addition, the tightness of the heat pump and the functionality of the refrigerant circuit must be checked at regular intervals.

NOTE Further information and country-specific standards for leak testing heat pumps can be found in the respective installation instructions for the heat pump.

ATTENTION
Work on refrigerant-carrying components may only be carried out by qualified refrigeration personnel.

2.2 Air / water heat pumps for outdoor installation

Development costs for outdoor installation (Installation at ground level)

The heat pump or the heat source module requires a sufficiently stable, frost-proof and horizontal foundation, which is to be created in accordance with the local requirements and the rules of construction technology. For the heat pump flow and return, the electrical connection or connection lines as well as for the condensate drain, appropriate recesses must be provided in the foundation, which can be found in the foundation plan of the heat pump. The exhaust side must not be positioned towards the building.

- Frost-proof foundation
- Laying thermally insulated heating lines for flow and return in the ground
- Laying electrical connection and load lines in the ground
- Wall ducts for connection lines
- Condensate drain (frost-proof)
- If necessary, observe state building regulations

Lineup

Heat pumps for outdoor installation are equipped with specially painted metal sheets and are therefore weatherproof. The device must always be set up on a permanently flat and horizontal surface. Frost-proof laid pavement slabs or foundations are suitable as a substructure. The frame must lie tightly against the floor all round to ensure soundproofing, prevent water-bearing parts from cooling down and protect the interior of the device from small animals. If this is not the case, gaps must be sealed with weatherproof insulation material. In order to prevent small animals from entering the interior of the device, it is necessary, for example, to seal the connection opening in the base plate. The small animal protection should be made of non-rusting material.

A raised base or a higher foundation may be necessary for snowy regions. Detailed information on this or on snow loads (regionally divided into 5 zones) can be found, for example, on: www.schneelast.info can be viewed.

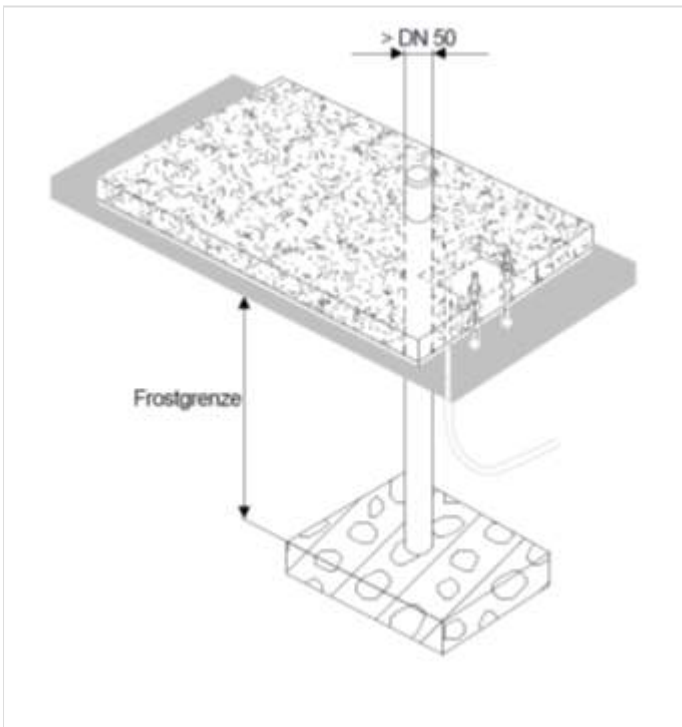


Fig. 2.1.5: Sketch of the concrete foundation

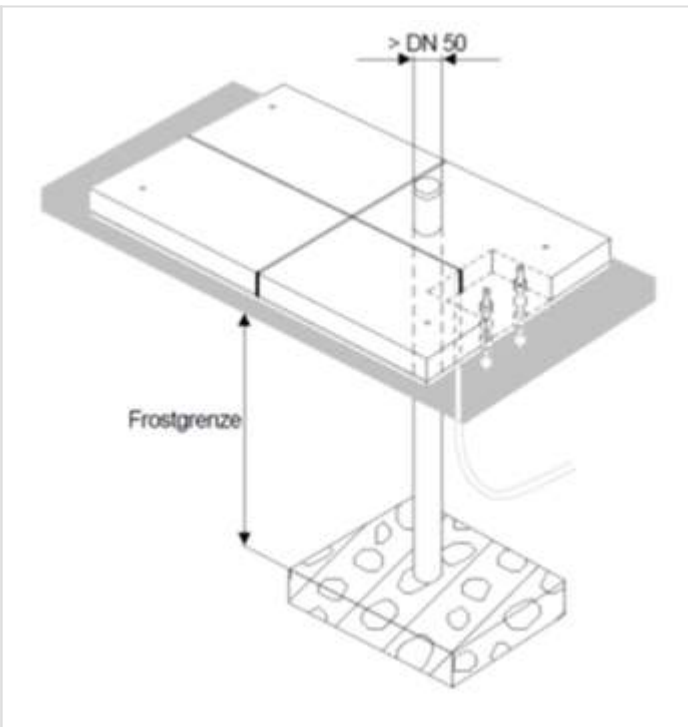


Fig. 2.1.6: Sketch of the foundation with pavement slabs

⚠ ATTENTION The heat pump is basically designed for installation at ground level. In the case of deviating conditions (e.g. installation on a platform, flat roof, etc.) or if there is an increased risk of tipping (exposed location, high wind loads, etc.), an additional anti-tipping device must be provided.

ℹ NOTE
In the case of installation close to the wall, the air flow in the intake and discharge area can lead to increased dirt deposits. The colder outside air should be blown out in such a way that it does not increase heat losses in adjacent heated rooms.
In addition, physical influences must be taken into account. There should be no windows or doors in the blower area of the fan.

⚠ ATTENTION
Installation in hollows or inner courtyards is not permitted, as the cooled air collects on the floor and is drawn in again by the heat pump during longer periods of operation.
Development costs for outdoor installation (wall mounting)

ℹ NOTE
The wall structure at the installation site must be able to bear the weight of the heat pump including the wall bracket. In the case of thermally insulated houses, the thermal decoupling must be carried out on site.

ℹ NOTE
The mounting height of the wall bracket should be a maximum of 1.0 m above ground level.

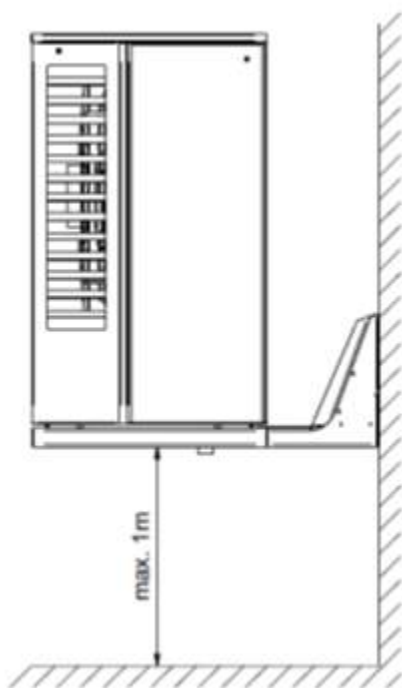


Fig. 2.1.7: Sketch of the wall bracket

For mounting heights over 1 m, additional safety measures against falling are required depending on the local conditions (e.g. wind loads). Access for maintenance work must be possible at all times.

Make sure that no electrical, gas or water lines are laid at the assembly site. Do not mount the wall bracket near windows and doors, as the air blown out of the side of the heat source module is significantly colder than the ambient air.

⚠ ATTENTION
Country-specific building regulations must be observed!

Minimum clearances

It must be possible to carry out maintenance work without any problems. The minimum clearances for the various heat pumps can be found in the installation instructions.

Parallel line-up

When installing several heat pumps in parallel, make sure that the air flow for all heat pumps is the same. In addition, a minimum distance must

be maintained between the individual heat pumps. This is necessary to prevent an air short circuit between the individual heat pumps. In addition, the minimum clearances for maintenance work in the respective assembly instructions must be taken into account. Maintain a minimum distance of 1.0 m between the individual heat pumps.

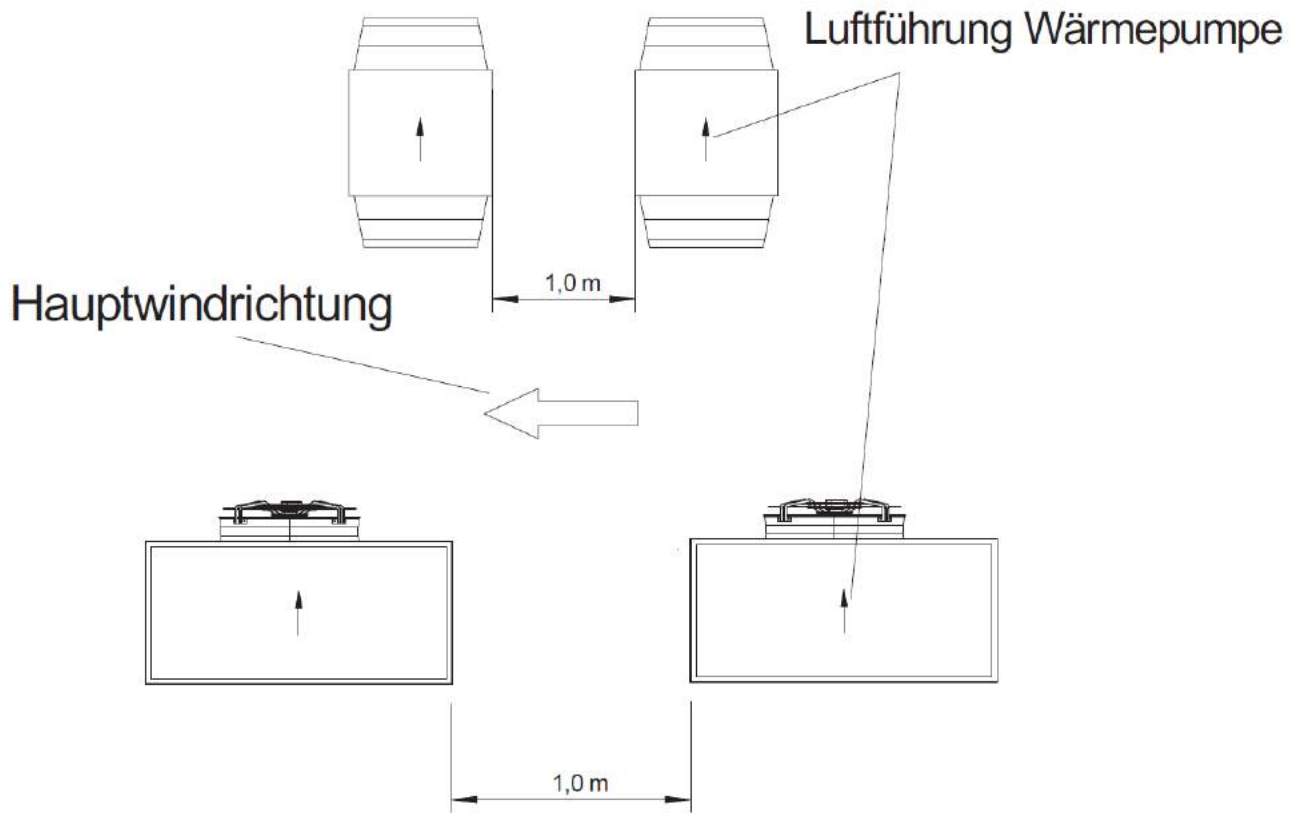


Fig. 2.1.8: Parallel connection of heat pumps

Soundproofing measures

The lowest sound emissions are achieved if there are no sound reflections from reverberant surfaces (e.g. facade) on the discharge side within a radius of 3–5 meters. In addition, the foundation can be covered with sound-absorbing material (e.g. bark mulch) up to the level of the cladding sheets. Noise emissions depend on the respective sound power level of the heat pump and the installation conditions. In chap. 5 the relationships between the factors influencing sound emissions, sound propagation and sound immissions are explained in more detail.

Air short circuit

With air / water heat pumps, a free, unhindered air flow must be ensured over the heat pump's evaporator. Air short circuits between the air flow evaporator inlet (intake) and the air flow evaporator outlet (outlet) must be prevented. This is particularly important when installing several heat pumps set up parallel to one another. The heat pump must be set up in such a way that the air cooled by heat extraction is blown out freely. In the case of installation close to the wall, the discharge must not be in the direction of the wall.

Installation in hollows or inner courtyards is not permitted, as the cooled air collects on the floor and is drawn in again by the heat pump during longer periods of operation.

The air blown out by the heat pump is below the current air temperature. Therefore, there should be no water-carrying pipes such as gutters in the direction of discharge.

i NOTE

The minimum clearances for maintenance work can be found in the respective assembly instructions.

Electrical connection cable

The power supply (control and load line) is laid separately from the heating water lines in one or two protective pipes (e.g. KG pipe, minimum diameter DN 70).

ELECTRICAL CONNECTION

A shielded communication line (J-Y (ST) Y... LG) (provided by the customer) connects the controller installed in the heat pump with the heat pump manager. The connection can be found in the electrical documentation for the heat pump.

An electrical connection cable is required to operate the air-to-water heat pumps listed in Table 2.1. This enables the heat pump manager installed in the technical room to control all electrical components (e.g. compressor, expansion valve) in the heat pump.

Order reference	Heat pumps	length
EVL 10U - EVL 40U	LA 25TU-2 LA 40TU-2	10 - 40 m*
EVL 10UE - EVL 40UE	LA 6S-TU (R) LA 60TU-2 LA 60TUR +	10 - 40 m*

Tab.2.1: Overview of electrical connection cables (* available in special lengths on request)

NOTE The pre-assembled connection lines must be ordered as a separate accessory and selected depending on the type of heat pump.

ATTENTION

The pre-assembled electrical connection cables are available as standard in lengths of 10, 20, 30 and 40 m. Special lengths up to 99 m are available on special order. An on-site extension of the control line is not permitted.

ATTENTION

The load line should be laid separately from the control line to ensure problem-free signal transmission. The electrical connection lines are to be laid in a protective tube with a diameter of at least 70 mm.

Intermediate terminals / disconnection of connection lines between the heat pump and WPM

The following points should be checked in the case of separated and reconnected lines:

The maximum cable length and minimum cross-section must not be exceeded or undercut, the following points must be observed:

- Terminal points executed according to regulations
- Terminal material selected to match the cross-section
- Correct contact
- Correct strand connections (e.g. 1 -> 1; 2 -> 2; etc.)
- Protective measures for terminal points observed:
 - IP degree of protection
 - Contact protection
 - Earthing with metal housing

2.2.1 Connection on the heating side

The connection to the heating in the house is to be made with two thermally insulated pipes according to ENEC. Pre-assembled heating water connection lines are recommended, consisting of two flexible pipes for flow and return in a jacket pipe with integrated thermal insulation made of PE foam, including a pre-assembled 90 ° bend for quick and easy connection to the heat pump. The jacket pipe is laid frost-free in the ground and passed through a wall opening into the boiler room or the technical room at ground level. Costly damage to the pipelines can be avoided in advance if there are no deep-rooted plants in the area of the connecting lines.

NOTE Adjust the pipe trench depth according to the use of the site! Ensure load class SWL 60 in the trafficable area.

The distance between the heat pump and the heating distribution in the building should be kept as small as possible. The use of bends and elbows should be minimized, as any additional pressure loss caused by them reduces the efficiency of the overall system.

The maximum length (connecting lines (electrical and hydraulic) from the heat pump installed outside to the heating distribution in the building) should not exceed 40 m and must be in accordance with the applicable technical guidelines.

PE pipes:

Depending on the heat pump output, a PE pipe with at least DN 50 (e.g. PE-X, PE 80/100, outer diameter 50 mm, wall thickness 4.6 mm) must be used from a total pipe length of 20 m to 40 m, up to one Total line length 20 m, PE pipe with DN 40 (e.g. PE-X, PE 80/100, outer diameter 40 mm, wall thickness 3.7 mm) can also be used. If the PE pipes are laid above ground, appropriate protection against UV radiation must also be ensured.

Copper pipelines:

The use of copper pipes with a cross-section of 35 mm is recommended. The use of a smaller cross-section (e.g. CU-28 mm) results in high pressure losses (example: the pressure loss when laying 2 m of copper pipe with a cross-section of 28 mm corresponds to 8 m of laid copper pipe with a cross-section of 35 mm).

NOTE

The distance between the building and the heat pump has an impact on the pressure loss and the heat loss in the connecting lines and must be taken into account when designing the circulation pump and the thickness of the insulation.

The heat pump connections are routed downwards or to the side of the device. The location of the heating lines and the condensate drain can be found in the respective foundation plans in the dimension drawings (see installation and operating instructions).

NOTE

To make installation easier, it is recommended when using insulated district heating pipes that they end at the base frame of the heat pump and that the connection to the heat pump is made using flexible hoses (e.g. stainless steel Wellflex pipe, insulated).

The implementation in the building is done with insulation and jacket pipe. The building can be sealed with a pipe that is adapted to the heating water connection

- direct implementation in the dry area
- Sealing sleeve against non-pressing water (DIN 18337)
- Wall sealing flange against pressing water (DIN 18336)

NOTE

In the case of masonry walls, the building entries must be sealed against the ingress of water with a bituminous protective coating. To seal against pressing water, the house lead-through (flange) must also be stabilized with a casing pipe.

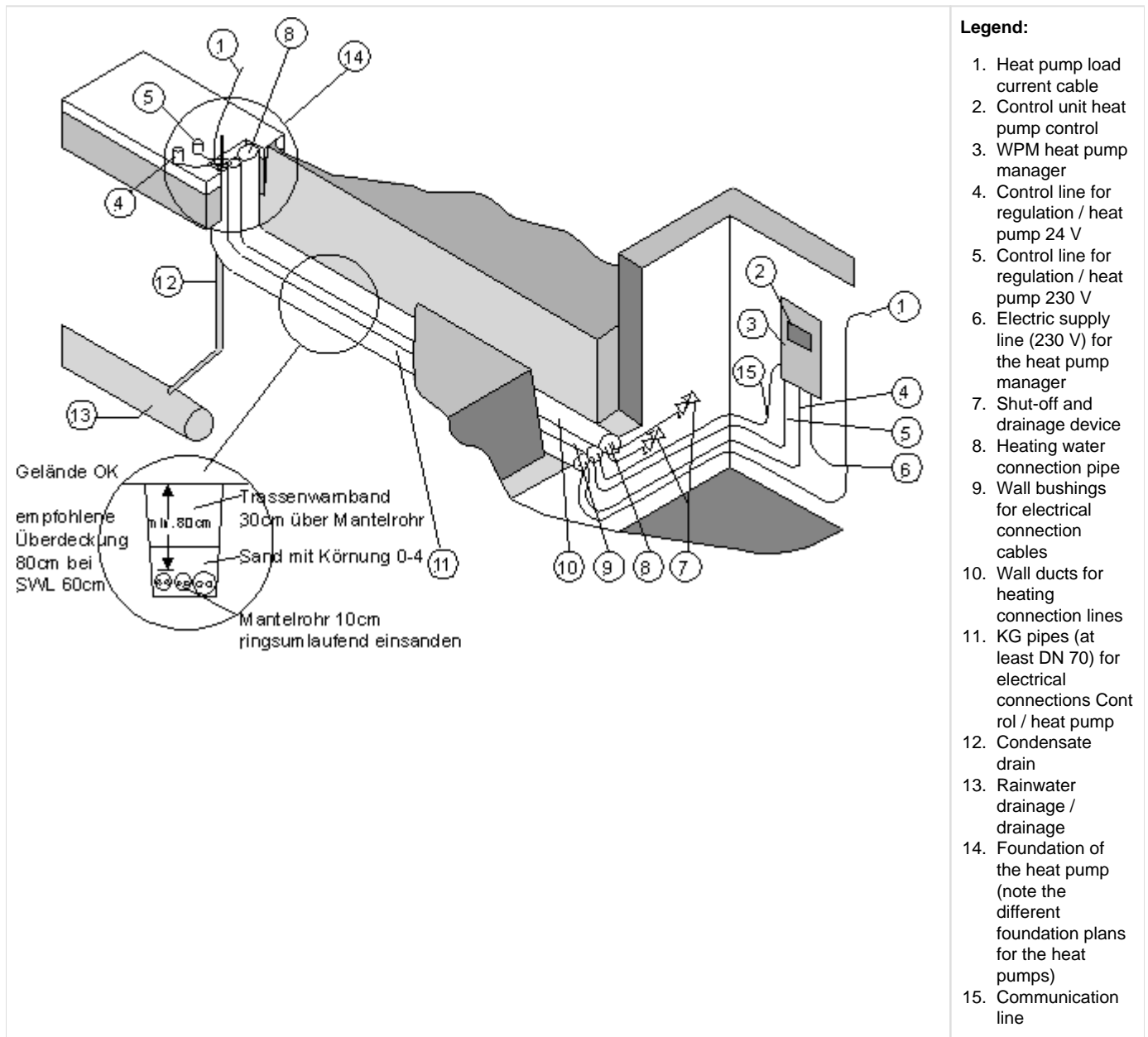


Fig. 2.2: Hydraulic and electrical connections when buried in the ground

NOTE

NOTE With air / water heat pumps of the (S) -TU series, the hydraulic connection can be routed either downwards or to the side (special accessory RBS required). If the heat pump is installed close to the wall, the heating water connection line and the electrical connection lines can be introduced into the building above ground.

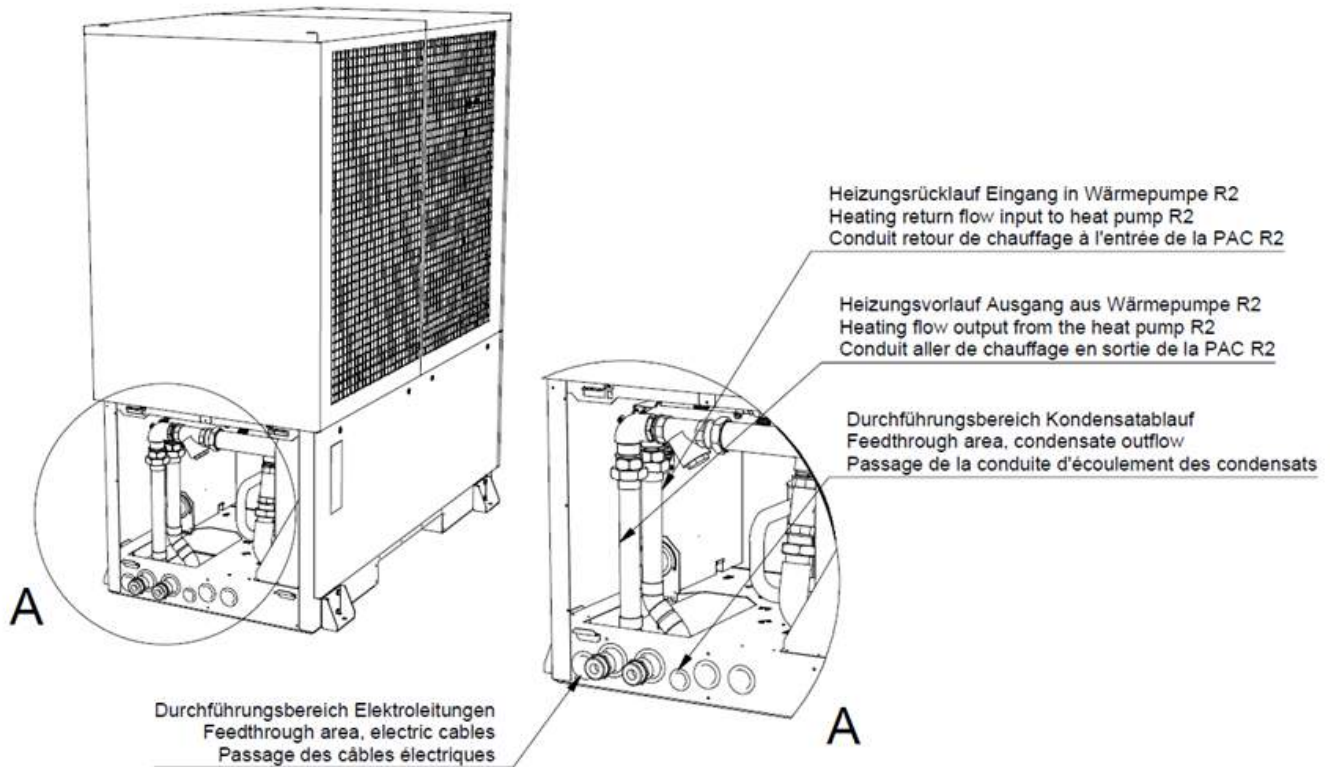


Fig. 2.3: Hydraulic and electrical connections with side connection

2.2.2 Wall duct

Direct implementation in dry areas:

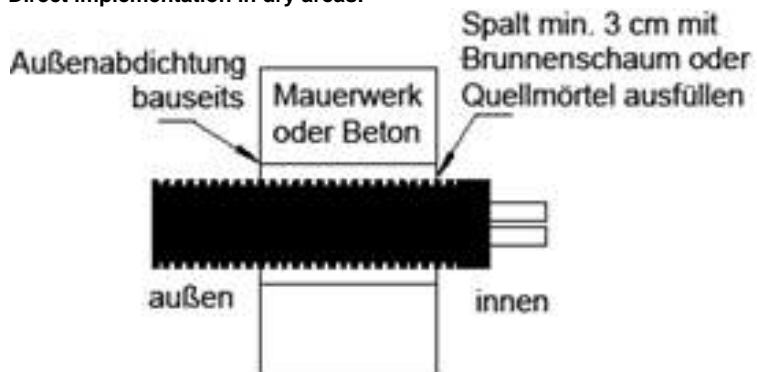
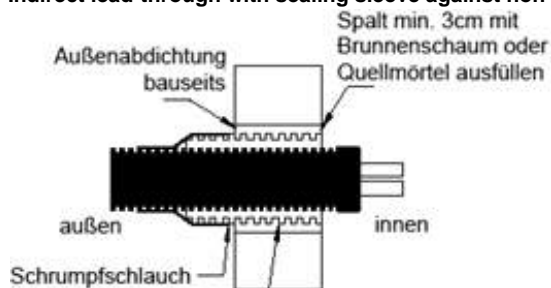


Fig. 2.4: Sketch of direct wall penetration

Indirect lead-through with sealing sleeve against non-pressing water



MDM —

Fig. 2.5: Sketch of wall penetration, non-pressing water

Flange against pressing water

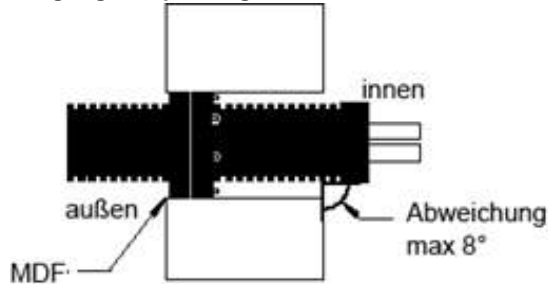


Fig. 2.6: Sketch of wall penetration with pressing water

Shortly after the heating water connections have entered the building (approx. 0.8 m below ground level), a filling and draining device must be provided for the heating water flow and return. For buildings at ground level, provide a suitably thermally insulated shaft or enable emptying using compressed air.

2.3 Air / water heat pump for indoor installation

Development costs for indoor installation

- Air ducting (e.g. ducts)
- Breakthroughs in the wall
- Condensate drain

Generally

An air / water heat pump should be set up in a separate room (e.g. technical room) and not in the living area of a building. In extreme cases, cold outside air at temperatures as low as -25°C is fed through the heat pump. In rooms with high humidity (e.g. utility rooms) this can lead to the formation of condensation at wall openings and air duct connections and thus to structural damage in the long term. With a room humidity of over 50% and outside temperatures below 0°C , the formation of condensation cannot be ruled out despite good thermal insulation. Unheated and frost-free rooms, e.g. cellars, garages, are therefore more suitable.

Please also note:

- Sufficiently dimension air ducts, take into account the available pressure of the fan.
- Provide wall openings, avoid short-circuit currents from the exhaust air to the supply air.
- Place the intake and exhaust openings on different sides of the building, if possible, leave a distance of at least 2 m if they are on the same side of the building.
- Condensate drainage
- Sound propagation

i NOTE

If there are increased requirements for sound insulation, the discharge should take place via a 90° bend or a corner installation with straight air ducts is recommended. The deflector hood (LUH) available as an accessory reduces the sound pressure level in the discharge direction by approx. 3 dB (A).

If the heat pump is installed on an upper floor, the load-bearing capacity of the ceiling must be checked. When installing on a wooden ceiling, the structure-borne sound decoupling and the statics must be considered separately.

i NOTE

When installing the heat pump above inhabited rooms, on-site measures for structure-borne noise decoupling must be provided.

Air duct

For efficient and trouble-free operation, an air / water heat pump installed inside must be supplied with a sufficiently large air volume flow. This depends primarily on the heat output of the heat pump and is between 2500 and $9000\text{ m}^3/\text{h}$ (see installation and operating instructions). The minimum dimensions for the air duct must be observed. The air flow from the intake via the heat pump to the discharge should be designed to be as aerodynamic as possible in order to avoid unnecessary air resistance.

2.3.1 Requirements for the installation room

ventilation

The room where the heat pump is installed should, if possible, be ventilated with outside air so that the relative humidity remains low and the formation of condensation is avoided. Particularly during building drying and commissioning, condensation can form on cold parts.

i NOTE

The heat pump must not be operated without an air duct, as there is a risk of injury from rotating parts (fan).

Air permeability of buildings

Depending on the type of building and technical equipment, the air permeability must not exceed certain limit values. These limit values are specified in DIN 4108-7 "Thermal insulation and energy savings in buildings - Part 7 Airtightness of buildings". How a building is to be measured and how heat pumps are to be taken into account when measuring is regulated in DIN EN 13829 "Determination of the air permeability of buildings".

2.3.2 Air ducts and accessories

When installing heat pumps installed inside, ensure that the air flow is as short as possible. A corner installation is particularly suitable here.

2.3.2.1 Straight air ducts and bends

The vapor-permeable and moisture-resistant air ducts are available as a kit. They are offered in the corresponding cross-sections as a 90 ° bend and as an extension. The internal insulation made of mineral wool and laminated glass fiber fleece prevents condensation from forming. Minor damage to the outer jacket has no effect on the functionality and can be repaired with commercially available plaster. If necessary, the channels can be painted with commercially available emulsion paint. The air duct kit LKL ...A consists of four side walls made of glass fiber reinforced concrete including adhesive and two cover frames. It is not delivered pre-assembled, but must be assembled on site. The air duct kit can be easily transported and shortened to the required length on site.



Fig. 2.7: Components for kit LKL ...A

Advantages of the LKL ...A kit

- Low risk of damage during transport
- The kit can easily be shortened to the correct length on site
- Cover frames enable quick and easy assembly

description	execution	length in mm	Width x height in mm	Device type
LKL 500A	just	1000	500 x 500	LIK 8TH
LKL 600A	just	1000	600 x 600	LI 11TES LIK 12TU (exhaust) LI 9TU, LI 12TU, LI 16I-TUR (exhaust)
LKB 600A	90 ° bend	1100	600 x 600	LI 11TES LIK 12TU (exhaust) LI 9TU, LI 12TU, LI 16I-TUR (exhaust)
LKL 700A	just	1000	694 x 694	LI 16th LI 20th
LKB 700A	90 ° bend	1244	694 x 694	LI 16th LI 20th
LKL 800A	just	1000	769 x 769	LI 20TES - LI 28TES LI 9TU, LI 12TU, LI 16I-TUR (intake) LIK 12TU (intake)
LKB 800A	90 ° bend	1319	769 x 769	LI 20TES - LI 28TES LI 9TU, LI 12TU, LI 16I-TUR (intake) LIK 12TU (intake)

Tab.2.2: Kits for air ducts (straight and curved)

2.3.2.2 equipment

The following air routing components are available in four different sizes and matched to the available performance levels:

- Rain protection grille
- Air ducts (duct / arch including end and extension frames)
- Sealing sleeves
- Air deflector hood

Sealing sleeve

The sealing sleeve is used to seal the air ducts made of glass fiber lightweight concrete on the heat pump. The air ducts themselves are not screwed directly to the heat pump. When it is ready for operation, only the rubber seal touches the heat pump. On the one hand, this ensures easy assembly and dismantling of the heat pump and, on the other hand, good structure-borne noise decoupling is achieved.

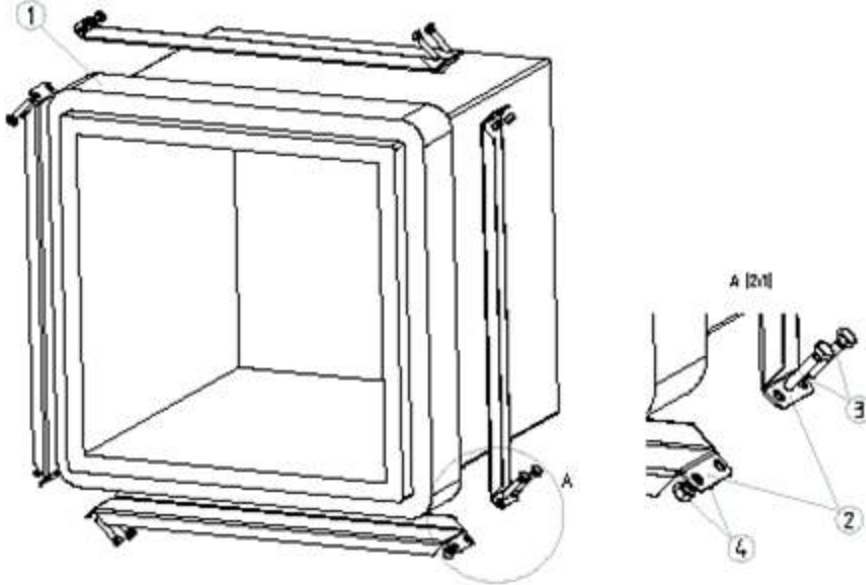


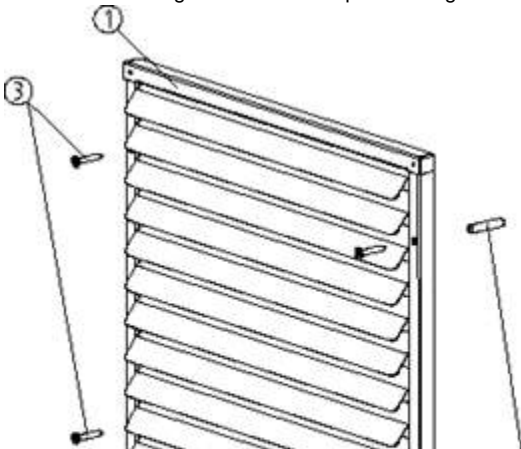
Fig.2.8. Sealing sleeve for air ducts

Rain protection grille for heat pumps

Rain protection grids serve as an optical screen for wall openings above ground level and to protect the air duct from the effects of the weather. It is attached to the wall from the outside and can be used regardless of the type of air duct. The rain protection grille (special accessory) specially developed for heat pumps has a significantly lower pressure loss than commercially available weather protection grids. It can be used on both the intake and the exhaust side. To protect against small animals and leaves, a wire mesh should be attached between the wall and the rain protection grille. The free cross-section of the grid must be at least 80% (mesh size > 0.8 cm). Any burglar protection that may be required must be added on site.

Item	description	500-700	800
1	Protective grille	1 piece	1 piece
2	Dowel 6x30	4 pieces	6 pieces
3	Screw 5x70	4 pieces	6 pieces

Tab. 2.3: Fastening material for rain protection grille



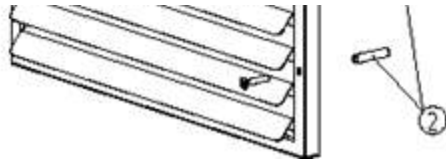


Fig. 2.9: Rain protection grille for heat pumps

Type	X	Y	Z
RSG 500	650	625	400
RSG 600	750	725	500
RSG 700	840	815	590
RSG 800	920	895	2 x 335

Tab.2.4: Dimension table for fastening the RSG 500-800

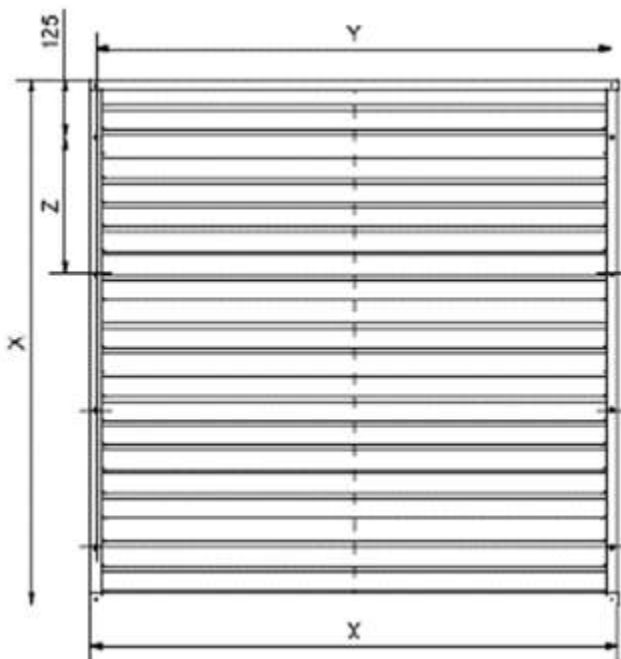


Fig.2.10: Dimensions for RSG 500-800

2.3.3 Air duct hose set for air / water heat pumps

FR E I: Air hose set LUS 2 or LUS 4

Fig.2.11 Free

Fig.2.12 Free

2.3.4 Project planning for air ducts

2.3.4.1 Pressure loss in air ducts

In the case of air / water heat pumps installed inside, an air duct may be necessary on the intake and / or exhaust side, which creates an additional pressure loss on the heat source side (intake and exhaust side). Since the fan only has a limited free pressure, the air duct system must be dimensioned accordingly. When planning the air routing (air intake and air discharge), it must be ensured that the maximum pressure loss of the individual components does not exceed the free compression value specified in the device information (see installation and operating instructions). Cross-sectional areas that are too small or frequent deflections (e.g. weather protection grilles, corner ducts) result in inadmissibly high pressure losses and lead to inefficient or even failure-prone operation. The suction and discharge can be done either via a light shaft or wall opening with rain protection grille.

Air ducting component	Pressure drop

Air duct straight	1 Pa / m
Air duct bend 90 °	4 Pa / pc
Rain protection grille	5 Pa
Light shaft intake	5 Pa
Light shaft blow-out	7-10 Pa

Tab.2.5: Reference values for the air duct system accessories

NOTE Depending on the type of heat pump, 20 - 25 Pascal (Pa) can be assumed as the maximum permissible pressure loss. In the case of greater pressure losses in the air duct system, the installation of a support fan is required on site. In this case, it must be checked in advance whether it is possible to set up an air / water heat pump installed outside.

The components for the air duct available as special accessories are below the free pressures in the standard setups shown. This means that there is no need to check the total pressure loss.

The suction and discharge can be done either via a light shaft or wall opening with rain protection grille.

ATTENTION If there are deviations from the standard connections or if air ducting components provided by the customer are used, compliance with the above criteria must be checked and ensured.

2.3.4.2 Installation of air ducts

If a standard installation variant is selected, the duct sections can be installed without being shortened. When positioning the air duct, the required minimum distances between the heat pump and walls must be observed. Air ducts or bends are foamed into the wall opening using commercially available construction foam in accordance with the dimensional drawings. The duct sections are fixed in a self-supporting manner from the floor using a suitable substructure or from the ceiling using threaded rods. A distance of approx. 2 cm should be left between the heat pump and the duct to facilitate subsequent maintenance of the heat pump, if necessary. In order to avoid structure-borne noise being introduced into the building, no force-fit connection (e.g. screw connection) must be established between the heat pump and air ducts. The air duct to the heat pump is sealed with the sealing sleeve available as an accessory (dimensions for RSG 500-800).

2.3.4.3 Butt joint between two duct parts

Manufacture of custom lengths

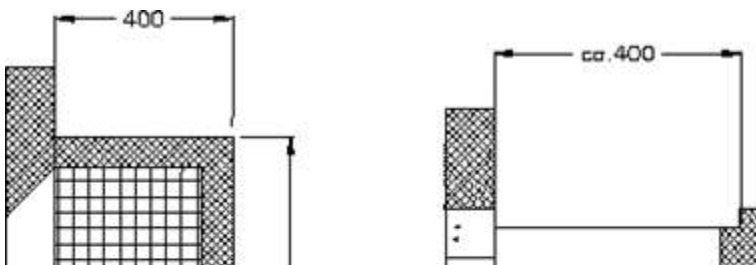
Air duct kits can be shortened or adapted before the actual gluing. The resulting cut edges are coated with a multi-force adhesive included in the scope of delivery and framed by a galvanized U-profile. If a straight duct is shortened or adapted, two air ducts can be created from it with the end frame set (ARLK) available as a special accessory. With the connection set (VSLK) available as a special accessory, air ducts can be extended (observe max. Free compression).

2.3.4.4 Air intake or exhaust via light shafts

If the wall ducts of the air ducts at the intake or outlet are below ground level, it is advisable to route the air through aerodynamic plastic light shafts. An air baffle must be used for concrete manholes. The light shaft on the exhaust side should be provided with a sound-absorbing lining. Weather-resistant mineral fiber boards with a density of approx. 70 kg / m³ or open-cell foam (e.g. melamine resin foam) are suitable for this.

- The minimum cross-sections of the shafts must at least correspond to the dimensions of the air ducts used
- Sealing of the transition between light shaft and wall opening (see **Insulating the wall breakthroughs**)
- Cover with grating (burglar protection)
- Provide a drain for condensate
- To protect against small animals and leaves, a wire mesh (mesh size > 0.8 cm) should also be attached.
- Provide protection against snow build-up

NOTE The minimum dimensions of the air ducts can be found in the device information.



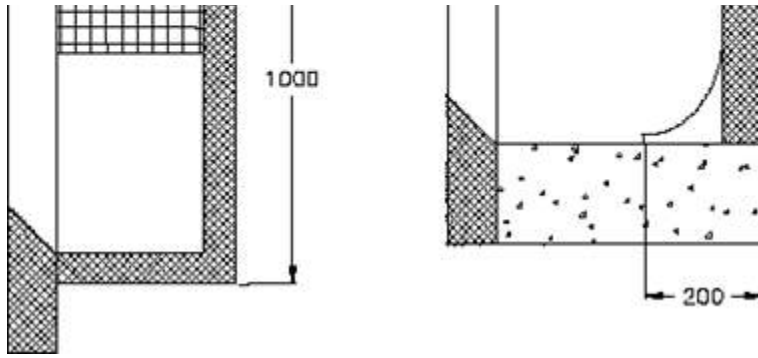


Fig. 2.13: Example: Dimensions for standard light wells

2.3.4.5 Insulating the wall breakthroughs

The necessary wall openings are to be created on site. It is imperative that they are clad with thermal insulation on the inside to prevent the masonry from cooling down or condensation. In the example for the execution of a wall opening, for example, insulation using diffusion-proof rigid foam (insulation thickness 25 mm - e.g. PU rigid foam) is shown. The transition between wall insulation and air duct (outside wall side) must be connected airtight. In unfavorable weather conditions (e.g. in driving rain), penetrating water must be drained away on a slope.

i NOTE

In order to avoid the formation of condensation on the masonry and the resulting mold formation, the air duct must be thermally insulated all the way to the outer edge of the building envelope.

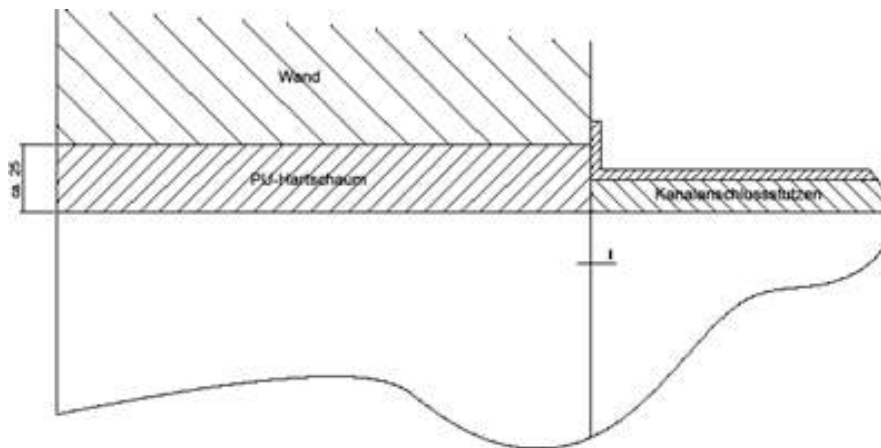


Fig. 2.14: Example of a wall opening

2.3.4.6 Sound reduction through air ducts

The inside insulation made of mineral wool and laminated glass fiber fleece prevents the formation of water condensation and significantly reduces the sound radiation on the weather protection grille on the outlet side of the air duct.

Straight air duct A reduction in sound pressure of ~ 1 dB (A) per meter of air duct.

Air duct arch A reduction in sound pressure of ~ 2 to 3 dB (A) per sheet.

2.3.5 Installation variants for air ducts

The dimensions for the installation of the heat pump and the position of the wall openings are determined as follows:

1. Step: Determination of the appropriate air routing components for the respective air / water heat pump type.
2. Step: Selection of the appropriate installation variant.
3. Step: Take the required dimensions from the tables for the corresponding installation variant.
4. Step: Planning the appropriate insulation for the outer wall penetration

Item	description
1	Rain protection grille
1.1	Rain protection grille intake

1.2	Rain protection grille discharge
2	Sealing sleeve
2.1	Sealing sleeve suction
2.2	Sealing sleeve blow-out
3	Air duct straight
3.1	Air duct straight intake
3.2	Air duct straight discharge
3.12	Air duct straight suction optional
3.22	Air duct straight discharge optional
4th	Air duct arch
4.1	Air duct arch suction
4.2	Air duct arch discharge
4.11	Air duct bow suction optional
4.12	Air duct arch discharge optional
5	Buffer storage tank (underlay storage tank)

Tab. 2.6: Legend for installation variants for air ducts

NOTE When using an insulating strip or adjustable feet under the heat pump, the specified height must be adjusted accordingly.

2.3.5.1 Air routing variants Air / water heat pumps for indoor installation

The following heat pumps are supplied with an insulating strip for the intake and exhaust side as standard. This enables a corner installation of the heat pump without air ducts or a wall installation with an air duct on the discharge side (variant 1, 2 and 4).

Heat pumps

- LI 9TU, LI 12TU and LI 16I-TUR
- LIK 8TH
- LIK 12TU

ATTENTION A corner or wall installation requires a level surface so that the insulating strip is flush with the wall and thus prevents an air short circuit in the room.

Version 1: Corner installation without air duct

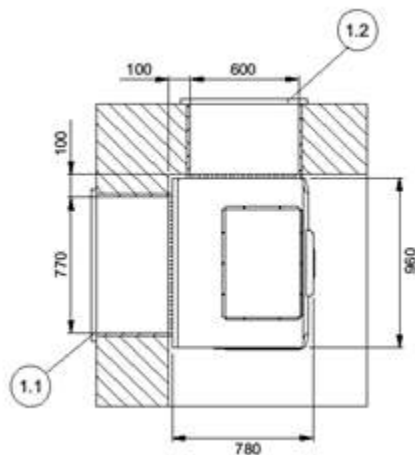


Fig. 2.15: Top view - direct corner installation with insulation strips

Variation 2: Wall installation with air duct on the discharge side

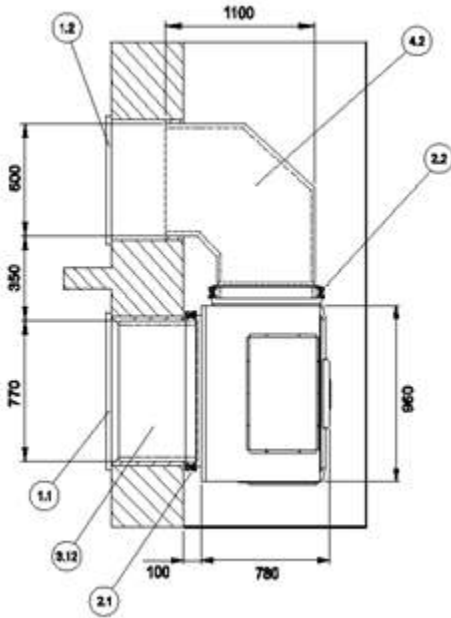


Fig. 2.16: Wall installation with air duct on the discharge side - top view

Variation 3: Wall installation with air duct on the intake and exhaust side

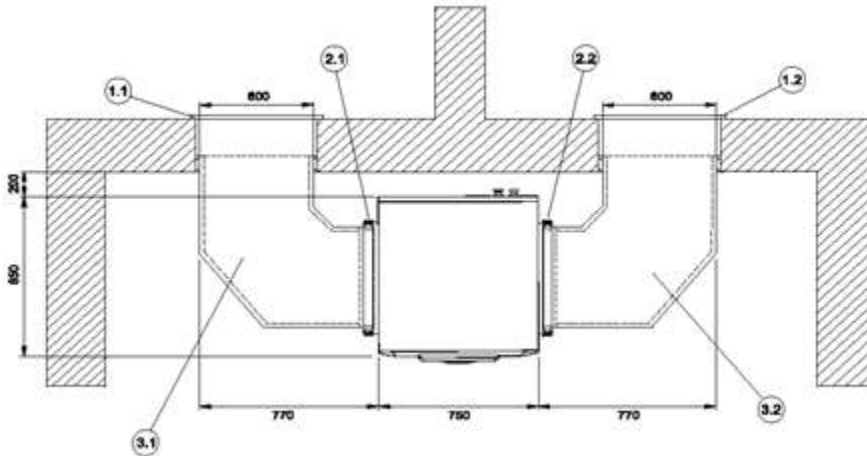


Fig. 2.17: Wall installation with air duct on the intake and exhaust side - top view

ATTENTION

Avoid short-circuit currents from the extract air to the supply air. Place the suction and discharge openings on different sides of the building, if possible, provide a distance of at least 2 m if they are on the same side of the building or provide a partition wall.

Variation 4: Installation of variants 1 - 3 with storage tank below

For various indoor heat pumps, there are buffer storage tanks available below, on which the heat pump can be installed. This increases the overall height of the heat pump so that the air ducts can be installed directly below the ceiling.

Device type	Buffer storage
LI 9TU / LI 12TU / LI 16I-TUR	PSP 120U
LI 11TES / LI 16TES / LI 20TE	PSP 140U

Tab. 2.7: Shelf buffers for air / water heat pumps installed inside



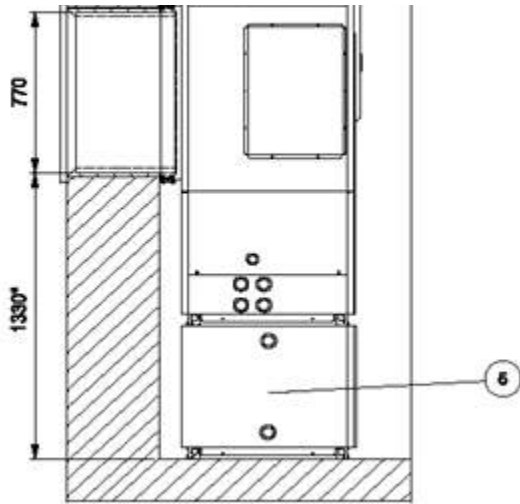


Fig. 2.18: Installation with storage tank below - side view

NOTE In the case of increased sound requirements, an air duct on the exhaust side is recommended.

2.3.5.2 Installation examples heat pump with storage tank below

LI 9TU, LI 12TU, LI 16I-TUR

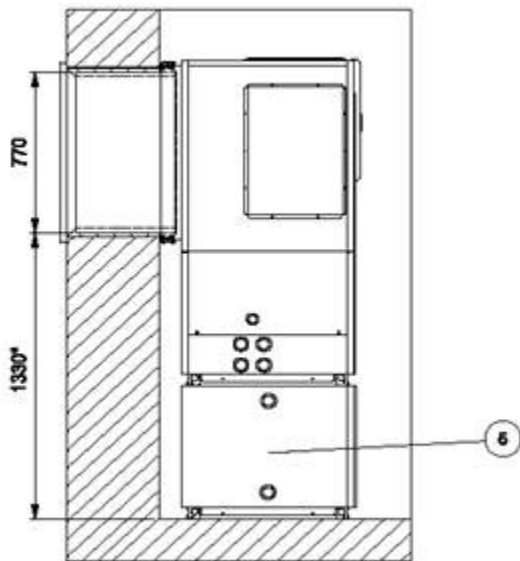
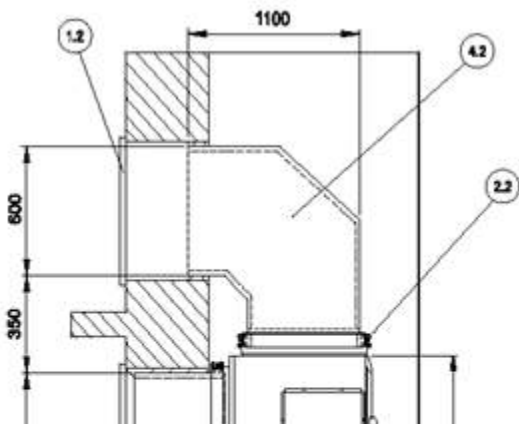


Fig.2.19: Side view - LI 9TU, LI 12TU and LI 16I-TUR (wall installation - air duct on discharge side)



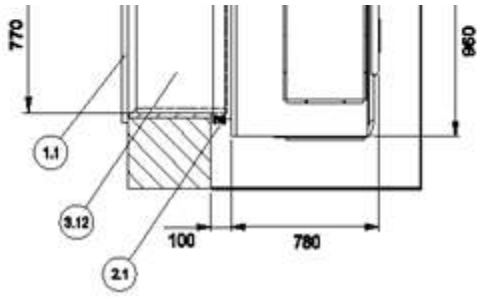


Fig.2.20: Top view - LI 9TU, LI 12TU and LI 16I-TUR (wall-mounted installation - air duct on discharge side)

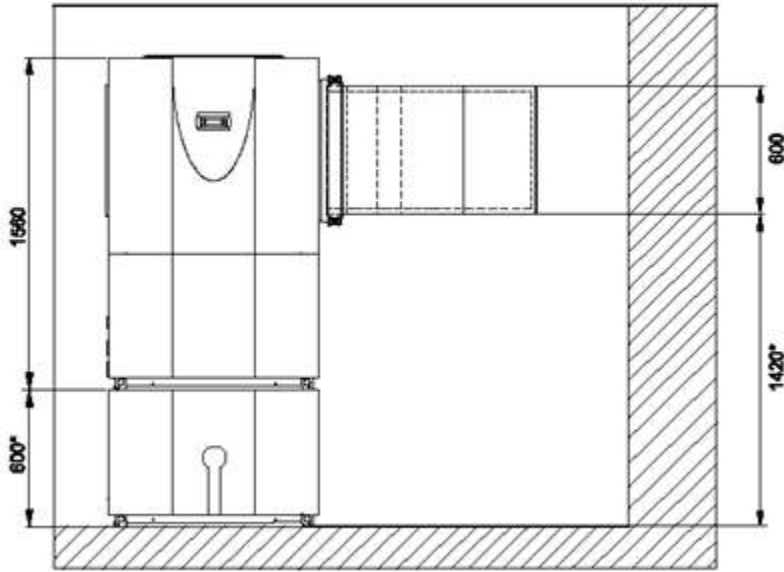


Fig.2.21: Front view - LI 9TU, LI 12TU and LI 16I-TUR (wall installation - air duct on discharge side)

LI 11TES

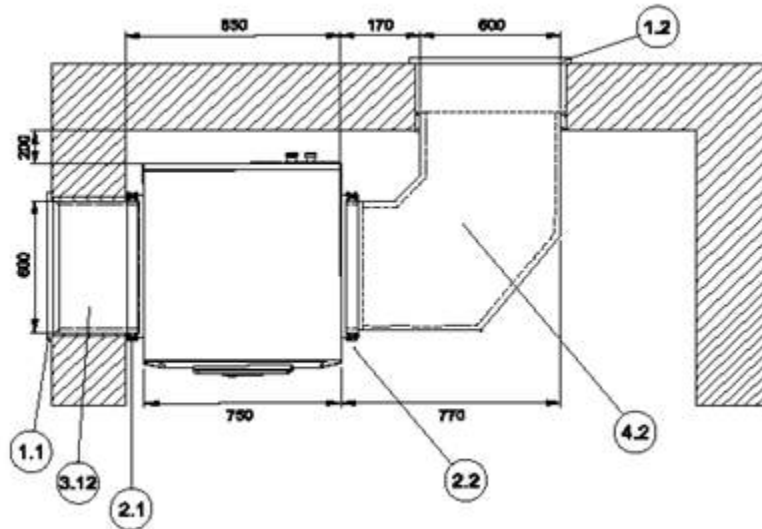
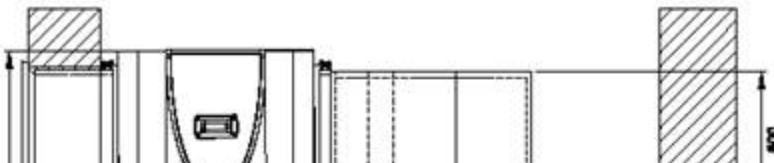


Fig.2.22: Top view - LI 11TES (wall installation - air duct on discharge side)



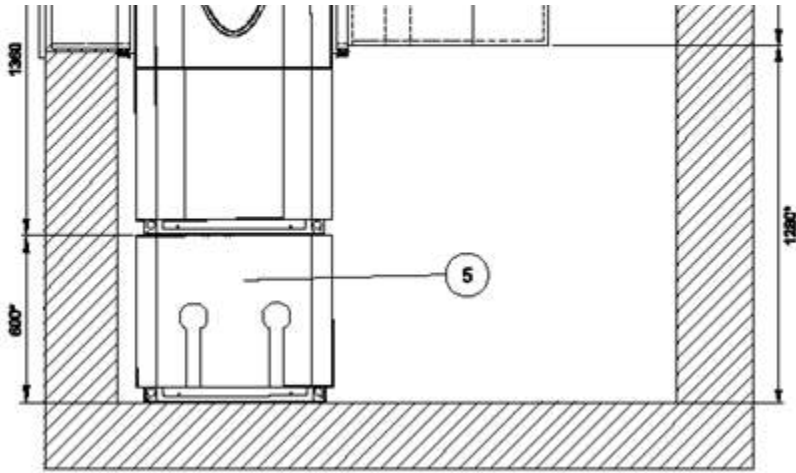


Fig.2.23: Front view - LI 11TES (wall installation - air duct, discharge side)

LI 16th, LI 20th

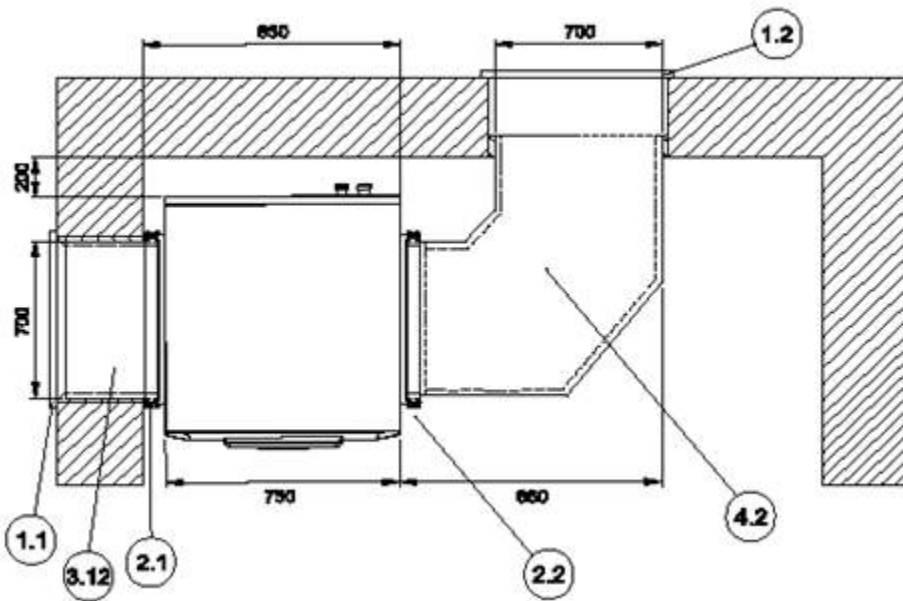
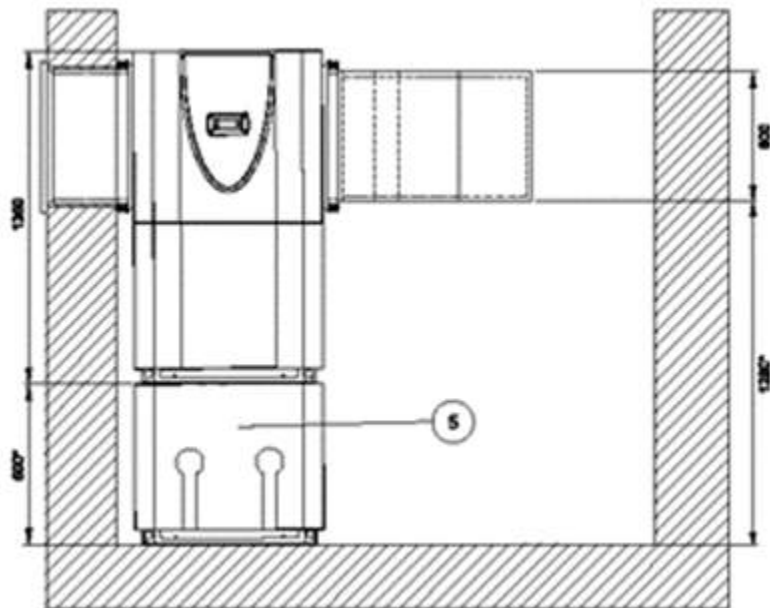


Fig.2.24: Top view - LI 16TES, LI 20TES (wall installation - air duct on discharge side)



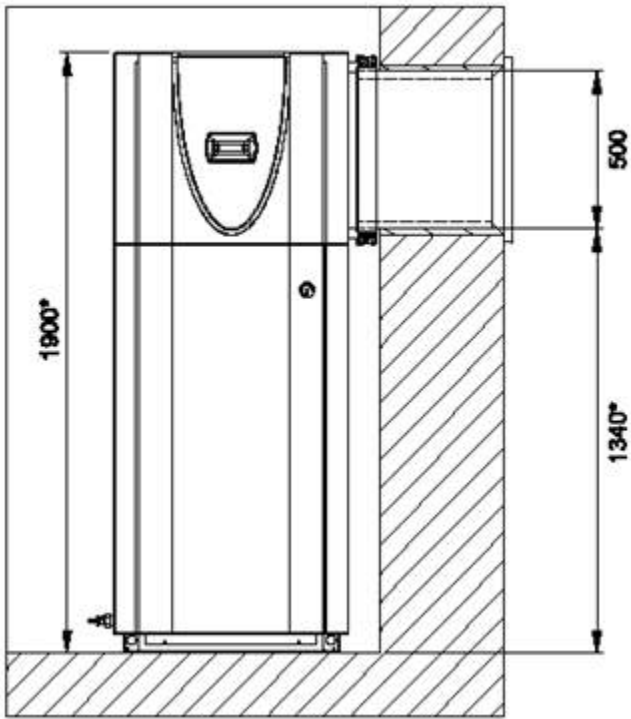


Fig.2.28: Front view - LIK 8TES (corner installation)

LIK 8TES - wall installation with air duct on the discharge side

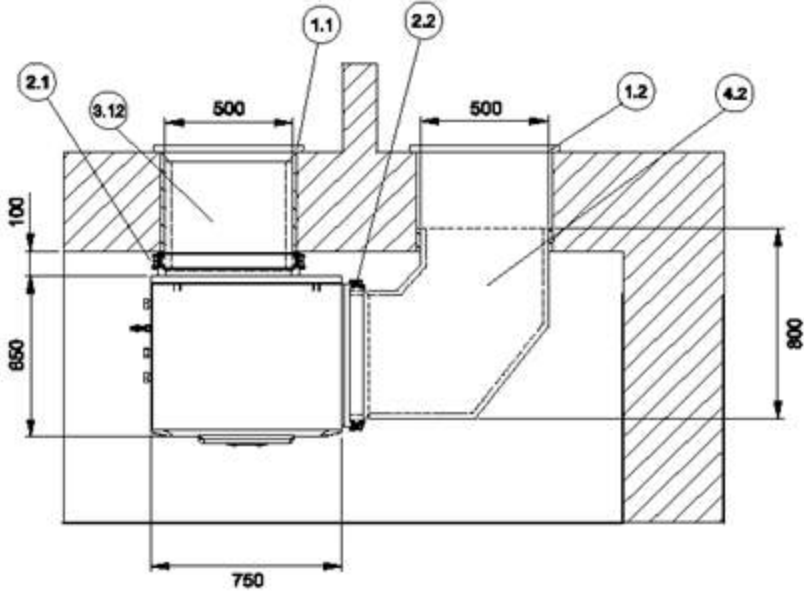
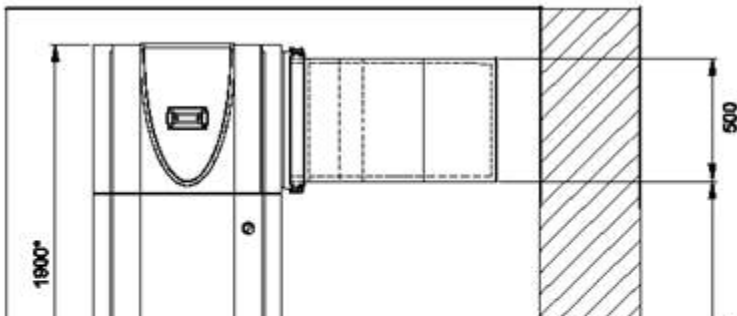


Fig.2.29: Top view - LIK 8TES (Wall installation - air duct, discharge side)



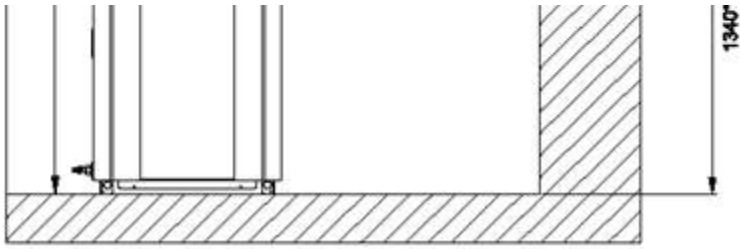


Fig.2.30: Front view - LIK 8TES (wall installation - air duct, discharge side)

LI 9TU, LI 12TU and LI 16I-TUR - corner installation

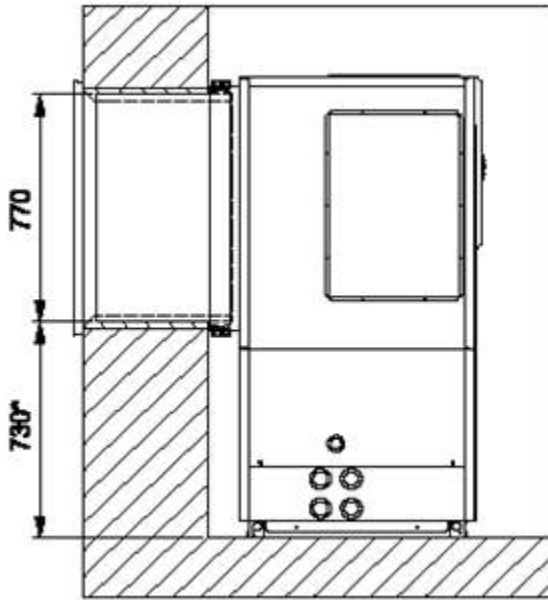


Fig.2.31: Side view - LI 9TU, LI 12TU

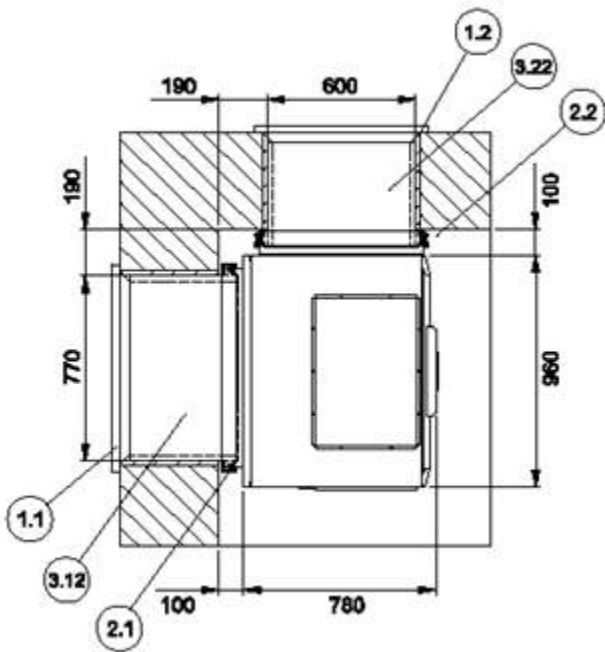


Fig.2.32: Top view - LI 9TU, LI 12TU (corner installation)

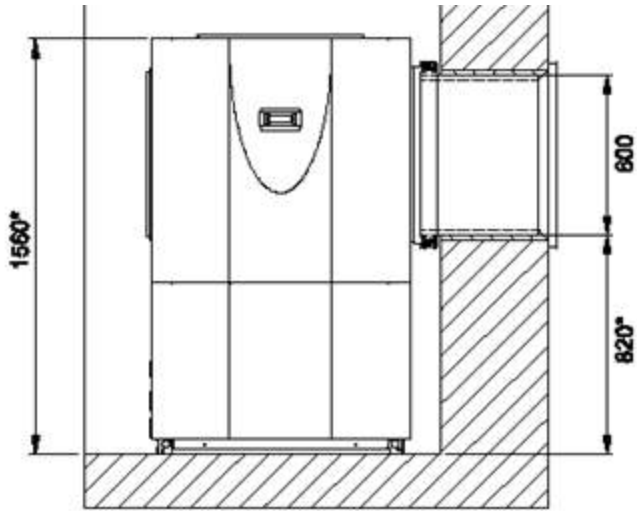


Fig.2.33: Front view - LI 9TU, LI 12TU (corner installation)

LI 9TU, LI 12TU and LI 16I-TUR - wall installation with air duct on the discharge side

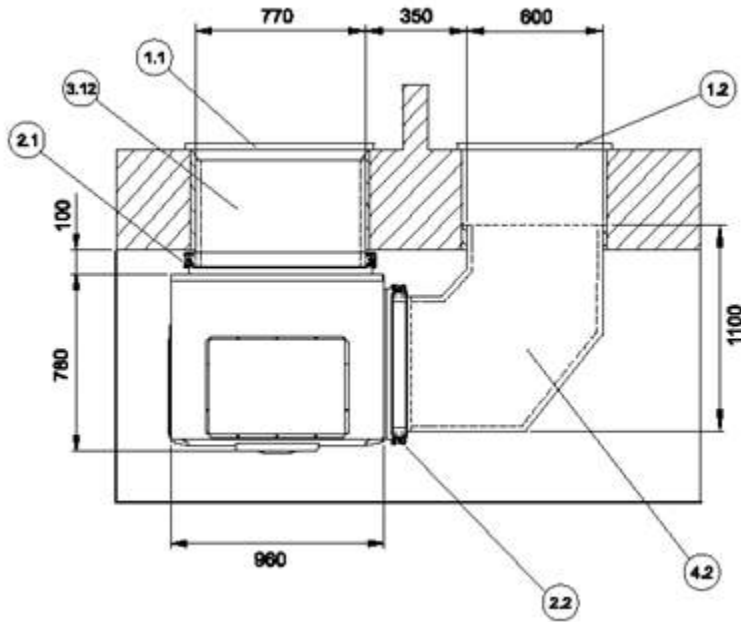


Fig.2.34: Top view - LI 9TU, LI 12TU and LI 16I-TUR (wall installation with air duct on the discharge side)

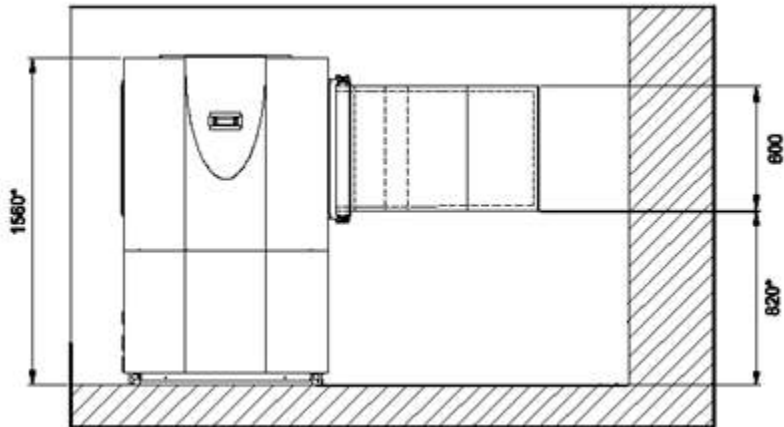


Fig.2.35: Front view - LI 9TU, LI 12TU and LI 16I-TUR (wall installation with air duct on the discharge side)

LIK 12TU - Corner installation

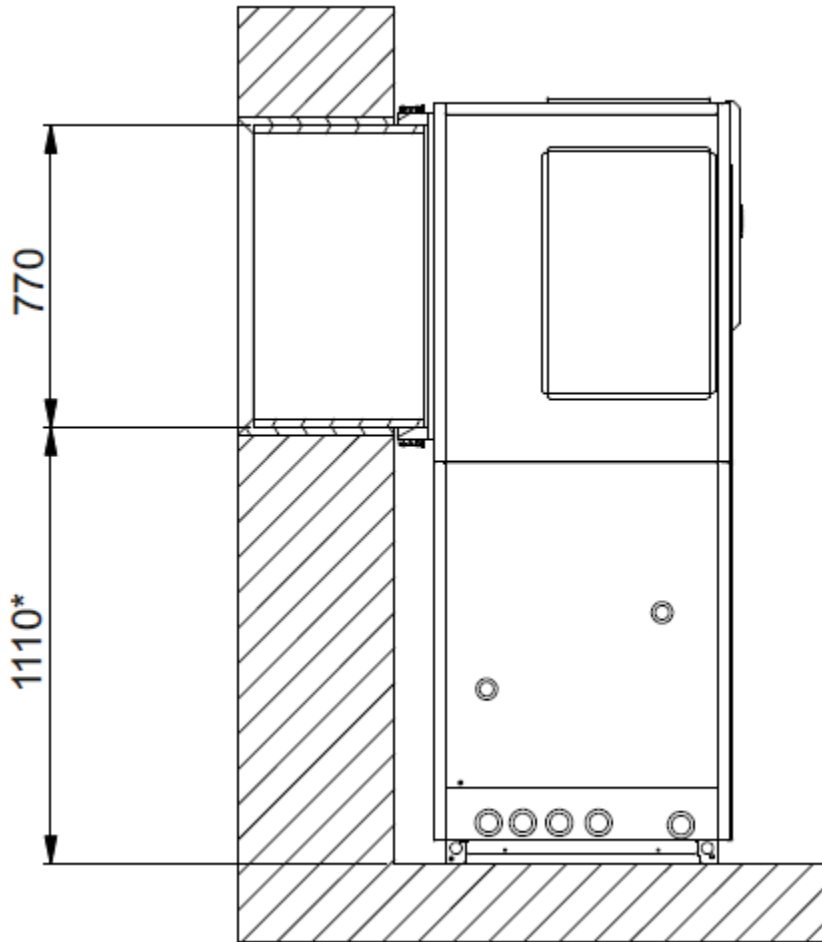
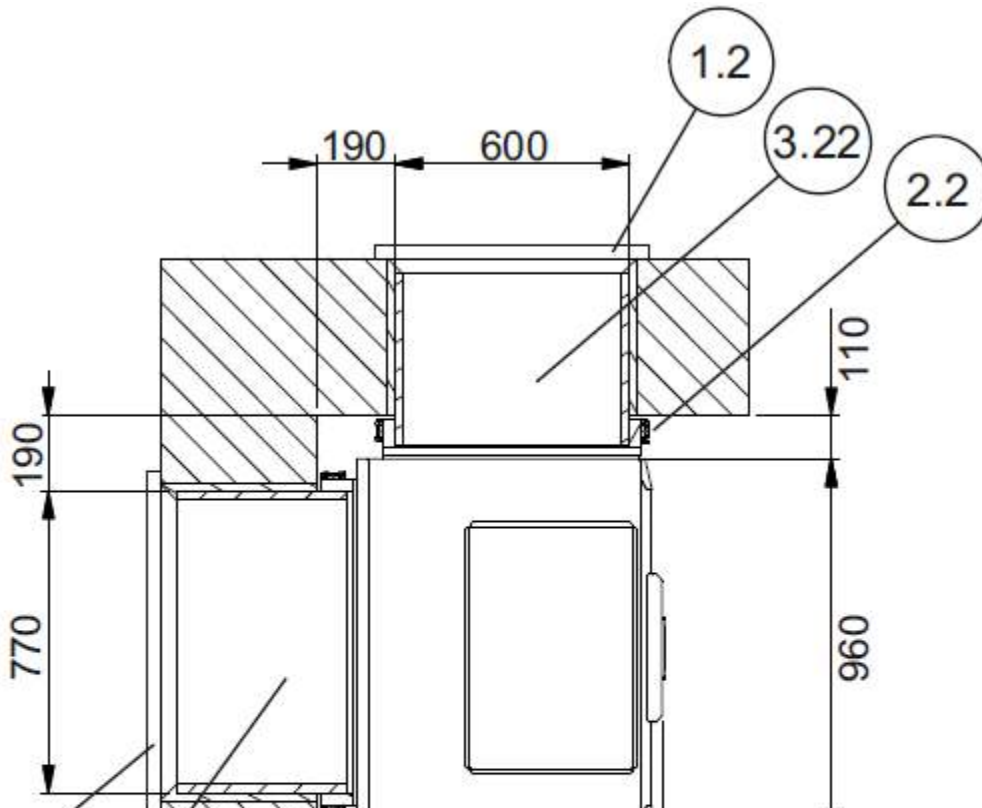


Fig.2.36: side view - LIK 12TU



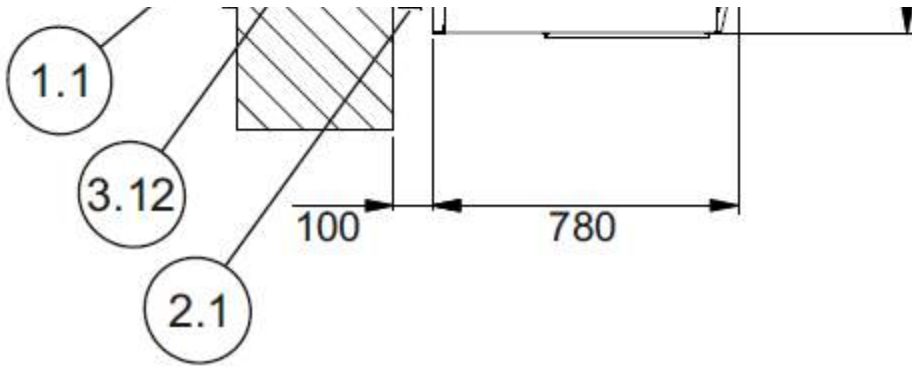


Fig.2.37: Top view - LIK 12TU (corner installation)

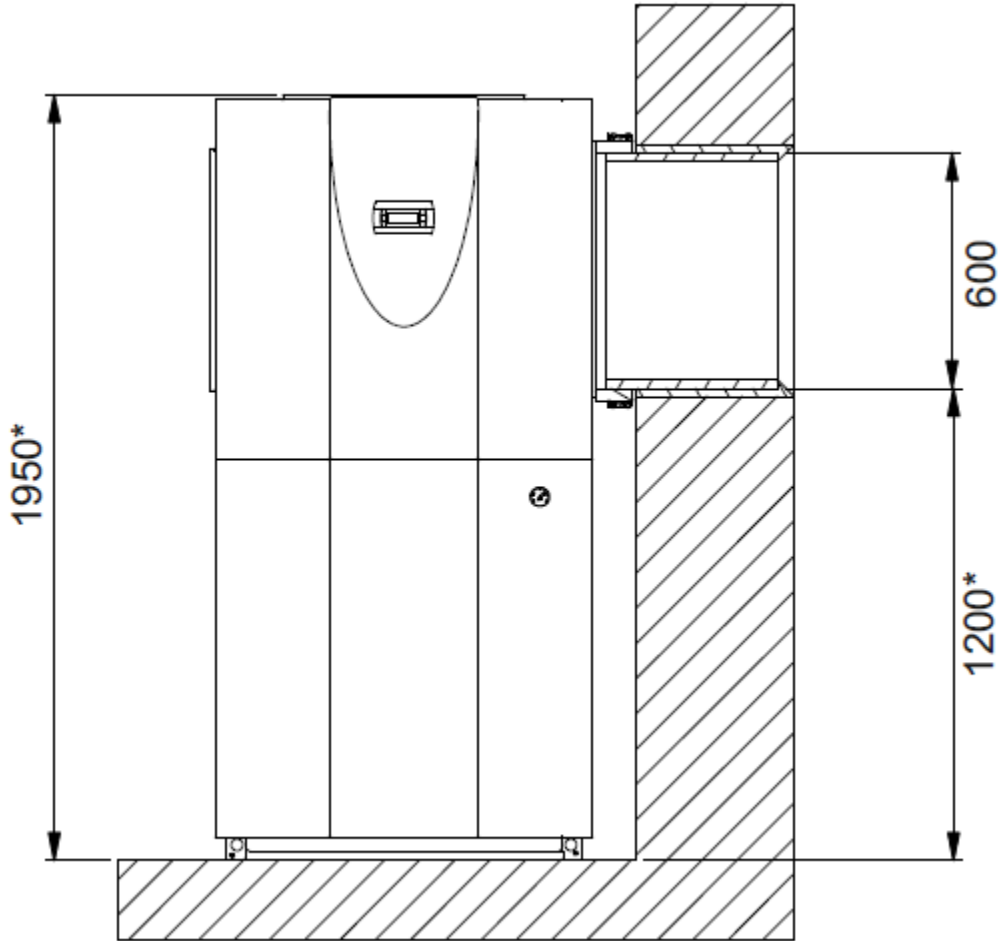
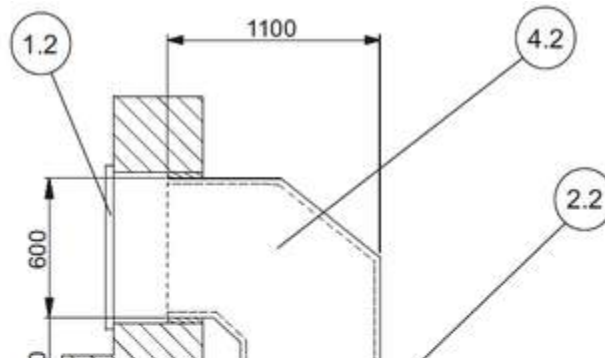


Fig.2.38: Front view - LIK 12TU (corner installation)

LIK 12TU - Wall installation with air duct on the discharge side



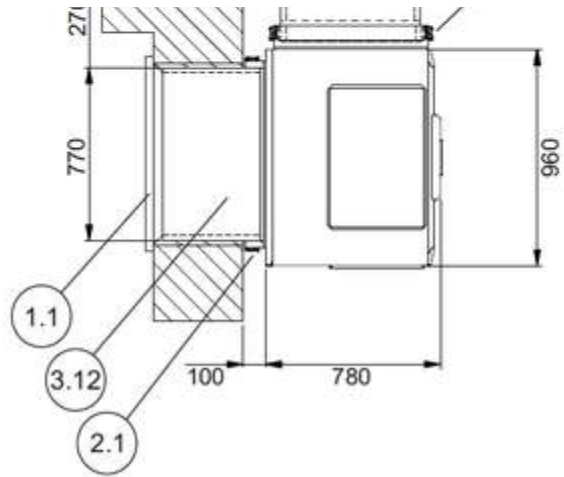


Fig. 2.39: Top view - LIK 12TU (Wall installation with air duct on the discharge side)

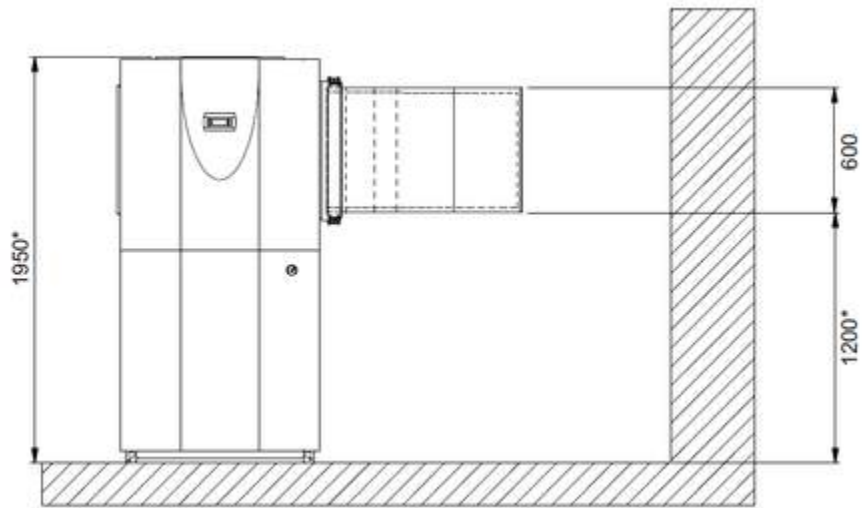


Fig.2.40: Front view - LIK 12TU (wall installation with air duct on the discharge side)

LI 11TES - Wall installation with air ducts on the intake and exhaust side

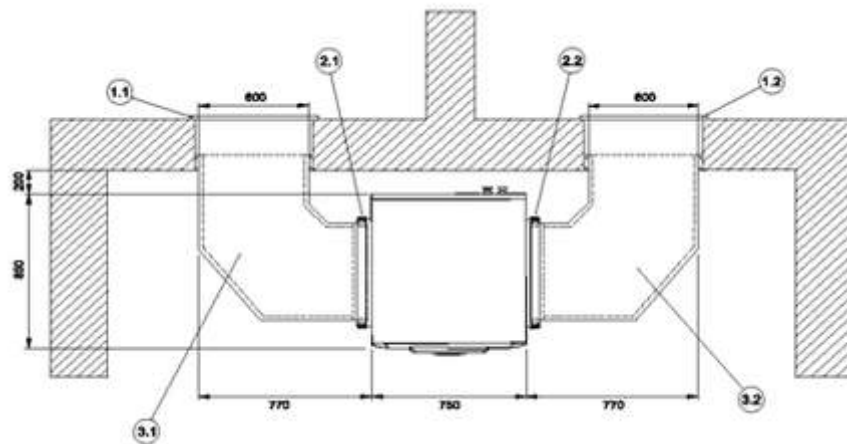
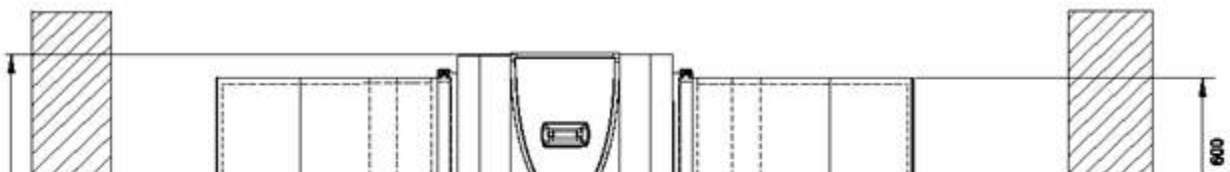
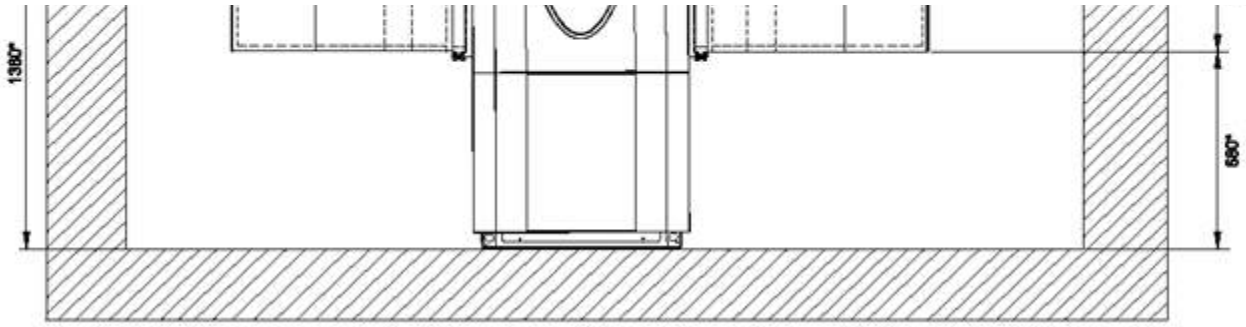


Fig.2.41: Top view - LI 11TES (Wall installation with air duct on the intake and exhaust side)





LI 11TES - wall installation with air duct on the exhaust side

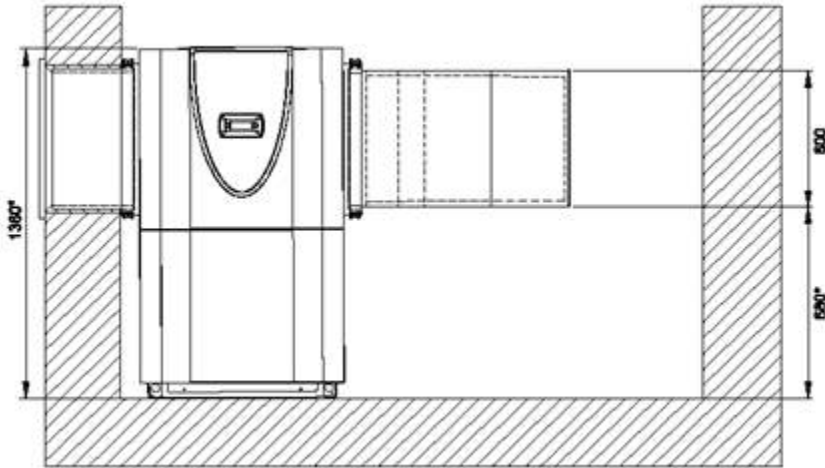


Fig.2.43: Front view - LI 11TES (Wall installation with air duct on the discharge side)

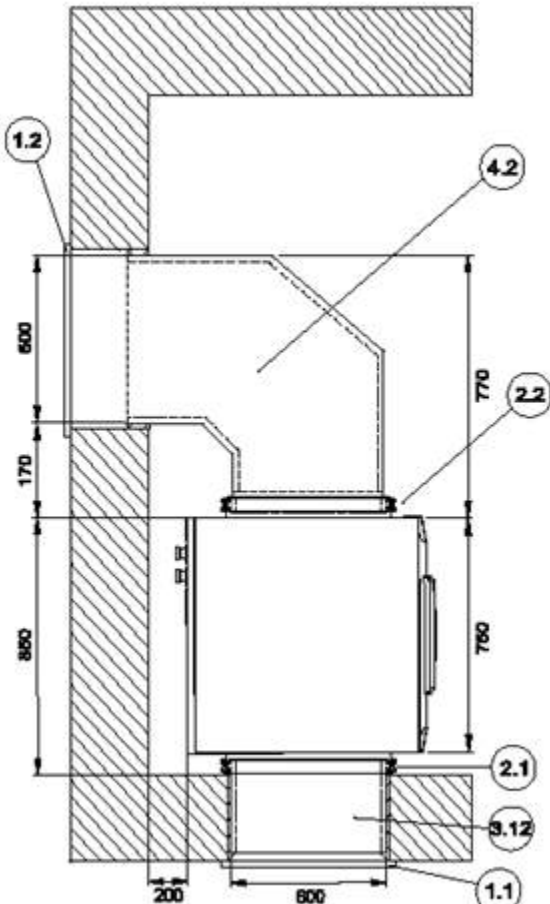


Fig.2.44: Top view - LI 11TES (Wall installation with air duct on the discharge side)

LI 16th, LI 20th - Wall installation with air duct on the exhaust side

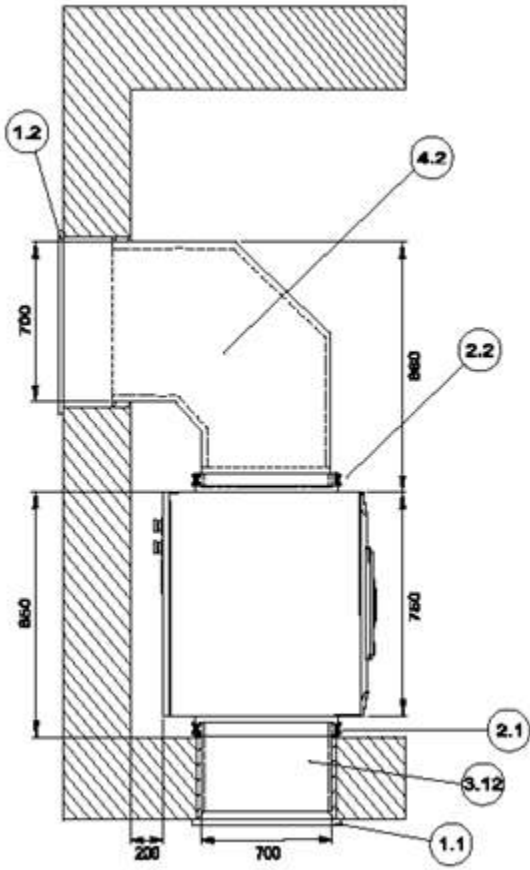


Fig.2.45: Top view - LI 16TES, LI 20TES (wall installation with air duct on the discharge side)

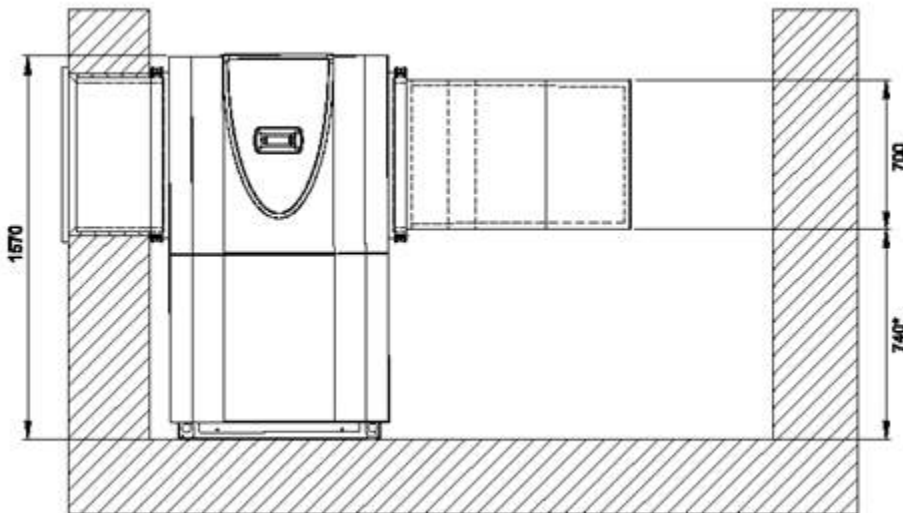


Fig.2.46: Front view - LI 16TES, LI 20TES (Wall installation with air duct on the discharge side)

LI 16TES, LI 20TES - Wall installation with air ducts on the intake and exhaust side



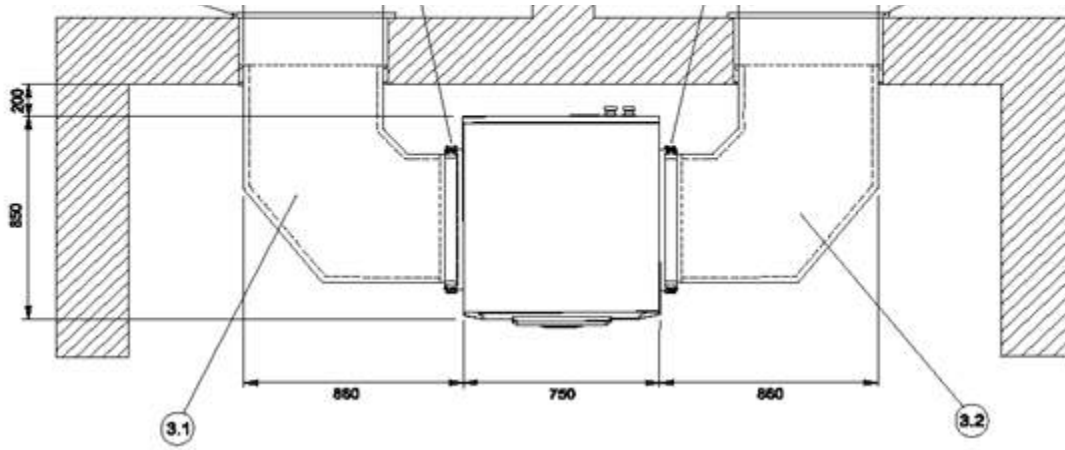


Fig.2.47: Top view - LI 16TES, LI 20TES (wall installation with air duct on the intake and exhaust side)

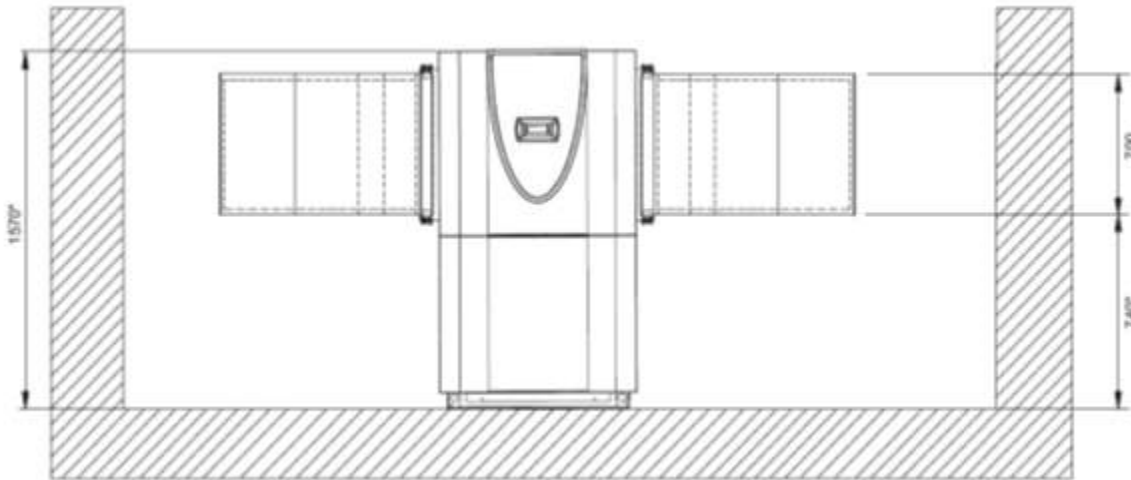


Fig.2.48: Front view - LI 16TES, LI 20TES (Wall installation with air duct on the intake and exhaust side)

LI 24TES, LI 28TES - Wall installation with air duct on the discharge side

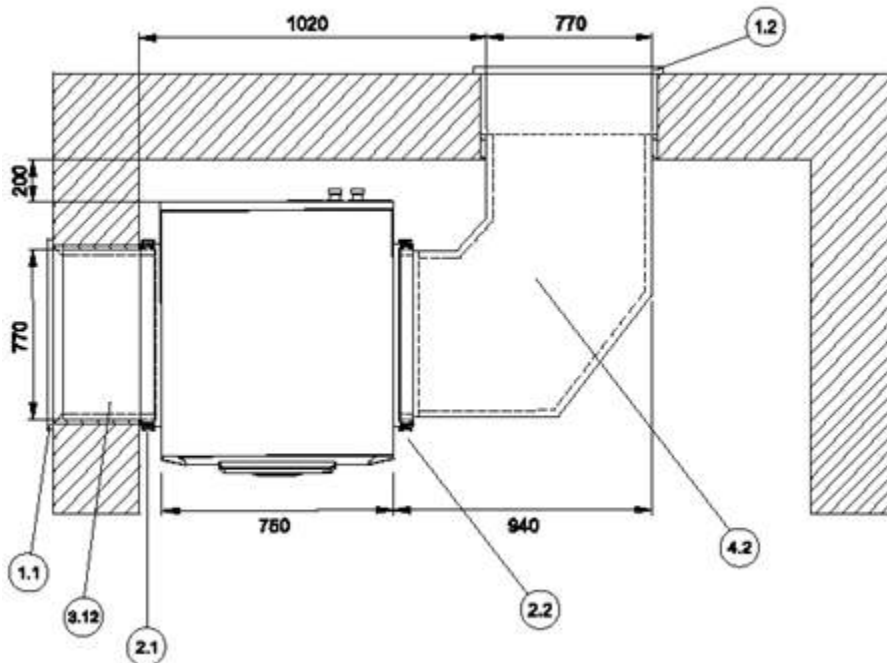


Fig.2.49: Top view - LI 24TES and LI 28TES (wall installation with air duct on the discharge side)

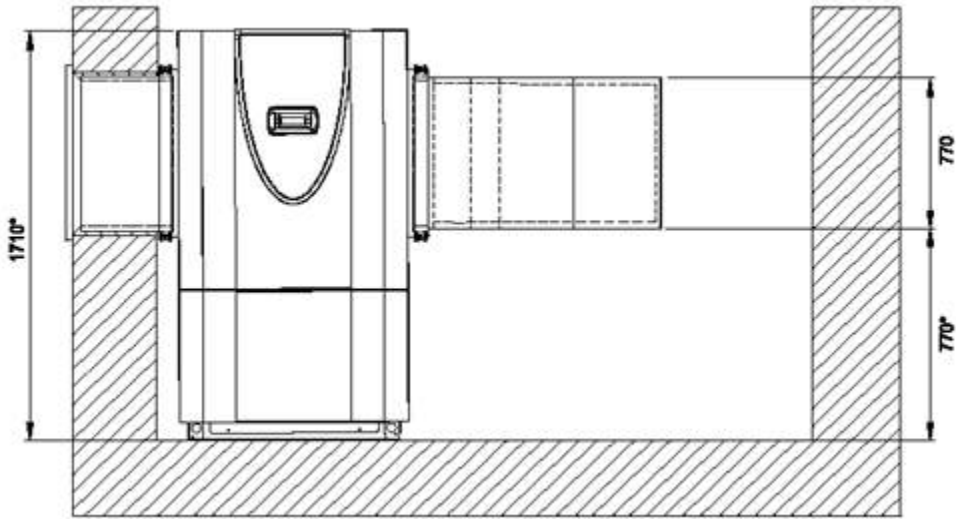


Fig.2.50: Front view - LI 24TES and LI 28TES (wall installation with air duct on the discharge side)

LI 24TES, LI 28TES - Wall installation with air ducts on the intake and exhaust side

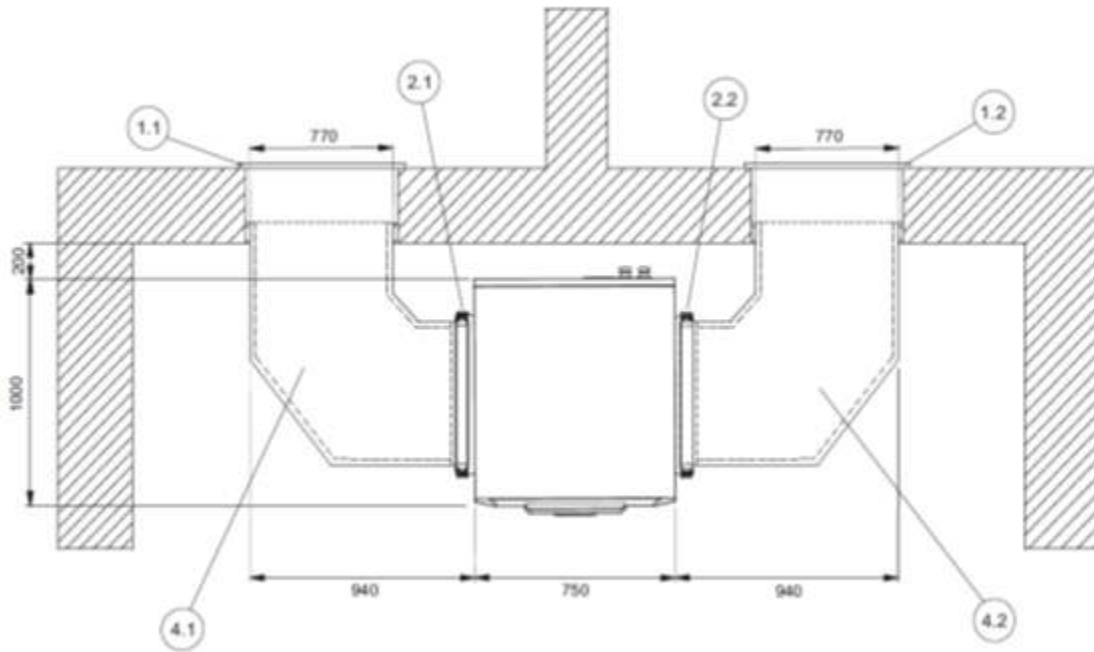


Fig.2.51: Top view - LI 24TES and LI 28TES (wall installation with air duct on the intake and exhaust side)

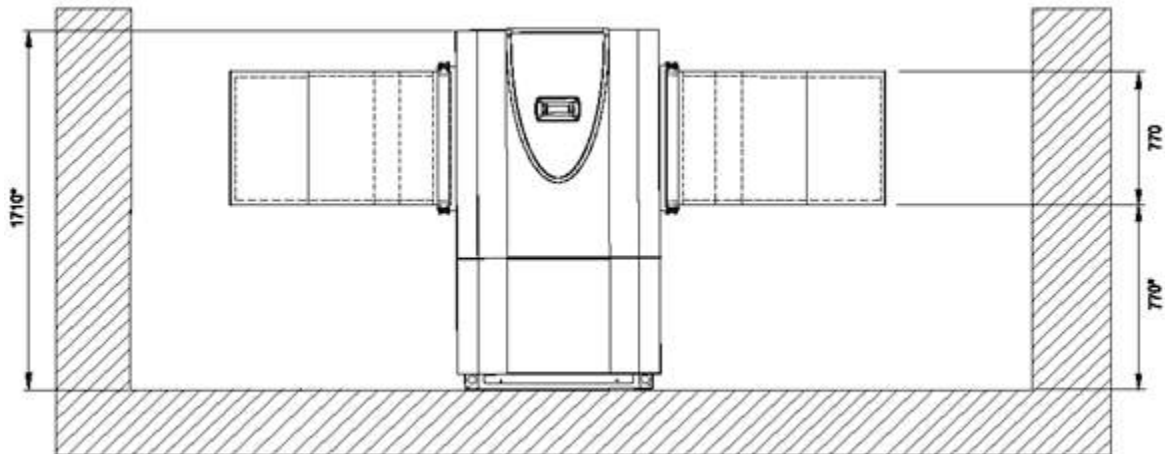


Fig.2.52: Front view - LI 24TES and LI 28TES (wall installation with air duct on the intake and exhaust side)

2.4 Air / water heat pumps in integral / split design

Integral (split) heat pumps consist of an outdoor and indoor unit, which are connected by a line that carries refrigerant. The outdoor unit contains the compressor, an air-pressurized evaporator and the expansion valve, and the indoor unit contains the condenser. The energy contained in the refrigerant for heating and hot water preparation is transferred to the heating circuit via this.

Areas of application of the Integral-/ Split heat pump

-22 ° C ... + 30 ° C (LAW / LAK heat pumps) -22 ° C ... + 35 ° C (System M / M Flex)

Availability of the heat source outside air:

- unrestricted

Usage options:

- monoenergetic
- bivalent
- regenerative
- cool

2.4.1 Installation

When installing the integral / split heat pumps, various requirements regarding installation and minimum space requirements must be observed. The refrigerant and electrical lines between the indoor and outdoor units are to be routed through the house wall. The wall ducts described (see **Insulating the wall breakthroughs**) be used. These are available as accessories.

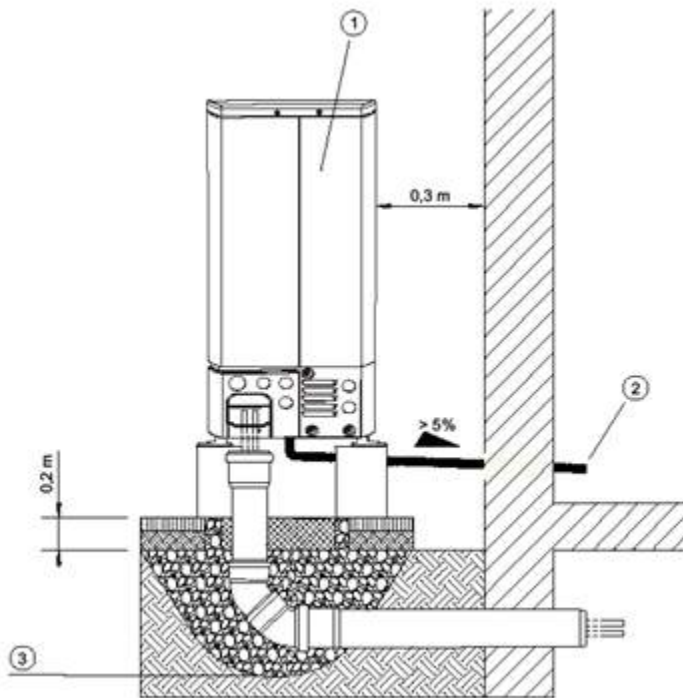
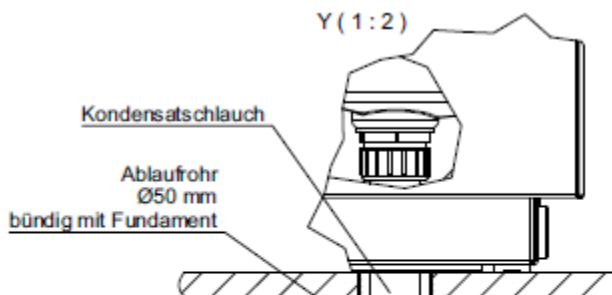


Fig.2.53: LAW ..IMR / ITR condensate drain



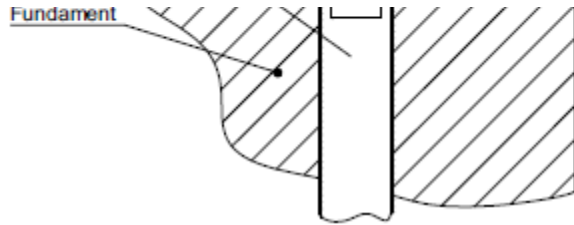


Fig.2.54: M Flex condensate drain and System M

Development costs external unit

- Laying electrical connection and load lines
- Laying of refrigerant lines between the indoor and outdoor units
- Wall openings for connection lines
- Observe the minimum clearances for assembly
- If necessary, observe state building regulations

NOTE In the case of refrigerant lines laid underground, measures must be taken to prevent refrigerant and oil from escaping into the ground (e.g. casing pipe). The maximum permissible refrigerant line length can vary depending on the type of construction (e.g. system M / M Flex max. 10 m between the external and internal unit) and must be checked when planning the system!

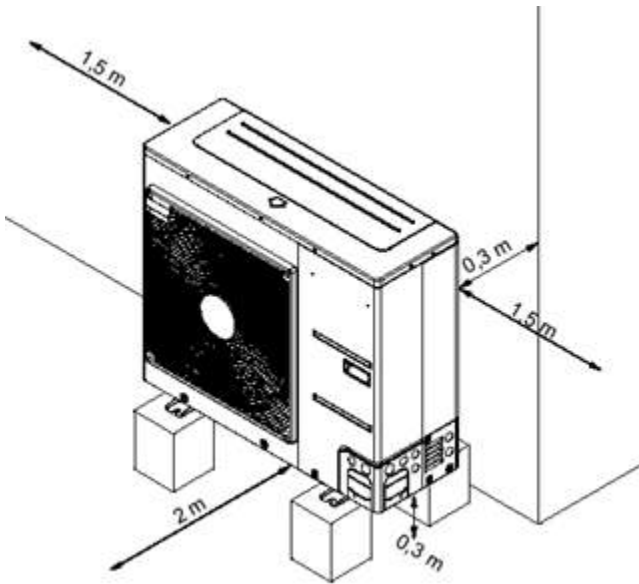
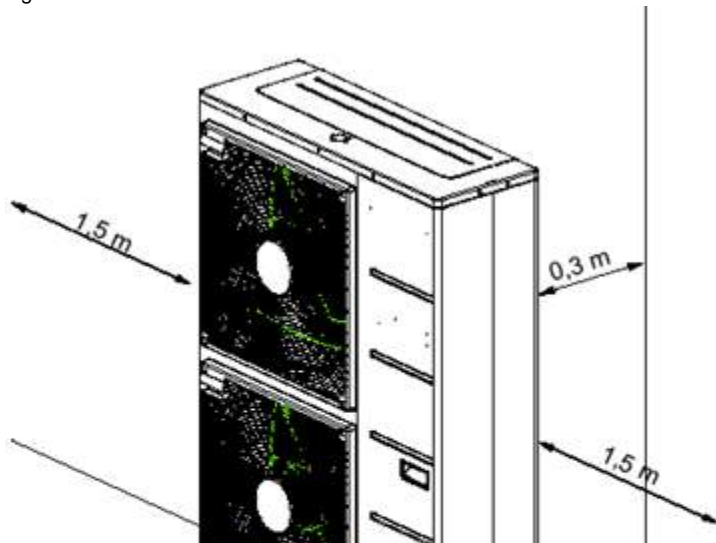


Fig.2.55: Installation of the LAW 9IMR external unit



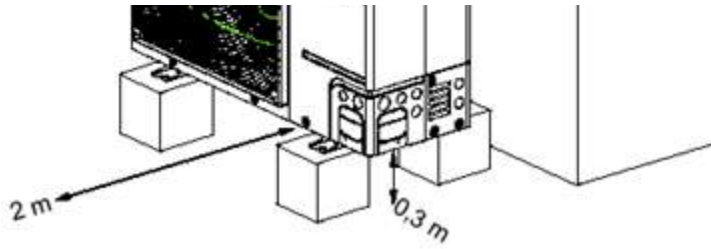


Fig.2.56: Installation of the LAW 14ITR external unit

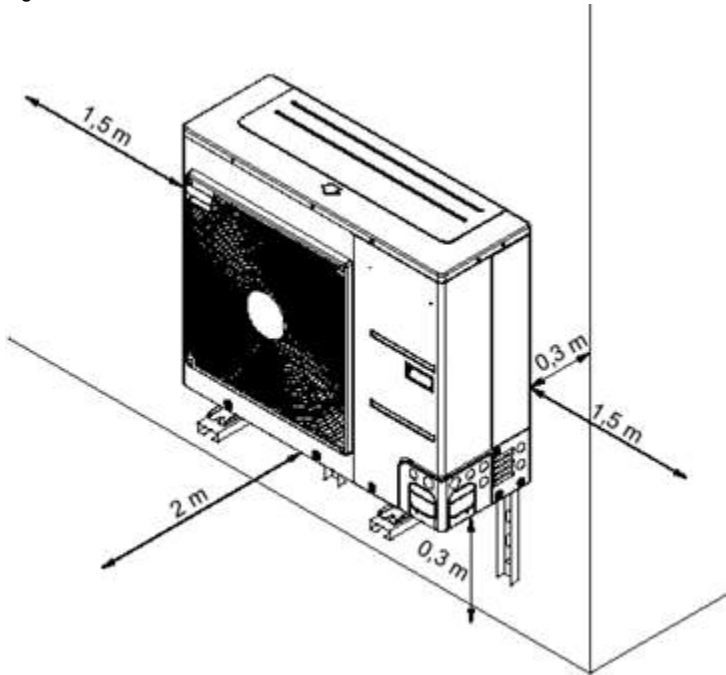


Fig. 2.57: Installation of the LAW 9IMR external unit using a wall bracket

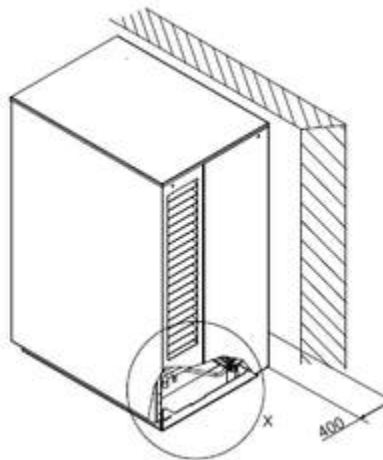
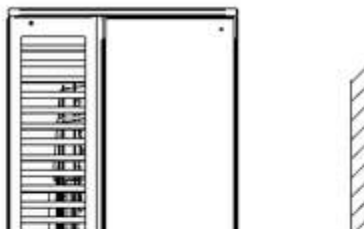


Fig.2.58: Installation of the M Flex outdoor unit and the M Comfort system



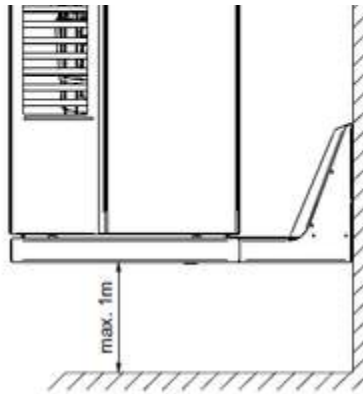


Fig. 2.59: Installation of the M Flex external unit and M system with wall bracket

If the external unit (heat source module) is installed using a wall bracket, the following points must be observed:

- Note the weight of the external unit.
- Recommended maximum height of the wall bracket above the floor 1 m. For mounting heights over 1 m, additional safety measures against falling are required depending on the local conditions (e.g. wind loads).
- Access for maintenance work must be possible at all times.
- Use suitable mounting material depending on the nature of the wall to attach the wall bracket.
- If necessary, use rubber buffers as silencers.

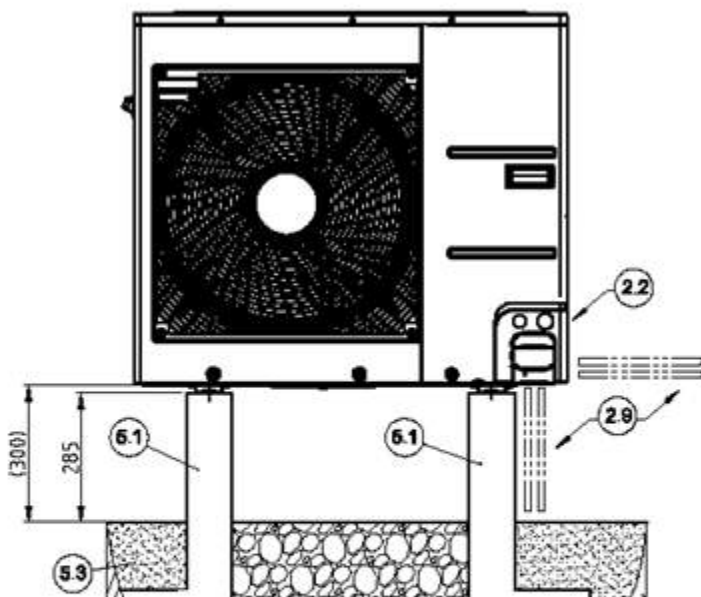
NOTE The wall structure at the installation site must be able to bear the weight of the heat pump including the wall bracket. In the case of thermally insulated houses, the thermal decoupling must be carried out on site.

NOTE Make sure that no electrical, gas or water lines are laid at the assembly site. Do not mount the wall bracket near windows and doors, as the air blown out of the side of the heat source module is significantly colder than the ambient air.

2.4.2 Condensate drain of the external unit

The condensate water that accumulates in the outdoor unit during operation must be drained away frost-proof (infiltration capacity of at least 1.5 liters per kW heating output of the heat pump). The condensate pan of the external unit offers various options for this. It is possible to let the condensate drip flat onto the floor in an uncontrolled manner. The floor under the heat pump should be designed with coarse and fine gravel so that the condensate can drain away quickly (see Figure 2.65). If there is insufficient infiltration capacity, increased ice formation can occur during periods of frost. This does not apply to the ground below the foundation.

NOTE The variant of free condensate drainage is only suitable in regions with short periods of frost.



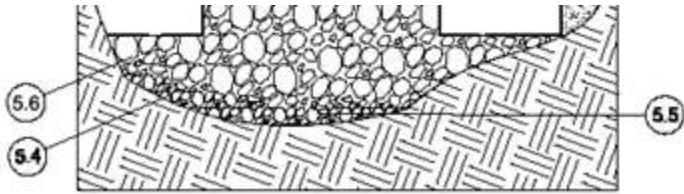


Fig. 2.60: LAW ..IMR / ITR foundation plan with gravel bed

In regions with longer periods of frost, controlled condensate drainage is recommended. The condensate is drained off at a defined point in the condensate pan (see Fig. 2.66). When discharging via a drain elbow, particular attention should be paid to short distances at the building entry in order to prevent the condensate from freezing on the drain pipe. Additional insulation measures are also required on the drain pipe.

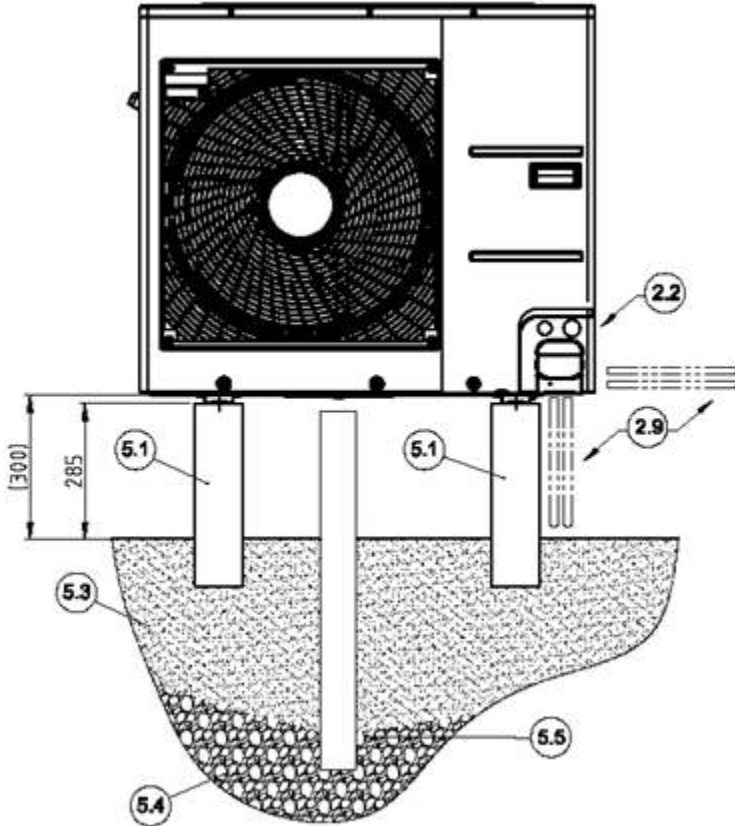


Fig. 2.61: LAW ..IMR / ITR foundation plan with a controlled process

Item	description
2.2	Implementation of electric line
2.5	Condensate drain
2.6	Condensate line
2.9	Refrigerant line - optional routing
3.5	drilling
4.1	Air direction
5.1	foundation
5.3	Earth
5.4	Gravel layer
5.5	Frost line

5.7 To the rainwater sewer or below the frost line

Tab.2.8: Legend to Fig. 2.60 and Fig. 2.61

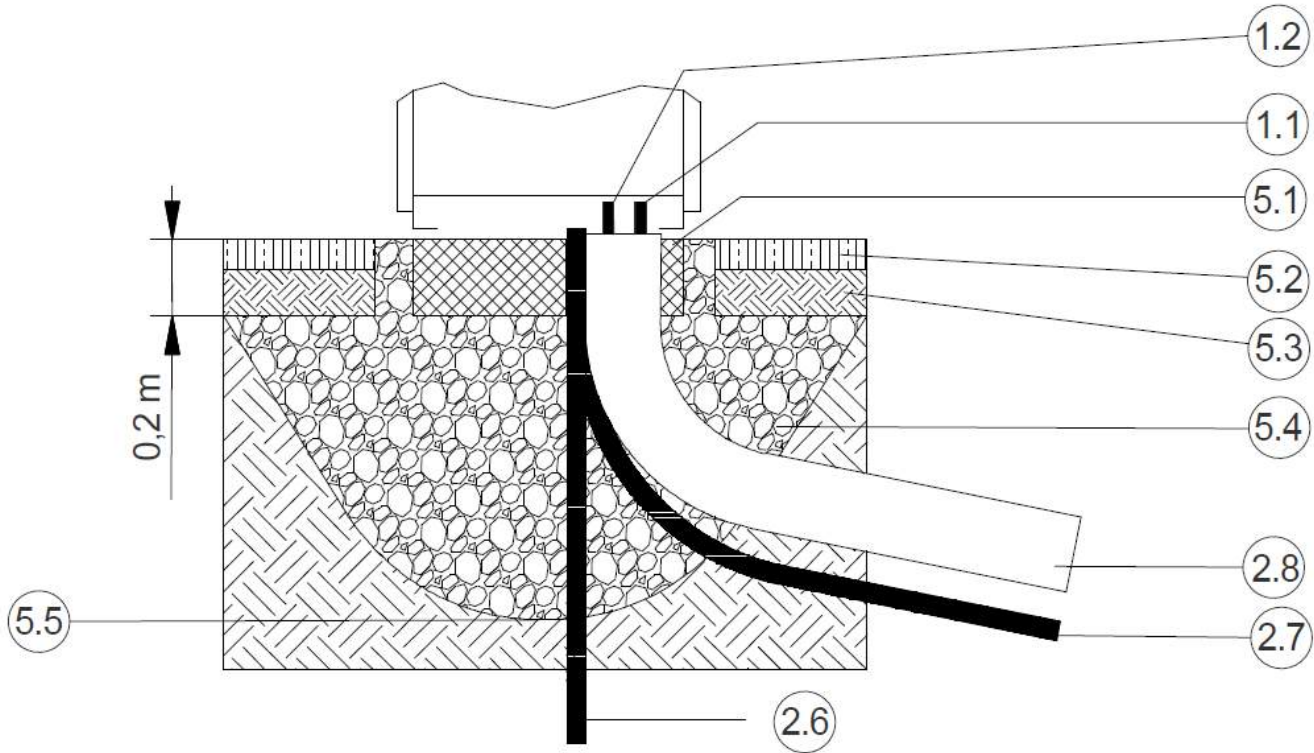


Fig. 2.62: Foundation plan M Flex and System M Comfort with gravel bed

Item	description
1.1	Heating flow
1.2	Heating return
2.6	Condensate line
2.7	Empty conduit electrical cables
2.8	District heating pipe
5.1	foundation
5.2	Meadow
5.3	Earth
5.4	Gravel layer
5.5	Frost line

Tab.2.9: Legend to Fig.2.62

2.4.2.1 Indoor unit with integrated buffer and hot water storage tank (LAW)

The indoor unit (LAW) must always be set up indoors on a flat, smooth and horizontal surface. The device must be set up in such a way that maintenance work can be carried out from the operator's side without any problems. This is guaranteed if a distance of 1m is maintained on the front. With the required height of the installation room, the space requirement, approx. 30 cm, for changing the protective anode must be taken into account (see Fig. 2.65) The installation must take place in a frost-proof room and via short cable routes.



ATTENTION

In the unfilled state (buffer storage tank and hot water storage tank without water) the device tends to tip over in the direction of the hydraulic assembly group. Do not lean against the back of the device!

The set-up and installation must be carried out by an approved specialist company. When installing the indoor unit on an upper floor, the load-bearing capacity of the ceiling must be checked and, for acoustic reasons, the vibration decoupling must be planned very carefully. An installation on a wooden ceiling is to be rejected.

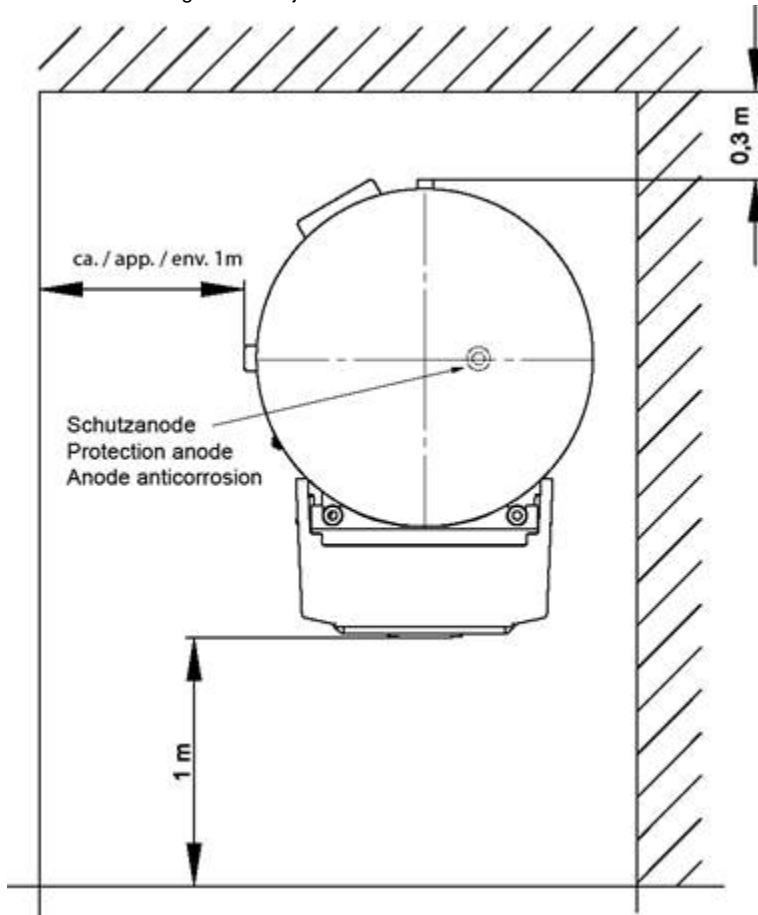


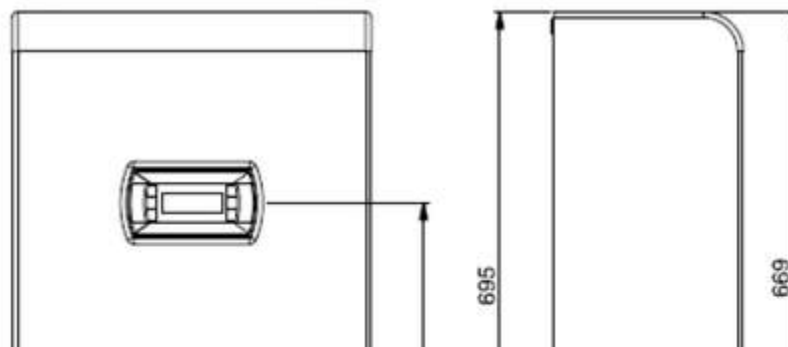
Fig. 2.63: Installation of the indoor unit

2.4.2.2 Compact indoor unit without integrated hot water and buffer storage (LAK)

The indoor unit (LAK) must always be installed indoors on a flat and smooth vertical wall. Maintenance work can be carried out from the operator's side without any problems (a minimum distance to the side is not required for maintenance work). This is guaranteed if a distance of 1m is maintained on the front. The indoor unit should be installed at a height of approx. 1.3 m. (see Fig. 2.66) The installation must take place in a frost-proof room and via short cable routes.

ATTENTION When installing the indoor unit, the load-bearing capacity of the wall must be checked and, for acoustic reasons, the vibration decoupling must be carefully planned

The set-up and installation must be carried out by an approved specialist company.



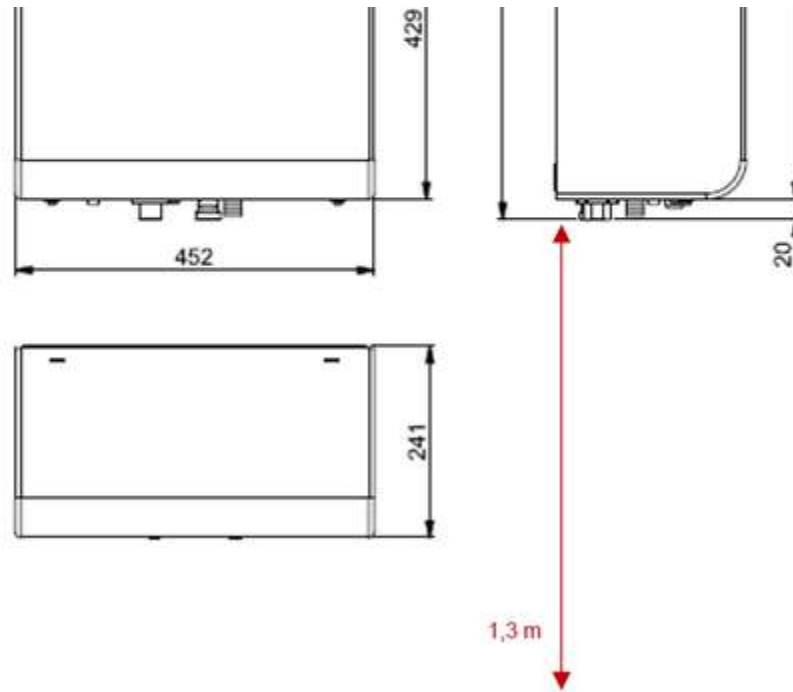
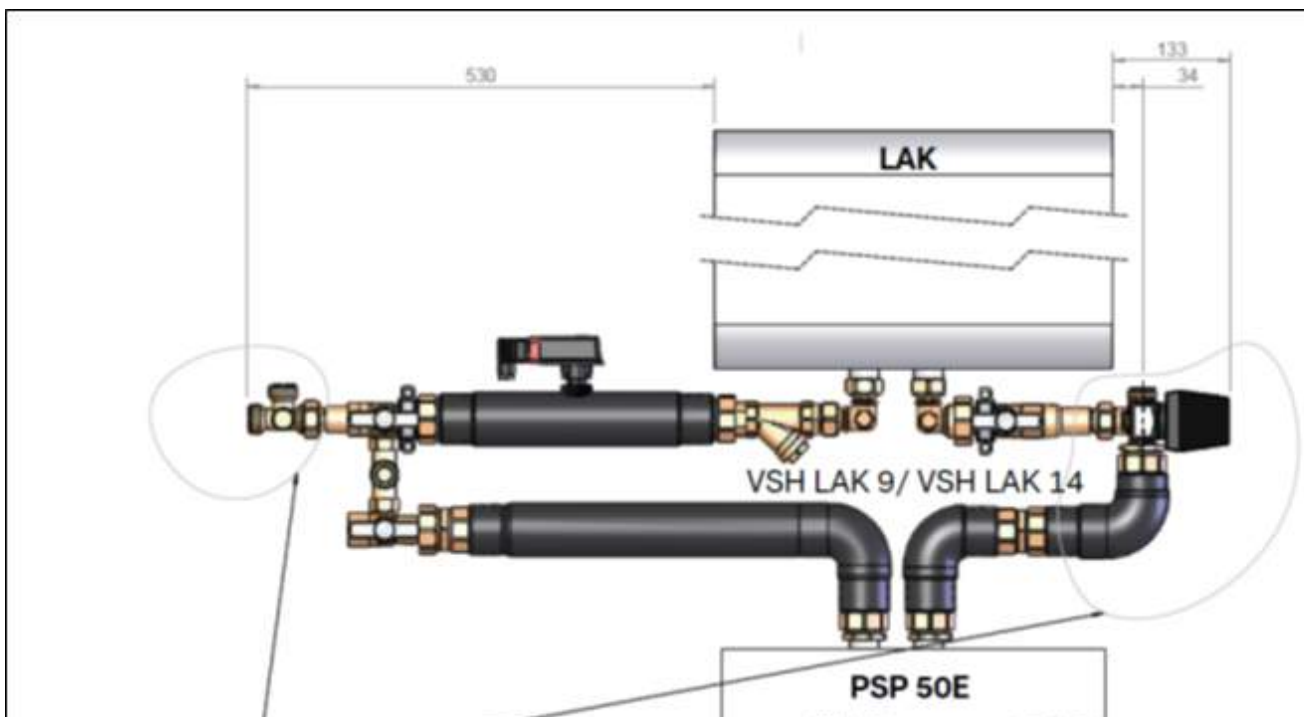


Fig. 2.64: Installation of the internal unit

NOTE When dismantling the device cover, make sure that the length of the connection line - between the control unit in the device cover and the controller on the control panel - is only 1.5 m. If the dismantled device hood can only be parked further away, the plug connection on the controller or on the control unit must first be loosened.

The connections on the heating side of the indoor unit are provided with 1" flat-sealing external thread. When connecting, an open-end wrench must be held at the transitions. There is a hose nozzle on the safety valve for on-site connection of a plastic hose. This must be led into a siphon or drain.

ATTENTION The heat pump hydraulics must contain a flow switch, overflow valve and dirt trap to ensure that the heat pump functions properly. In the connection sets available as accessories (VSH LAK or VSW LAK), all function-relevant components are compact and pre-assembled (see Fig. 2.65).



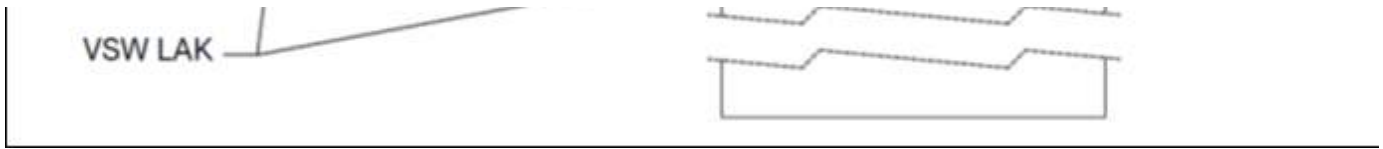


Fig. 2.65: Connection sets VSH LAK and VSW LAK

2.4.2.3 Indoor unit with integrated buffer storage (System M / M Flex)

The indoor unit must be set up in a frost-free and dry room on a flat, smooth and horizontal surface. The frame should lie close to the floor all around to ensure adequate soundproofing. The subsurface must have sufficient load-bearing capacity for the weight of the heat pump and the amount of hot water. The indoor unit must be set up in such a way that customer service can be carried out without any problems. This is guaranteed if a distance of 1 m is maintained in front of and on the right side of the heat pump. The distance indicated on the left is required for the hydraulic and electrical connection by the installer.

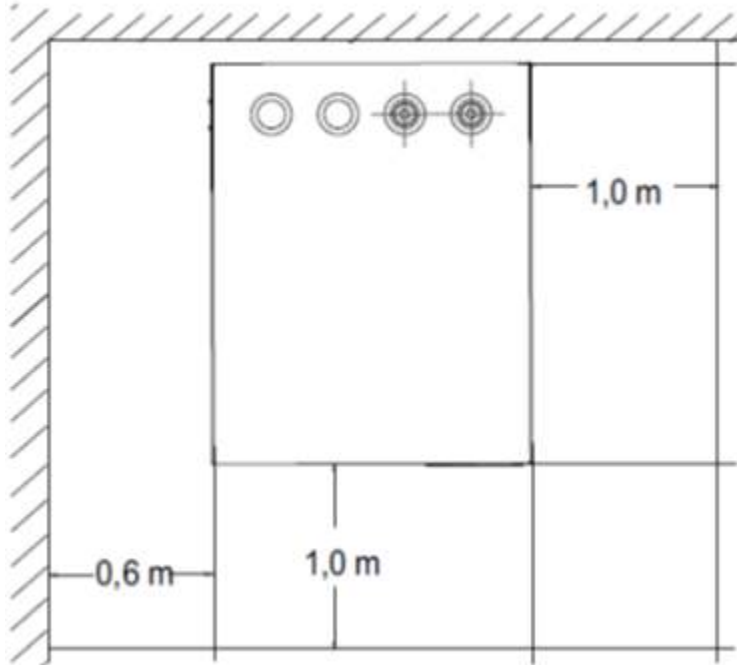


Fig. 2.66 Maintenance intervals for indoor unit M Flex / System M

Frost or temperatures higher than 35 ° C must not occur in the installation room at any time of the year. The minimum volume of the room in which the heat pump is installed must not fall below the following value, depending on the amount of refrigerant in the device:

Leistungsstufe	Kältemittelmenge	zulässige Konzentration im Aufstellraum nach DIN EN 378 (Tab. C.3)	minimal zulässiges Raumvolumen bei Innenaufstellung
16 kW	4,78 kg R410A	0,39 kg/m ³	12,3 m ³

Tab. 2.10: Minimum volume of the installation room depending on the amount of refrigerant

If the amount of refrigerant is increased, the room volume must be calculated using the following formula: minimum allowable room volume [m³] = amount of refrigerant [kg] / allowable concentration 0.39 [kg / m³]

2.4.2.4 Indoor unit with integrated buffer tank and adjacent hot water tank system M

The indoor unit and the hot water storage tank must be set up in a frost-free and dry room on a flat, smooth and horizontal surface. The frame of the indoor unit should lie close to the floor all around to ensure adequate soundproofing. The hot water storage tank can be aligned exactly to the indoor unit using adjustable feet. The subsurface must have sufficient load-bearing capacity for the weight of the heat pump and the amount of hot water. Both parts must be set up in such a way that customer service work can be carried out without any problems. This is guaranteed if a distance of 1 m is maintained in front of and on the right side of the heat pump.

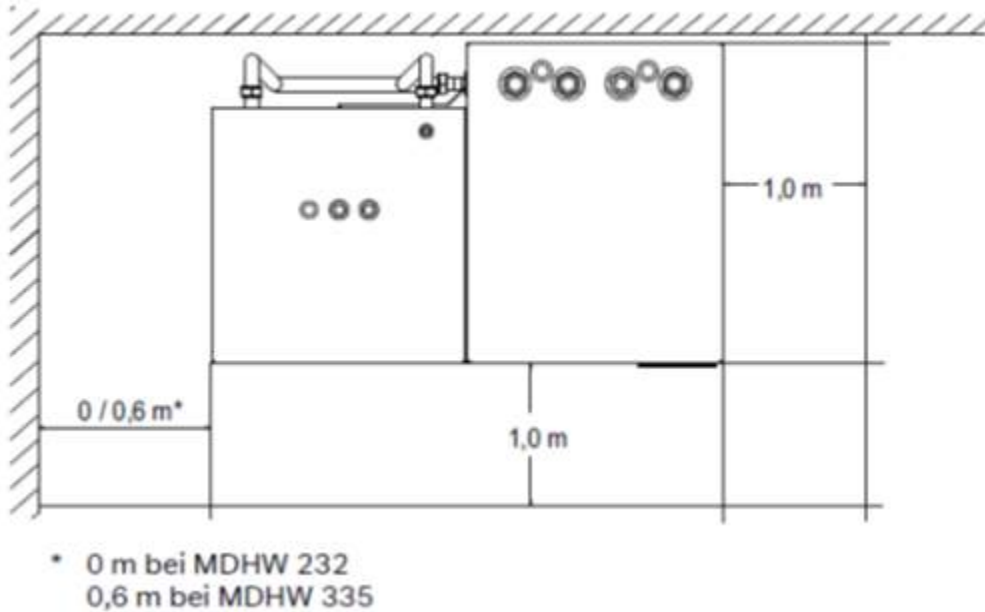


Fig. 2.67 Maintenance intervals for the system M indoor unit and the adjacent designer hot water storage tank

With the corner installation shown above, the hot water storage tank can only be installed after the hydraulic, electrical and refrigeration lines have been connected to the indoor unit. The flexible lines for flow and return to the hot water storage tank must first be attached to the indoor unit and connected to the storage tank from above after the storage tank has been positioned. The hot water sensor pre-installed on the indoor unit must be inserted into the immersion sleeve provided on the back of the storage tank. In the case of hot water storage tanks with additional electrical heating, there are two immersion sleeves at different heights on the back of the storage tank for the installation of the hot water sensor. Lower position for high dumping capacities, upper position for energy-optimized operation. The cold and hot water connections can then be made. For this purpose, easy-to-open connections are recommended in the event of service. Frost or temperatures higher than 35 ° C must not occur in the installation room at any time of the year.

2.4.3 Connection of indoor and outdoor unit (refrigerant line)

The connection between the indoor and outdoor units is established via a refrigerant line.

LAW and LAK heat pumps

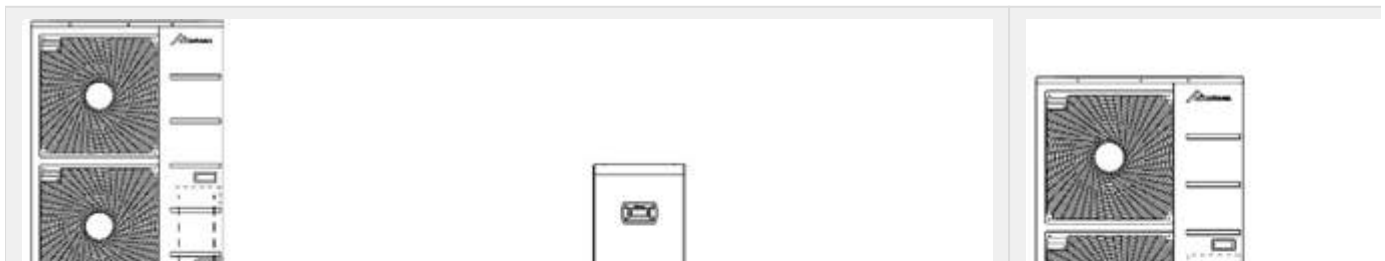
Unfilled refrigerant lines with a length of 25 m are available as accessories for all LAW and LAK heat pumps. If the distance between the indoor and outdoor units of the split heat pumps is greater than 15 m, additional refrigerant must be added (see legend for installation options for air ducts).

M Flex and System M - heat pumps

Unfilled refrigerant lines with a length of 3 m, 7 m and 10 m (MREF ...) are available as accessories for all M Flex and System M heat pumps, longer refrigerant lines are not possible.

ATTENTION Installation and maintenance work on refrigerant lines may only be carried out by refrigeration specialists.

ATTENTION If the indoor unit is installed higher than the outdoor unit, if the height difference is greater than 4 m, the installation of oil tear-off and oil lifting bends in the hot gas line must be checked by a refrigeration specialist.



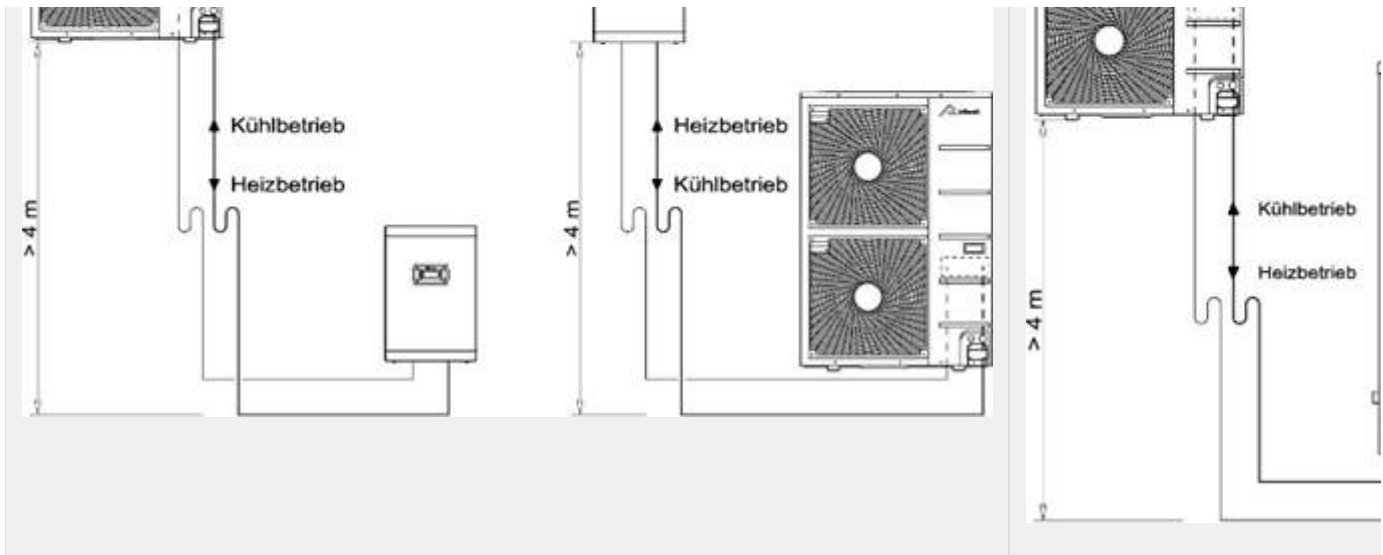


Fig.2.68 Installation sketch of lifting arch (example LAK and LAW heat pump)



ATTENTION



Refrigerant lines must not be sawed, otherwise chips can get into the refrigeration circuit.

model	Pipe dimension mm			Length A (m)		Increase B (m)		additional refrigerant (g / m)
	gas	liquid	normal	Max.	normal	Max.		
LAW / LAK 9IMR	15.88 (5/8 ")	9.52 (3/8 ")	7.5	50	0	30th	30th	
LAW / LAK 14ITR / IMR	15.88 (5/8 ")	9.52 (3/8 ")	7.5	50	0	30th	60	
System M Compact / M Flex 0609	12th	10	7th	10	0	7th	xx	
System M Comfort / M Flex 0916 (M)	18th	12th	7th	10	0	7th	xx	

Tab. 2.11: Design table for refrigerant refill LAW / LAK ..IMR / ITR, M Flex and System M

2.4.4 Electrical connection of split and integral heat pumps

2.4.4.1 Outdoor unit LAW / LAK

A load and control line must be connected to the outdoor unit. Both lines must be laid between the indoor and outdoor units. The load line is used to supply power to the outdoor unit and the control line for communication between the outdoor and indoor unit. When designing and installing the two lines, VDE guidelines and regulations as well as local conditions must be observed. The electrical protection for the outer part is located in the inner part. The entire heat pump must also be protected externally. The load line for the 9 kW outdoor unit must be 3-wire and connected to the L / N / PE (power supply) terminals. In the case of the 14 kW outdoor unit, the load line must be 5-core and connected to terminals R / S / T / N / PE. A shielded 2-core cable is to be used as the control line. The control line is connected to the terminals (Bus_A  / Bus_B ) the gateway board (smaller board in the outdoor part) and connected to the heat pump manager (+/-) in the indoor part.

2.4.4.2 LAW / LAK indoor unit

Two electrical lines must be connected to the indoor unit: the load line of the heat pump and the control voltage for the integrated heat pump manager (see appendix, chapter 3.3), (load: 3 ~; 1x 5-wire; control: 1 ~; 1x 3-wire). When designing and installing the cables, VDE guidelines and regulations as well as local conditions must be observed. Only in the case of the heat pump combination with the 9 kW outdoor unit can the power be supplied through two separate supply lines (2x 1 ~ / N / PE; 230 VAC; 50 Hz) through load sharing. Otherwise the power is always supplied via a cable (3 ~ / N / PE; 400 VAC; 50 Hz).



NOTE

Especially with the 9kW device and when using two supply lines, the positions of the copper bridges must be changed (see the appendix load connection diagram, chapter 2.3). In the delivery state, the copper bridges for the single-phase connection of the heat pump are pre-wired or installed.

The up to 5-core load line for the power section of the heat pump is led from the heat pump's electricity meter via the EVU blocking contactor (if required) into the heat pump (for load voltage, see installation instructions for LAK and LAW). In the load line for the heat pump, an all-pole disconnection with a contact gap of at least 3 mm (e.g. EVU blocking contactor, power contactor), as well as an all-pole circuit breaker with common tripping of all external conductors, must be provided (tripping current and characteristics according to device information). The load line (1 ~ L / N / PE ~ 230 V, 50 Hz) for the heat pump manager must be connected to permanent voltage and must therefore be tapped in front of the EVU blocking contactor or connected to the household electricity, otherwise important things during the EVU blocking Protective functions are out of order. The control voltage must be protected according to the GI sheet / type label. The EVU blocking contactor (K22) with 3 main contacts (1/3 /5 // 2/4/6) and an auxiliary contact (NO contact 13/14) must be designed according to the heat pump output and provided on site.

The normally open contact of the EVU blocking contactor (13/14) is looped from terminal strip X3 / G to plug terminal N1-J5 / ID3. **CAUTION! Low voltage!**

In the indoor unit, the load line must be connected to terminal strip X1 and the control voltage to terminal X2. For detailed instructions on how to connect external components and how the heat pump manager works, please refer to the device connection diagram and the enclosed installation and operating instructions for the heat pump manager. The 2nd heat generator is connected to a heating output of 6 kW in the delivery state. To reduce the power to 4 kW or 2 kW, one or both copper bridges in terminal area X7 (see circuit diagram in the installation and operating instructions) must be removed. For detailed information, see the circuit diagrams in the appendix. The electrical cables can be inserted into the device from below (in the area of the cold connection) or above (there is a cable duct molded into the PU foam under the storage tank cover).

2.4.4.3 Heat source module system M / M Flex

NOTE The plugs are secured against pulling. Before removing these, they must be unlocked with a small screwdriver.

A load line (plug + A110-X1 <> + A100-XA110) and control line (plug + A110-X5 <> + A100-X5.2) must be laid between the cooling circuit and the external unit parallel to the refrigerant line. The two connecting lines are supplied with the refrigerant lines in an appropriately preconfigured length.

NOTE The assignment of the heat pump manager can be found in the Quick Installation Guide. The functions are also printed on the label on the heat pump manager.

LAN / network connection (standard with System M or with accessories for M Flex)

The heat pump is intended for connection to the Internet via a router. This means that the user can access the system at any time for setting parameters or for reading out information. Maintenance cases or software updates are simplified. A commercially available network cable (Cat. 5) is required for connection, which is plugged between the external router (+ A350) and the network interface (+ A210) of the indoor unit.

2.4.4.4 Indoor unit system M / M Flex

NOTE The plugs are secured against pulling. Before removing these, they must be unlocked with a small screwdriver.

At least the following electrical lines / signals must be connected to operate the heat pump: **Load voltage / cooling circuit** In the power supply for the cooling circuit, all-pole disconnection with a contact gap of at least 3 mm (e.g. EVU blocking contactor, power contactor) must be provided. A 1- or 3-pole automatic circuit breaker (tripping current according to device information) for the 1st or 3-phase cooling circuit module provides short-circuit protection, taking into account the layout of the internal wiring. The relevant components in the heat pump contain internal overload protection. The connection to the switch box of the refrigeration circuit is made at + A100-X1 (L, N, PE or L1, L2, L3, N, PE - observe the phase sequence).

ATTENTION

With 3-phase connection:

Note clockwise rotating field: If the wiring is incorrect, the heat pump will not start up. A corresponding warning is displayed.

Communication / control voltage (hydraulic <-> cooling circuit)

The communication and control voltage lines from the hydraulic switch box (with heat pump manager) to the cooling circuit module are already pre-wired and end at plugs + A100-X2 (control voltage) and + A100-X5.1 (communication). Under certain circumstances, these only need to be plugged in.

Control voltage

The 3-core electrical load line for the heat pump manager (+ A200-N1) is routed into the heat pump to the hydraulic switch box + A200-X2. The supply line (L / N / PE; 230 V; 50 Hz) must be connected to permanent voltage and for this reason must be tapped in front of the EVU blocking contactor or connected to the household electricity, otherwise important protective functions will be out of operation during the EVU blocking.

EVU lock

The EVU blocking contactor (-K22) with main contact and auxiliary contact (NO contact 13/14) must be designed according to the heat pump output and provided on site. The potential-free normally open contact of the EVU blocking contactor (13/14) is wired to the hydraulic switch box and is to be connected to the corresponding plug + A200-XK22 there.

Outside sensor

The outside sensor is connected to the hydraulic module via the connector + A200-XR1. **CAUTION! Low voltage!**

Hydraulic load voltage

For the voltage supply of the 2nd heat generator, a load line must be pulled to the device according to the output and connected to plug + A400-X1 on the hydraulic switch box. In the delivery condition, the 2nd heat generator is configured to 6 kW in order to ensure the increased heat demand during the drying out of the building. In normal operation, this must be adapted to the additional heating output actually required. To reduce this to 4 or 2 kW, one or two connections between + A400-K20 (relay 2nd heat generator) and + A400-F17 (safety temperature limiter) - both contained in the hydraulic switch box - must be removed.

2.4.5 Connection diagram LAW 9IMR

Anschlussplan - LAW 9 IMR

Hinweise Haftungsausschluss:

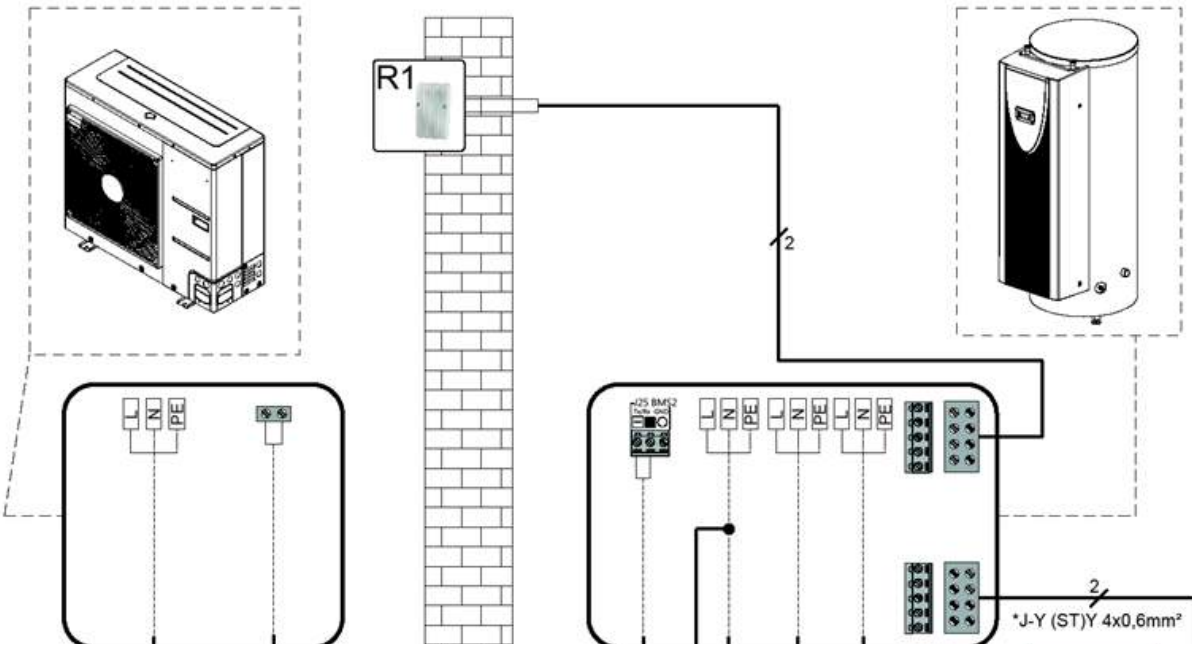
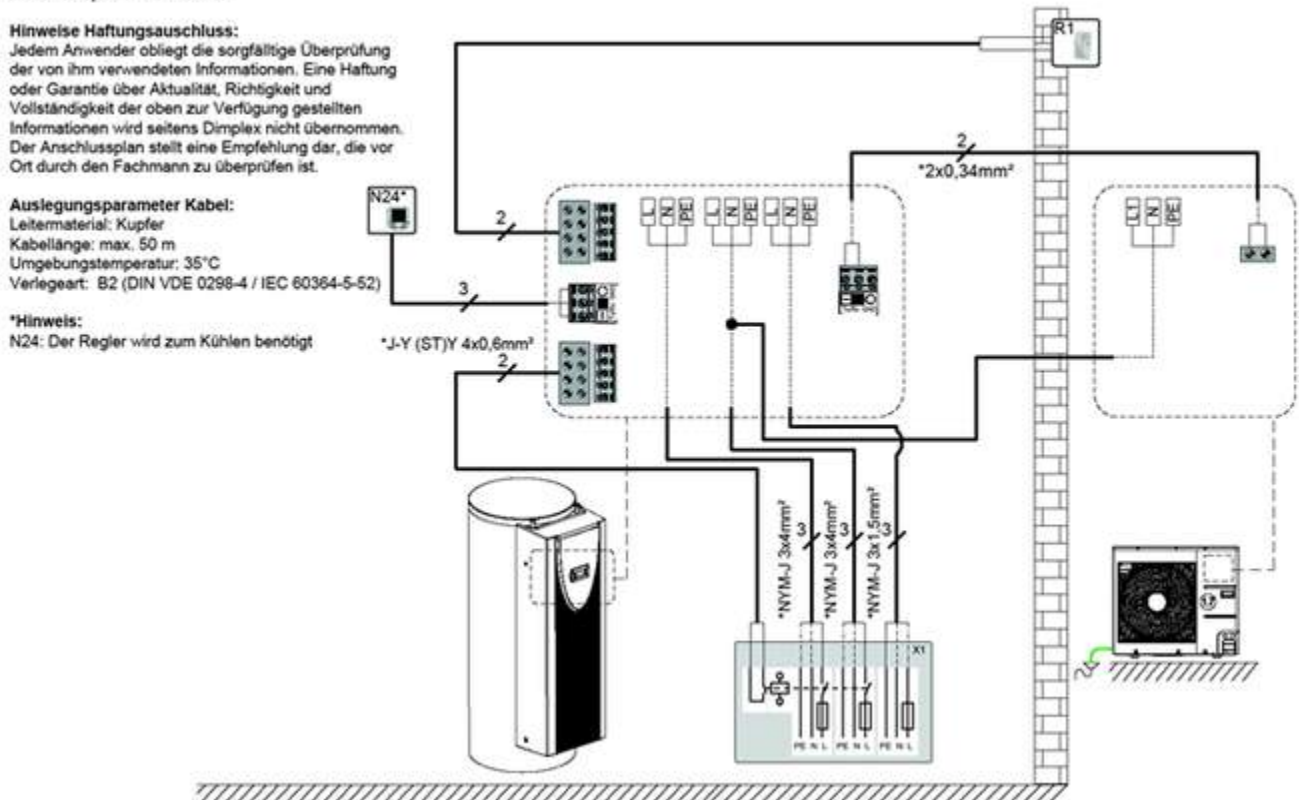
Jedem Anwender obliegt die sorgfältige Überprüfung der von ihm verwendeten Informationen. Eine Haftung oder Garantie über Aktualität, Richtigkeit und Vollständigkeit der oben zur Verfügung gestellten Informationen wird seitens Dimplex nicht übernommen. Der Anschlussplan stellt eine Empfehlung dar, die vor Ort durch den Fachmann zu überprüfen ist.

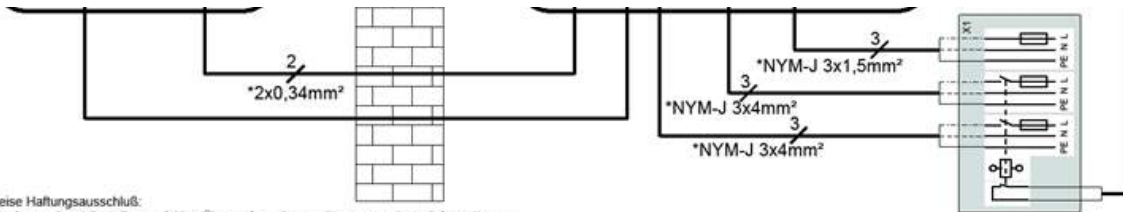
Auslegungsparameter Kabel:

Leitmaterial: Kupfer
 Kabellänge: max. 50 m
 Umgebungstemperatur: 35°C
 Verlegeart: B2 (DIN VDE 0298-4 / IEC 60364-5-52)

*Hinweis:

N24: Der Regler wird zum Kühlen benötigt





Hinweise Haftungsausschluss:
 Jedem Anwender obliegt die sorgfältige Überprüfung der von ihm verwendeten Informationen.
 Eine Haftung oder Garantie über Aktualität, Richtigkeit und Vollständigkeit der oben zur Verfügung
 gestellten Informationen wird seitens Dimplex nicht übernommen.
 Der Anschlussplan stellt eine Empfehlung dar, die vor Ort durch den Fachmann zu überprüfen ist.

*Auslegungsparameter Kabel:
 Leitermaterial - Kupfer, Kabellänge - max. 50 m, Umgebungstemperatur 35°C, Verlegeart - B2 (DIN VDE 0298-4 / IEC 60364-5-52)

Fig. 2.69: Connection plan LAW 9IMR

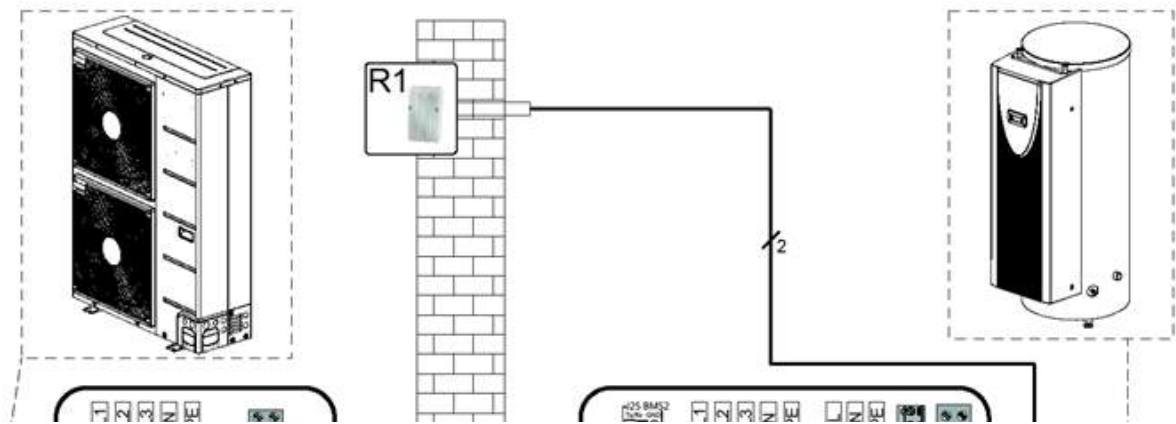
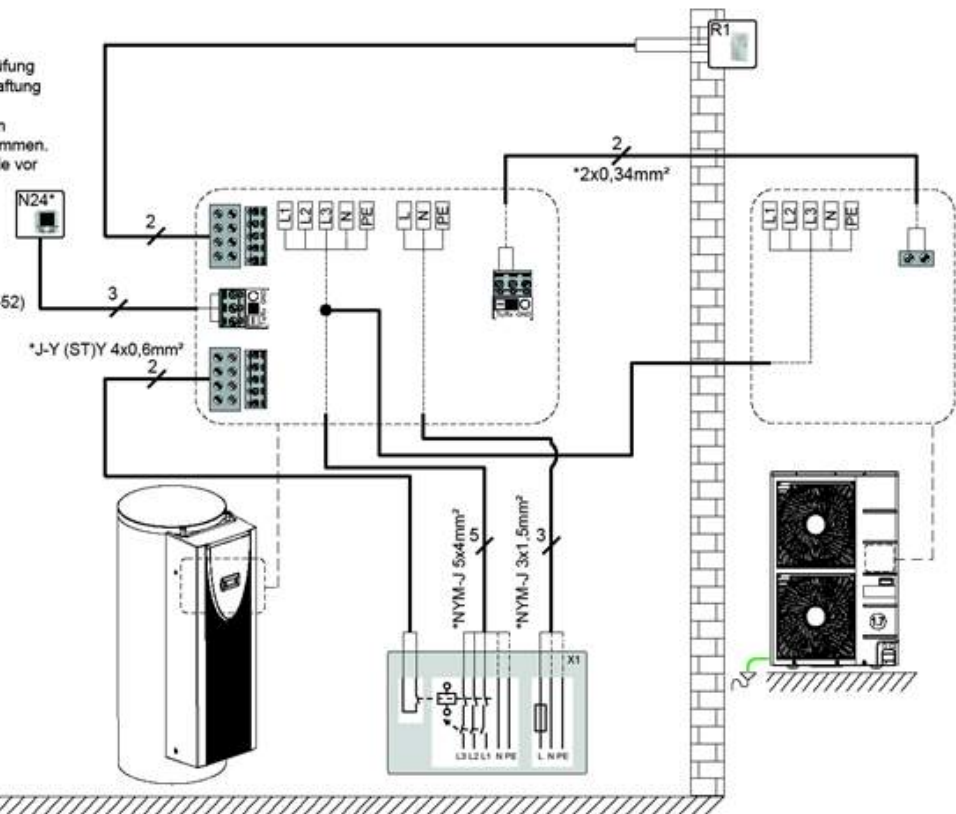
2.4.6 Connection diagram LAW 14ITR

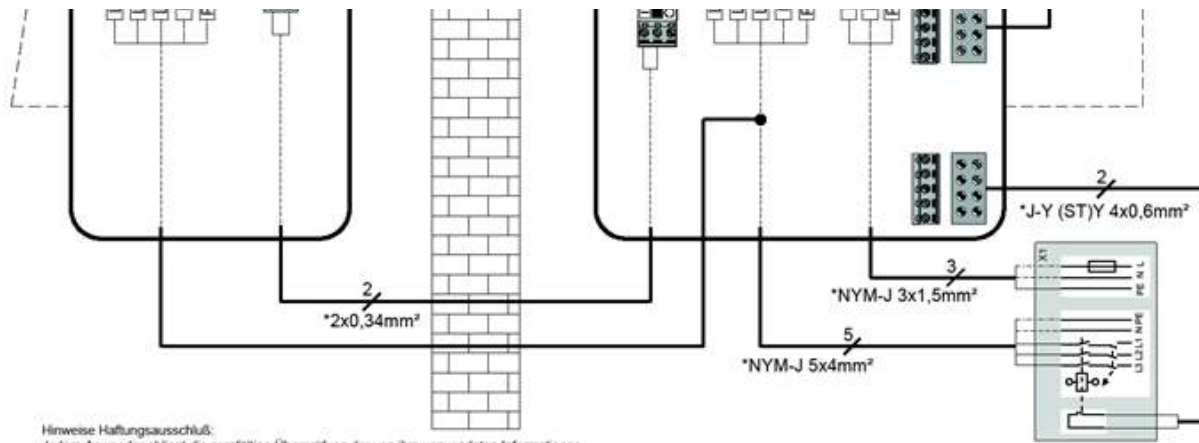
Anschlussplan - LAW 14 ITR

Hinweise Haftungsausschluss:
 Jedem Anwender obliegt die sorgfältige Überprüfung der von ihm verwendeten Informationen. Eine Haftung
 oder Garantie über Aktualität, Richtigkeit und Vollständigkeit der oben zur Verfügung gestellten
 Informationen wird seitens Dimplex nicht übernommen.
 Der Anschlussplan stellt eine Empfehlung dar, die vor Ort durch den Fachmann zu überprüfen ist.

Auslegungsparameter Kabel:
 Leitermaterial: Kupfer
 Kabellänge: max. 50 m
 Umgebungstemperatur: 35°C
 Verlegeart: B2 (DIN VDE 0298-4 / IEC 60364-5-52)

*Hinweis:
 N24: Der Regler wird zum Kühlen benötigt





Hinweise Haftungsausschluss:
 Jedem Anwender obliegt die sorgfältige Überprüfung der von ihm verwendeten Informationen.
 Eine Haftung oder Garantie über Aktualität, Richtigkeit und Vollständigkeit der oben zur Verfügung
 gestellten Informationen wird seitens Dimplex nicht übernommen.
 Der Anschlussplan stellt eine Empfehlung dar, die vor Ort durch den Fachmann zu überprüfen ist.

*Auslegungsparameter Kabel:
 Leitermaterial - Kupfer, Kabellänge - max. 50 m, Umgebungstemperatur 35°C, Verlegeart - B2 (DIN VDE 0298-4 / IEC 60364-5-52)

Fig. 2.70: Connection plan LAW 14ITR

2.4.7 LAK 9IMR connection diagram

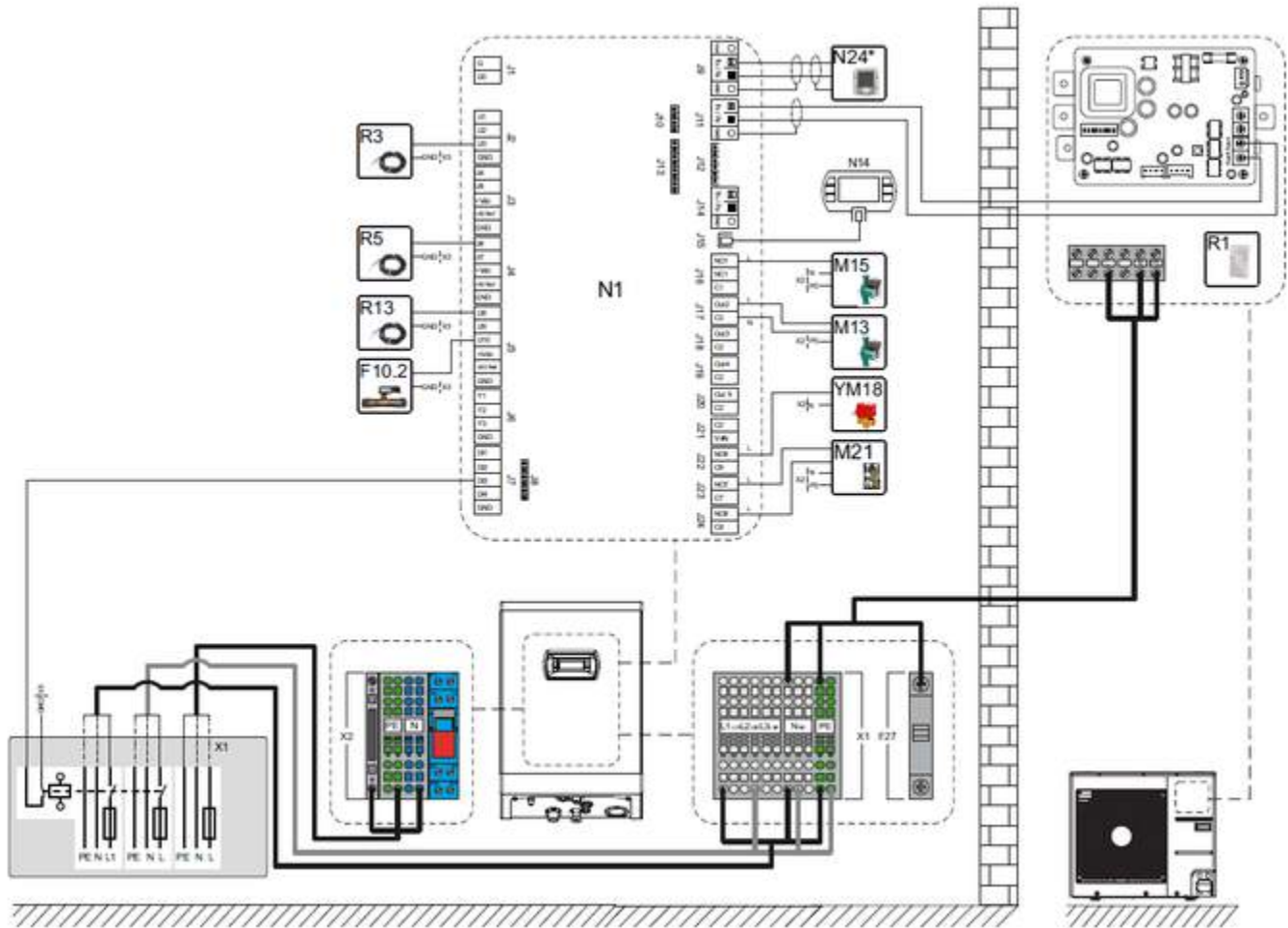


Fig.2.71: LAK 9IMR connection diagram

2.4.8 LAK 14ITR connection diagram

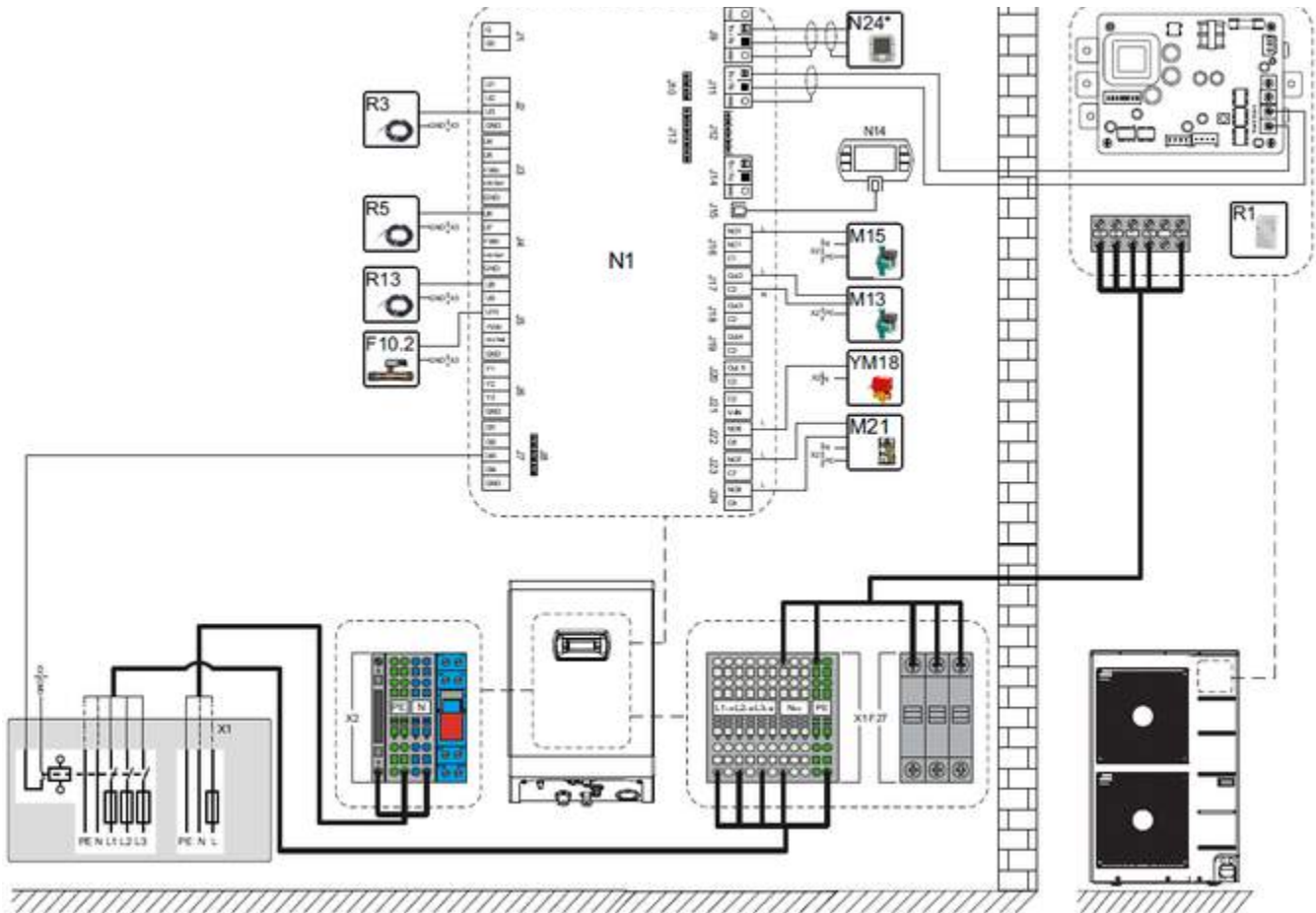
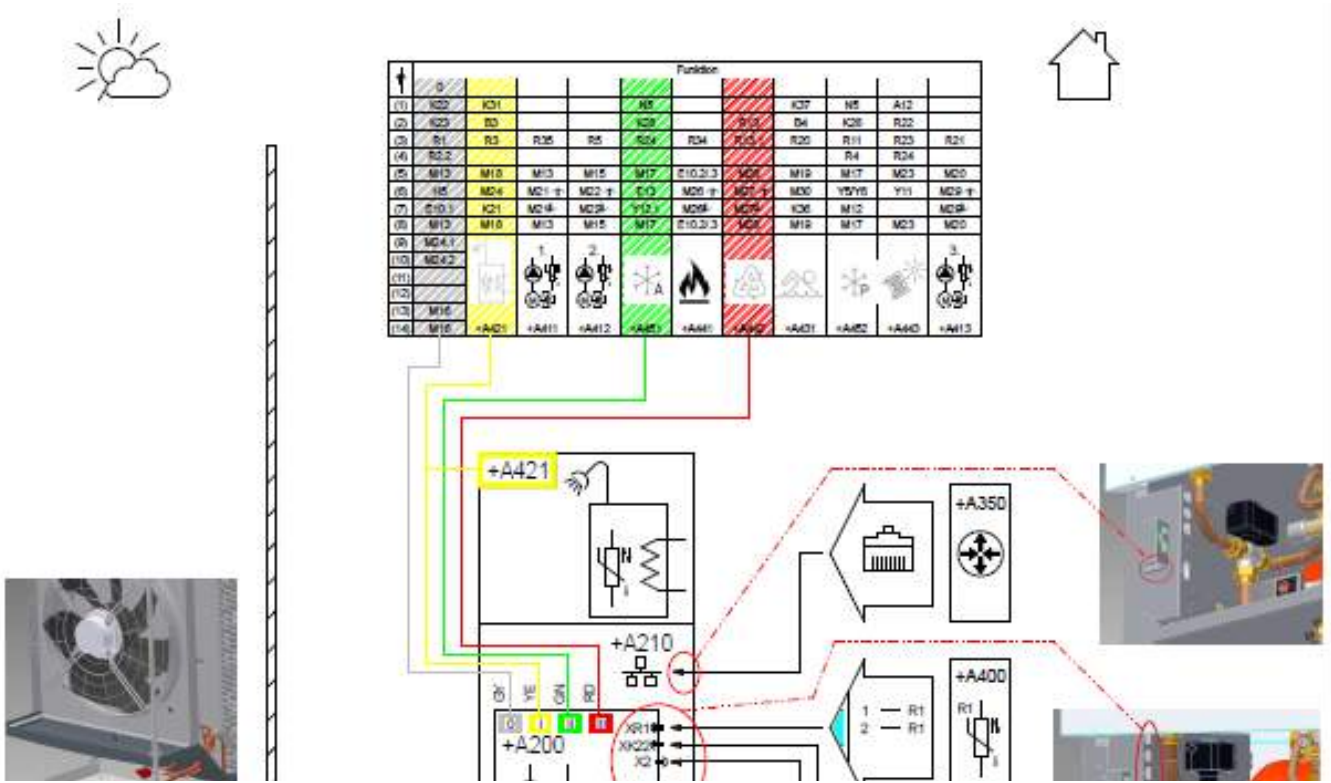


Fig.2.72: LAK 14ITR connection plan

2.4.9 2.4.9 M Compact system connection diagram



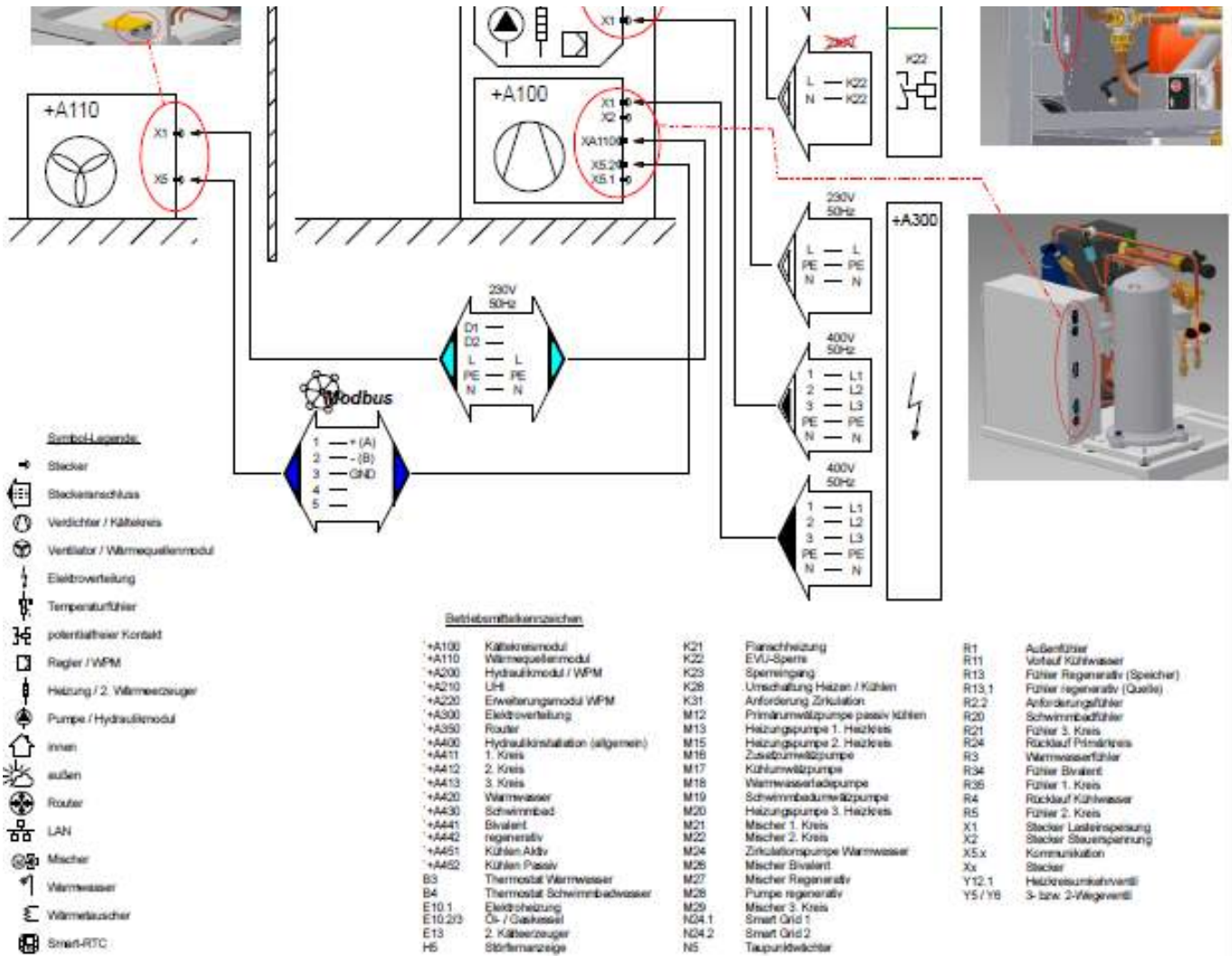
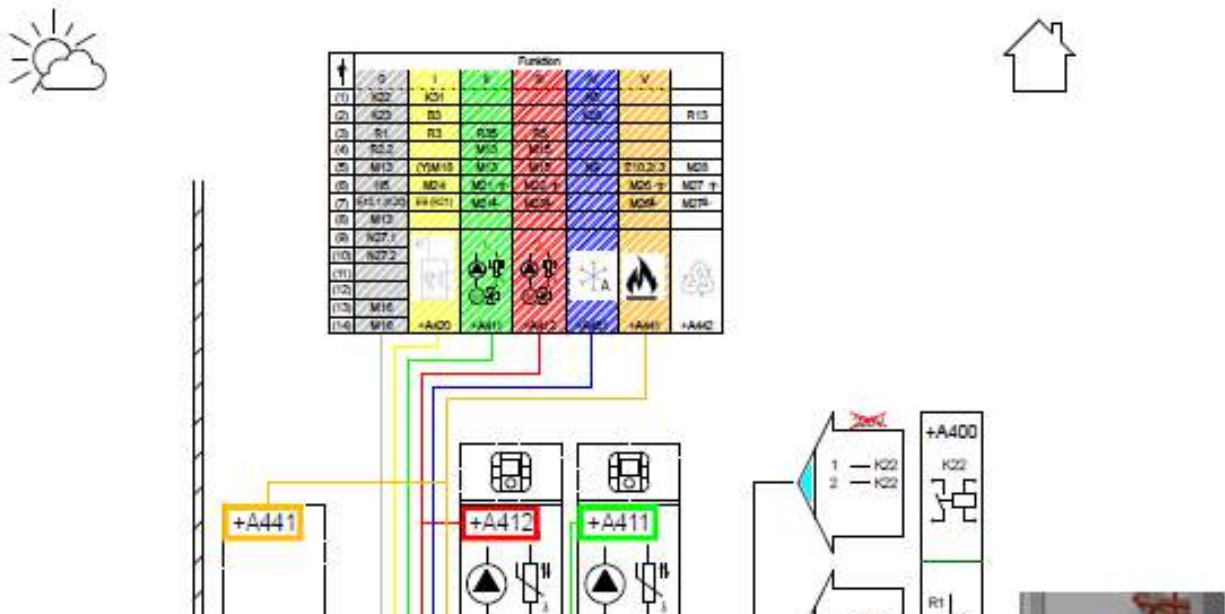


Fig.2.73: Connection plan system M Compact (230V)

2.4.10 System M Comfort connection diagram



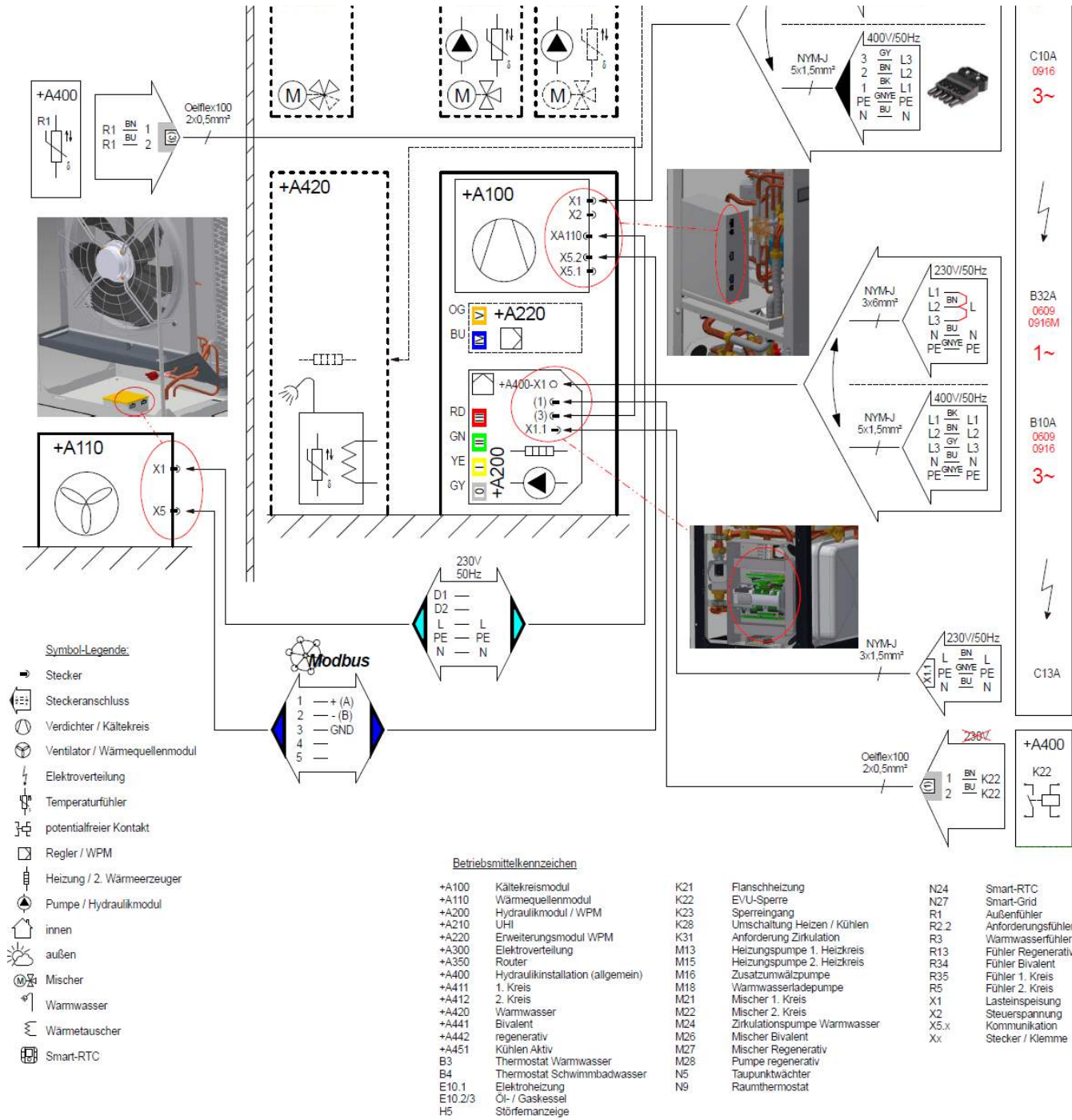


Fig.2.75: Connection plan M Flex 0609 (230V), 0916 (M) (230 / 400V)

2.4.12 Cable plan for air / water heat pumps for outdoor installation

	cable	-W -A100.1	-W -A100.2	-W -A100.3	--W -A200
		Heat pump load voltage	Control voltage heat pump	Communication heat pump	Control voltage for heat pump manager
	from	Electrical distribution EVU contactor K22	Heat pump manager Terminal strip X1	Heat pump manager N1	Electrical distribution Fuse heat pump manager F + A200
	after	Heat pump Terminal strip X1	Heat pump Terminal strip X2	Heat pump Terminal strip X5 or N0 for LA 22 / 28TBS	Heat pump manager N1

375530	LA 6S-TU		Installation lead NYM-J 5x1.5mm ²	Installation lead NYM-J 3x1.5mm ²	BUS cable, 2-core shielded J-Y (ST) Y ..LG 4x0. 28mm ²	Installation lead NYM-J 3x1.5mm ²
375550	LA 6S-TUR		Installation lead NYM-J 5x1.5mm ²	Installation lead NYM-J 3x1.5mm ²	BUS cable, 2-core shielded J-Y (ST) Y ..LG 4x0. 28mm ²	Installation lead NYM-J 3x1.5mm ²
372330	LA 9S-TU		Installation lead NYM-J 5x1.5mm ²	Installation lead NYM-J 3x1.5mm ²	BUS cable, 2-core shielded J-Y (ST) Y ..LG 4x0. 28mm ²	Installation lead NYM-J 3x1.5mm ²
372970	LA 9S-TUR		Installation lead NYM-J 5x1.5mm ²	Installation lead NYM-J 3x1.5mm ²	BUS cable, 2-core shielded J-Y (ST) Y ..LG 4x0. 28mm ²	Installation lead NYM-J 3x1.5mm ²
372340	LA 12S-TU		Installation lead NYM-J 5x1.5mm ²	Installation lead NYM-J 3x1.5mm ²	BUS cable, 2-core shielded J-Y (ST) Y ..LG 4x0. 28mm ²	Installation lead NYM-J 3x1.5mm ²
372980	LA 12S-TUR		Installation lead NYM-J 5x1.5mm ²	Installation lead NYM-J 3x1.5mm ²	BUS cable, 2-core shielded J-Y (ST) Y ..LG 4x0. 28mm ²	Installation lead NYM-J 3x1.5mm ²
372350	LA 18S-TU		Installation lead NYM-J 5x1.5mm ²	Installation lead NYM-J 3x1.5mm ²	BUS cable, 2-core shielded J-Y (ST) Y ..LG 4x0. 28mm ²	Installation lead NYM-J 3x1.5mm ²
372990	LA 18S-TUR		Installation lead NYM-J 5x1.5mm ²	Installation lead NYM-J 3x1.5mm ²	BUS cable, 2-core shielded J-Y (ST) Y ..LG 4x0. 28mm ²	Installation lead NYM-J 3x1.5mm ²
370240	LA 22TBS		Installation lead NYM-J 5x2.5mm ²	Installation lead NYM-J 3x1.5mm ²	BUS cable, 2-core shielded J-Y (ST) Y ..LG 4x0. 6mm ²	Installation lead NYM-J 3x1.5mm ²
370250	LA 28TBS		Installation lead NYM-J 5x4mm ²	Installation lead NYM-J 3x1.5mm ²	BUS cable, 2-core shielded J-Y (ST) Y ..LG 4x0. 6mm ²	Installation lead NYM-J 3x1.5mm ²
378460	LA 35TBS		Installation lead NYM-J 5x4mm ²	Installation lead NYM-J 3x1.5mm ²	BUS cable, 2-core shielded J-Y (ST) Y ..LG 4x0. 28mm ²	Installation lead NYM-J 3x1.5mm ²
378450	LA 60S-TU		Installation lead NYM-J 5x16mm ²	Installation lead NYM-J 3x1.5mm ²	BUS cable, 2-core shielded J-Y (ST) Y ..LG 4x0. 28mm ²	Installation lead NYM-J 3x1.5mm ²
374620	LA 60S-TUR		Installation lead NYM-J 5x16mm ²	Installation lead NYM-J 3x1.5mm ²	BUS cable, 2-core shielded J-Y (ST) Y ..LG 4x0. 28mm ²	Installation lead NYM-J 3x1.5mm ²
376670	LA 25TU-2		400V supply line for HP		EVL connection line (Functionally necessary accessories)	Installation lead NYM-J 3x1.5mm ²
376680	LA 40TU-2		400V supply line for HP		EVL connection line (Functionally necessary accessories)	Installation lead NYM-J 3x1.5mm ²

Tab. 2.12: Cable plan for air / water heat pumps for outdoor installation

NOTE

All cable types listed and selected in Table 2.12 are recommendations. The selection, dimensioning and professional installation of cables and electrical lines depends on the local conditions and is the responsibility of the specialist trade.

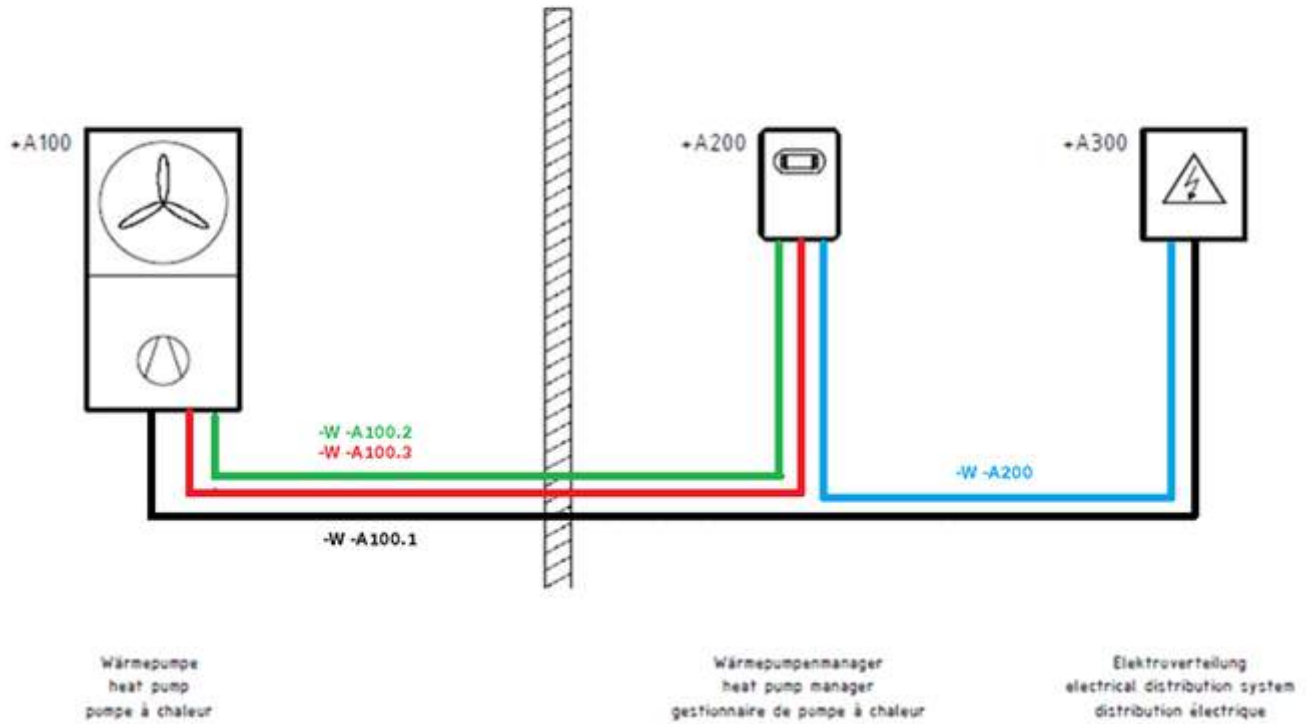


Fig. 2.76: Cable plan for air / water heat pumps for outdoor installation

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Chapter 3 - Brine / water heat pump

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3 Brine / water heat pumps

3.1 Ground heat source

Temperature range of the earth's surface at a depth of approx. 1 m	+3 ... + 17 ° C
Temperature range in deep layers (approx. 15 m)	+8 ... + 12 ° C
Area of application of the brine / water heat pump	-5 ... + 25 ° C

i NOTE

When commissioned by customer service and an antifreeze content of 30% by volume monoethylene glycol, the lower application limit of the high-efficiency brine / water heat pumps can be extended to -10 ° C.

Possibility of use

- monovalent
- monoenergetic
- bivalent (alternative, parallel)
- bivalent regenerative

i NOTE

Information on the indirect use of the heat source groundwater or waste heat from cooling water with brine / water heat pumps and intermediate heat exchangers can be found in the chapter "Heat source water with intermediate heat exchanger".

3.1.1 Dimensioning information - ground heat source

The geothermal heat exchanger, which serves as a heat source for the brine / water heat pump, must be designed for the cooling capacity of the heat pump. This can be calculated from the heating power minus the electrical input power of the heat pump in the design point.

The basic rule for the heat source is that the power Q transferred to the heat pump's evaporator Q_0 must be permanently available. The following applies:

$$\text{Evaporator output } Q_0 \text{ (kW}_{\text{th}}) = \text{Heating capacity } Q_C \text{ (kW}_{\text{th}}) - \text{electrical power consumption of the compressor } P_{\text{el}} \text{ (kW}_{\text{el}})$$

NOTE

A heat pump with a higher coefficient of performance has a lower electrical power consumption and thus a higher cooling capacity with a comparable heating output.

When replacing an old heat pump with a newer model, the performance of the geothermal heat exchanger must therefore be checked and, if necessary, adjusted to the new cooling capacity. Here, the minimum brine temperatures and the running times of the past heating periods provide important information about the heat source.

- Brine temperatures are well below 0 ° C over a longer period of time.
=> The heat source may not be able to guarantee the higher extraction capacity of a more efficient heat pump. The installation of a second heat generator, e.g. a heating element, is recommended
- The heat pump has only a few hours of full annual use
=> The heat pump seems to be oversized. Replacing it with a heat pump with a lower heating capacity leads to longer running times, lower peak extraction rates and thus more efficient operation.

The heat transport in the ground takes place almost exclusively through thermal conduction, whereby the thermal conductivity increases with increasing water content. Just like the thermal conductivity, the heat storage capacity is largely determined by the water content of the soil. The icing of the water contained leads to a significant increase in the amount of energy that can be recovered, since the latent heat of the water is very high at approx. 0.09 kWh / kg. For optimal use of the ground, icing around the pipe coils laid in the ground is therefore not disadvantageous.

Dimensioning of the brine circulation pump

The brine volume flow depends on the performance of the heat pump and is conveyed by the brine circulation pump. The circulating pump is to be dimensioned in such a way that a mass flow corresponding to the evaporator output is conveyed. Depending on the output, the mass flow should be selected so large that a temperature spread across the evaporator of 2 - 3 Kelvin is set at the lowest heat source temperature. At higher brine temperatures (e.g. summer operation / hot water), larger spreads can result.

The brine throughput specified in the device information of the heat pump corresponds to a temperature spread of the heat source of approx. 3 K. In addition to the volume flow, the pressure losses in the brine circuit system and the technical data of the pump manufacturer must be taken into account. In doing so, pressure losses in pipelines, internals and heat exchangers connected in series must be added.

NOTE

The pressure loss of an antifreeze / water mixture (25%) is higher by a factor of 1.5 to 1.7 compared to pure water (see also Fig.

NOTE

A detailed design of ground collectors is available in Germany for all regions with the operating cost calculator www.dimplex.de/betriebkostenrechner possible.

Maintenance instructions

In order to be able to guarantee safe operation of the heat pump, it must be serviced at regular intervals. The following work can also be carried out without special training:

- Cleaning the dirt filter in the heat pump's brine circuit

NOTE

Further information on the maintenance of heat pumps can be found in the installation and operating instructions for the heat pump.

3.1.2 Building drying

When building houses, large amounts of water are usually used for mortar, plaster, plaster and wallpaper, which only slowly evaporates from the structure. In addition, rain can additionally increase the moisture in the building. Due to the high level of humidity in the entire building, the heating requirement of the house is increased in the first two heating seasons.

The building should be dried out with special, on-site devices. If the heating output of the heat pump is limited and the building dries out in autumn or winter, it is advisable to install an additional electric heating element, especially with brine / water heat pumps, to compensate for the increased heat demand. This should only be activated in the first heating period depending on the brine flow temperature (approx. 0 ° C).

NOTE

NOTE

In the case of brine / water heat pumps, the increased compressor run times can lead to undercooling of the heat source and thus to a safety shutdown of the heat pump.

3.1.3 Brine liquid

Brine concentration

In order to prevent frost damage to the heat pump's evaporator, an anti-freeze agent must be added to the water on the heat source side. In the case of underground pipe coils, frost protection of -14 °C to -18 °C is required due to the temperatures occurring in the cooling circuit. A monoethylene glycol-based antifreeze is used. The brine concentration when laying in the ground is 25 to a maximum of 30% by volume.

A mixture of water and an anti-freeze agent is used as the heat transfer medium in order to achieve a lower freezing point. Ethanediol (ethylene glycol) is used as an antifreeze in the majority of plants in Germany, Austria and Switzerland.

NOTE

Authorities are placing ever higher demands on the environmental compatibility of brine fluids. In particular, the unknown composition of the added inhibitors, e.g. for corrosion protection, are viewed critically. In Germany, only heat transfer media can be accepted that contain additives of WGK 1 with less than 3 mass%. On the other hand, additives of WGK 2 and 3 and substances not determined with certainty may not be added below the consideration limit (according to Appendix 1 AwSV) of 0.2% by mass. Suitable brine fluids are summarized in a positive list of the "Federal / State Working Group on Water (LAWA)" and can be found on their website at <https://www.lawa.de/Publikationen-363-Waermetraeger,-Erdwaerme-.html> can be viewed.

The use of pure monoethylene glycol is therefore recommended if it can be ensured that there is no permanent supply of oxygen during operation due to a closed brine circuit (e.g. AFN 824, AFN 825).

NOTE

Due to the choice of materials for the brine accessories, the more environmentally friendly ethylene and propylene glycol without corrosion inhibitors can be used with Dimplex heat pumps.

Surname	synonym	Chemical formula
Ethanediol	Ethylene glycol	$C_2H_6O_2$
1,2 propanediol	Propylene glycol	$C_3H_8O_2$
Ethanol	Ethyl alcohol	C_2H_5OH

Table 3.1: Approved antifreeze agents recommended by Dimplex

NOTE

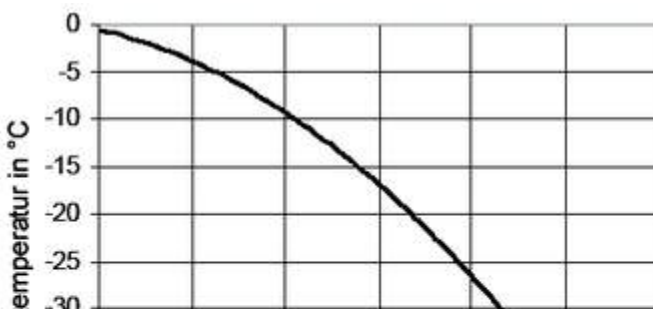
The performance data of the heat pumps are recorded with ethylene glycol (25%). Propylene glycol and ethyl alcohol can also be used; no measurements are available on the effects on performance and COP.

The following antifreeze agents are not approved due to a lack of long-term experience:

- "Thermera", which is made on the basis of betaine and is not without controversy from an environmental point of view.
- "Tyfo special without corrosion protection inhibitors", as this antifreeze attacks non-ferrous metals such as copper.
- "Tyfo special with corrosion protection inhibitors", as this is not officially approved by our suppliers and is so aggressive that it leads to corrosion on the sheet metal cladding in the event of leaks.

NOTE

The list does not claim to be complete.



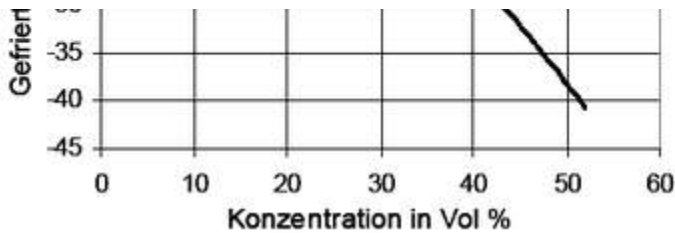


Fig. 3.1: Freezing curve of monoethylene glycol / water mixtures as a function of the concentration

Pressure protection

If only heat is extracted from the ground, brine temperatures between approx. 5 ° C and approx. +20 ° C can occur. Due to these temperature fluctuations, there is a change in volume of approx. 0.8 to 1% of the system volume. In order to keep the operating pressure constant, an expansion vessel with a pre-pressure of 0.5 bar and a maximum operating pressure of 3 bar must be used.

NOTE

In heat pump systems with a cooling function (reversible heat pumps), the expansion vessel on the brine side must be designed to be larger than in heat pumps with a pure heating function due to the higher spread

ATTENTION

A component-tested diaphragm safety valve must be installed to protect against overfilling. According to DIN EN 12828, the discharge line of this safety valve must end in a collecting tray. A manometer with minimum and maximum pressure markings must be provided for pressure monitoring.

Filling the plant

The system should be filled in the following order:

- Mix the required antifreeze-water concentration in an external container
- Check the previously mixed antifreeze / water concentration with an antifreeze tester for ethylene glycol
- Filling the brine circuit (max. 2.5 bar)
- Vent the system (install microbubble separator)

ATTENTION

Even after the brine circulating pump has been in operation for a long time, there is no homogeneous mixture when the brine circuit is filled with water and then antifreeze is added. The unmixed water column freezes in the evaporator and destroys the heat pump!

Relative pressure loss

The pressure loss in the brine circuit depends on the temperature and the mixing ratio. As the temperature falls and the proportion of monoethylene glycol increases, the pressure loss in the brine increases.

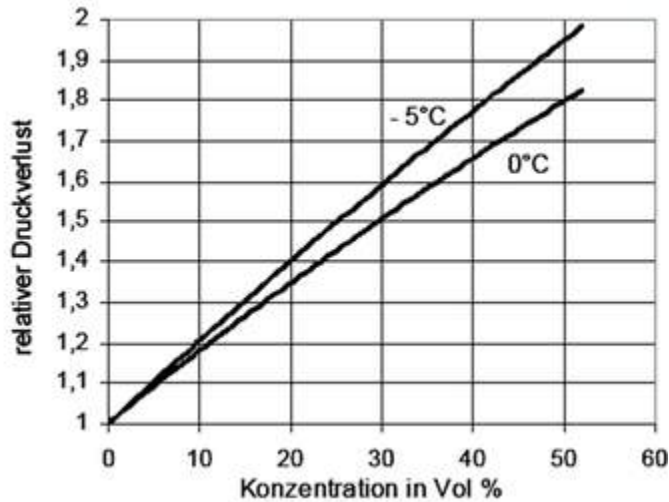


Fig. 3.2: Relative pressure loss of monoethylene glycol / water mixtures compared to water as a function of the concentration at 0 ° C and -5 ° C

Pipe DIN 8074 (PN 12.5) [mm]	Volume per 100 m [l]	Frost protection per 100 m [l]	Max. Brine throughput [l / h]

25 x 2.3	32.7	8.2	1100
32 x 2.9	53.1	13.3	1800
40 x 3.7	83.5	20.9	2900
50 x 4.6	130.7	32.7	4700
63 x 5.8	207.5	51.9	7200
75 x 6.9	294.2	73.6	10800
90 x 8.2	425.5	106.4	15500
110 x 10	636	159	23400
125 x 11.4	820	205	29500
140 x 12.7	1031	258	40000
160 x 12.7	1344	336	50000

Table 3.2: Total volume and amount of frost protection per 100 m pipe for PE pipes and frost protection down to -14 ° C

3.1.4 Materials in the brine circuit

Material for geothermal collectors

Pipes made of PE 100 / PE-X can be used in stone-free floors. For stony soils, crosslinked pipes made of polyethylene (e.g. PE 100-RC / PE-X) with an outer diameter of 32 mm are recommended due to their higher notch impact strength. PE-RT can be used for applications in which higher temperatures in the brine circuit are to be expected (e.g. energy fences or waste heat utilization). These can be used for operating temperatures of up to 70 ° C.

Other materials

When using other materials such as copper, brass or stainless steel in the brine circuit, the corrosion resistance of the materials must be checked. Corrosion can also occur due to condensation on pipes that are not or inadequately insulated in the brine circuit.

NOTE

The Dimplex antifreeze AFN 824 / AFN 825 for filling the brine circuit does not contain any corrosion inhibitors.

3.1.5 Parallel connection of brine / water heat pumps

When connecting brine / water heat pumps in parallel, care must be taken that there is no incorrect flow in the brine circuit in individual heat pumps. If only one heat pump is in operation, there may be an external flow through the heat exchanger of the second heat pump if there is no check valve in the brine circuit. To prevent this, a non-return valve must be installed in the flow after each brine circuit pump.

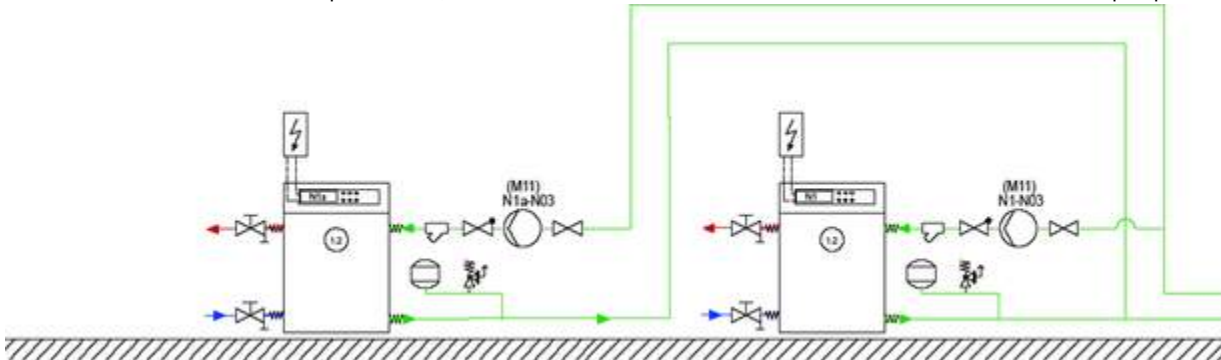


Fig. 3.3: Parallel connection of brine / water heat pumps

NOTE

The non-return valve behind the M 11 brine circulating pump is not included in the brine accessories package, but must be provided by the customer.

A similar incorrect flow can also occur when using a passive cooling station (PKS). A non-return valve / non-return valve must also be installed on site after each brine circulating pump.

3.2 Geothermal collector

Geothermal collectors extract seasonally stored energy from the subsurface under the free surface of the earth. In particular, the liquid / solid phase change of the water in the ground is used as a latent heat store in winter. The maximum extraction capacity and the annual extraction work are limited by the storage capacity, the heat transport properties and the thermal regeneration of the subsoil as well as the collector geometry and the operating mode of the system. With regard to the soil, the water content is a major influencing factor.

The coupling to the earth's surface is decisive for the performance of geothermal collectors, as they are affected by heat input from outside air, solar radiation and precipitation in the warmer months be regenerated. The following design guidelines and application limits therefore apply exclusively to geothermal collectors that are not covered or sealed and that are covered by the natural soil. The heat inflow from the earth's interior is less than 0.1 W / m^2 and therefore negligible.

NOTE

Laying a collector under terraces or buildings does not make sense due to the lack of regeneration. The formation of ice on the collector causes uplifts and depressions that can lead to cracks or damage to the building.

The most important criteria for a system decision and the preliminary planning are summarized below:

- In individual cases, geothermal collectors are subject to notification or approval from the lower water authority.
- Building over the geothermal collector is not permitted. The terrain surface above a collector system must not be sealed, as this impairs regeneration.
- A deeply rooted vegetation over a collector is to be avoided. In the worst case, the vegetation delay over a collector is around two weeks.
- The following minimum clearances and standard dimensions are recommended:
 - between collector and buildings: 1.2 m
 - Lines leading between collector and water: 1.5 m
 - between the collector and the property line: 1 m
 - Installation depth of the collector: see section below
 - Installation distance of the collector pipes: see section below

NOTE

The maximum extraction energy per year is 30 to 50 kWh / m² in sandy soils and 50 to 70 kWh / m² in cohesive soils².

NOTE

Under www.dimplex.de/online-planer the Dimplex operating cost calculator can be found. With this it is possible to design ground collectors in Germany using the zip code of the respective region.

3.2.1 Laying depth

In cold regions, the ground temperatures at a depth of 1 m can reach the freezing point even without using heat. At a depth of 2 m, the minimum temperature is approx. 5 ° C. This temperature rises with increasing depth, but the heat flow from the earth's surface decreases. A thawing of the icing in spring is not guaranteed if it is laid too deeply. Therefore, the laying depth should be approx. 0.2 to 0.3 m below the maximum frost limit. In most regions of Germany this is 1.0 to 1.5 m.

ATTENTION

When laying geothermal collectors in trenches, a laying depth of 1.25 m must not be exceeded for reasons of lateral protection. Risk of spillage!

3.2.2 Installation distance

When determining the laying distance d_a It must be taken into account that the ice radii that form around the earth snakes have thawed out after a period of frost to such an extent that rainwater can seep away and no waterlogging occurs. The recommended laying distances are between 0.5 and 0.8 m, depending on the type of soil and climatic region. In regions with sandy soils, a laying distance of 0.3 to 0.4 m may also be necessary.

- The longer the maximum duration of the frost period, the greater the laying distance and the required area.
- In the case of poor heat conduction of the floor (e.g. sand), the installation distance must be reduced for the same installation area and thus the total pipe length increased.

NOTE

In cold regions with normal outside temperatures below -14 ° C (e.g. southern Germany), a laying distance of approx. 0.8 m is required. In warmer regions with normal outside temperatures of -12 ° C and warmer, the installation distance can be reduced to approx. 0.6 m. The climate data can be found in the DIN / TS 12831-1 standard.

3.2.3 Collector area and pipe length

The area required for a horizontally laid ground collector depends on the following factors:

- Cooling capacity of the heat pump
- Soil type and moisture content of the soil and climatic region
- Maximum length of the frost period
- Annual full hours of use

NOTE

In low mountain ranges from heights of approx. 900 m to 1000 m above sea level, the extraction rates are very low and geothermal collectors are not recommended

NOTE

Standard values for dimensioning geothermal collectors are shown in Table 3.4.

Step 1	Determine the heat output of the heat pump in the design point (e.g. B0 / W35) Calculation of the cooling output by subtracting the electrical input power in the design point from the heat output			
	Q_0	=	$Q_{WP} - P_{el}$	Example: SI 14TU
	Q_{WP}	=	Heat output of the heat pump	13.9 kW
	P_{el}	=	electr. Power consumption of the heat pump in the design point	2.78 kW
	Q_0	=	Cooling capacity or extraction capacity of the heat pump from the ground at the design point	11.12 kW
step 2	Refer to Table 3.3 for the specific extraction rate depending on the type of soil			
	Soil type	Specific withdrawal benefits		
		for 1800 h		
	dry non-cohesive soil (sand)	approx. 10 W / m		
	Clay / silt	approx. 19 W / m		
	Sandy clay	approx. 21 W / m		
step 3	Determination of the required pipe length:			
	• Cooling capacity from 2nd step = 11.12 kW Soil type clay / silt			
	• Pipe length $L = 11120 \text{ W} / 19 \text{ W} / \text{m} = 585.3 \text{ m}$			
	• => 6 circles of 100 m each are selected			
Step 4	The collector area results from the pipe length and the laying distance:			
	• Collector area $A = L \text{ (pipe length)} * b \text{ (installation distance)}$			
	• The required laying distance at a location in southern Germany is 0.8 m. 0.8 m is selected			
	• Collector area $A = 600 \text{ m} * 0.8 \text{ m} = 480 \text{ m}^2$			

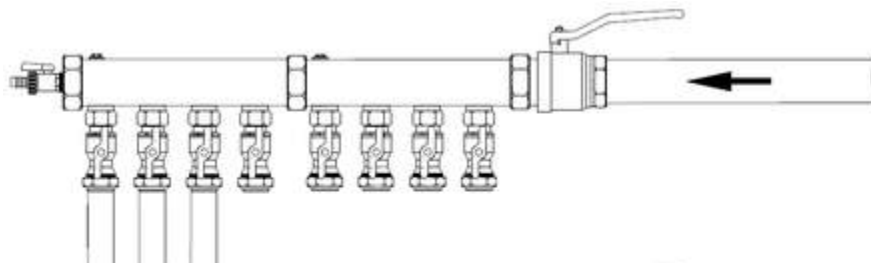
NOTE

In practice, the calculated minimum pipe length is rounded up to a full 100 m circles.

3.2.4 Relocation of the brine collector and distributor

The brine distributors connect geothermal probes or geothermal collectors easily and safely with a heat pump. A water-glycol mixture is usually used as the heat transfer fluid for transferring geothermal energy. In a closed circuit, the brine flows from the collector or probe pipes via the brine collector to the heat pump and via the brine distributor back to the heat source.

Depending on the number of brine circuits to be flown through, the brine collector or brine distributor must be installed (see Figures 3.4 and 3.5). To completely shut off individual collector or probe circuits (e.g. in the event of leaks), both the collector and the distributor are equipped with ball valves. The PE pipes of the collectors or probes can be mounted directly on the ball valves with the pre-assembled compression fittings.



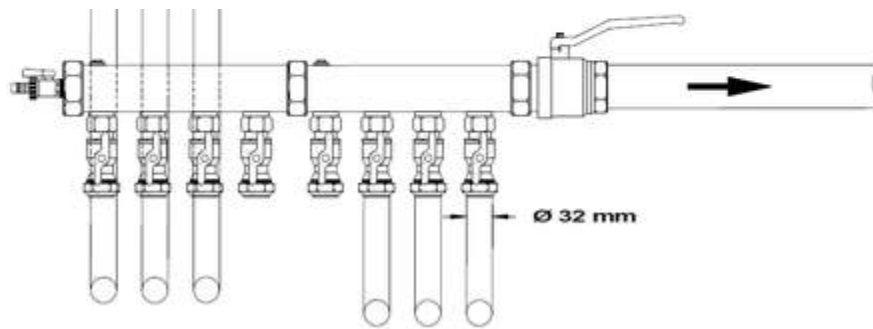


Fig. 3.4: Assembly of brine distributors up to a maximum of 8 circuits

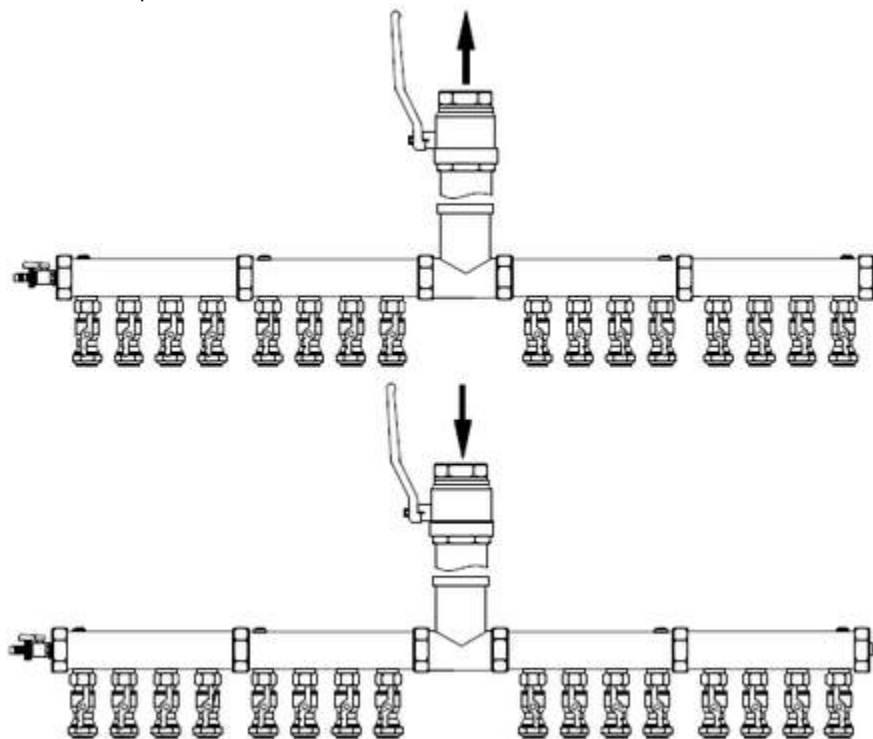
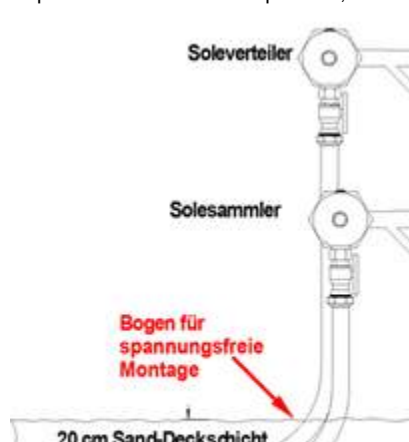


Fig.3.5: Assembly of the brine distributor for a maximum of 16 (2 x 8) circuits

Various points must be observed when installing the brine distributors:

- Mount the brine distributor firmly on a shaft or building wall (e.g. using a wall bracket).
- The collector or probe pipes must be inserted into the manifold from below in a bend free of tension in order to compensate for linear expansion during summer or winter time (tension cracks).
- Ideally, the arch is made using a welding socket.
- Outside the building, the brine distributors should be installed in accessible shafts - protected from rainwater.
- When installing the shaft, it is recommended to cover or support the collector or probe pipes in the ground with an approx. 20 cm thick layer of sand. If an elbow is welded on to compensate for the linear expansion, it should be above ground level.



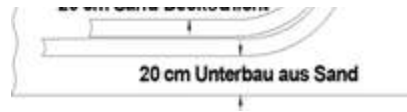


Fig. 3.6: Installation of the pipelines on the brine distributor



Fig. 3.7: Installation of the pipelines with welding on the brine distributor

- If the brine distributors are installed inside a building, they and all pipelines in the house and through the house wall must be insulated so that they are vapor-diffusion-proof in order to prevent condensation.
- For each collector circuit, the collector pipe should not be longer than 100 m, with probe pipes DN 32 a maximum depth of 80 m should not be exceeded - note pressure loss.
- Hand-tighten all screw connections on the brine collector and distributor. Then tighten with a tightening torque of 60 to a maximum of 70 Nm. Do not damage the union nuts when tightening.
- Coat the union nut between the brine distributor or brine collector and the ball valve (compression fitting) with a grease paste to prevent moisture from penetrating.

NOTE

When laying brine circles of the same length, no hydraulic balancing is required (Tichelmann principle).

3.2.5 Installation of the brine circuit

- The individual brine circuits must be hydraulically balanced with one another. Ideally, collector pipe coils of the same length and material properties are laid (Tichelmann principle). Bar regulating valves (e.g. taco-setter) in the individual brine circuits mean an additional pressure loss and thus higher power consumption by the circulation pump in the heat source circuit.
- Each brine circuit must be provided with at least one shut-off valve.
- The brine circles must all be of the same length in order to ensure an even flow and extraction capacity of the brine circles.
- The geothermal collectors should be installed a few months before the heating season if possible so that the ground can settle.
- The minimum bending radii of the pipes according to the manufacturer's specifications must be observed.
- The filling and venting device must be installed at the highest point on the site.
- When laying the brine lines and the intermediate circuit, it must be ensured that no air pockets form.
- All brine pipes (flow and return) in the house and through the house wall must be insulated so that they are vapor diffusion-proof in order to avoid heat and cold losses and to prevent condensation.
- All pipes carrying brine must be made of corrosion-resistant material.
- Brine distributors and return collectors should be installed outside the house.
- When installing the brine circulating pump of the heat source system, the temperature ranges of the pump in the installation instructions must be observed. The position of the pump head must be set so that no condensate can flow into the connection box. If it is installed in a building, it must be insulated so that it is vapor diffusion-proof in order to prevent condensation and ice formation. In addition, soundproofing measures may be necessary.
- The laying distance between pipes carrying brine and water pipes, canals and buildings should be at least 1.2 - 1.5 m in order to avoid frost damage. If this installation distance cannot be maintained for structural reasons, the pipes must be adequately insulated in this area.
- Geothermal collectors must not be built over and the surface must not be sealed.
- The large ventilator with micro-bubble separator should be located at the highest point of the brine circuit. The brine accessories can be installed both inside and outside the building.

NOTE

Due to the design, high-efficiency brine circulating pumps must be installed in a frost-free and dry location.

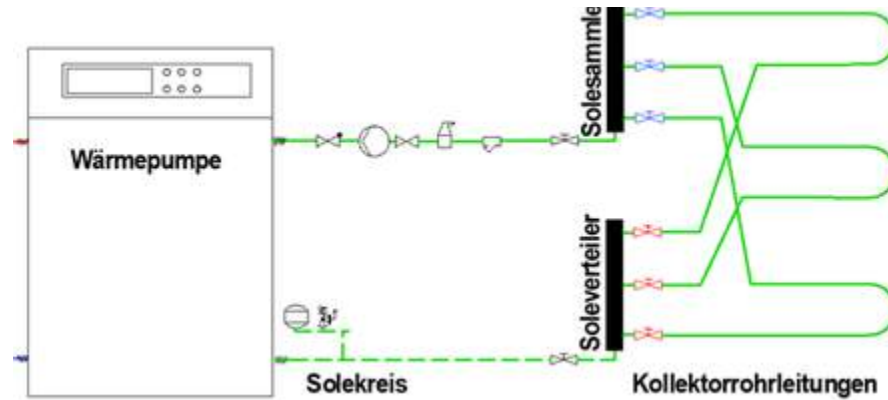


Fig. 3.8: Heat pump circuit on the heat source side

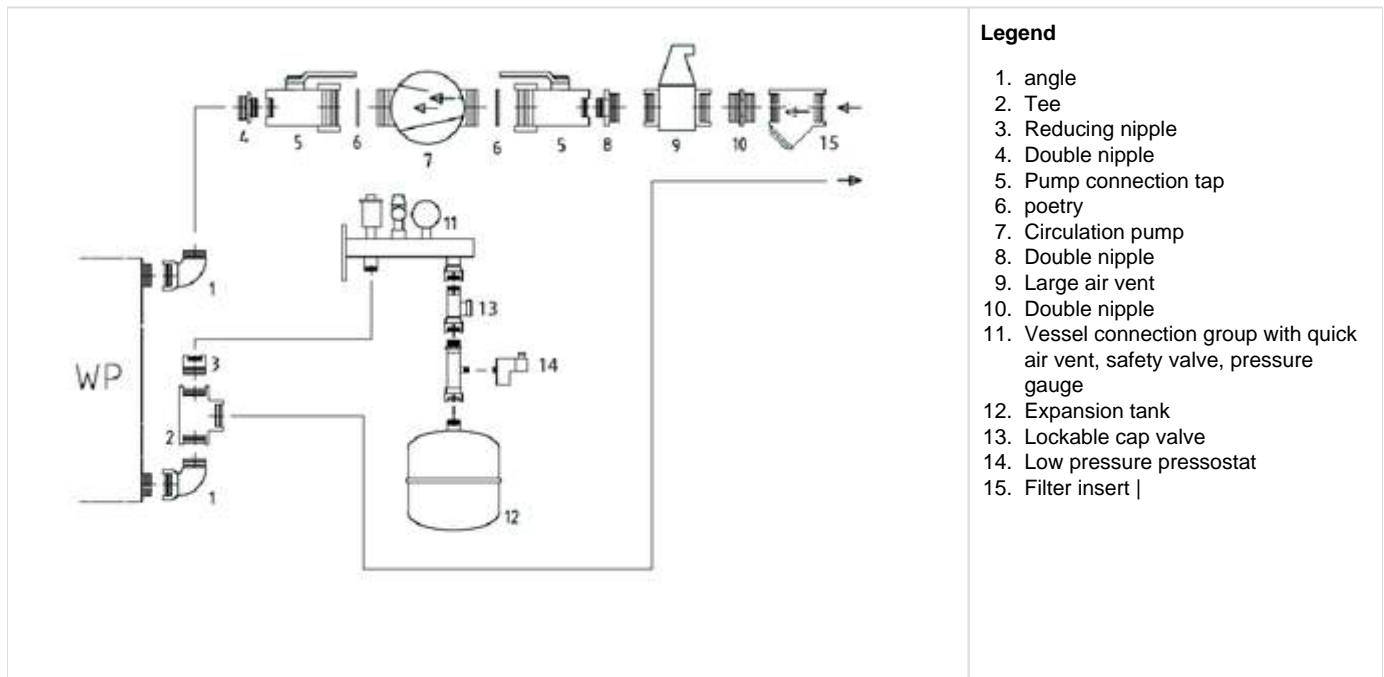


Fig. 3.9: Structure of the brine circuit feed line including fittings

NOTE

All pipe sections and fixtures in the brine circuit must be provided with diffusion-proof, fully glued insulation, as the dew point is not reached here. The functionality of the individual components must not be restricted.

NOTE

The dirt trap included in the scope of delivery of the heat pump (mesh size 0.6 mm) protects the evaporator of the heat pump. This must be installed directly in the pipeline in front of the heat pump and must be cleaned for the first time after the brine circulating pump has flushed for 24 hours.

NOTE

In order to prevent the insulation from becoming damp, insulation materials that cannot absorb moisture should be used. In addition, the joints must be glued in such a way that no moisture can get to the cold side (e.g. brine pipe) of the insulation.

3.2.6 Standard dimensioning of geothermal collectors

The dimensioning table below is based on the following assumptions:

- PE pipe (brine circles): pipe DIN 8074 32 x 2.9 mm - PE 100 (PN 12.5)
- PE supply pipe between heat pump and brine circuit according to DIN 8074:
- Nominal pressure PN 12.5 (12.5 bar)

- specific extraction capacity of the soil approx. 25 W / m² at a laying distance of 0.8 m
- Brine concentration min. 25% to max. 30% antifreeze (glycol-based)
- Pressure expansion vessel: 0.5 - 0.7 bar pre-pressure

NOTE

The design of the brine circulating pumps only applies to line lengths up to a maximum of 100 m and the specified number of brine circuits!

An increase in the number of brine circuits and a shortening of the line lengths are not critical with regard to the pressure losses if all other parameters remain unchanged. If the framework conditions deviate (e.g. specific extraction capacity, brine concentration), a new dimensioning of the permissible total pipe length for the flow and return between the heat pump and brine distributor is required.

The required quantities of antifreeze in Tab.3.2 refer to the specified wall thicknesses. With thinner walls, the amount of water and frost protection must be increased and adjusted so that the minimum brine concentration of 25% by volume is achieved.

ATTENTION

When the heat source system is filled, a larger amount of air enters the pipelines with the brine. It is therefore necessary to rinse the individual collector circuits thoroughly after filling. Rinsing should take place over an open vessel. Check the heat source system, clean the dirt trap and ventilate again if necessary, especially in the initial period after commissioning.

Technical specifications										Perm. Total pipe length for flow and return between HP and SVT								Pressure drops							
Heat pump (WP)	Nominal intake (B0 / W35)	Circulation pump Grundfos	Circulation pump Wilo	Minimum volume flow	Cold performance	Pipe length collector at 20W / m ²	Pressure expansion vessel	Max. Length of brine distributor (SVT)	Brine circuit	32 x 2.9	40 x 3.7	50 x 4.6	63 x 5.7	75 x 6.8	90 x 8.2	110 x 10	125 x 11.4	140 x 12.7	Evaporator	WP-SVT pipe capacity	Brine distributor	collector	Total pressure drop	Total pressure loss	
	kW			m ³ / h	kW	m	l	m		m	m	m	m	m	m	m	m	m	Pa	mWS (100m)	Pa	Pa	Pa	Pa	mWS
SIW 6TES	1.26	UPM Geo 25-85	xx	1.3	4.6	232	8th	20.0	3	20th	45	120							15000	3.7	11100	10,000	7800	43900	4.4
SIW 8TES	1.61	UPM Geo 25-85	xx	1.5	6.2	310	8th	25.0	4th		25th	70							11500	3.7	13875	10,000	7800	43175	4.3
SIW 11TES	2.12	UPMXL Geo 25-125	xx	2.6	8.4	419	12th	15.0	5		15th	75							16000	3.7	8325	10,000	7800	42125	4.2
SIK 6TES	1.24	UPM Geo 25-85	xx	1.1	4.7	233	8th	15.0	3	15th	40	110							10,000	3.7	8325	10,000	7800	36125	3.6
SIK 8TES	1.61	UPM Geo 25-85	xx	1.5	6.2	310	8th	20.0	4th		20th	65							16000	6.2	18600	10,000	7800	52400	5.2
SIK 11TH	2.13	UPMXL Geo 25-125	xx	2.2	8.5	424	12th	10.0	5		10	70							13000	3.7	5550	10,000	7800	36350	3.6
SIK 14TH	2.78	UPMXL Geo 25-125	xx	2.7	10.3	516	18th	20.0	6th		20th	70							13000	4.7	14100	10,000	7800	44900	4.5
SI 6TU	1.30	UPM Geo 25-85	Yonos Para HF 25/10 *	1.5	5.0	250	8th	20.0	3	20th	100								8700	4.7	14100	10,000	7800	40600	4.1
SI 8TU	1.67	UPM Geo 25-85	Yonos Para HF 25/10 *	1.9	6.43	322	12th	10.0	4th	10	35	100							11000	4.7	7050	10,000	7800	35850	3.6
SI 11TU	2.22	UPMXL Geo 25-125	Yonos Para HF 25/10 *	2.6	8.68	434	12th	10.0	5		10	70							14000	3.7	5550	10,000	7800	37350	3.7
SI 14TU	2.78	UPMXL Geo 25-125	Yonos Para HF 25/10 *	3.4	11.12	556	18th	20.0	6th		20th	70							14000	4.7	14100	10,000	7800	45900	4.6
SI 18TU	3.70	Magna Geo 32-100	Yonos Para HF 30/10 *	4.3	13.8	690	18th	60.0	7th		100	300							21500	1.6	14400	10,000	7800	53700	5.4
SI 22TU	5.10	Magna Geo 32-100	Yonos Para HF 30/12 *	5.5	17.97	899	18th	80.0	9		80	270							34000	2.7	32400	10,000	7800	84200	8.4
SIH 9TE	2.02	UPM Geo 25-85	Yonos Para HF 25/10 *	2.3	7.5	375	8th	20.0	4th		20th	65							7500	6.2	18600	10,000	7800	43900	4.4
SIH 11TE	2.44	UPMXL Geo 25-125	Yonos Para HF 25/10 *	3.0	9.0	450	12th	10.0	5		10	70							8000	3.7	5550	10,000	7800	31350	3.1
SIH 20TE	4.86	Magna3 40-120F	Yonos Para HF 30/12 *	5.1	17.0	850	18th	100.0	9		100	300							11000	3.0	45000	10,000	7800	73800	7.4
SI 26TU	5.45	xx	Stratos Para 30 / 1-12	6.5	22.0	1100	18th	100.0	12th		100	300							12000	2.7	40500	10,000	7800	70300	7.0
SI 35TU	7.25	Magna3 32-120F	xx	8.0	28.0	1400	18th	120.0	15th			130	360						20600	2.6	46800	10,000	7800	85200	8.5
SI 50TU	10.45	Magna3 40-120F	xx	12.4	39.0	1950	25th	75.0	20th				75	180					14300	2.2	24750	10,000	7800	56850	5.7
SI 75TU	15.31	Magna3 65-120F	xx	18.3	59.0	2950	40	120.0	32						120	300			32000	1.8	32400	10,000	7800	82200	8.2
SI 90TU	18.50	Magna3 65-120F	xx	17.6	70.0	3500	50	200.0	35						50	200	320		13000	1.3	39000	10,000	7800	69800	7.0
SIH 90TU	18.85	Magna3 65-120F	xx	20.5	70.0	3500	50	200.0	38						50	200	320		18300	1.3	39000	10,000	7800	75100	7.5
SI 130TU	29.50	Magna3 65-150F	xx	27.1	106.4	5320	50	140.0	55								130	280	19300	1.2	25200	10,000	7800	62300	6.2

Reversible heat pumps - with collectors only HEATING !!!

SI 35TUR	7.40	Magna3 32-120F	xx	8.2	27.0	1350	18th	100.0	16									12600	2.6	39000	10,000	7800	69400	6.9
SI 50TUR	10.80	Magna3 40-120F	xx	12.2	37.5	1875	25th	75.0	20th									22500	2.3	25875	10,000	7800	66175	6.6
SI 70TUR	15.90	Magna3 65-120F	xx	17.0	55.0	2750	40	120.0	32									29500	2.0	36000	10,000	7800	83300	8.3
SI 85TUR	18.50	Magna3 65-120F	xx	17.5	69.5	3475	50	180.0	36									20000	1.3	35100	10,000	7800	72900	7.3
SI 130TUR R+	25.83	Magna3 65-150 F*	xx	24.5	85.0	4250	50	150.0	50									21500	1.3	29250	10,000	7800	68550	6.9

* Pump part of "Brine accessory package SZB"

Tab.3.4: Dimensioning table of the brine / water heat pumps for a specific extraction capacity from the ground of 20 W / m² Geothermal collector. (Assumptions: brine concentration 25% by volume of antifreeze, 100 m strand length of the individual brine circuits, pipes made of PE 100 (PN12.5), 32 x 2.9 mm according to DIN 8074 and 8075.

Remarks:

- Collector length 100 m; DN 32 x 2.9
- Volume flow per collector: 0.6 m³/H
- Mixing factor water - glycol: 1.5
- Pressure loss collector: 0.52 mWS (water)
- Pressure loss collector: 0.78 mWS (glycol)
- Extraction power from the ground: 20 W / m²

3.3 Geothermal probes

The most common type of probe, the double U probe, consists of U-shaped pipe loops bundled in pairs. The single U-probes consisting of only one pipe loop and the coaxial probes consisting of an inner and outer pipe are rarer.

In a geothermal probe system, a heat exchanger system is installed in deep boreholes of mostly 20 m to 100 m in the ground. The plastics PE 100, PE 100-RC and PE-X (PE: polyethylene) are used almost exclusively as pipe material.

The most important criteria for a system decision and the preliminary planning are summarized below:

- Geothermal probes up to a drilling depth of 100 m are subject to approval from the lower water authority, drilling depths over 100 m are subject to approval from the mining authority.
- Building over the probe is only permitted for frost-free operation.
- Required access width for the drilling rig: at least 1.5 m for caterpillars or 2.5 m for trucks
- Required work area for drilling rig, rinsing tub, etc. : at least 6 m x 5 m for caterpillars, at least 8 m x 5 m for trucks

However, the exact dimensioning depends on the geological and hydrogeological conditions, which are usually not known to the installer. The execution should therefore be entrusted to a drilling company certified by the international heat pump association or approved according to DVGW W120. In Germany, VDI-4640 sheets 1 and 2 must be taken into account. Boreholes from a depth of 100 m are subject to the mining law BBergG and must be approved in advance by the competent authority.

Earth temperatures

The earth temperature is 10 ° C all year round from a depth of approx. 15 m.

i NOTE

The temperatures in the probe drop as a result of the extraction of heat. The design should be such that there are no permanent brine outlet temperatures below 0 ° C.

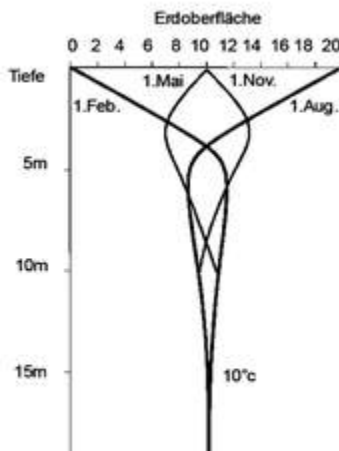


Fig. 3.10: Representation of the temperature profile at different depths of the earth and depending on a seasonal, mean temperature value at the earth's surface

3.3.1 Design of geothermal probes

Geothermal probes are generally designed by planning offices for geothermal energy. An approximate determination of geothermal probes, even in the small power range, is not permitted. This is necessary because the extraction rate depends on the nature of the soil and the water-bearing layers. These factors can only be clarified on site by an executing company.

NOTE

When planning and designing geothermal probes, the legal requirements of the individual countries must be taken into account.

The long-term, computational simulation of load profiles enables long-term effects to be recognized and taken into account in the project planning. For example, using the probe in summer for passive cooling has a positive effect on regeneration.

NOTE

In general, when designing probe systems as a heat source, it must be ensured that the size of the probe system is selected depending on the annual building heat demand. Particular attention is to be paid to this topic in the case of bivalent systems. Usually, the extraction capacity of the probe system is designed for an annual heat pump running time of 1800 to 2400 hours. However, since the runtime of the heat pump increases in bivalent systems, the probe system must also be enlarged accordingly.

3.3.2 Creation of the probe bore

The distance between the individual probes should be at least 6 m so that there is little mutual influence and regeneration in summer is ensured. If several probes are required, they should not be arranged parallel, but transversely to the direction of groundwater flow.

The following additional minimum distances are recommended:

- between probe and buildings: 2 m (the statics must not be impaired).
- between the probe and the pipes carrying water: 2 m to 3 m (differently regulated locally)
- between connecting pipes and pipes carrying water: 1.5 m
- Distances to the neighboring property vary from country to country (recommendation VDI 4640 Part 2, distance between geothermal probes 6 m, distance to the neighbor's probe 10 m, exceptions are possible in coordination with the neighbors).

NOTE

The same rules apply to the brine concentration, the materials used, the arrangement of the distributor shaft, the installation of the pump and the expansion tank as for a geothermal collector system.

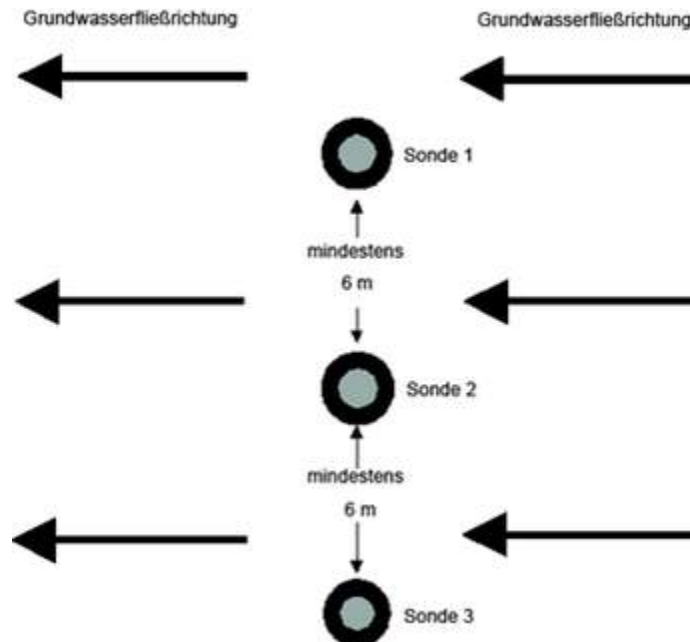


Fig. 3.11: Arrangement and minimum distance of probes depending on the direction of groundwater flow

Fig. 3.12 shows a cross-section through a double U-probe, as it is usually used for heat pumps. With this type of probe, a hole with a radius r_1 created. Four probe pipes and a backfill pipe are inserted into this and the borehole is backfilled with a cement-bentonite mixture. The probe fluid flows down in two probe tubes and up again in the other two. The tubes are connected to a probe base at the lower end, so that a closed probe circuit is created.

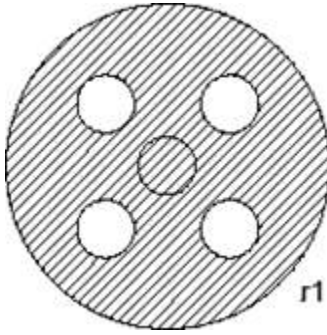


Fig. 3.12: Probe cross-section of a double U probe with a filling pipe

NOTE

When using brine accessories or with heat pumps with an integrated brine circulating pump, the pressure losses of the probe must be determined and compared with the free pressure of the brine circulating pump. In order to avoid unnecessarily large pressure losses, DN 40 pipes should be used from probe depths of more than 80 m.

3.3.3 Filling geothermal probes

As with ground collectors, ground probes are generally filled with a 25 to 30 vol% glycol solution. This means that brine inlet temperatures of -5°C can easily be achieved in the heat pump. The heat pump is protected from freezing due to the glycol content. In some cases, however, it may also be necessary to operate the geothermal probe with pure water without frost protection. In this case, the brine inlet temperature must not fall below 0°C , as otherwise the water in the brine line can freeze and damage it. For this reason, various points must be observed when operating geothermal probes with water:

- Instead of a brine / water heat pump, a water / water heat pump is used
- In this case, the minimum brine outlet temperature must not be less than 4°C
- The transmission performance of the probe is reduced due to the higher temperatures. The number of probes required roughly doubles compared to a soil probe with water-glycol.
- The pre-pressure of the brine expansion vessel must be reduced from 2.5 bar to 0.5 - 0.7 bar.

3.4 Accessories for the ground heat source

3.4.1 Installation instructions for connecting the heat source circuit

Temperatures of below -15°C are sometimes present on the brine pipes when the heat pump is in operation. For this reason, both brine pipes inside the building must be insulated so that they are diffusion-proof, as otherwise condensation would occur.

The wall penetrations into the building should be insulated with well foam or cold-resistant pipe penetrations. All pipe penetrations through walls and ceilings are to be designed with structure-borne noise insulation.

The vibrations caused by the compressor during operation of the heat pump (oscillating movement) are largely compensated for by the internal vibration decoupling. In the case of unfavorable installation conditions, residual vibrations may still occur, which can then be transmitted as structure-borne noise via the pipelines. In this case, wall clamps for fastening the brine piping should not be positioned too close to the heat pump during installation in order to avoid a too rigid connection. Cold pipe clamps also prevent structural damage from condensation. In particularly difficult cases, the installation of expansion joints can help, which are installed as close as possible to the heat pump.

3.4.2 Brine packages and accessories

The following brine accessory packages including a circulation pump are available for using the brine heat source.

Brine Accessory package	Heat pump	Circulation pump
SZB 140E	SI 6TU - SI 14TU	Yonos Para HF 25/10
SZB 180E	SI 18TU	Yonos Para HF 30/10
SZB 220E	SI 22TU / SIH 20TE	Yonos Para HF 30/12
SZB SIW	SIW 6 - SIW 11TH	UPM 25-85 (SIW 6 + 8TES) * UPM 25-125 (SIW 11TES) *

Integrated in the heat pump	SIK 6 - SIK 14TH	UPM 25-85 (SIK 6 + 8TES) * UPM 25-125 (SIK 11 + 14TES) *
SZB 1300E	SI 130TUR +	Magna3 65-150F
SZB 40G-18	SI 26TU	Stratos Para 30 / 1-12 *
SZB 40F-18	SI 35TU / SI 35TUR	Magna3 32-120F *
SZB 65F-25	SI 50TU / SI 50TUR	Magna3 40-120F *
SZB 65F-35	SI 75TU / SI 70TUR	Magna3 65-120F *
SZB 65F-50	SI 90TU / SIH 90TU / SI 85TUR	Magna3 65-120F *
SZB 80F-50	SI 130TU	Magna3 65-150F *

Tab.3.5: Brine accessory packages for various heat pumps

* Included in the scope of delivery of the heat pump

3.4.3 Pump assignments for 2-compressor brine / water heat pumps

Brine / water heat pump		SI26TU	SI35TU	SI35TUR	SI50TU	SI50TUR	SI70TUR
Producer group							
Nominal connection size	customs	G 1 ½ "AG	G 1 ½ "AG	G 1 ½ "AG	Rp 1 ½ "	Rp 2 ½ "	Rp 2 ½ "
Heating water Throughput V_{HW}	m³ / h	4.4	6.0	5.7	8.6	8.4	12.0
Pressure loss p_{HW}	Pa	7500	9800	9700	5200	5000	12600
Pump M16		Stratos Para 30 / 1-12	Stratos Para 30 / 1-12	Stratos Para 30 / 1-12	Stratos Para 30 / 1-12	Magna3 40-80 F.	Magna3 40-80 F.
Installation length	mm	180	180	180	220	220	220
signal	0-10V PWM	0-10V	0-10V	0-10V	0-10V	0-10V	0-10V
free compression f_P	m	11.2	9.0	9.2	5.8	5.3	3.8
Pump M16	Art.-Des. GDD	PP 32-100G	PP 32-100G	PP 32-100G	PP 32-100G	PP 40-80F	PP 40-80F
Heat source circuit							
Nominal connection size	customs	G 1 ½ "AG	G 1 ½ "AG	G 1 ½ "AG	Rp 2 ½ "	Rp 2 ½ "	Rp 2 ½ "
Brine throughput V_{BW}	m³ / h	6.5	8.0	8.2	12.4	12.2	17.0
Pressure loss p_{BW}	Pa	12000	20600	12600	14300	22500	29500
Pump M11		Stratos Para 30 / 1-12	Magna3 32-120 F	Magna3 32-120 F	Magna3 40-120 F	Magna3 40-120 F	Magna3 65-120 F
Installation length	mm	180	220	220	250	250	340
signal	0-10V PWM	0-10V	0-10V	0-10V	0-10V	0-10V	0-10V
free compression f_P	m	8.2	7.0	5.4	7.0	4.3	6.5
Pump M11	Art.-Des. GDD	PP 32-100G	PP 32-120F	PP 32-120F	PP 40-120F	PP 40-120F	PP 65-120F
Brine / water heat pump		SI75TU	SIH90TU	SI90TU	SI 85TUR	SI130TU	
Producer group							
Nominal connection size	customs	Rp 2 "	Rp 2 "	R 2 ½ "	Rp 2 ½ "	R 2 ½ "	
Heating water flow rate V_{HW}	m³ / h	12.4	15.5	15.0	14.8	16.0	
Pressure loss p_{HW}	Pa	13200	15100	11000	14000	15000	

Pump M16		Magna3 40-80 F	Magna3 50-120F	Magna3 65-80F	Magna3 65-80F	Magna3 65-80F	
Installation length	mm	220	280	340	340	340	
signal	0-10V PWM	0-10V	0-10V	0-10V	0-10V	0-10V	
free compression fP	m	3.5	6.5	6.1	5.2	5.4	
Pump M16	Art.-Des. GDD	PP 40-80F	PP 50-120F	PP 65-80F	PP 65-80F	PP 65-80F	
Heat source circuit							
Nominal connection size	customs	Rp 2 ½ "	Rp 3 "	R 2 ½ "	Rp 2 ½ "	R 3 "	
Brine throughput V_{BW}	* m³ / h *	18.3	20.5	20.0	20.5	31.5	
Pressure loss P_{BW}	Pa	32000	18300	19000	20000	35000	
Pump M11		Magna3 65-120 F	Magna3 65-120 F	Magna3 65-120 F	Magna3 65-120 F	Magna3 65-150 F	
Installation length	mm	340	340	340	340	340	
signal	0-10V PWM	0-10V	0-10V	0-10V	0-10V	0-10V	
free compression fP	m	6.0	7.0	7.0	6.9	7.5	
Pump M11	Art.-Des. GDD	PP 65-120F	PP 65-120F	PP 65-120F	PP 65-120F	PP 65-150F	

Tab.3.6: Overview table of the 2-compressor brine / water heat pumps with generator circuit and brine circulating pumps for B7 / W35 for standard systems (included in the delivery of the heat pump)

3.4.4 Brine accessory packages for 2-compressor brine / water heat pumps PP 65-80F

Brine accessory package SZB	Art.-Des. SZB	40G-18	40F-18	65F-25	65F-35	65F-50	80F-50
Expansion tank	liter	18 liters	18 liters	25 liters	35 liters	50 liters	50 liters
Pump (separate)	Nominal size	G2 "	DN 32F	DN 40F	DN 65F	DN 65F	DN 65F
Heat pump	Nominal size	G 1 1/2 "	G 1 1/2 "	Rp 2 1/2 "	Rp 2 1/2 "	Rp 2 1/2 "	Rp 3 "
ventilator	Nominal size	1 1/2 "	1 1/2 "	DN 50F	DN 65F	DN 65F	DN 80F
Barrier	Nominal size	1 1/2 "	1 1/2 "	DN 50F	DN 65F	DN 65F	DN 80F
SMF (separate)	Nominal size	1 1/2 "	1 1/2 "	2 1/2 "	2 1/2 "	2 1/2 "	3 "

Tab.3.7: Overview table of the brine accessory packages for 2-compressor brine / water heat pumps

NOTE

The brine accessory packages SZB 40G-18 to SZB 80F-50 contain an electronically controlled brine circulating pump that can / must be controlled by the heat pump manager via a 0-10 V signal.

ATTENTION

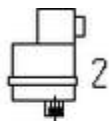
For geothermal probes, the free pressures specified in the device information must be observed (max. Probe depth for DN 32 is 80 m).

Brine deficiency and leakage

In order to detect a possible lack of fluid or a leak in the brine circuit or to meet official requirements, the "low-pressure pressostat brine", available as a special accessory, can be installed in the brine circuit. Heat pump locks.

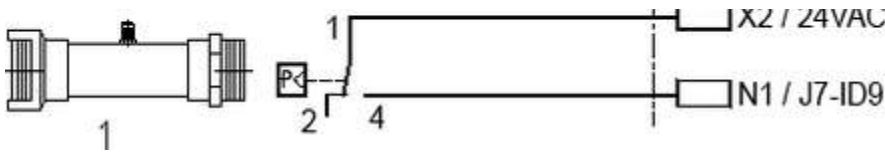
NOTE

The low-pressure pressostat must be type-tested in accordance with AwSV and TRwS 779.



Kontaktstellung bei
befülltem Solekreis

Regler WP



1. Pipe section with internal and external thread
2. Pressostat with plug and plug seal

Fig.3.13: Low pressure pressostat brine (structure and interconnection)

⚠ ATTENTION

The expansion vessels contained in the brine package are designed for double U-probes. When using other technologies to develop the ground heat source (e.g. Geokoax probes), the probe volume can be significantly larger. In this case, the expansion vessel must be recalculated.

The pre-pressure of the brine expansion vessel must be reduced from 2.5 bar to 0.5 - 0.7 bar.

The pipe section shown in the sketch is to be installed between the cap valve and the expansion vessel in the brine circuit. The pressure switch is to be connected to the connecting piece on the pipe section. Thanks to the lockable cap valve, the low-pressure pressostat can be easily installed or removed and its function checked. When checking the function of the low-pressure pressostat, keep the drain cock open until the pressostat blocks the heat pump manager and thus the heat pump via a digital signal due to the pressure drop in the brine circuit. Catch the brine in a suitable container. If the low-pressure pressostat does not block the heat pump when there is a visible drop in pressure, the sensor must be checked for function and, if necessary, replaced. After completing the check, fill the brine circuit again with the collected brine liquid. Then check the brine circuit for leaks and the heat pump for its function.

3.5 Other heat source systems for geothermal energy use

As an alternative to geothermal collectors, other types of heat source systems such as geothermal baskets, trench collectors, energy piles, spiral collectors, etc. are also offered. These heat source systems must be designed in accordance with the manufacturer's or supplier's specifications. The manufacturer must guarantee the long-term functioning of the system in accordance with the following information:

- Minimum permissible brine temperature
- Cooling capacity and brine throughput of the heat pump used
- Operating hours of the heat pumps per year

In addition, the following information must be provided:

- Pressure loss at the specified brine throughput for the design of the brine circulating pump
- Possible influences on the vegetation
- Installation regulations

📘 NOTE

Experience shows that the extraction performance of classic geothermal collectors differs only insignificantly from other systems, since the 1 m³ Energy stored in the ground is limited to approx. 50 to 70 kWh / a.

Possible optimization of the extraction performance depends primarily on the climatic conditions and the type of soil and not on the type of heat source system.

3.6 Heat source water with intermediate heat exchanger

3.6.1 Development of water as a heat source in the event of contamination

For indirect use of the water heat source, brine / water heat pumps can be operated via an intermediate circuit with an additional stainless steel heat exchanger. For this purpose, an additional heat exchanger is installed in the heat source circuit of the heat pump and the intermediate circuit is filled with monoethylene glycol.

The external stainless steel heat exchanger makes it possible to use the groundwater heat source even in areas with heavier water pollution. In areas with a year-round water temperature below 13 ° C, no water analysis for corrosion is necessary.

⚠ ATTENTION

If the limit values for iron (Fe up to 0.2 mg / l) or manganese (Mn up to 0.1 mg / l) are exceeded, there is a risk of the heat source system becoming clogged. This also applies to the use of stainless steel heat exchangers.



NOTE

Under www.dimplex.de/betriebskostenrechner an online planner is available which enables the annual performance factor including the intermediate heat exchanger to be calculated.

There are various package solutions available, consisting of a heat pump, heat exchanger, suitable brine accessories and a safety thermostat to protect the heat pump from freezing. In this case, the heating output of the heat pumps is specified differently at operating point B7 / W35. This corresponds to a brine inlet temperature of 7 ° C with an assumed water temperature of 10 ° C and a gradient or spread over the heat exchanger of 3 K.

Order reference	Heat pump	Heat exchanger	Brine accessories	Brine pump	Heating capacity with B7 / W35	COP at B7 / W35
WSI 27TU	SI 22TU	WTE 20	ZKP 40G-18	Stratos Para 30 / 1-12	27 kW	5.1
WSI 32TU	SI 26TU	WTE 30	ZKP 40G-18	Stratos Para 30 / 1-12	32 kW	5.1
WSI 45TU	SI 35TU	WTE 40	ZKP 40F-18	Magna3 40-80F	45 kW	5.2
WSI 65TU	SI 50TU	WTE 50	ZKP 65F-25	Magna3 65-80F	65 kW	4.9
WSI 90TU	SI 75TU	WTE 75	ZKP 65F-25	Magna3 65-100F	90 kW	5.1
WSI 110TU	SI 90TU	WTE 100	ZKP 65F-25	Magna3 65-100F	110 kW	5.1
WSI 150TU	SI 130TU	WTE 130	ZKP 80F-25	Magna3 65-150F	150 kW	5.0
WSIH 26TE	SIH 20TE	WTE 20	SZB 220E	Yonos Para HF 30/12	26 kW	5.0
WSIH 110TU	SIH 90TU	WTE 100	ZKP 80F-25	Magna3 65-100F	110 kW	5.1
WSI 40TUR	SI 35TUR	WTE 40	ZKP 40F-18	Magna3 40-80F	42 kW	5.5
WSI 65TUR	SI 50TUR	WTE 50	ZKP 65F-25	Magna3 65-80F	58 kW	5.4
WSI 85TUR	SI 70TUR	WTE 75	ZKP 65F-25	Magna3 65-100F	85 kW	5.2
WSI 110TUR	SI 85TUR	WTE 100	ZKP 65F-25	Magna3 65-100F	98 kW	5.4

Tab.3.8: Heat pump packages with intermediate heat exchanger

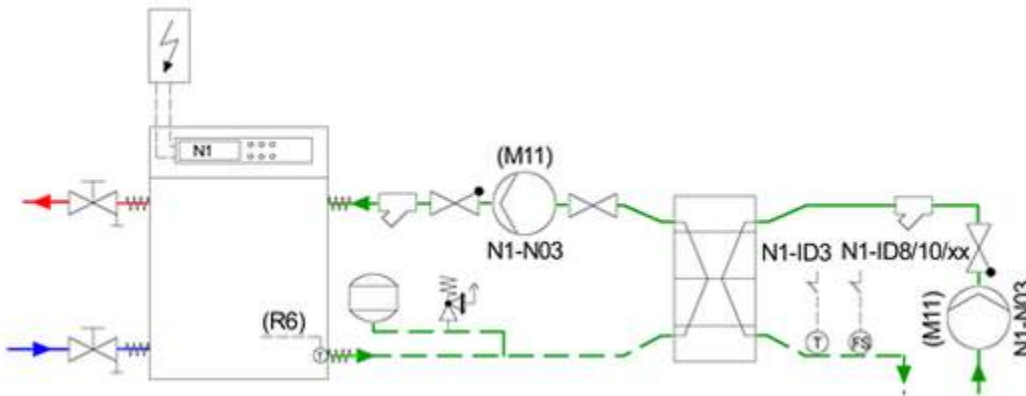


Fig.3.14: Heat pump with intermediate heat exchanger

The flow switch in the primary circuit (FS) prevents the heat pump from being switched on if there is no volume flow from the cooling or groundwater pump.

In the case of brine / water heat pumps, the intermediate heat exchanger circuit must be filled with antifreeze (at least -14 ° C).

The brine circuit is to be designed in the same way as with conventional ground collectors or geothermal probes with a circulation pump and safety fittings. The circulation pump must be dimensioned so that it does not freeze in the intermediate heat exchanger.

When using a brine / water heat pump, temperatures below 0 ° C can occur in the secondary circuit. To protect the intermediate heat exchanger, it must be protected by an additional frost protection thermostat (T). This must be installed at the water outlet of the primary circuit in order to reliably prevent the heat exchanger from freezing. When the thermostat is switched off, the heat pump is blocked via the digital input ID3 of the heat pump manager. The thermostat should also be passed on as a fault message to any existing building management system in order to prevent the heat pump from cycling. The switch-off point of the thermostat (e.g. 4 ° C) depends on the on-site system configuration, the measurement tolerances and hysteresis.

The maximum permissible flow temperatures on the heat source side of a brine / water heat pump are 25 ° C. To prevent the heat pump from switching off due to excessive brine inlet temperatures, there are various options that are described in the following chapter.

ATTENTION

The terminal assignment of the heat pump manager in the respective installation instructions must be observed!

NOTE

When using a brine / water heat pump with an intermediate heat exchanger, the water throughput in the primary circuit must be at least 10% higher than that in the secondary circuit.

3.6.2 Extension of the temperature range

If the temperature of the heat source fluctuates, the use of a brine / water heat pump is recommended, as minimum brine outlet temperatures of -9°C are possible here. In comparison, water / water heat pumps switch off at a minimum water outlet temperature of 4°C . The maximum brine inlet temperature for both brine / water and water / water heat pumps is 25°C . Exceeding or falling below the application limits can be prevented in various ways.

NOTE

The brine / water heat pumps SI 26-75TU can also be operated with higher brine temperatures. Further information can be found in the device information for the respective heat pump.

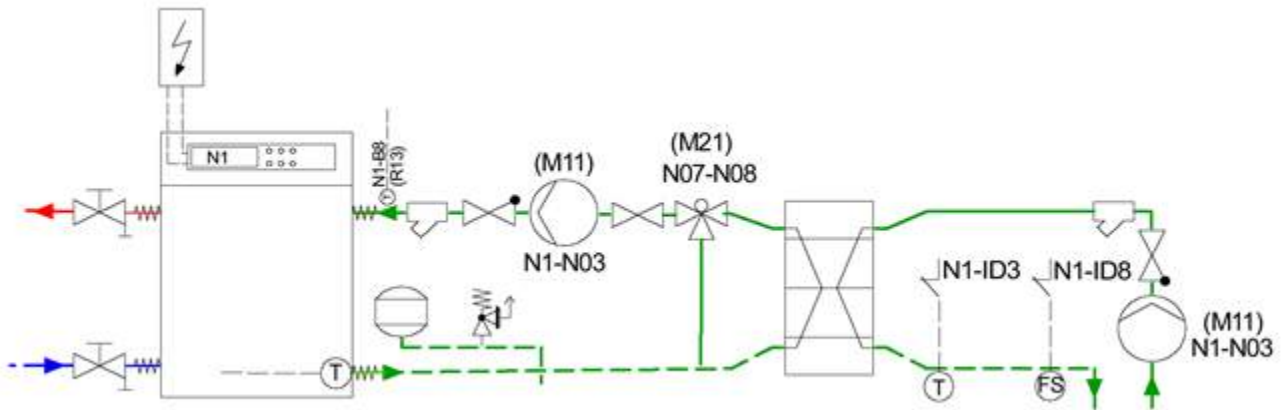


Fig.3.15: Heat pump with thermostatically controlled 3-way valve in the brine circuit M21 (to be provided by the customer)

Variant 1 - heat pump with 3-way valve

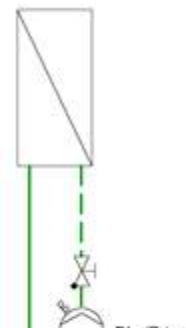
A thermostatically controlled 3-way valve is installed in the brine circuit. If the brine inlet temperature rises above 25°C , a partial volume flow of the brine return flow is added to the brine flow via the mixer. The mixer is controlled by an external control.

Variant 2 - heat pump with buffer storage in the brine circuit

Variant 2 provides for the use of a buffer storage tank in the brine circuit (see Fig. 3.16 on p. 22). The buffer storage tank is loaded by means of an external control system via pump P1. From a minimum temperature of 3°C in the buffer tank, the pump is activated and loads it. Pump P1 switches off when the temperature reaches a maximum of 24°C . The heat source pump (primary circulation pump M11) in the brine circuit is controlled by the heat pump manager. If a temperature of 3°C below or a temperature of 25°C is reached on the temperature sensor (R6), the heat pump manager switches off the heat source pump. The brine circuit must be filled with glycol with at least 25% by volume.

NOTE

If the brine temperatures in the buffer storage tank and in the pipelines are low, condensate can form on the buffer storage tank. For this reason, this must be provided with diffusion-proof insulation on site.



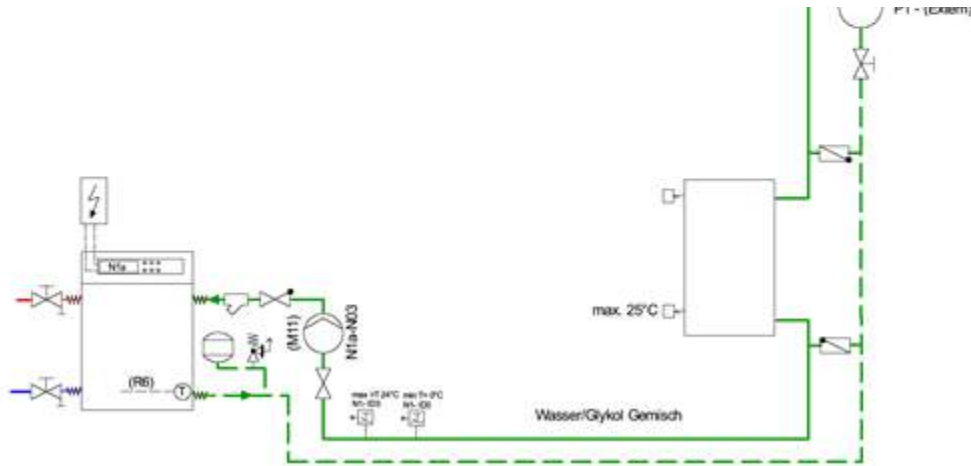


Fig.3.16: Heat pump with buffer storage in the brine circuit

NOTE

When using a steel buffer storage tank (ST 37) in connection with an antifreeze, this must be provided with corrosion protection inhibitors.

3.7 Heat source absorber systems (indirect use of air or solar energy)

Temperature range of the brine	-15 ... + 50 ° C
Area of application of the brine / water heat pump	+5 ... + 25 ° C

Availability

Restrictions due to weather influences and limited areas possible.

Possibility of use

- bivalent
- monovalent in combination with an additional geothermal collector

Development effort

- Absorber system (energy roof, pipe register, massive absorber, energy fence, energy tower, energy stack, etc.)
- Brine based on ethylene glycol or propylene glycol in frost-proof concentration
- Piping system and circulation pump
- Construction work

Pay particular attention to:

- structural requirements
- Weather influences

Dimensioning of absorber systems

When it comes to the dimensioning of roof absorbers, energy columns or fences, the individual constructions differ considerably, so that basically the information guaranteed by the manufacturer must be used for the design.

As practice shows, however, the following data can be used as a basis:

- The design of the absorber surface should in principle be based on the specified night performance of the absorber.
- At air temperatures above 0 ° C, rain, condensation or snow can freeze on the absorber surface at low brine temperatures, which negatively affects the flow of heat.
- Monovalent operation is only possible in combination with the use of geothermal energy.
- With solar energy gains in the transition period, brine temperatures of 50 ° C and more occur, which exceed the application range of the heat pump.

ATTENTION

If the heat source temperature can rise above 25 ° C, a temperature-controlled mixer must be provided which, at temperatures above 25 ° C, mixes a partial volume flow of the cooling water return with the cooling water supply. (see chapter "Extension of the temperature range")

Brine concentration

In the case of roof absorbers, energy fences, etc., a frost protection of $-25\text{ }^{\circ}\text{C}$ is required due to the low outside temperatures. The brine concentration in this system is 40%. With increasing brine concentration, increased pressure losses must be taken into account when designing the brine circulating pump.

Filling the system:

The system is filled as described in the "Brine fluid" chapter.

Design of the expansion vessel:

When the absorber is operated exclusively, the brine temperatures fluctuate between approx. $-15\text{ }^{\circ}\text{C}$ and approx. $+50\text{ }^{\circ}\text{C}$. Due to these temperature fluctuations, an expansion vessel is required in the heat source system. The form is to be adapted to the height of the system. The maximum overpressure is 2.5 bar.

Air-loaded absorber

Brine concentration:	approx. 40%
Relative pressure loss	approx 1.8

NOTE

When commissioning by customer service and an antifreeze content of 30% monoethylene glycol, the lower operating limit can be extended to $-10\text{ }^{\circ}\text{C}$.

4 chapter	5 chapter	6 chapter	7 chapter	8 chapter
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Chapter 4 - Water-to-water heat pump

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 - 4.1.1 Dimensioning information - heat source water
 - 4.1.2 Development of the heat source groundwater
 - 4.2 Water quality requirements
 - 4.3 Development of the heat source
 - 4.3.1 Direct use of water of consistently good quality
 - 4.3.1.1 Heat source groundwater
 - 4.3.1.2 Heat source waste heat from cooling water
 - 4.3.2 Indirect use of water as a heat source
 - 4.3.3 Planning recommendation groundwater / intermediate circuit heat exchanger
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4 water / water heat pumps

4.1 Groundwater as a heat source

If the appropriate boundary conditions exist, the thermal energy generation via the groundwater can represent a very efficient form of thermal use of the subsoil for heating and / or cooling purposes. When planning, building and operating well systems for thermal use of the subsoil, the water law requirements and the respective country-specific regulations must be observed. For thermal use, with a view to the efficiency of the system as well as groundwater protection, groundwater near the surface with a free groundwater level (same groundwater-bearing layer) should primarily be used.

When using deeper groundwater levels, special protective measures are required. The planning and execution of well systems must be carried out by relevant planning offices or appropriately qualified specialist companies in the well construction trade. The recommendations of guideline VDI 4640 Part 2 must be observed here. Information about the productivity of the groundwater stock and the chemical composition of the groundwater is absolutely essential. A test borehole, which can later be converted into a well, is recommended for assessment. The manufacturer's recommendations for the quality of the well water must be observed (see Section 4.2). If the water quality does not meet the manufacturer's specifications, either a heat pump model with a suitable evaporator (stainless steel heat exchanger) or an intermediate circuit with a screwed stainless steel plate heat exchanger (see Section 3.6 and Section 4.3.4) can be used. The evaporator must be protected from frost damage, for example by means of temperature monitoring or an intermediate circuit that is operated with an anti-freeze mixture. The manufacturer's specifications are to be observed. The intermediate circuit requires additional energy to operate the brine pump and reduces the heat source temperature by around 3 K, which leads to a reduced coefficient of performance.

For small systems, groundwater is a rather difficult heat source to assess if there is no experience with systems in the immediate vicinity, because the effort for a test borehole is very high. The test hole cannot be used if it is unsuitable. For large systems, the costs for a test borehole and for a pumping test are of lesser importance; greater depths (up to 50 m) are economically justifiable here. The most important criteria for a system decision and preliminary planning are summarized below:

- Approval according to the Water Management Act (WHG) by the lower water authority
- Distance between suction and suction wells: at least 15 m in the direction of flow of the groundwater flow
- Recommended minimum distance between boreholes and existing buildings: 2 m
- The stability of buildings must not be endangered.

Temperature range of the groundwater	7 ... 12 ° C
Area of application of the water / water heat pump	7 ... 25 ° C
Guide value for the amount of water required	min. 2 m ³ / h for 10 kW heating capacity or min. 220 l / h for 1 kW evaporator output

Availability

- All year round

Possibility of use

- monovalent
- monoenergetic
- bivalent (alternative, parallel, partially parallel)
- bivalent regenerative

Development effort

- Approval procedure (lower water authority)
- Delivery wells / absorption wells with airtight closure of the well heads
- Water quality (water analysis)
- Piping system
- Well pump
- Earthworks / construction work

Maintenance instructions In order to be able to guarantee safe operation of the heat pump, it must be serviced at regular intervals. The following work can also be carried out without special training:

- Cleaning the inside of the heat pump
- Cleaning the primary circuit (dirt trap, particulate filter, ...)

In addition, the tightness of the heat pump and the functionality of the refrigerant circuit must be checked at regular intervals.

NOTE

Further information and country-specific standards for leak testing heat pumps can be found at www.glendimplex.de/wartungsvertraege.

NOTE

Further information on the maintenance of heat pumps can be found in the installation instructions for the heat pump.

Work on refrigerant-carrying components may only be carried out by appropriately trained and instructed personnel.

4.1.1 Dimensioning information - heat source water

The heat source of the water / water heat pump must be designed for the cooling capacity of the heat pump. This can be calculated from the heating power minus the electrical input power of the heat pump in the design point. The basic rule for the heat source is that the power Q transferred to the heat pump's evaporator Q_0 must provide. The following applies: Evaporator output Q_0 (kW_{th}) = Heating capacity Q_C (kW_{th}) - electrical power consumption of the compressor P_{el} (kW_{el})

NOTE

A heat pump with a higher coefficient of performance has a lower electrical power consumption and thus a higher cooling capacity with a comparable heating output.

When replacing an old heat pump with a newer model, the output of the heat source must therefore be checked and, if necessary, adjusted to the new cooling output.

Dimensioning the well pump

The water volume flow depends on the performance of the heat pump and is conveyed by the well pump. Depending on the output, the mass flow should be selected so that at the lowest heat source temperature (7 °C) there is a temperature spread across the evaporator of 2 - 3 Kelvin. The water throughput specified in the device information of the heat pump corresponds to a temperature spread of the heat source of approx. 3 K. In addition to the volume flow, the pressure losses in the well system and the technical data of the pump manufacturer must be taken into account. In doing so, pressure losses in pipelines, internals and heat exchangers connected in series must be added.

ATTENTION

When designing the well pump, note the back pressure ** in the delivery well in order to avoid bearing damage to the well pump. The decisive factor for the design of the well pump is the height of the water level in the well and not the depth at which the well pump is located!

** The back pressure corresponds to the free compression of the well pump at the operating point minus the pressure difference between the highest point of the well system and the water level (level) in the well (manometer).

Temperature difference heat source groundwater

The Water Management Act (WHG) defines the difference between the inlet and outlet temperature of a water / water heat pump. These values are defined as follows:

- Permissible change in temperature of the water to be introduced compared to the extraction temperature of the groundwater: +/- 6 K
- Minimum temperature of the water to be introduced: 5 °C
- Maximum temperature of the water to be introduced: 20 °C

4.1.2 Development of the heat source groundwater

From a well depth of 8 to 10 m, the groundwater heat source is suitable for monovalent heat pump operation, as this only shows slight temperature fluctuations (7-12 °C) all year round. In principle, the approval of the responsible water authority must be available for heat extraction from groundwater. It is generally issued outside of water protection zones, but is tied to certain conditions, such as a maximum withdrawal quantity or a water analysis. The amount withdrawn depends on the heating output. For the operating point W10 / W35, Table 4.1 contains the required withdrawal quantities. The planning and construction of the well system with delivery and absorption wells should be entrusted to a drilling company certified by the international heat pump association with a seal of approval or approved according to DVGW W120. In Germany, VDI 4640 sheets 1 and 2 must be taken into account.

Heat pump	Stainless steel spiral heat exchanger	Well pump (recommended for standard)	Circulation pump with poor water quality and use of an intermediate circuit with plate heat exchanger	Pressing well pump ²	Cold water throughput heat pump	Heat pump heating output	Heat pump cooling capacity	Evaporator or pressure loss	Well diameter from	Motor protection
				bar	m ³ /H	kW	kW	Pa	customs	A.
WI 10TU	x	UWE 200-95	not mandatory ¹	1.55	2.2	9.6	8.0	6200	4th	1.4
WI 14TU	x	Grundfos SP 3A-3	not mandatory ¹	1.4	3.1	13.3	11.1	14000	4th	1.4
WI 18TU	x	Grundfos SP 5A-3	not mandatory ¹	1.5	4.0	17.1	14.2	15200	4th	1.4
WI 22TU	x	Grundfos SP 5A-3	not mandatory ¹	1.2	5.3	22.3	18.5	21400	4th	1.4
WI 35TU		Grundfos SP 8A-3	WSI 32TU (SI 26TU with Stratos Para 30 / 1-12)	1.3	8.2	35.6	30.0	22000	4th	on site
WI 45TU		Grundfos SP 14A-3	WSI 45TU (SI 35TU with Magna3 40-80F)	1.7	10.0	46.2	38.0	37000	4th	on site
WI 65TU		Grundfos SP 14A-3	WSI 65TU (SI 50TU with Magna3 65-80F)	1.15	16.0	68.5	58.0	25,000	6th	on site
WI 95TU		Grundfos SP 30-2	WSI 90TU (SI 75TU with Magna3 65-100F)	1.75	23.2	99.0	82.0	55000	6th	on site
WI 120TU		Grundfos SP 30-2	WSI 110TU (SI 90TU with Magna3 65-100F)	1.54	27.7	118.5	98.3	21500	6th	on site
WIH 120TU		Grundfos SP 30-2	WSIH 110TU (SIH 90TU with Magna3 65-100F)	1.55	28.1	122.5	100.0	30800	6th	on site
WI 180TU		Grundfos SP 46-2	WSI 150TU (SI 130TU with Magna3 65-150F)	1.7	42.1	177.0	144.5	41500	8th	on site

¹ Stainless steel spiral heat exchanger as standard! ² Pay attention to the counter pressure of the well system in order to avoid bearing damage to the well pump!

Tab.4.1: Dimensioning table of the minimum required well pumps for water / water heat pumps for W10 / W35 for standard systems with closed wells. The final definition of the well pump must be made in consultation with the well builder.

NOTE The motor protection switch built into the WI 10 - WI 22TU heat pumps must be set to the nominal data of the well pump used during installation.

ATTENTION If another well pump is used in the WI 10 - WI 22TU heat pumps, the motor protection switch must be checked on site and replaced if necessary.

4.2 Water quality requirements

Regardless of the legal regulations, the groundwater must not contain any settable substances and the iron (<0.20 mg / l) and manganese (<0.10 mg / l) limit values must be observed in order to prevent the heat source system from becoming clogged. Experience shows that soiling with grain sizes over 1 mm, especially with organic components, can easily lead to damage. Rainy material (fine sand) does not settle if the specified water flow rates are adhered to. The dirt trap included in the scope of delivery of the heat pump (mesh size 0.6 mm) protects the evaporator of the heat pump and must be installed directly at the inlet of the heat pump.

ATTENTION The finest, colloidal contaminants, which lead to clouding of the water, often have a sticky effect, can cover the evaporator and thereby impair the heat transfer. These contaminants cannot be removed by filters with an economically justifiable expense.

The use of surface water or salty waters is not permitted. Initial information about a possible use of the groundwater can be obtained from the local water supply company.

1. Water / water heat pumps with welded stainless steel spiral heat exchanger (Tab.4.1)

A water analysis regarding corrosion of the evaporator is not necessary if the annual mean temperature of the groundwater is below 13 °

C. In this case, only the limit values for iron and manganese have to be complied with (oher formation). At temperatures above 13 ° C (e.g. waste heat recovery), a water analysis must be carried out in accordance with Tab.4.2 and the resistance of the stainless steel evaporator of the heat pump must be verified. If one characteristic is negative "-" or two characteristics are "0" in the "Stainless steel" column, the analysis is to be assessed as "Negative".

- Water / water heat pumps with copper-brazed stainless steel plate heat exchangers** Irrespective of the legal provisions, a water analysis according to Tab. 4.2 must be carried out in order to prove the resistance for the copper-soldered evaporator of the heat pump. If one characteristic is negative "-" or two characteristics are "0" in the "Copper" column, the analysis is to be assessed as "Negative".

NOTE If the required water quality is not achieved or if this cannot be guaranteed over the long term, we recommend using a brine / water heat pump with an intermediate circuit.

Assessment criterion	Concentration range (mg / l)	copper	Stainless steel > 13 ° C	Assessment criterion	Concentration range (mg / l)	copper	Stainless steel > 13 ° C
settable substances (organic)		0	0	oxygen	<2 > 2	+ 0	+ +
ammonia NH3	<2 2 to 20 > 20	+ 0 -	+ + 0	Hydrogen sulfide (H2S)	<0.05 > 0.05	+ -	+ 0
chloride	<300 > 300	+ 0	+ 0	HCO ₃ ⁻ / SO ₄ ²⁻	<1 > 1	0 +	0 +
electr. conductivity	<10 µS / cm 10 to 500 µS / cm > 500 µS / cm	0 + -	0 + 0	Hydrogen carbonate (HCO ₃ ⁻)	<70 70 to 300 > 300	0 + 0	+ + 0
Iron (Fe) dissolved	<0.2 > 0.2	+ 0	+ 0	Aluminum (Al) dissolved	<0.2 > 0.2	+ 0	+ +
free (aggressive) carbon dioxide	<5 5 to 20 > 20	+ 0 -	+ + 0	SULPHATES	up to 70 70 to 300 > 300	+ 0 -	+ + 0
MANGAN (Mn) released	<0.1 > 0.1	+ 0	+ 0	SULPHITE (SO ₃), free	<1	+ 0	+ +
NITRATES (NO ₃) solved	<100 > 100	+ 0	+ +	Chlorine gas (Cl ₂)	<1 1 to 5 > 5	+ 0 -	+ + 0
PH value	<7.5 7.5 to 9 > 9	0 + 0	0 + +				

Tab 4.2: Resistance of copper-brazed or welded stainless steel plate heat exchangers to water constituents "+" normally good resistance; "0" Corrosion problems can arise, especially if several factors are rated with 0; "-" should not be used; [<less than,> greater than]

NOTE Regularly check the well system for incrustations, clogging and deposits, take countermeasures if necessary.

Even if the limit values for the water quality specified in Table 4.2 are adhered to, constant deposits of iron, manganese and lime can impair the performance of the heat pump, up to and including complete failure of the well and heat pump system. Therefore, the well system must be checked regularly and, if necessary, the well pump system cleaned.

4.3 Development of the heat source

4.3.1 Direct use of water of consistently good quality

Water with temperatures between 7 ° C and 25 ° C can be used directly with a water / water heat pump if the compatibility of the groundwater, cooling water or wastewater has been proven according to Tab. 4.2. In the event of a negative assessment of the water quality or if the water quality changes, a heat pump with an intermediate circuit (see Section 4.3.2 ff) must be used.

4.3.1.1 Heat source groundwater

Extraction wells The groundwater, which the heat pump uses as a heat source, is taken from the ground via a well. The well output must ensure continuous extraction for the minimum water flow through the heat pump.

Inlet fountain The groundwater cooled by the heat pump is fed back into the ground via an injection well. This must be drilled at least 15 m behind the delivery well in the direction of the groundwater flow in order to exclude a "flow short circuit". The intake well must be able to absorb the same amount of water as the delivery well can deliver.



NOTE

The planning and construction of the wells, on which the functional reliability of the system depends, must be left to an experienced well builder.

NOTE Before commissioning the heat pump, a test run of the primary pump of 48 hours must be carried out to ensure that the minimum volume flow on the heat source side can be guaranteed over the long term. This must be confirmed when commissioning is required.

NOTE Under www.glendimplex.de/foerderung/erdwaerme-service you will find more information about geothermal energy

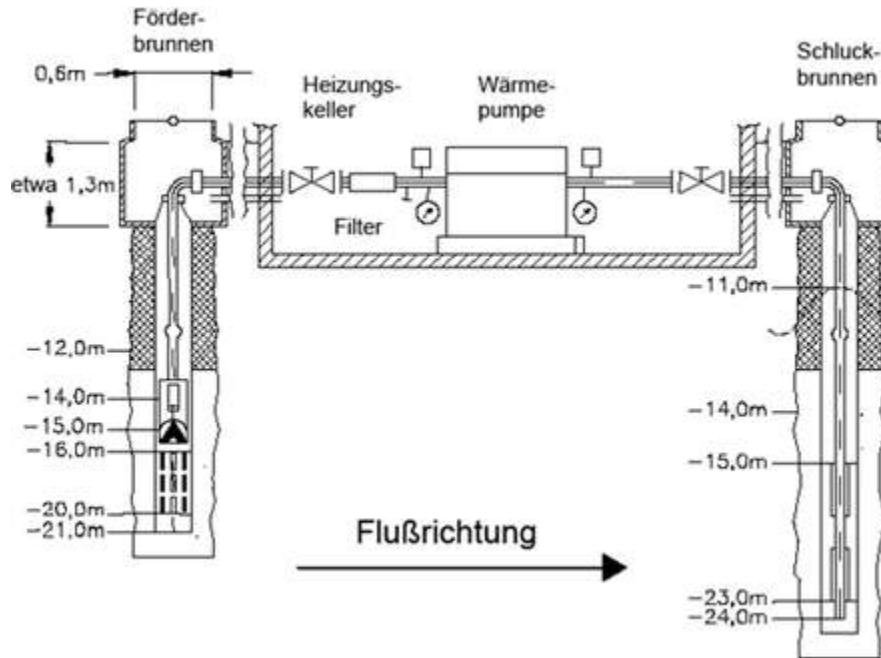


Fig. 4.1: Example of an integration of the water / water heat pump with delivery and absorption wells

NOTE The flow and return of the well system in the building must be equipped with diffusion-proof, fully glued insulation to avoid condensation

4.3.1.2 Heat source waste heat from cooling water

Temperature range

When using water with temperatures between 8 ... 25 ° C, it must first be clarified whether the cooling water is available in sufficient quality and quantity and to what extent the heat generated by the heat pump can be used. If the compatibility of the cooling or waste water according to Table 4.2 is permanently ensured, a water / water heat pump can be used.

ATTENTION If the heat source temperature can rise above 25 ° C, a temperature-controlled mixer must be provided which, at temperatures above 25 ° C, mixes a partial volume flow of the cooling water outlet with the cooling water.

4.3.2 Indirect use of water as a heat source

If the compatibility of the water cannot be proven or there is a risk that the quality of the water can change, an intermediate heat exchanger must be connected upstream to protect the heat pump. The intermediate circuit increases operational reliability, especially when a brine / water heat pump is used and the secondary circuit is thus filled with brine. A water / water heat pump with an intermediate heat exchanger should only be used if the use of brine as a heat transfer medium is not permitted and permanent water temperatures above 10 ° C (e.g. waste heat from production processes) can be guaranteed.

NOTE As a rule, brine / water heat pumps should be used to extend the temperature range downwards and thus increase operational reliability. In the case of water / water heat pumps, the lower operating limit is already reached at an outlet temperature of 4 ° C.

4.3.3 Planning recommendation groundwater / intermediate circuit heat exchanger

Brine heat pump with intermediate circuit heat exchanger (WSI packages)

(Use of groundwater, closed system)

The minimum brine outlet temperature must be set to > 1 ° C. A thermostat must be provided in the heat source circuit that switches off the heat pump in the event of a fault (strap-on thermostat included in the scope of delivery of the WSI packages).

Water heat pump with intermediate circuit heat exchanger

(Groundwater use, open system)

Installation of a flow switch is recommended because there can be time delays until sufficient groundwater is pumped or the volume flow can drop abruptly during operation.

Water heat pump with stainless steel spiral heat exchanger for groundwater

(Groundwater use, open system)

A stainless steel spiral heat exchanger ("Spirec") increases the reliability of the heat pump system. The use of a flow switch (DFS) contributes to a further increase in operational safety.

4.3.4 Heat exchanger (System separator) to protect the heat pump

The external The heat exchanger must be planned according to the heat pump used, the existing temperature level and the water quality. In the simplest case, the heat exchanger consists of PE pipes that are laid directly in the heat source and therefore do not require an additional heat source pump. This cost-effective alternative can be used if the volume of the heat source is sufficiently large (e.g. waste water basin, flowing water).

Otherwise, screwed plate heat exchangers are to be used.

The heat exchanger is configured depending on the following parameters:

- Water quality
- Operating temperature range
- Cooling capacity of the type of heat pump used
- Water flow primary and secondary circuit

NOTE When using aggressive liquids such as sea or process water, titanium plate heat exchangers must be used.

Depending on the software version of the heat pump control, the frost protection of a brine / water heat pump can be adjusted. If the standard value is increased from -8 ° C to +4 ° C, the heat pump is switched off at brine outlet temperatures below +4 ° C.

Assembly of the heat exchanger For optimal heat transfer, the heat exchangers must be connected using the counterflow principle. They must also be protected from contamination. For this purpose, a dirt trap with a mesh size of approx. 0.6 mm must be installed in front of the inlet of the heat exchanger. Compensators should be used to reduce the transmission of structure-borne noise and vibrations (e.g. heat source pumps ...).

Maintenance of the heat exchangers Depending on the degree of pollution in the water, the heat exchanger can become dirty, reducing its transmission capacity. Regular cleaning should take place to prevent this. For example, the so-called CIP process (cleaning-in-place) is used. The heat exchanger is rinsed on site with a weak acid such as formic, citric or acetic acid to remove deposits.

Heat pump		WI35TU	WI45TU	WI65TU	WI95TU	WIH120TU	WI 120TU	WI 180TU
Connection of the generating circuit	customs	1 ½ "	1 ½ "	1 ½ "	2 "	2 "	2 ½ "	2 ½ "
Heating water flow rate V _{HW}	* m ³ / h *	5.9	7.9	11.5	16.9	21.2	20.6	22.2
Pressure loss p _{HW}	Pa	10,000	17900	9200	24500	25,000	36000	36000
Generator circuit pump M16		Stratos Para 30 / 1-12 **	Stratos Para 30 / 1-12 **	Magna3 40-80 F.	Magna3 40-120 F.	Magna3 50-120 F.	Magna3 65-80F	Magna3 65-80F
Installation length	mm	180	180	220	250	280	340	340
Input signal		0-10V	0-10V	0-10V	0-10V	0-10V	0-10V	0-10V
free compression fP	m	9.0	6.2	5.0	3.5	3.2	2.5	2.0
connection Heat source	customs	1 ½ "	1 ½ "	2 ½ "	2 ½ "	3 "	2 ½ "	3 "
Heat source flow rate V _{BW}	* m ³ / h *	7.6	10	14th	23	28.1	27.7	42.1
Pressure loss p _{BW}	Pa	22000	37000	25,000	55000	30820	21500	41500
Well pump M11*		Grundfos SP8A-3	Grundfos SP14A-3	Grundfos SP14A-3	Grundfos SP30-2	Grundfos SP30-2	Grundfos SP30-2	Grundfos SP46-2
free compression fP	m	10.5	13.3	11.5	12.0	11.7	13.4	13.3

* Suggestion for a well pump ** Control with 0 - 10V input signal absolutely necessary

Tab. 4.3: Overview table of the 2-compressor water / water heat pumps with generator circuit pumps (included in the scope of delivery of the heat pump) and the minimum required well pumps for W10 / W35 for standard systems with closed wells. The final definition of the well pump must be made in consultation with the well builder.

NOTE We recommend checking the heat exchanger for contamination at least every two years.

4.3.4.1 Stainless steel plate heat exchangers WTE 20 to WTE 40

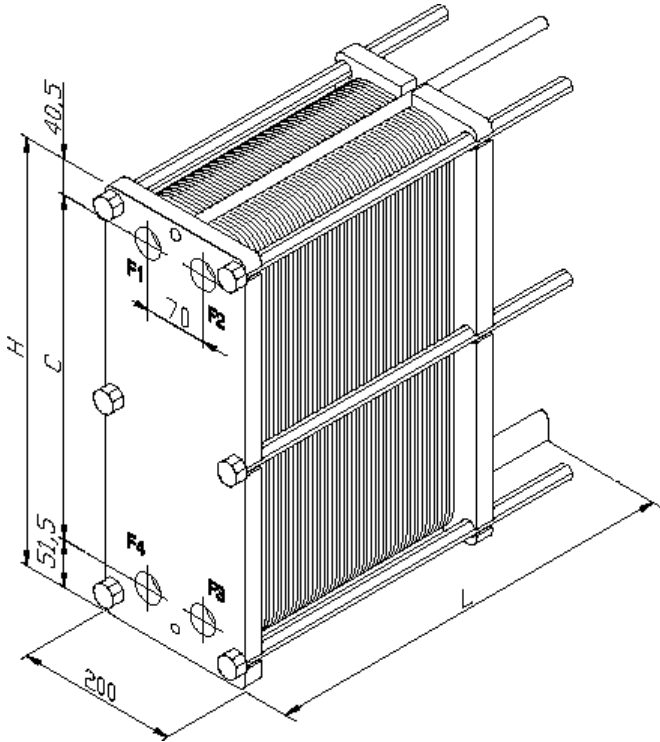


Fig.4.2: WTE 20 - WTE 37

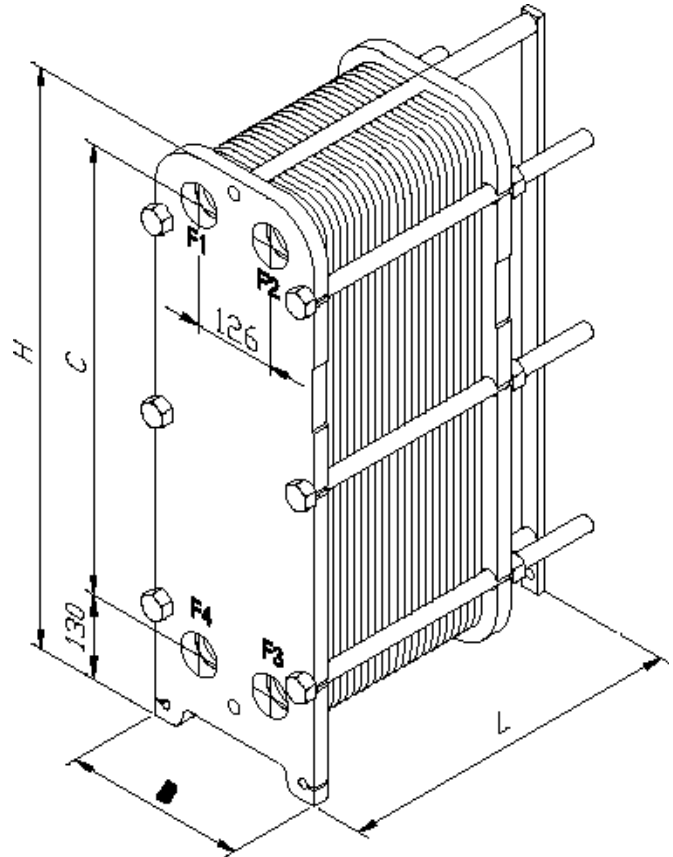


Fig.4.3: WTE 40

Device information stainless steel plate heat exchanger

mass and weight	unit	WTE 20		WTE 30		WTE 37		WTE 40	
Number of plates		34		43		50		28	
Effective area	m ²	2.69		3.44		4.03		3.90	
volume	dm ³	7th		9		11		9	
Height [H]	mm	748		748		748		896	
Width [B]	mm	200		200		200		283	
Depth [L]	mm	270		320		420		437	
Net weight	kg	67		71		76		132	
Gross weight	kg	74		80		87		143	
equipment		SZB 250		SZB 300		SZB 400		SZB 400	
		Secondary	Primary	Secondary	Primary	Secondary	Primary	Secondary	Primary
lot	m ³ / h	4.5	5.8	7.0	8.0	8.5	9.3	11.0	11.0
Inlet temperature	° C	5.00	10.00	5.00	10.00	5.00	10.00	5.00	10.00
Outlet temperature	° C	8.41	7.00	8.07	7.00	7.92	7.00	7.58	7.00
Pressure drop	Pa	23740	30220	32110	37750	36630	37720	37610	32960
Transferred power	kW	18th		25th		29		33	
Inlet port		F1	F3	F1	F3	F1	F3	F1	F3
Outlet port		F4	F2	F4	F2	F4	F2	F4	F2
Secondary connections		DN 32 (1 1/4 "AG)						DN 50 (2 "AG)	
Connections primary		DN 32 (1 1/4 "AG)						DN 50 (2 "AG)	

Pressure drop	Pa	38910	36400	38830	35380	39770	38960	40190	36720
Transferred power	kW	40		63		77		105	
Inlet port		F1	F3	F1	F3	F1	F3	F1	F3
Outlet port		F4	F2	F4	F2	F4	F2	F4	F2
Secondary connections		DN 50 (2 "AG)						DN 65 (flange)	
Connections primary		DN 50 (2 "AG)						DN 65 (flange)	
Plate material		0.4 mm AISI 316							
Sealing material		NITRILE HT HANG ON (H) / 140							

Tab.4.5: Technical data of screwed stainless steel plate heat exchangers WTE 50 - WTE 130

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Chapter 5 - Noise emissions from heat pumps

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5 Noise emissions from heat pumps

Every source of noise, be it a heat pump, a car or an airplane, emits a certain amount of sound. The air around the noise source is set in vibrations and the pressure spreads in waves. When it reaches the human ear, this pressure wave causes the eardrum to vibrate, which then triggers the process of hearing.

The sound field sizes are used to describe this so-called airborne sound. Two of them are sound pressure and sound power. The sound power is a theoretical quantity that is typical of a sound source. It can be calculated from measurements. The sound power is the total sound energy radiation in all directions. Sound pressure is understood to be the change in air pressure as a result of the air caused to vibrate by the sound source. The greater the change in air pressure, the louder the noise is perceived. The sound pressure is what is perceived at the ear of a listener or the microphone of a measuring device.

Physically, sound is the propagation of pressure and density fluctuations in a gas, a liquid or a solid. Sound is generally perceived by humans in the form of airborne sound as noise, tone or bang. Pressure changes in a range of $2 \cdot 10^{-5}$ Pa to 20 Pa can be detected by the human ear. These changes in pressure correspond to vibrations with frequencies of 20 Hz to 20 kHz and represent the audible sound or the audible range of the human being. The individual tones result from the frequencies. Frequencies above the audible range are referred to as ultrasound, and frequencies below that as infrasound.

The sound radiation from noise or sound sources is specified or measured as a level in decibels (dB). This is a reference value, with the value 0 dB roughly representing the hearing limit. Doubling the level, e.g. by using a second sound source with the same sound radiation, corresponds to an increase of +3 dB. For the average human hearing, an increase of +10 dB is necessary so that a noise is perceived as twice as loud.

The sound propagation can be divided into two types.

Structure-borne noise

Mechanical vibrations are introduced into bodies such as machines and parts of buildings as well as liquids, are transmitted in them and finally partly emitted as airborne sound elsewhere.

Airborne sound

Sound sources (bodies excited to vibrate) generate mechanical vibrations in the air that spread like waves and are perceived by the human ear.

5.1 Sound pressure level and sound power level

The terms sound pressure and sound power level are often confused and incorrectly compared with one another. In acoustics, sound pressure is understood to be the measurable level that is caused by a sound source at a certain distance. The closer you are to the sound source, the greater the measured sound pressure level and vice versa. The sound pressure level is thus a measurable, distance- and direction-dependent variable that is decisive for compliance with the immission-related requirements according to TA-Lärm, for example.

The entire change in air pressure emitted in all directions by a sound source is referred to as the sound power or the sound power level. With increasing distance from the sound source, the sound power is distributed over an ever larger area. If you consider the total, radiated sound power and relate it to the enveloping surface at a certain distance, the value always remains the same. Since the sound power emitted in all directions cannot be precisely measured, the sound power must be calculated from the measured sound pressure at a certain distance. The sound power level is therefore a sound source-specific, distance and direction-independent variable that can only be determined by calculation. Based on the emitted sound power level, sound sources can be compared with one another.

5.1.1 Emission and Immission

The entire sound emitted by a sound source (sound event) is referred to as sound emission. Emissions from sound sources are usually specified as sound power levels. The effect of sound on a specific location is called sound immissions. Noise immissions can be measured as the sound pressure level. Fig.5.1 graphically shows the relationship between emissions and immissions.

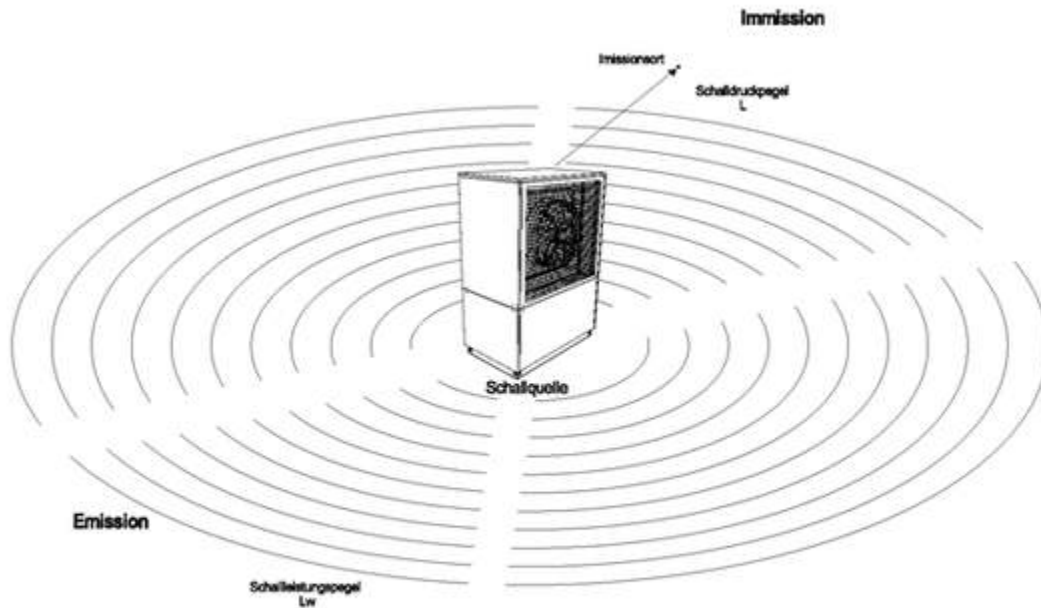


Fig. 5.1: Emission and immission

Noise immissions are measured in dB (A), these are sound level values that are related to the sensitivity of the human hearing. Noise is the term used to describe sound that can disturb, endanger, significantly disadvantage or annoy neighbors or third parties. Guide values for noise at immission locations outside of buildings are specified in DIN 18005 "Noise protection in urban development" or in the "Technical Instructions for Protection against Noise" (TA Lärm). The requirements according to TA-Lärm are listed in Table 5.1.

Territory category	Day	night
Hospitals, health resorts	45	35
Schools, old people's homes	45	35
Allotments, parks	55	55
Purely residential areas WR	50	35
General residential areas WA	55	40
Small settlement areas WS	55	40
Special residential areas WB	60	40
Core areas of MK	65	50
Village areas MD	60	45
Mixed areas MI	60	45
Business parks GE	65	50
Industrial areas GI	70	70

Table 5.1: Limit values for noise immissions in dB (A) according to DIN 18005 and TA-Lärm

Sound source	Sound level [dB]	Sound pressure [MicroPa]	sensation
Absolute silence Inaudible	0 10	20th 63	

			Inaudible Inaudible
A pocket watch ticking, quiet bedroom	20th	200	Very quiet
Very quiet garden, air conditioning in the theater	30th	630	Very quiet
Residential area with no traffic, air conditioning in offices	40	$2 \cdot 10$	Quiet
Quiet stream, river, quiet restaurant	50	$6.3 \cdot 10$	Quiet
Normal conversational language, passenger cars	60	$2 \cdot 10^{4th}$	According to
Noisy office, loud language, motorbike	70	$6.3 \cdot 10^{4th}$	According to
Intense traffic noise, loud radio music	80	$2 \cdot 10^5$	Very loud
Heavy truck	90	$6.3 \cdot 10^5$	Very loud
Car horn at a distance of 5 m	100	$2 \cdot 10^{6th}$	Very loud
Pop group, boilermaker	110	$6.3 \cdot 10^{6th}$	Unbearable
Drilling jumbo in tunnel, 5 m distance	120	$2 \cdot 10^{7th}$	Unbearable
Jet, take-off, 100 m distance	130	$6.3 \cdot 10^{7th}$	Unbearable
Jet engine, 25 m distance	140	$2 \cdot 10^{8th}$	Painful

Tab.5.2: Typical sound levels

5.1.2 Sound propagation

As already described, the sound power is distributed over a larger area with increasing distance, so that the sound pressure level is reduced as the distance increases. Furthermore, the value of the sound pressure level at a certain point depends on the propagation of the sound.

The following properties of the environment have a decisive influence on the propagation of sound:

- Shading by massive obstacles such as buildings, walls or terrain formations
- Reflections on reverberant surfaces such as plastered and glass facades of buildings or the asphalt and stone surfaces of floors
- Reduction of the level spread through sound-absorbing surfaces, such as freshly fallen snow, bark mulch or the like
- Increase or decrease through humidity and air temperature or through the respective direction of the wind

Calculation of the sound pressure level The sound pressure level of the heat pump at the receiving location can be determined using the following formula: **Formula:**

$$L_{Aeq} = L_{WAeq} + 10 \cdot \log\left(\frac{Q}{4 \cdot \pi \cdot r^2}\right)$$

with:

- L_{Aeq} = Sound pressure level at the receiving location
- L_{WAeq} = Sound power level at the sound source
- Q = guideline factor
- r = distance between receiver and sound source

The guideline factor Q depends on the installation of the heat pumps. There are three different variants:

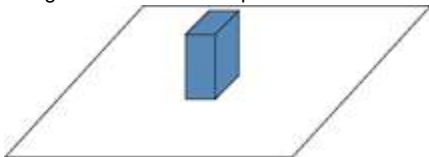


Fig.5.2: Free installation of a heat pump (Q = 2)

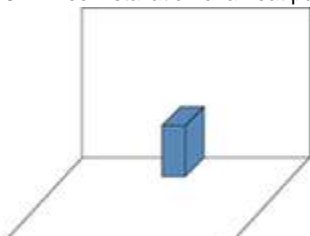




Fig.5.3: Heat pump or air inlet or outlet (for indoor installation) on a wall (Q = 4)

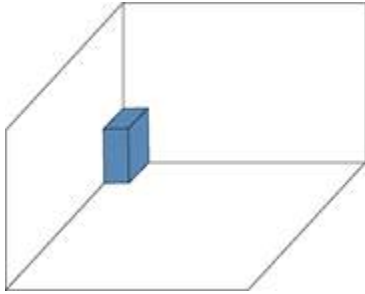


Fig.5.4: Heat pump or air inlet or outlet (for indoor installation) on a house wall with a reentrant corner (Q = 8)

For each of these set-up variants, there is a different decrease in the sound pressure level the further you are away from the heat pump.
Example: Sound power level LA 9S-TU: 5360 dB (A) The following diagram shows the decrease in the sound pressure level for the three different installation variants for an air / water heat pump LA 9S-TU.

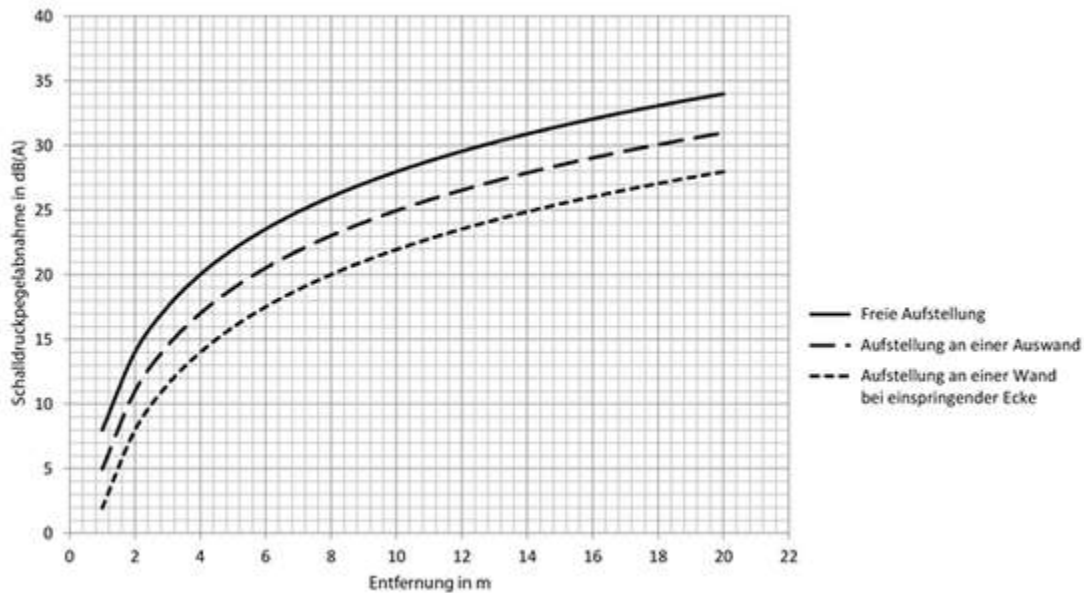


Fig. 5.5: Sound pressure level decrease with different installation

5.2 Sound propagation from heat pumps

5.2.1 Indoor installation

Like any boiler, a heat pump should be connected using separating fittings. For the connections between the heat pump and the heating flow and return, it is advisable to use pressure, temperature and aging-resistant, elastic hoses to avoid the transmission of vibrations. Most heat pumps also have a vibration-decoupled compressor base plate. This means that the compressor is mounted on a separate base plate that is placed on rubber buffers to decouple structure-borne noise. Furthermore, the heat pump should be installed on the SYL 250 sylomer strips, which are available as a special accessory, to further reduce the transmission of structure-borne noise.

Especially with indoor air / water heat pumps, the use of air ducts and bends available as accessories leads to a reduction in noise emissions at the air intake and outlet. The inside insulation made of mineral wool and laminated glass fiber fleece not only prevents condensation, but also significantly reduces the sound radiation at the weather protection grille (air intake and exhaust) of the air duct. As a guideline, the following apply:

Straight air duct

A sound reduction of ~ 1 dB (A) per meter of air duct.

Air duct arch

A sound reduction of ~ 2 to 3 dB (A) per arch.

5.2.2 Outdoor installation

Structure-borne noise decoupling is only necessary if the foundation of the heat pump is in direct contact with the building. Flexible hoses make it easier to connect the heat pump to the heating system and at the same time prevent possible transmission of vibrations.

In addition, most heat pumps installed outside also have a vibration-decoupled compressor base plate, as already described for the units installed inside. When installing heat pumps outdoors, the sound propagation must be taken into account. It should be avoided that the sound emissions are reflected on walls.

Blowing directly onto house walls etc. should also be avoided, as this can lead to an increase in the sound pressure level. The propagation of sound can be reduced by structural obstacles. The outlet side should be aligned towards the street if possible.

NOTE The air flow from air / water heat pumps installed outside must not be obstructed on any side.

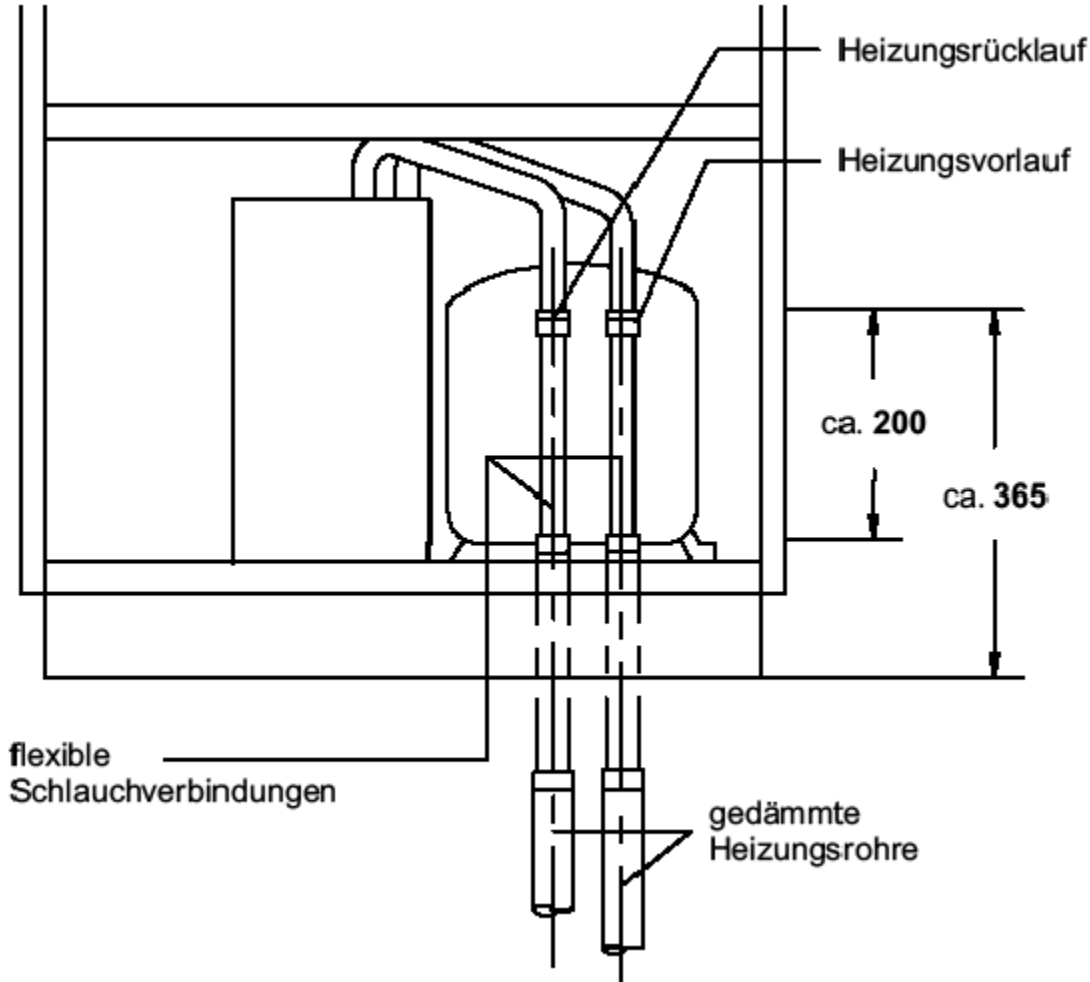
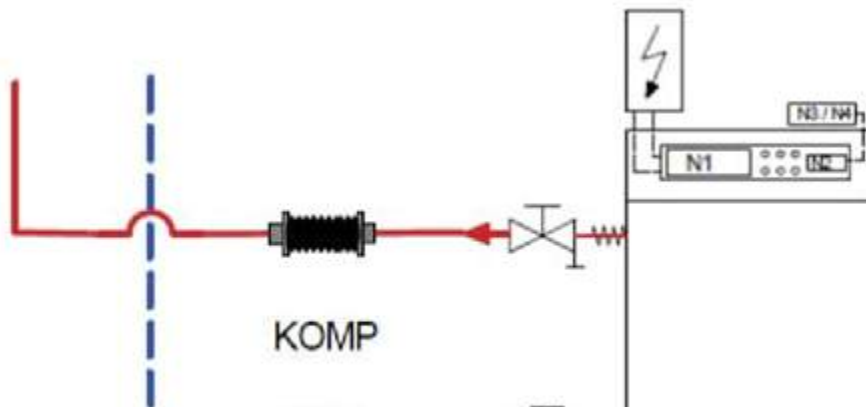


Fig. 5.6: Integration example of a heat pump for outdoor installation

Vibration decoupling through compensators

All Dimplex heat pumps are internally decoupled from structure-borne noise. However, if further structure-borne noise decoupling is desired or necessary on site, this can be implemented as follows. Double bellows rubber expansion joints are used to decouple the heat pump and heating system. The expansion joints absorb vibrations and movements caused by circulation pumps, compressors, fittings, etc. Furthermore, they reduce noise and compensate for tensions (axial and lateral differences) from assembly inaccuracies.



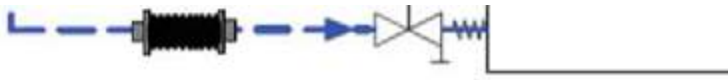


Fig. 5.7: Integration option for compensators Exchange heat pump image

In order to ensure the functionality of the expansion joints and not to shorten their service life due to additional stress, some rules must be observed:

- Compensators must be installed in such a way that their position and movement are not hindered.
- During assembly and after installation, make sure that no offsets and twisting (torsion) are transferred to the bellows.
- Protect the bellows from damage caused by external mechanical, thermal or chemical influences.
- Bellows shafts must be free from contamination.

Noise emissions from air / water heat pumps installed outside

Fig. 5.8 shows the four main directions of sound propagation. The suction side has the direction number "1", the discharge side the number "3".

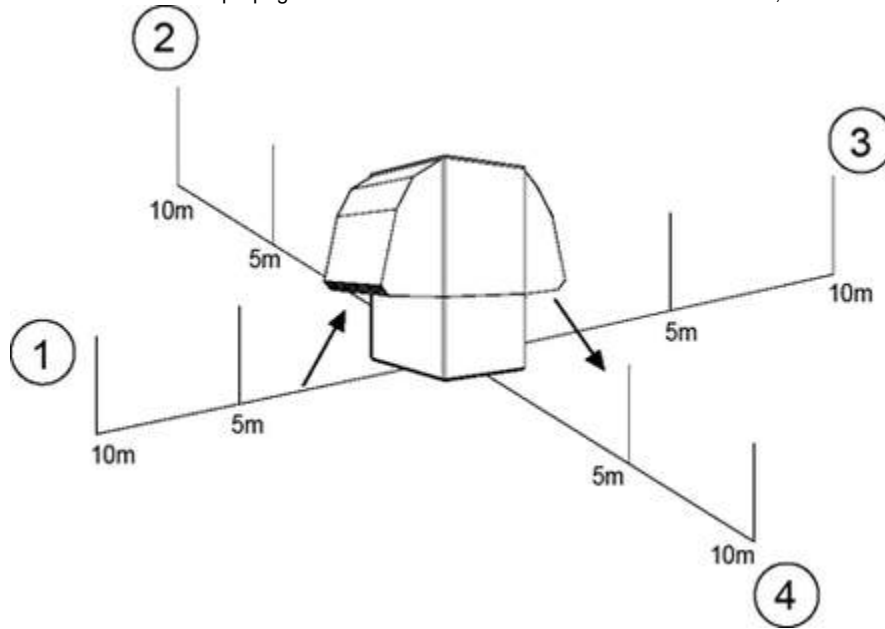


Fig.5.8:Sound directions for air / water heat pumps of the LA ... S-TU (R) series installed outdoors

With the help of the tables, the directed sound pressure level of the air / water heat pumps can be read off. The values at a distance of 1 m are actually measured values. The values at a distance of 5 and 10 m are calculated using a hemispherical spread in the free field. In practice, deviations caused by sound reflection or sound absorption due to local conditions are possible. As can be seen from the values in the table, an air / water heat pump has the highest noise emissions in the discharge direction, followed by the suction side. Significantly lower emission levels occur on the sides.

NOTE For heat pumps installed outside, the directional sound pressure levels are decisive.

Type	LA 22TBS Air-to-water heat pump installed outdoors			
direction	1	2	3	4th
1m	43	38	47	38
5 m	32	26	36	26
10m	27	21	31	21

Tab.5.3: Sound propagation LA 22TBS Air / water heat pump installed outdoors (approx. 22kW)


If emissions from heat pumps are to be determined or calculated in advance, the use of the BWP sound calculator has established itself in the industry. Experience shows that the results are accepted by all authorities.


NOTE The sound calculator of the Bundesverband Wärmepumpe e.V. is used to calculate noise emissions from heat pumps, which can be found under the following link: <http://www.waermepumpe.de/schallrechner/>

5.3 Example for a sound calculator

LA12S-TU at a distance of 8m in a general residential area with installation close to the wall (<3m)

Calculation results with explanations:





Bundesverband
Wärmepumpe e.V.

Schallberechnung

Generelle Angaben

Name	Max Mustermann
Adresse	Am Goldenen Feld 18, 95326 Kulmbach
Telefon	+49 9221 709 100
E-Mail	info@glendimplex.de

Angaben zur Luft / Wasser-Wärmepumpe

Hersteller	Dimplex
Modell / Typ	LA 12S-TU
Leistung	9.5 kW
Schalleistung nach ErP	54.00 dB(A)
Max. Schalleistungspegel im Tagbetrieb	54.00 dB(A)
Max. Schalleistungspegel im reduzierten Nachtbetrieb	53.00 dB(A)
Tonhaltigkeit	nicht hörbar

Immissionsrichtwert gemäß TA Lärm

Empfindlichkeitsstufe	allgemeines Wohngebiet / Kleinsiedlungsgebiet
-----------------------	---

Aufstellung

Raumwinkelmaß K0	+6 dB(A) WP an einer Wand, Abstand zum Gerät bis zu 3 m
Distanz (s) Quelle - Empfänger	8 m
Abschirmung:	Sichtkontakt: DI = 0 dB(A)

Der Immissionsrichtwert wird sowohl im Tag- als auch im Nachtbetrieb um mindestens 6 dB(A) unterschritten. Die Anlage ist nicht relevant nach TA Lärm 3.2.1.

Tagbetrieb

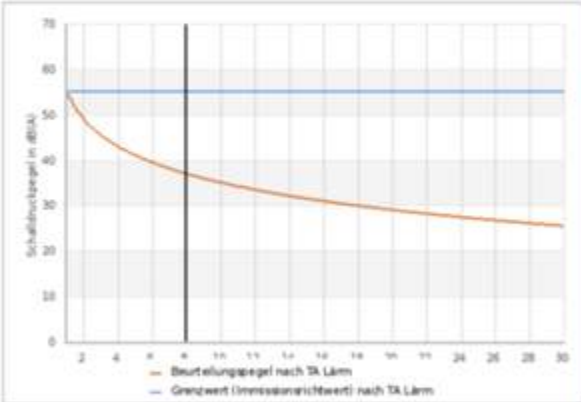
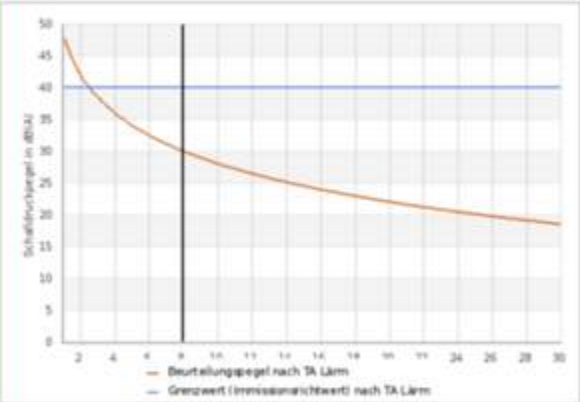
Beurteilungspegel Lr: 36.9 dB(A)

Unterschreitung des Immissionsrichtwertes der TA Lärm um 18.1 dB(A)

Nachtbetrieb (mit Schallreduzierung)

Beurteilungspegel Lr: 29.9 dB(A)

Unterschreitung des Immissionsrichtwertes der TA Lärm um 10.1 dB(A)

— Beurteilungspegel nach TA Lärm
— Grenzwert (Immissionsrichtwert) nach TA Lärm

Eine Dämpfung durch die Richtwirkung der Quelle wurde nicht berücksichtigt.
Die Vorbelastung wurde nicht einbezogen, das Ergebnis wird als Differenz zur Gesamtbelastung ausgewiesen.
Bei sämtlichen Gerätedaten handelt es sich um Herstellerangaben, die Verantwortung für die Richtigkeit liegt beim jeweiligen Unternehmen.
Aus reduziertem Betrieb kann eine Leistungsreduzierung der Wärmepumpe resultieren.

Fig.5.9: Sound calculation according to BWP sound calculator

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Chapter 6 - DHW heating with heat pumps

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 - 6.1.1 Determination of the hot water requirement for heating heat pumps
 - 6.1.2 Design method for heating heat pumps in apartment buildings
 - 6.1.3 Simplified procedure for heating heat pumps in single and two-family houses
 - 6.1.4 General calculation bases for drinking water heating
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6 DHW heating with heat pumps

6.1 Hot water demand in buildings

There are different approaches in practice for determining needs. For residential buildings, the design is often based on DIN 4708-2 using the so-called ML-number (performance indicator of a normal apartment). However, this design and dimensioning method, which is valid for heating boilers, cannot generally be used for heat pump systems because ML Numbers of the storage tanks for the flow temperatures used in heat pump operation are hardly available. Therefore, it makes sense to carry out the design based on the amount of heat required. Several mutually influencing factors must be taken into account (see Section 6.1.1).

NOTE As a result, the design and dimensioning method that is valid for heating boilers can generally not be used for heat pump systems. NL numbers with typical flow temperatures for heat pump operation are not available for hot water storage tanks.

6.1.1 Determination of the hot water requirement for heating heat pumps

The design of the heating heat pump and the hot water storage tank should be based on the amount of heat required in the system. The following factors must be taken into account:

- the daily requirement
- the peak demand
- anticipated losses
- required hot water temperatures
- the available heating power for reheating the hot water storage tank

interpretation In order to be able to cover the hot water requirement of the building during the reference time, the required hot water output must be available either as stored hot water or as heating output.

1. For the design, the maximum daily hot water requirement and the corresponding consumption behavior must first be determined. In addition to real consumption values, average tapping profiles can also be used for this determination. These are shown in EN 15450 as an example for three user groups in Appendix E and can be expanded individually.
2. The period with the greatest power requirement is determined from the load profile. A memory size then results from this power requirement. When selecting the storage tank, it must be taken into account that there is heat loss due to heat dissipation from the surface (see heat retention losses S on the energy label of the storage tank) and mixing of the storage tank due to inflowing cold water.

NOTE As a rough estimate, an average daily hot water requirement of 1.45 kWh per person can be assumed. At a storage temperature of 60 ° C, this corresponds to an amount of water of 25 l per person.

Tap type	energy kWh	volume l	Desired value for K	Draw-off duration at the specified mass flow rate (min) at:			
				3.5 l / min	5.5 l / min	7.5 l / min	9 l / min
Little	0.105	3	30th	0.9	0.5	0.4	0.3
floor	0.105	3	30th	0.9	0.5	0.4	0.3
Clean	0.105	2	45	0.6	0.4	0.3	0.2
Dishwasher little	0.315	6th	45	1.7	1.1	0.8	0.7
Dishwasher medium	0.420	8th	45	2.3	1.5	1.1	0.9
Dishwasher more	0.735	14th	45	4th	2.5	1.9	1.6
"Much"	0.525	15th	30th	4.3	2.7	2	1.7
Have a shower**	1,400	40 **	30th	11.4	7.3	5.3	4.4
bathe	3.605	103	30th	29.4	18.7	13.7	11.4

Tab.6.1: Assumption of the dispensing volume according to EN 15450

** With rain showers, the average consumption is around 25 to 50% higher than with "classic" shower heads.

No.	Time of day hh : mm	Energy tapping process kWh	Purchase period for partial storage systems		Tap type	Desired value for (to be reached during removal) K	Minimum value of ° C to start counting energy use
1	07:00	0.105			little		25th
2	07:30	0.105			little		25th
3	08:30	0.105			little		25th
4th	09:30	0.105			little		25th
5	11:30	0.105			little		25th
6th	11:45	0.105			little		25th
7th	12:45	0.315			Wash the dishes	50	0
8th	18:00	0.105			little		25th
9	18:15	0.105			Clean		45
10	20:30	0.420			Wash the dishes	50	0
11	21:30	0.525			much		45
$Q_{DP}[\text{kWh}] \quad t_{DP}[\text{hh: mm}]$		2.114: 30	1,789: 00	0.9451: 00			

					36 l at 60 ° C	
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Tab.6.2: Average dispensing volume of an individual (36 liters; 60 ° C) according to EN 15450

No.	Time of day h h: mm	Energy tapping process kWh I	Purchase period for partial storage systems		Tap type	Desired value for (to be achieved during withdrawal) K	Minimum value of ° C to start counting energy use
1	07:00	0.105			little		25th
2	07:15	1,400			have a shower		40
3	07:30	0.105			little		25th
4th	08:01	0.105			little		25th
5	08:15	0.105			little		25th
6th	08:30	0.105			little		25th
7th	08:45	0.105			little		25th
8th	09:00	0.105			little		25th
9	09:30	0.105			little		25th
10	10:30	0.105			floor	30th	10
11	11:30	0.105			little		25th
12th	11:45	0.105			little		25th
13	12:45	0.315			Wash the dishes	45	10
14th	14:30	0.105			little		25th
15th	3:30 pm	0.105			little		25th
16	16:30	0.105			little		25th
17th	18:00	0.105			little		25th
18th	18:15	0.105			Clean		40
19th	18:30	0.105			Clean		40
20th	19:00	0.105			little		25th
21	20:30	0.735			Wash the dishes	45	10
22nd	21:15	0.105			little		25th
23	21:30	1,400			have a shower		40
Q_{DP} [kWh] t_{DP} [hh: mm]		5.84514: 30	2.74014: 15	2,241: 00			
					100.2 l at 60 ° C		

Table 6.3: Average tap volume of a family (without bathing; 100 liters; 60 ° C) according to EN 15450

No.	Time of day hh : mm	Energy tapping process kWh I	Purchase period for partial storage systems		Tap type	Desired value for (to be achieved during withdrawal) K	Minimum value of ° C to start counting energy use
1	07:00	0.105			little		25th
2	07:55	1,400			shower		40
3	07:30	0.105			little		25th
4th	07:45	0.105			little		25th
5	08:05	3.605			bath		10
6th	08:25	0.105			little		25th
7th	08:30	0.105			little		25th
8th	08:45	0.105			little		25th
9	09:00	0.105			little		25th
10	09:30	0.105			little		25th
11	10:30	0.105			floor	30th	10
12th	11:30	0.105			little		25th
13	11:45	0.105			little		25th
14th	12:45	0.315			Wash the dishes	45	10

15th	14:30	0.105			little		25th
16	3:30 pm	0.105			little		25th
17th	16:30	0.105			little		25th
18th	18:00	0.105			little		25th
19th	18:15	0.105			clean		40
20th	18:30	0.105			clean		40
21	19:00	0.105			little		25th
22nd	20:30	0.735			Wash the dishes	45	10
23	21:00	3.604			bath	30th	10
24	21:30	0.105			little		25th
$Q_{DP}[\text{kWh}]$		11.65514: 30	11.44513: 55	4.4451: 00			
$t_{DP}[\text{hh: mm}]$							
						199.8 l at 60 ° C	

Tab.6.4: Average tap volume of a family (with bathing; 200 liters; 60 ° C) according to EN 15450

6.1.2 Design method for heating heat pumps in apartment buildings

The design is shown below using an example calculation for a multi-family house.

NOTE The following calculation is an example calculation. If the values differ, a recalculation is necessary.

Building data

- Multi-family house with 6 residential units
- 3 people per unit

Determination of the reference period and the hot water requirement The reference period with the greatest energy requirement can be read from the corresponding design table in accordance with EN 15450. The following applies to the calculation example:

- Reference period from 8:30 p.m. to 9:30 p.m.
- Energy requirement for hot water preparation of 4.445 kWh per residential unit

19:00	0.105			little	
20:30	0.735			Wash the dishes	
21:00	3.604			bath	
21:30	0.105			little	
$Q_{DP}[\text{kWh}]$	11.65514: 30	11.44513: 55	4.4451: 00		
$t_{DP}[\text{hh: mm}]$					
					199.8 l at 60 ° C

Tab.6.5: Selection of the reference period

The energy requirement for the entire building during the reference period is determined from: $Q_{DPB} = N_{NE} * Q_{DPBNN}$ with:

- Q_{DPB} = Energy demand during a reference period in kWh
- Q_{DPBNN} = Energy demand of a usage unit during a reference period in kWh
- N_{NE} = Usage units with the same profile

1st step: Required energy requirements

- $Q_{DPBNN} = 4.445 \text{ kWh}$
- $N_{NE} = 6$
- $Q_{DPB} = 26.67 \text{ kWh}$

The required amount of hot water can now be determined from this:

$$V_{DP} = \frac{Q_{DPB}}{c_{\text{water}} \cdot (t_{\text{DHW}} - t_{\text{cold}})}$$

with:

- V_{DP} = required amount of hot water during a reference period in liters
- Q_{DPB} = Energy demand during a reference period in kWh
- c_w = specific heat capacity 1.163 Wh / kgK of water
- t_{target} = Target storage tank temperature
- t_{cw} = Cold water temperature

Step 2: Required amount of hot water

- $Q_{DPB} = 26.67$ kWh
- $c_w = 1.163$ Wh / kgK
- $t_{target} = 60$ ° C
- $t_{cw} = 10$ ° C
- $V_{DP} = 459$ l

Selection of the hot water storage tank The storage volume including a surcharge for mixing losses results from:

$$V_{Spmin} = V_{DP} \cdot DMV$$

with:

- V_{Spmin} = Minimum storage volume in liters
- V_{DP} = required amount of hot water during a reference period in liters
- DMV = mixing losses (15 to 20%)

3rd step: Volume of the hot water storage tank

- $V_{DP} = 459$ l
- DMV = 1.15 (corresponds to 15%)
- $V_{Spmin} = 582$ l

Variant 1 - storage tank with internal heat exchanger

Two hot water tanks with internal heat exchangers with a capacity of 390 l each are selected here. The storage losses are 2.78 kWh / 24h. The storage losses over the entire reference period are sufficiently taken into account in the larger storage volume. In the hot water storage tanks there is the option of using special accessories (e.g. DFM 1988-1 / DFM 1988-WPM) to guarantee the outlet temperature of 60 ° C in the upper third.

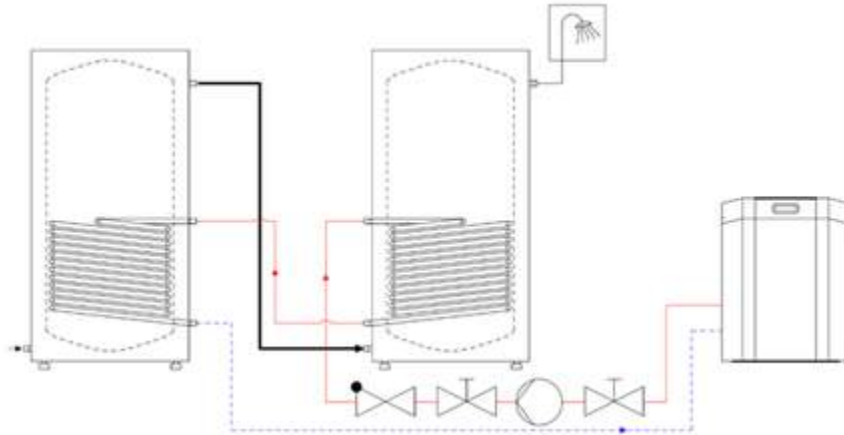


Fig.6.1: Series connection of hot water storage tanks

Variant 2 - load storage tank with external heat exchanger (e.g. fresh water station) A 750 l storage tank is selected here. The storage losses are 3.2 kWh / 24h. A storage tank outlet temperature of 60 ° C must also be guaranteed with this solution. Depending on the type of heat pump, the storage tank must be reheated using a second heat generator or directly electrically.



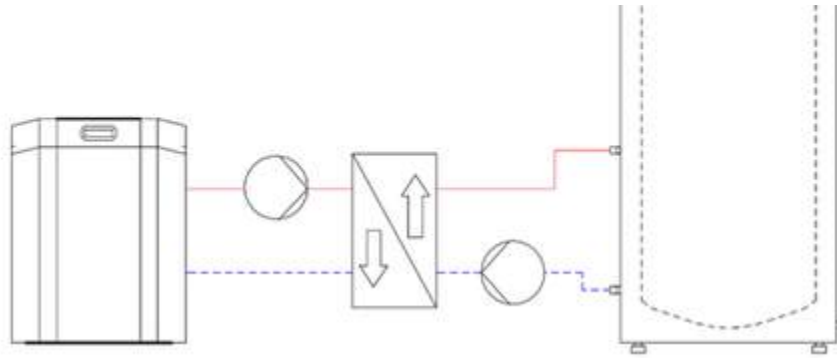


Fig. 6.2: Load storage tank with external heat exchanger

Selection of the heat pump

In the next step, the heating output of the heat pump required for warm water heating must be determined. This value is the required surcharge for warm water heating on the heating output of the heat pump and is based on the time available between the individual reference periods.

08:45	0.105		
09:00	0.105		
09:30	0.105		
10:30	0.105		
11:30	0.105		
11:45	0.105		
12:45	0.315		
14:30	0.105		
3:30 pm	0.105		
16:30	0.105		
18:00	0.105		
18:15	0.105		
18:30	0.105		
19:00	0.105		
20:30	0.735		
21:00	3.604		
21:30	0.105		
Q_{DP} [kWh]	11.65514: 30	11.44513: 55	4.4451: 00
t_{DP} [hh: mm]			

Tab. 6.6: Selection of the time between two reference periods

$$Q_{WP} = \frac{V_{Sp} \cdot c_w \cdot (t_{soll} - t_{cw})}{T_{aufh}}$$

with:

- Q_{WP} = required heating output of the heat pump in kW
- V_{Sp} = Storage volume (total) in liters
- c_w = specific heat capacity 1.163 Wh / kgK of water
- t_{target} = Target storage tank temperature
- t_{cw} = Cold water temperature
- T_{stop} = Time between the reference periods in h

4th step: Selection of the heat pump

- $V_{Sp} = 780 \text{ l}$ (two storage tanks á 390 liters)
- $c_w = 1.163 \text{ Wh / kgK}$
- $t_{target} = 60 \text{ ° C}$
- $t_{cw} = 10 \text{ ° C}$
- $T_{stop} = 11.5 \text{ h}$
- **QWP = 3.94 kW**

The necessary heating output of the heat pump is heavily dependent on the time span between two reference periods. If the period of time is very short, the required heating power is significantly higher. In this case, alternatives can be considered. Either the storage tank size is increased by the value for the second reference period or a second heat generator for hot water preparation is provided as a bivalent heat generator. The latter can be the better solution from a cost perspective, since lower investment costs are incurred for tapping the primary source of the heat pump.

Review of the design If the heat pump is designed using the reference periods, a plausibility check should be carried out at the end of the calculation. The heating output determined for the heating-up time must be greater than the computationally necessary output with constant tapping over the entire day.

$$Q_{WP} > Q_{DPT} \cdot N_{NE}$$

with:

- Q_{WP} = required heating output of the heat pump in kW
- Q_{DPT} = Power requirement for daily consumption in kW
- N_{NE} = Number of residential units with the same usage profile

5th step: Checking the calculation

- $Q_{DPT} = 11.445 \text{ kWh / 24 h}$
- $N_{NE} = 6$
- $Q_{WP} = 3.94 \text{ kW}$
- $3.94 \text{ kW} > 6 \cdot 11.445 \text{ kWh / 24 h}$
- **3.94 kW > 2.86 kW**

6.1.3 Simplified procedure for heating heat pumps in single and two-family houses

In the one- and two-family house area with standard sanitary equipment, the required storage tank size and the required heating power can be determined with the help of a simplified procedure. A daily hot water requirement of 50 liters, based on a hot water temperature of 60 ° C, is assumed per person. To select a storage unit for up to 10 people, the minimum storage volume must first be determined. In addition, the daily hot water requirement is doubled. This minimum volume is converted to the actual storage temperature.

$$V_{Sp} = V_{tsoll} = V_{DP60} \cdot \frac{(60 - t_{cw})}{(t_{soll} - t_{cw})}$$

with:

- V_{Sp} = Storage volume (total) in liters
- V_{tsoll} = Hot water volume at t_{target} in liters
- V_{DP60} = Hot water volume at 60 ° C in liters
- t_{target} = Target storage tank temperature
- t_{cw} = Cold water temperature

example

- $V_{DP60} = 200 \text{ l}$ (4 people at 25 liters per person)
- $t_{target} = 50 \text{ ° C}$
- $t_{cw} = 10 \text{ ° C}$
- **$V_{Sp} = 250 \text{ l}$**

NOTE The calculation is an example calculation. If the values differ, a recalculation is necessary.

6.1.4 General calculation bases for drinking water heating

	Formel	Beispiel
Erforderliche Wärmemenge Q		Welche Wärmemenge ist erforderlich um 100 kg Was-

in Wh	$Q = m \cdot c \cdot \Delta \vartheta$ $Q = m \cdot c \cdot (\vartheta_2 - \vartheta_1)$	ser von 10°C auf 55°C zu erwärmen $Q = \frac{100 \text{ kg} \cdot 1,163 \text{ Wh} \cdot (55-10) \text{ K}}{\text{kg} \cdot \text{K}}$ $Q = 5234 \text{ Wh}$
Erforderlicher Energiebedarf W (Arbeit) in Wh	$W = \frac{m \cdot c \cdot \Delta \vartheta}{\eta}$ $W = \frac{m \cdot c \cdot (\vartheta_2 - \vartheta_1)}{\eta}$	Welcher Energiebedarf ist erforderlich um 100 kg Wasser von 10°C auf 55°C zu erwärmen $W = \frac{100 \text{ kg} \cdot 1,163 \text{ Wh} \cdot (55-10) \text{ K}}{0,98 \cdot \text{kg} \cdot \text{K}}$ $W = 5340 \text{ Wh}$
Erforderliche Leistung P in W	$P = \frac{m \cdot c \cdot \Delta \vartheta}{t \cdot \eta}$ $P = \frac{m \cdot c \cdot (\vartheta_2 - \vartheta_1)}{t \cdot \eta}$	Welche Wärmeleistung ist erforderlich um 100 kg Wasser von 10°C auf 55°C in 8h zu erwärmen $P = \frac{100 \text{ kg} \cdot 1,163 \text{ Wh} \cdot (55-10) \text{ K}}{8\text{h} \cdot 0,98 \cdot \text{kg} \cdot \text{K}}$ $P = 668 \text{ W}$
Aufheizzeit t in h	$t = \frac{m \cdot c \cdot \Delta \vartheta}{P \cdot \eta}$ $t = \frac{m \cdot c \cdot (\vartheta_2 - \vartheta_1)}{P \cdot \eta}$	Wie lange dauert die Erwärmung von 100 kg Wasser von 10°C auf 55°C bei einer Leistung von 2000 W $t = \frac{100 \text{ kg} \cdot 1,163 \text{ Wh} \cdot (55-10) \text{ K}}{2000\text{W} \cdot 0,98 \cdot \text{kg} \cdot \text{K}}$ $t = 2,7 \text{ h}$
Mischwassertemperatur in °C	$\vartheta_M = \frac{m_1 \cdot \vartheta_1 + m_2 \cdot \vartheta_2}{m_1 + m_2}$	Mischwassertemperatur bei Mischung von 100kg Wasser mit 55°C mit 40kg Wasser mit 10°C $\vartheta_M = \frac{100 \text{ kg} \cdot 55^\circ\text{C} + 40\text{kg} \cdot 10^\circ\text{C}}{100\text{kg} + 40\text{kg}}$ $\vartheta_M = 42^\circ\text{C}$
Mischwassermenge in kg	$m_M = \frac{m_2 \cdot (\vartheta_2 - \vartheta_1)}{(\vartheta_M - \vartheta_1)}$	Welche Mischwassermenge mit 40°C erhält man durch Zumischung von Kaltwasser mit 10°C in 100 kg Warmwasser mit 55°C. $m_M = \frac{100 \text{ kg} \cdot (55^\circ\text{C} - 10^\circ\text{C})}{40^\circ\text{C} - 10^\circ\text{C}}$ $m_M = 150 \text{ kg}$
Erklärung der Formelzeichen		
Q = Wärmemenge in Wh P = Leistung in W W = Energiebedarf in Wh t = Aufheizzeit in h η = Wirkungsgrad m = Wassermenge in kg (1kg entspricht ca. 1 Liter)	c = spezifische Wärme- kapazität in $\frac{\text{Wh}}{\text{kg} \cdot \text{K}}$ Wasser c = 1,163 $\frac{\text{Wh}}{\text{kg} \cdot \text{K}}$ = 4,1868 $\frac{\text{Wh}}{\text{kg} \cdot \text{K}}$	Δϑ = Temperaturdifferenz in K aus (ϑ ₂ - ϑ ₁) ϑ ₁ = Kaltwassertemperatur in °C ϑ ₂ = Warmwassertemperatur in °C ϑ _M = Mischwassertemperatur °C m ₁ = Kaltwassermenge in kg m ₂ = Warmwassermenge in kg m _M = Mischwassermenge in kg

Tab. 6.7: Calculation bases for drinking water heating

6.2 Hot water heating with the heating heat pump

In addition to regulating the heating, the heat pump manager also takes on the hot water preparation (see chapter Control). The integration of the hot water heating with the heat pump must take place in a separate hydraulic circuit, since different temperature levels are usually required for hot water and heating.

6.2.1 Requirements for the hot water storage tank

The standard continuous outputs specified by various storage tank manufacturers are not a suitable criterion for selecting the storage tank for heat pump operation. Decisive for the selection of the storage tank are the size of the heat exchanger surfaces, the construction, the arrangement of the heat exchangers in the storage tank, the standard continuous output, the flow rate and the arrangement of the thermostat or sensor.

The following criteria must be taken into account:

- Reheating as a result of standing losses without tapping (coverage of standing losses - static condition).
- The selected hot water storage tank must be able to draw the heating output made available by the heat pump even at the maximum heat source temperature (e.g. air +35 ° C).
- When a circulation line is operated, the storage tank temperature is reduced. The circulation pump should be controlled as required.
- The defined draw-off quantities must also be achieved during a blocking period, i.e. without reheating by the heat pump.
- Targeted reheating using a flange heater is only possible in conjunction with a temperature sensor inserted into the hot water storage tank.

⚠ ATTENTION If the hot water is prepared using a generator circuit (e.g. a holiday home) filled with antifreeze (e.g. glycol), the drinking water circuit must be protected by suitable protective measures in the event of a leak. This can be done by using glycol, which is suitable for use in the food sector, or by using double-walled safety heat exchangers.

6.2.2 Hot water storage tank for heating heat pumps

The hot water storage tanks are used to heat drinking water, e.g. for sanitary use. The heating takes place indirectly via a built-in smooth-tube heat exchanger through which the heating water flows or in accordance with the flow principle (fresh water systems).

Corrosion protection

Enamelled storage tanks are protected according to DIN 4753 Part 3 on the entire inner surface by a tested enamelling. In connection with the additionally built-in magnesium sacrificial anode, this guarantees reliable corrosion protection. According to DVGW, the magnesium sacrificial anode must first be checked by a specialist after 2 years and then at appropriate intervals and replaced if necessary. Depending on the drinking water quality (conductivity), it is advisable to check the sacrificial anode in shorter periods of time. If the anode (33 mm) is broken down to a diameter of 10-15 mm, it is recommended to replace it.

As an alternative to the magnesium anode, an impressed current anode (Correx anode) can also be used. This should be used if the magnesium sacrificial anode is broken down too quickly, the water smells unpleasant or too many air bubbles form when the water is drawn from the tap. The impressed current anode (titanium anode) must be connected directly to a voltage source (230 V ~) and is maintenance-free.

Water hardness Depending on the location / region, the drinking water contains more or less lime. Hard water means very hard water. There are different hardness ranges, which are measured as a unit in degrees of German hardness (° dH).

Hardness range soft	=	less than 1.5 millimoles of calcium carbonate per liter (corresponds to <8.4 ° dH)
Medium hardness	=	1.5 to 2.5 millimoles of calcium carbonate per liter (corresponds to 8.4 to 14 ° dH)
Hardness range hard	=	more than 2.5 millimoles of calcium carbonate per liter (corresponds to > 14 ° dH)

In Switzerland the term "French degrees of hardness" is used

1 ° i.e.	=	1.79 ° FR.
1 ° fr. H.	=	0.56 ° d.H.

When using electrical flange heaters for general reheating to temperatures above 50 ° C, we recommend water from hardness range III with a hardness > 14 ° d.H. (hard and very hard water) the installation of a decalcifying system.

Installation Before starting up the heat pump, check whether the water supply (cold water supply) is open and the storage tank is full. The first filling and commissioning must be carried out by an approved specialist company. The function and tightness of the entire system including the parts installed by the manufacturer (e.g. flange cover, flange heating) must be checked.

Cleaning and care The required cleaning intervals differ depending on the water quality and the level of the storage tank temperature. We recommend cleaning the storage tank and checking the system once a year. The enamelled smooth surface largely prevents limescale from sticking and enables quick cleaning, e.g. using a water jet. Large scale limescale may only be crushed with a wooden stick before rinsing. Sharp-edged, metallic objects must never be used for cleaning.

The function of the safety valve must be checked at regular intervals. Annual maintenance by a specialist company is recommended.

Thermal insulation and cladding

For storage tanks with a nominal capacity of up to 500 liters, the thermal insulation consists of high-quality PU (polyurethane) rigid foam which is foamed directly onto the storage tank wall. For storage tanks larger than 500 liters, the thermal insulation can be removed and consists of PE (polyethylene) or PS (polystyrene) foam with a foil jacket.

regulation The storage tanks are supplied as standard with a sensor (NTC 10 - DIN 44574) including a 5 m connection cable, which is connected directly to the heat pump manager as sensor R 3 and inserted into the immersion sleeve on the storage tank, ensuring good heat transfer. The temperature setting, time-controlled charging and, if necessary, reheating by means of flange heating is carried out by the heat pump manager. The hysteresis must be taken into account when setting the target hot water temperature. The hysteresis is subtracted from the setpoint specification and defines the switch-on point of the heat generator. For example, setpoint 50 ° C - hysteresis 7 K results in a switch-on temperature of 43 ° C and a switch-off temperature of 50 ° C.

Alternatively, control can be carried out with an external thermostat. The hysteresis should not exceed 2K (2-point controller).

Operating conditions:

Permissible operating pressure	
Heating water	max. 3 bar
Drinking water	10 bar

Permissible operating temperature	
Heating water	110 ° C
Drinking water	95 ° C

Tab 6.8: Permissible operating conditions

Assembly

The assembly is limited to the hydraulic integration including safety devices and the electrical connection of the sensor.

equipment

Flange heaters with leakage resistance (insulated installation), designed for enamelled hot water storage tanks, for thermal disinfection are available as accessories. The screw-in heating elements of the CEHK series can also be installed in enamelled hot water storage tanks with an additional screw socket 1 ½ ". The screw-in heating elements CTHK have no leakage resistance and must therefore not be used for enamelled storage tanks.

NOTE Electrical inserts may only be connected by approved electrical installers in accordance with the corresponding circuit diagram. The relevant regulations according to TAB and the VDE guidelines must be observed.

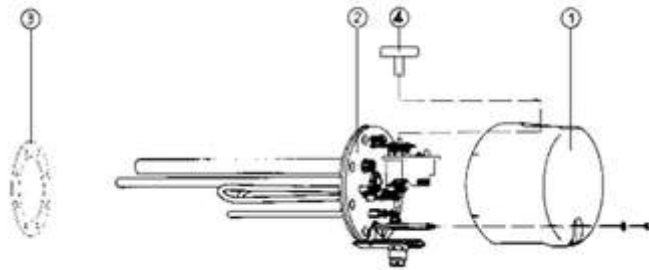


Fig. 6.3: Structure of a flange heater

1	protective cap
2	Heating flange
3	poetry
4th	Electrical connection

Tab.6.9: Legend of flange heating

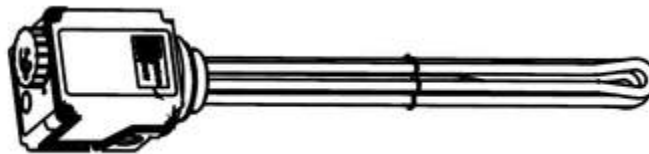


Fig. 6.4: Structure of the screw-in heater CEHK

Installation site

The storage tank may only be set up in a frost-free room. Installation and commissioning must be carried out by an approved specialist company.

Water-side connection

The cold water connection must be carried out in accordance with DIN 1988 and DIN 4573 Part 1 (see Fig. 6.5).

NOTE Connect all pipes to the hot water tank with detachable connections!

Since a circulation line causes high standby losses, it should only be connected to a widely ramified drinking water network. If circulation is required, it must be equipped with an automatically acting device (e.g. time or pressure controlled) to interrupt the circulation operation.

All connection lines including fittings must be insulated against heat loss in accordance with country-specific standards (e.g. Germany Energy Saving Ordinance (EnEV)). Poorly or not at all insulated pipe connections lead to an energy loss that is many times greater than the energy loss of the storage tank itself. A check valve must be provided in the heating water connection to avoid uncontrolled heating or cooling of the storage tank. The discharge line of the safety valve (safety valve combination) in the cold water supply line must always remain open. The operational readiness of the safety valve must be checked regularly for function, e.g. by venting it.

Emptying

A possibility of emptying the storage tank must be provided on site in the cold water connection pipe.

Pressure reducing valve

If the maximum network pressure can exceed the permissible operating pressure of 10 bar, a pressure reducing valve in the connection line is essential. However, in order to reduce the development of noise (e.g. pressure surges in the drinking water network), the line pressure within buildings should be reduced to an operationally permissible level in accordance with DIN 4709. For this reason, depending on the type of building, a pressure reducing valve in the storage tank inlet can be useful.

Safety valve

The system must be equipped with a component-tested safety valve that cannot be shut off towards the storage tank. No constrictions, such as dirt traps, may be installed between the storage tank and the safety valve.

When the storage tank is heated up, water must flow out (drip) from the safety valve in order to absorb the expansion of the water or to prevent an excessive increase in pressure. The discharge line of the safety valve must open freely, without any constriction, above a drainage device. The safety valve must be installed in an easily accessible and observable location so that it can be opened during operation. There is a sign near or on the valve itself with the inscription: "During heating, water can escape from the exhaust line! Do not close! "

Only component-tested, spring-loaded diaphragm safety valves may be used. The blow-off line must be at least as large as the safety valve outlet cross-section. If, for compelling reasons, more than two bends or a length of more than 2 m are required, the entire blow-off line must be one nominal diameter larger. In addition, like a sewer pipe, it should have a slight gradient away from the safety valve. It usually ends over a small collecting funnel to see whether water is escaping or not. More than three arches and 4 m in length are not permitted. The drainage line behind the collecting funnel must have at least twice the cross-section of the valve inlet. The safety valve must be set so that the permissible operating pressure of 10 bar is not exceeded.

Check valve, test valve

To prevent the heated water from flowing back into the cold water line, a non-return valve (non-return valve) must be installed. The function can be checked by closing the first shut-off valve in the flow direction and opening the test valve. Except for the water present in the short piece of pipe, no water may escape.

Shut-off valves

Shut-off valves are to be installed on the storage tank shown in Fig. 6.10 in the cold and hot water connection as well as the heating water flow and return, making sure that the fittings are suitable for drinking water (e.g. KTW approval).

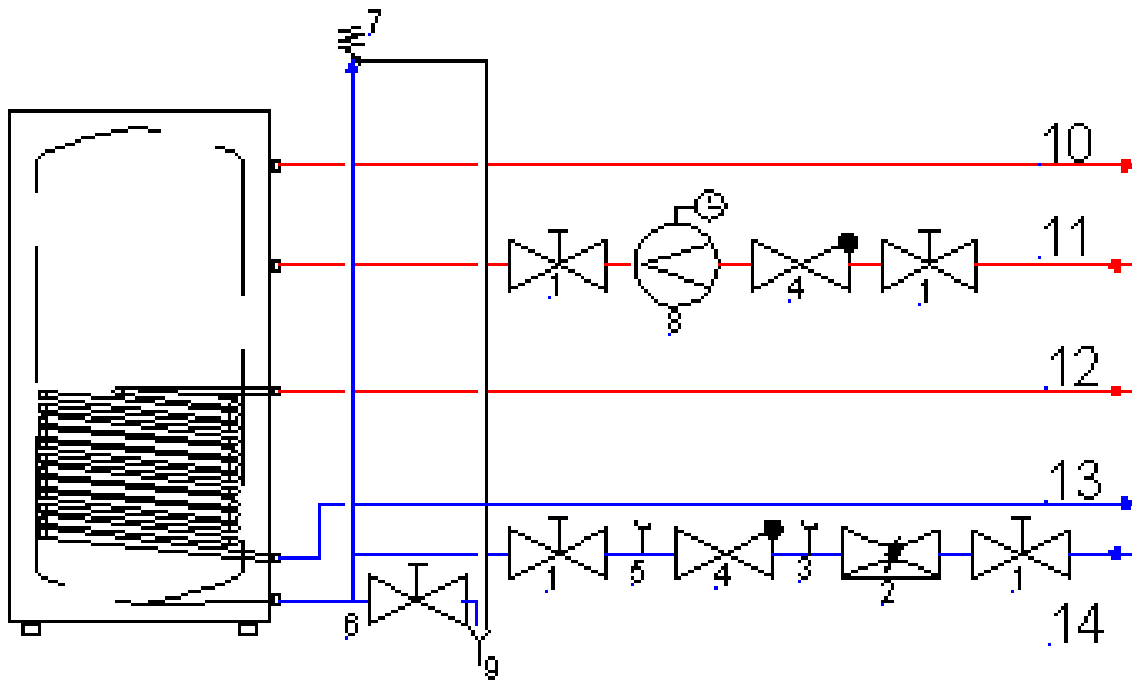




Fig.6.5: Water-side connection

Pressure drops

When dimensioning the charge pump for the hot water storage tank, the pressure losses of the internal heat exchanger must be taken into account.

Temperature setting for hot water preparation with the heating heat pump

Low temperature heat pumps have a maximum flow temperature of up to 60 ° C. This temperature must not be exceeded during hot water preparation so that the heat pump does not switch off via the high pressure pressure switch. Therefore, the temperature set on the controller should be below the maximum attainable storage tank temperature.

The maximum achievable storage tank temperature depends on the output of the installed heat pump and the heating water flow rate through the heat exchanger (smooth tube heat exchanger). The maximum achievable hot water temperature for heating heat pumps can be determined according to chap. 6.2.3 take place. It should be taken into account that the amount of heat stored in the heat exchanger leads to a further reheating of approx. 3K. In the case of hot water preparation with the heat pump, the set temperature can be 2 to 3 K below the desired hot water temperature.

6.2.3 Achievable hot water storage tank temperatures

The maximum hot water temperature that can be achieved with the heat pump depends on:

- the heating output (heat output) of the heat pump
- the heat exchanger surface installed in the storage tank and
- the delivery rate (volume flow) of the circulation pump.

The selection of the hot water storage tank must be based on the maximum heating output of the heat pump (summer operation with air / water heat pumps or high heat source temperatures with brine / water heat pumps) and the desired storage tank temperature (e.g. 50 ° C).

When designing the hot water charging pump, the pressure losses in the storage tank must be taken into account.

The maximum achievable hot water temperature depends on the factors listed above.

If the set hot water target temperature (see also chapter Control and regulation) is selected too high, it cannot be achieved in pure heat pump operation. The set target hot water temperature can still be achieved by means of flange heating and activated reheating.

If a hot water temperature of 40 ° C is reached in the storage tank in pure heat pump operation, it is advisable to check the above factors.

If the power provided by the heat pump cannot be transferred to the hot water storage tank, the pressure in the cooling circuit increases. When the maximum permissible pressure is reached in the cooling circuit, the high-pressure safety program automatically switches off the heat pump and blocks hot water heating for a maximum of 2 hours.

In hot water storage tanks with sensors, the integrated learning function automatically adjusts the maximum achievable temperature - before the maximum pressure is reached. Means: DHW temperature maximum new = current actual temperature in the DHW cylinder - 1 Kelvin.

If higher hot water temperatures are required, this can be done via

- electrical reheating (flange heating in the hot water storage tank)
- 2. Heat generator (oil or gas boiler, pellet boiler, etc.)

take place.

NOTE The target hot water temperature should be set a maximum of 5 K below the maximum flow temperature of the heat pump. In the case of monoenergetic heat pump systems - as soon as the heat pump cannot cover the heat demand of the building on its own - the hot water is produced exclusively by the flange heater.

Example:

Heat pump with a maximum heating output of 14 kW and a maximum flow temperature of 55 °C

Hot water tank 400l storage

Volume flow of the hot water charging pump: 2.0 m³/H The result is a hot water temperature of: ~ 47 °C

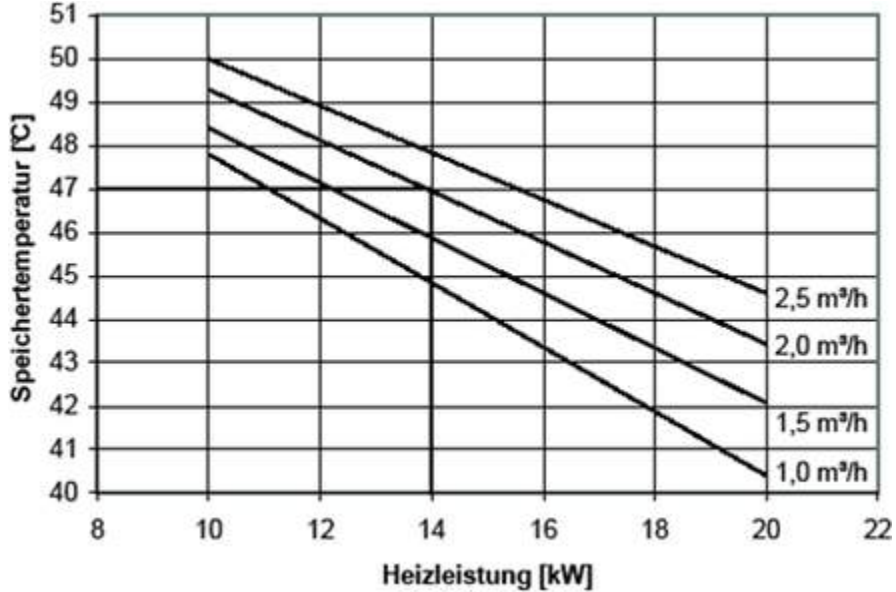


Fig.6.6: Design of a hot water storage tank using the example of WWSP 442

Calculation of the heat exchanger capacity (register capacity)

The performance of the registry depends on several factors:

- Area of the register
- Material property
- Operating conditions

The performance of the register can be calculated from this:

$$Q = A \cdot T_m$$

	Heat transfer coefficient (enamelled steel = 310 W / (m ² * K); chrome steel = 420 W / (m ² * K)
A.	Area of the register
T _m	Average temperature difference from flow / return and cold water / hot water

Example:

4 m² Register surface in an enamelled steel container, heating side flow / return = 58/48 °C, cold water inlet of 10 °C, hot water temperature 45 °C.

This results in the following mean temperatures: 53 °C on the heating side and 27 °C on the domestic water side and a mean temperature difference T_m from 26 K

$$Q = 310 \frac{W}{m^2 \cdot K} \cdot 4 m^2 \cdot 26 K = 32.240 W = 32,2 kW$$

Calculation of the draw-off quantities (continuous output)

$$m = \frac{Q}{c_p \cdot \Delta T}$$

Q	Performance of the register
C _p	specific heat capacity (water c _p = 4.2 J / (g * K))
T	Temperature difference

Example:

With a register output of 32.2 kW, water should be heated from 10 ° C to 45 ° C.

$$m = \frac{32200 \text{ W}}{4,2 \frac{\text{J}}{\text{g} \cdot \text{K}} * 35\text{K}} = 219,05 \frac{\text{g}}{\text{s}}$$

So 219 g or 200 ml of water are heated from 10 ° C to 45 ° C per second. That corresponds to 13 liters per minute or 788 liters per hour.

6.2.4 Design aid for combination and hot water storage tanks

The table shows the allocation of hot water charging pumps and storage tanks to the individual heat pumps in which a hot water temperature of 45 ° C is reached in 1-compressor heat pump operation (maximum temperatures of the heat sources: air: 25 ° C, brine: 10 ° C, water 10 ° C, maximum Pipe length between heat pump and storage tank 10 m). The maximum hot water temperature that can be reached in pure heat pump operation depends on:

- the heating output (heat output) of the heat pump
- the heat exchanger surface installed in the storage tank
- the volume flow as a function of the pressure loss and delivery rate of the circulation pump.

NOTE Higher temperatures can be achieved through larger heat transfer surfaces in the storage tank, by increasing the volume flow or through targeted reheating using a heating rod or a second heat generator

NOTE According to Article 3, Paragraph 3 of the European Pressure Equipment Directive EN 378, buffer and hot water storage tanks may not have a CE mark. There it says, among other things. "Pressure equipment and / or assemblies ... must be designed and manufactured in accordance with good engineering practice in a member state to ensure that they can be used safely." The system installer is responsible for proper installation.

Air-to-water heat pumps (installed outside)					
Heat pump	Volume in liters	Exchanger area in m ²	Storage enamelled	Charge pump M18 r respectively. Changeover valve	Storage tank flow principle / Hydrotower
LA 6S-TU (R)	200	2.9	WWSP 229	UP 75-25PK / DWUS 25	- / HWK 230Econ5S
LA 9S-TU (R)	300	3.5 / 3.2	WWSP 335 / PWS 332	UP 75-25PK / DWUS 25	PWD 750 / HWK 230Econ5S / HWK 332 (Econ5S)
LA 12S-TU (R)	300	3.5 / 3.2	WWSP 335 / PWS 332	UP 75-25PK / DWV 25	PWD 750 / HWK 332 (Econ5S)
LA 18S-TU (R)	300	3.5 / 3.2	WWSP 335 / PWS 332	UP 75-32PK / DWV 32	PWD 750 / HWK 332 (Econ5S)
LA 22TBS	400	4.2	WWSP 442	UPH 90-32 / DWV 32	PWD 750 / -
LA 28TBS	400	4.2	WWSP 442	UPH 90-32 / DWV 32	PWD 750 / -
LA 35TBS	400	4.2	WWSP 442	UPH 90-32 / DWV 32	PWD 750 / -
LA 25TU-2	400	4.2	WWSP 442	UPH 90-32 / DWV 32	PWD 750 / -
LA 40TU-2	500	5.7	WWSP 556	UPH 90-32 / DWV 40	PWD 750 / -
	700	7.0	WWSP 770		
LA 60S-TU	700	7.0	WWSP 770	UPH 120-32PK / DWV 40	PWD 750 / -
LA 60S-TUR	700	7.0	WWSP 770	UPH 120-32PK / DWV 40	PWD 750 / -
Air / water heat pumps (installed inside)					

Heat pump	Volume in liters	Exchanger area in m ²	Storage enamelled	Charge pump M18 respectively. Changeover valve	Storage tank flow principle / Hydrotower
LIK 8TH	300	3.5	WWSP 335	UP 75-25PK / DWUS 25	- / -
LIK 12TU	300	3.5	WWSP 335	UP 75-25PK / DWUS 25	- / -
LI 9TU	300	3.5 / 3.2	WWSP 335 / PWS 332	UP 75-25PK / DWUS 25	PWD 750 / HWK 332
LI 12TU	300	3.5 / 3.2	WWSP 335 / PWS 332	UP 75-25PK / DWUS 25	PWD 750 / HWK 332
LI 11TES	300	3.5 / 3.2	WWSP 335 / PWS 332	UP 75-25PK / DWUS 25	PWD 750 / HWK 332
LI 16TES	400	4.2	WWSP 442	UP 75-25PK / DWV 25	PWD 750 / -
LI 16I-TUR					
LI 20th	400	4.2	WWSP 442	UPH 90-32 / DWV 32	PWD 750 / -
LI 24TES	400	4.2	WWSP 442	UPH 90-32 / DWV 32	PWD 750 / -
LI 28TES	400 500	4.2 5.7	WWSP 442 WWSP 556	UPH 90-32 / DWV 32	PWD 750 / -

Air / water heat pumps M Flex

Heat pump	Volume in liters	Exchanger area in m ²	Storage enamelled	Charge pump M18 respectively. Changeover valve	Storage tank flow principle / Hydrotower
M Flex 0609	200 300	2.9 3.2 3.5	WWSP 229 MDHW 232 WWSP 335 / MDHW 335	Integrated switching valve	- / -
M Flex 0916	200 300 400	3.2 3.5 4.2	MDHW 232 WWSP 335 / MDHW 335 WWSP 442	Integrated switching valve	- / -
M Flex 0916M	200 300 400	3.2 3.5 4.2	MDHW 232 WWSP 335 / MDHW 335 WWSP 442	Integrated switching valve	- / -

NOTE With System M heat pumps, the hot water storage tanks including pump hydraulics are already integrated as standard, depending on the configuration

Split air / water heat pumps

Heat pump	Volume in liters	Exchanger area in m ²	Storage enamelled	Charge pump M18 respectively. Changeover valve	Storage tank flow principle / Hydrotower
LAW 9IMR	300	3.2	integrated	Integrated pump	- / LAWC 9IMR
LAW 14ITR	300	3.2	integrated	Integrated pump	- / LAWC 14ITR
LAW 14IMR	300	3.2	integrated	Integrated pump	- / LAWC 14IMR
LAK 9IMR	200 300	2.9 3.2	WWSP 229 WWSP 335	Switching valve (VSW LAK)	- / -
LAK 14ITR	300	3.5	WWSP 335	Switching valve (VSW LAK)	- / -
LAK 14IMR	300	3.5	WWSP 335	Switching valve (VSW LAK)	- / -

Brine / water heat pumps

Heat pump	Volume in liters	Exchanger area in m ²	Storage enamelled	Charge pump M18 respectively. Changeover valve	Storage tank flow principle / Hydrotower
SIK 6TES	200/300	2.9 / 3.5	WWSP 229 / WWSP 335	UP 75-25PK / DWUS 25	- / -
SIK 8TES	300	3.5	WWSP 335	UP 75-25PK / DWUS 25	- / -
SIK 11TH	300/400	3.5 / 4.2	WWSP 335 / WWSP 442	UP 75-25PK / DWUS 25	PWD 750 / -

SIK 14TH	400	4.2	WWSP 442	UP 75-25PK / DWV 25	PWD 750 / -
SIW 6TES	170 l integrated	2.15	170 l integrated	integrated	- / -
SIW 8TES	170 l integrated	2.15	170 l integrated	integrated	- / -
SIW 11TES	170 l integrated	2.15	170 l integrated	integrated	- / -
SI 6TU	200/300	2.9 / 3.5 / 3.2	WWSP 229 / WWSP 335 / PWS 332	UP 75-25PK / DWUS 25	- / HWK 332
SI 8TU	300	3.5 / 3.2	WWSP 335 / PWS 332	UP 75-25PK / DWUS 25	- / HWK 332
SI 11TU	300/400	3.5 / 4.2 / 3.2	WWSP 335 / WWSP 442 / PWS 332	UP 75-25PK / DWUS 25	PWD 750 / HWK 332
SI 14TU	400	4.2	WWSP 442	UP 75-25PK / DWV 25	PWD 750 / HWK 332
SI 18TU	400	4.2	WWSP 442	UPH 90-32 / DWV 32	PWD 750 / -
SIH 20TE	400	4.2	WWSP 442	UPH 90-32 / DWV 32	PWD 750 / -
SI 22TU	500	5.7	WWSP 556	UPH 90-32 / DWV 32	PWD 750 / -
SI 26TU	500	5.7	WWSP 556	UPH 90-32 / DWV 40	PWD 750 / -
SI 35TU	500	5.7	WWSP 556	UPH 120-32PK / DWV 40	PWD 750 / -
SI 35TUR	500	5.7	WWSP 556	UPH 120-32PK / DWV 40	PWD 750 / -
SI 50TU	500/700	5.7 / 7.0	WWSP 556 / WWSP 770	UPH 120-32PK / DWV 50	PWD 750 / -
SI 50TUR	500/700	5.7 / 7.0	WWSP 556 / WWSP 770	UPH 120-32PK / DWV 50	PWD 750 / -
SI 70TUR	700	7.0	WWSP 770	UPH 120-32PK / DWV 50	PWD 750 / -
SI 75TU	700	7.0	WWSP 770	UPH 120-32PK / DWV 50	PWD 750 / -
SI 85TUR	2 x 500	11.4	2 x WWSP 556	UPH 80-40F / DWV 50	PWD 750 / -
SI 90TU	2 x 700	14.0	2 x WWSP 770	UPH 80-40F / DWV 50	PWD 750 / -
SIH 90TU	2 x 700	14.0	2 x WWSP 770	UPH 80-40F / DWV 50	PWD 750 / -
SI 130TU	2 x 700	14.0	2 x WWSP 770	11.5 m ³ /h / DWV 50	PWD 750 / -
SI 130TUR +	2 x 700/3 x 500	14.0 / 17.1	2 x WWSP 700/3 x WWSP 556	UPH 80-40F / DWV 50	PWD 750 / -
Water / water heat pumps					
Heat pump	Volume in liters	Exchanger area in m ²	Storage enamelled	Charge pump M18 respectively. Changeover valve	Storage tank flow principle / Hydrotower
WI 10TU	300	3.5 / 3.2	WWSP 335 / PWS 332	UP 75-25PK / DWUS 25	PWD 750 / HWK 332
WI 14TU	300	3.5 / 3.2	WWSP 335 / PWS 332	UP 75-25PK / DWV 25	PWD 750 / HWK 332
WI 18TU	400	4.2	WWSP 442	UP 75-32PK / DWV 32	PWD 750 / -
WI 22TU	500	5.7	WWSP 556	UPH 90-32 / DWV 32	PWD 750 / -
WI 35TU	500	5.7	WWSP 556	UPH 120-32PK / DWV 32	PWD 750 / -
WI 45TU	500/700	5.7 / 7.0	WWSP 556 / WWSP 770	UPH 120-32PK / DWV 40	PWD 750 / -
WI 65TU	2 x 500	11.4	2 x WWSP 556	UPH 120-32PK / DWV 50	PWD 750 / -
WI 95TU	2 x 700	14.0	2 x WWSP 770	UPH 80-40F / DWV 50	- / -
WI 120TU	2 x 700	14.0	2 x WWSP 770	11.5 m ³ /h / DWV 50	- / -
WIH 120TU	2 x 700	14.0	2 x WWSP 770	11.5 m ³ /h / DWV 50	- / -

WI 180TU	3 x 700	21.0	3 x WWSP 770	15.0 m ³ /H / -	- / -
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Tab.6.10: Design aid for combination and hot water storage tanks

6.2.4.1 Legionella

6.2.4.1.1 How do legionella bacteria develop in drinking (warm) water installations

Legionella are mostly found in stagnant water and occur at a water temperature between 25 ° C and 55 ° C. Possible causes promote the occurrence of legionella:

- Stagnation due to oversizing of the drinking water pipes
- Excessive saving of water by users
- Vacancy (e.g. unlet residential unit) or longer absence of residents (e.g. holiday home)
- Lime and sludge deposits in pipelines and hot water storage tanks, especially in "older" buildings
- Missing hydraulic balancing of the drinking water pipe
- Insufficient insulation of the cold and hot water pipes
- Incorrect energy saving by reducing the flow temperature of the heat generator

6.2.4.1.2 How can Legionella be avoided or removed in the drinking (warm) water installation

Thermal disinfection

Thermal disinfection is the best method of preventing legionella in drinking water today. From a temperature of 55 ° C legionella can no longer multiply, from a water temperature of 60 ° C they die. In order to ensure that Legionella is killed, the tapping points must be rinsed with hot water (> 60 ° C) for at least 3 minutes; in the case of large objects and drinking water systems, this must be done by strands.

Disadvantages: The high temperatures during "rinsing" make the material more susceptible to corrosion, in particular welding seams, soldered joints or seals are heavily stressed, and the high temperatures also cause more limescale to precipitate and deposit in the pipelines.

Legionella circuit

The legionella switch is a periodic, thermal disinfection that is intended to counteract the growth of legionella. The hot water storage tank or drinking water heater and the entire hot water network including the tapping points are heated to temperatures > 70 ° C for at least 3 minutes in a defined cycle. It is important that all draw-off or tap points are open. The legionella switch is a preventive measure and has no effect on already contaminated systems.

Legionella detection - test procedure

The drinking water from the water supply company is usually flawless and has a pH value between 6.5 and 9.5 when it leaves the waterworks. This range of the pH value is anchored in law. From the house feed to the extraction point, however, the drinking water can be polluted by various impurities in the pipe system, pipes and fittings by bacteria or heavy metals. A drinking water analysis with a rapid bacterial test can reliably and clearly identify and quantify possible contamination of the drinking water. This test is particularly recommended for spot checks after renovation work on the property, if there is any suspicion of contamination or health protection concerns.

Chemical disinfection

If the limit values of the Drinking Water Ordinance for microbiological parameters are exceeded in a drinking water installation, the microbial contamination must be removed immediately. The structural differences usually require an individual action plan that includes regular preventive measures such as flushing the pipe network or installing an ultrafiltration system. The disinfection of an already contaminated system is usually carried out sustainably and effectively by flushing the drinking water system with chlorine dioxide. This not only kills legionella, but also removes the biofilm that has settled in the pipelines. In contrast to pure chlorine, chlorine dioxide systems do not degrade the disinfection effect as the pH value rises, and it is very effective and odorless even at very low concentrations. This process should be carried out by a licensed specialist, as improper use can result in undesirable by-products.

6.2.4.2 Country-specific requirements for drinking water quality

6.2.4.2.1 Germany - DVGW - Worksheet W 551

The DVGW worksheet W 551 defines construction and operating requirements for systems for the provision of hygienically perfect drinking hot water with special consideration and measures to reduce the growth of legionella in drinking water systems. Be differentiated **Small systems** (One- and two-family houses) and **Large systems** (all other systems with storage capacity greater than 400 liters and a pipe capacity greater than 3 liters between storage facility and tapping points).

Requirements for small systems

1. Delimitation / general:
 - a. Volume of the Drinking water storage tank <400 liters (does not apply to one- and two-family houses)
 - b. Line volume¹⁾ <3 liters
 - c. It is necessary to inform the user about health risks when operating at low temperatures
2. Construction requirement:
 - a. It must be possible to reach an outlet temperature of > 60 ° C at the drinking water storage tank
3. Operational requirement:
 - a. no specifications for operating temperature, but:
 - Recommendation > 60 ° C at the outlet of the drinking water storage tank
 - Temperatures <50 ° C should be avoided

- b. If necessary (after a long standstill): thermal disinfection²⁾ recommended
- 4. Summary:
For small systems, it is recommended to set the temperature on the drinking water storage tank to 60 ° C. However, operating temperatures below 50 ° C should be avoided in any case. When using low-temperature heat pumps, for reasons of economy, post-heating in the hot water storage tank should be carried out using an additional electrical heater.

Requirements for large systems

1. Demarcation
 - a. Volume of the drinking water storage tank > 400 liters (does not apply to one- and two-family houses) or
 - b. Line volume¹⁾ > 3 liters
2. Construction requirements:
 - a. Complete heating of the drinking water storage tank must be possible (mixing equipment may be required for this)
 - b. With line volume¹⁾ > 3 liters a circulation line is required
3. Operational requirement:
 - a. Outlet temperature at the drinking water storage tank > 60 ° C; Short-term, operationally-related shortfalls are permissible (e.g. removal)
 - b. Operating temperature of the entire system permanently > 55 ° C. Therefore: drop in temperature stratification up to the connection point of the circulation line in the drinking water storage tank < 5 K)
 - c. 1x complete heating of the drinking water storage tank > 60 ° C per day
4. Summary:
In large systems, either the water at the hot water outlet of the storage tank must be heated to at least 60 ° C. Alternatively, the entire storage volume (usable content) can be exchanged within 72 hours.

¹⁾ "Line volume" refers to the content of a pipeline from the drinking water heater to the tapping point without the content of the return to the drinking water heater via a circulation line. The individual pipelines are considered, not the total volume of the pipeline system.

²⁾ A minimum of 70 ° C is required for thermal disinfection. This temperature does not necessarily have to be made available by the drinking water heater. External additional heating is also possible.

Line lengths with 3l content	
Copper pipe x mm	Cable length / m
10 x 1.0	60.0
12 x 1.0	38.0
15 x 1.0	22.5
18 x 1.0	14.9
22 x 1.0	9.5
28 x 1.0	5.7
28 x 1.5	6.1

Tab. 6.11: Water content per pipe length for different pipe cross-sections

NOTE The installation of a flange heater is generally recommended to enable heating to temperatures above 60 ° C. Depending on the application or customer requirements, the electrical reheating can be timed by the controller.

6.2.4.2.2 Switzerland - SVGW leaflet TPW

The leaflet "Legionella in drinking water installations - what must be considered?" Shows where problems with legionella can occur in drinking water and what options exist to effectively reduce the risk of legionella disease.

6.2.4.3 Accessories for hot water preparation - flow rate measurement DFM 1988-1 / DFM 1988-WPM

The flow meter DFM 1988 is a measuring and control device with which the tap volume of a central drinking water storage tank at the cold water inlet is recorded. According to DIN 1988-200, the storage tank temperature may be reduced to a minimum of 55 ° C with high hot water exchange. This enables the hot water tank to be heated more efficiently (e.g. with a heat pump).

functionality

If the requirement for drinking water installations after a complete exchange of the drinking water in the storage tank is not met within 72 hours, a switching output on the electronics unit of the DFM 1988 is released to control a second heat generator (electric immersion heater). This enables the drinking water in the storage tank to be heated to a temperature of more than 60 ° C. The required setpoint is maintained until the required water exchange has taken place within 72 hours. The switching output for the second heat generator is active until the switch-off temperature of 62 ° C has been reached. It is switched on again at 60 ° C.



NOTE The DFM 1988 does not meet the requirement of the DVGW guideline W 551 for a permanent 60 ° C at the hot water tank outlet, but that of DIN 1988-200 in systems with increased water exchange. The DIN was created in accordance with the guideline and represents the current state of the art, on which the DVGW also contributed.

The system installer must dimension the system so that the required water exchange is usually achieved within 3 days. The DFM 1988 is used as a safeguard to automatically increase the hot water temperature to 60 ° C if the water exchange is too low. The heat pump system - consisting of heat pump and storage tank - is to be designed in such a way that 55 ° C is reached in pure heat pump operation under normal conditions. In normal operation with high water exchange, the DFM 1988 does not generate any additional energy expenditure for the electric immersion heater in the hot water storage tank, as the heat pump generates a hot water temperature of 55 ° C. In systems without DFM 1988-1 in which the increased water exchange cannot be ensured, the system must be operated continuously at 60 ° C. In systems with permanently programmed locking times for the energy supplier (e.g. 3 x daily up to 2 hours), the system should be programmed so that the hot water temperature is increased to 60 ° C before this locking time.

NOTE The operator must be informed about the possible health risk (legionella growth) by the system installer during commissioning.

Establishment of the DFM in 1988

The DFM 1988 consists of an electronic module for wall mounting, a turbine sensor for determining the amount drawn off and an NTC-10 temperature sensor.

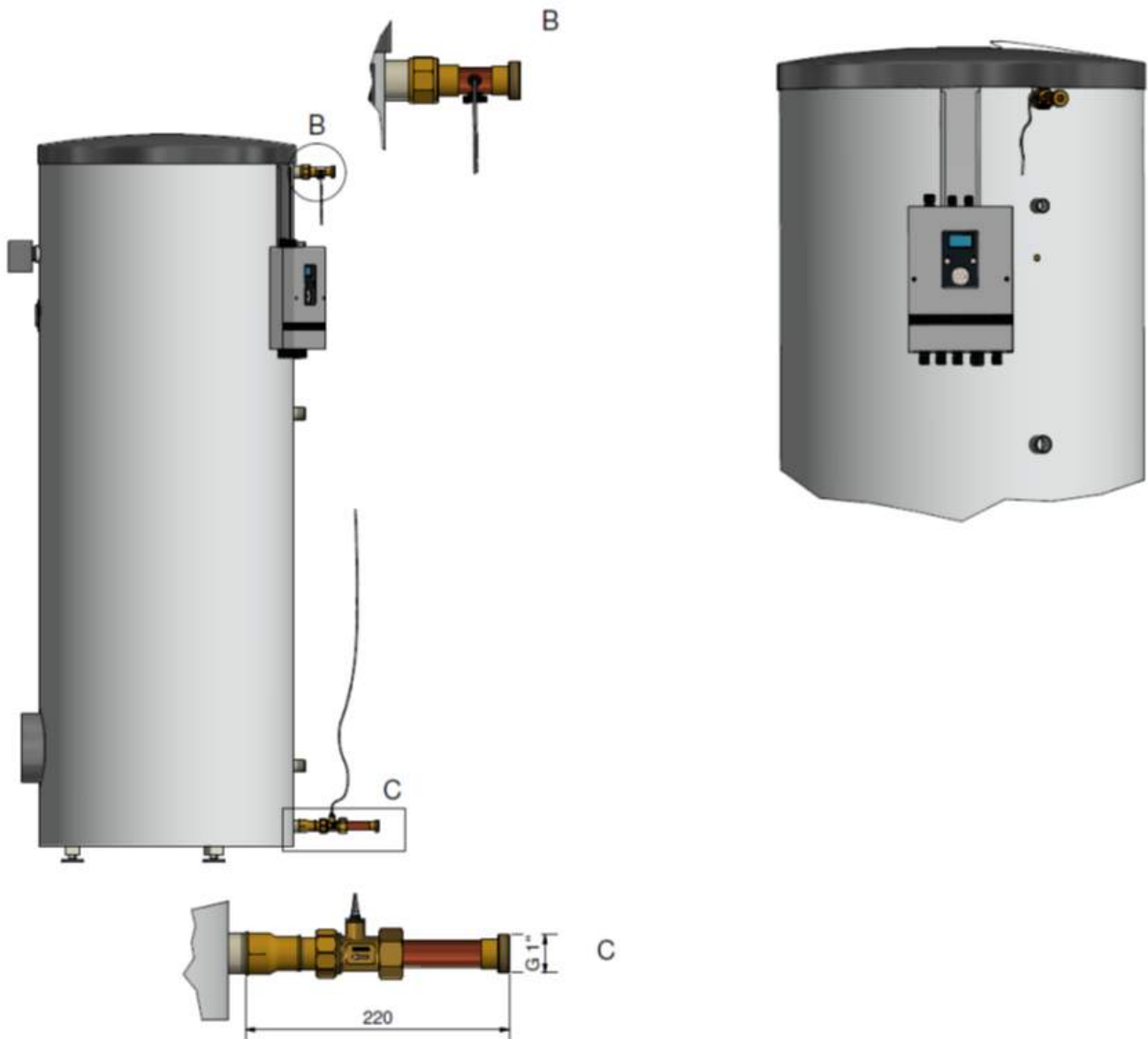


Fig.6.7: Hydraulic structure of the DFM 1988-1

According to DIN 1988-200, hot water temperatures of greater than 50 ° C are permissible if the hot water installation can be exchanged within 3 days during operation. If you take into account the use of a circulation line with a heat loss of 5 Kelvin in the return line, the hot water outlet temperature must be at least 55 ° C.

As a result, the heat pump used must be able to permanently provide a hot water temperature of 55 ° C in the storage tank during normal operation, depending on the heat output of the heat pump, the hot water tank used and the volume flow.

The following heat pumps achieve a maximum hot water outlet temperature of 55 ° C under the following conditions in pure heat pump operation

	Usable content memory	WWSP 442	WWSP 556	WWSP 770	Exchange area min. In m ²	Source temperature		Volume flow	DHW charging pump *
		400	500	700		min	Max		
LA 18S-TU (R)			1		5.7	-7 ° C	35 ° C	1.4 m ³ / h	UP 75-32PK
LA 22TBS		1	1	1	4.2	-7 ° C	35 ° C	3.3 m ³ / h	UPH 90-32
LA 28TBS		1	1	1	4.2	-7 ° C	35 ° C	4.6 m ³ / h	UPH 90-32
LA 35TBS			1	1	5.7	-7 ° C	35 ° C	3.1 m ³ / h	UPH 90-32
LA 60S-TU		-	2	1	7th	-7 ° C	35 ° C	5.0 m ³ / h	UPH 120-32PK
LA 60S-TUR		-	2	1	7th	-7 ° C	35 ° C	5.0 m ³ / h	UPH 120-32PK
SIK 14TH		1	1	-	4.2	0 ° C	20 ° C	2.2 m ³ / h	UP 75-25PK
SI 14TU		1	1	-	4.2	0 ° C	20 ° C	2.4 m ³ / h	UP 75-25PK
SI 18TU		1	1	1	4.2	0 ° C	20 ° C	3.0 m ³ / h	UP 75-25PK
SI 22TU		-	1	1	5.7	0 ° C	20 ° C	4.0 m ³ / h	UPH 90-32
SI 26TU		-	1	1	5.7	0 ° C	20 ° C	4.5 m ³ / h	UPH 90-32
SI 35TU		-	1	1	5.7	0 ° C	20 ° C	6.1 m ³ / h	UPE 100-32K
SI 50TU		-	1	1	5.7	0 ° C	20 ° C	8.8 m ³ / h	UPH 120-32PK
SI 75TU		-	2	1	7th	0 ° C	20 ° C	12.7 m ³ / h	UPH 120-32PK
SI 90TU		-	2	1	7th	0 ° C	20 ° C	15.1 m ³ / h	UPH 80-40F
SI 130TU		-	3	2	14th	0 ° C	20 ° C	17.2 m ³ / h	UPH 80-40F
SIH 20TE		1	1	1	4.2	0 ° C	20 ° C	3.7 m ³ / h	UPH 90-32
SIH 90TU		-	2	2	9	0 ° C	20 ° C	15.4 m ³ / h	UPH 80-40F
SI 35TUR		-	1	1	5.7	0 ° C	20 ° C	5.9 m ³ / h	UPE 100-32K
SI 50TUR		-	1	1	5.7	0 ° C	20 ° C	8.4 m ³ / h	UPH 120-32PK
SI 70TUR		-	2	1	7th	0 ° C	20 ° C	12.1 m ³ / h	UPH 80-40F
SI 85TUR		-	2	1	7th	0 ° C	20 ° C	14.1 m ³ / h	UPH 80-40F
SI 130TUR +		-	1	1	5.7	0 ° C	20 ° C	19.0 m ³ / h	UPH 80-40F
WI 14TU		1	1	-	4.2	7 ° C	20 ° C	2.3 m ³ / h	UP 75-25PK
WI 18TU		1	1	-	4.2	7 ° C	20 ° C	2.9 m ³ / h	UP 75-25PK
WI 22TU		-	1	1	5.7	7 ° C	20 ° C	3.8 m ³ / h	UPH 90-32
WI 35TU		-	1	1	5.7	7 ° C	20 ° C	6.1 m ³ / h	UPH 90-32
WI 45TU		-	1	1	5.7	7 ° C	20 ° C	7.9 m ³ / h	UPE 100-32K
WI 65TU		-	2	1	7th	7 ° C	20 ° C	12.1 m ³ / h	UPH 120-32PK
WI 95TU		-	2	1	7th	7 ° C	20 ° C	17.0 m ³ / h	UPH 80-40F
WI 120TU		-	3	2	14th	7 ° C	20 ° C	20.6 m ³ / h	UPH 80-40F
WI 180TU		-	4th	3	20th	7 ° C	20 ° C	22.2 m ³ / h	UPH 80-40F
WIH 120TU		-	3	2	14th	7 ° C	20 ° C	21.2 m ³ / h	UPH 80-40F

* Alternatively, changeover heating / hot water generation with 3-way changeover valve DWV 32, DWV 40, DWV 50.

The hot water temperature displayed by the heat pump manager may differ from the hot water outlet temperature depending on the positioning of the sensor

Tab.6.11a: Permissible system configurations heat pump, DFM 1988-1 and hot water storage tank

6.2.5 Hydraulic interconnection of hot water storage tanks

6.2.5.1 Interconnection of the combination memory PWD 750

The following drawing shows the hot water preparation via a combination storage tank PWD 750 with circulation line. In normal tapping operation, part of the drinking water is fed through the heat exchangers of the PWD 750 and heated. The desired hot water target temperature is regulated via the built-in 3-way valve. When the circulation pump is activated, part of the water is fed through the bypass into the upper right-hand heat

exchanger and heated there. The thermostatic 3-way valve then mixes the heated water in the circulation line until the desired temperature is reached.

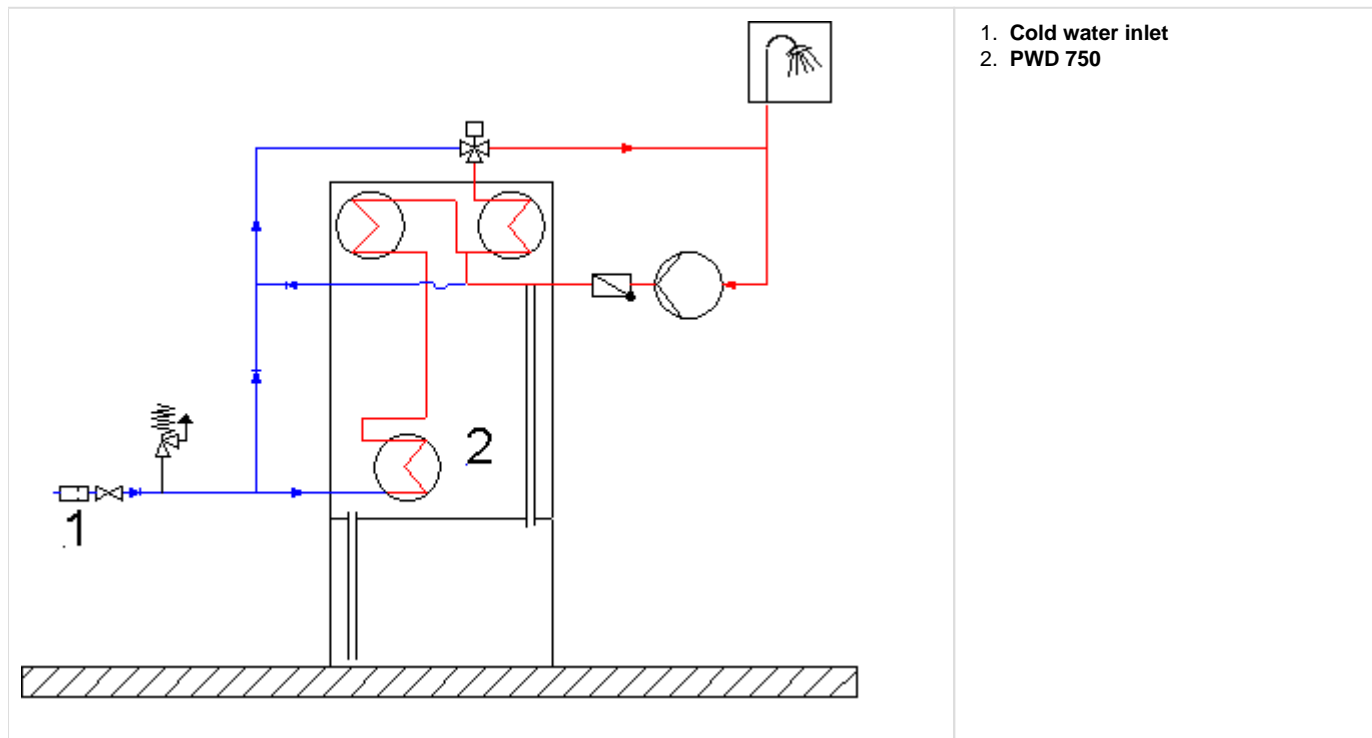


Fig. 6.8: Integration of the circulation return in the cold water inlet of the thermostatic mixer

6.2.5.2 Combination of several hot water tanks

In the event of a high water requirement and the resulting heat pump output, the heat exchanger surface required for this can be implemented by connecting the heat exchanger surfaces of hot water storage tanks in parallel or in series. This is usually necessary with heat pump outputs of approx. 28 KW for hot water preparation in order to achieve sufficiently high hot water temperatures.

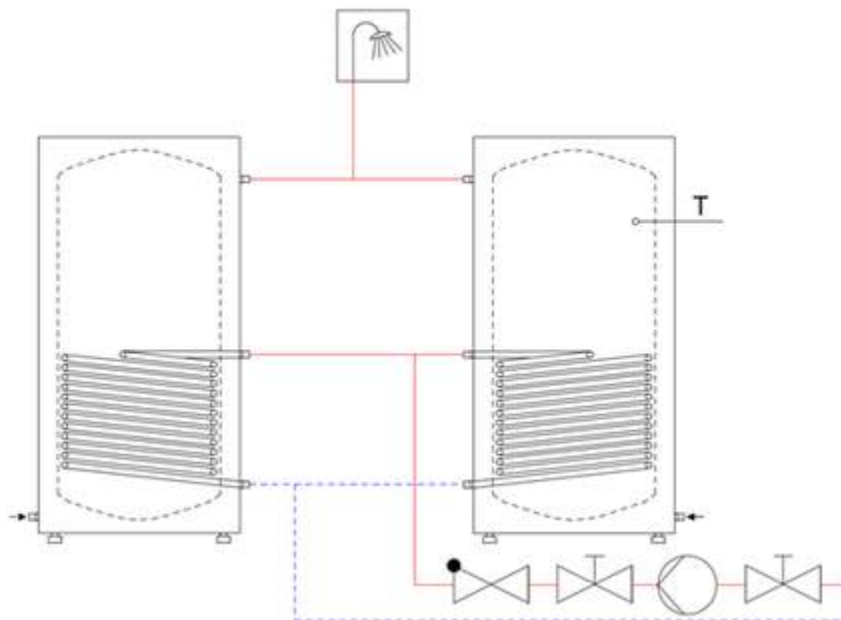


Fig. 6.9: Parallel connection of hot water storage tanks

the **Parallel connection** is only possible with identically constructed hot water storage tanks. When interconnecting the heat exchanger and the hot water connection, the pipes from the T-piece to both storage tanks must have the same pipe diameter and length (Tichelmann principle) in order to evenly distribute the volume flows for loading and unloading with an identical pressure loss. (see Fig.6.9)

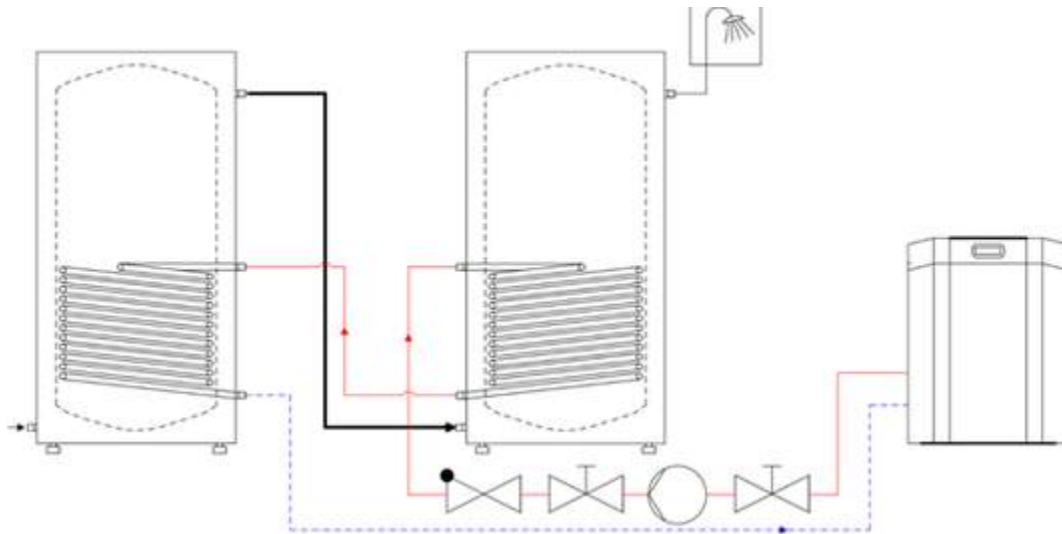


Fig. 6.10: Series connection of hot water storage tanks

In the **Series connection** In the case of hot water storage tanks, it must be taken into account that the heating water is first fed through the storage tank from which the warm drinking water is taken. In addition, the higher pressure losses in contrast to the parallel connection must be taken into account when designing the hot water charging pump (see Fig. 6.10).

NOTE For other applications for domestic hot water preparation and the combination of hot water storage tanks, see "Guide for drinking water heating" from the Federal Association for Heat Pumps.

6.2.6 Storage tank for DHW preparation WWSP

6.2.6.1 Overview table DHW storage tank WWSP

Technical specifications	WWSP 229	WWSP 335	WWSP 442	WWSP 556	WWSP 770
Nominal content	237 l	300 l	400 l	500 l	700 l
Usable content	212 l	273 l	353 l	433 l	691 l
Heat exchanger surface	2.9 m ²	3.5 m ²	4.2 m ²	5.65 m ²	7.0 m ²
Contents heat exchanger		24 l	29 l	42 l	49 l
height	1433 mm	1350 mm	1598 mm	1925 mm	2050 mm
broad	640 mm	710 mm	710 mm	710 mm	1000 mm
depth	650 mm	700 mm	700 mm	700 mm	1000 mm
diameter	-	700 mm	700 mm	700 mm	1000 mm
Height without insulation	-	-	-	-	1900 mm
Width without insulation	-	-	-	-	790 mm
Depth without insulation	-	-	-	-	750 mm
Diameter without insulation	-	-	-	-	750 mm
Tilted dimension	1580 mm	1438 mm	1715 mm	2050 mm	2107 mm (without D.)
Perm. Operating temperature heating water	110 ° C	110 ° C	110 ° C	110 ° C	110 ° C
Perm. Operating pressure heating water	10 bar	10 bar	10 bar	10 bar	10 bar
Perm. Operating temperature hot water	95 ° C	95 ° C	95 ° C	95 ° C	95 ° C
Perm. Operating pressure hot water	10 bar	10 bar	10 bar	10 bar	10 bar
Heat loss ¹	1.27 kWh / 24h	1.66 kWh / 24h	1.99 kWh / 24h	2.26 kWh / 24h	3.00 kWh / 24h
Energy efficiency class	B (53W)	B (69W)	C (83W)	C (94W)	C (125W)
Storage weight (net)	124 kg	125 kg	159 kg	180 kg	247 kg

¹Room temperature 20 ° C; Storage temperature 65 ° C

connections	WWSP 229	WWSP 335	WWSP 442	WWSP 556	WWSP 770
Cold water	R 1 "	R 1 "	R 1 "	R1 "	R 1 ¼ "
Hot water	R 1 "	R 1 "	R 1 "	R1 "	R 1 ¼ "
circulation	G ¾ "IG	G ¾ "IG	G ¾ "IG (2x)	G ¾ "IG (2x)	G ¾ "IG (2x)
Heating water flow	G 1 ¼ "IT	G 1 ¼ "IT	G 1 ¼ "IT	G 1 ¼ "IT	G 1 ¼ "IT
Heating water return	G 1 ¼ "IT	G 1 ¼ "IT	G 1 ¼ "IT	G 1 ¼ "IT	G 1 ¼ "IT
flange	TK150 / DN110	DN 110 (TK 150) 8 holes	DN 110 (TK 150) 8 holes	DN 110 (TK 150) 8 holes	DN 110 (TK 150) 8 holes
Anode diameter	33 mm	33 mm	33 mm	33 mm	33 mm
Anode length	685 mm	750 mm	850 mm	1100 mm	590 mm
Anode connection thread	G 1 ¼ "IT	G 1 ¼ "IT	G 1 ¼ "IT	G 1 ¼ "IT	G 1 ¼ "IT
Immersion sleeve 1	- Ø 20 x 200 mm	Ø 20 x 200 mm	Ø20 x 200 mm	Ø20 x 200 mm	Ø20 x 200 mm

Tab.6.12: Technical data of the DHW cylinder WWSP

6.2.6.2 DHW cylinder WWSP 229

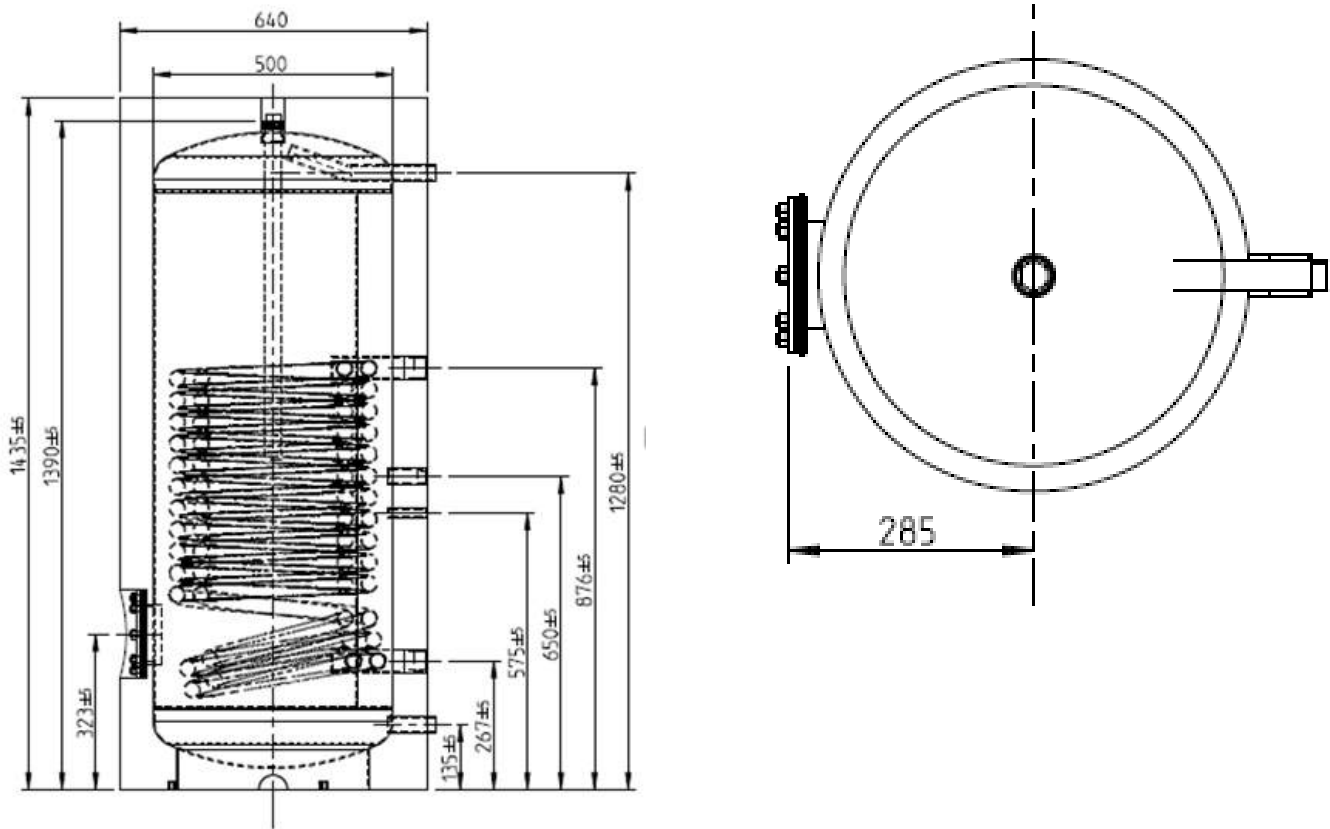
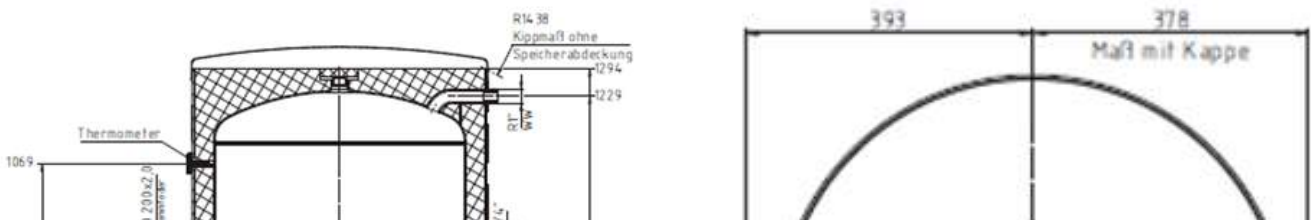


Fig. 6.11: Drawing WWSP 229

6.2.6.3 DHW cylinder WWSP 335



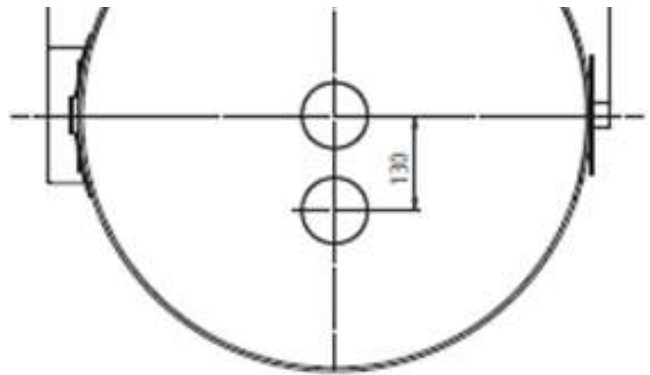
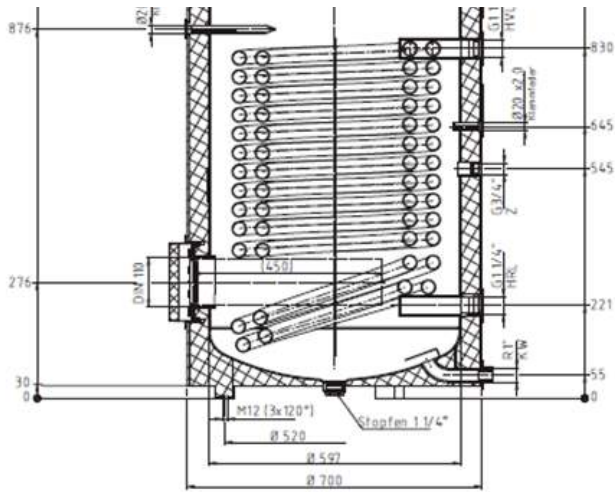


Fig.6.12: Drawing WWSP 335

6.2.6.4 DHW cylinder WWSP 442

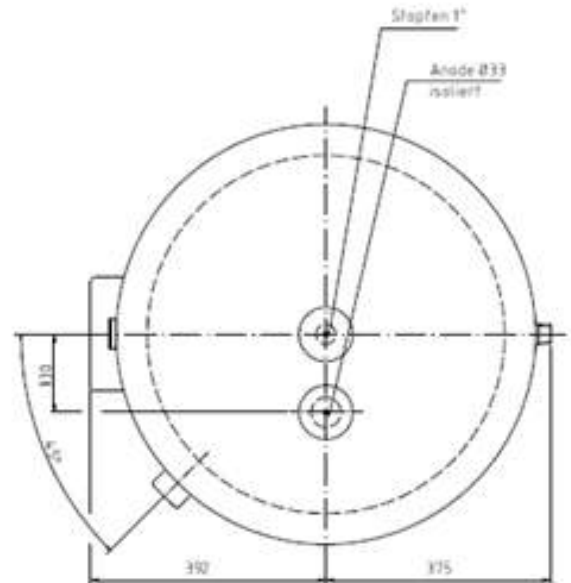
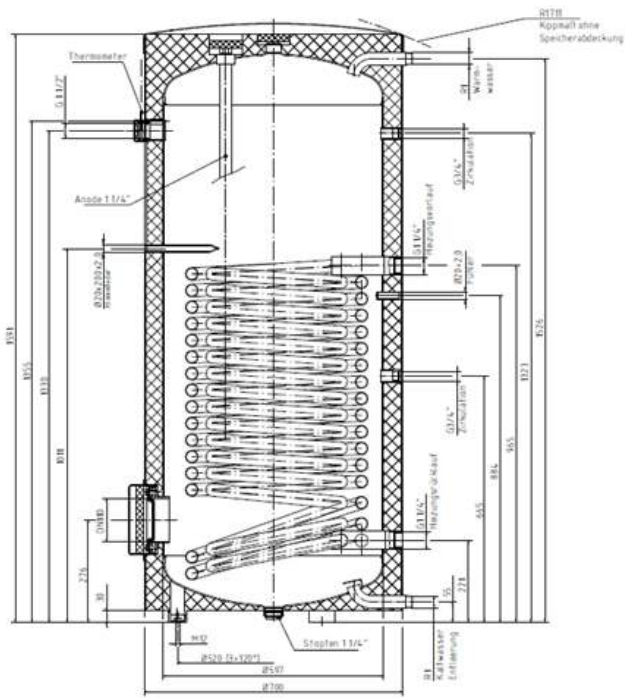
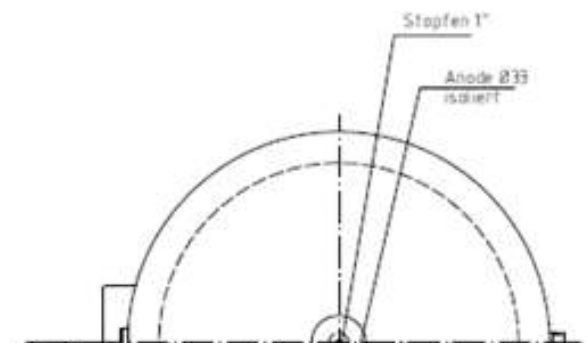
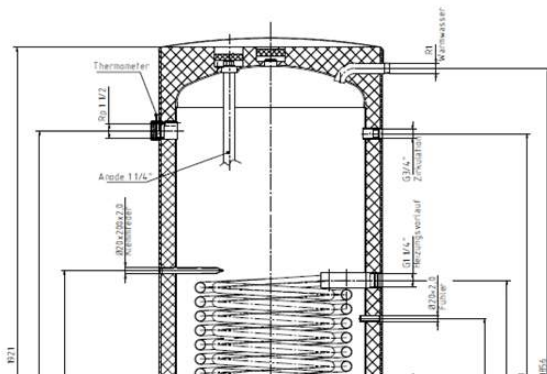


Fig.6.13: Drawing WWSP 442

6.2.6.5 DHW cylinder WWSP 556



NOTE The hot water consumption can vary depending on the required pouring capacity of the existing fittings

ATTENTION When operating fresh water stations, the requirements of the DVGW guideline - especially for large systems - must be observed. Fresh water stations must have DVGW approval.

6.3.2 How a fresh water station works

The fresh water station supplies the tapping points with fresh hot water. The warm water is only heated when required using the flow principle via a stainless steel plate heat exchanger.

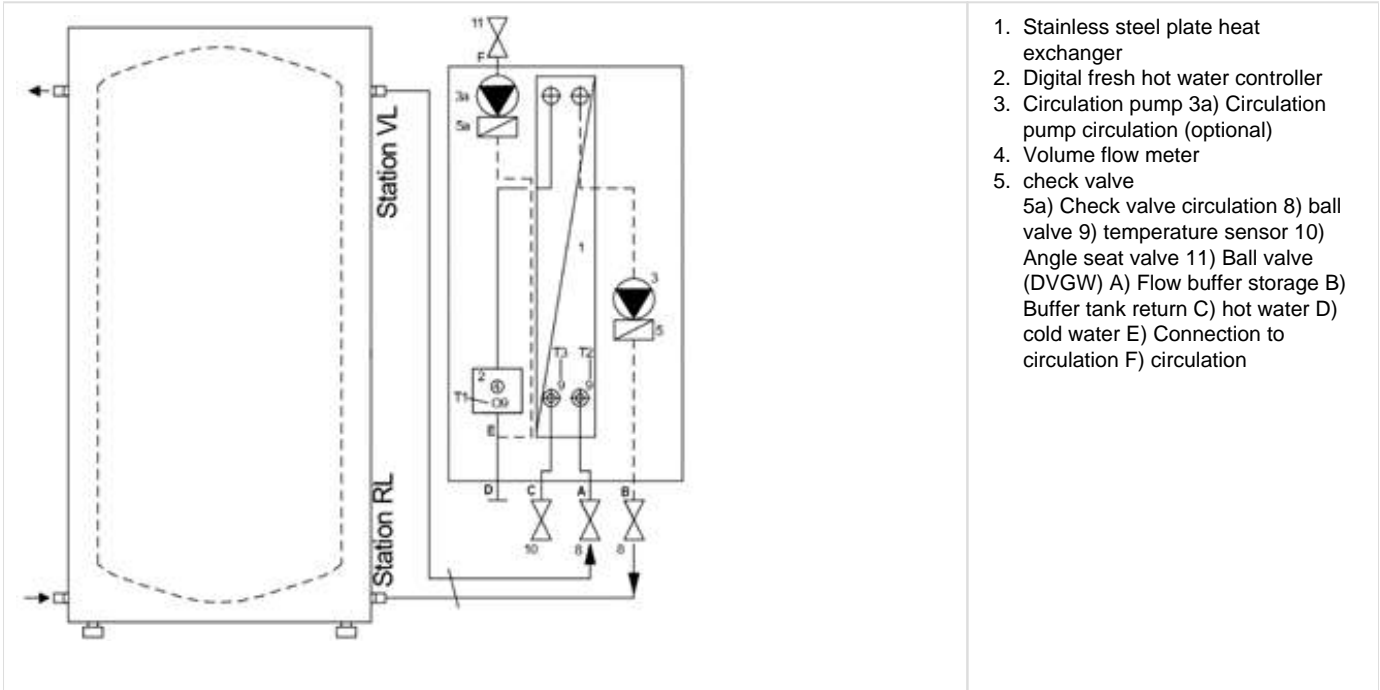


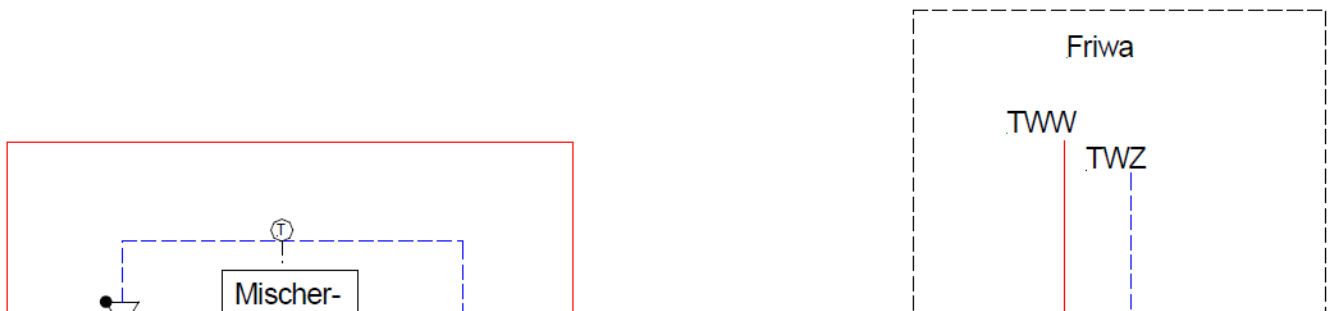
Fig. 6.16: Functional representation of the fresh water station

The energy is supplied by heating water with a flow temperature of at least 50 ° C from a buffer storage tank. The buffer temperature determines the maximum hot water temperature. The heating water is fed to the heat exchanger in the fresh water station by a circulating pump that is regulated as required.

In adequately dimensioned fresh water stations, the heating water is usually cooled to temperatures of 20 ° C to 30 ° C. Mixing in the buffer storage tank is to be avoided so that the highest possible pouring capacity can be achieved. This applies in particular to the loading with the heat pump due to its maximum spread of approx. 10 K. To prevent mixing of the buffer in the upper area, the flow of the heat pump can be integrated in the middle area, depending on the buffer storage used. If this is not possible, a mixing valve must be installed to increase the heat pump return (return increase). By increasing the return, sufficiently high flow temperatures can be achieved. A return increase during tapping ensures that it can be used with heat pumps.

NOTE When designing and setting the valve, it is important to ensure fast control behavior. The maximum flow temperature of the heat pump must not be exceeded in any operating situation.

6.3.3 Hydraulic integration of fresh water stations



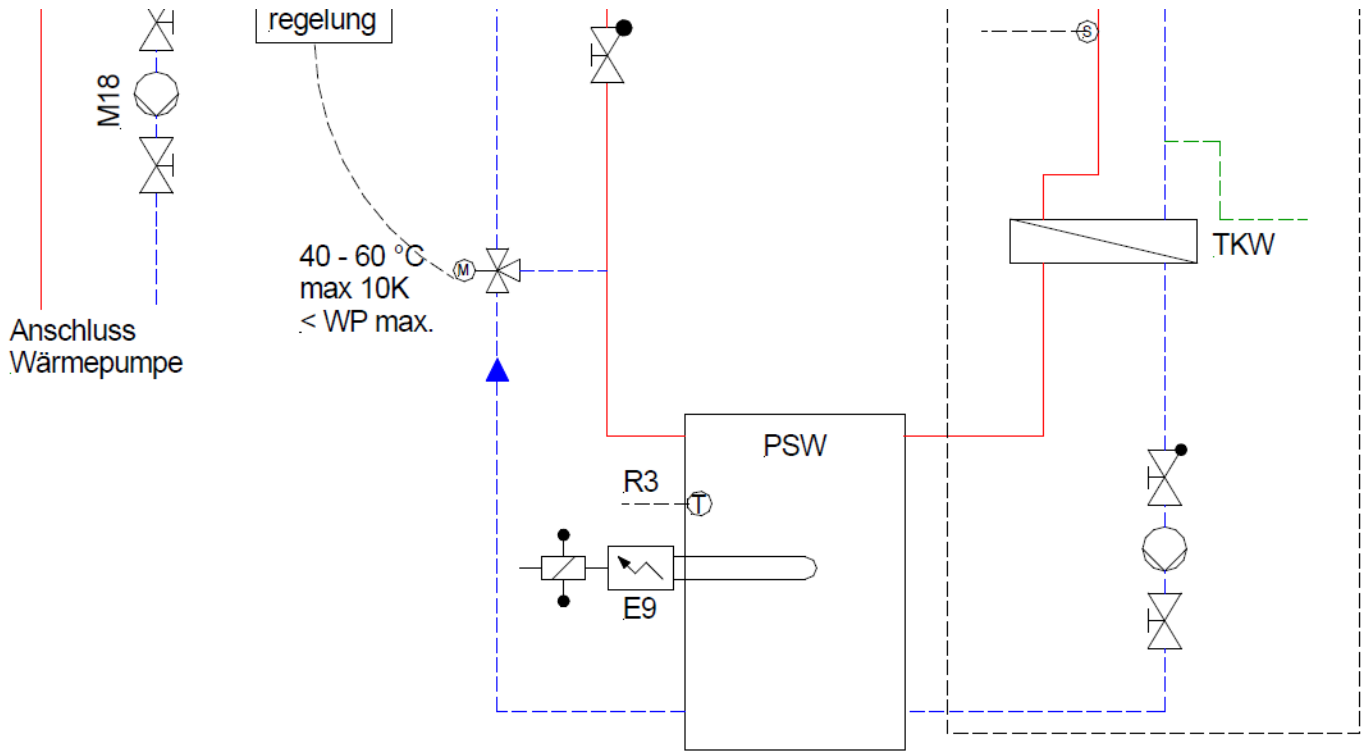


Fig. 6.17: Hydraulic integration of the fresh water station with return flow increase

- 1 Warmwasserentnahmestelle
- 2 Rücklauf Zirkulation
- 3 Absperrung Pumpe Zirkulation
- 4 Zirkulationspumpe
- 5 Rückschlagventil Zirkulation
- 5a Einbidnungsfitting für Zirkulation
- 6 Zeitschaltuhr für Zirkulationspumpe
- 7 Absperrung Kaltwasserhauptleitung
- 8 Rückschlagventil Kaltwasserhauptleitung
- 9 Sicherheitsgruppe Kaltwasser laut Norm
- 10 Strömungsschalter im KW-Zulauf der FriWa
- 11 Frischwasserstation
- 12 Warmwassersteigstrang

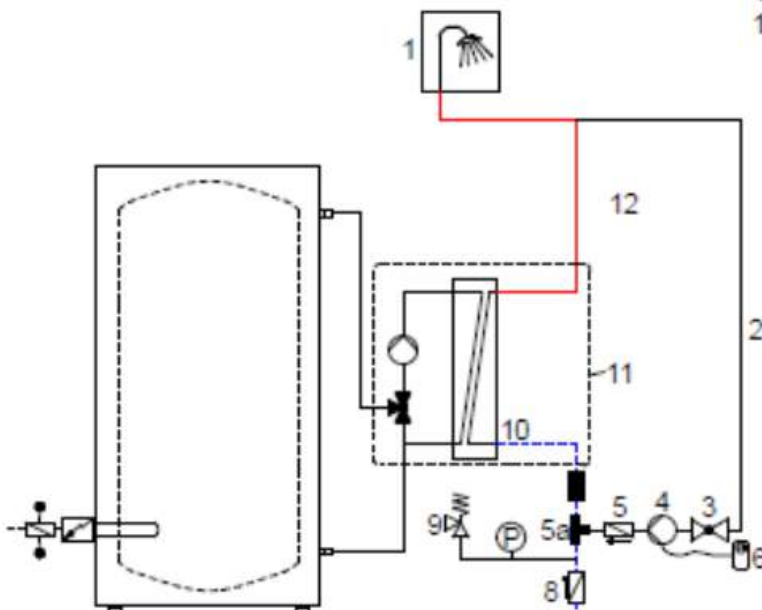




Fig. 6.18: Functional diagram of the fresh water station with circulation connection

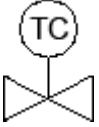

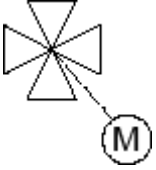
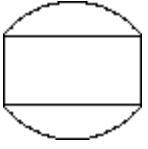




6.3.4 Integration schemes for hot water preparation



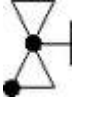
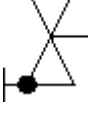







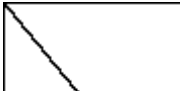
6.3.5 Legend

1.	Heat pump
1.1	Air Water heatpump
1.2	Brine / water heat pump
1.3	Water / water heat pump
1.7	Split air / water heat pump
2	Heat pump manager
3.	Row cache
3.1	Regenerative storage
4th	Hot water tank
5.	Swimming pool heat exchanger
13.	Heat source
14th	Compact distributor
E9	Flange heating
E10	Second heat generator (2nd WE)
E10.1	Electric immersion heater
E10.2	Oil / gas boiler
E10.3	Solid fuel boiler
E10.4	Central storage tank (water)
E10.5	Solar system
F7	Safety temperature monitor
K20	Contactactor 2nd heat generator
K21	Contactactor immersion heater hot water
N1	Heating controller
N12	Solar controller (not included with the WPM)
M11	Primary pump heat source
M13	Heating circulation pump
M15	Heating circulation pump 2nd heating circuit
M16	Additional circulation pump
M18	DHW charging pump
M19	Swimming pool circulation pump
R1	Outside wall sensor
R2	Return sensor

R3	Hot water sensor
R5	2nd heating circuit sensor
R9	Flow sensor
R12	Defrosting probe
R13	Sensor 3rd heating circuit / storage tank regenerative
SMF	Mud flaps
TC	Room temperature controller
EV	Electrical distribution
KW	Cold water
WW	Hot water
MA	Mixer open
MZ	Mixer closed
Y13	3-way switch valve

Tab.6.14: List of abbreviations for integration schemes

	thermostatically controlled valve
	Three-way mixer
	Four-way mixer
	Expansion tank
	Safety valve combination
	Temperature sensor
	leader
	Rewind

	Heat consumer
	Shut-off valve
	Stop valve with check valve
	Stop valve with drainage
	Circulation pump
	Overflow valve
	Three-way switch valve with actuator
	Two-way valve with actuator
	Safety temperature monitor
	High-performance deaerator with microbubble separation
	Electric immersion heater (pipe heating)
	Mud flaps

	Expansion tank
	thermostat

Tab.6.15: List of symbols for integration schemes

NOTE The following hydraulic connections are schematic representations of the functionally necessary components and serve as an aid for planning to be carried out. They do not contain all of the safety devices required in accordance with DIN EN 12828, components for maintaining constant pressure and any additional shut-off devices required for maintenance and service work.

NOTE The actual electrical connection of the individual heat pump types can be found in the electrical documentation for the heat pump.

6.3.6 Integration of hot water preparation

DHW heating with switching valve YM 18		configuration	setting
A heating circuit with a double differential pressure-free distributor			
		Mode of operation electric heating	Additional heating in the buffer
		1. Heating circuit	Heat
		1. Heating circuit	no
		Hot water	yes with feeler
		Flange heating	Yes
swimming pool	no		
		Ensuring the heating water throughput via a double differential pressure-free distributor.	

Fig.6.19: Integration scheme for monoenergetic heat pump operation with one heating circuit, Row buffer storage and hot water preparation

The use of the double differential pressure-free distributor DDV is recommended for connecting all heat pumps. The circulation pump (M16) in the generator circuit is only in operation when the compressor is running in order to avoid unnecessary running times. The hot water generation is carried out with the additional circulation pump (M16) and closing changeover valve (YM18).

DHW heating with circulation pump M 18

A heating circuit with a double differential pressure-free distributor

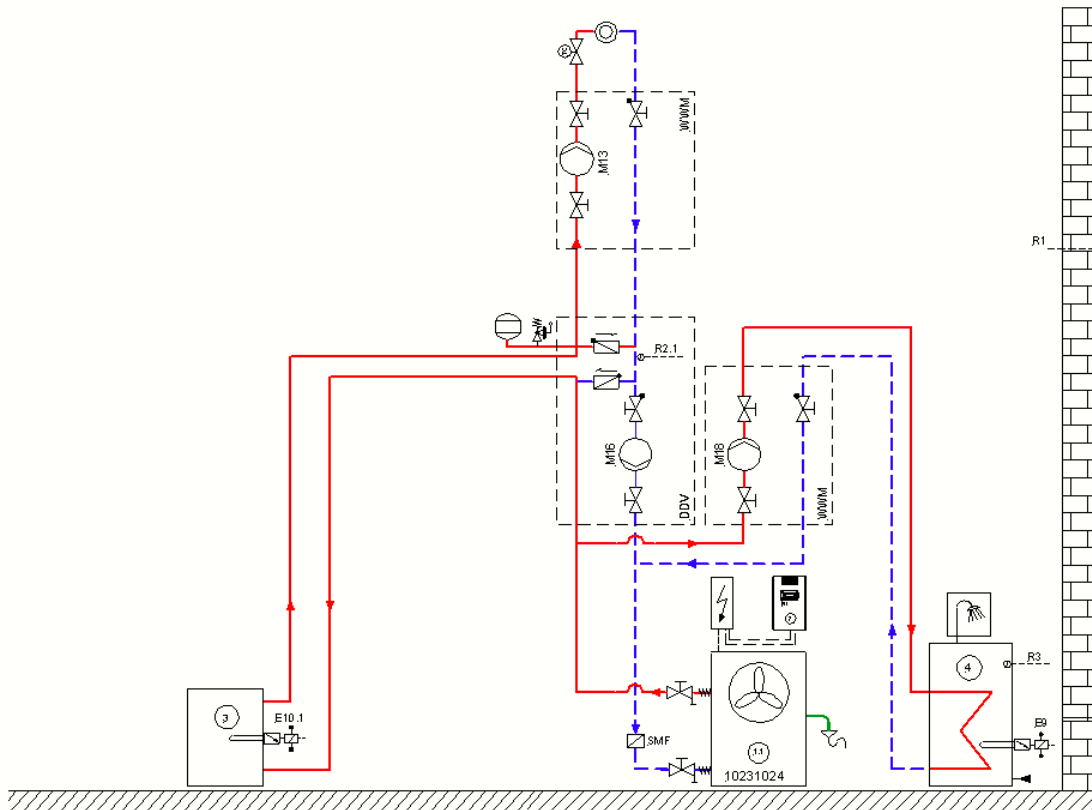


Fig.6.20: Integration scheme for monoenergetic heat pump operation with one heating circuit, Row buffer storage and hot water preparation

configuration	setting
Mode of operation	Additional heating in the buffer
electric heating	
1. Heating circuit	Heat
1. Heating circuit	no
Hot water	yes with feeler
Flange heating	Yes
swimming pool	no
Ensuring the heating water throughput via a double differential pressure-free distributor.	
The use of the double differential pressure-free distributor DDV is	

recommended for connecting all heat pumps. The circulation pump (M16) in the generator circuit is only in operation when the compressor is running in order to avoid unnecessary running times. The hot water generation is carried out with the additional circulation pump (M16) and closing changeover valve (YM18).

6.4 Hot water heating with the hot water heat pump

The hot water heat pump is a ready-to-connect heater and essentially consists of the hot water storage tank, the components of the refrigerant, air and water circuit, as well as all the control, regulating and monitoring devices required for automatic operation. The hot water heat pump uses the heat of the sucked in air for hot water preparation with the supply of electrical energy.

As the temperature of the air drawn in falls, the heat pump heating output decreases and the heating-up time increases. The profitability of the operation increases with increasing air intake temperatures.

The water-side installation must be carried out in accordance with DIN 1988. The hot water heat pump is wired ready for connection, just plug the power plug into the earthed socket installed on site.

NOTE The connection of the hot water heat pump to a possibly existing heat pump meter is possible with a permanent connection.

An additional electric immersion heater is integrated in the hot water heat pump. This fulfills several functions:

Additional heating

By operating the heat pump in parallel, the heating time for the water is shortened.

Frost protection

If the air inlet temperature falls below 8 ± 1.5 °C, the electric heating element switches on automatically and heats the water (nominal) up to the set hot water temperature. With the DHW heat pump, the heating element is automatically switched on below -8 °C + -1.5 °C and the heat pump mode is deactivated. Below a temperature of 8 °C, the heating element is switched on if the set target temperature has not been reached after a period of 8 hours. This function is inactive if the domestic water is heated by a second heat generator via the internal heat exchanger. The hot water temperature generated by the heating element in the frost protection function can rise above the set value!

Emergency heating

If the heat pump malfunctions, the hot water supply can be maintained by the heating rod.

Thermal disinfection

Water temperatures above 60 °C (up to 75 °C) can be programmed on the control panel keypad in the thermal disinfection menu. These temperatures are above 60 °C by the electr. Reached the heating element. To achieve higher temperatures, the adjusting screw on the housing of the temperature controller must be turned to the right stop.

NOTE At hot water temperatures > 60 °C, the heat pump is switched off and hot water is only generated via the immersion heater. The immersion heater controller is set to 65 °C at the factory.

Condensate drain The condensate hose is attached to the rear of the device. It is to be laid in such a way that the accumulating condensate can flow off without hindrance and is to be drained into a siphon.

6.4.1 Functional description of the hot water heat pump

Various operating modes or time programs can be set on the controller of the hot water heat pump. With some types it is still possible to connect a second heat generator via an integrated heat exchanger. All hot water heat pumps can be combined with a photovoltaic system thanks to the SG Ready function.

Modes of operation

A maximum of two independent blocking times can be programmed on the controller. During the blocking times, the storage tank is kept at an

adjustable minimum temperature in order to avoid a loss of comfort. All other programs are possible during this time. The storage tank is reheated by the integrated heating rod as soon as the heat pump's area of application is not reached. In addition, the 'Rapid heating' button can be used to select whether the heating element should be active within a certain time or whether it should be permanently active.

ventilation

The ventilation function can be activated manually. It comes into play when the heat pump is off, i.e. there is no hot water requirement. The fan of the heat pump continues to run according to the set target value. This should ensure a minimum amount of exhaust air regardless of the heat pump operation, e.g. in the case of commercial waste heat utilization.

Combination with a second heat generator

With the help of the integrated pipe heat exchanger, an existing heat generator (2nd heat generator) or a solar system can be used to heat the storage tank. For this purpose, a circulation pump can be controlled by the integrated control.

The use of a second heat generator must be activated in the menu. It is requested when the heat pump's areas of application are left. This means if the lower or upper air inlet limit or the maximum permissible hot water temperature are exceeded. In this case, the 2nd heat generator has priority over the electric immersion heater in the heat pump. When activating the 2nd heat generator, a changeover temperature can also be selected that deviates from the lower application limit of the air temperature. If this temperature is not reached, the heat pump operation is blocked from the set temperature and the 2nd heat generator is used.

Alternatively, the hot water heat pump can also be operated in combination with a solar thermal system. As soon as a solar yield is recognized, the solar circulation pump is switched on and the heat pump is blocked. If there is no more solar yield or if a temperature limit value on the collector or in the storage tank is exceeded, the circulation pump is switched off again. The solar function has priority over the heat pump operation and the immersion heater.

⚠ ATTENTION A temperature sensor with the resistance characteristic of a PT1000 must be used for the collector sensor.

Combination of hot water heat pump and a photovoltaic system

Hot water heat pumps can also be combined with a photovoltaic system. For this purpose, the controller of the heat pump can be connected to an additional evaluation unit (e.g. inverter) via a potential-free input - **this must have a potential-free normally open contact**. If sufficient power is available from the photovoltaic system in the "Photovoltaic" mode, the heat pump starts via the normally open contact and regulates to an adjustable, higher hot water setpoint for photovoltaic operation. The solar function has priority over the photovoltaic function. The operation of the heat pump with electricity from the photovoltaic system is shown on the display.

i NOTE When using a 3 kWp photovoltaic system in conjunction with a hot water heat pump, the proportion of self-used electricity can be significantly increased.

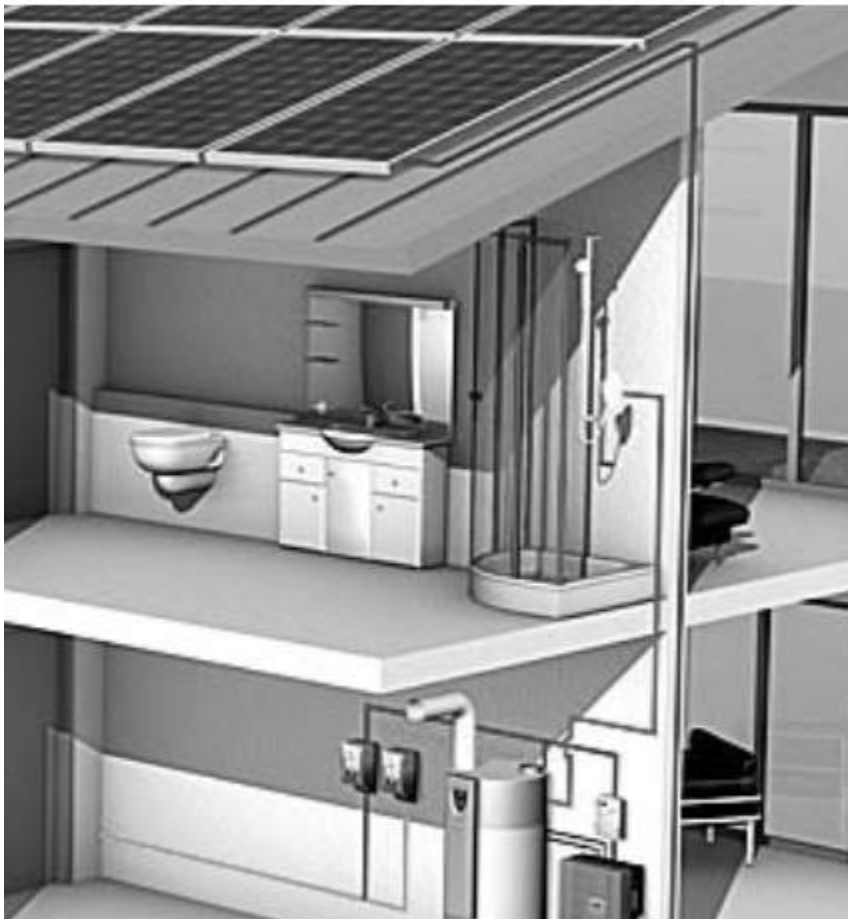




Fig. 6.21: Hot water heat pump combined with a photovoltaic system

If the output of the photovoltaic system is insufficient, the hot water heat pump is operated exclusively with electricity from the energy supplier's network. Excess solar power is fed into the power grid via an inverter.

In the case of hot water heat pumps with an internal additional heat exchanger, a relay with a potential-free contact automatically switches on a second heat generator if required.

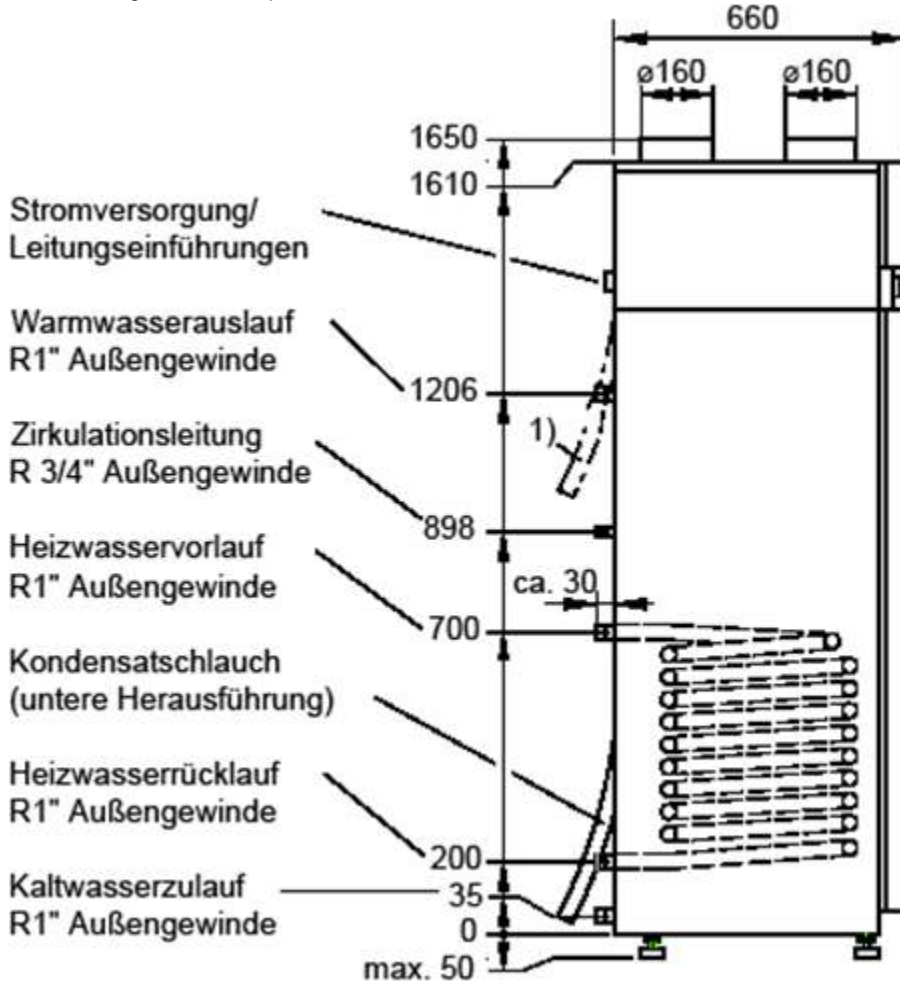
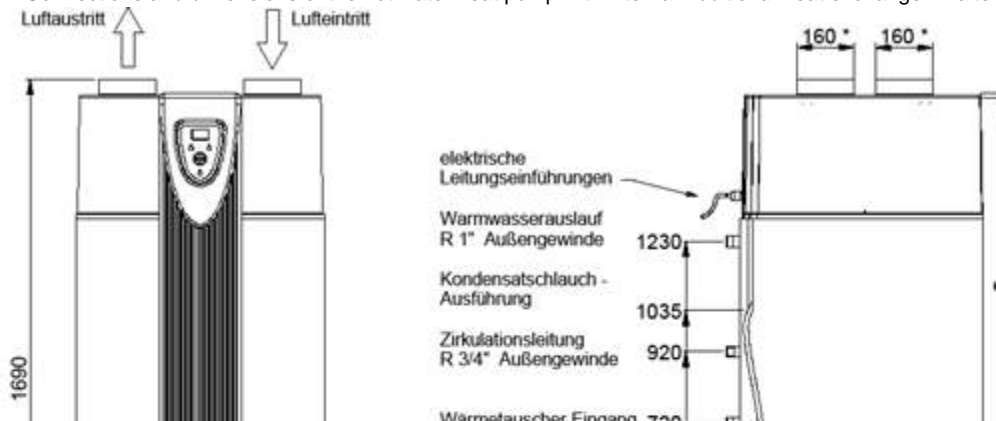


Fig. 6.22: Connections and dimensions of the hot water heat pump with internal Additional heat exchanger ¹⁾ alternative condensate flow



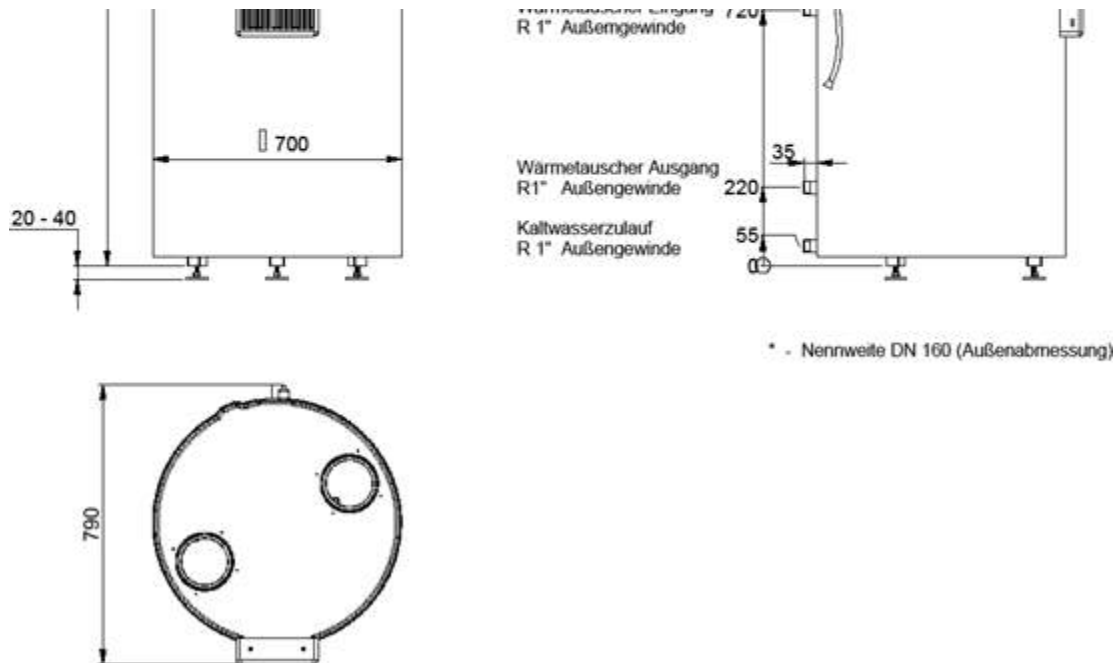
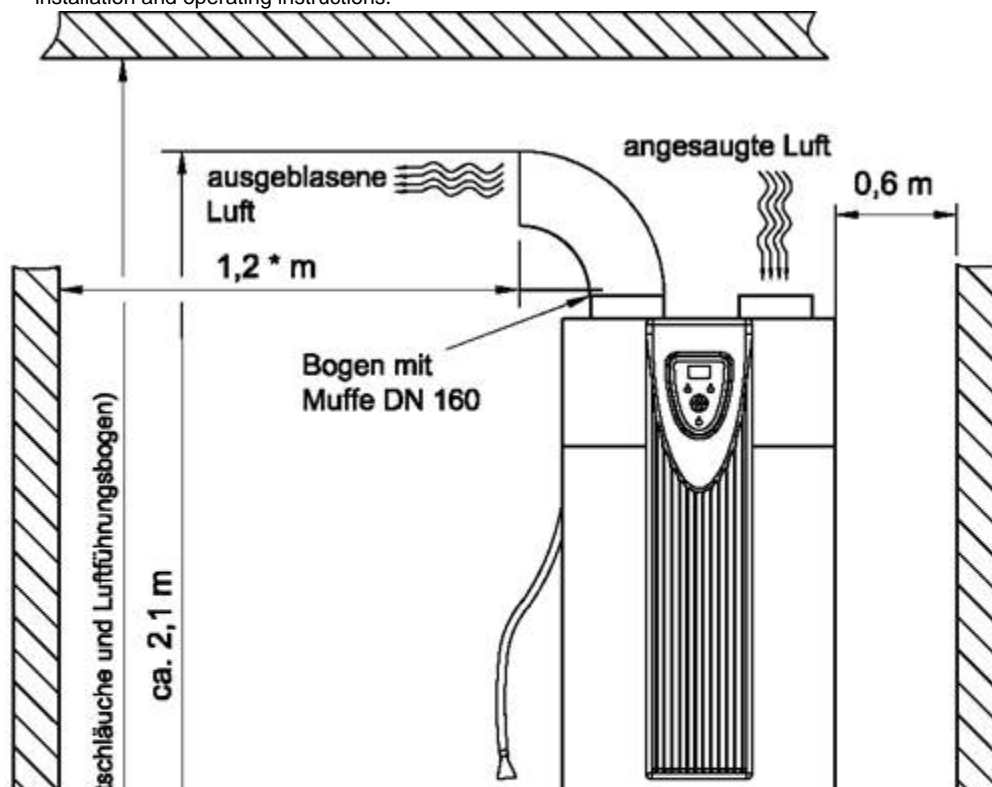


Fig. 6.23: Connections and dimensions of the hot water heat pump BWP 30HLW with internal additional heat exchanger

6.4.2 Installation

The following applies to the choice of the device location:

- The hot water heat pump must be installed in a frost-free and dry room.
- Furthermore, the installation and the air intake must not take place in rooms that are potentially explosive due to gases, vapors or dust.
- The air drawn in must not be excessively contaminated or heavily dusted.
- If the installation room cools down due to the operation of the hot water heat pump, the room must be insulated from adjacent living spaces to avoid moisture damage (thermal bridges).
- The resulting condensate must be drained away frost-free.
- The subsurface must have sufficient load-bearing capacity.
- For trouble-free operation as well as for maintenance and repair work, minimum clearances must be observed in accordance with the installation and operating instructions.



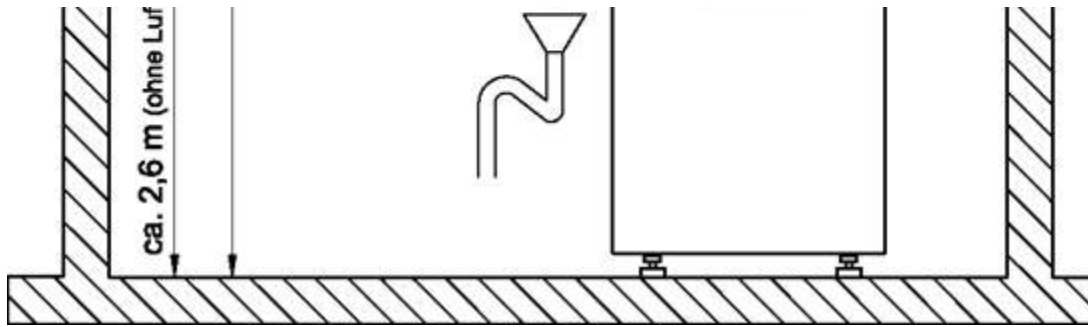


Fig. 6.24: Installation conditions for free sucking in and blowing out of the process air. *) The minimum distance between the outlet opening of the air duct and the wall is 1.2 m

Optionally, air lines can be connected on both the intake and the exhaust side, which must not exceed a total length of 10 m. Flexible, sound and heat insulated air hoses DN 160 are available as accessories.

6.4.3 Air flow variants

Variable switching of the intake air

A pipe duct system with integrated bypass flaps enables variable use of the heat in the outside or room air for hot water preparation (lower limit of use: + 8 ° C).

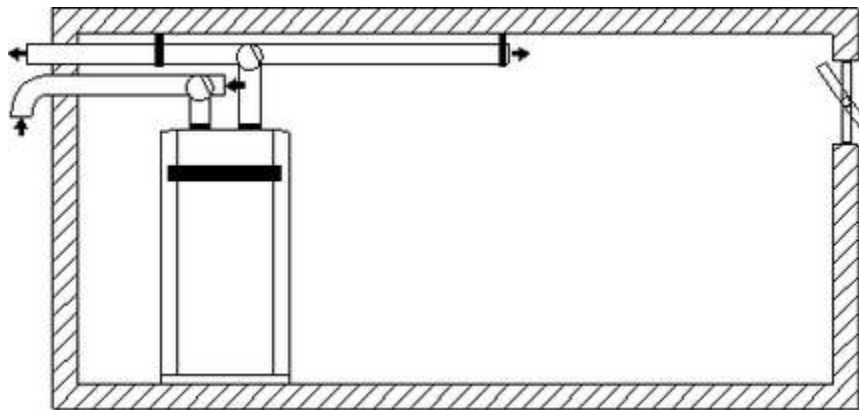


Fig. 6.25: Variable switching of the intake air

Cooling in recirculation mode Room air is extracted via an air duct, e.g. from the storage room or wine cellar, cooled in the hot water heat pump, dehumidified and blown back in. The hobby, heating or utility room is suitable as a set-up location. To avoid the formation of condensation water, air ducts in the warm area must be insulated in a diffusion-proof manner.

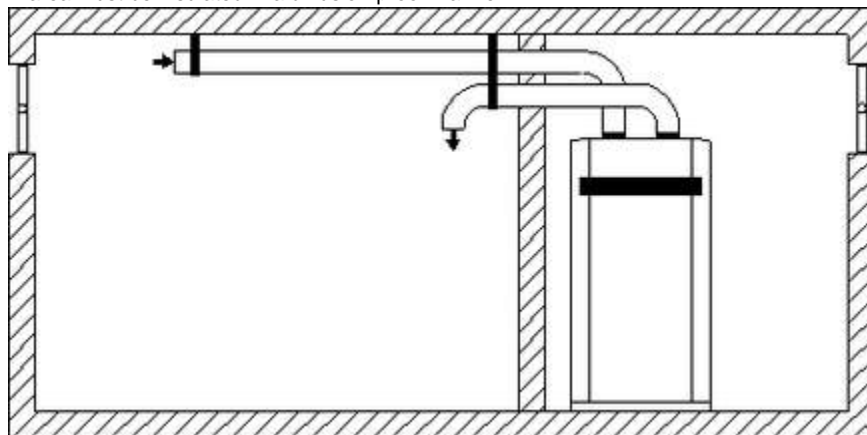


Fig.6.26: Cooling in recirculation mode

Dehumidification in recirculation mode Dehumidified room air in the utility room supports laundry drying and prevents moisture damage

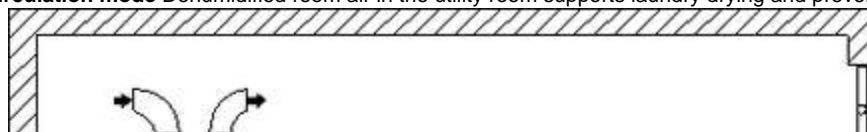




Fig. 6.27: Dehumidifying in recirculation mode

Waste heat is useful heat

The optionally built-in heat exchanger of a hot water heat pump enables direct connection to a second heat generator, e.g. solar system or boiler.

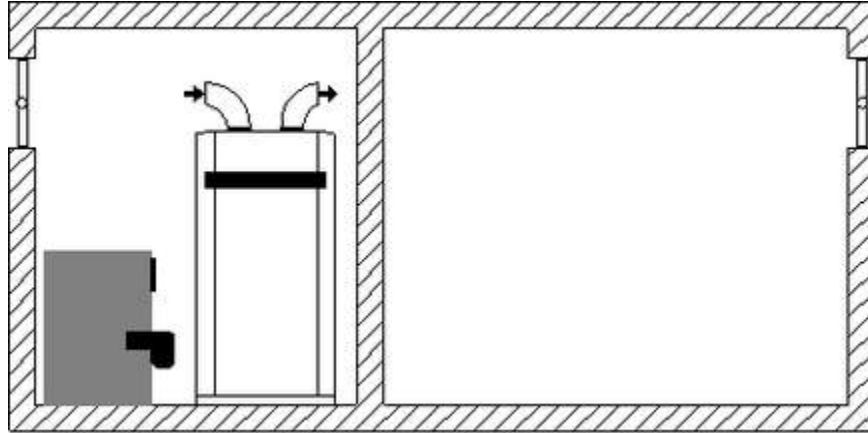


Fig. 6.28: Use of waste heat with a domestic water heat pump

6.5 Residential ventilation units with hot water generation

New materials and building materials are the cornerstones for a significantly reduced use of heating energy. Optimized insulation with a tight outer shell of the building ensures that almost no heat is lost to the outside. Extremely airtight windows in particular prevent the necessary exchange of air in old and new buildings. An effect that heavily pollutes the air in the room. Water vapor and pollutants accumulate in the air and must be actively ventilated.

Correct ventilation, but how?

Probably the simplest type of living space ventilation is the air renewal via an open window. Regular boost ventilation is recommended to maintain an acceptable indoor climate. This activity, which has to be carried out several times a day in all rooms, is annoying, time-consuming and often not feasible due to living and working habits alone.

Automatic living space ventilation with heat recovery ensures that the air exchange that is necessary from a hygienic and structural point of view is energy and cost-conscious.

Advantages of home ventilation devices

- Fresh, clean air without indoor air pollutants and excessive humidity
- Automatic assurance of the necessary number of air changes without any active intervention
- Reduced ventilation losses through heat recovery
- Integrable filters against insects, dust and dust-like air pollutants
- Shielding from outside noise and increased security with closed windows
- Positive evaluation according to the Energy Saving Ordinance (EnEV)

The use of mechanical home ventilation with heat recovery is indispensable in many cases. Before deciding on a ventilation system, the way in which waste heat is used should be clarified.

For the ventilation of residential units, it makes sense to use the exhaust air as an energy source for hot water, as it is in a building **all year round** there is a need for both ventilation and hot water. If there is an increased demand for hot water, a second heat generator must also be integrated.

NOTE Further information on the design of ventilation devices and our current product portfolio can be found on our homepage in the "Ventilation" section

6.6 Convenience and cost comparison with different options for warm water heating

6.6.1 Decentralized hot water supply (e.g. electrical instantaneous water heater)

advantages

- low investment
- extremely low space requirement
- no additional heating power requirement for the hot water preparation of the heating heat pump necessary
 - no downtime and circulation losses

disadvantage

- higher operating costs
- higher network connection capacities and cable cross-sections required

6.6.2 Electric storage tank

advantages

- low investment
- higher hot water temperatures in the storage tank possible
- greater availability of the heat pump for heating (especially with monovalent operation and blocking times).
 - Use of photovoltaics possible (self-consumption)

disadvantage

- higher operating costs
 - more calcification at higher temperatures
 - longer heating times

6.6.3 Hot water heat pump

advantages

- A cooling or dehumidifying effect can be achieved at the installation site (e.g. storage cellar) in summer
 - no additional heating power requirement for the hot water preparation of the heating heat pump necessary
- easy integration of solar thermal and photovoltaic systems
- higher hot water temperatures in pure heat pump operation

disadvantage

- long reheating times of the hot water storage tank due to low post-heating output
 - Cooling down of the installation room in winter (with room air dependent operating mode)

6.6.4 Apartment ventilation unit with hot water generation

advantages

- comfortable home ventilation to ensure hygienic air exchange
- Hot water preparation through year-round active heat recovery from the exhaust air
- greater availability of the heat pump for heating (especially with monovalent operation and blocking times)
 - easy integration of solar thermal systems
- higher hot water temperatures in pure heat pump operation

disadvantage

- Significantly longer reheating times for the hot water storage tank in heat pump operation
- If there is a high demand for hot water, it must be combined with a second heat generator

7 chapter

8 chapter

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Chapter 7 - Heat Pump Manager

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7 heat pump manager

The heat pump manager is necessary for the operation of the heat pump system and is included in the scope of delivery. It regulates a bivalent, monovalent or mono-energetic heating system and monitors the safety devices of the refrigeration circuit. Depending on the type of heat pump, the heat pump manager is built into the housing of the heat pump or the hydro-tower or is supplied as a wall-mounted controller with the heat pump and controls the generator and distribution circuits.

Function overview

- Fulfillment of the requirements of the energy supply company (EVU) e.g. EVU lock, switching cycle lock, see TAB
- Switch-on delay when the mains voltage returns or a utility company blocking time is canceled (10 s to 200 s)
- The heat pump's compressors are switched on a maximum of three times per hour
- Shutdown of the heat pump due to EVU blocking signals with the option of switching on the 2nd heat generator
- Self-adapting defrost cycle time for air-to-water heat pumps
- Monitoring and safeguarding the refrigeration circuit in accordance with DIN 8901 and DIN EN 378
- Recognition of the optimal operating mode in each case, with the greatest possible proportion of heat pumps
- Frost protection function
- Brine pressure switch for installation in the brine circuit in brine / water heat pumps (special accessory)
- Automatic, outside temperature dependent operating mode switchover winter - summer - cooling
- Return temperature-based control of the heating and cooling operation via outside temperature, adjustable fixed value or room temperature.

- Smart-RTC + individual room control with up to 10 room temperature controllers per heating circuit possible
- Control of up to 3 consumer circuits (heating and cooling circuits)
- Dew point-dependent flow temperature control depending on the room temperature and humidity in cooling mode
- Optional dew point monitoring in cooling mode
- Requirement priorities
 - Water heating
 - Heating / cooling mode
 - Swimming pool preparation
- Control of a 2nd heat generator (oil or gas boiler or electrical auxiliary heating)
- Release of a second heat generator for bivalent operation (oil and gas boiler) including control of the associated mixer
- Control of a mixer for the bivalent use of a regenerative heat source (solid fuel boiler, solar thermal)
- Special program for 2nd heat generator to ensure minimum running (oil boiler) or minimum charging times (central storage tank)
- Control of a flange heater for targeted reheating of the hot water with adjustable time programs and for thermal disinfection
- Control of a hot water circulation pump via pulse or time programs
- Energy-efficient defrost management for air / water heat pumps
- Control of circulation pumps in the generator and consumer circuit via an optional 0-10V or PWM signal
- Heat quantity and operating hours recording (not suitable for heating billing)
- User group-dependent operating concept
- 10-fold alarm memory with date and time information and error description
- Interface for the connection of further communication options for LAN, EIB / KNX, Modbus RTU, Modbus TCP, optional accessories required
- Functional heating program (DIN EN 1264-4), standardized or customizable program for targeted drying of the screed with storage of the start and completion times
- Remote control for the heat pump manager via an app for iOS and Android, optional accessories required
- SG-Ready function (Smart-Grid) => also update for new controllers

NOTE

The exact descriptions of the points listed can be found in the operating instructions for the heat pump manager installer.

7.1 Operation

Currently, two control units are used depending on the type of heat pump (see current price list).

7.1.1 Color display with touch operation

The settings required for operation can be made and the displays viewed via the display and control unit.



Fig.7.1: Heat pump manager display with touch display (pGDx)

The settings and advertisements are divided into different user groups.

- operator
- Professional
- service

Access to the user groups is selected via the start screen. Depending on the selected user group, a password may be required for access.

7.1.2 LC display with key operation

- The heat pump manager is operated using 6 push buttons: ESC, mode, menu, , , . Depending on the current display (standard or menu), different functions are assigned to these buttons.
- The operating status of the heat pump and heating system is shown in plain text on the 4 x 20 character LC display (WPM 2007 plus heat pump manager). 6 different operating modes can be selected: Cooling, summer, winter, party, vacation, 2nd heat generator, automatic.
- The menu consists of 3 main levels: Settings, operating data, history

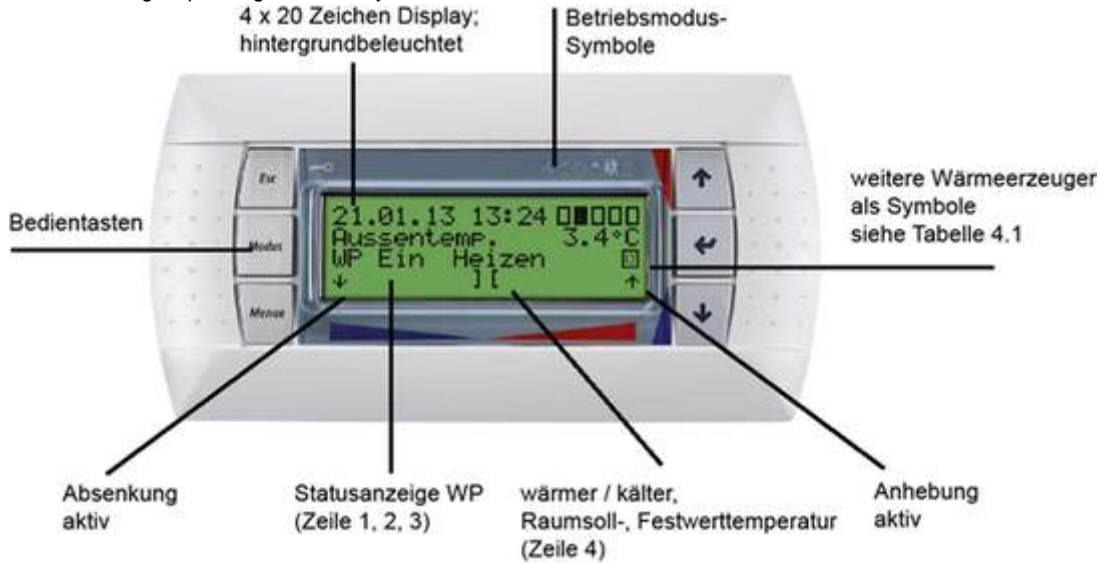


Fig. 7.2: WPM 2007 plus or WPM EconPlus heat pump manager with separate LC display, standard display with control buttons

7.2 Temperature sensor

Depending on the type of heat pump, the following temperature sensors are already installed or must be installed additionally:

- Outside temperature (R1)
- 1st, 2nd and 3rd heating circuit temperature sensors (R35, R5 and R21)
- Demand sensor (R2.2)
- Hot water temperature sensor (R3)
- Regenerative storage tank temperature sensor (R13)

	Temperature in ° C																
	-20	-15	-10	-5	0	5	10	15th	20th	25th	30th	35	40	45	50	55	60
Norm-NTC-2 in kOhm	14.6	11.4	8.9	7.1	5.6	4.5	3.7	2.9	2.4	2.0	1.7	1.4	1.1	1.0	0.8	0.7	0.6
NTC-10 in kOhm	67.7	53.4	42.3	33.9	27.3	22.1	18.0	14.9	12.1	10.0	8.4	7.0	5.9	5.0	4.2	3.6	3.1

Tab. 7.1: Nominal sensor values standard NTC-2 and NTC-10 (Carel characteristic) for connection to the heating controller

The temperature sensors to be connected to the heat pump manager must correspond to the sensor curve shown in Fig.7.3. The only exception is the outside temperature sensor included in the scope of delivery of the heat pump (see Fig.7.5)



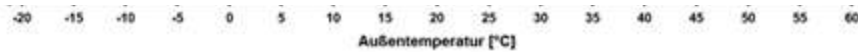


Fig. 7.3: NTC-10 sensor curve for connection to the heating controller



Fig. 7.4: Dimensions of the NTC 10 heating sensor with metal sleeve

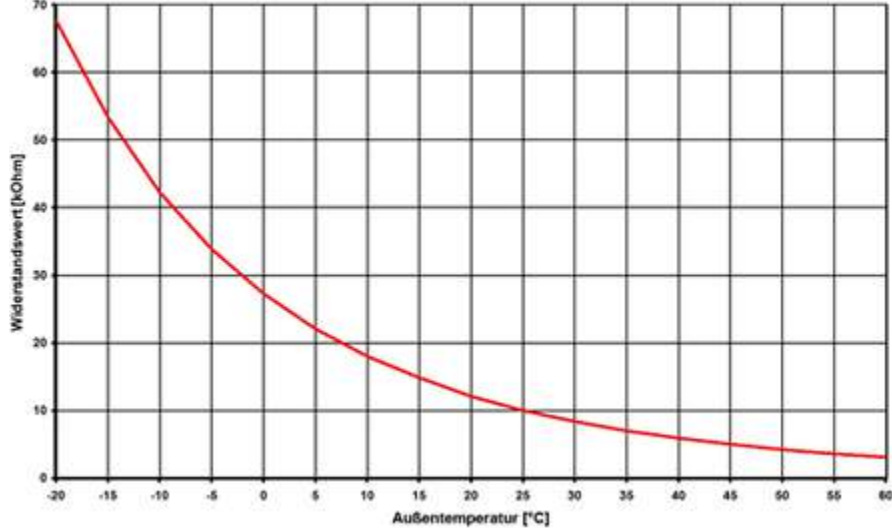


Fig.7.5: Sensor characteristic curve Norm-NTC-2 according to DIN 44574

7.2.1 Installation of the outside temperature sensor

The temperature sensor must be attached in such a way that all weather influences are recorded and the measured value is not falsified.

- Attach to the outside wall of a heated living room and, if possible, on the north or north-west side
- do not mount in a "protected location" (e.g. in a wall niche or under the balcony)
- Do not install near windows, doors, exhaust air vents, outside lights or heat pumps
- Do not expose to direct sunlight at any time of the year

Sizing parameters for the sensor line	
Conductor material	Cu
Cable length	50 m
Ambient temperature	35 ° C
Laying type	B2 (DIN VDE 0289-4 / IEC 60364-5-52) 3.1
outer diameter	4-8 mm

Tab.7.2: Sizing parameters for the sensor line

7.2.2 Mounting the clip-on sensors

The installation of the clip-on sensors is only necessary if they are included in the scope of delivery of the heat pump but not installed.

The clip-on sensors can be mounted as pipe clip-on sensors or inserted into the immersion sleeve of the compact distributor.

- Clean the heating pipe from paint, rust and scale
- Brush the cleaned surface with thermal paste (apply thinly)

- Fasten the sensor with a hose clamp (tighten it well, loose sensors lead to malfunctions) and insulate them thermally

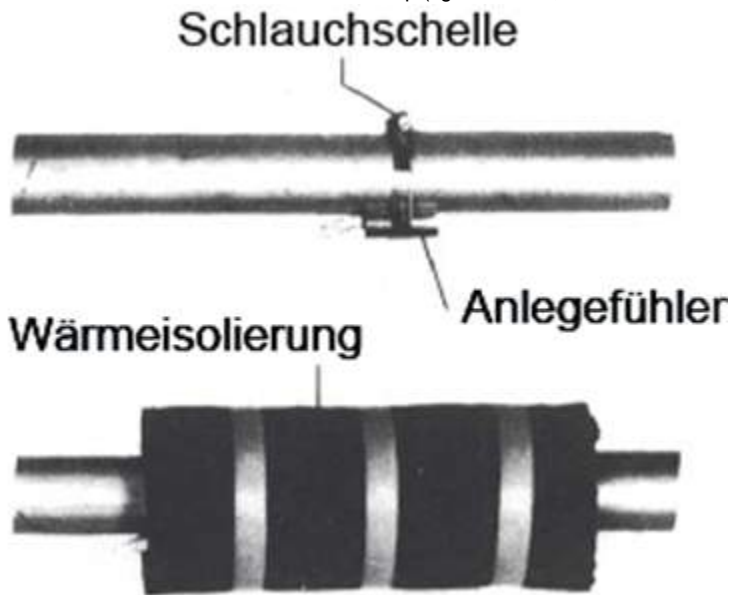


Fig. 7.6: Installation of a pipe wrap sensor

7.3 Heat meter WMZ

NOTE

The high-efficiency heat pumps have an integrated heat meter as standard. The measurement takes place via pressure sensors in the heating circuit, which are directly connected to the heat pump manager (not suitable for heating cost accounting).

general description

The heat meter (WMZ 25) for connection to the heat pump manager is used to record and evaluate the amount of heat given off by the heat pump.

Sensors in the flow and return of the heating water pipe and an electronic module record the measured values and transmit a signal to the heat pump manager, which, depending on the current operating mode of the heat pump (heating / hot water / swimming pool), adds up the amount of heat in kWh and displays it in the menu and history brings. The amount of energy for cooling operation is not recorded.

7.3.1 Hydraulic and electrical integration of the heat meter

The heat meter needs two measuring devices for data acquisition:

- The measuring tube for flow measurement
This must be installed in the heat pump flow before the hot water preparation branch (note the direction of flow).
- A temperature sensor (copper pipe with immersion sleeve)
This is to be installed in the heat pump return.

The installation location of the two measuring tubes should be as close as possible to the heat pump in the generator circuit.

Too little distance to pumps, valves and other built-in components should be avoided, as turbulence can lead to falsified heat metering. A calming distance of 50 cm is recommended.

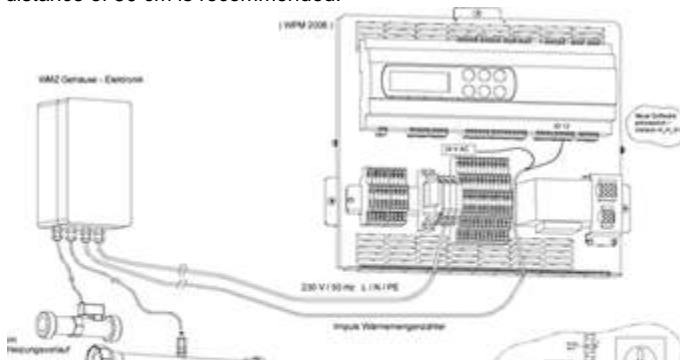




Fig. 7.7: Hydraulic and electrical components of the heat meter

NOTE
Use only pure water in the heating circuit (no mixtures, no antifreeze)!

The control board of the electronic module requires its own power supply, which can be tapped directly from the mains or via the terminal strip (mains L / N / PE ~ 230 VAC) of the heat pump manager.

A 2-wire connection cable that transmits the pulse must be connected between terminal X2 / 1/2 of the electronic module and the heat pump manager (N1).

Compact heat pumps

In the case of heat pumps with built-in heating components for an unmixed heating circuit (compact heat pump), it is not possible to install the heat meter inside the heat pump (before the hot water preparation branch). For this reason, the heat meter is installed in the heating flow to record the heating operation. An additional heat meter can be installed in the hot water flow to record optional hot water preparation.

7.3.2 Settings on the heat pump manager

NOTE
The heat pump manager requires software version H6x (or higher) to evaluate the pulses.

In order to activate the heat quantity recording, the "heat quantity meter" must be programmed to YES in the pre-configuration of the heat pump manager. In the "History" menu, the values for heating, hot water and swimming pool are displayed depending on the system settings. The amount of heat emitted is displayed in kWh.

The counter reading can be reset in the "Operating data" menu!

7.4 Electrical connection work, heat pump and heat pump manager

ATTENTION
When connecting the load line, pay attention to the clockwise rotating field (if the rotating field is incorrect, the heat pump will not perform well, it is very loud and the compressor can be damaged).

If a clockwise rotating field cannot be guaranteed, a mains and rotating field monitoring relay must be installed to protect against starting with the wrong direction of rotation. This recognizes an error in the power supply and reports the fault to the heat pump manager via the EVU contact (N1 / ID3 - in series with the EVU blocking contact). This locks the heat pump and prevents it from starting.

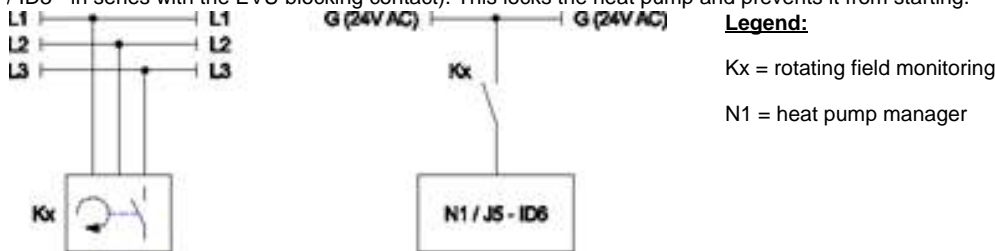


Fig.7.8: Connection of rotating field monitoring

NOTE
When using three-phase pumps, a power contactor can be controlled with the 230V output signal of the heat pump manager. Sensor cables can be extended up to 40 m with 2 x 0.75 mm cables.

NOTE
A detailed connection drawing of the WPM EconPlus heat pump manager, as shown in chapter 7.4.4 on page 93, is also available in the operating cost calculator at www.dimplex.de/betriebkostenrechner to be found at the end of the layout.

i

NOTE

The values for electrical protection given on the heat pump nameplate and in the device information are maximum values. This means that the wiring of the heat pump is designed for these currents (short-circuit current and operating current). The function of the heat pump is guaranteed at all times / operating points. Fusing the heat pump with a lower tripping current than specified in the device information or on the nameplate is possible, but not recommended, as this would trigger earlier and lead to irregular operation of the heat pump.

NOTE

The cable cross-section results from the required cable length, the type of installation, the ambient temperature, the cable type, the maximum voltage drop and the prescribed maximum protection of the heat pump. The required minimum cross-section of the supply line is to be designed by the installer.

7.4.1 Heat pump with WPM Touch

- 1.) The up to 5-core electrical supply line for the power section of the heat pump is fed into the heat pump from the heat pump's electricity meter via the EVU blocking contactor (if required) (for load voltage, see heat pump instructions). In the power supply for the heat pump, an all-pole disconnection with a contact gap of at least 3 mm (e.g. EVU blocking contactor, power contactor), as well as an all-pole circuit breaker with common tripping of all external conductors, must be provided (tripping current and characteristics according to device information).
- 2.) The 3-core electrical supply line for the heat pump manager (N1) is routed into the heat pump (devices with integrated controller) or to the subsequent assembly area of the heat pump manager (WPM). The supply line (L / N / PE ~ 230 V, 50 Hz) for the WPM must be connected to permanent voltage and for this reason must be tapped in front of the EVU blocking contactor or connected to the household electricity, otherwise important protective functions during the EVU blocking are operating.
- 3.) The EVU blocking contactor (K22) with 3 main contacts (1/3/5 / / 2/4/6) and an auxiliary contact (NO contact e.g. 13/14) must be designed according to the heat pump output and provided on site. The normally open contact of the EVU blocking contactor (13/14) is clamped to plug (1) (= DI1) of function block 0 (gray). CAUTION! Low voltage!
- 4.) The contactor (K20) for the immersion heater (E10) must be designed for mono-energetic systems (2nd heat generator) according to the heater output and must be provided by the customer. The control (230 V AC) takes place from the heat pump manager via plug (7) (= NO3) of function block 0 (gray) clamped.
- 5.) The contactor (K21) for the flange heater (E9) in the hot water storage tank must be designed according to the radiator output and provided on site. The control (230 V AC) takes place from the WPM via plug (7) of the defined function block.
- 6.) The contactors of points 3; 4; 5 are installed in the electrical distribution. The load lines for the radiators are to be designed and secured in accordance with DIN VDE 0100.
- 7.) The heating circulation pump (M13) is connected to plug (5) (230 V AC) and (8) (control signal) of function block 0 (gray).
- 8.) The outside sensor (R1) is clamped to plug (3) (= U1) of function block 0 (gray).

NOTE

When using three-phase pumps, a power contactor can be controlled with the 230 V output signal of the heat pump manager. Sensor cables can be extended up to 50 m with 2 x 0.75 mm cables.

NOTE

Further information on wiring the heat pump manager can be found in the electrical documentation. The communication cable is essential for the function of air-to-water heat pumps installed outdoors. It must be shielded and laid separately from the load line. It is connected to N1-J25. For more information, see electrical documentation.

ATTENTION

The communication cable is essential for the function of air-to-water heat pumps installed outdoors. It must be shielded and laid separately from the load line. It is connected to N1-J25. For more information, see electrical documentation.

7.4.2 Heat pump with WPM EconPlus

1. The 3- or 4-core supply line for the power section of the heat pump is led from the heat pump meter via the EVU blocking contactor (if required) into the heat pump (1L / N / PE ~ 230V, 50Hz or 3L / PE ~ 400V, 50Hz) . Protection according to the current consumption information on the nameplate, by a 3-pole miniature circuit breaker with C characteristics and common tripping of all 3 lanes. Cable cross-section according to DIN VDE 0100
2. The current consumption is stated on the nameplate, through an all-pole circuit breaker of the phases with C characteristic and common tripping of all 3 lanes. Cable cross-section according to DIN VDE 0100.
3. The 3-core supply line for the heat pump manager (heating controller N1) is routed into the heat pump (devices with integrated controller) or to the subsequent assembly area of the heat pump manager (WPM).
The supply line (L / N / PE ~ 230V, 50Hz) for the WPM must be connected to permanent voltage and for this reason must be tapped in front of the EVU blocking contactor or connected to the household electricity, otherwise important protective functions will be out of order during the EVU blocking .

4. The EVU blocking contactor (K22) with 3 main contacts (1/3/5 // 2/4/6) and an auxiliary contact (NO contact 13/14) must be designed according to the heat pump output and provided on site.
The normally open contact of the EVU blocking contactor (13/14) is looped from terminal strip X3 / G to plug terminal N1-J5 / ID3.
CAUTION! Low voltage!
5. The contactor (K20) for the immersion heater (E10) is to be designed for monoenergetic systems (2nd heat exchanger) according to the heater output and to be provided by the customer. The control (230VAC) takes place from the heat pump manager via terminals X1 / N and N1-J13 / NO 4.
6. The contactor (K21) for the flange heater (E9) in the hot water storage tank must be designed according to the radiator output and provided on site. The control (230VAC) takes place from the WPM via the terminals X2 / N and N1-X2 / K21.
7. The contactors of points 3; 4; 5 are built into the electrical distribution. The load lines for the radiators are to be designed and secured in accordance with DIN VDE 0100.
8. The heating circulation pump (M13) is connected to terminals X2 / N and N1-X2 / M13.
9. The hot water charging pump (M18) is connected to terminals X2 / N and N1-X2 / M18.
10. In the case of air / water heat pumps for outdoor installation, the return sensor is integrated and is routed to the heat pump manager via the control line. The return sensor only needs to be installed in the immersion sleeve in the distributor when using a double differential pressure-free distributor. Then the single wires are attached to terminals X3 / GND and X3 / R2.1. The jumper A-R2, which is located between X3 / B2 and X3 / 1 in the delivery state, must then be moved to terminals X3 / 1 and X3 / 2.
11. The outside sensor (R1) is attached to terminals X3 / GND (Ground) and N1-X3 / R1.
12. The hot water sensor (R3) is built into the hot water storage tank and is connected to terminals X3 / GND (ground) and N1-X3 / R3.

7.4.3 Heat pump with WPM 2006 plus / WPM 2007 plus

1. The 4-core supply line for the power section of the heat pump is led from the heat pump meter via the EVU contactor (if required) into the heat pump (3L / PE ~ 400V, 50Hz).
Protection according to the current consumption information on the nameplate, by a 3-pole miniature circuit breaker with C characteristics and common tripping of all 3 lanes.
Cable cross-section according to DIN VDE 0100
2. The 3-core supply line for the heat pump manager (heating controller N1) is routed into the heat pump (devices with integrated controller) or to the later installation location of the wall-mounted heat pump manager (WPM).
The supply line (L / N / PE ~ 230V, 50Hz) for the WPM must be connected to permanent voltage and for this reason must be tapped in front of the EVU blocking contactor or connected to the household electricity, otherwise important protective functions will be out of order during the EVU blocking.
3. The EVU blocking contactor (K22) with 3 main contacts (1/3/5 // 2/4/6) and an auxiliary contact (NO contact 13/14) must be designed according to the heat pump output and provided on site.
The normally open contact of the EVU blocking contactor (13/14) is looped from terminal strip X2 to plug terminal J5 / ID3. CAUTION! Low voltage!
4. The contactor (K20) for the immersion heater (E10) must be designed for monoenergetic systems (2nd heat exchanger) according to the radiator output and must be provided by the customer. The control (230VAC) takes place from the heat pump manager via terminals X1 / N and J13 / NO 4.
5. The contactor (K21) for the flange heater (E9) in the hot water storage tank must be designed according to the radiator output and provided on site. The control (230VAC) takes place from the WPM via the terminals X1 / N and J16 / NO 10.
6. The contactors of points 3; 4; 5 are built into the electrical distribution. The 5-core load lines (3L / N / PE 400V ~ 50Hz) for the radiators must be designed and secured in accordance with DIN VDE 0100.
7. The heating circulation pump (M13) is connected to terminals X1 / N and J13 / NO 5.
8. The hot water charging pump (M18) is connected to terminals X1 / N and J13 / NO 6.
9. The brine or well pump is connected to terminals X1 / N and J12 / NO 3.
With air / water heat pumps, a heating circulation pump must never be connected to this output!
10. The return sensor (R2) is integrated in brine and water / water heat pumps or is included. In air / water heat pumps for indoor installation, the return sensor is integrated and is routed to the heat pump manager via two individual wires in the control line. The two single wires are attached to terminals X3 (Ground) and J2 / B2. In the case of air / water heat pumps for outdoor installation, the return sensor must be attached to the common return of the heating and hot water (e.g. immersion sleeve in the compact distributor). The connection to the WPM is also made at the terminals: X3 (Ground) and J2 / B2.
11. The outside sensor (R1) is connected to terminals X3 (Ground) and J2 / B1.
12. The hot water sensor (R3) is built into the hot water storage tank and is connected to terminals X3 (ground) and J2 / B3.
13. The connection between the heat pump (round plug) and the heat pump manager is made via coded control lines that must be ordered separately for heat pumps installed outside. Single wire no. 8 is only to be connected to terminal J4-Y1 for heat pumps with hot gas defrosting.

7.5 Energy efficient circulation pumps

Energy-efficient circulation pumps are wet-running pumps with synchronous motors (direct current motors) that comply with the Ecodesign Directive 2009/125 / EC and, compared to conventional pumps with asynchronous motors, consume up to 70% less electricity with the same pump output.

Energy-efficient circulation pumps have a so-called energy efficiency index (EEI). The smaller the EEI, the less electrical energy the pump uses and the better the energy classification. Pumps that are sold on the market must have at least an EEI index 0.23 (as of 2020). Pumps with an EEI 0.2 are also eligible according to BAFA (as of 2020).

Electronically controlled circulation pumps usually have high starting currents, which under certain circumstances can shorten the life of the heat pump manager. For this reason, a coupling relay must be installed between the output of the heat pump manager and the electronically controlled circulation pump.

This is not necessary if the electronically controlled circulation pump does not exceed the maximum permissible operating current of the heat pump manager of 2 A and the maximum permissible starting current of the heat pump manager of 12 A, or if the pump manufacturer has approved it.

⚠ ATTENTION

It is not permitted to switch more than one electronically controlled circulation pump via one relay output.

⚠ ATTENTION

All electronically controlled circulation pumps from the Dimplex range are supplied with coupling relays and a connection diagram as standard to protect the heat pump manager.

ℹ NOTE

Depending on the system configuration and the heat pump manager, the coupling relay can be installed in a separate distribution in the heat pump manager or in the switch box of the heat pump. The coupling relay can be mounted on a top hat rail.

Coupling relay

High-efficiency and regulated circulation pumps have high starting currents when they are switched on. To protect the switching contacts on the WPM, a relay is switched between the pump and the WPM in order to decouple the control circuit from the load circuit (flashover resistance).

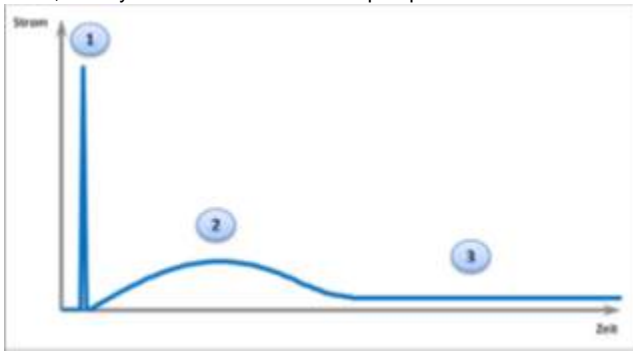


Fig.7.9: Starting currents for circulating pumps

1 Inrush current peak (microseconds)

Duration less than 1s

- Cause: EMC filter capacitors

2 Charging current peak (milliseconds)

Duration less than 8ms

- Cause: DC link capacitor

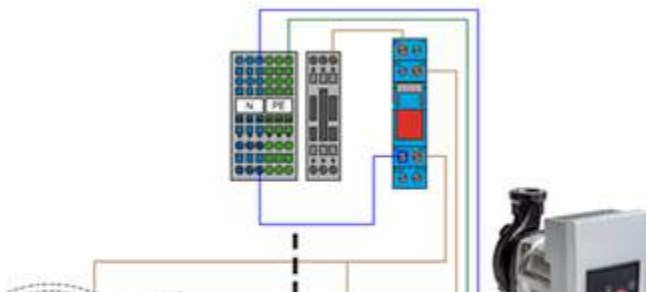
3 Nominal current - operating point of the pump

A coupling relay is not required if the electronically controlled circulation pump does not exceed the maximum permissible operating current of the heat pump manager of 2 A and the maximum permissible starting current of the heat pump manager of 12 A, or if the pump manufacturer has approved it.

ℹ NOTE

High starting currents shorten the life of the heat pump manager

4th Connection of coupling relay



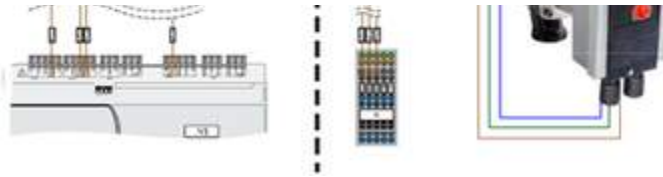


Fig.7.10: Connection diagram coupling relay

5 Examples of suitable coupling relays

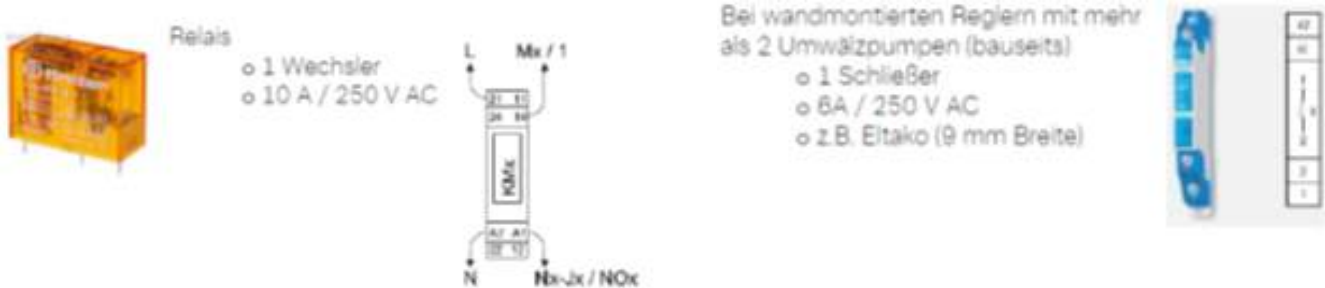


Fig.7.11: Coupling relay

Difference between energy-efficient circulation pumps (UPH / UP) and electronically controlled circulation pumps (UPE / UP)

UPH / UP are energy-efficient circulation pumps that may be used in the generator circuit of a heating heat pump and must ensure the minimum heating water throughput through the heat pump regardless of the pressure loss.

UPE / UP are electronically controlled circulation pumps for the consumer circuit, which regulate themselves via the system pressure.

UPH pumps can be controlled with a 0-10V signal (VDC) or pulse width modulation (PWM), depending on the pump type. If there is no control signal, a VDC pump does not run, a PWM pump runs at full speed.

NOTE

A UPH pump with a 0-10V input signal must be controlled by the WPM. If a pump with PWM input signal is used, in contrast to a pump with 0-10V control, it always runs at the highest speed (max.characteristic curve)

7.5.1 Electronically controlled circulation pump for the consumer circuit (M13 / M15)

Electronically controlled circulation pumps for the consumer circuit must be adapted to the heating distribution system (volume flow / pressure loss of the pipes and radiators) of the building. Therefore, directly speed-adjustable, self-regulating (electronically) circulating pumps are advantageous. But pumps with a PWM input signal can also be used if they can be controlled by the heat pump manager. The advantage of this control is that if the signal transmission is disturbed, this pump goes to maximum speed and the building continues to be supplied with heat. Pumps with a 0 - 10 V signal are not recommended, as they switch off in the event of a fault in the signal transmission.



Fig. 7.12: Example for electronically controlled circulation pumps UPE 80-25 (32) PK / UP 75-25 (32) PK with PWM input signal



Fig.7.13: Example of electronically controlled circulation pumps UPH 90-25 (32) / UPE 100-25 (32) K - self-regulating

Depending on the pump type, the following types of pump control are stored:

- 1: Control type: Fixed speed
- 2: Control type p-v
- 3: Control type p-v
- 4: Control via PWM input signal

7.5.2 Energy-efficient circulation pumps for the generator or brine circuit (M16 / M11)

Generator and brine circuit pumps are energy-efficient circulation pumps that can or must be controlled by the heat pump manager and ensure the minimum heating water throughput through the heat pump in the generator circuit and the heat source throughput in the brine circuit. It is controlled either via a PMW or 0-10 V input signal.

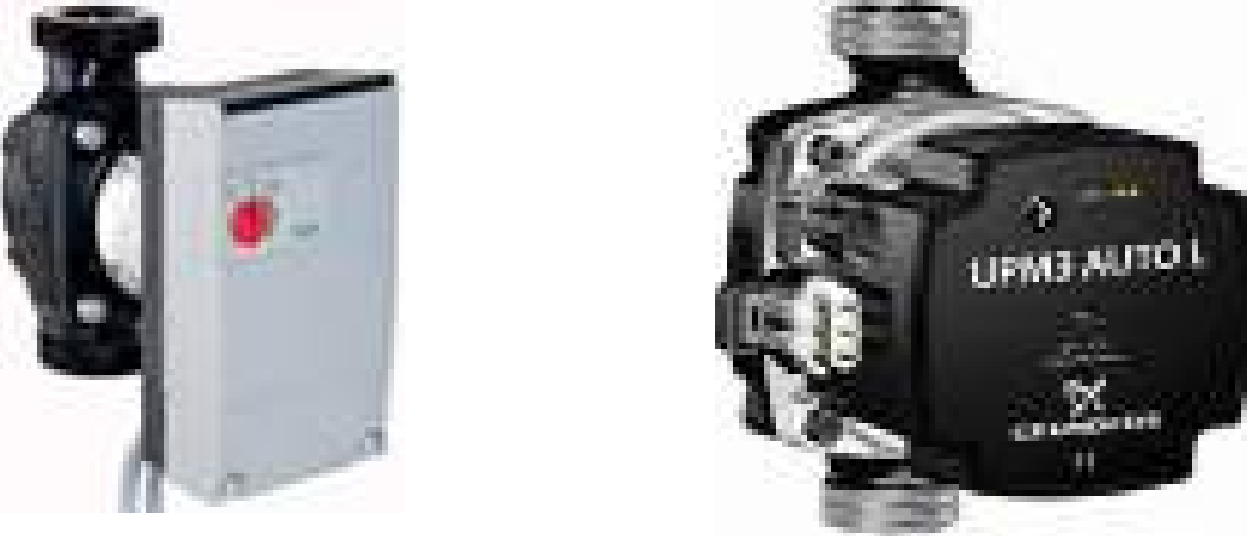


Fig.7.14: Example for generator circuit pumps UPH 120-32PK / UP 75-25 (32) PK with PWM input signal



Fig.7.15: Example for Magna3 brine circuit pumps (e.g. UPH 120-50F) with 0-10V input signal

Comparison of input signals pumps:

<p>0 - 10V signal (VDC)</p>			<p>No speed without input signal Control absolutely necessary!</p>
<p>PWM signal (PWM)</p>			<p>Maximum speed without input signal Control possible</p>

Tab.7.3: Pumps with input signal 0-10 V (VDC) and PWM (pulse width modulation)

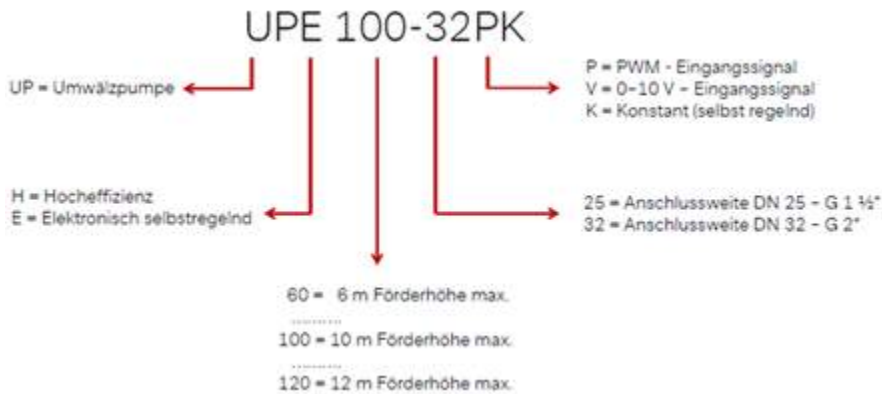
	UP 70-25PK (32)	UPH 90-25 (32)	UPH 80-25P	UPH 120-32PK	UPH 80-40F	UPH 120-50F	UPE 70-25PK (32)	UPE 80-25 (32PK)	UPE 100-25K (32)	UPE 120-32K
Heat generator circuit (M16)	x	x	x	x	x	x	x	x	x	x
Control via WPM required										
Control via WPM possible	x		x	x	x	x	x	x		
Can be used in the heat consumer circuit (M13, M14, M15, M20)	x	x	x	x	x	x	x	x	x	x
Can be used as a hot water charging pump (M18)	x	x	x	x	x	x	x	x	x	x
Can be used as a brine circulating pump (M11)		x	x	x	x	x	x	x	x	x
Constant speed	x	x			x	x		x	x	x
Self-regulating via p / c (constant)		x		x	x	x		x		
Self-regulating via p / v (proportional)		x		x	x	x	x		x	x
Controllable via 0-10V signal					x	x				
Controllable via PWM signal	x		x	x			x	x		

Operating temperature range	+2 to 110 °C	-10 to 95 °C	-10 to 95 °C	-10 to 110 °C	-10 to 110 °C	-10 to 110 °C	-10 to 100 °C	-10 to 110 °C	-10 to 100 °C	-10 to 100 °C
Mains connection 230V	Molex plug 1.5 m cable	Molex plug 1.5 m cable	Molex plug 1.5 m cable	1.5 m cable	Load terminal block	Load terminal block	Molex plug 1.5 m cable	Molex connector 1.5 m cable	Load terminal block	Load terminal block
Control line (signal cable)	Plug with PWM Signal cable 1.5 m		Plug with PWM Signal cable 1.5 m	1.5 m cable	Control terminal block	Control terminal block	Plug with PWM Signal cable 1.5 m	Plug with PWM signal cable 1.5 m OPTIONAL as an accessory		
Delivery head max. In m	7.5	9.5	8.5	12th	8th	12th	7.5	8.4	10	12th
Volume flow max. In m³ / h	3	5.5	5	11	16	30th	3.5	3.5	8th	11
connection	DN 25/32 thread	DN 25/32 thread	DN 25 thread	DN 32 thread	DN 40 flange	DN 50 flange	DN 25/32 thread	DN 25/32 thread	DN 25/32 thread	DN 32 thread
Pitch in mm	180	180	180	180	220	280	180	180	180	180

Tab.7.4: Complete overview of circulation pumps (status 11/2021)









7.5.3 Circulation pumps - general information

7.5.3.1 Nomenclature of circulation pumps



7.5.3.2 Circulation pumps control types:





description	image	Control	Remarks
UPE 70-25 (32) PK		PWM Manually • p-v (proportional pressure) • Constant speed	Can only be used in conjunction with a flow switch in the generator circuit for air / water heat pumps with circuit reversal! Can be used as a brine pump!
UPE 80-25 (32) PK		PWM Manually • p-c (constant pressure) • Constant speed	Can only be used in conjunction with a flow switch in the generator circuit for air / water heat pumps with circuit reversal! Can be used as a brine pump!
UPE 100-25 (32) K		Manually • p-c (constant pressure)	Can only be used with a flow switch in the generator circuit of air / water heat pumps with circuit reversal! No control by WPM possible.




<p>UPE 120-32K</p>		<ul style="list-style-type: none"> • p-v (proportional pressure) • Constant speed 	
<p>UPH 70-25P UPH 80-25P</p>		<p>PWM</p>	<p>No use in the primary circuit! (lower limit of use at 5 ° C)</p>
<p>UPH 60-25 (32)</p>		<p>Manually</p> <ul style="list-style-type: none"> • p-c (constant pressure) • p-v (proportional pressure) • 3 fixed speed levels 	<p>No use in the primary circuit (lower limit of use at 5 ° C) No control by WPM possible!</p>
<p>UPH 90-25 (32)</p>		<p>Manually</p> <ul style="list-style-type: none"> • p-c (constant pressure) • p-v (proportional pressure) 	<p>No control by WPM possible! Can be used as a brine pump!</p>
<p>UPH 120-32PK</p>		<p>PWM</p> <p>Manually</p> <ul style="list-style-type: none"> • p-c (constant pressure) • p-v (proportional pressure) 	<p>Can be used as a brine pump!</p>
<p>UP 75-25 (32) PK</p>		<p>PWM</p> <p>Manually</p> <ul style="list-style-type: none"> • 4 fixed speed levels 	<p>No use in the primary circuit! (lower limit of use at 2 ° C)</p>
<p>UPH 100-25 (32) P. UPH 100-25 (32) V.</p>		<p>PWM</p> <p>0-10V</p>	<p>UPH 100-32P no longer available from August 2016. UPH 100-25 (32) V no longer available from January 2018.</p>
<p>UPH 80-40F UPH 120-50F</p>		<p>0 -10V</p> <p>Manually</p> <ul style="list-style-type: none"> • p-c (constant pressure) • p-v (proportional pressure) 	<p>Can be used as a brine pump!</p>

- 3 fixed speed levels

Tab.7.5: Complete overview of wet-running pumps control types

7.5.3.3 Hydraulic areas of application, circulation pumps

description	image	image	M13	M16	M18	M11	M12 / 17 / ...
UPE 70-25 (32) PK UPE 80-25 (32) PK UPE 100-25 (32) K UPE 120-32K		 	X	X With DFS *	X	X	X
UPH 70-25P			X *	X	X		
UPH 80-25P UPH 100-25 (32) P / V			X * X *	X	X	X	X
UPH 60-25 (32) UP 75-25 (32) PK			X	X	X		X
UPH90-25 (32)			X	X	X	X	X






								
UPH120-32PK			X	X	X	X	X	X
UPH 80-40F UPH 120-50F			X	X	X	X	X	x

* DFS = flow switch

Tab. 7.6: Complete overview of hydraulic integration options for wet-running pumps

7.5.3.4 Operating temperature range for circulating pumps


image	description	Application limits	Insert M11 (brine)
	UPE 70-25 (32) PK UPE 80-25 (32) PK UPE 100-25 (32) K UPE 120-32K	-10-110 ° C	X X X
	UPH 70-25P UPH 80-25P	5 -95 ° C -10-95 ° C	 X

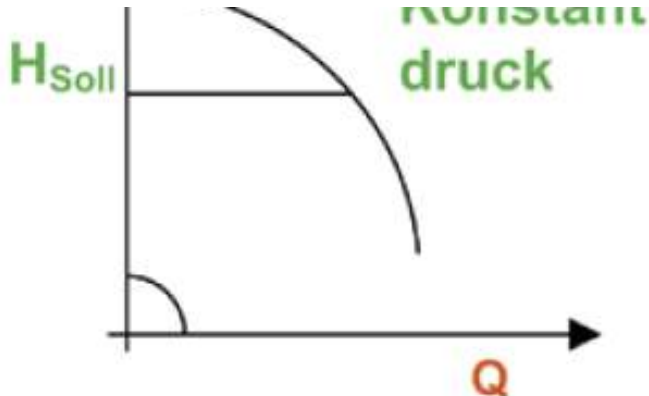
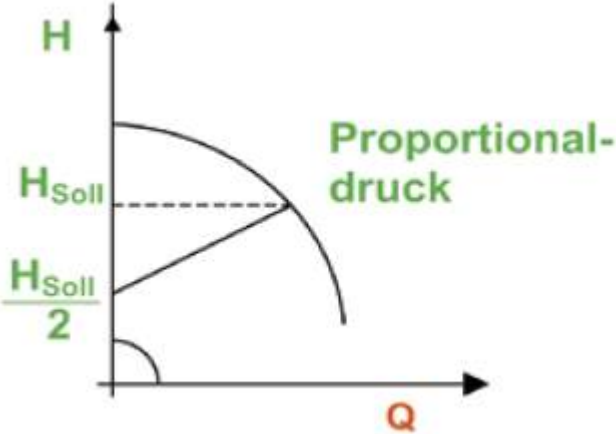
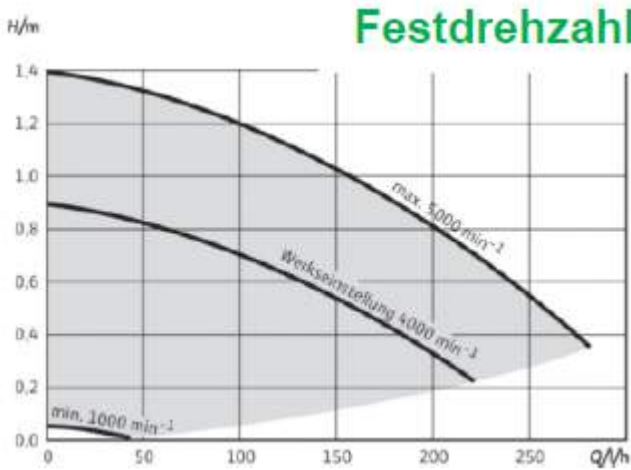
	UPH 100-25 (32) P / V	-10-95 ° C	X
	UPH 60-25 (32) UP 75-25 (32) PK	5-110 ° C 2-110 ° C	
	UPH 90-25 (32)	-10-95 ° C	X
	UPH 120-32PK	-10-110 ° C	X
	UPH 80-40F UPH 120-50F	-10-110 ° C	X

Tab.7.7: Complete overview of the temperature application range for wet-running pumps

7.5.3.5 Self-regulating circulation pumps according to control types

- p-c (constant pressure)
- p-v (variable pressure)
- Fixed speed

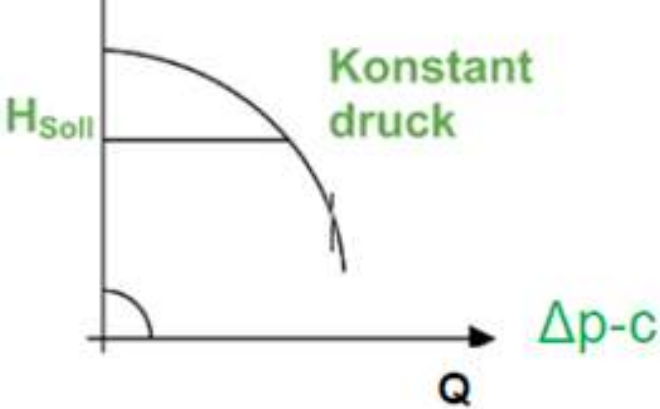
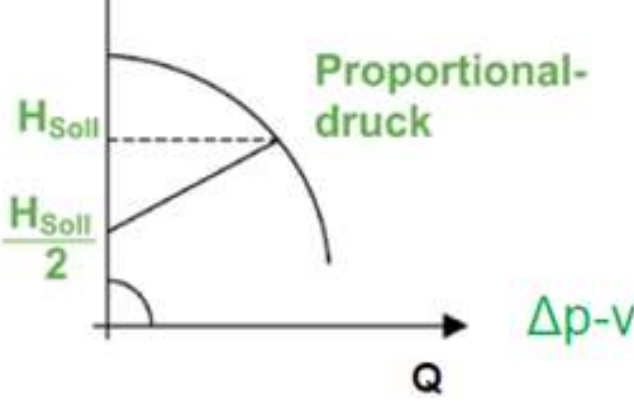
Signal type	Control curve	pump
p-c constant pressure		<ul style="list-style-type: none"> • UPE 80-25 (32) PK • UPE 100-25 (32) K • UPE 120-32K • UPH 60-25 (32) • UPH 90-25 (32) • UPH 120-32PK • UPH 80-40F

		<ul style="list-style-type: none"> • Magna3 32-120F (PP 32-120F) * • Magna3 40-80F (PP40-80F) * • Magna3 40-120F (PP40-120F) * • Magna3 50-120F (PP50-120f) * • Magna3 65-80F (PP65-80F) * • Magna3 65-100F (PP65-100F) * • Magna3 65-120F (PP65-120F) * • Magna3 65-150F (PP65-150F) *
<p>p-v pressure variable</p>		<ul style="list-style-type: none"> • UPE 70-25 (32) PK • UPE 100-25 (32) K • UPE 120-32K • UPH 90-25 (32) • UPH120-32PK
<p>Fixed speed (Constant speed)</p>		<ul style="list-style-type: none"> • UPE 70-25 (32) PK • UPE 80-25 (32) PK • UPE 100-25 (32) K • UPE 120-32K • UPH 60-25 (32) • UPH 80-40F • UP 75-25 (32) PK • Magna3 32-120F (PP 32-120F) * • Magna3 40-80F (PP40-80F) * • Magna3 40-120F (PP40-120F) * • Magna3 50-120F (PP50-120f) * • Magna3 65-80F (PP65-80F) * • Magna3 65-100F (PP65-100F) * • Magna3 65-120F (PP65-120F) * • Magna3 65-150F (PP65-150F) *

Tab.7.8: Control types wet running pumps (self-regulating)

7.5.3.6 Setting the control types




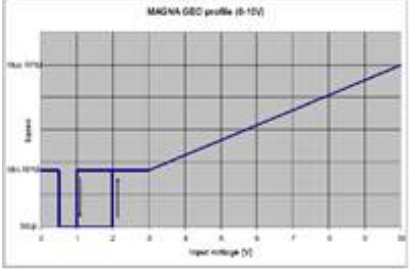

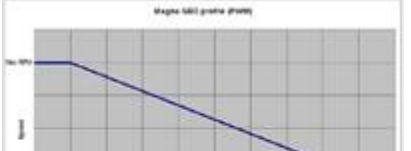
 <p>Konstant druck</p> <p>H_{Soll}</p> <p>$\Delta p-c$</p> <p>Q</p>	 <p>Proportional-druck</p> <p>H_{Soll}</p> <p>$\frac{H_{Soll}}{2}$</p> <p>$\Delta p-v$</p> <p>Q</p>
<p>Differential pressure is regulated to a constant value. Delivery head H does not increase with decreasing flow rate</p>	<p>Differential pressure is managed depending on the volume flow. Delivery head H decreases with decreasing volume flow.</p>
<p>mission</p>	<p>mission</p>
<p>2-pipe heating systems with great consumer authority $HN < 2$ m</p>	<p>2-pipe heating systems with low consumer authority $HN > 4$ m</p>
<p>1-pipe heating with thermostatic or zone valves for different circuits</p>	<p>1-pipe heating with thermostatic valves and high pressure losses</p>
<p>Underfloor heating systems with thermostatic valves</p>	<p>Underfloor heating systems with thermostatic valves and large pressure losses</p>
<p>In primary circuits of systems with low pressure losses in the primary circuit</p>	<p>In primary circuits of systems with high pressure losses in the primary circuit</p>

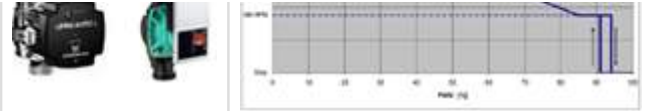
Tab.7.9: Setting / selection of the control types for wet-running pumps (self-regulating)

7.5.3.7 Circulation pumps with input signal

- Pulse forwarding - "PWM"
- 0-10V input signal - "VDC"

List of circulation pumps that are controlled by the heat pump manager **can / have to:**

Signal type	image	Control curve	comment	pump
<p>0 - 10V signal</p> <p>(VDC)</p>			<p>No rotational speed without input signal</p>	<ul style="list-style-type: none"> • UPH 100-32V (PP 32-100G) ** • UPH 80-40F • Magna3 32-120F (PP 32-120F) * • Magna3 40-80F (PP40-80F) * • Magna3 40-120F (PP40-120F) * • Magna3 50-120F (PP50-120F) * • Magna3 65-80F (PP65-80F) * • Magna3 65-100F (PP65-100F) * • Magna3 65-120F (PP65-120F) * • Magna3 65-150F (PP65-150F) *
<p>PWM signal</p>			<p>Maximum rotational speed without input signal</p>	<ul style="list-style-type: none"> • UPE 70-25PK • UPE 70-32PK • UPE 80-25PK • UPE 80-32PK • UP 75-25PK • UP 75-32PK • UPH 70-25P



- UPH 80-25P
- UPH100-25P
- UPH120-32PK

(PWM)

* Included in delivery: SI 75-130TU (M16), SIH 90TU (M16), SI 35-130TU (M11), SIH 90TU (M11), WI 45-180TU (M16), WIH 120TU (M16)

** Included in delivery: SI 26TU –SI 50TU (M16), SI 26TU (M11), SI 35TUR (M16), WI 35-45TU (M16)

Tab. 7.10: Complete overview of wet-running pumps that must / can be controlled by the heat pump manager.

7.5.4 Circulation pumps - series and pump types UPE / UPH / UP

7.5.4.1 Electrical connection and characteristics

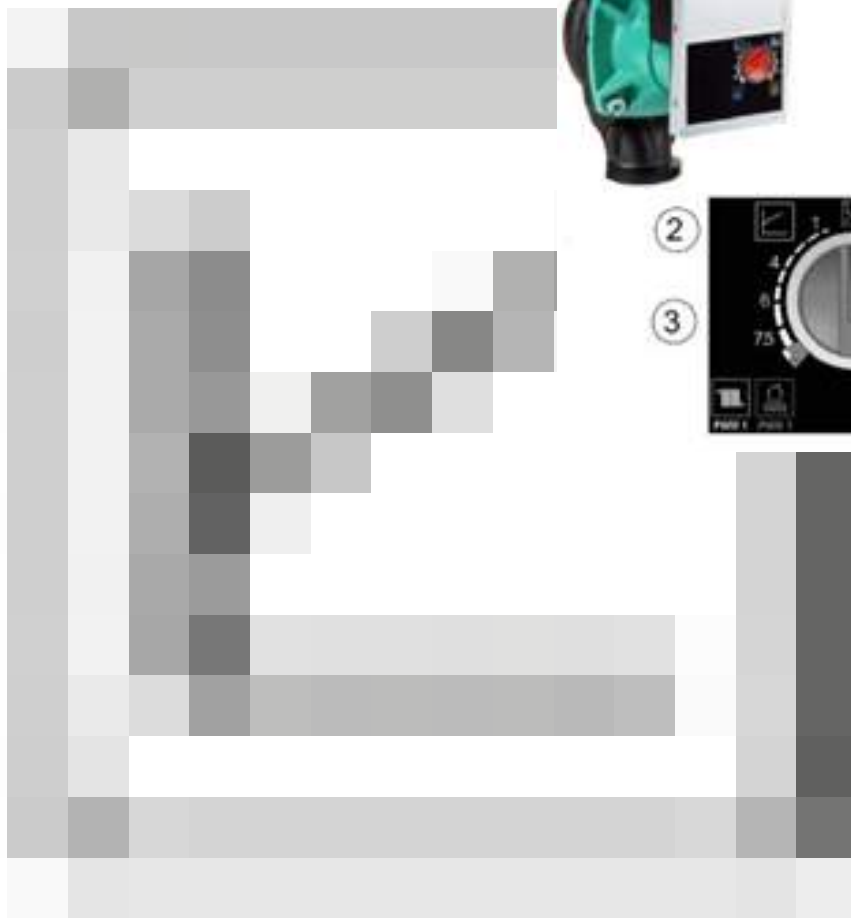
7.5.4.1.1 Circulation pump UPE 70-25 (32) PK

(corresponds to Wilo Yonos RSTG 25 (32) / 7.5)

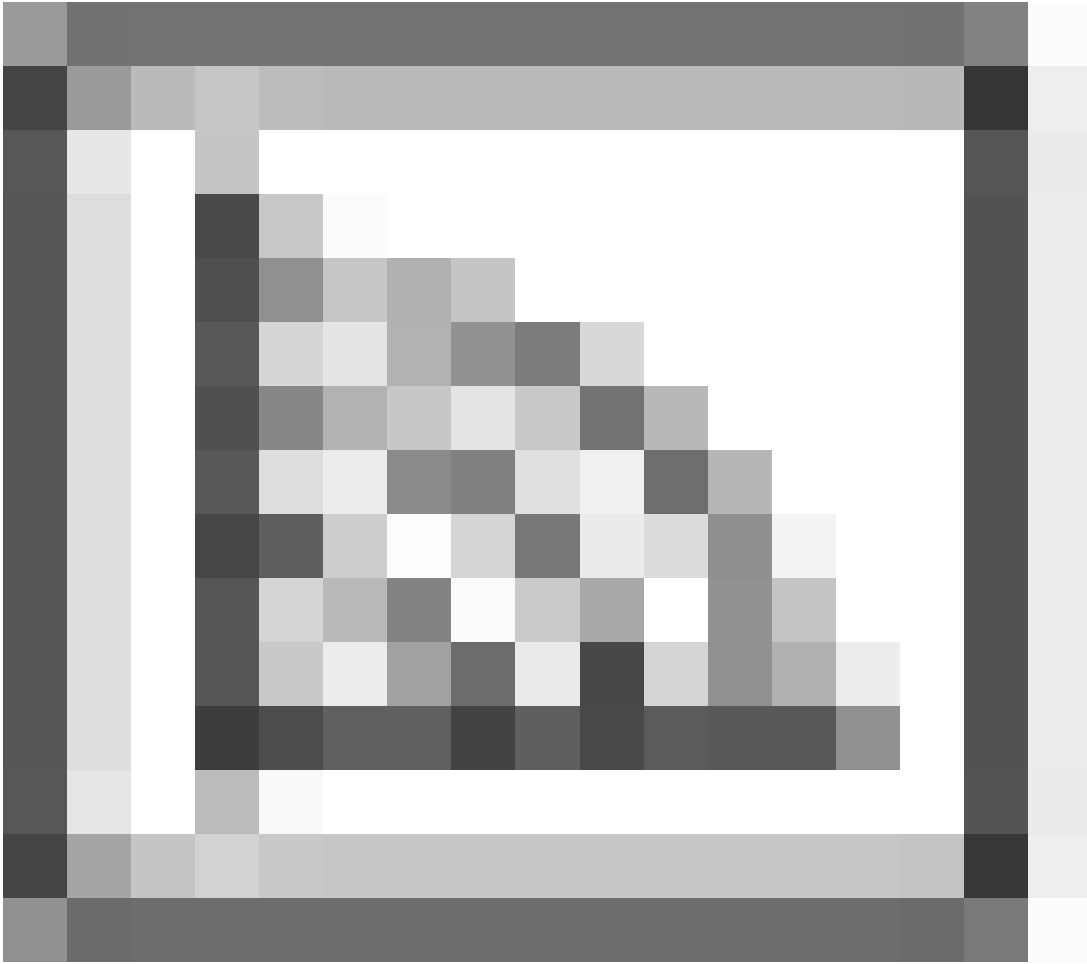
Self-regulating circulation pump for the **Consumer group** ... (M13)

Setting options:

2



1

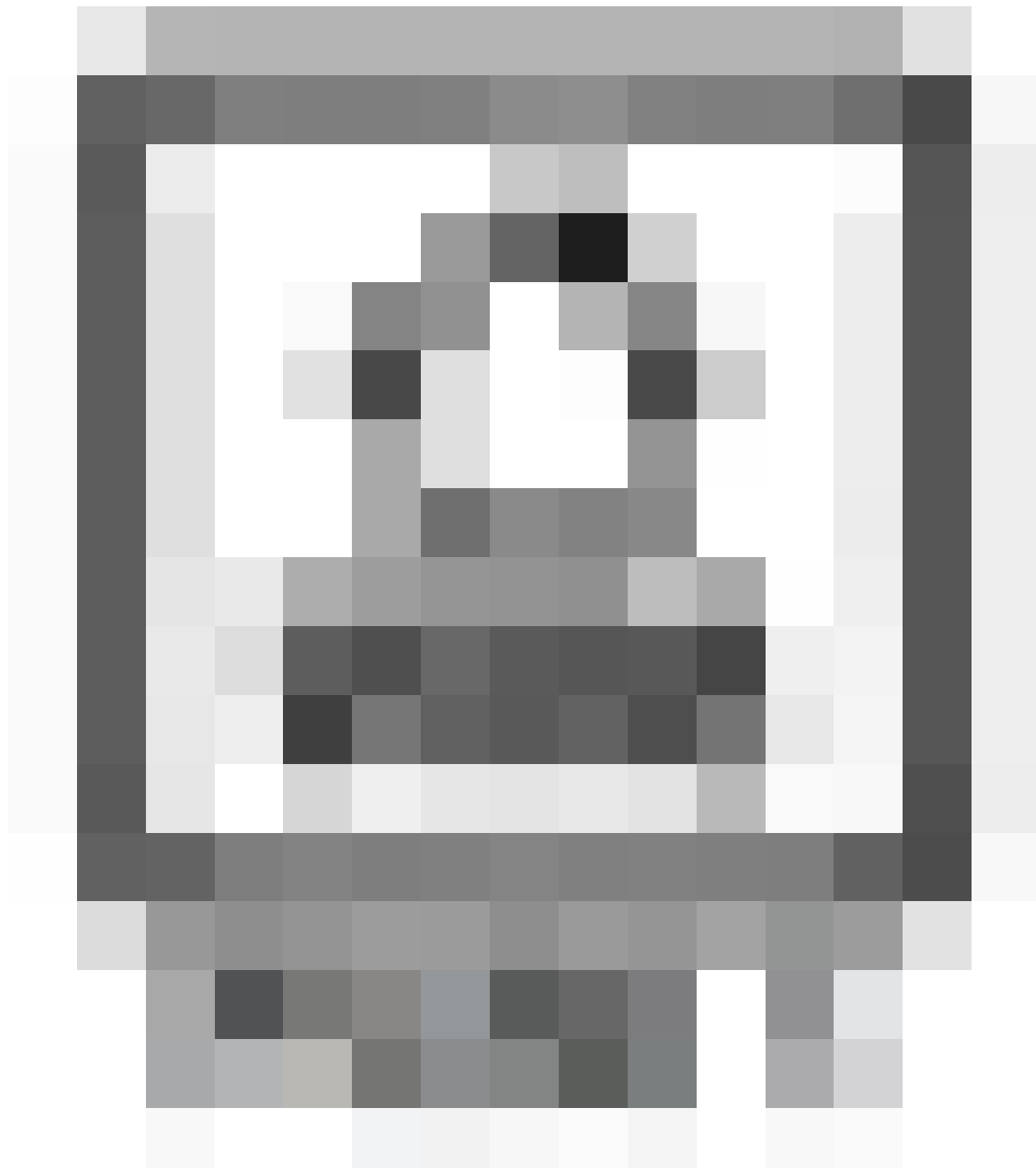


3

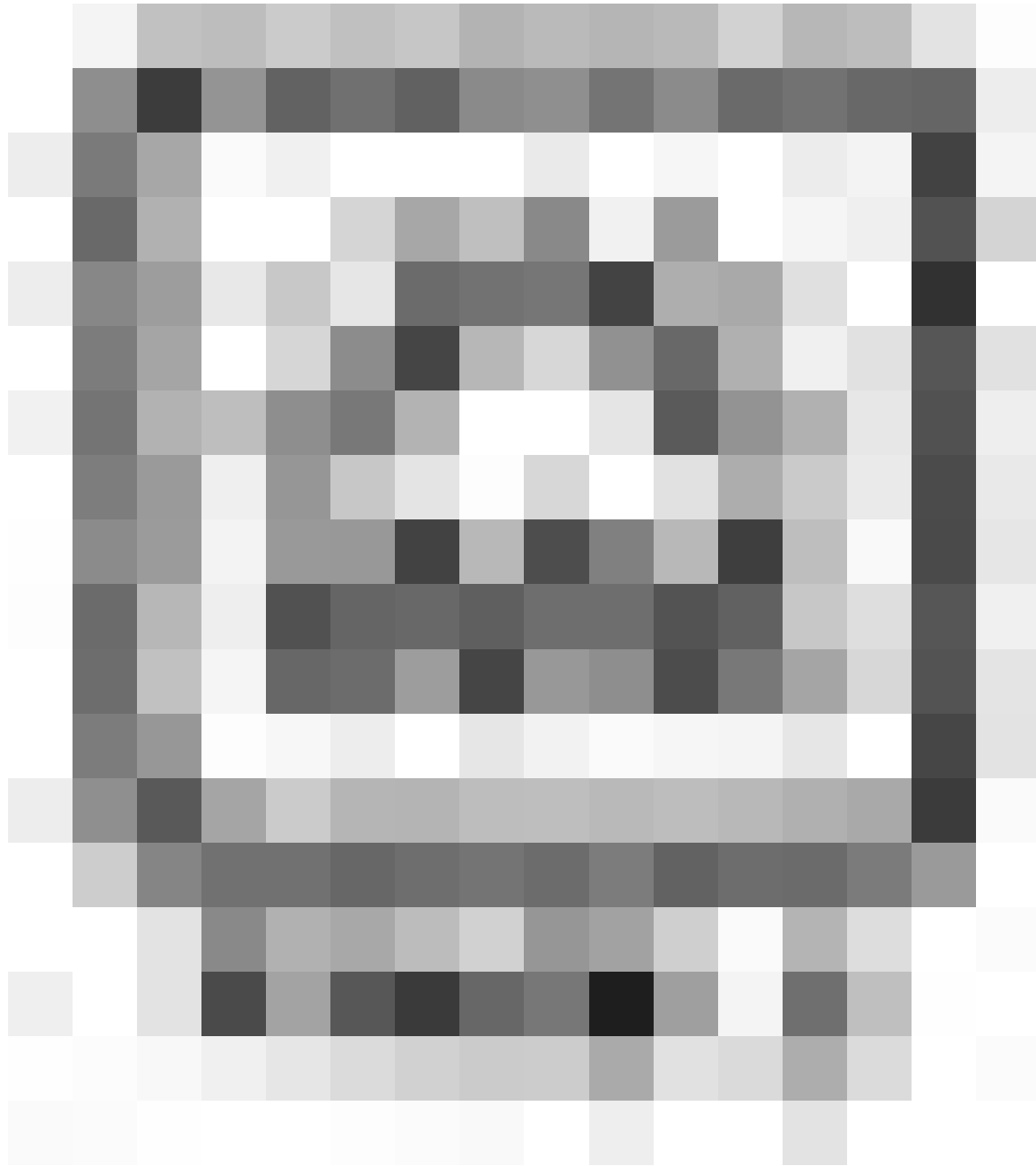




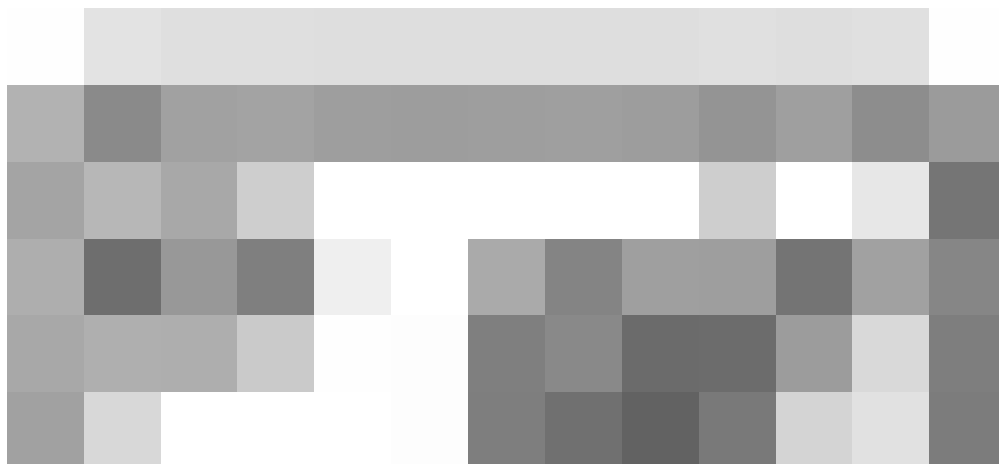
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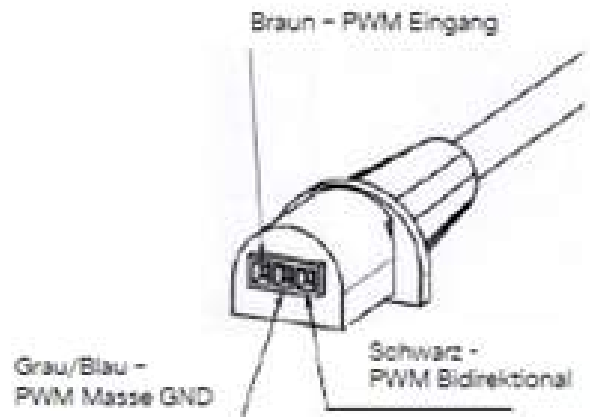
Optionally controllable by means of a PWM signal by the heat pump manager !!!

Fig.7.16: Setting options UPE 70-25 (32) PK

Electrical connection
Load cable 3 x 10 mm²



Control cable: 3 x 0.75 mm² PWM signal



L1 SCHWARZE/BRAUNE LITZE
 N Blaue Litze
 PE Gelb/grüne Litze

Load cable 1.5 m with plug included with the pump, control cable optional (item no. : 452169.41.79)

Fig.7.17: Electrical connection UPE 70-25 (32) PK

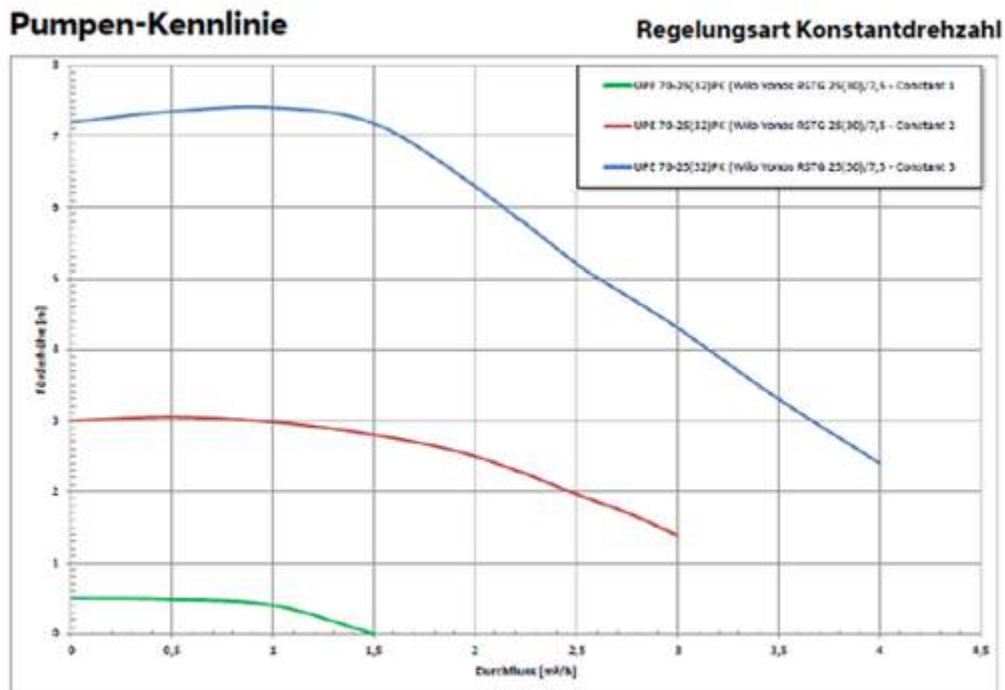
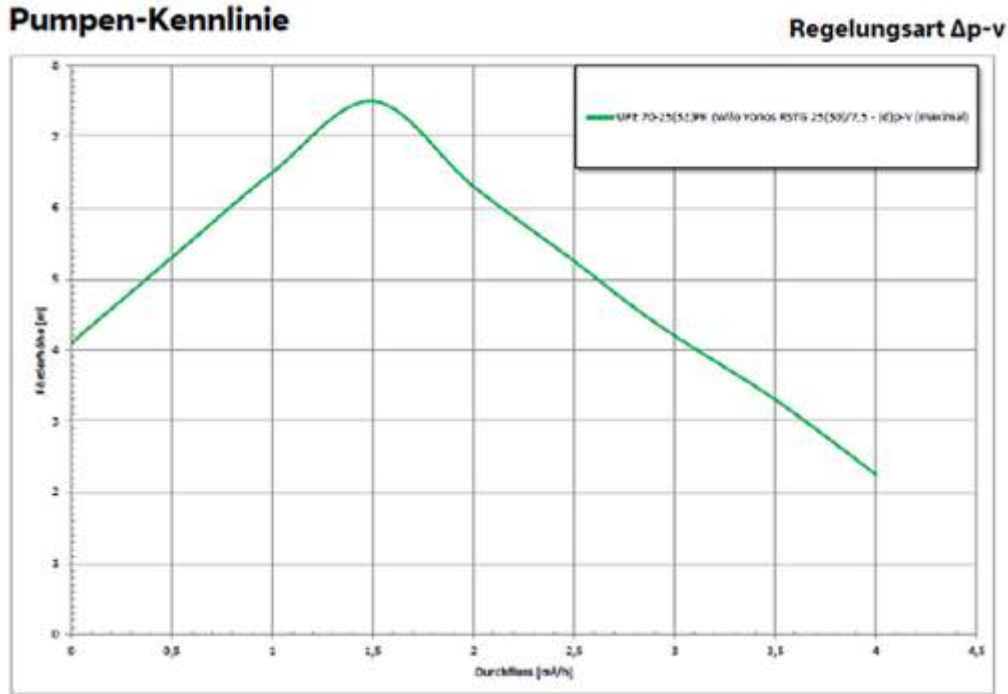


Fig.7.18: Characteristic curves UPE 70-25 (32) PK

7.5.4.1.2 Circulation pump UPE 80-25 (32) PK

(Wilo Para STG 25-180 / 8-75 / SC / I-12)

Self-regulating circulation pump for the **Consumer group ...** (M13)

Setting options:

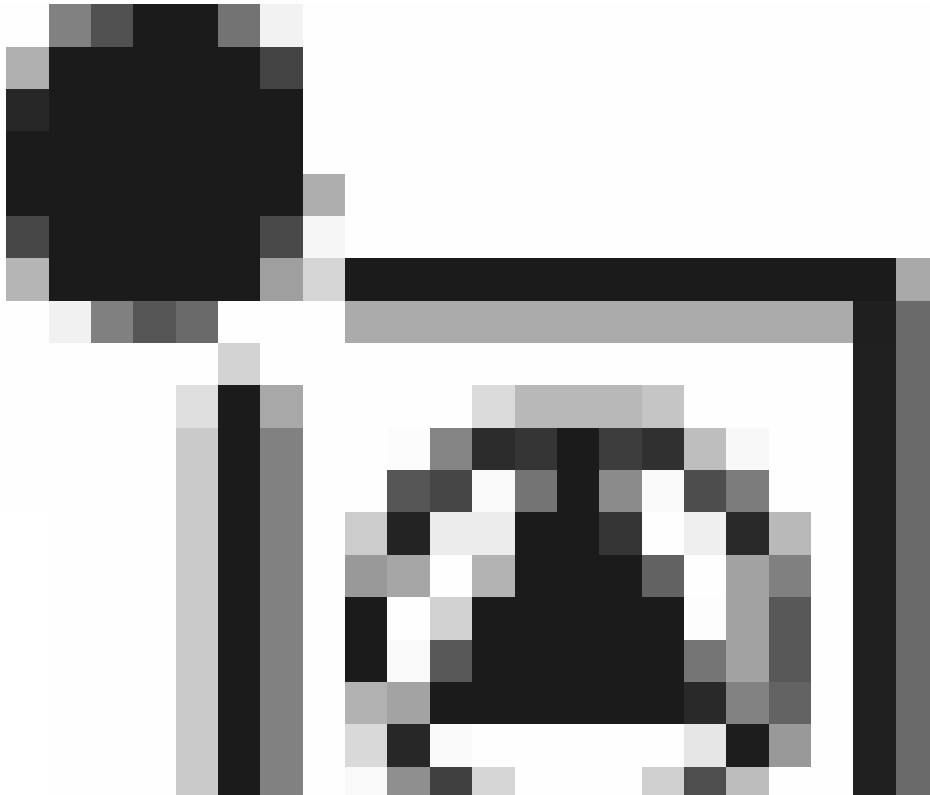


2. Load: AC 230 V Molex incl. 1.5 m connection cable



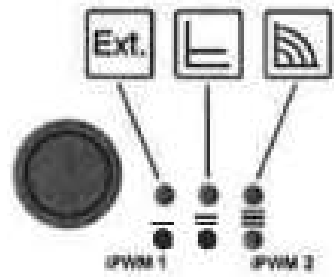
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Display option:



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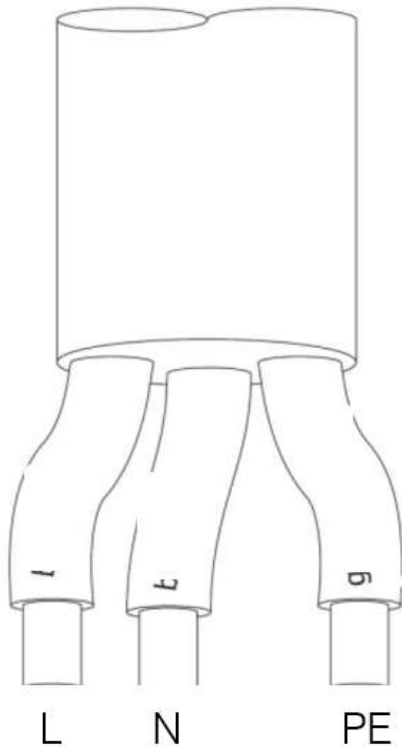
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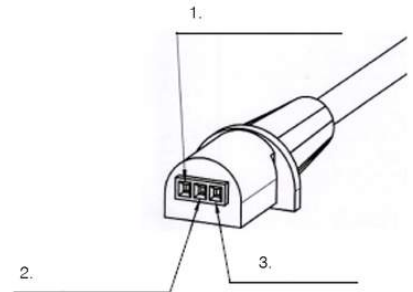
Optionally controllable by means of a PWM signal by the heat pump manager !!!

Electrical connection:

Load cable: 3 x 1.0 mm²



Control cable: 3 x 0.75 mm² PWM signal



- 1. Brown - PWM input
- 2. Gray / blue - PWM ground GND
- 3. Black - PWM bidirectional

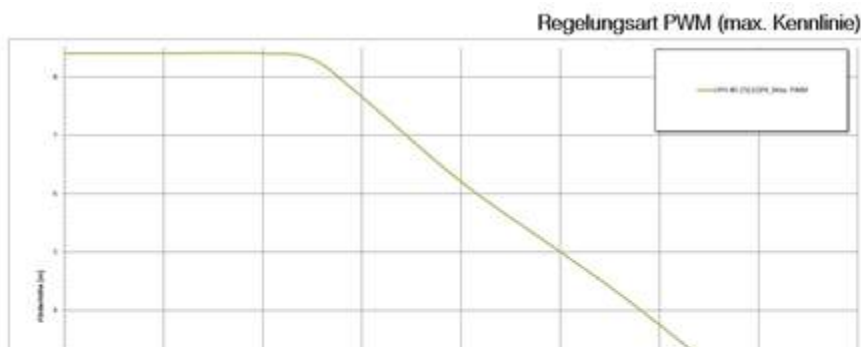
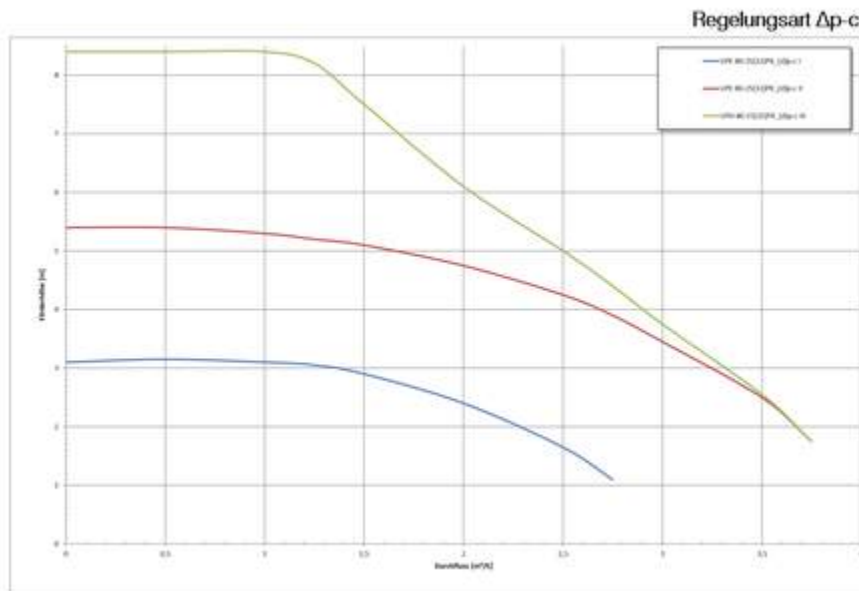
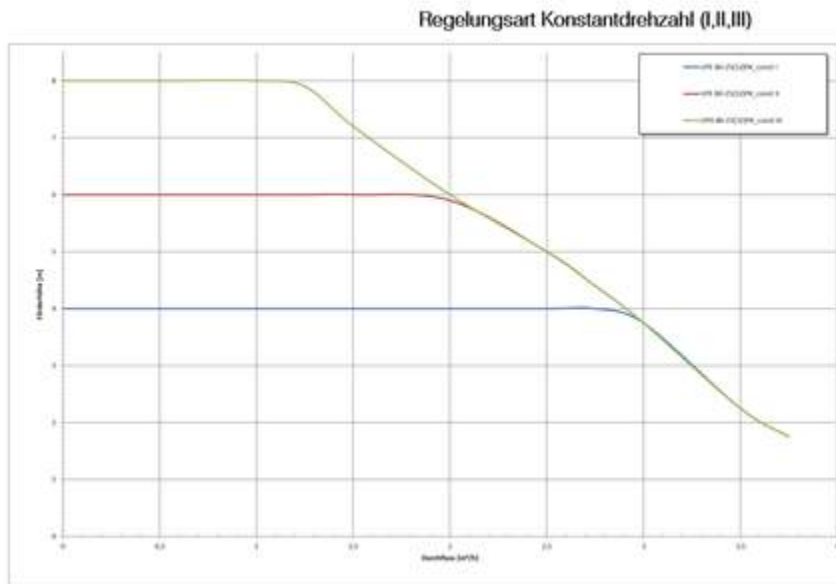
L1 - black / brown wire

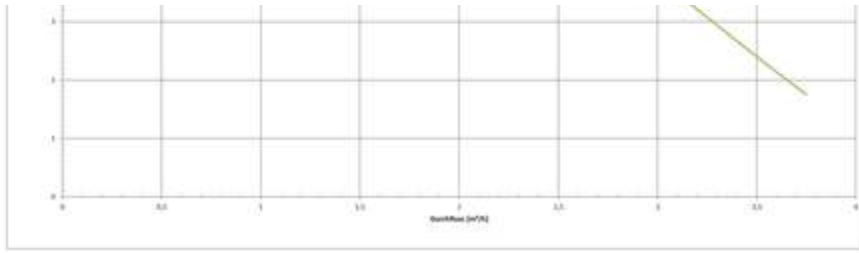
N - blue wire

PE - yellow / green stranded wire

Load cable 1.5 m with Molex plug included with the pump, control cable optional (item no.: 452169.41.79)!

7.5.4.1.3 Characteristic curve UPE 80-25 (32) PK





7.5.4.1.4 Circulation pump UPE 100-35 (32) K / UPE 120-32K

(corresponds to WILO Yonos Para HF 25 (30) / 10 & Yonos Para HF 30/12)

Circulation pump for the **Consumer group** - self-regulating (not controllable)



Fig.7.19: Setting options UPE 100-25 (32) K and UPE 120-32K

Electrical connection: none Control with 0-10V or PWM signal possible!

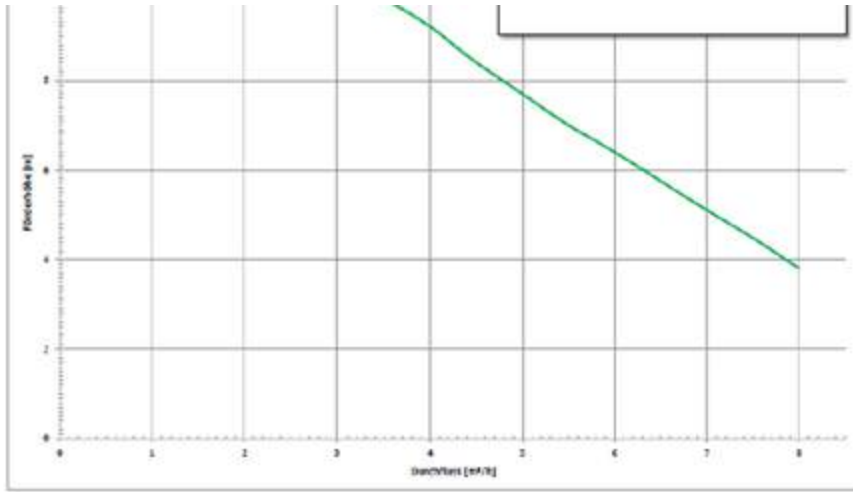


Electrical connection directly in the connection box of the pump head - NO plug, NO cable required !!!

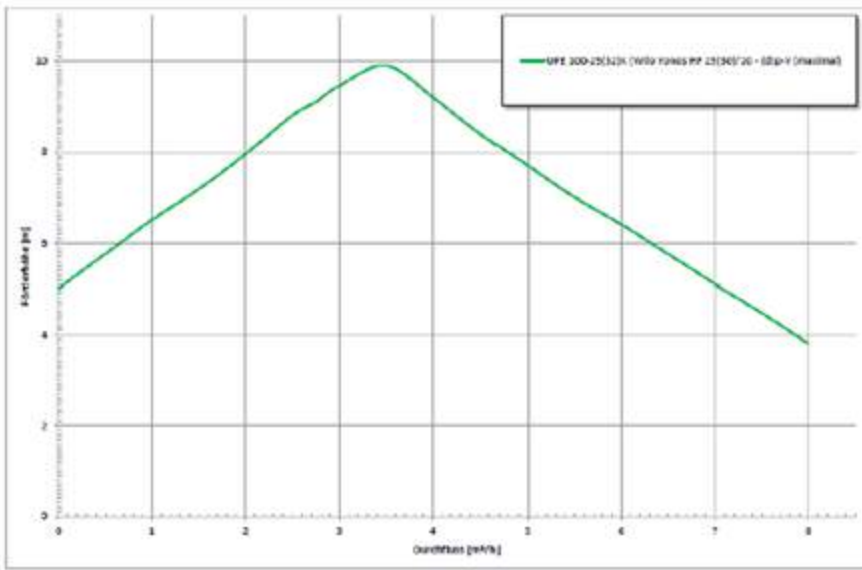
Fig.7.20: Electrical connection UPE 100-25 (32) K and UPE 120-32K

7.5.4.1.5 Characteristic curves UPE 100-25 (32) K





Regelungsart (d)p-v



Regelungsart Konstantdrehzahl

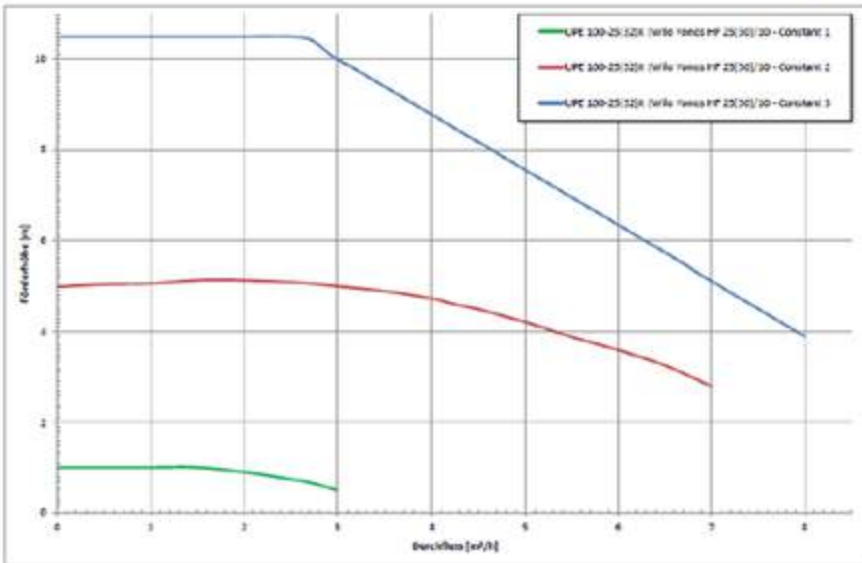
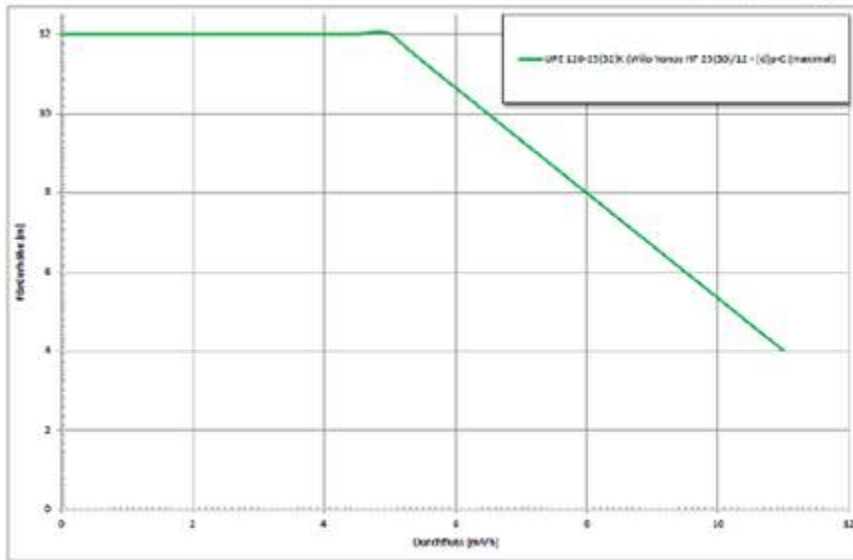


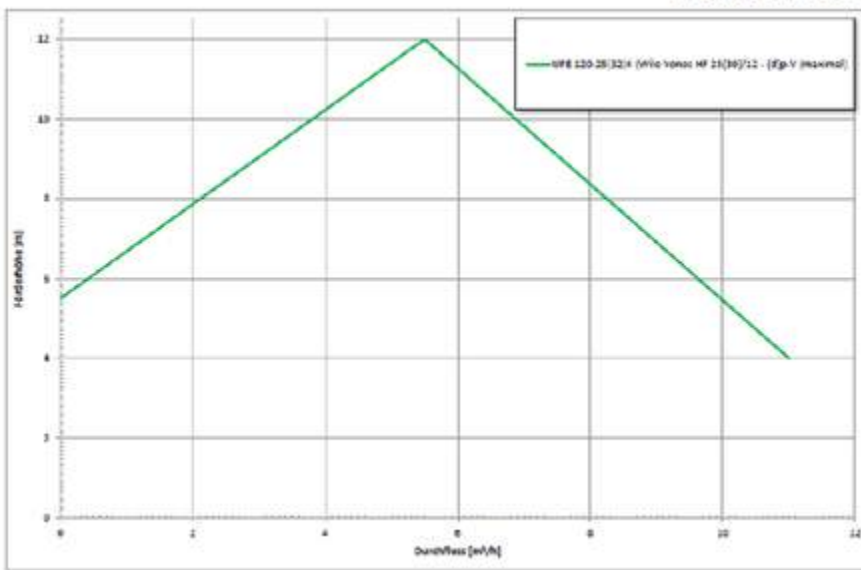
Fig.7.21: Characteristic curves UPE 100-25 (32) K

7.5.4.1.6 Characteristic curves UPE 120-32K

Regelungsart (d)p-c



Regelungsart (d)p-v



Regelungsart Konstantdrehzahl

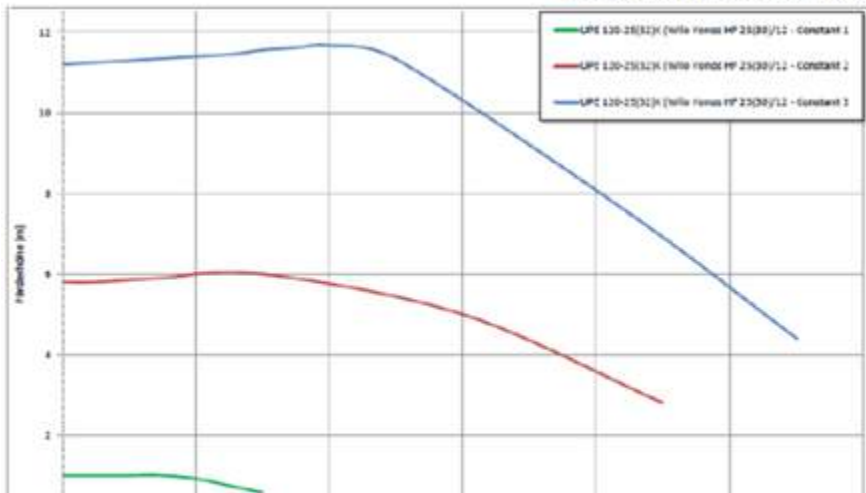




Fig.7.22: Characteristic curves UPE 120-25 (32) K

7.5.4.1.7 UPH 60-25 and UPH 60-32

(corresponds to Grundfos Alpha2L 25 (32) -60)

Circulation pump with permanently stored constant speed levels, the control modes p-c and p-v.
No control via WPM possible!

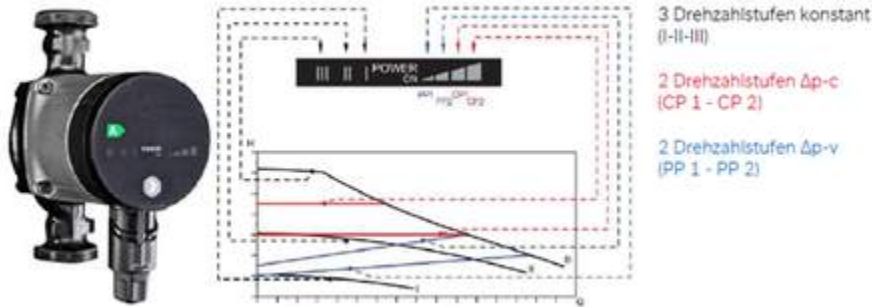


Fig.7.23: UPE 60-25 setting options (32)



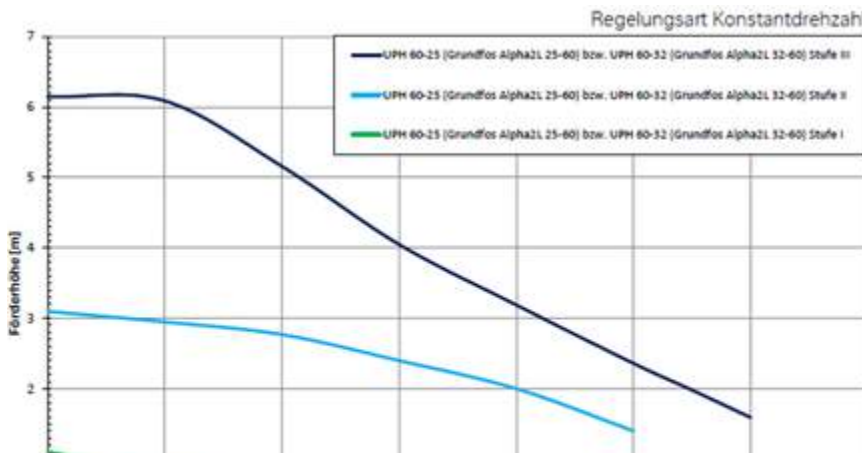
Connection:

Alpha connector (load connector) - included with the pump

No control 0-10V or PWM possible!

Fig.7.24: Electrical connection UPE 60-25 (32)

7.5.4.1.8 Characteristic curves UPH 60-25 (32)



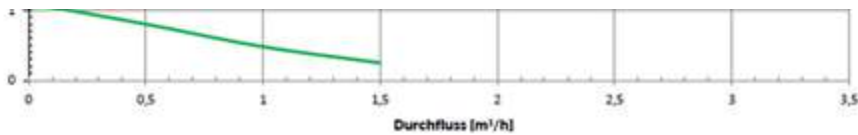
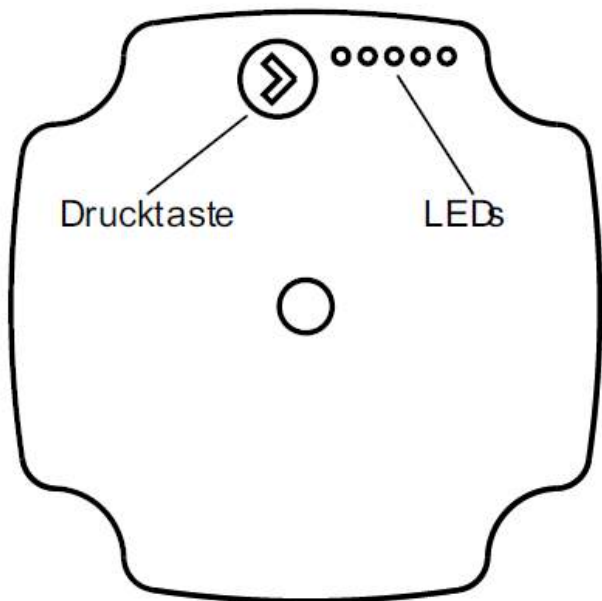


Fig.7.25: Characteristic curves UPE 60-25 (32)

7.5.4.1.9 UP 75-25PK and UP 75-32PK

(corresponds to Grundfos UPM3 Flex AS 25 (32) -75)

Both pumps can be controlled by the heat pump manager or, alternatively, set manually using four standard speed levels



Anzeige	Bedeutung	Leistung in % bezogen auf P1,MAX
Grün LED (blinkt)	Standby (nur extern angesteuert)	0
Grüne LED und 1 gelbe LED	Niedrige Förderleistung	0-25
Grüne LED und 2 gelbe LED's	Niedrige mittlere Förderleistung	25-50
Grüne LED und 3 gelbe LED's	Hohe mittlere Förderleistung	50-75
Grüne LED und 4 gelbe LED's	Hohe Förderleistung	75-100

Control panel with a push button and five LEDs

Fig.7.26: Setting options UP 70-25 (32) PK



Connection load cable:

Connection cable load
(3 x 0.75 mm², 2 m with Superseal connector)

L1 - black / brown wire
N - blue wire
PE - yellow / green stranded wire

PWM signal:

Connection cable PWM signal (PWM - 3 x 0.5 mm², 2 m with FCI plug)

Brown wire - PWM input
Blue wire - PWM GND
Black wire - PWM (output signal)

Both cables and plugs included with the pump.

Fig.7.27: Electrical connection UP 70-25 (32) PK

7.5.4.1.10 Characteristic curves UP 75-25PK and UP 75-32PK



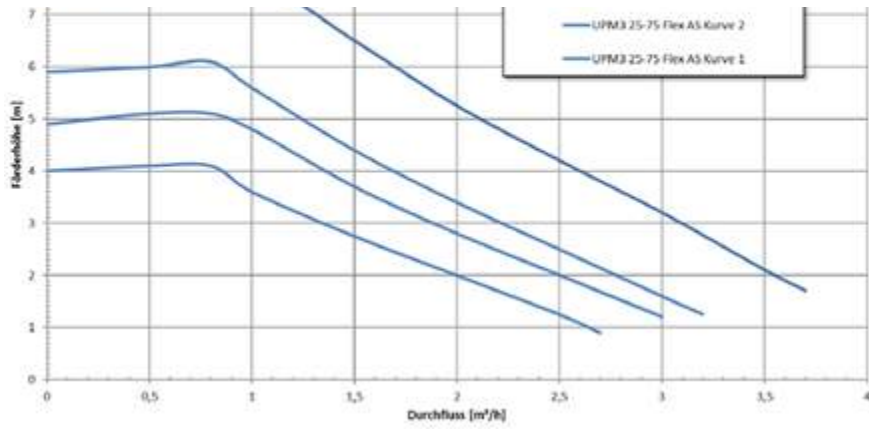


Fig.7.28: Characteristic curves UP 70-25 (32) PK

7.5.4.1.11 UPH 80-25P and UPH70-25P

(corresponds to Grundfos UPMGeo 25-85 and Grundfos UPM2 25-75)

Both pumps should be controlled by the heat pump manager - if the pump is not controlled, it goes to maximum speed.



Connection load:

Connection cable load
(3 x 0.75 mm², 2 m with Molex connector)

L1 - black / brown wire
N - blue wire
PE - yellow / green stranded wire

PWM signal:

Connection cable PWM signal (PWM - 3 x 0.5 mm², 2 m)

Brown wire - PWM input
Blue wire - PWM GND
Black wire - PWM (output)

Both cables with plugs included with the pump

Attention: Control with PWM signal: First remove the UPM plug (bridge). Keep the UPM plug in a safe place!

Fig.7.29: Electrical connection UP 80-25P and UP 70-25P

7.5.4.1.12 Characteristic curves UPH 80-25P and UPH70-25P

Ansteuerung PWM (Maximalkennlinie)

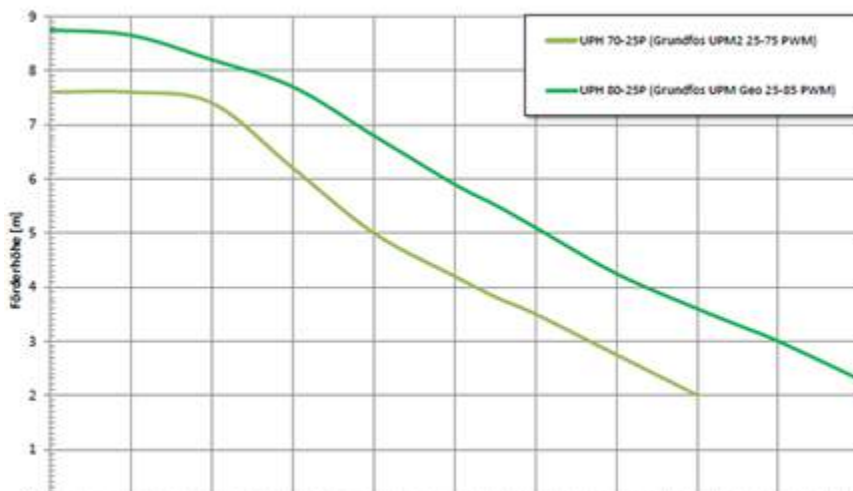




Fig. 7.30: Characteristic curves UP 70-25P and UP 80-25P

7.5.4.1.13 UPH 90-25 and UPH 90-32

(corresponds to Grundfos UPML 25 (32) -95 AUTO)

Circulation pump with fixed control modes p-c and p-v!
No control via WPM possible!

The pump allows the setting of 6 preset speed levels:

- 3 proportional pressure levels p-v (PP)
- 3 constant pressure levels p-c (CP)



Flashing fast III II I	PP1
Flashing fast III II I	PP2
Flashing fast III II I	PP3
Flashing slow III II I	CP1
Flashing slow III II I	CP2
Flashing slow III II I	CP3

Fig.7.31: UPH 90-25 setting options (32)



Connection:

Load cable
(3 x 0.75 mm², 2m Molex connector)

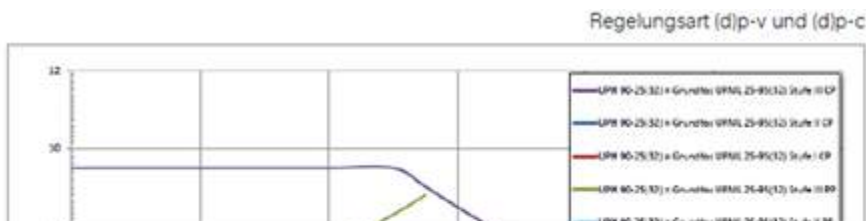
L1 - black / brown wire
N - blue wire
PE - yellow / green wire

No control 0-10V or PWM possible!

Cable with plug included with the pump.

Fig.7.32: Electrical connection UPH 90-25 (32)

7.5.4.1.14 Characteristic curves UPH 90-25 and UPH 90-32



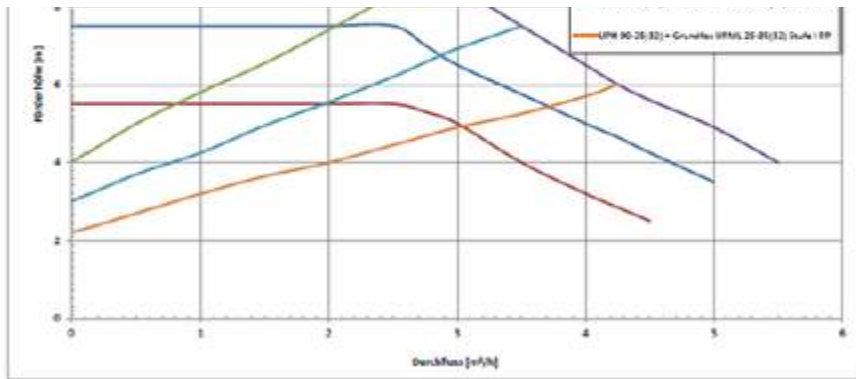


Fig.7.33: Characteristic curves UPH 90-25 (32)

7.5.4.1.15 UPH 100-25 (32) P and UPH 100-25 (32) V

(corresponds to Grundfos MagnaGeo 25 (32) -100 PWM and Grundfos MagnaGeo 25 (32) -100 VDC)



- Pumps with 0-10 V input signal (VDC) **have to** be controlled by the heat pump manager,
- Pumps with a PWM signal run at maximum speed without an input signal

NOTE

UPH 100-32V as pump package PP 32-100G included in the scope of delivery of the heat pumps SI 26TU (M16 and M11), SI 35TU (M16), SI 50TU (M16), SI 35TUR (M16) and WI 45TU (M16) until 09/2018

Fig.7.34: Setting options UPH 100-25 (32) P and UPH 100-25 (32) V



Connection load cable:

- L1 - black / brown wire
- N - blue wire
- PE - yellow / green wire

"Alpha" plug included with the pump

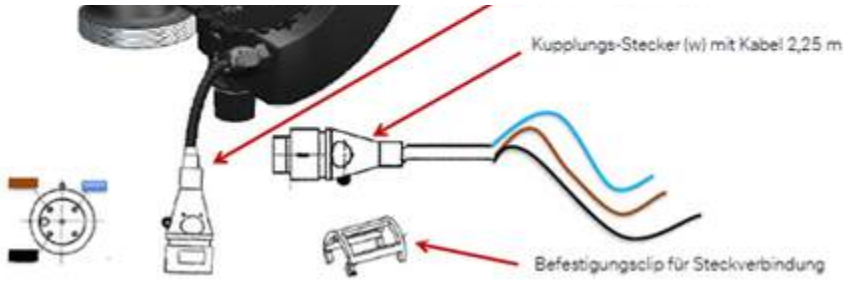
Fig.7.35: Electrical connection of load cables UPH 100-25 (32) P and UPH 100-25 (32) V



Anschluss Steuerleitung (PWM oder 0-10V):

- braune Litze 0-10 V oder PWM Eingangssignal
- blaue Litze 0-10 V oder PWM GND
- schwarze Litze PWM (Ausgangssignal) wird nicht benötigt

Stecker an der Pumpe (m)



Plug (m) and coupling (f) with 2.25 m cable (including plug connector) included with the pump
 Fig.7.36: Electrical connection control cable UPH 100-25 (32) P and UPH 100-25 (32) V

7.5.4.1.16 Characteristic curve UPH 100-25 (32) P and UPH 100-25 (32) V

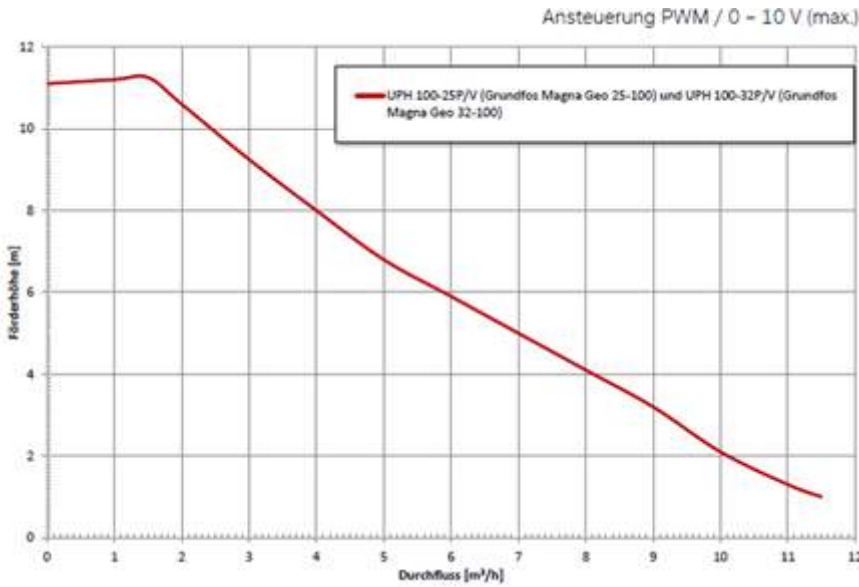
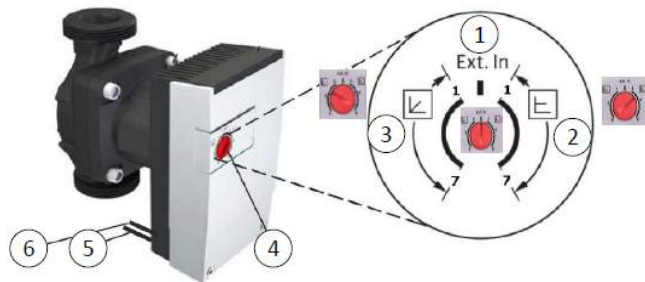


Fig.7.37: Characteristic curves UPH 100-25 (32) P and UPH 100-25 (32) V

7.5.4.1.17 UPH 120-32 PK

(corresponds to WILO Stratos Para 30 / 1-12 PWM)

Circulation pump for the generator, consumer and brine circuit with the control types p-c, p-v and control by means of a PWM input signal



1. Control type: speed adjustment by input signal PWM
2. Control mode p-c
3. Control type p-v
4. Adjustment knob
5. Control line analog signal (PWM) 2-wire
6. Mains connection cable (1 ~ 230V / N / PE) 3-core

Fig.7.38: UPH 120-32 PK setting options



Connection:

Connection cable load
 (3 x 0.75 mm², 1.5 m)

L1 - black / brown wire
 N - blue wire
 PE - yellow / green stranded wire

PWM signal:

Connection cable PWM signal
 (PWM - 2 x 0.5 mm², 2 m)

Brown wire - PWM GND
 Blue wire - PWM input signal



Load and control cable 1.5 m permanently attached to the pump.

Fig.7.39: Electrical connection UPH 120-32 PK

7.5.4.1.18 Characteristic curve UPH 120-32 PK

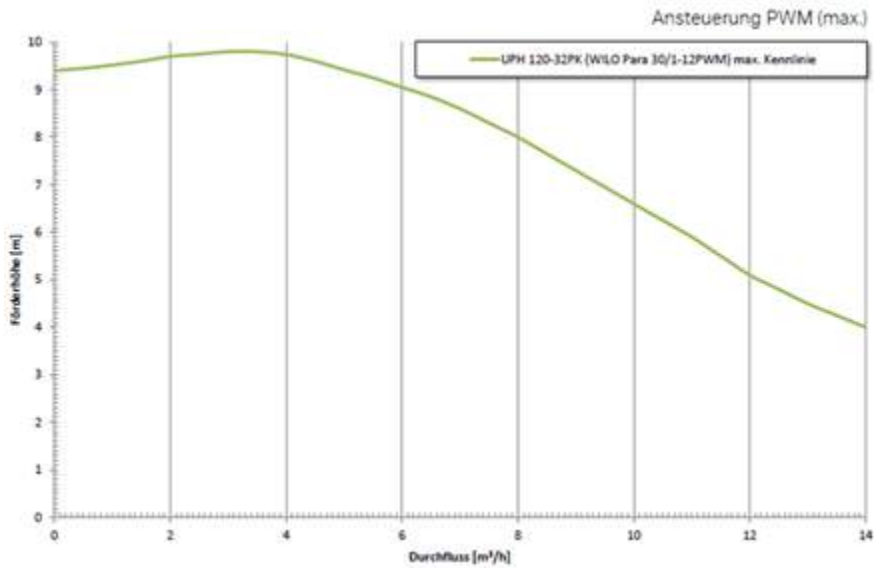


Fig.7.40: Characteristic curve UPH 120-32 PK

7.5.4.1.19 UPH 80-40F

(corresponds to Grundfos Magna3 40-80F)

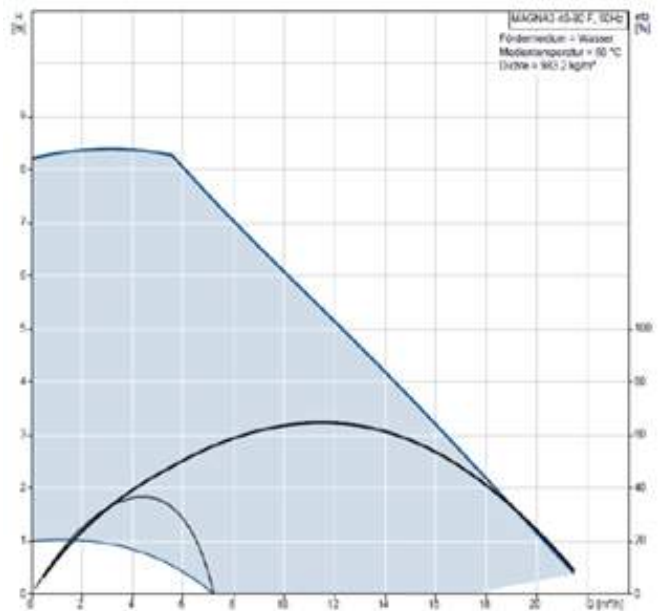
Technical specifications:

Operating temperature range: -10 ° C to 110 ° C

Installation length: 220mm flange DN 40

Power consumption max. (P1): 265W

Current consumption max. (L1): 1.2A



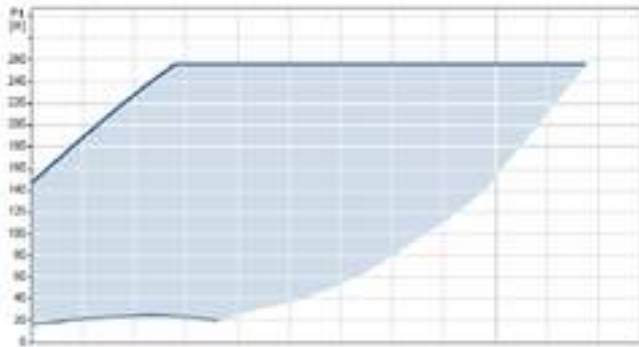


Fig. 7.41: Application limits and characteristics UPH 80-40F

7.5.4.1.20 UPH 120-50F

(Grundfos Magna3 50-120F)
 Technical specifications:

Operating temperature range: -10 ° C to 110 ° C
 Installation length: 220mm flange DN 50
 Power consumption max. (P1): 563W
 Current consumption max. (L1): 12.37A

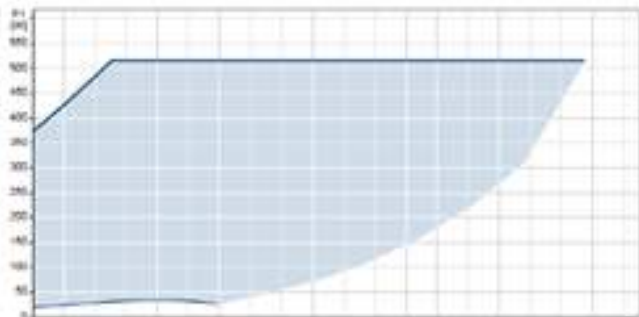
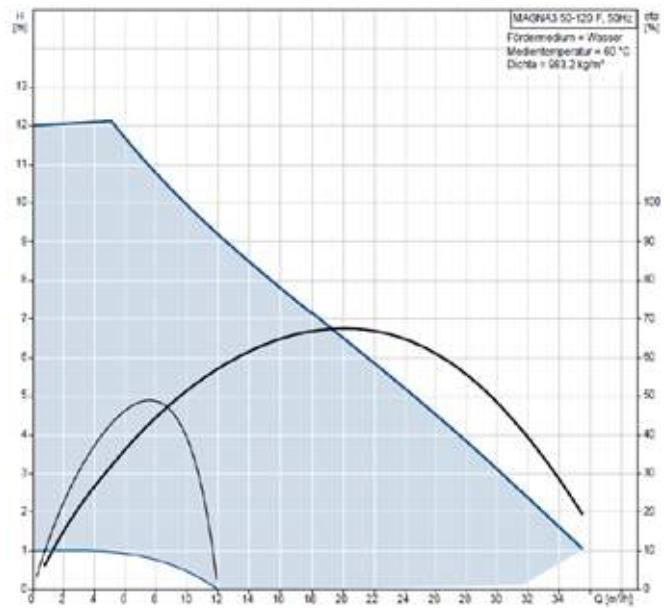
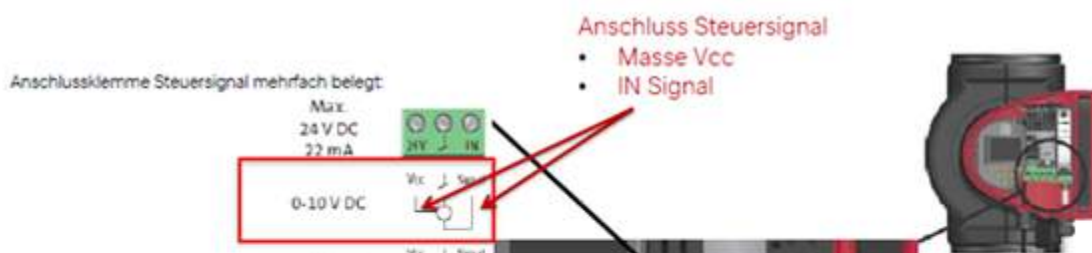


Fig.7.42: Application limits and characteristics UPH 120-50F

7.5.4.2 Electrical connection of load and control circuit UPH 80-40F and UPH 120-50F

Constant speed levels stored, control with 0-10V possible!

(Unscrew the pump cover - wiring diagram in the connection box)



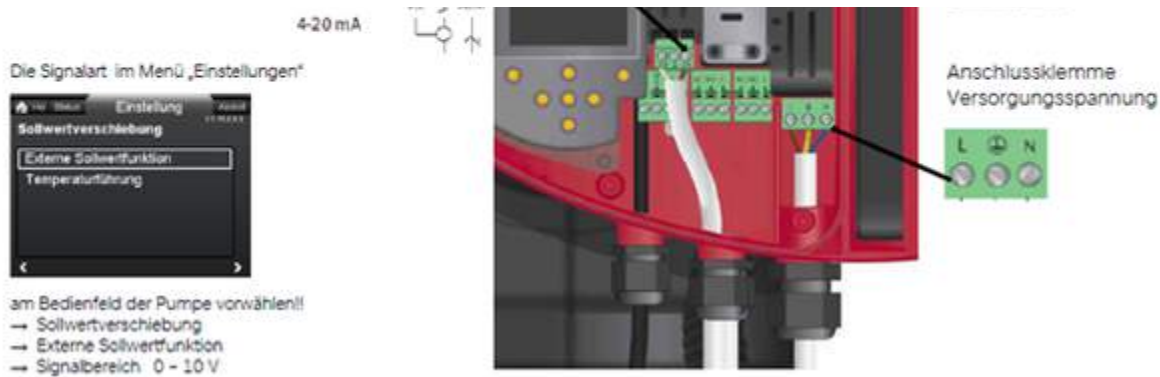


Fig.7.43: Electrical connection UPH 80-40F and UPH 120-50F

7.5.4.3 Heat pump manager and electronic circulation pump

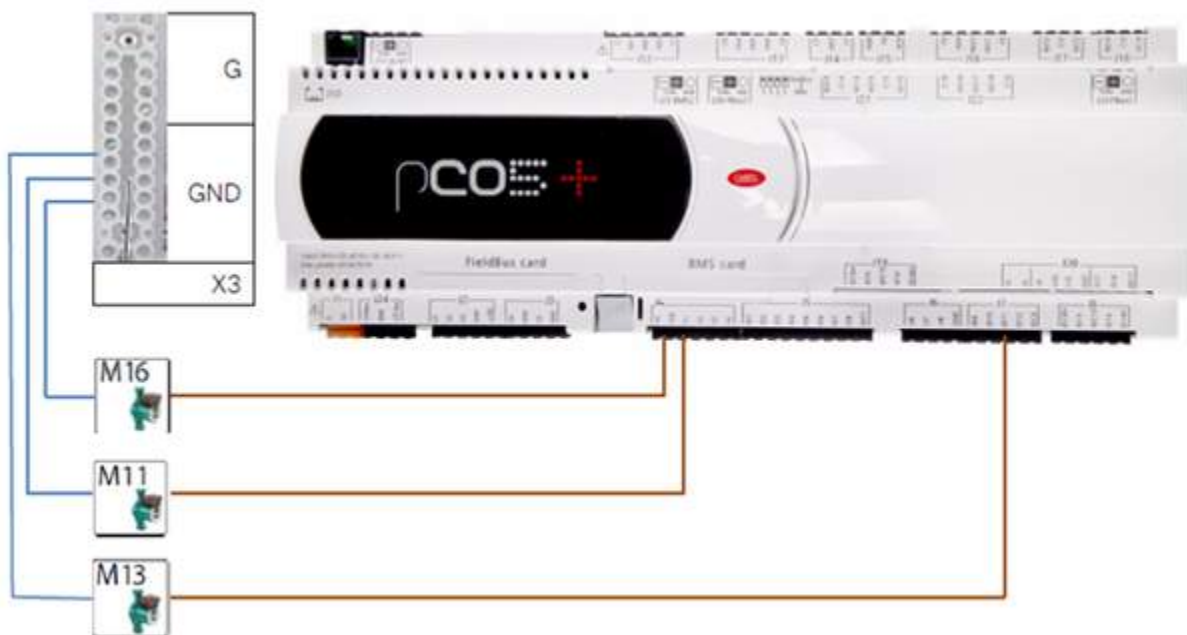


Fig. 7.44: Electrical wiring of the control signal on the WPM Econ5plus heat pump manager

7.5.4.4 Starting currents for circulating pumps

Article no.	Article no. Spare part	Pump type GDD	Pump type manufacturer	Control	Starting current	max.current	Coupling relay
368050	452161.41.38	UPH 100-25V	Magna Geo 25-100 VDC	0-10V	5.64 A	1.25 A.	no
368060 368610	452161.41.39	UPH 100-32V PP 32-100G	Magna Geo 32-100 VDC	0-10V	5.64 A	1.25 A.	no
367850	452161.41.36	UPH 100-25P	Magna Geo 25-100 PWM	PWM	5.64 A	1.25 A.	no
367860	452161.41.37	UPH 100-32P	Magna Geo 32-100 PWM	PWM	5.64 A	1.25 A.	no
368620	452237.41.05	PP 32-120F	Magna3 32-120F	0 - 10 V manually	13 A	1.50 A.	Yes
371800 368630	452237.41.06	UPH 80-40F PP 40-80F	Magna3 40-80F	0 - 10 V manually	13 A	1.20 A.	Yes
368640	452237.41.07	PP 40-120F	Magna3 40-120F	0 - 10 V manually	13 A	1.95 A	Yes
379020 368650	452115.91.27 452237.41.08	UPH 120-50F PP 50-120F	Magna3 50-120F	0 - 10 V manually	13 A	2.37 A	Yes
371280	452237.41.39	PP 65-80F	Magna3 65-80F	0 - 10 V manually	13 A	2.12 A	Yes
371300	452237.41.41	PP 65-100F	Magna3 65-100F	0 - 10 V manually	13 A	2.70 A	Yes

368660	452237.41.09	PP 65-120F	Magna3 65-120F	0 - 10 V manually	26 A	3.38 A	Yes
371290	452237.41.40	PP 65-150F	Magna3 65-150F	0 - 10 V manually	26 A	5.68 A	Yes
367870	452161.41.12	UPH 60-25	Alpha2L 25-60	manually	7.8 A	0.38 A	no
366920	452161.41.35	UPH 60-32	Alpha2L 32-60	manually	7.8 A	0.38 A	no
367830	452162.41.17	UPH 70-25P	UPM2 25-75 GDY	PWM	9.6 A	0.52 A	no
367840	452162.41.23	UPH 80-25P	UPM Geo 25-85 GDY	PWM	9.6 A	0.71 A	no
370410	452115.28.14	UPH 90-25	UPML 25-95 AUTO	manually	10.3 A	1.10 A	no
370420	452115.28.15	UPH 90-32	UPML 32-95 AUTO	manually	10.3 A	1.10 A	no
xxx	452231.41.84		UPMXL GEO 25-125 PWM	PWM	10.3 A	1.40 A	no
375750	452162.41.52	UPH 120-32PK	Stratos Para 30 / 1-12 - T20	PWM manually	15-20 A / 10 ms	1.37 A	Yes
362790	452115.41.86	UPE 70-25	Stratos Para 25 / 1-7	0 - 10 V manually	<20 A / 8 ms	0.69 A	Yes
362800	452115.41.87	UPE 70-32	Stratos Para 30 / 1-7	1 - 10 V manually	<20 A / 8 ms	0.69 A	Yes
362810	452115.41.88	UPE 80-25	Stratos Para 25 / 1-8	2 - 10 V manually	<20 A / 8 ms	1.30 A.	Yes
362820	452115.41.89	UPE 80-32	Stratos Para 30 / 1-8	3 - 10 V manually	<20 A / 8 ms	1.30 A.	Yes
362830	452115.41.90	UPE 120-32	Stratos Para 30 / 1-12	4 - 10 V manually	15-20 A / 10 ms	1.37 A	Yes
374700	452115.42.40	UPE 70-25PK	Yonos Para RSTG 30 / 7.5	PWM manually	<20 A / 8 ms	0.66 A	Yes
374710	452115.42.39	UPE 70-32PK	Yonos Para RSTG 25 / 7.5	PWM manually	<20 A / 8 ms	0.66 A	Yes
380160	452115.42.71	UPE 80-32PK	Para STG 25-180 "8-75" SC "I-12	PWM manually	<20 A / 8 ms	0.66 A	no
380170	452115.42.72	UPE 80-25PK	Para STG 30-180 "8-75" SC "I-12	PWM manually	<20 A / 8 ms	0.66 A	no
374720	452115.42.38	UPE 100-25K	Yonos Para HF 25/10	manually	<20 A / 8 ms	1.30 A.	Yes
374730	452115.42.37	UPE 100-32K	Yonos Para HF 30/10	manually	<20 A / 8 ms	1.30 A.	Yes
374740	452115.42.41	UPE 120-32K	Yonos Para HF 30/12	manually	<20 A / 8 ms	1.33 A	Yes
Maximum permissible data from the WPM heat pump manager					12.0 A	2.0 A.	

Tab .: Overview table of starting currents and coupling relays for circulating pumps

7.5.5 Circulation pumps - settings and connection to the heat pump manager

7.5.5.1 Heat pump manager and electronic circulation pumps

7.5.5.1.1 Overview of pre-assignment of the analog outputs (PWM & 0 - 10V) on the heat pump manager

		Y1	Y2	Y3	Y4	Y5	Y6	
		Analoges Ausgangssignal			0-10V			
Wärmepumpenmanager	WPM 2006/2007	Luft/Wasser		M19		Nicht belegt!		
		Sole- oder Wasser/Wasser	M11	M19				
	WPM EconPlus	Luft/Wasser		M16		M16	M13	
		Sole- oder Wasser/Wasser	M11	M16		M16	M13	
	WPM EconSPiUS	Analoges Ausgangssignal		0-10V	PWM/0-10V		0-10V	
		Luft/Wasser (incl. HWK Econ-E)			M16	M13		M18
	Sole- oder Wasser/Wasser	M11		M16	M11	M13	M18	

Ausgänge vorbelegt, nicht veränderbar
 Ausgänge vorbelegt bzw. in Ebene 3 einstellbar
Bezugspunkt: X3/GND

Fig. 7.45: Pre-assignment of the analog outputs (PWM & 0 - 10V) of the various heat pump managers

7.5.5.1.2 Electrical wiring of control signal 0 - 10 V on WPM 2006/2007 Plus



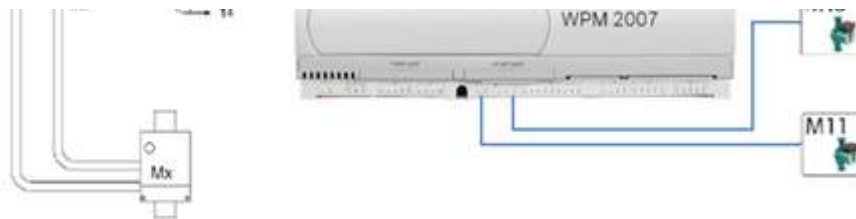


Fig.7.46: Electrical wiring of control signal 0 - 10V on the WPM 2006/2007 Plus

Pump / fan	Clamp	signal
M11 / M2	J4 / Y1 - X3 / GND	0 - 10V
M16 **	J4 / Y4 - X3 / GND	0 - 10V

** Optionally adjustable

Tab.7.11: Pin assignment control signal 0 - 10V on the WPM 2006/2007 Plus

7.5.5.1.3 Electrical wiring WPM EconPlus 0-10V signal

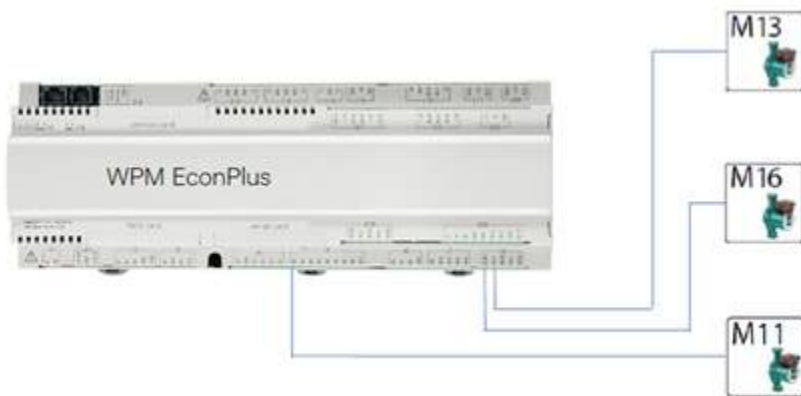


Fig.7.47: Electrical wiring of control signal 0 - 10V on the WPM EconPlus

pump	Clamp	signal
M 11	J4 / Y1 - X3 / GND	0 - 10V
M 13	J20 / Y6 - X3 / GND	0 - 10V
M 16	J20 / Y5 - X3 / GND	0 - 10V

Tab.7.12: Pin assignment control signal 0 - 10V on the WPM EconPlus

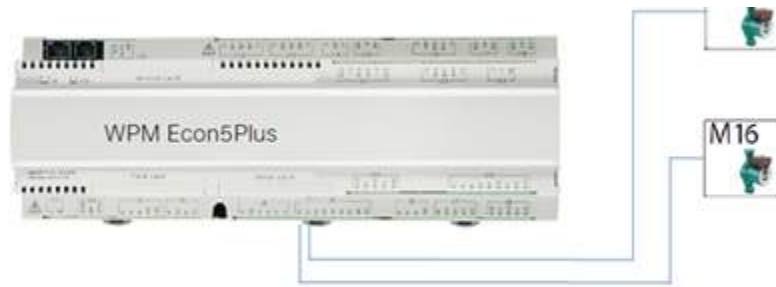
7.5.5.1.4 WPM Econ5Plus electrical wiring with PWM and 0 - 10V signal

- Circulation pumps can be controlled with 0 - 10 V or PWM signal!
- Two outputs are available for pulse width modulation (PWM).
- These can be used as follows:

	Brine / well pump fan	Heating circulation pumps	
	M11	M13	M16
Air / water heat pumps	0-10V	0-10V / PWM	0-10V / PWM
Brine and water / water heat pumps	0-10V / PWM	0-10V	0-10V / PWM

Tab.7.13: Outputs for control signals 0 - 10V and PWM on the WPM Econ5Plus





Luft/Wasser-Wärmepumpen!!

Fig. 7.48: Electrical wiring of control signal 0 - 10V and PWM for air / water heat pumps on the WPM Econ5Plus

pump	Clamp	signal
M13	J4 / Y4 - X3 / GND	0 - 10V / PWM
M16	J4 / Y4 - X3 / GND	0 - 10V / PWM

Tab.7.14: Terminal assignment control signal 0 - 10V and PWM for air / water heat pumps on the WPM Econ5Plus



Sole- und Wasser/Wasser-Wärmepumpen!!

Fig. 7.49: Electrical wiring of control signal 0 - 10V and PWM for brine / water heat pumps on the WPM Econ5Plus

pump	Clamp	signal
M 11	J4 / Y4 - X3 / GND	0 - 10V / PWM
M 13	J20 / Y55 - X3 / GND	0 - 10V
M 16	J4 / Y3 - X3 / GND	0 - 10V / PWM

Tab.7.15: Terminal assignment control signal 0 - 10V and PWM for brine / water heat pumps on the WPM Econ5Plus

7.5.5.1.5 Settings on the heat pump manager

The settings of the electronic circulation pumps are made in the installation menu level 2 under pump control: settings

Pump control
Heating M16

- step 1
- Level 2
- level 3
- automatically
- manual (30 - 100%)



Fig. 7.50 Settings on the heat pump display

Reduce M13 in the settings:

Menu + Enter

Set settings à pump control à heating M13 to manual then a percentage value can be set on the right or adapted to the system accordingly.

7.5.5.1.6 Settings on the heat pump manager - general description of functions

general description

- Level 1 - 3
 - By selecting a level 1 - 3, a fixed speed is specified
 - Level 1 corresponds to the lowest and level 3 to the maximum speed
- Manually
 - If manual is selected, a freely selectable voltage can be set as a fixed value between 30 and 100%

Heating circulation pumps

- Automatically
 - If automatic is selected, the control takes place depending on the return temperature
 - Return temperature <35 ° C = 80% capacity control
 - Return temperature 35 - 45 ° C = 70% capacity control
 - Return temperature > 45 ° C = 60% capacity control
 - When the compressor is at a standstill, the pumps are regulated at 50% output

Brine / well pumps

- Automatically
 - If automatic is selected, the control is based on a fixed, predetermined spread between the heat source inlet and outlet temperature:
 - Heat source inlet < - 5 ° C = 2K spread
 - Heat source inlet -5 - 15 ° C = 3K spread
 - Heat source inlet > 15 ° C = 4K spread
 - When the compressor is at a standstill, the pumps are regulated at 50% output
 - Brine or water / water heat pumps without an electronic expansion valve do not have a heat source inlet sensor; the spread-dependent control function cannot be used with these heat pump types.

7.5.6 Circulation pumps - pumps for 2-compressor brine and water / water heat pumps (TU series)

7.5.6.1 Pumps for brine / water heat pumps SI (H) 26 - 130TU

7.5.6.1.1 Brine (heat source) and heat generator circuit pump (M11 and M16)

M16 (generator circuit pump)

Regulation via flow and return temperature



M11 (heat source pump)

Regulation via brine inlet and outlet temperature



Fig. 7.51: Overview of heat source and generator circuit pumps for 2-compressor brine / water heat pumps

ATTENTION

- The supplied high-efficiency pumps have a major impact on increasing the JAZ
- Due to constructional conditions, all high-efficiency pumps (especially brine circulating pumps) must be installed in a frost-free and weather-protected location!
- The supplied insulation shells may be on the heat source side not be used!!!

Overview table of pump assignments for 2 compressors, brine / water heat pumps up to September 2018

	SI 26TU	SI 35TU	SI 50TU	SI 75TU	SI 90TU	SIH 90TU	SI 130TU
M16 Producer group	UPH 100-32V (Magna Geo 32-100VDC)	UPH 100-32V (Magna Geo 32-100VDC)	UPH 100-32V (Magna Geo 32-100VDC)	Magna3 40-80F	Magna3 65-80F	Magna3 50-120F	Magna3 65-80F
M11 Brine circuit	UPH 100-32V (Magna Geo 32-100VDC)	Magna3 32-120F	Magna3 40-120F	Magna3 65-120F	Magna3 65-120F	Magna3 65-120F	Magna3 65-150F

Tab.7.16: Pump assignments for 2 compressors, brine / water heat pumps up to September 2018

Overview table of pump assignments for 2 compressors Brine / water heat pumps from September 2018

	SI 26TU	SI 35TU	SI 50TU	SI 75TU	SI 90TU	SIH 90TU	SI 130TU
M16 Producer group	Stratos Para 30 / 1-12	Stratos Para 30 / 1-12	Stratos Para 30 / 1-12	Magna3 40-80F	Magna3 65-80F	Magna3 50-120F	Magna3 65-80F
M11 Brine circuit	Stratos 30 / 1-12	Magna3 32-120F	Magna3 40-120F	Magna3 65-120F	Magna3 65-120F	Magna3 65-120F	Magna3 65-150F

Tab.7.17: Pump assignments for 2 compressors, brine / water heat pumps from September 2018

7.5.6.1.2 Heat generator circuit free compression pump M16

Magna3: control with 0 - 10V possible!

MagnaGeo: Control with 0 - 10V necessary!!!



M16: Control via flow and return temperature

Technical data generator circuit pump 2 compressors brine / water heat pumps until September 2018

	SI 26TU	SI 35TU	SI 50TU	SI 75TU	SI 90TU	SIH 90TU	SI 130TU
M 16 Producer group	UPH 100-32V (Magna Geo 32-100VDC)	UPH 100-32V (Magna Geo 32-100VDC)	UPH 100-32V (Magna Geo 32-100VDC)	Magna3 40-80F	Magna3 65-80F	Magna3 50-120F	Magna3 65-80F
Free pressing (Pa) B0 / W35	69000	50000	35000	37000	62000	64800	54000
Residual head (mbar)	690	500	350	370	620	648	540

B0 / W35							
Nominal throughput (m ³ /H)	4.5	6.1	8.8	12.7	14.9	15.4	17.9
B0 / W 35							

Tab.7.18: Technical data for generator circuit pumps, 2 compressors, brine / water heat pumps up to September 2018

Technical data generator circuit pumps 2 compressors brine / water heat pumps from September 2018

	SI 26TU	SI 35TU	SI 50TU	SI 75TU	SI 90TU	SIH 90TU	SI 130TU
M 16	Stratos Para 30/1 - 12	Stratos Para 30 / 1- 12	Stratos Para 30/1 - 12	Magna3 40-80F	Magna3 65-80F	Magna3 50-120F	Magna3 65-80F
Producer group							
Free pressing (Pa) B0 / W35	112000	90000	58000	37000	62000	64800	54000
Residual head (mbar) B0 / W35	1120	900	580	370	620	648	540
Nominal throughput (m ³ /H) B0 / W 35	4.5	6.1	8.8	12.7	14.9	15.4	17.9

Tab.7.19: Technical data generator circuit pumps 2 compressors brine / water heat pumps from September 2018

7.5.6.1.3 Brine circuit free compression pump M11

Magna3: control with 0 - 10V possible!

MagnaGeo: Control with 0 - 10V necessary!!!



M11: Control via brine inlet and outlet temperature

Technical data Brine (heat source) pump 2 compressors Brine / water heat pumps until September 2018

	SI 26TU	SI 35TU	SI 50TU	SI 75TU	SI 90TU	SIH 90TU	SI 130TU
M 11	UPH 100-32V	Magna3 32-120F	Magna3 40-120F	Magna3 65-120F	Magna3 65-120F	Magna3 65-120F	Magna3 65-150F
Producer group	(Magna Geo 32-100VDC)						
Free pressing	31000	64000	37000	64000	85000	70000	95000

(Pa) B0 / W35							
Residual head (mbar)	310	640	370	640	850	700	950
B0 / W35							
Nominal throughput (m ³ /H)	6.4	8.2	13.0	18.4	17.6	20.7	27.1
B0 / W 35							
Cooling capacity (KW)	22nd	28	39	59	70	70	107

Tab.7.20: Technical data, brine (heat source) pump 2 compressors Brine / water heat pumps up to September 2018

Technical data Brine (heat source) pump 2 compressors Brine / water heat pumps from September 2018

	SI 26TU	SI 35TU	SI 50TU	SI 75TU	SI 90TU	SIH 90TU	SI 130TU
M 11	Stratos Para 30 / 1-12	Magna3 32-120F	Magna3 40-120F	Magna3 65-120F	Magna3 65-120F	Magna3 65-120F	Magna3 65-150F
Producer group							
Free pressing	82000	64000	37000	64000	85000	70000	95000
(Pa) B0 / W35							
Residual head (mbar)	820	640	370	640	850	700	950
B0 / W35							
Nominal throughput (m ³ /H)	6.4	8.2	13.0	18.4	17.6	20.7	27.1
B0 / W 35							
Cooling capacity (KW)	22nd	28	39	59	70	70	107

Tab.7.21: Technical data brine (heat source) pump 2 compressors Brine / water heat pumps from September 2018

7.5.6.2 Pumps for reversible brine / water heat pumps SI 35 - 90TUR

7.5.6.2.1 Brine and heat generator circuit pumps (M11 and M16)

Overview table of pump assignments for 2 compressors Brine / water heat pumps reversible until September 2018

	SI 35TUR	SI 50TUR	SI 70TUR	SI 90TUR
M16	UPH 100-32V	Magna3 40-80F	Magna3 40-80F	Magna3 65-80F
Producer group	(Magna Geo 32-100VDC)			
M11	Magna3 32-120F	Magna3 40-120F	Magna3 65-120F	Magna3 65-120F
Brine circuit				

Tab.7.22: Pump assignments for 2 compressors Brine / water heat pumps reversible until September 2018

Overview table of pump assignments for 2 compressors, reversible brine / water heat pumps from September 2018

	SI 35TUR	SI 50TUR	SI 70TUR	SI 90TUR
M16	Stratos Para 30 / 1-12	Magna3 40-80F	Magna3 40-80F	Magna3 65-80F
Producer group				
M11	Magna3 32-120F	Magna3 40-120F	Magna3 65-120F	Magna3 65-120F
Brine circuit				

Tab.7.23: Pump assignments for 2 compressors Brine / water heat pumps reversible from September 2018

7.5.6.2.2 Free pressing heat generator circuit M16

Magna3: control with 0 - 10V possible!

MagnaGeo: Control with 0 - 10V necessary!!!





M16: Control via flow and return temperature

Technical data generator circuit pump 2 compressors brine / water heat pumps reversible until September 2018

	SI 35TUR	SI 50TUR	SI 70TUR	SI 90TUR
M 16 Producer group	UPH 100-32V (Magna Geo 32-100VDC)	Magna3 40-80F	Magna3 40-80F	Magna3 65-80F
Free pressing (Pa) B0 / W35	50000	53000	59000	52000
Residual head (mbar) B0 / W35	500	530	590	520
Nominal throughput (m ³ /H) B0 / W 35	5.7	8.4	12.0	14.8

Tab.7.24: Technical data generator circuit pump 2 compressors Brine / water heat pumps reversible until September 2018

Technical data generator circuit pump 2 compressors brine / water heat pumps reversible from September 2018

	SI 35TUR	SI 50TUR	SI 70TUR	SI 90TUR
M 16 Producer group	Stratos Para 30 / 1-12	Magna3 40-80F	Magna3 40-80F	Magna3 65-80F
Free pressing (Pa) B0 / W35	92000	53000	59000	52000
Residual head (mbar) B0 / W35	920	530	590	520
Nominal throughput (m ³ /H) B0 / W 35	5.7	8.4	12.0	14.8

Tab.7.25: Technical data generator circuit pump 2 compressors Brine / water heat pumps reversible from September 2018

7.5.6.2.3 Brine circuit free compression pump M11

Magna3: control with 0 - 10V possible!

MagnaGeo: Control with



0 - 10V necessary!!!



M11:

Regulation via brine inlet and outlet temperature

Technical data Brine (heat source) pump 2 compressors Brine / water heat pumps reversible

	SI 35TUR	SI 50TUR	SI 70TUR	SI 90TUR
M 11	Magna3 32-120F	Magna3 40-120F	Magna3 65-120F	Magna3 65-120F
Producer group				
Free pressing (Pa) B0 / W35	54400	43000	65000	69000
Residual head (mbar) B0 / W35	544	430	650	690
Nominal throughput (m ³ /H) B0 / W 35	8.2	12.2	1.0	20.5

Tab. 7.26: Technical data Brine (heat source) pump 2 compressors Brine / water heat pumps reversible

7.5.6.3 Pumps for water / water heat pumps WI (H) 35-180TU

7.5.6.3.1 Heat generator circuit pump M16 - water / water heat pump



WI 95TU



WI 35TU auf PSP 300E

Fig. 7.52: Overview of generator circuit pumps for 2-compressor brine / water heat pumps

Overview table of pump assignments for 2 compressors, water / water heat pumps up to September 2018

	WI 35TU	WI 45TU	WI 65TU	WI 95TU	WIH 120TU	WI 120TU	WI 180TU
M16 producer group	UPH 100-32V (Magna Geo 32-100VDC)	UPH 100-32V (Magna Geo 32-100VDC)	Magna3 40-80F	Magna3 40-120F	Magna3 65-80F	Magna3 50-120F	Magna3 65-80F

Tab.7.27: Pump assignments for 2 compressors for water / water heat pumps up to September 2018

Overview table of pump assignments for 2 compressors, water / water heat pumps from September 2018

	WI 35TU	WI 45TU	WI 65TU	WI 95TU	WIH 120TU	WI 120TU	WI 180TU
M16 producer group	Stratos Para 30 / 1-12	Stratos Para 30 / 1-12	Magna3 40-80F	Magna3 40-120F	Magna3 65-80F	Magna3 50-120F	Magna3 65-80F

Tab.7.28: Pump assignments for 2 compressors, water / water heat pumps from September 2018

7.5.6.3.2 Heat generator circuit free compression pump M16

Magna3: control with 0 -10V possible!

MagnaGeo: Control with 0 -10V necessary!!!



M 16: Control via flow and return temperature

Technical data generator circuit pump 2 compressors water / water heat pumps until September 2018

	WI 35TU	WI 45TU	WI 65TU	WI 95TU	WIH 120TU	WI 120TU	WI 180TU
M16 producer group	UPH 100-32V (Magna Geo 32-100VDC)	UPH 100-32V (Magna Geo 32-100VDC)	Magna3 40-80F	Magna3 40-120F	Magna3 50-120F	Magna3 50-120F	Magna3 65-80F
Free pressure (Pa)	47000	28000	48000	34000	36500	36000	40000
W10 / W35							
Residual head (mbar)	470	280	480	340	365	360	400
W10 / W35							
Nominal throughput (m ³ /H)	6.1	7.9	12.1	17.0	21.2	20.6	22.2
W10 / W35							

Tab.7.29: Technical data of the generator circuit pump for 2 compressors for water / water heat pumps up to September 2018

Technical data generator circuit pump 2 compressor water / water heat pumps from September 2018

	WI 35TU	WI 45TU	WI 65TU	WI 95TU	WIH 120TU	WI 120TU	WI 180TU
M16 producer group	Stratos Para 30 / 1-12	Stratos 30 / 1-12	Magna3 40-80F	Magna3 40-120F	Magna3 50-120F	Magna3 50-120F	Magna3 65-80F
Free pressure (Pa)	90000	62000	48000	34000	36500	36000	40000
W10 / W35							
Residual head (mbar)	900	620	480	340	365	360	400
W10 / W35							
	6.1	7.9	12.1	17.0	21.2	20.6	22.2

Nominal throughput (m ³ /H)							
W10 / W35							

Tab.7.30: Technical data generator circuit pump 2 compressor water / water heat pumps from September 2018

7.5.6.4 Characteristic curves and technical data for circulating pumps

7.5.6.4.1 Grundfos MagnaGeo 32-100 VDC

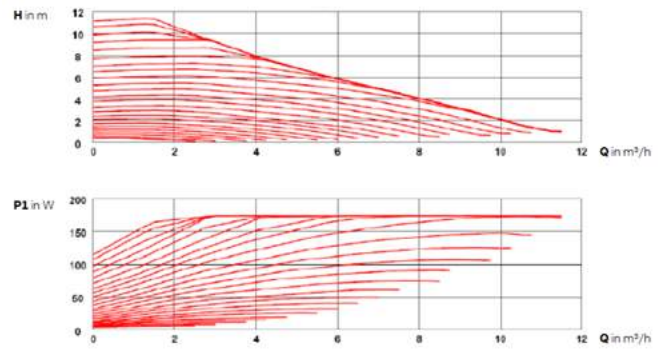


Technical specifications:

Operating temperature range	-10 ° C to 110 ° C
Installation length	180 mm
Power consumption max. (P1)	175 W
Current consumption max. (L1)	1.3 A

Fig.7.53: Delivery head MagnaGeo 32-100VDC

Fig.7.54: Power consumption MagnaGeo 32-100VDC



7.5.6.4.2 WILO Stratos Para 30 / 1-12 0-10V



Technical specifications:

Operating temperature range	-10 ° C to 110 ° C
Installation length	180 mm
Power consumption max. (P1)	310 W
Current consumption max. (L1)	1.37 A



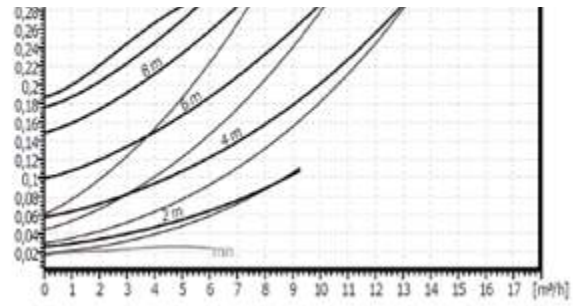
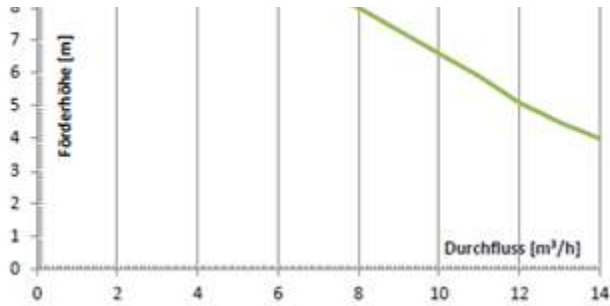


Fig.7.55: Delivery head Stratos Para 30 / 1-12 Fig.7.56: Power consumption Stratos Para 30 / 1-12

7.5.6.4.3 Grundfos Magna3 32-120F

Technical specifications:

Operating temperature range: -10 °C to 110 °C

Installation length: 220 mm flange DN 32

Power consumption max. (P1): 336W

Current consumption max. (L1): 1.5A

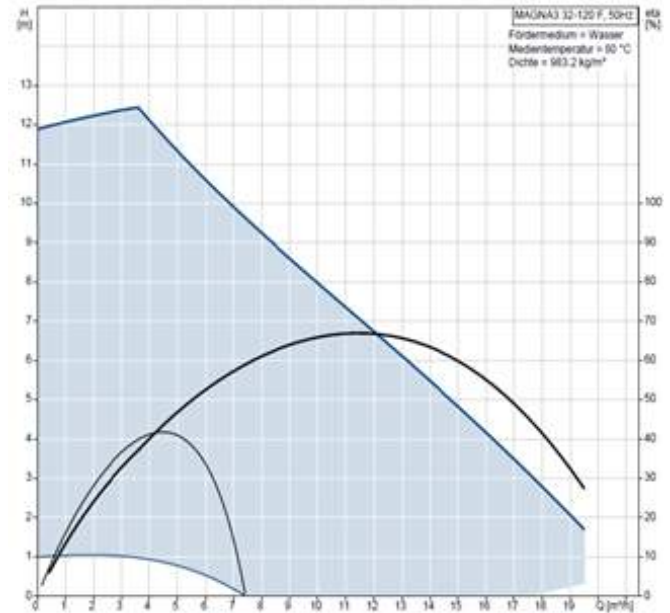


Fig.7.58: Delivery head Magna3 32-120F

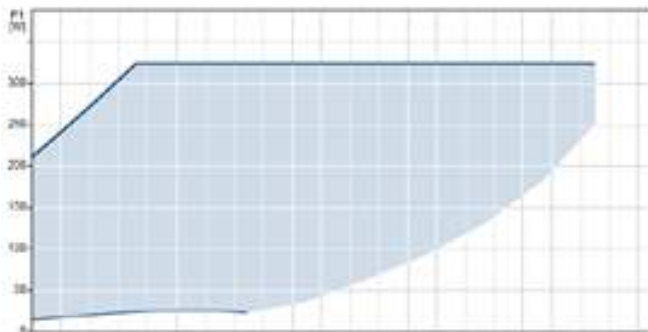


Fig.7.57: Power consumption Magna3 32-120F

7.5.6.4.4 Grundfos Magna3 40-80F

Technical specifications:

Operating temperature range: -10 °C to 110 °C

Installation length: 220 mm flange DN 40

Power consumption max. (P1): 265W

Current consumption max. (L1): 1.2A



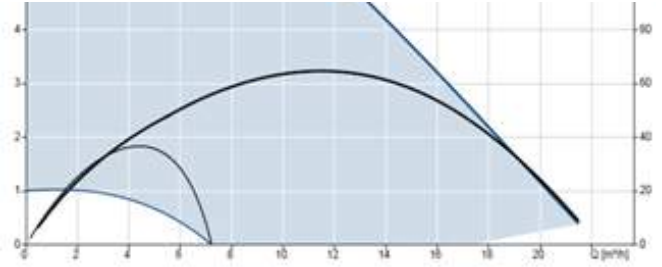


Fig. 7.60: Delivery head Magna3 40-80F

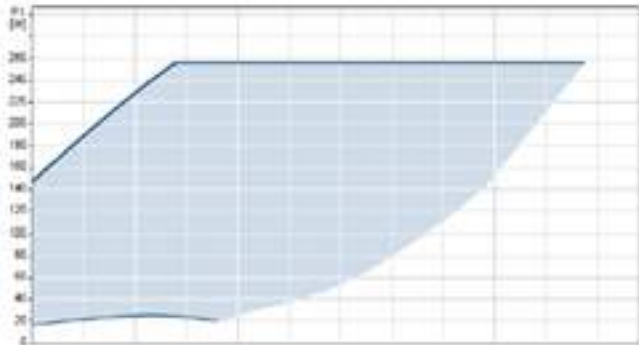


Fig.7.59: Power consumption Magna3 40-80F

7.5.6.4.5 Grundfos Magna3 40-120F

Technical specifications:

- Operating temperature range: -10 ° C to 110 ° C
- Installation length: 250 mm flange DN 40
- Power consumption max. (P1): 440W
- Current consumption max. (L1): 1.95A

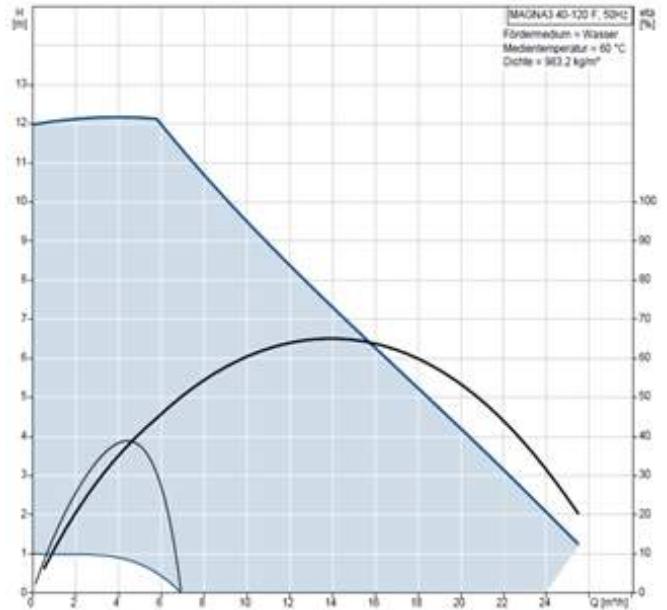


Fig.7.62: Delivery head Magna3 40-120F

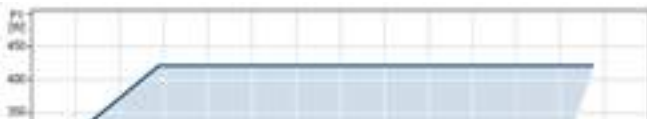




Fig.7.61: Power consumption Magna3 40-120F

7.5.6.4.6 Grundfos Magna3 50-120F

Technical specifications:

Operating temperature range: -10°C to 110°C
 Installation length: 280 mm flange DN 50
 Power consumption max. (P1): 563W
 Current consumption max. (L1): 2.37A

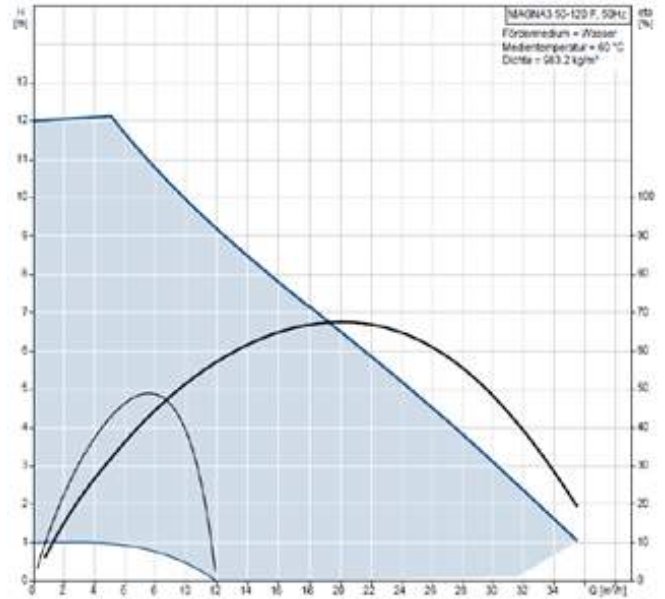


Fig.7.64: Delivery head Magna3 50-120F

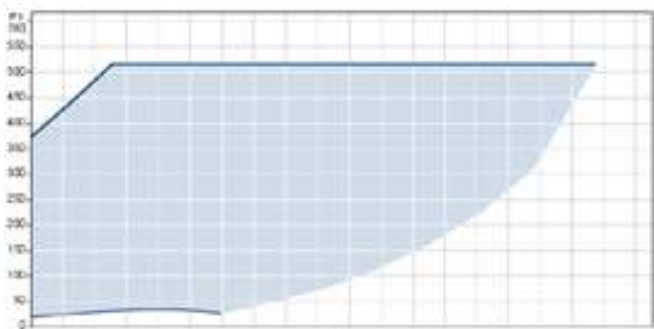
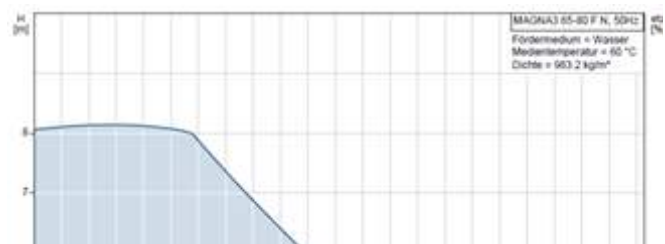


Fig.7.63: Power consumption Magna3 50-120F

7.5.6.4.7 Grundfos Magna3 65-80F

Technical specifications:

Operating temperature range: -10°C to 110°C
 Installation length: 340 mm flange DN 65
 Power consumption max. (P1): 478W
 Current consumption max. (L1): 2.12A



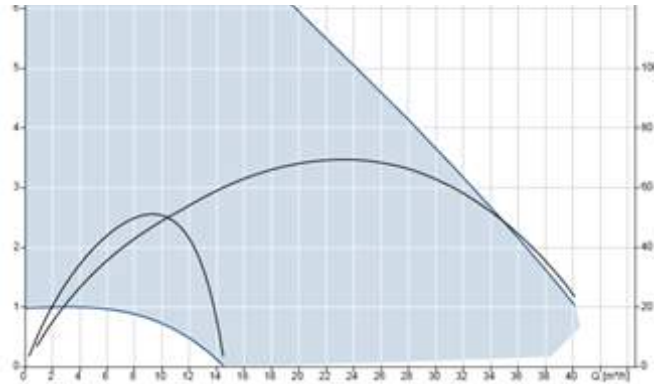


Fig.7.66: Delivery head Magna3 65-80F

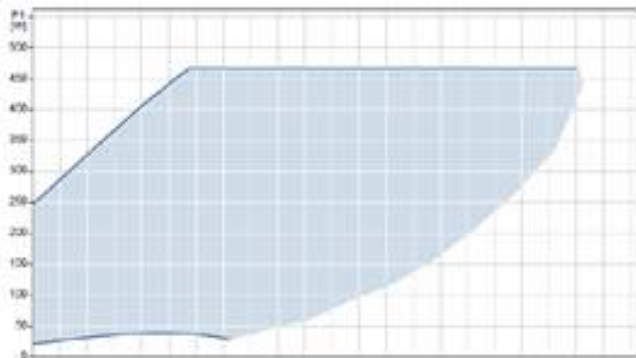


Fig.7.65: Power consumption Magna3 65-80F

7.5.6.4.8 Grundfos Magna3 65-100F

Technical specifications:

Operating temperature range: -10°C to 110°C

Installation length: 340 mm flange DN 65

Power consumption max. (P1): 613W

Current consumption max. (L1): 2.7A

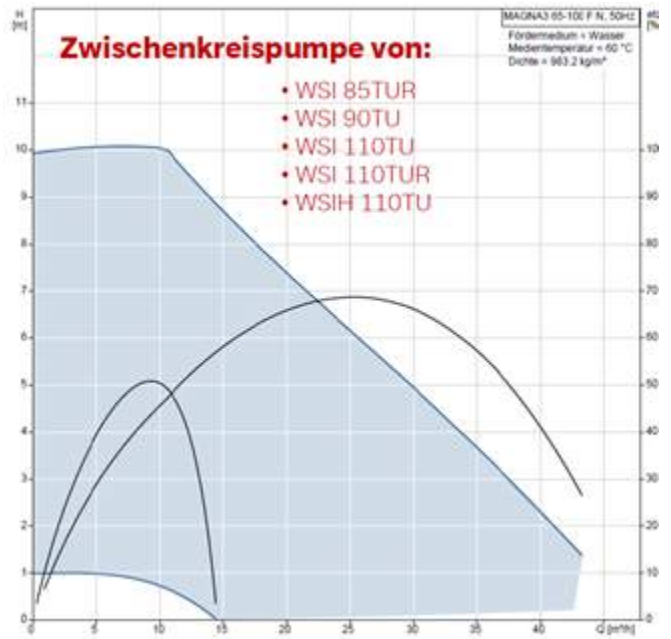


Fig.7.68: Delivery head Magna3 65-100F

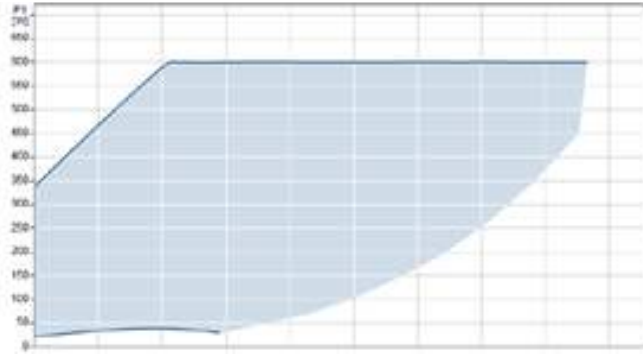


Fig.7.67: Power consumption Magna3 65-100F

7.5.6.4.9 Grundfos Magna3 65-120F

Technical specifications:

- Operating temperature range: -10 ° C to 110 ° C
- Installation length: 340 mm flange DN 65
- Power consumption max. (P1): 769W
- Current consumption max. (L1): 3.38A

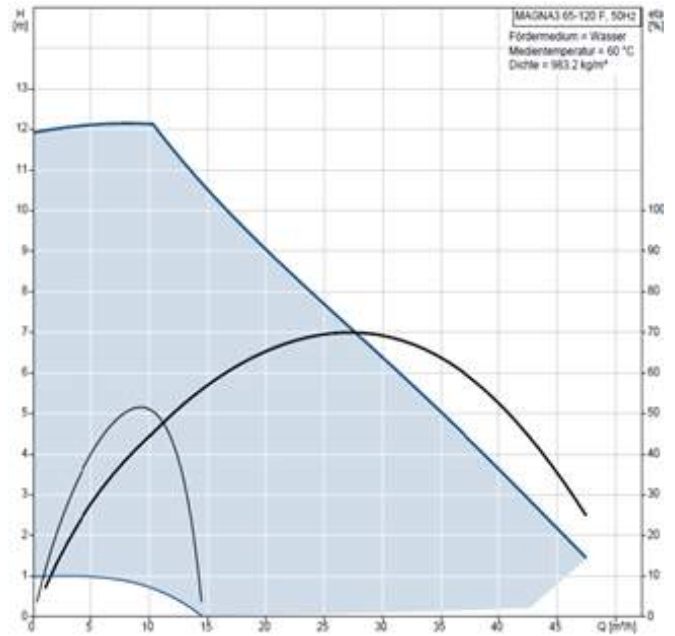


Fig.7.70: Delivery head Magna3 65-120F

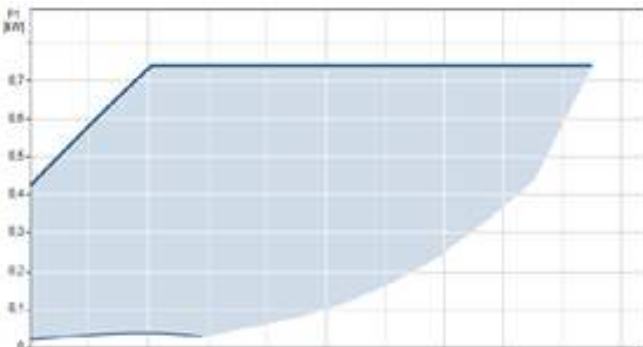


Fig. 7. 69: Power consumption Magna3 65-120F

7.5.6.4.10 Grundfos Magna3 65-150F

Technical specifications:



Operating temperature range: -10 ° C to 110 ° C
 Installation length: 340 mm flange DN 65
 Power consumption max. (P1): 1301W
 Current consumption max. (L1): 5.68A

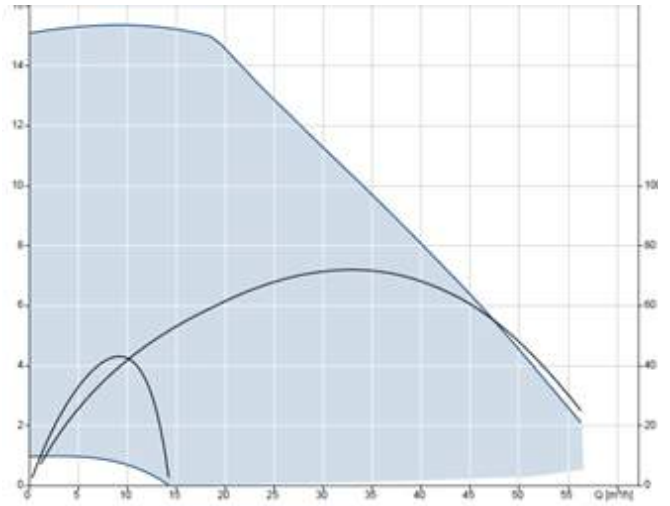


Fig.7.72: Delivery head Magna3 65-150F

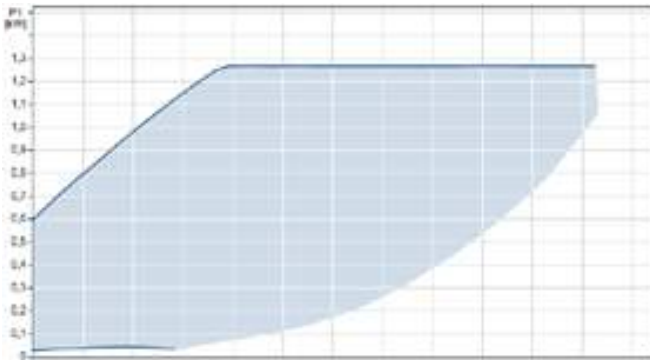
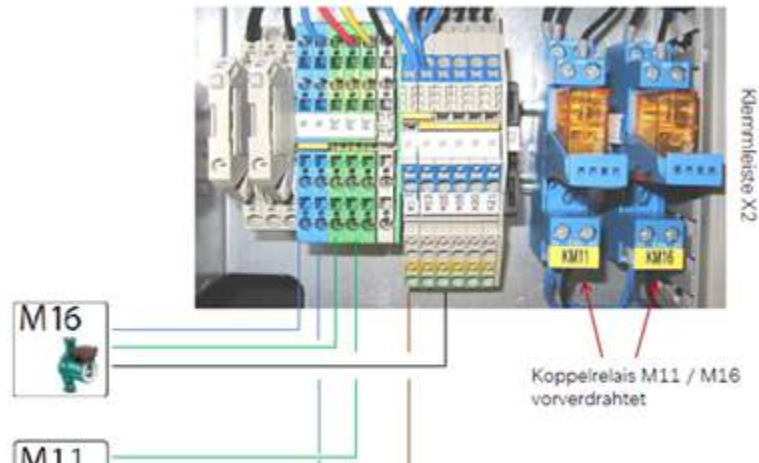


Fig.7.71: Power consumption Magna3 65-150F

7.5.7 Circulation pumps - connection and installation of 2-compressor brine and water / water heat pumps (TU (R) series)

7.5.7.1 Connection and installation of the generator circuit and brine pump

7.5.7.1.1 Electrical wiring (load 230V) pumps M11 / M16 on the WPM Econ5plus **





** For water / water heat pumps WI (H)... TU only M16! Well pump M11 including contactor and motor protection switch on site.

Fig. 7.73: Electrical connection 230V generator and heat source (brine) pump

7.5.7.1.2 Electrical wiring (control signal 0 - 10V) M11 & M16 on the WPM Econ5plus **

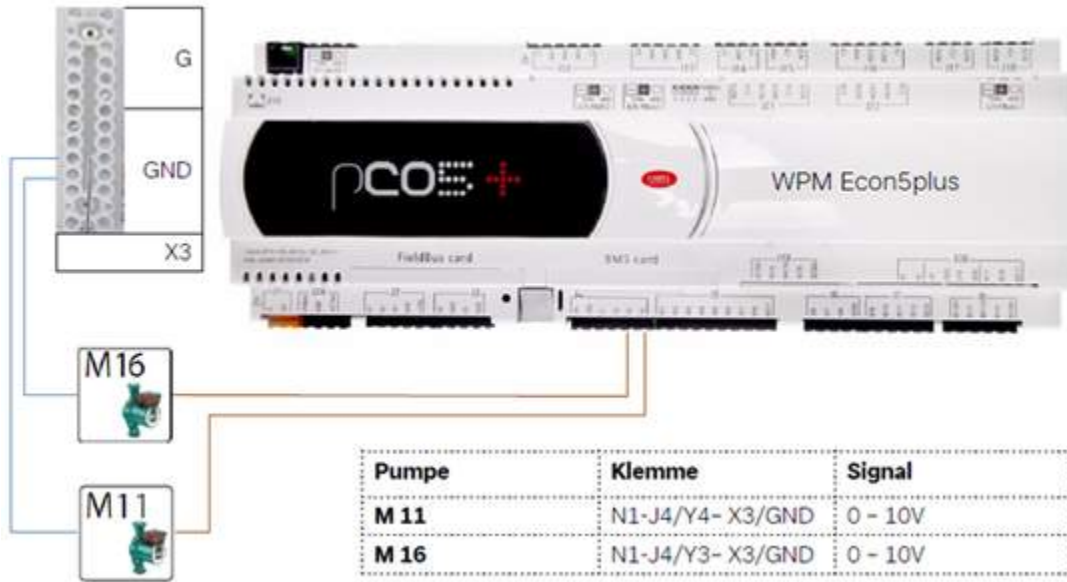


Fig. 7.74: Electrical connection control signal 0 - 10V generator and heat source (brine) pump

7.5.7.1.3 Grundfos Magna3 series - hydraulic connection

Turning the pump head (electronics unit):

Because of the drain hole in the stator housing, the separation point of the tension band must be arranged as shown after turning the pump knob:



Fig.7.75: Turning the pump head in the Magna3 series



Fig.7.76: Insulation on site! Never insulate the electronics unit!

⚠ ATTENTION

The supplied insulation shells may be on the heat source side not be used!

7.5.7.1.4 Grundfos Magna3 series - electrical connection of load and control circuit

Load and control signal connection

(Unscrew the pump cover - wiring diagram in the connection box)

Constant speed levels stored, control with 0-10V possible!

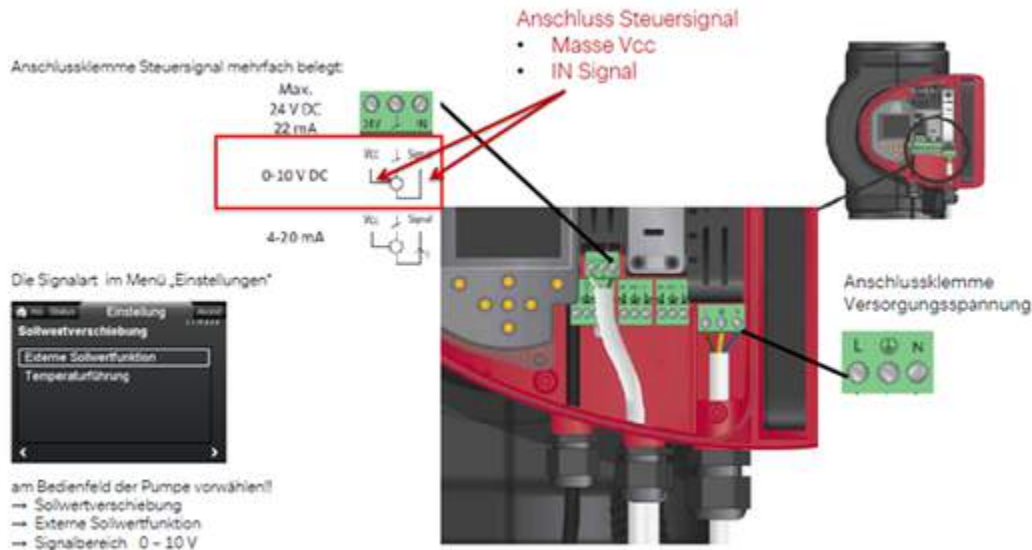


Fig.7.77: Electrical connection load (230 V) and control signal Magna3 series

7.5.7.1.5 Grundfos Magna3 series - electrical connection - digital input

Digital input

(Unscrew the pump cover - wiring diagram in the connection box)

The digital input can be used for external

Connection terminal
Supply voltage

- ON / OFF control or for that
- Switching to max or min characteristic be used.

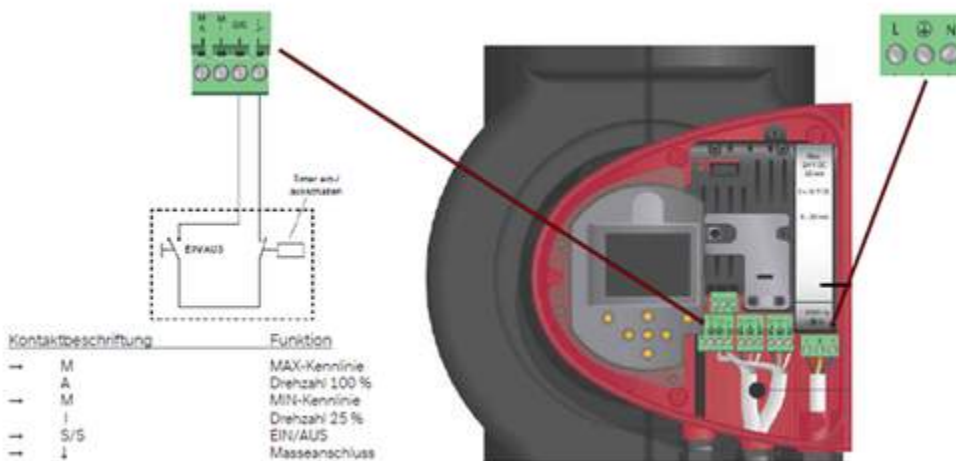


Fig. 7.78: Electrical connection of digital input Magna3 series

7.5.7.1.6 Grundfos MagnaGeo 32-100 VDC connection load cable (~ 230V)



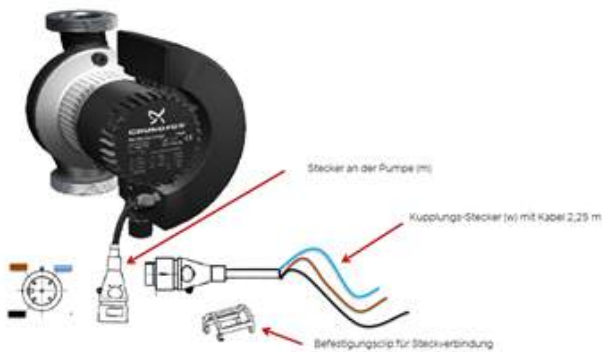


L1 - black / brown wire
 N - blue wire
 PE - yellow / green stranded wire

"Alpha" plug included with the pump.

Fig.7.79: Electrical connection load (230V) MagnaGeo pump

7.5.7.1.7 Grundfos MagnaGeo 32-100 VDC control line connection (0-10V)



Signal input control with 0 - 10V necessary!!!

Brown wire - input signal
 Blue wire - X3-GND
 Black wire PWM (output signal) is not needed!!

Plug (m) and coupling (f) with 2.25 m cable (including plug connector) included with the pump

Fig. 7.80: Electrical connection input signal 0 - 10V MagnaGeo pump

7.5.7.1.8 WILO Stratos Para 30 / 1-12 0-10V: Connection of control and load line (0-10V)



Connection load
 (3 x 0.75 mm²; 1.5 m)

L1 - black / brown wire
 N - blue wire
 PE - yellow / green wire

Connection 0-10V signal
 (2 x 0.5mm²; 1.5 m)

Brown wire 0 - 10V GND
 White / blue wire 0 - 10V input signal

Load and control cable 1.5 m permanently attached to the pump.

Fig.7.81: Electrical connection load (230V) and control signal 0 - 10V Wilo Stratos Para pump series

7.5.8 Circulation pumps - exchange level for uncontrolled circulation pumps

Unregulated Circulation pump	Manufacturer type	Article no.:	Circulation pump regulated	Manufacturer Type	Article no.:
UP 60	WILO Star RS 25/6 Grundfos UPS 32-60	340300	UP 75-25PK	Grundfos UPM3 Flex AS 25-75	376740
UP 60-32	WILO Star RS 30/6 Grundfos UPS 32-60	355970	UP 75-32PK	Grundfos UPM3 Flex AS 32-75	376750
UP 80	Grundfos UPS 25-80	340310	UPH 90-25	Grundfos UPML 25-95	370410

UP 70-32	WILO Top S 30/7	354020	UPH 90-32	Grundfos UPML 32-95	370420
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Table 7.31: Exchange level for uncontrolled pumps - electronically controlled circulation pumps

When replacing, the following points must generally be observed:

- Purpose of the pump (note the temperature range)
- Alternating or three-phase current (electronically controlled wet-running pumps can only be connected via alternating current)
- Coupling relay due to high starting currents have to between the pump and the heat pump manager

Pumps with threaded pipe connection

- Installation length (without screw connection and seals).
- Thread on the pump housing.

Flanged pumps

- Pay attention to the nominal pressure for pumps of the same nominal size.
- Installation length (always without counter flanges and seals).

7.5.9 WPM EconPlus connection diagram

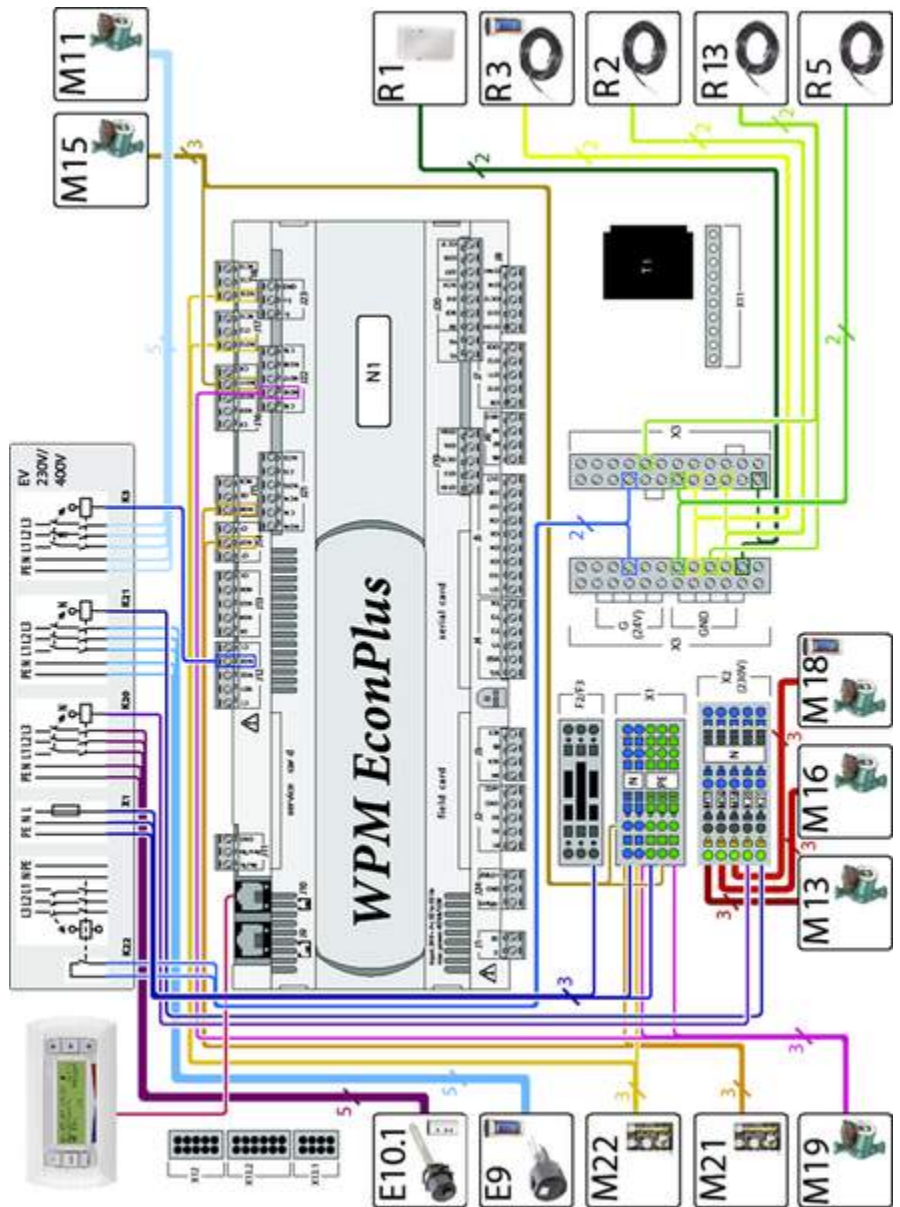


Fig.7.82: Connection diagram of the wall-mounted WPM EconPlus heat pump manager

7.5.10 WPM Econ5Plus connection diagram

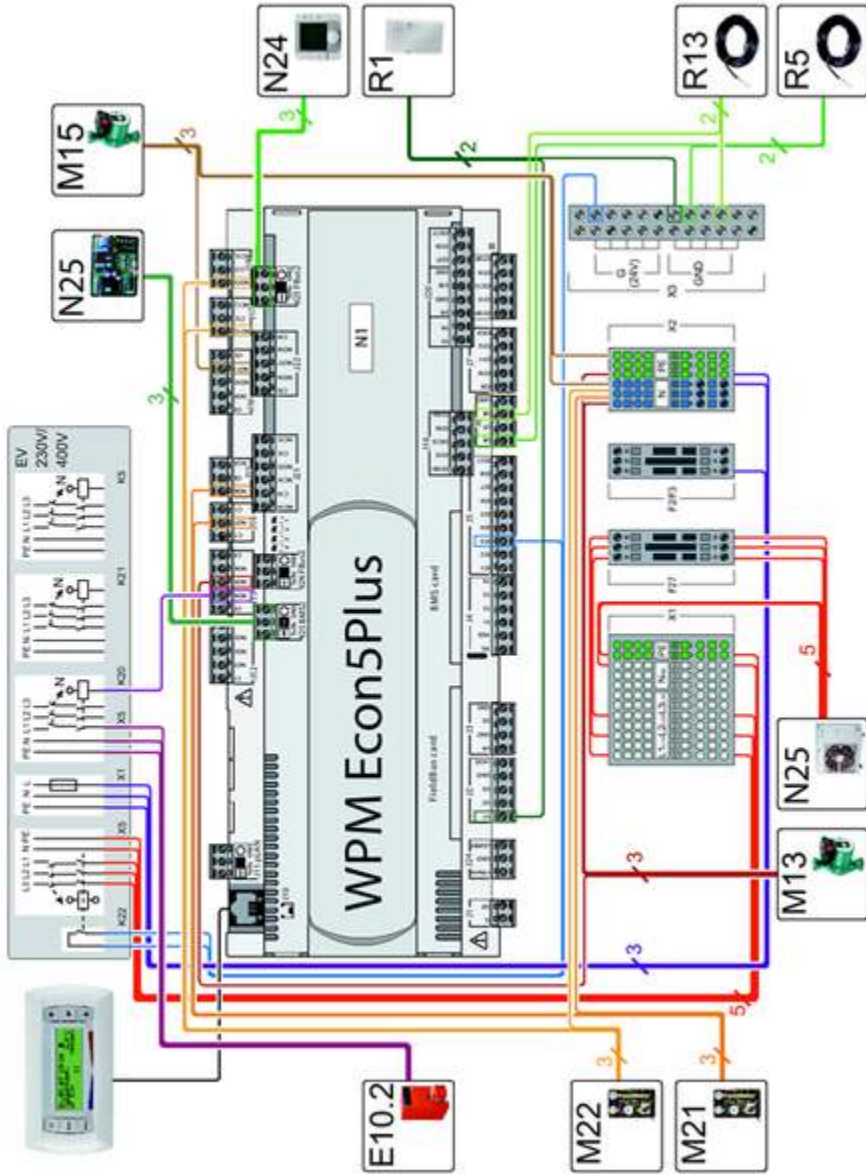
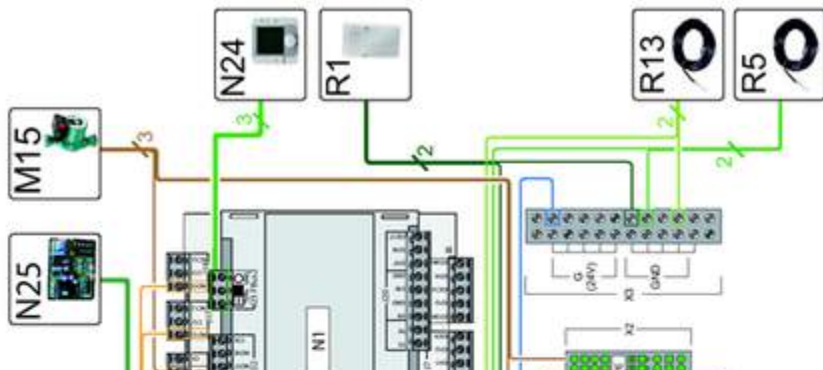


Fig. 7.83: Connection diagram of the WPM Econ5Plus heat pump manager for the LAW 9IMR and LAW 14ITR heat pumps

7.5.11 Connection diagram WPM EconSol



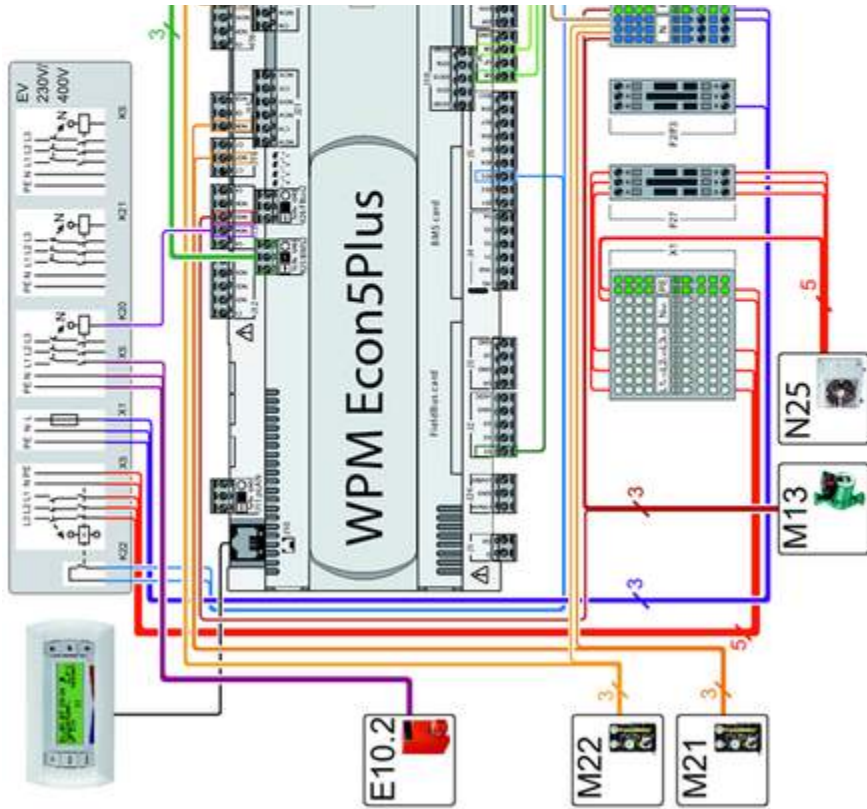


Fig.7.84: WPM EconSol connection plan

7.5.12 Legend for connection diagrams

A.	bridges
A1	Bridge: EnergieVersorgerSperr - must be engaged if the load voltage is not through the Energy supplier is interrupted
A2	Bridge: block heat pump - frost protection guaranteed
A3	Bridge for heat pumps without motor protection contact of the primary circulation pump or the fan
A4	Bridge for heat pumps without a motor protection contact of the compressor
A5	Additional heating bridge
B.	Auxiliary switch
B2 *	Pressostat low pressure brine
B3 *	Hot water thermostat
B4 *	Swimming pool water thermostat
E.	Heating, cooling and auxiliary organs
E3	End of defrosting - pressostat
E5	Condensation pressure - pressostat
E9	Flange heating hot water

E10 *	1. Heat generator (function can be selected via controller)
E13 *	1. Chiller
F.	Security organs
F1	Tax protection of N2 / N6
F2	Load fuse for plug-in terminals J12 and J13 5x20 / 4.0Ar
F3	Load fuse for plug-in terminals J15 to J18 5x20 / 4.0Ar
F4	Pressostat - high pressure
F5	Pressostat - low pressure
F6	Freeze protection thermostat
F7	Safety temperature monitor
F10	Flow switch (cooling mode)
F21.3	Fuse 5x20 / 4.0 AT
F23	Motor protection M1 / M11
H	to shine
H5 *	Remote fault indicator light
K	Contactors, relays, contacts
K1	Contactor compressor 1
K1.1	Start-up contactor compressor 1
K1.2	Compressor 1 timing relay
K2	Contactor (relay) fan 1
K3	Contactor compressor 2
K3.1	Start-up contactor compressor 2
K3.2	Time relay compressor 2
K4	Contactor fan 2
K5	Primary circulation pump contactor - M11
K6	Primary circulation pump contactor 2 - M20
K7	Solid State Relay - Defrost
K8	Contactor / relay auxiliary heating
K9	Coupling relay 230V / 24V for end of defrosting or freezing protection
K11 *	Electronic relay for remote fault indication
K12 *	Electronic relay for swimming pool water circulation pump
K20 *	Contactor 2nd heat generator
K21 *	Contactor flange heating hot water
K22 *	EVU blocking contactor (EVS)
K23 *	Auxiliary relay for lock

M.	Engines
M1	Compressor 1
M2	fan
M3	Compressor 2
M11 *	Primary circulation pump heat source
M13 *	Heating circulation pump main 1st heating circuit
M15 *	Heating circulation pump 2nd heating circuit
M16 *	Additional circulation pump
M18 *	DHW charging pump (storage tank charging pump)
M19 *	Swimming pool water circulation pump
M20 *	Heating circulation pump 3rd heating circuit
M21 *	Mixer bivalent or 3rd heating circuit
M22 *	Mixer 2nd heating circuit
M23 *	Solar pump
N	Control elements
N1	Heating controller
N10 *	remote control
N11 *	Relay assembly
N14	Control unit for WPM 2007
N17.4	"Solar" module (WPM EconSol)
Q1	Circuit breaker M11
R.	Feelers, resistors
R1	Outside temperature sensor
R2	Return temperature sensor
R3 *	Hot water temperature sensor
R4	Cooling water return temperature
R5 *	Temperature sensor 2nd heating circuit
R6	Freeze protection temperature sensor
R7	Coding resistor
R9	Flow temperature sensor (frost protection sensor)
R12	Defrost end temperature sensor
R13	Temperature 3rd heating circuit / temperature regenerative
R17 *	Room temperature sensor
R18	Hot gas temperature sensor
R20	Swimming pool temperature sensor

R22 *	Solar storage
R23 *	Collector sensor
T	T transformer
T1	Safety transformer 230 / 24V AC
W.	cables
W1	15-pin control line
W1 - #	Wire number of line W1 W1- # 8 must always be connected!
X	Terminals, distributors, connectors
X1	Terminal strip mains connection 230V (L / N / PE)
X2	Low voltage
X3	Low voltage
X4	Terminal connector
X5	Distribution terminal 0V AC
X8	Control line connector (low voltage)
X11	Plug module connection
Y	Valves
Y1	4-way switch valve
Y5 *	Three-way diverting valve
Y6 *	Two-way shut-off valve
*	optionally to be provided externally

Tab.7.32: List of abbreviations for the heat pump connection diagram

7.5.13 Terminal assignment heat pump manager

N1	Heating controller
N1-J1	Power supply (24V AC / 50Hz)
N1-J2-B1	Outside temperature sensor - R1
N1-J2-B2	Return temperature sensor - R2
N1-J2-B3	Hot water temperature sensor - R3
N1-J3-B4	Coding - R7
N1-J3-B5	Heating flow or frost protection temperature sensor - R9
N1-J4-Y1	Defrost
N1-J4-Y2	Luminaire remote fault indication - H5 via K11

N1-J4-Y3	Swimming pool water circulation pump - M19 via K12
N1-J5-ID1	Hot water thermostat - B3
N1-J5-ID2	Swimming pool water thermostat - B4
N1-J5-ID3	Energy supplier lock
N1-J5-ID4	Lock
N1-J5-ID5	Fault fan / primary pump - M2 / M11
N1-J5-ID6	Compressor fault - M1 / M3
N1-J5-ID8	Flow switch (cooling mode)
N1-J5-ID7	End of defrosting - pressostat - E3; Freeze protection - Pressostat - F6
N1-J6-B6	Temperature sensor 2nd heating circuit / defrosting end temperature sensor - R5
N1-J6-B7	Freeze protection sensor - R6; Defrost end probe - R12
N1-J6-B8	Frost protection sensor cooling - R8; Sensor 3rd heating circuit / sensor regenerative - R13
N1-J7-ID9	Pressostat low pressure brine - B2
N1-J7-ID10	Hot gas thermostat - F7
N1-J7-ID11	Changeover protocol TAE
N1-J8-ID13H	Pressostat high pressure - 230V AC - F4
N1-J8-ID13	Pressostat high pressure - 24V AC - F4
N1-J8-ID14	Pressostat low pressure - 24V AC - F5
N1-J8-ID14H	Pressostat low pressure - 230V AC - F5
N1-J10	Remote control - N10 / control unit - N14
N1-J11	pLAN connection
N1-J12-NO1	Compressor 1 - M1
N1-J12-NO2	Compressor 2 - M3
N1-J12-NO3	Primary circulation pump - M11 / fan - M2
N1-J13-NO4	1. Heat generator (E10)
N1-J13-NO5	Heating circulation pump - M13
N1-J13-NO6	DHW charging pump - M18
N1-J14 / J15-NO7 / NO8	Mixer 3rd heating circuit open / close - M21
N1-J16-NO9	Auxiliary circulation pump - M16
N1-J16-NO10	Flange heating hot water - E9
N1-J16-NO11	Heating circulation pump 2nd heating circuit - M15
N1-J17 / J18-NO12 / NO13	Mixer 2nd heating circuit open / close - M22
N1-J20-B9	
N17.4	"Solar" module (WPM EconSol)
N17.1-J5-NO1	Solar circulation pump - M23
N17.1-J9-B1	Solar storage tank sensor - R22

N17.1-J10-B4	Collector sensor - R23
*	optionally to be provided externally

Tab.7.33: Overview table of the heat pump manager terminal plan

- Recognition of the optimal operating mode in each case, with the greatest possible proportion of heat pumps
- Frost protection function
- Low pressure pressostat brine for installation in the brine circuit (special accessory)

7.6 Master for parallel connection of several heat pumps Chapter also under Heat pump manager?

The use of a higher-level master control is recommended when 2 heat pumps are connected in parallel. This means that even compressor runtimes are achieved, even when different heat pumps are combined in one system.

7.6.1 Description of the WPM Touch Master

The wall-mounted WPM Master is available for the parallel control of up to 14 heat pumps. With this controller, up to 30 power levels of a monovalent, monoenergetic or bivalent system with outside temperature-dependent operating mode switching can be controlled.

Function description

- Parallel connection of max. 14 heat pumps
- Maximum 30 power levels (1 x passive cooling, 28 x compressor, 1 x 2nd heat generator)
- Control of a maximum of 3 heating circuits (1 x unmixed, 2 x mixed)
- Combination of active and passive cooling
- Central switching of the operating mode (cooling, summer, winter)
- Automatic central operating mode switchover via limit temperatures (cooling, summer, winter)
- Demand-based performance level management

Central and decentralized control

When controlling several heat pumps, a distinction can be made between centralized and decentralized hot water generation.

Central control

- Central specification of the priorities for hot water, heating, cooling and swimming pool
- Requirements are processed individually
- Specification of the maximum output levels for hot water generation
- Decentralized evaluation of a heat pump fault

Decentralized control

- Central specification of priorities for heating and cooling
- Decentralized specification of the priorities for hot water and swimming pool
- Parallel operation of heating / cooling and hot water preparation / swimming pool possible with reversible heat pumps with additional heat exchanger

Allocation of priorities

For the most efficient operation of the entire system, the heat pumps are controlled by the master controller with different priorities. The master controller receives feedback from the individual heat pump managers and recognizes blocked heat pumps due to a fault or a decentralized request. When combining different types of heat pumps (air / water and brine / water heat pumps), the different heat pumps are controlled depending on the outside temperature:

- Preferred use of air / water heat pumps above an adjustable outside temperature
- Preferred use of brine / water heat pumps below an adjustable outside temperature

In order to achieve the most uniform possible distribution of the running times, the master controller preferably starts the compressor with the shortest running time, and the master controller determines the running times of the individual compressors.

7.6.2 Electrical connection WPM Touch Master

1. The 3-wire **supply line** for the **Heat pump manager** (Heating controller N1) is routed into the heat pump (devices with integrated controller) or to the subsequent assembly area of the heat pump manager (WPM). The supply line (L / N / PE ~ 230V, 50Hz) for the WPM must be connected to permanent voltage and for this reason must be tapped in front of the EVU blocking contactor or connected to the household electricity, otherwise important protective functions will be out of order during the EVU blocking .
2. That **Contactor** (K20) for the **Immersion heater** (E10) is to be designed for mono-energetic systems (2.WE) according to the radiator output and **on site** to be provided. The control (230VAC) takes place from the heat pump manager via terminals X1 / N and N1-J13 / NO 4.

The contactor is built into the electrical distribution. The load lines for the immersion heater must be designed and secured in accordance with DIN VDE 0100.

3. the **Heating circulation pump** (M13) is connected to terminals X2 / N and N1-X2 / M13.
4. The return sensor (R2) is attached to terminals X3 / GND (Ground) and N1-X3 / R2.
5. Of the **Outside sensor** (R1) is attached to terminals X3 / GND (Ground) and N1-X3 / R1.

NOTE

When using three-phase pumps, a power contactor can be controlled with the 230V output signal of the heat pump manager. Sensor cables can be extended up to 40 m with 2 x 0.75 mm cables.

7.6.3 Configuration of the network

The network is set up in a line structure and is connected via terminal J11 (both on the heat pump manager and on the master controller). There can be a maximum of 32 participants in the network (16 controllers and 16 control units).

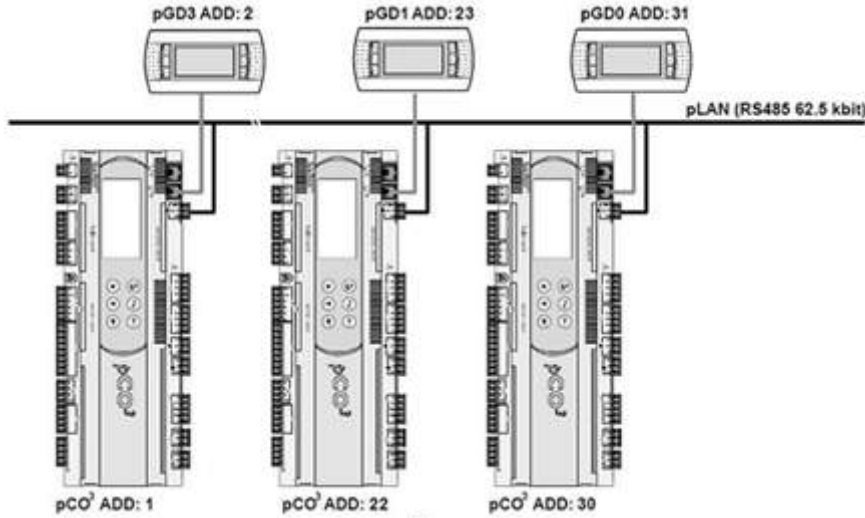


Fig.7.85: Example of a possible network including three heat pump managers with 3 control units (pGDx)

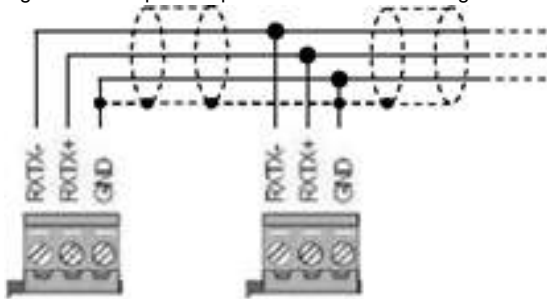


Fig. 7.86: View of the connection on terminal J11 of the WPM

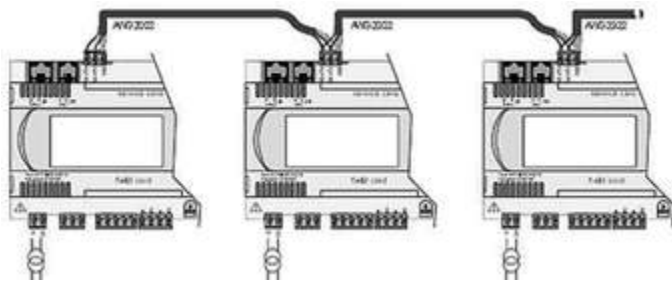


Fig. 7.87: Three heat pump managers, each with its own power supply

NOTE

We recommend using a twisted, shielded cable AWG20 / 22 (0.75 / 0.34 mm²) as the connection cable. The network must not exceed a maximum length of 500 m. The capacitance per unit length of the cable must be less than 90 pF / m.

7.7 SG Ready to use load-variable tariffs Does that also belong under heat pump manager? Between chapters 7.1 and 7.2

7.7.1 Regulations of the Federal Heat Pump Association (BWP) e.V.

According to the SG Ready regulations of the Bundesverband Wärmepumpe (BWP) e.V., a manufacturer may label an electrical heating heat pump with the "SG Ready" logo if the heat pump manager can react to the following four operating states of a traffic light tariff with load-variable tariffs.

Operating state 1

- Switching state with terminal solution 1: 0
- This operating mode is downward compatible with the EVU lock and includes a maximum of 2 hours of hard lock time

Operating condition 2

- Switching status with terminal solution 0: 0
- In this circuit, the heat pump runs in energy-efficient normal mode with a proportion of the heat storage tank being filled for a maximum of two hours from the utility company

Operating status 3

- Switching state with terminal solution 0: 1
- In this operating state, the heat pump runs within the controller in intensified operation for room heating and hot water preparation.
- This is not a definitive start-up command, but a switch-on recommendation based on today's increase.

Operating status 4

- Switching status with terminal solution 1: 1
- This is a definitive start-up command, insofar as this is possible within the framework of the controller settings.
- For this operating state, different control models must be set on the heat pump manager for different tariff and usage models.
- Variant 1: The heat pump (compressor) is actively switched on
- Variant 2: The heat pump (compressor and electrical auxiliary heating) is actively switched on, optional: higher temperatures in the heat storage tanks

7.7.2 Implementation on the heat pump manager

In order to meet the regulations of the Bundesverband Wärmepumpe e.V., a switching signal can be applied to terminals ID 1, ID 2 and ID 3. Different operating states of the heat pump are possible depending on the terminal assignment.

Red operating status - high electricity price

- Input ID 2 closed (connection of input ID 2)
- Lowering of the heating curve by an adjustable lowering value
- Hot water lock (minimum temperature adjustable)
- Swimming pool lock



Fig.7.88: Connection of input ID 2

Yellow operating status - normal electricity price

- Input ID 1 and ID 2 open (connection of input ID 1 and ID 2)
- Heating operation takes place according to the set heating curve / room temperature
- Hot water generation takes place according to the set target temperature
- Swimming pool preparation takes place according to the set target temperature





Fig.7.89: Connection of input ID 1 and ID 2

Green operating status - low electricity price

- Input ID 1 closed (e.g. low electricity price or free electricity) (connection of input ID 1)
- Switch-on command for the heat pump
- Raising the heating curve by the increase value
- Hot water generation takes place up to a maximum hot water temperature or determined HP-max. temperature



Fig.7.90: Wiring of input ID 1

7.7.3 Own use of self-generated electricity

The use of self-generated electricity (e.g. PV electricity) ultimately represents a load-variable tariff in which the heat pump can be operated with inexpensive electricity. In this case the input for green power (ID 1) is connected. In this operating state, the heat pump runs in increased mode for space heating, hot water or swimming pool preparation.

NOTE

In order to be able to use self-generated electricity to operate the heat pump, the heat pump and the PV system must be connected to the same meter (e.g. household electricity meter). For this, a separate approval from the respective energy provider may be necessary.

The use of self-generated electricity is possible with the heat pump managers WPM 2006 plus / WPM 2007 plus and the WPM EconPlus / WPM Econ5Plus. The following tables show the possible system configurations for the various heat pump managers.

System configuration	1. heating circle	2. heating circle	3. heating circle	Warm-water
Heat pump	+	+	+	+
Heat pump + boiler	+	+	-	+
Heat pump + reg. Memory (3.1)	+	+	-	+
Heat pump + reg. Memory (3.1) + swimming pool ^{1 2 3}	+	-	-	+

1 Not possible in systems with swimming pool / hot water preparation via thermostat

2 2. Heating circuit sensor (R5) becomes the swimming pool sensor (R20)

3 Only possible in combination with relay module RBG WPM (M19)

Tab.7.34: Possible combinations with a WPM 2006 plus / WPM 2007 plus

System configuration	1, heating circle	2. heating circle	3. heating circle	Warm water
Heat pump	+	+	+	+
Heat pump	+	+	-	+

+ Boiler				
Heat pump + reg. Memory (3.1)	+	+	-	+
Heat pump + reg. Memory (3.1) + swimming pool ^{1 2}	+	-	-	+

1 Not possible in systems with swimming pool / hot water preparation via thermostat

2.2. Heating circuit sensor (R5) becomes the swimming pool sensor (R20)

Tab.7.35: Possible combinations with a WPM EconPlus / WPM Econ5Plus

NOTE

In order to be able to use the SG Ready function, software L20 or higher is required.

SUPPLEMENT CHAPTER

- Smart grid
- Individual room control
- Reference room control
- Superordinate load management

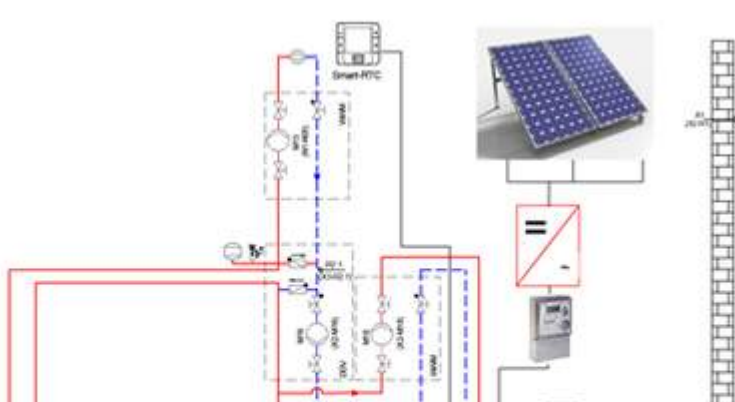
A higher-level load management is usually used for the following requirements:

- Combination of different heat sources
- Individual capacity control with adjustable compressor - switch-on and switch-off times
- Central hot water preparation via all heat pumps connected in parallel

Power level	Contact position
0 = heat pump off	ID1 open ID2 open
1 = heat pump on with 1 compressor	ID1 closed ID2 open
2 = heat pump on with 2 compressors and a second heat generator	ID1 open ID2 closed

Tab.7.36: Overview table of contact positions for higher-level load management

Combination of heat pump and photovoltaic system

Use of variable tariffs	configuration	setting
	Heat pump	mono-energetically
	1. Heating circuit	Heat
	1. Heating circuit	(optional)
	1. Heating circuit	(optional)
	Hot water	Yes, with a feeler
	swimming pool	Yes, with probe (optional)

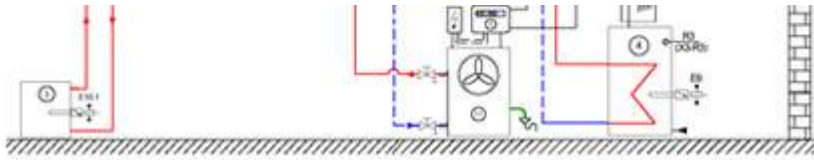


Fig. 7.91: Integration scheme for the use of variable tariffs with row buffer storage and hot water storage

Heat pump in mono-energetic operation with 1 heating circuit and hot water preparation.

Activation of the function via the switching contacts ID 1 and ID 2 on the heat pump manager.

The hot water temperature is increased to the maximum set hot water temperature. Increase of the heating curve / room temperature by the set increase value.

NOTE

Room temperature control using Smart-RTC is recommended.

Use of temporary peak loads

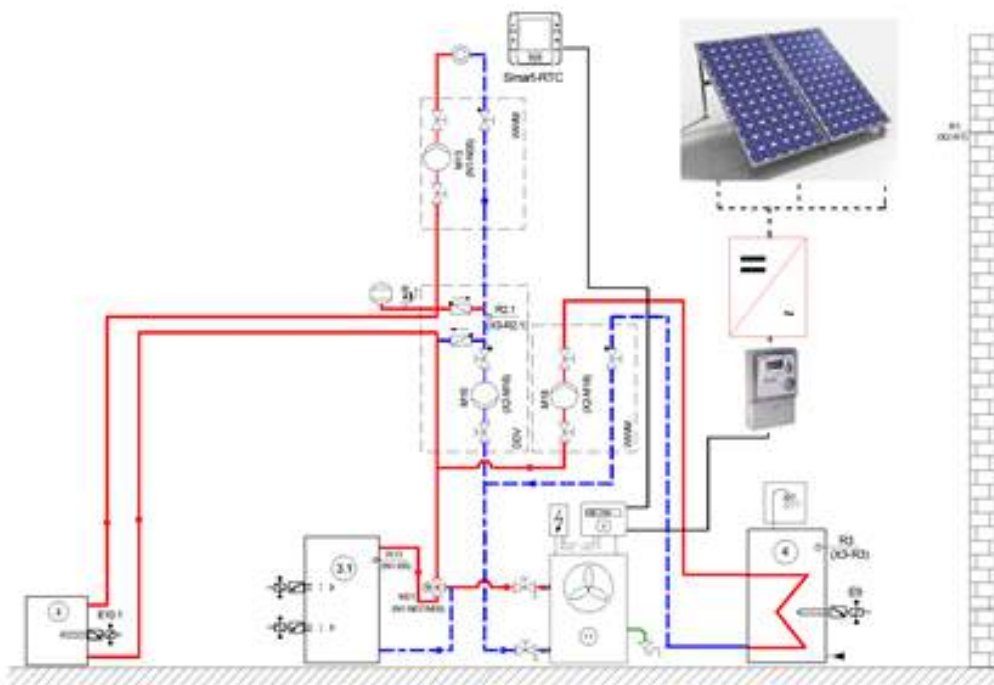


Fig. 7.92: Integration scheme for the use of time-limited load peaks with row buffer storage, hot water storage and regenerative storage with additional heating rods

configuration	setting
Heat pump	Bivalent-Regenerative
1. Heating circuit	Heat
1. Heating circuit	(optional)
Hot water	Yes, with a feeler
swimming pool	Yes, with probe (optional)

System hydraulics with 1 heating circuit, hot water preparation and regenerative storage.

Activation of the function via the switching contacts ID 1 and ID 2 on the heat pump manager.

The hot water temperature is increased to the maximum set hot water temperature. Increase of the heating curve / room temperature by the set increase value.

Optionally, if there is a surplus of electricity, electric heating rods can charge the regenerative storage and absorb short-term load peaks (external control).

Use of temporary peak loads



configuration	setting
Heat pump	Bivalent-Regenerative
1. Heating circuit	Heat
1. Heating circuit	(optional)

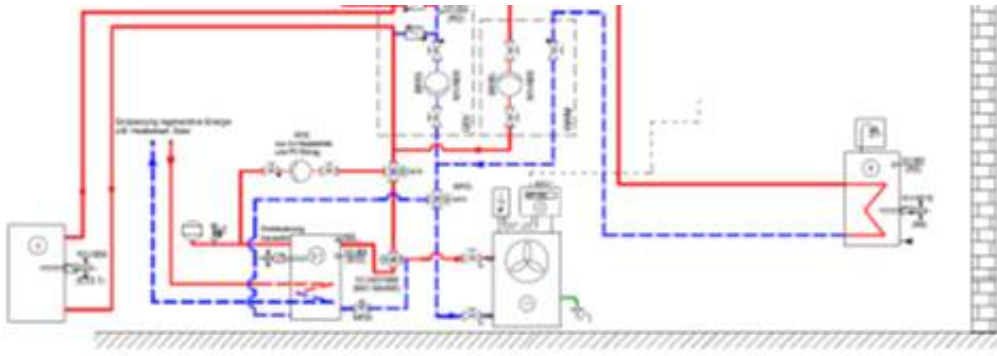


Fig. 7.93: Integration scheme for the use of temporary load peaks with row buffer storage, hot water storage and regenerative storage with additional heating elements.

NOTE

It is to be clarified with the EVU in advance whether the PV electricity can be fed in to drive the heat pump due to possibly existing meters.

Hot water	Yes, with a feeler
swimming pool	NO

System hydraulics with 1 heating circuit, hot water preparation and regenerative storage.

Activation of the function via the switching contacts SG-Ready switching contacts on the heat pump manager.

Loading of the regenerative buffer tank using the M 19 pump.

The hot water temperature is increased to the maximum set hot water temperature. Increase of the heating curve / room temperature by the set increase value.

Optionally, if there is a surplus of electricity, electric heating rods can charge the regenerative storage and absorb short-term load peaks (external control).

8 chapter

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Chapter 8 - Integration of the heat pump in the heating system

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8 Integration of the heat pump in the heating system

8.1 Hydraulic requirements

8.1.1 Integration of the heat pump in the heating system

When integrating a heat pump hydraulically, it must be ensured that the heat pump only ever has to generate the temperature level actually required (flow temperature) in order to increase efficiency. The aim is to feed the temperature level generated by the heat pump unmixed into the heating system.

NOTE

In pure heat pump operation, a mixed heating circuit is only necessary if two different temperature levels, e.g. for underfloor and radiator heating, have to be supplied.

In order to prevent the mixing of different temperature levels, the heating operation is interrupted during a hot water request and the heat pump is operated with the higher flow temperatures necessary for hot water preparation.

The following basic requirements must be met:

- Guarantee of frost protection Chap. 8.2
- Safeguarding the minimum heating water throughput Chap. 8.3
- Ensuring the minimum term

Furthermore, when setting the setpoint or the heating curve, it must be ensured that living comfort is ensured, but the setpoint or the heating curve is not set higher than is absolutely necessary.

NOTE

With every Kelvin higher flow temperature, the efficiency of the heat pump heating system drops by up to 2.5%.

In order to heat the building with the lowest possible flow temperature, the heat distribution system must be designed for this flow temperature. The following examples are suitable for operation with a low flow temperature:

- Underfloor heating
- Concrete core activation
- Fan coil units
- Low temperature radiator
- Ventilation register with enlarged heat exchanger surface

NOTE

In rooms with a bathtub or shower (sanitary areas), additional heating must be implemented in conjunction with underfloor heating. This can be achieved, for example, with an electric heater (e.g. towel dryer).

8.1.2 Safety devices in the heat generator circuit

The heating in the heat generator circuit causes the heating water to expand, which must be compensated for by an expansion vessel. The design is based on the heating water volume and the maximum system temperature.

During operation or in the event of a malfunction, an impermissibly high pressure may occur in the heating system (e.g. heating up or filling the system). If the pressure is too high, it must be discharged via a safety valve in accordance with EN 12828. The safety valve must be easily accessible either on the heat generator or installed in the flow, without a shut-off between the heat generator and the safety valve being possible. Devices must be available (outlet nozzle or blow-off line) that enable the safety valve to be blown off safely and safely.

Bivalent systems

The expansion vessel and safety valve integrated in the circuit of the 2nd heat generator have no effect when the mixer is tightly closed. For this reason, a safety valve and an expansion vessel are required for each heat generator. The expansion vessel in the heat pump's generator circuit should be designed for the entire system volume (heat pump, storage tank, radiator, pipes, 2nd heat generator).

8.1.2.1 Safety valve

A safety valve is used in closed heating, brine and solar systems. However, closed hot water storage tanks must also be equipped with the safety fitting in order to prevent damage caused by excessively high pressures in the system.

8.1.2.1.1 Design and assembly of a safety valve

So that the safety valve can reliably protect heating, drinking water, brine or solar systems, the response pressure must match the system. In single and two-family houses, components with a response pressure of 2.5 to 3.0 bar are usually used. The nominal size must be selected so that the valve can divert the entire heat generator output of the system in an emergency. For systems with a capacity of up to 50 kW, this corresponds to a nominal size of DN 15. The blow-off line must then be one dimension larger (in this case DN 20). The safety valve sits upright in the flow, as close as possible to the heat generator. It may have a connection line of a maximum of one meter, the installation of a bend is permitted. With this nominal size, the blow-off line must not be longer than two meters. Only two bends are allowed here so that water can drain off quickly. The drainage line of the sewage system (e.g. siphon) must at least correspond to the nominal width DN 40 (see DIN EN 12828).

The safety valve can also be part of a safety group. In addition to the valve, there is also a pressure gauge and a vent on a compact manifold.

8.1.2.1.2 Reasons for water leaking from the safety valve

If water leaks from the safety valve, it can have various causes. A defective expansion vessel, for example, is typical. This can no longer compensate for the fluctuating water volume and the system pressure rises. Furthermore, too much liquid in the system or an increase in temperature (e.g. due to external heat sources) can trigger the safety valve.

8.1.2.1.3 Regular maintenance to ensure functionality

To ensure that the safety valve works reliably in the event of a trigger, it must be serviced regularly. By manually opening the valve (turn the cap), liquid must escape. When you let go of the cap, the safety valve must close again by itself. If this is the case, proper function is ensured, otherwise the safety valve must be replaced.

8.1.2.2 Dimensioning the expansion vessel

To ensure safe operation of the system, an expansion tank must be installed.

The expansion tank (also called the MAG diaphragm expansion vessel) absorbs the change in volume of the liquid and thus ensures constant pressure in the entire system.

The correct function of the expansion vessel prevents water from escaping through the safety valve.

To be taken into account when designing the expansion vessel for the entire system, including the heat pump.

The following parameters are required for the design:

- Lowest system temperature T0 in K
- Highest system temperature T1 in K
- Set or selected water pressure in the system in Pa
- Maximum pressure (depending on the safety valve) in Pa
- Water content of the heating system in l

Average water temperature and expansion coefficient			
Average temperature of hot water Tm in ° C	Expansion coefficient	Average temperature of hot water Tm in ° C	Expansion coefficient
0	0.0002	50	0.0121
5	0.0000	55	0.0145
10	0.0004	60	0.0171
15th	0.0009	65	0.0198
20th	0.0018	70	0.0228
25th	0.0029	75	0.0258
30th	0.0044	80	0.0290
35	0.0050	85	0.0321
40	0.0079	90	0.0359
45	0.0100	95	0.0396

Table 8.1: Coefficient of expansion for water

$$T_m = \frac{T_1 - T_0}{2}$$

$$V = \frac{\varepsilon \cdot V_s}{1 - \frac{P_1}{P_2}}$$

V = required content of the expansion vessel

= coefficient of expansion (at medium water temperature - see table)

P1 = lowest pressure (in the cold system) *

P2 = highest pressure (during heating) *

Vs = water content of the heating system

* P1 and P2 are to be used as absolute pressure

SAMPLE TASK

8.1.3 Check valve

If there is more than one circulation pump in a system, each pump assembly must be equipped with a non-return valve to prevent admixtures from other heating circuits. It must be ensured that the non-return valves close tightly and are noiseless when flowing through.

NOTE

Particles of dirt can prevent the non-return valve from closing completely and lead to incorrect circulation.

8.1.4 General installation regulations

Hydraulic balancing of the pipeline network is essential for an energy-efficient heat pump system. Even during the planning and installation phase, all pipes, fittings and other connections required for hydraulic balancing must be considered and taken into account.

In order to minimize pressure losses and thus the power requirements of circulation, brine and well pumps, pipeline cross-sections must be dimensioned appropriately large. The design criterion for this applies

- the specific pressure loss p per meter of pipe
- used medium
- the flow velocity c in the pipe

each related to the nominal volume flow.

The following maximum values should not be exceeded:

- $p_{Max} = 120 \text{ Pa / m}$
- $c_{Max} = 0.7 \text{ m / s}$ (pipes from DN 10 - DN 65)
- $c_{Max} = 1.2 \text{ m / s}$ (pipes from DN 80 - DN 125)
- $c_{Max} = 2.0 \text{ m / s}$ (pipes DN 150)

The actual pressure loss of the system is to be determined on the basis of a pipe network calculation. This calculated pressure loss and the volume flow required for the heat pump are required to make a selection.

NOTE

When using glycol-water mixtures (antifreeze), the pressure loss in the system increases due to the viscosity and must be taken into account when designing the pipe network or pump. A factor of 1.5 compared to a pure application with water has proven itself in practice.



NOTE

When using composite pipes, a higher pressure loss is to be expected due to possible cross-section constrictions on the fittings. For pipe sections with a large number of fittings, the pipe diameter should be at least one dimension larger or a different pipe material should be selected.

When designing other pipeline components (e.g. check valves, changeover valves, expansion joints, dirt traps ...), the pressure loss should also be kept as low as possible. The design criterion for this is:

- Per individual resistance p_{\max} : 5000 Pa (0.5 m)

However, it must be ensured that the valve authority (P_v) is the decisive criterion for the selection.

For valves and fittings, certain minimum pressure drops may be required for good control behavior. The manufacturer's information must be observed here.

All pipes, fittings, buffer and hot water storage tanks are or must be insulated in accordance with the generally applicable regulations. Particular attention must be paid to pipe sections where the pipe wall drops below the dew point due to the medium temperature. These must be equipped with diffusion-proof, fully glued insulation. This applies in particular to the following pipeline sections:

- Generator circuit including buffer storage, if this is also used for cooling (entire system with dynamic cooling)
- Cold water supply to the hot water tank
- Flow and return of a geothermal system
- Flow and return of a well system (suction and injection wells)

8.2 Guarantee of frost protection

In the case of heat pumps that are outdoors or through which outside air flows, measures must be taken to prevent the heating water in the heat pump from freezing in the event of downtimes or malfunctions.

If the temperature at the frost protection sensor (flow sensor) of the heat pump falls below a minimum, the heating and additional circulation pumps are automatically activated to ensure frost protection. In mono-energetic or bivalent systems, the second heat generator is released in the event of heat pump malfunctions in order to ensure frost protection.

⚠ ATTENTION

In the case of heating systems with cut-off times from the energy supply company (EVU), the supply line for the heat pump manager must be connected to permanent voltage (L / N / PE ~ 230 V, 50 Hz) and must therefore be tapped in front of the EVU blocking contactor or connected to the household electricity.

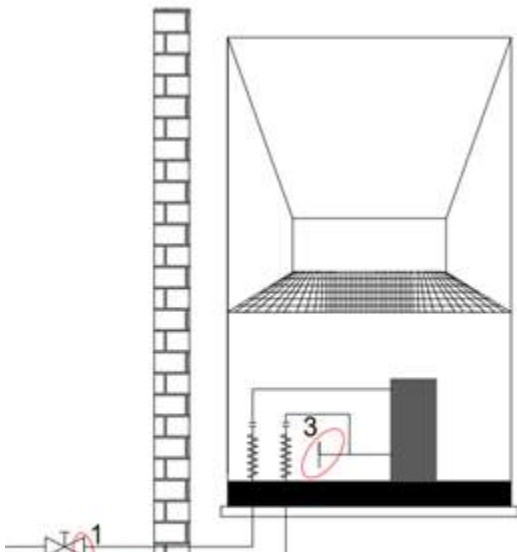
In the case of heat pump systems where a power failure cannot be detected (e.g. holiday homes), the heating system must be filled with suitable frost protection.

📘 NOTE

If the heat pump is operated with a water-glycol mixture with a glycol content of 25%, the heating and cooling efficiency is reduced by approx. 15%.

In permanently inhabited buildings, the use of antifreeze in the heating water is not recommended, as the control of the heat pump largely ensures frost protection and the antifreeze worsens the efficiency of the heating system.

Manual draining must be provided for heat pumps that are installed at risk of frost. When the heat pump is shut down or in the event of a power failure, the heat pump and the heating water connection line (flow and return) must be drained and, if necessary, blown out.



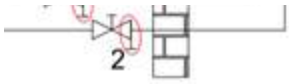


Fig. 8.1: Circuit diagram for the installation of heat pumps at risk of frost

⚠ ATTENTION

The hydraulic integration must be carried out in such a way that the heat pump - and thus the integrated sensor - is always flowed through, even in the case of special connections or bivalent operation.

8.3 Safeguarding the heating water throughput

In order to ensure that the heat pump operates reliably, the specified in the device information must be **Minimum**-Heating water flow can be ensured in all operating states. The circulation pump must be dimensioned in such a way that the water throughput through the heat pump is ensured with maximum pressure loss in the system (almost all heating circuits closed).

The specified minimum heating water throughput must be ensured on the system side regardless of the switching value of a built-in flow switch and must not be undercut in any operating state. A built-in flow switch is used exclusively to switch off the heat pump in the event of an unusual drop in the heating water flow rate and not to monitor and safeguard the required minimum heating water flow rate.

ℹ NOTE

When using electronically controlled pumps in the generating circuit, the instructions in Chapter 8.14 must be observed.

⚠ ATTENTION

With design temperatures of the heating system below 30 ° C in the flow (e.g. concrete core activation), air / water heat pumps must be designed for the maximum volume flow with a 5 K spread for A7 / W35.

The required temperature spread can be determined in two ways:

- Mathematical determination: Chap. 8.3.1
- Reading out table values depending on the heat source temperature: Chap. 8.3.2

When determining the heating water throughput in the heat pump's generator circuit, various points must be taken into account. The minimum heating water throughput must be ensured in all operating states.

ℹ NOTE

In the case of regulated pumps, particular care must be taken to ensure that they are set to a constant speed and that internal control functions of the pumps do not lead to a brief drop in the volume flow (e.g. standstill of the pump due to the venting function when air bubbles are detected).

A higher flow rate must be provided for lower flow temperatures. The following spreads are recommended in the design point:

- 35 ° C: approx. 5 K spread, but never below the minimum heating water throughput
- 45 ° C: approx. 7 K spread, but never below the minimum heating water throughput
- 55 ° C: max. 10 K spread, but never below the minimum heating water throughput
- 65 ° C: max. 10 K spread, but never below the minimum heating water throughput

In systems with extremely low system temperatures (return temperatures ≤ 25 ° C), a maximum spread of 5 K must be specified in the design point when planning. Systems for heating and cooling must be designed for the highest required water throughput (heating water or cooling water throughput).

8.3.1 Calculating the temperature spread

- Determination of the current heating output of the heat pump from the heating output curves at an average heat source temperature
- Calculation of the required spread using the minimum heating water throughput specified in the device information

ℹ NOTE

Tabular values for the required temperature spread depending on the heat source temperature can be found in Table 8.1.

Example air / water heat pump:

Heat output_{WP} = 10.9 kW with A10 / W35

Specific heat capacity of water: 1.163 Wh / kg K

Required minimum heating water flow: e.g. $V = 1000 \text{ l} / \text{h} = 1000 \text{ kg} / \text{h}$

Required spread:

$$\Delta T = \frac{10900 \text{ W kg K h}}{1,163 \text{ Wh} \cdot 1000 \text{ kg}} = 9,4 \text{ K}$$

8.3.2 Temperature spread depending on the heat source temperature

In the case of heat pumps that are not speed-controlled (fix-speed / without inverter), especially when the heat source is outside air, the heat output generated by the heat pump is heavily dependent on the current heat source temperature. The maximum temperature spread depending on the heat source temperature can be found in the following tables.

Air Water heatpump

Heat source temperature		Max. Temperature spread in 1-compressor operation between flow and return of the heat pump	
from	until	Heat pump with 1 compressor	Heat pump with 2 compressors
-20 ° C	-15 ° C	4K	2K
-14 ° C	-10 ° C	5K	2.5K
-9 ° C	-5 ° C	6K	3K
-4 ° C	0 ° C	7K	3.5K
1 ° C	5 ° C	8K	4K
6 ° C	10 ° C	9K	4.5K
11 ° C	15 ° C	10K	5K
16 ° C	20 ° C	11K	5.5K
21 ° C	25 ° C	12K	6K
26 ° C	30 ° C	13K	6.5K
31 ° C	35 ° C	14K	7K

Table 8.2: Heat source: outside air

Brine / water heat pump

Heat source temperature		Max. Temperature spread in 1-compressor operation between flow and return of the heat pump	
from	until	Heat pump with 1 compressor	Heat pump with 2 compressors
-5 ° C	0 ° C	5 K	10K
1 ° C	5 ° C	6 K	11K
6 ° C	9 ° C	6 K	12K
10 ° C	14 ° C	7 K	13K
15 ° C	20 ° C	7 K	14K
21 ° C	25 ° C	8 K	15K

Tab.8.3: Heat source: ground

Water / water heat pump

Heat source temperature		Max. Temperature spread in 1-compressor operation between flow and return of the heat pump	
from	until	Heat pump with 1 compressor	Heat pump with 2 compressors
7 ° C	12 ° C	5 K	10K
13 ° C	18 ° C	6 K	11K
19 ° C	25 ° C	6 K	12K

Tab.8.4: Heat source: groundwater

8.3.3 Overflow valve

In systems with one heating circuit, a common heating circulation pump (M13) can flow through the heat pump and the heating system (see Fig. 8.52).

When using room temperature controllers, the volume flows in the consumer circuit fluctuate. An overflow valve built into the generator circuit - downstream of the uncontrolled heating circulation pump (M13) - must compensate for these changes in volume flow.

If the pressure loss in the consumer circuit increases (e.g. due to closing valves), a partial volume flow is passed through the overflow valve and ensures the minimum heating water flow through the heat pump.

NOTE

In connection with an overflow valve, circulation pumps with constant speed (volume flow) must be used.

Setting the overflow valve

- To set the overflow valve, all control elements (actuators, thermostatic valves ...) of the heating circuits are closed, so that the operating state that is most unfavorable for the water throughput is present.
- The overflow valve is to be opened so far that at the current heat source temperature the values described in chap. 8.3.2 gives the maximum temperature spread between the heating flow and return. The temperature spread should be measured as close as possible to the heat pump.

NOTE

An overflow valve that is closed too far does not ensure the minimum heating water throughput through the heat pump. An overflow valve that is open too far can result in individual heating circuits no longer being adequately flowed through.

8.3.4 Differential pressure-free distributor (EB KPV)

The hydraulic decoupling of the generator circuit from the consumer circuit ensures the minimum heating water throughput through the heat pump in all operating states. The heating circulation pump (M13) ensures the minimum heating water flow of the heat pump in all operating states without manual settings being necessary. Different volume flows in the generator and consumer circuit are balanced out via the pressure-free distributor. The pipe cross-section of the pressure-free distributor should have the same diameter as the flow and return of the heating system.

NOTE

If the volume flow in the consumer circuit is higher than in the generator circuit, the maximum flow temperature of the heat pump is no longer reached in the heating circuits.

8.3.5 Double differential pressureless distributor (DDV)

The double differential pressure-free distributor enables the minimum heating water throughput of the heat pump to be ensured in combination with a series buffer storage tank without having to compromise on efficiency. The generator and consumer circuit are decoupled with a pressure-free distributor upstream and downstream of the in-line buffer storage tank. In addition, every distributor without differential pressure is equipped with a check valve (see Fig. 8.64).

Advantages of the distributor with no differential pressure:

- Hydraulic decoupling of the generator and consumer circuit
- More efficient pump control
- Reduction of mixing losses compared to other integrations
- Operation of the circulation pump (M16) in the generator circuit only when the heat pump is running in order to avoid unnecessary running times
- Ensuring the minimum running times of the compressor and during defrosting in all operating situations through complete flow through the in-line buffer tank
- Compact and space-saving dimensions possible thanks to the smaller buffer volume

NOTE

The hydraulic integration with a distributor with no differential pressure offers a high degree of flexibility, operational safety and efficiency.

8.4 Hot water distribution system

The hot water distribution system consists of coordinated individual components that can be combined in different ways depending on the requirements. The maximum permissible heating water throughput of each individual component must be taken into account when planning the project.

Modules for connecting the buffer tank and ensuring the heating water throughput

- Double differential pressure-free manifold
DDV 25
DDV 32

- Compact distributor DDV 40
 - Extension module for a pressure-free distributor DDV 50
- KPV 25
- EB KPV

Modules for the heating distribution system

- Unmixed heating circuit module (hot water module) WWM 25
WWM 32
WWM 50
 - Mixed heating circuit module
 - Distribution bar for connecting two heating circuits MMH 25
MMH 32
MMH 50
 - Distribution bar for connecting three heating circuits
- VTB 25-2
VTB 32-2
VTB 50
- VTB 25-3
VTB 32-3

Modules for the hot water distribution system

- Hot water module WWM 25 WWM 32
- Distribution bar for connecting KPV 25 and WWM 25 VTB 25-2 and VTB 25-3
- Hot water pump assembly for direct connection of the hot water charging pump to the hot water storage tank WPG 25
WPG 32
- Changeover valve for hot water preparation (hot water module WWM and circulation pump) DWV 25, DWV 32, DWV 40, DWV 50

The EMA DWV electromotive servomotor with short positioning times (30 seconds) is required for switching. The heating water throughput is carried out by the generator circuit pump M 16.

Extension modules for bivalent and regenerative systems

- Mixer module for bivalent systems (4-way mixer) MMB 25
 - 3-way mixer for bivalent-renewable systems MMB 32
- DWK 25
- DWK 32
- DWK 40
- DWK 50

The EMA DWK electromotive servomotor with positioning times (120 sec.) is required for admixing.

The following table shows the areas of application of the modules.

module	more recommended	maximum	
	Volume flow	Volume flow	
DDV 25	2.0 m ³ / h	3.0 m ³ / h	
DDV 32	2.5 m ³ / h	3.5 m ³ / h	
DDV 40	5.0 m ³ / h	7.5 m ³ / h	
DDV 50	7.5 m ³ / h	9.0 m ³ / h	
KPV 25	1.3 m ³ / h	2.2 m ³ / h	
EB KPV	2.0 m ³ / h	2.6 m ³ / h	
VTB 25	2.0 m ³ / h	3.0 m ³ / h	
VTB 32	2.5 m ³ / h	3.5 m ³ / h	
VTB 50	10.0 m ³ / h	15.0 m ³ / h	
WWM 25	1.8 m ³ / h	2.5 m ³ / h	
WWM 32	2.5 m ³ / h	3.5 m ³ / h	
WWM 50	8.0 m ³ / h	12.0 m ³ / h	
MMH 25	1.8 m ³ / h	2.5 m ³ / h	

MMH 32	2.5 m ³ / h	3.5 m ³ / h	
MMH 50	8.0 m ³ / h	12.0 m ³ / h	
MMB 25	1.8 m ³ / h	2.2 m ³ / h	
MMB 32	2.5 m ³ / h	3.5 m ³ / h	
WPG 25	1.5 m ³ / h	3.0 m ³ / h	
WPG 32	3.0 m ³ / h	4.5 m ³ / h	Kvs value
DWV 25			9.0 m ³ / h
DWV 32			13.0 m ³ / h
DWV 40			25.0 m ³ / h
DWV 50			37.0 m ³ / h
DWK 25			10.0 m ³ / h
DWK 32			16.0 m ³ / h
DWK 40			25.0 m ³ / h
DWK 50			40.0 m ³ / h

Tab.8.5: Area of application for heating system assemblies

NOTE

In the integration schemes in chap. 8.14, the components of the hot water distribution system are shown with dashed lines.

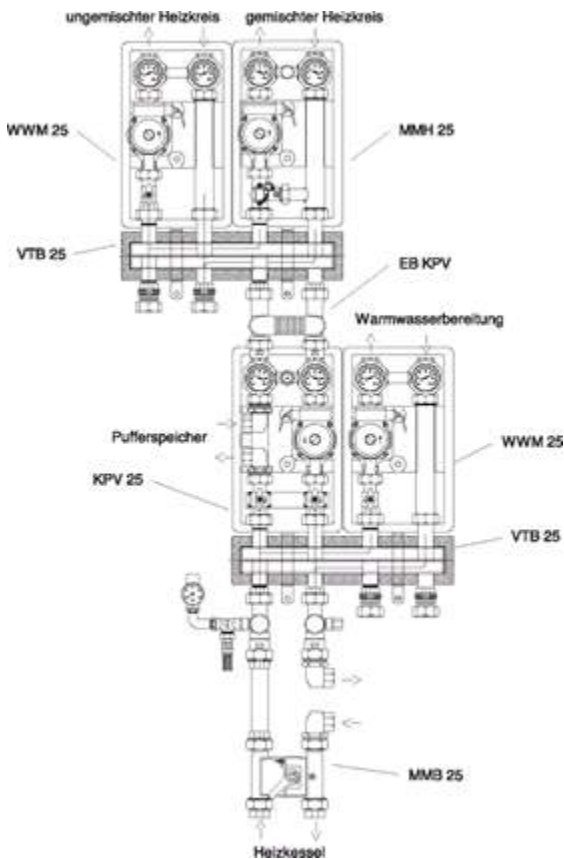


Fig. 8.2: Combination options for the hot water distribution system

The pressure losses for the individual components can be taken from the following diagrams:



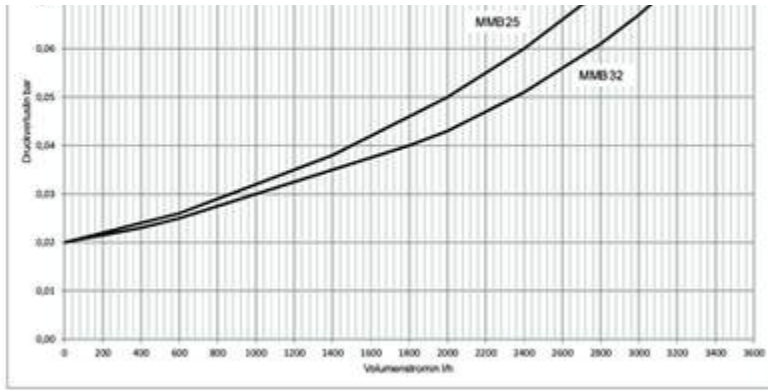


Fig.8.3: Diagram of pressure loss MMB 25 and MMB 32

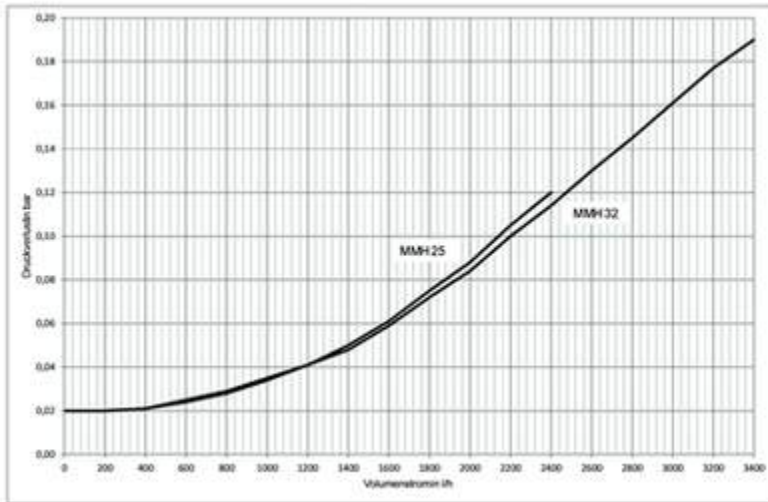


Fig.8.4: Diagram of pressure loss MMH 25 and MMH 32

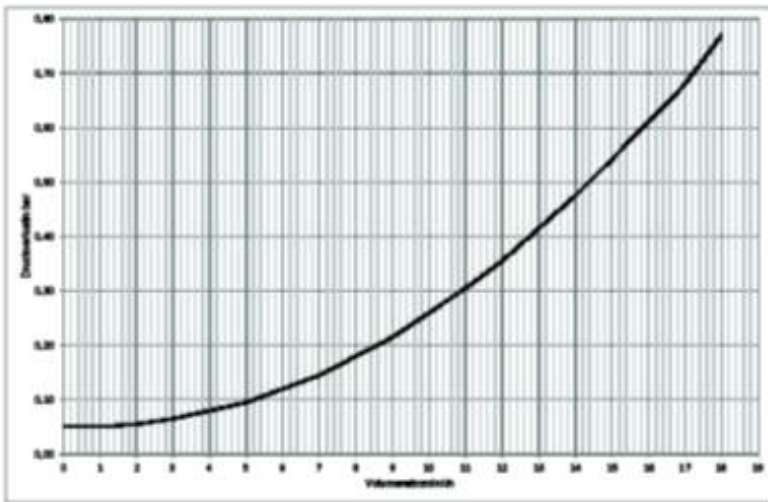


Fig.8.5: Diagram pressure loss MMH 50



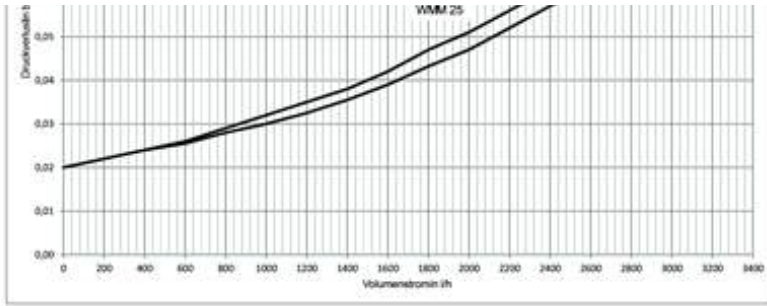


Fig.8.6: Diagram of pressure loss WWM 25 and WWM 32

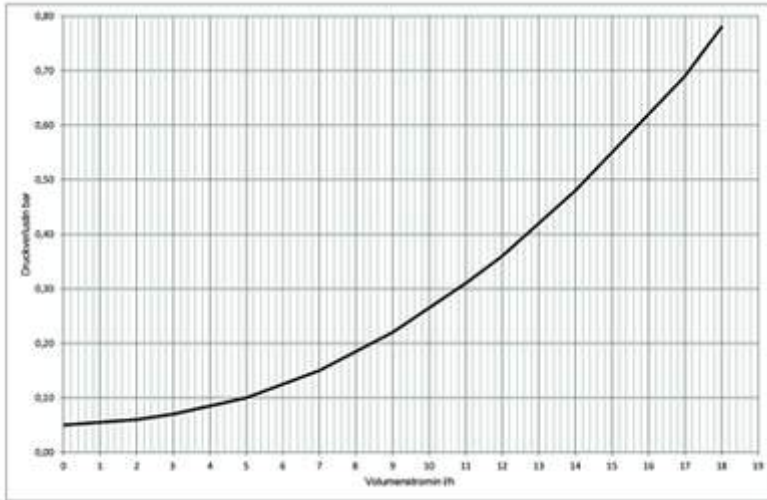
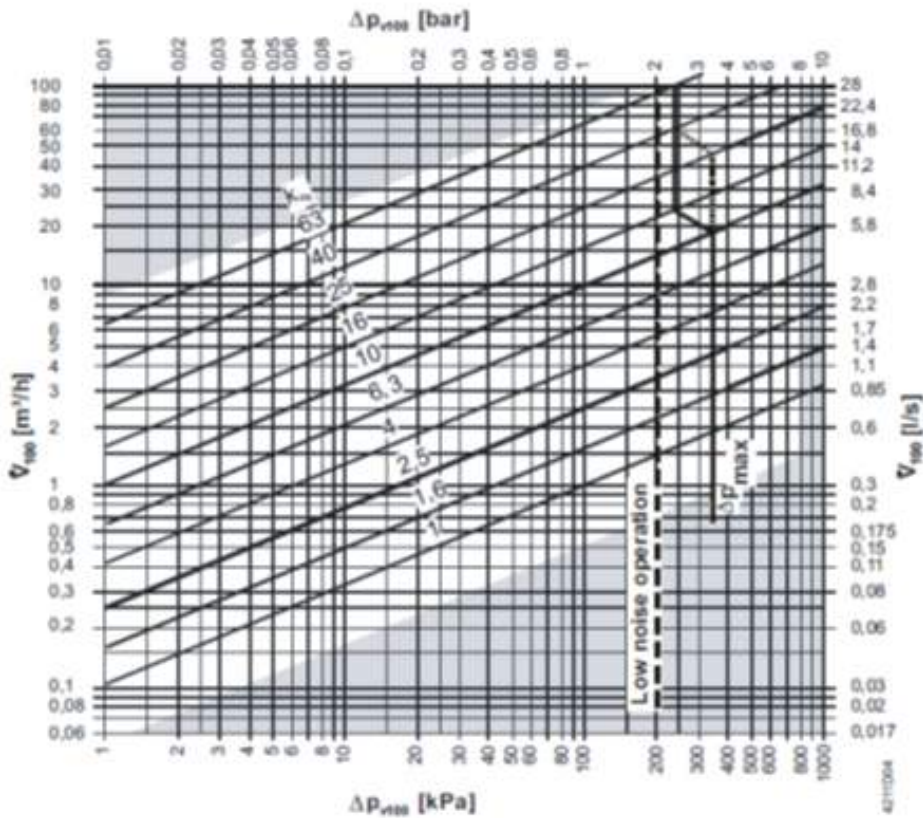


Fig.8.7: Diagram of pressure loss WWM 50



- Δp_{max} = maximal zulässiger Differenzdruck über dem Kugelhahn, gültig für den gesamten Stellbereich der Kugelhahn-Drehantriebs-Einheit; wird geräuscharmer Betrieb gewünscht, so empfehlen wir einen maximal zulässigen Differenzdruck von 200 kPa
- Δp_{V100} = Differenzdruck über dem voll geöffneten Kugelhahn und über dem Regelpfad bei einem Volumendurchfluss V_{100}
- V_{100} = Volumendurchfluss durch den voll geöffneten Kugelhahn
- 100 kPa = 1 bar = 10 mV S
- 1 m³/h = 0,278 l/s Wasser bei 20 °C

Fig. 8.8: Pressure loss diagram, changeover valve DWV

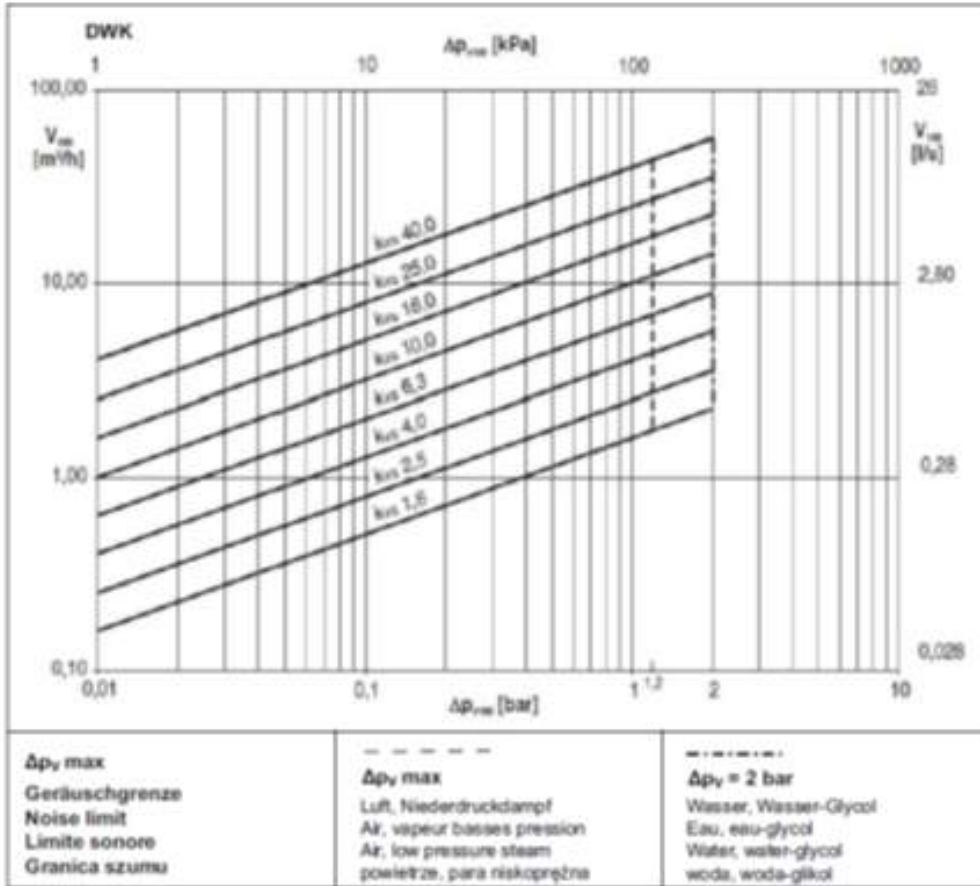


Fig. 8.9: Pressure loss diagram, mixing valve DWK

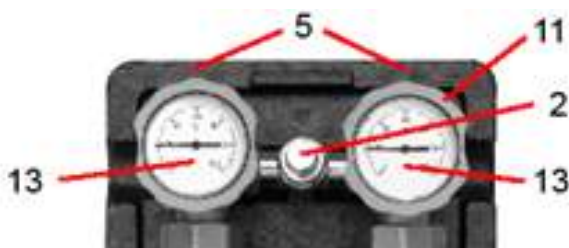
8.4.1 Compact distributor KPV 25

The compact distributor acts as an interface between the heat pump, the heating distribution system, the buffer tank and possibly also the hot water tank.

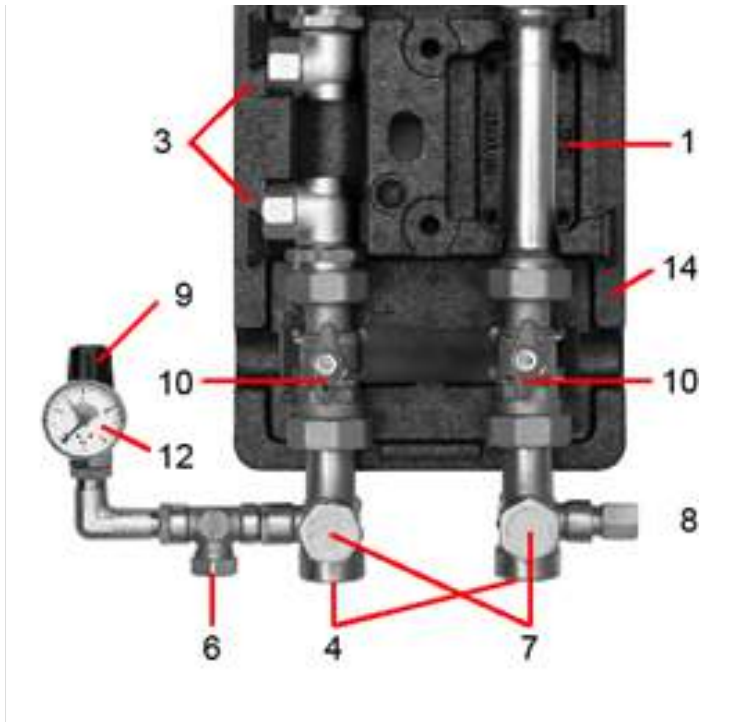
Instead of many individual components, a compact system is used to simplify installation.

NOTE

The compact distributor KPV 25 with overflow valve is used in heating systems with a heating water flow of 1.3 m³/h recommended.



1	Placement of the heating circulation pump (not included)
2	Overflow valve
3	Connections buffer tank 1 "IG
4th	Connections heat pump 1 "IG



5	Connections heating 1 "IG
6th	Connection expansion vessel ¾ "AG
7th	Connections for hot water heating 1 "AG
8th	Immersion sleeve for Return sensor incl. Plastic fuse
9	Safety valve ¾ "IG
10	Stop cocks
11	Stopcock with check valve
12th	thermometer
13	Shell insulation

Fig.8.10: Structure of compact distributor KPV 25

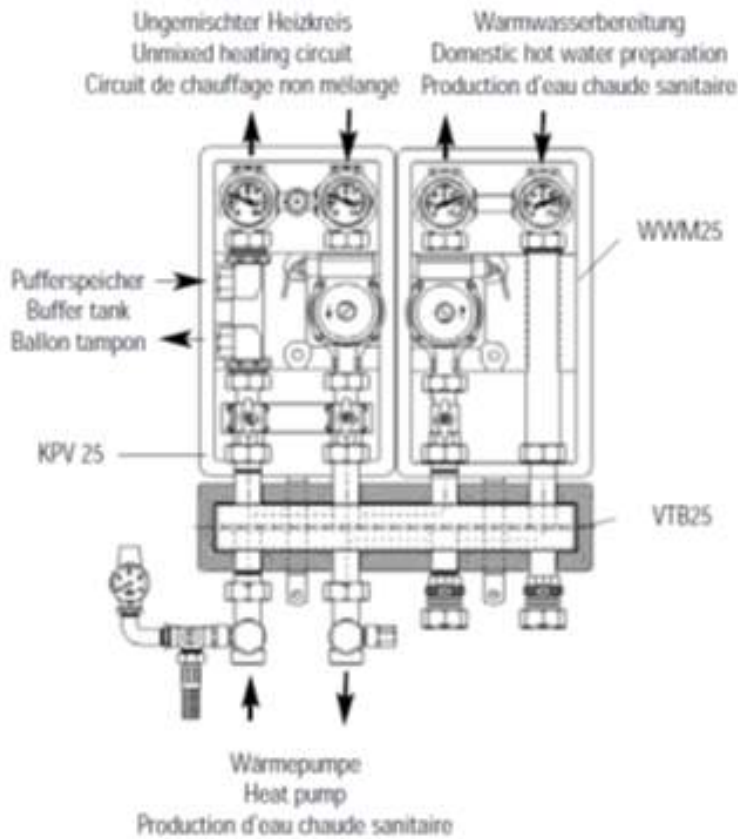
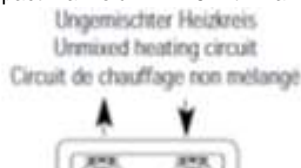


Fig.8.11: Compact manifold KPV 25 with manifold bar VTB 25 and hot water module WWM 25



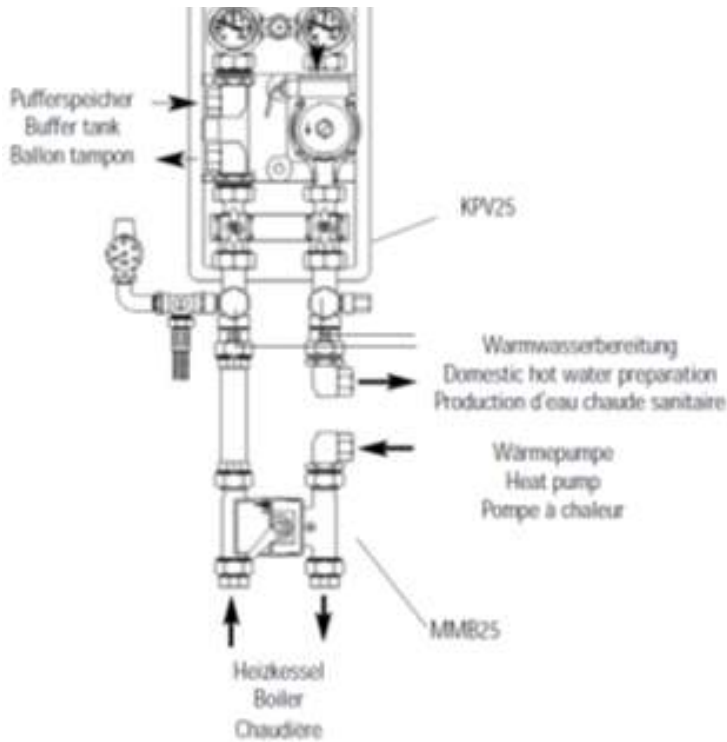
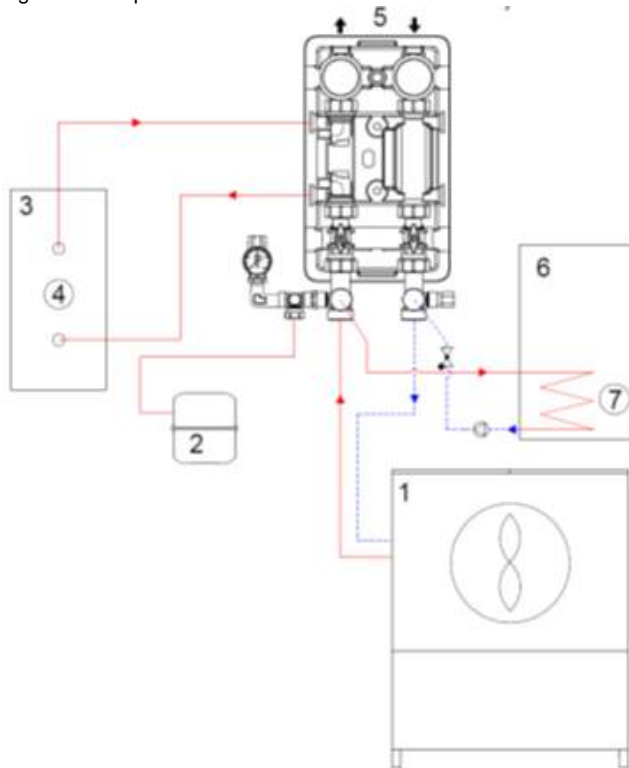


Fig.8.12: Compact distributor KP25 with mixer module bivalent MMB25



1. Heat pump
2. Expansion tank
3. Buffer storage
4. Immersion heater
5. Integration of the compact distributor for heating operation and hot water preparation
6. Hot water tank
7. Flange heating

Fig.8.13: Integration of the compact distributor for heating operation and hot water preparation



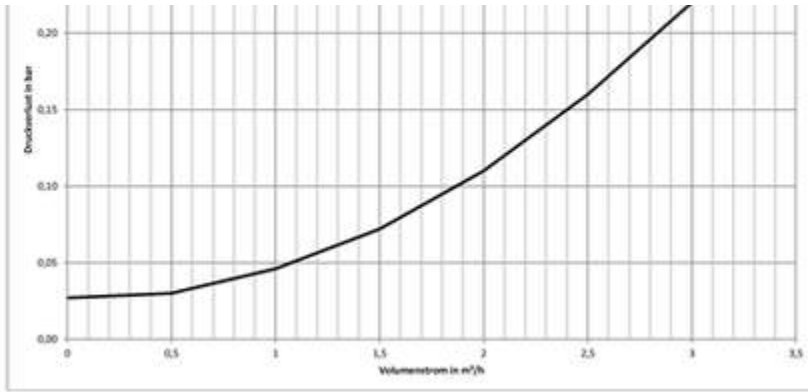


Fig.8.14: Pressure loss KPV 25 as a function of the volume flow

8.4.2 Compact distributor KPV 25 with extension module EB KPV

By combining the expansion module EB KPV, the compact distributor KPV 25 becomes a distributor without differential pressure. The generator and consumer circuit are hydraulically separated and each have a circulation pump.

NOTE

The use of the compact distributor KPV 25 with extension module EB KPV is used to connect heat pumps with a heating water flow of 2.0 m³/h recommended.

8.4.3 Double differential pressure-free distributor DDV

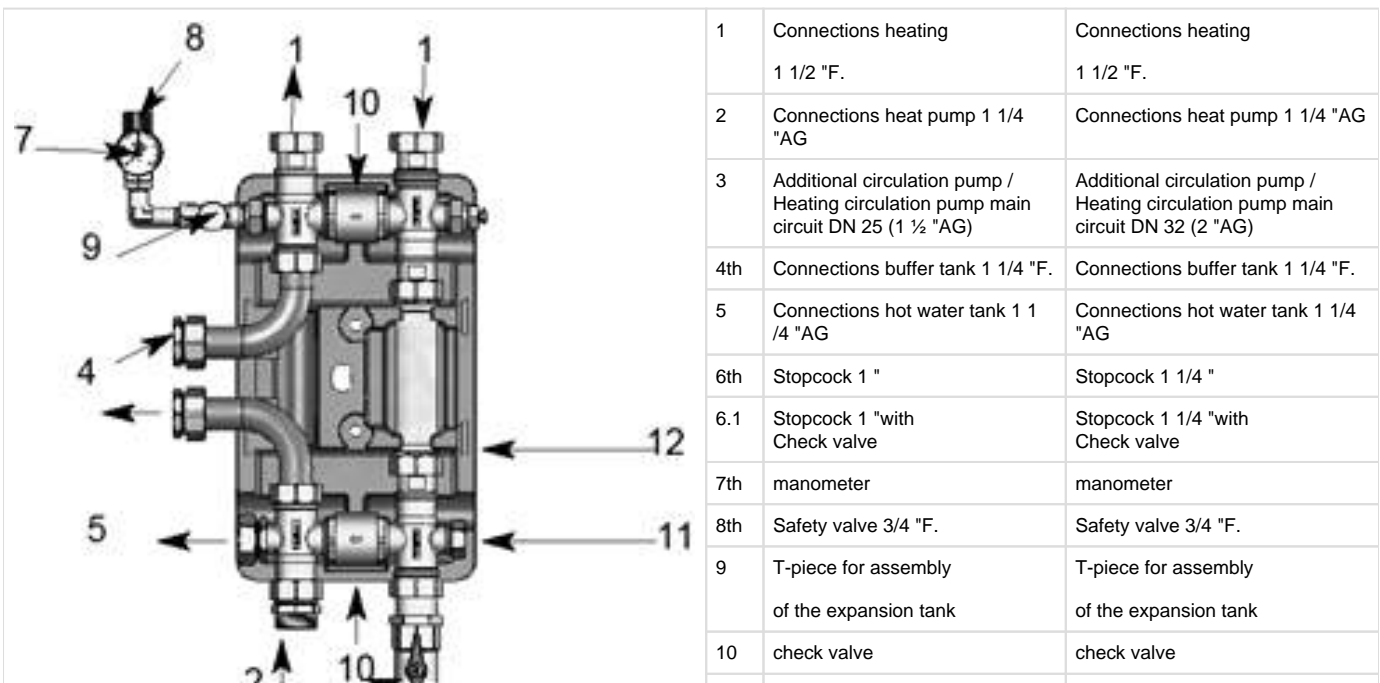
The double differential pressure-free distributor DDV acts as an interface between the heat pump, the heating distribution system, the buffer tank and possibly also the hot water tank.

Instead of many individual components, a compact system is used to simplify installation.

Different versions of the double differential pressure-free manifold are available:

- DDV 25
- DDV 32
- DDV 40
- DDV 50

8.4.3.1 Double differential pressureless distributors DDV 25 and DDV 32



	11	Immersion sleeve for Return sensor	Immersion sleeve for Return sensor
	12th	insulation	insulation
	13	Double nipple 1 "	Double nipple 1 1/4 "
Item	DDV 25		DDV 32

Fig.8.15: Double differential pressure-free distributor DDV for connecting a mixed heating circuit, external heating support and optional hot water preparation.

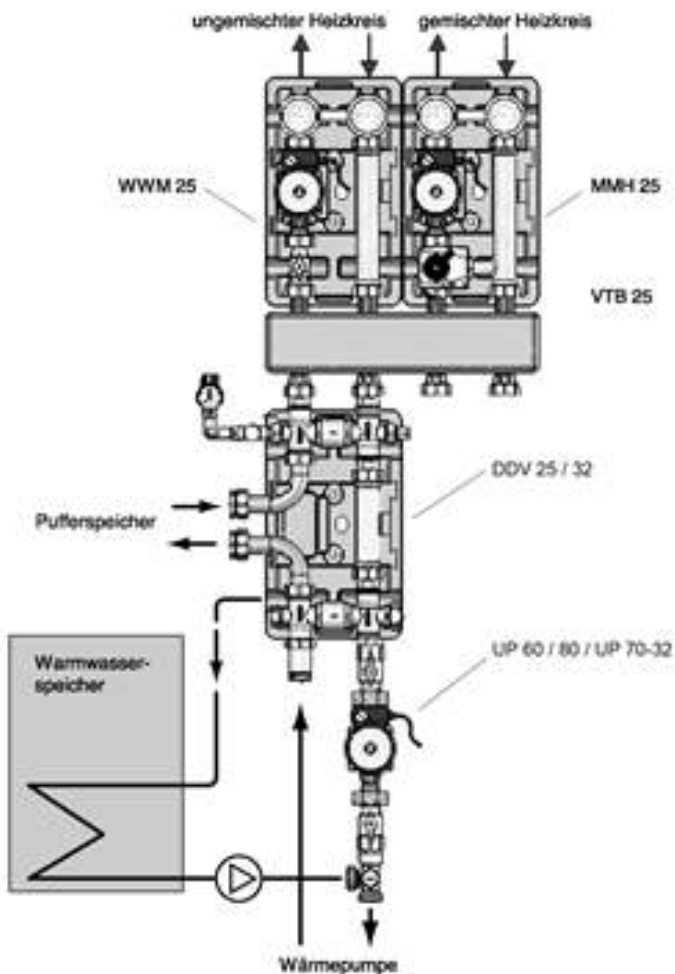


Fig.8.16: Integration of the double differential pressure-free distributor for heating operation and hot water preparation

NOTE

The installation height of the DDV 25 and DDV 32 including pumps is approx. 1 m!



NOTE

The DDV 25 and DDV 32 come with an NTC 10 return temperature sensor as an accessory.

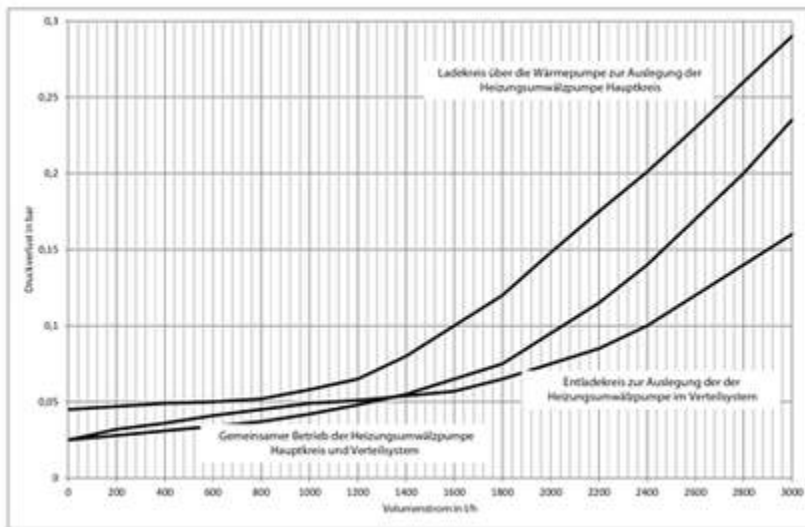


Fig.8.17: Volume flow / pressure loss diagram DDV 25 / DDV 32

8.4.3.2 Double differential pressureless distributors DDV 40 and DDV 50

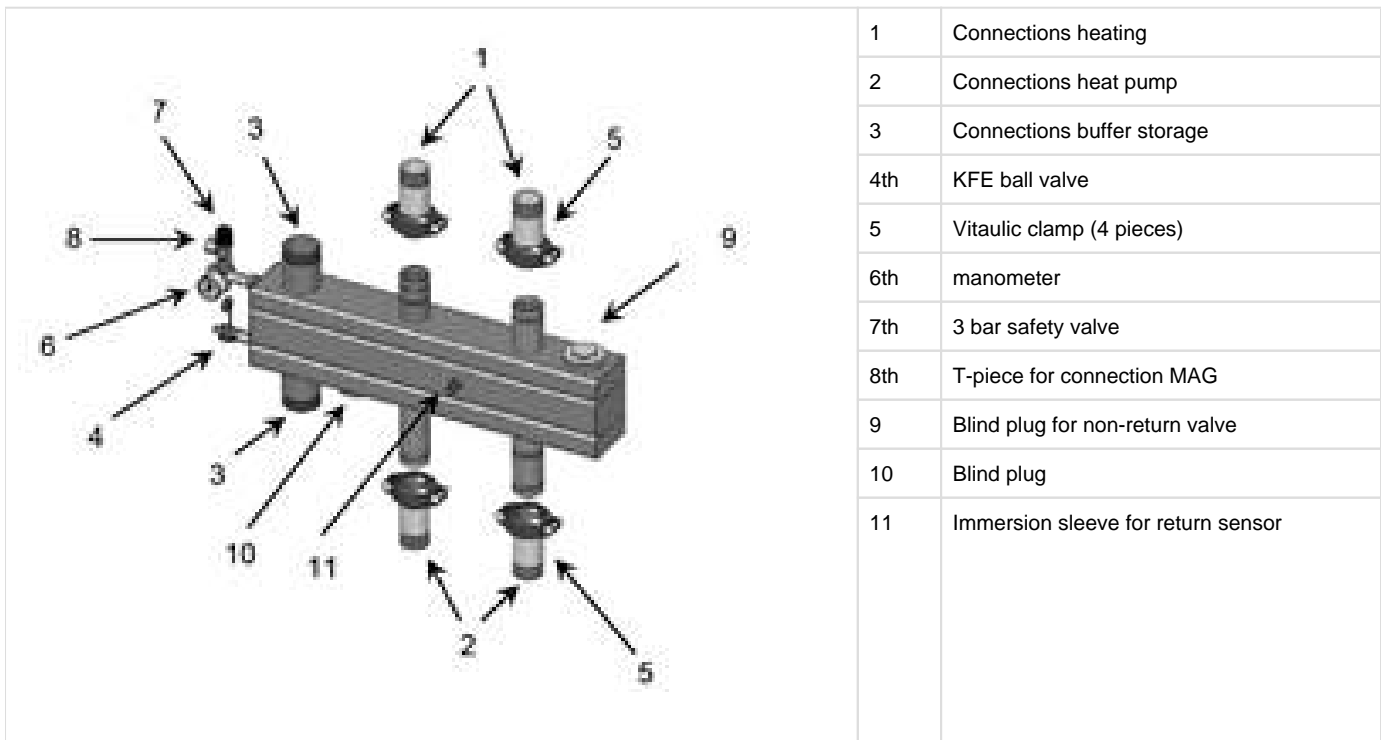


Fig. 8.18: Double differential pressure-free distributor DDV for connecting a mixed heating circuit, external heating support and optional hot water preparation.

	DDV 40	DDV 50
Connection heating	G 1 1/4 "	R 2 "
Connection of the heat pump	G 1 1/4 "	R 2 "
Connection buffer storage	R 2 "	R 2 1/2 "

Tab.8.6: Connections DDV 40 and 50

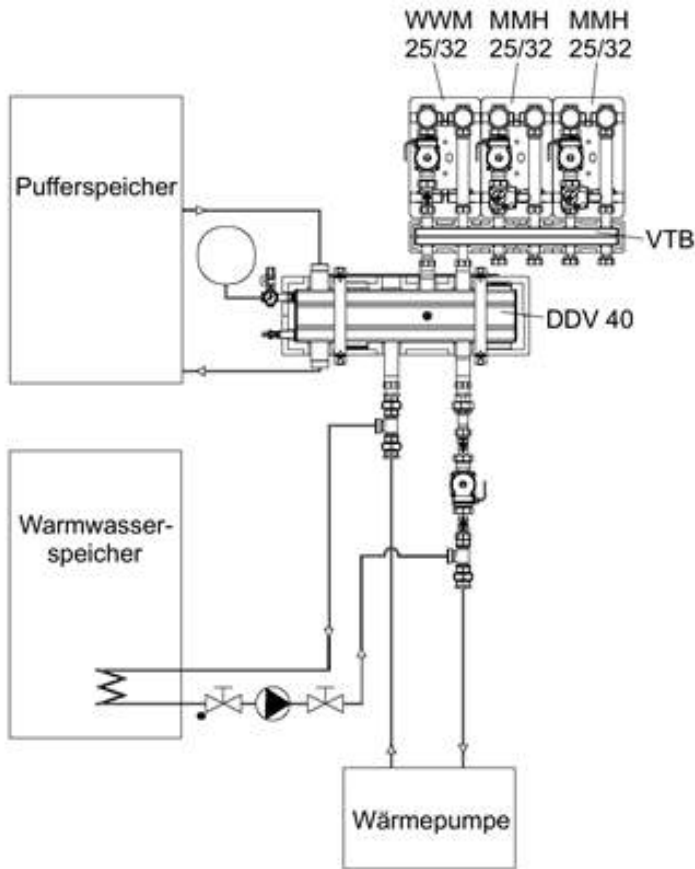


Fig.8.19: Integration of the double differential pressure-free distributor DDV 40 for heating operation and hot water preparation

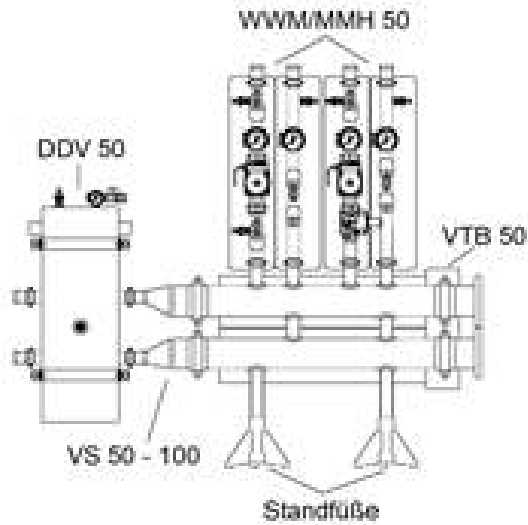
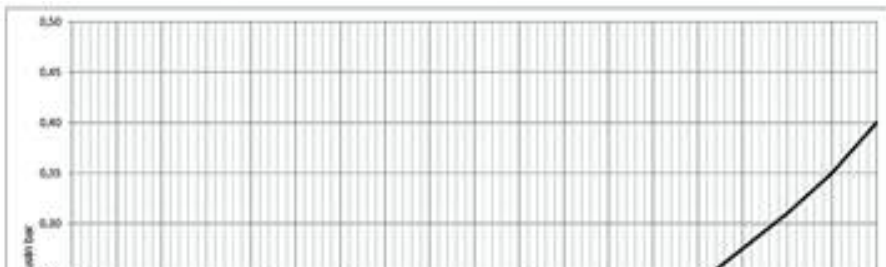


Fig. 8.20: Integration of the double differential pressure-free distributor DDV 50 for heating operation and hot water preparation



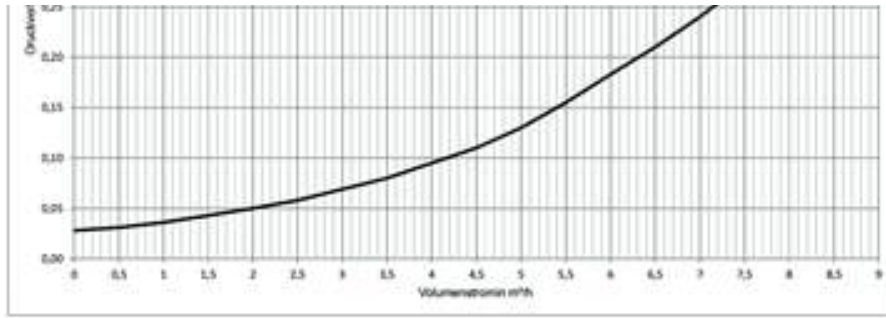


Fig.8.21: Pressure loss diagram DDV 40 and DDV 50

NOTE

The DDV 25 and DDV 32 come with an NTC 10 return temperature sensor as an accessory.

NOTE

The installation height of the DDV 40 and DDV 50 is around 0.8 m with a pump pitch of 180 mm.

8.5 Hydro tower and hydraulic tower

The hydro towers HWK 230, HWK 332 provide heat pump hydraulics in a very small space. It consists of a buffer tank and a hot water tank. The hydraulics, including components and pump assemblies for an unmixed heating circuit, each with a circulation pump in the generator and consumer circuit, are mounted in a compact and space-saving housing on the Hydro-Tower. The Hydro-Tower is connected to the heat pump via two hydraulic and one electrical connection lines. All electrical components such as circulation pumps, sensors and heating rods are pre-installed ready for use.

The hydraulic tower HPK 300 is suitable for heat pumps up to max. 35 kW and has a 300 liter buffer tank. The hydraulics including components and pump assemblies for an unmixed heating circuit with a circulation pump each in the generator and consumer circuit are mounted in a compact and space-saving housing on the storage tank. All electrical components such as circulation pumps, sensors and heating rods are pre-installed ready for use and are connected to the heat pump via pre-assembled and pre-wired electrical connection lines for the load and control circuit.

8.5.1 General characteristics of the Hydro Tower

Advantages of the Hydro-Tower:

- Little installation effort
- Good access to all components
- Integrated buffer storage reduces cycle cycles of the heat pump, resulting in higher system efficiency
- Integrated hot water storage tank with built-in flange heating (1.5 kW) for thermal disinfection
- The infinitely variable circulation pump in the heating circuit enables the output to be adjusted as required.
- (Switchable) pipe heating for heating support
- Optional immersion heater up to max. 6 kW
- Ready for connection, contains all essential components for pumps, barriers, safety technology and heat pump manager (HWK 230Econ5S / HWK 332Econ5S)

Hydraulic components of the Hydro-Tower:

- Buffer storage
- Hot water tank
- Double differential pressure-free distributor (HWK 332Econ5S) or overflow valve (HWK 230Econ5S)

Safety equipment of the Hydro-Tower:

- Safety valve, response pressure 2.5 bar
- Simple connection of the required expansion vessel possible (not included in the scope of delivery).

Electrical components of the Hydro Tower:

- Control box complete with heating contactor and connection terminals
- Heat pump manager (only Hydro-Tower HWK 332Econ5S and HWK 230Econ5S)
- 2. Heat generator as electrical pipe heating, heating output of 2, 4 to 6 kW (HWK 332Econ5S) or 2 kW (HWK 230Econ5S) protected by a safety temperature limiter
- Unmixed heating circuit including regulated circulation pump (stepless or 3 steps), shut-offs and non-return device
- Primary circuit heat generation including electronically controlled circulation pump, shut-offs (HWK 332Econ5S)

NOTE

The required expansion vessel and the associated pressure gauge are not included in the scope of delivery but must be ordered separately.

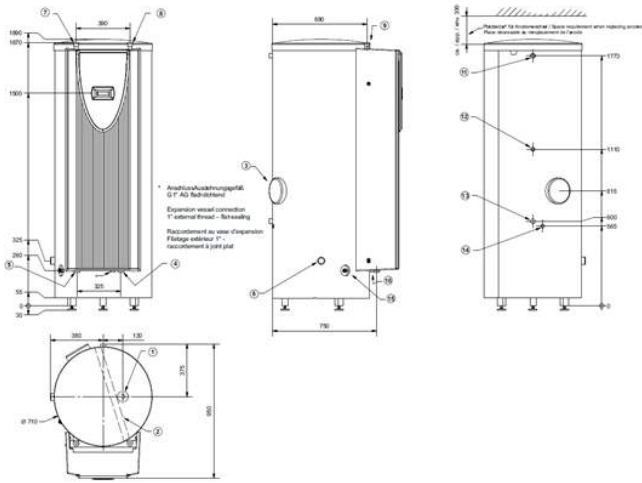


Fig.8.22: Structure of the Hydro-Tower HWK 332Econ (5S)

- ① Schutzanode
- ② Kabelkanal unter der Speichersitzdeckklappe oben
- ③ Elektro-Heizstab 1,5kW
- ④ Rücklauf zur Wärmepumpe G 1 1/4" AG flachdichtend
- ⑤ Vorlauf zur Wärmepumpe G 1 1/4" AG flachdichtend
- ⑥ G 1 1/2" (IG) für optionalen Anschluss Tauchheizkörper
- ⑦ Heizwasser-Rücklauf G 1 1/4" AG flachdichtend
- ⑧ Heizwasser-Vorlauf G 1 1/4" AG - flachdichtend
- ⑨ Kabeleinführung von oben
- ⑩ Kabeleinführung von unten
- ⑪ Warmwasser Austritt R 1" (AG)
- ⑫ Zirkulationsleitung G 3/4" (IG)
- ⑬ Kaltwasser-Zulauf R1" (AG)
- ⑭ Leerrohr Ø 22 (Leitungsdurchführung)
- ⑮ Füll - und Entleerungsahn 1/2" (incl. Schlauchteile)

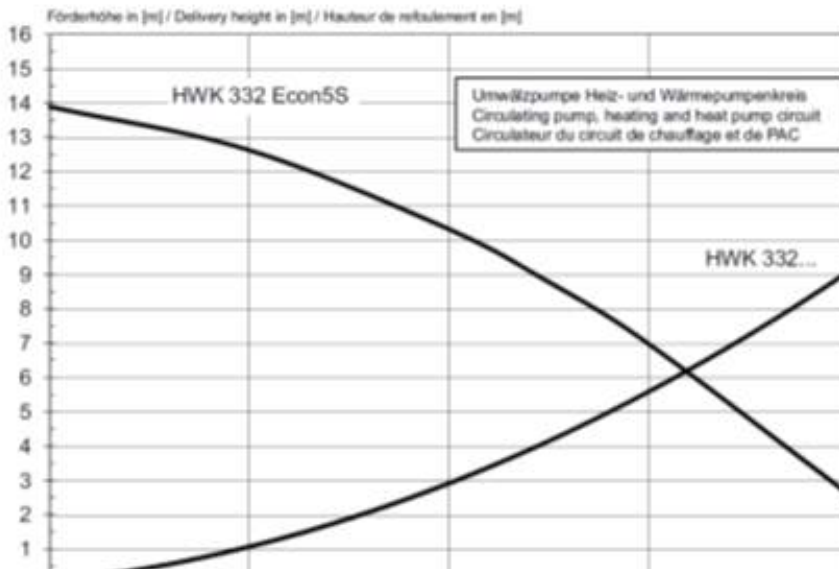




Fig.8.23: Pump and device characteristic curve, heating and heat pump circuit HWK 332Econ (5S)

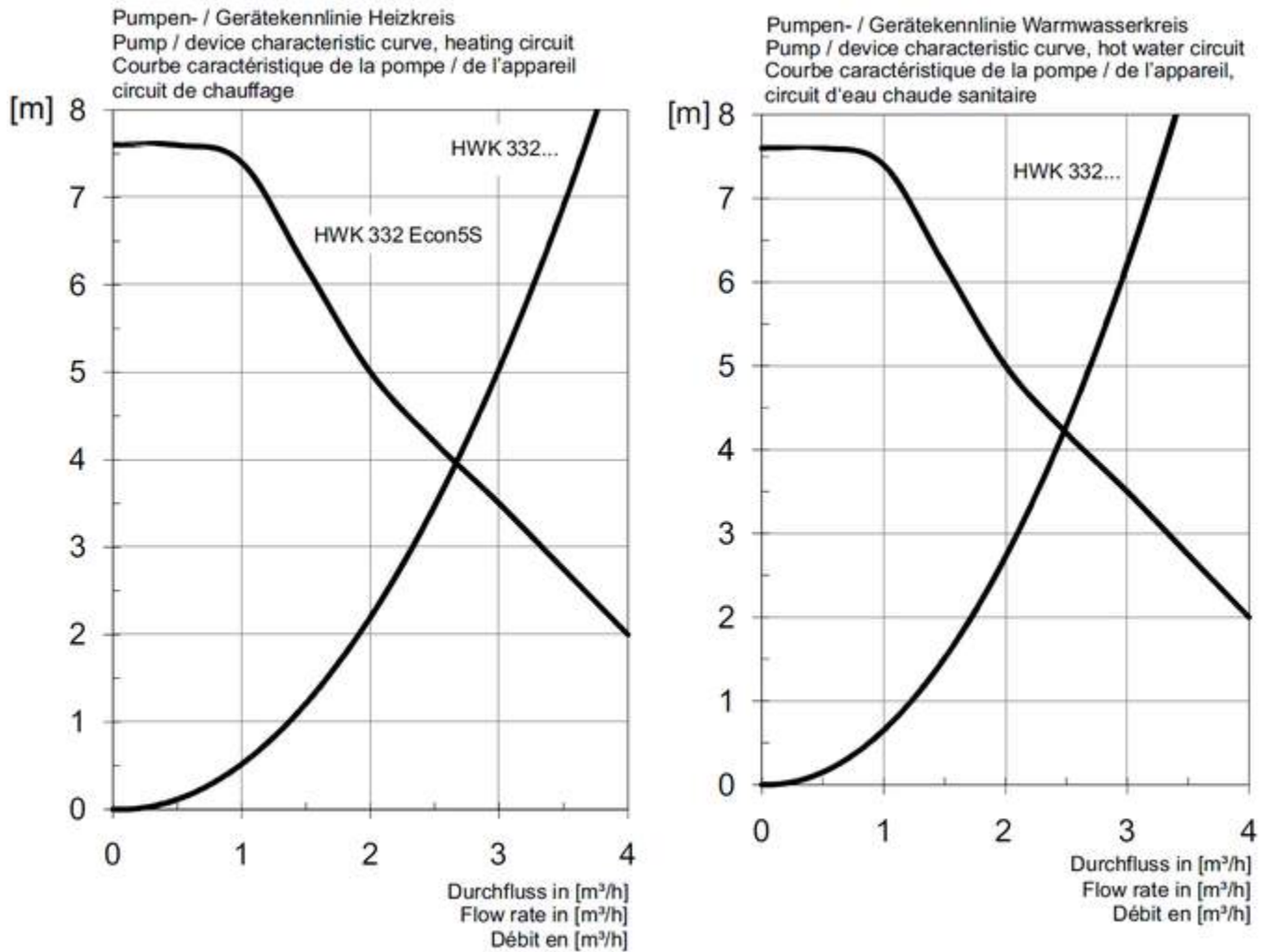
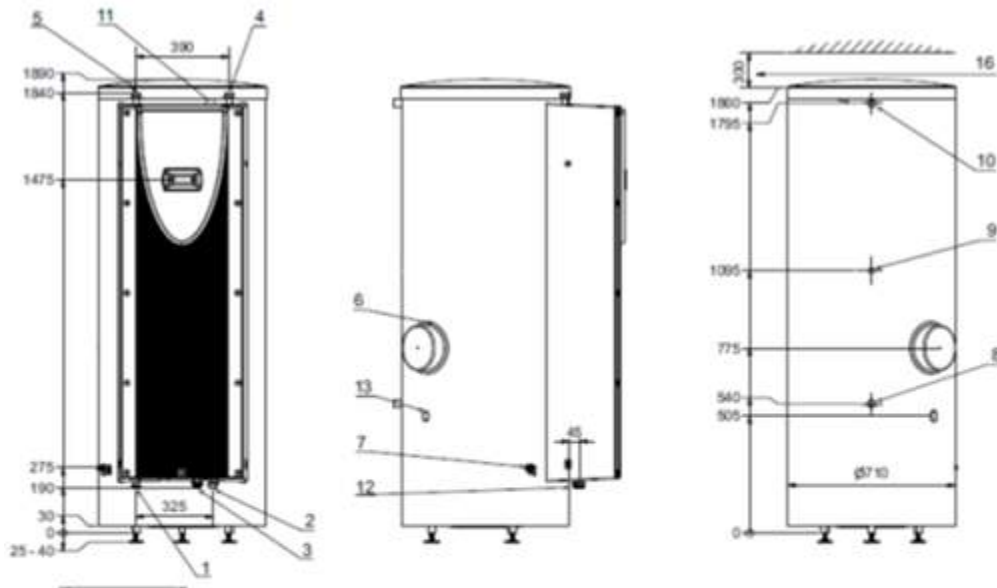


Fig.8.24: Pump and device characteristics - heating circuit - hot water circuit HWK 332 Econ5S



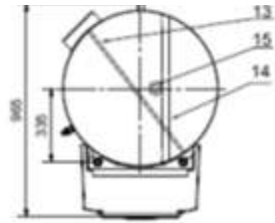


Fig.8.25: Dimensions HWK 332 (Econ5S)

1	Rücklauf - zur Wärmepumpe G 1" AG fachedelnd
2	Vorlauf - von der Wärmepumpe G 1" AG fachedelnd
3	Anschluss Ausdehnungsgefäß G 1" AG fachedelnd
4	Heizwasser - Vorlauf G 1" AG fachedelnd
5	Heizwasser - Rücklauf G 1" AG fachedelnd
6	Elektroheizung
7	Füll- und Entleerungshahn (mit Schlauchkappe)
8	Kaltwasser - Zulauf R 1" AG
9	Zirkulationsleitung G 3/4" IG
10	Warmwasser - Austritt R 1" AG
11	Kabeleinführung von oben
12	Kabeleinführung von unten
13	Leerschraube (Lastbelüftung intern)
14	Kabelkanal (unter Speicherabdeckung)
15	Korrosionsschutzanode
16	Platzbedarf für Schutzanodenwechsel

Fig.8.26: Legend to Fig.8.25

8.5.2 Possible uses of the HWK 332 / HWK 332 Econ5S hydro tower

The Hydro-Tower HWK is available in the variants Hydro-Tower HWK 332 (without heat pump manager) and Hydro-Tower HWK 230Econ5S or HWK 332 Econ5S (heat pump manager WPM Econ5Plus). The following table shows the possible combinations of heat pumps and hydro towers.

Order reference	For device type
HWK 332	LI 9-12TU, LI 11-20TES SI 6TU - SI 14TU WI 10TU, WI 14TU
HWK 332 Econ5S	LA 6S-TU - LA 18S-TU
HWK 332Econ5S with condensate tray	LA 6S-TUR - LA 18S-TUR
HWK 230Econ5S	LA 6 - 9S-TU

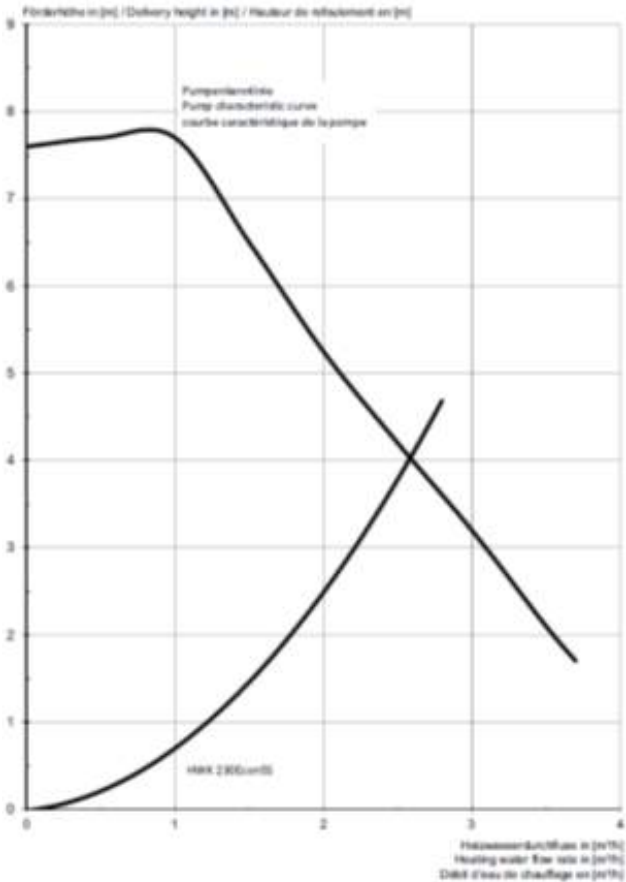


Fig.8.27: Pump and device characteristic curve, heating circuit HWK 230 Econ5S

Tab. 8.7: Possible combinations of Hydro-Tower and heat pump

NOTE

The required expansion vessel and the associated pressure gauge are not included in the scope of delivery and must be ordered separately.

8.5.3 General properties of the hydraulic tower

Advantages of the hydraulic tower:

- Little installation effort
- Good access to all components
- Integrated buffer storage reduces cycle cycles of the heat pump, resulting in higher system efficiency
- The infinitely variable circulation pump in the heating circuit enables the output to be adjusted as required.
- Immersion heater 6 kW for heating support integrated in the buffer tank
- Optional additional immersion heater up to max. 6 kW can be retrofitted
- Ready for connection, contains all essential components for pumps, barriers, safety technology
- Expansion module (pre-assembled) WWM HPK for connecting a hot water storage tank

Hydraulic components of the hydraulic tower:

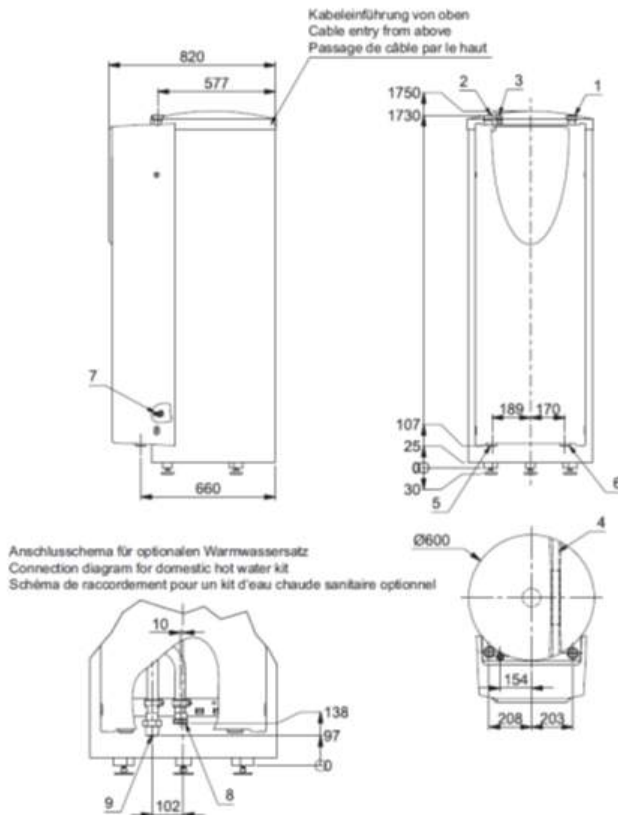
- Buffer storage 300 liters
- Double differential pressure-free manifold

Safety equipment of the hydraulic tower:

- Safety valve, response pressure 2.5 bar
- Simple connection of the required expansion vessel possible (not included in the scope of delivery)

Electrical components of the hydraulic tower:

- Control box complete with heating contactor, connection terminals and pre-wired electrical connection lines for the load and control circuit for easy connection to the heat pump
- Heat generator as immersion heater, heating output of 6 kW protected by a safety temperature limiter
- Unmixed heating circuit including regulated circulation pump (stepless or 3 steps), shut-offs and non-return device
- Primary circuit heat generation including electronically controlled circulation pump with PWM output signal, shut-offs



- ① Heizungsvorlauf Ausgang aus Speicher
1 1/2" Außengewinde
- ② Heizungsrücklauf Eingang in Speicher
1 1/2" Außengewinde
- ③ Anschluß Ausdehnungsgefäß
3/4" Außengewinde (verschlossen)
- ④ Durchführungsbereich Elektroleitungen
- ⑤ Vorlauf WP Eingang in Speicher
1 1/2" Außengewinde
- ⑥ Rücklauf WP Ausgang aus Speicher
1 1/2" Außengewinde
- ⑦ Füll- u. Entleerungshahn
1/2" (inkl. Schlauchtülle)
- ⑧ WW Vorlauf Ausgang aus Speicher
G 1 1/2" (verschlossen)

Fig.8.28: Structure of the HPK 300 hydraulic tower

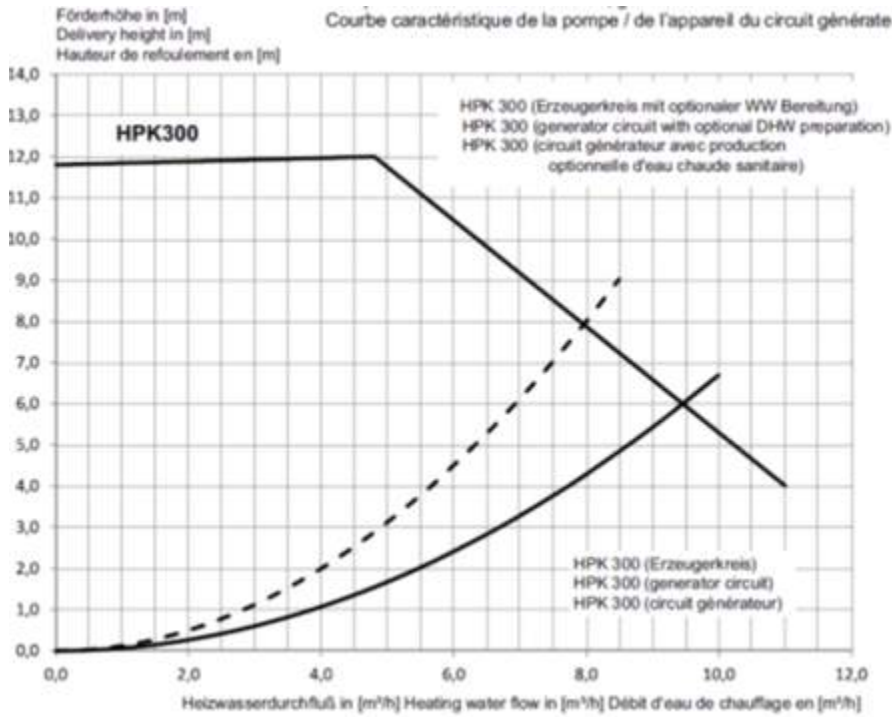


Fig.8.29: Pump / device characteristic curve generator circuit HPK 300

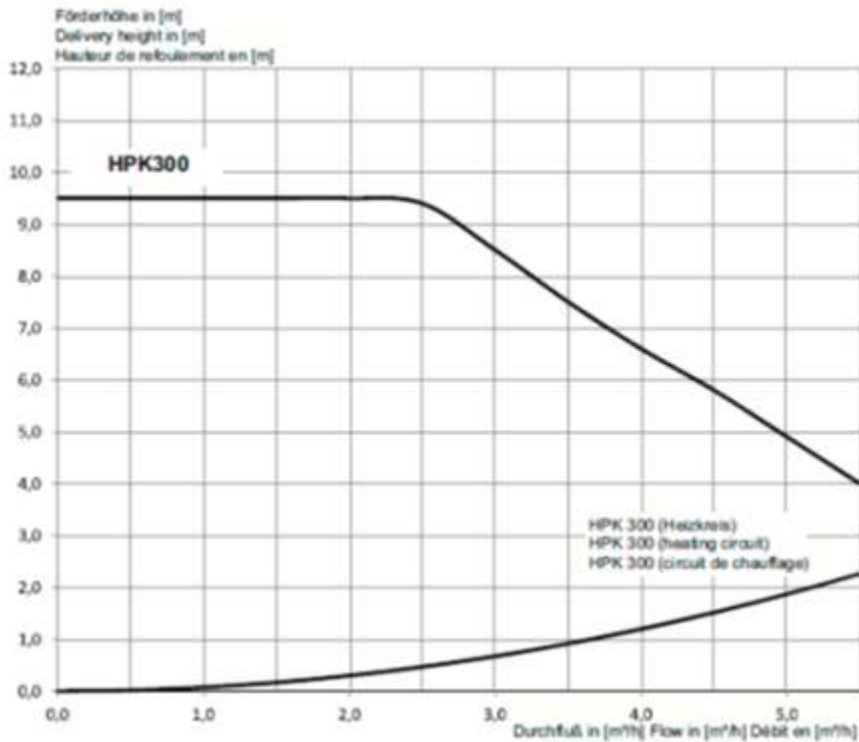


Fig.8.30: Pump / device characteristic curve for the HPK 300 consumer circuit

8.5.4 Possible uses of the HPK 300 hydraulic tower

The following table shows the possible combinations of heat pumps and hydraulic towers.

Order reference	For device type
HPK 300	LA 22-35TBS LI 20-28TH SI 18 - 35TU WI 18 - 35TU

Tab.8.8: Possible combinations of hydraulic tower and heat pump

NOTE

The required expansion vessel and the associated pressure gauge are not included in the scope of delivery but must be ordered separately.

8.6 Buffer storage

In the case of heat pump heating systems, an in-line buffer storage tank is recommended to ensure that the heat pump has a minimum running time of 6 minutes in all operating states.

Air-to-water heat pumps with defrosting via reverse circulation withdraw the defrosting energy from the heating system. To ensure defrosting, an in-line buffer storage tank must be installed in the flow of air / water heat pumps, in which the screw-in heating element is installed in mono-energetic systems.

In the case of air / water heat pumps with integrated pipe heating, it is possible to install the buffer storage tank in the heating return.

NOTE

When commissioning air / water heat pumps, the heating water must be preheated to the lower operating limit of at least 18 ° C to ensure defrosting.

ATTENTION

If a screw-in heater is installed in a buffer storage tank, it must be protected as a heat generator in accordance with DIN EN 12828 and equipped with a non-lockable expansion vessel and a type-tested safety valve.

In the case of brine / water heat pumps and water / water heat pumps, the buffer storage tank can be installed in the flow or, in the case of purely monovalent operation, also in the return.

Row buffer storage tanks are operated at the temperature level required by the heating system. They are not used to bridge blocking times but to ensure the minimum running time of the heat pump.

In the case of buildings of heavy construction or generally when using surface heating systems, the inertia compensates for any blocking times that may exist.

Time functions in the heat pump manager offer the option of programming an increase in the return temperature in advance if there are fixed blocking times. This is used to compensate for blocking times.

NOTE

Recommended content of the row buffer cylinder approx. 10% of the heating water throughput of the heat pump per hour. For heat pumps with two output levels, a volume of approx. 8% is sufficient, but should not be more than 30% of the heating water throughput per hour.

Example: heating water flow rate 0.9 m³/h corresponds to a recommended buffer volume of 90 liters

Oversized buffer storage tanks lead to longer compressor runtimes. In the case of heat pumps with two output levels, this can lead to unnecessarily short runtimes for the second compressor.

ATTENTION

Buffer tanks are not enamelled and must therefore never be used for domestic water heating.

8.6.1 Heating systems with individual room control

The individual room control (regulation in Germany according to ENEV - Energy Saving Ordinance) enables the desired room temperature to be adjusted without changing the heating curve settings in the heat pump manager. If the target room temperature set on the room temperature controller is reached, the valves of the individual consumers / heating circuits close so that the heating water no longer flows through the rooms.

If the volume flow is reduced by closing individual heating circuits, part of the heating water throughput flows through the overflow valve or the pressure-free distributor. This increases the return temperature and the heat pump switches off.

In systems with insufficient heat consumption or without a buffer tank, the heat pump is switched off before all rooms have been sufficiently heated. The start-up of the heat pump is limited to three cycles per hour due to the EVU conditions (switching cycle lock).

In systems with a buffer storage tank, the increase in the return temperature is delayed due to the flow through the storage tank. If the storage tank is connected in series, there are no increased system temperatures and therefore no deterioration in efficiency, which ultimately leads to a higher annual coefficient of performance. The larger circulated heating water volume results in longer running times and thus fewer compressor starts.

NOTE

A row buffer storage tank increases the circulated heating water volume and guarantees operational reliability, even if only individual rooms require heat.

8.6.2 Heating systems without individual room control

With plants **without individual room regulations** (In Germany, individual room control is required, e.g. by EnEV), the buffer storage tank can be dispensed with for brine / water and water / water heat pumps if the individual heating circuits are sufficiently large so that the minimum running time of the compressor of approx. 6 minutes is ensured in the transition period when there is little heat demand.

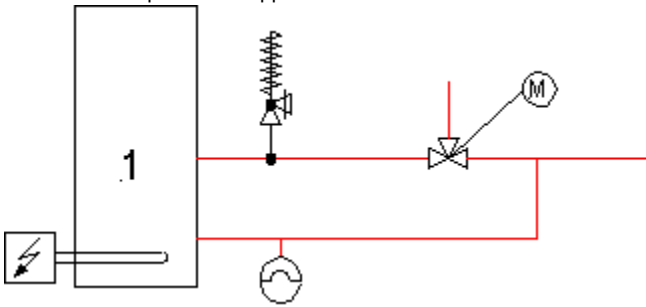


Fig.8.31: Heating system with constantly regulated buffer storage

8.6.3 Overview of PSP and PSW buffer tanks

mass and weight	unit	PSP 50E ³	PSP 100U	PSP 120U	PSP 140U	PSP 300U	PSW 100	PSW 200	PSW 500	PSW 1000	PSP 1000K ⁴ _{th}
Nominal content	l	50	100	120	140	300	100	200	500	1000	1000
diameter	mm						512	600	700	790 (990 ²)	790 (1000 ²)
height	mm	680	550	600	600	850	850	1300	1950	1983	2067
broad	mm	438	650	960	750	1000					
depth	mm	380	653	780	850	850					
Heating water return	customs	R 1 "	1¼ "AG	1¼ "AG	1 "AG	G 1 ½ "AG	1 "IG	1¼ "F.	2 x 2½ "	G 2 ½ "IG	G 2 ½ "IG
Heating water flow	customs	R 1 "	1¼ "AG	1¼ "AG	1 "AG	G 1 ½ "AG	1 "IG	1¼ "F.	2 x 2½ "	G 2 ½ "IG	G 2 ½ "IG
Allowable Operating pressure	bar	3	3	3	3	3	3	3	3	3	6th
Maximum Storage temperature	° C	95	95	95	95	95	95	95	95	95	95
Leveling feet (adjustable)	piece			4th	4th	4th		3	3	3	
Heating rod inserts 1 ½ "IG	number		1	1	2	3	2	3	3	6th	6th
Max. Heating output per heating rod	kW		7.5	9	9	9	4.5	6th	7.5	9	9
Flange DN 180	number								1		
Heat loss ¹	kWh / 24h	0.91	1.8	2.1	1.5	1.37	1.8	2.1	3.2	4.8	3.3
weight	kg	25th	54	72	72	124	55	60	115	125	120

1 room temperature 20 ° C; Storage temperature 65 ° C, 2 with insulation, 3 wall-hung, 4 cold storage completely insulated with Armaflex

Table 8.9: Technical data for PSP and PSW buffer tanks

NOTE

According to Article 3, Paragraph 3 of the European Pressure Equipment Directive, buffer and hot water storage tanks are not allowed to carry a CE mark. There it says, among other things, "Pressure equipment and / or assemblies ... must be designed and manufactured in accordance with the good engineering practice applicable in a member state so that it is guaranteed that they can be used safely."

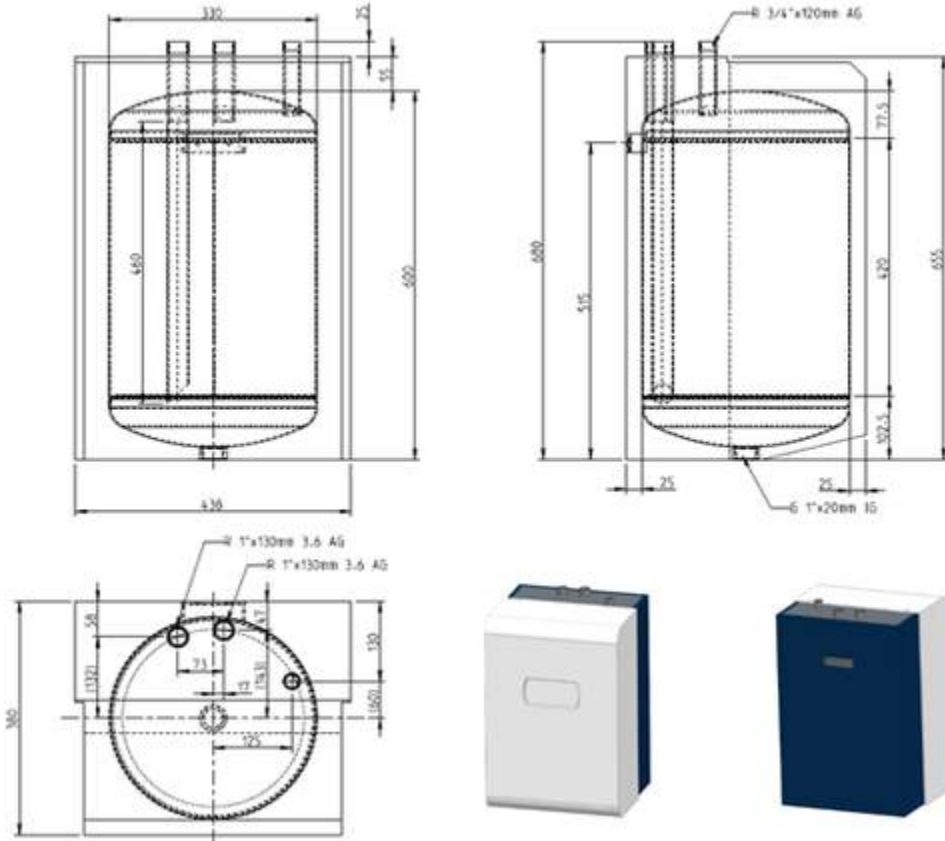


Fig.8.32: Dimensions of the wall-mounted PSP 50E buffer tank

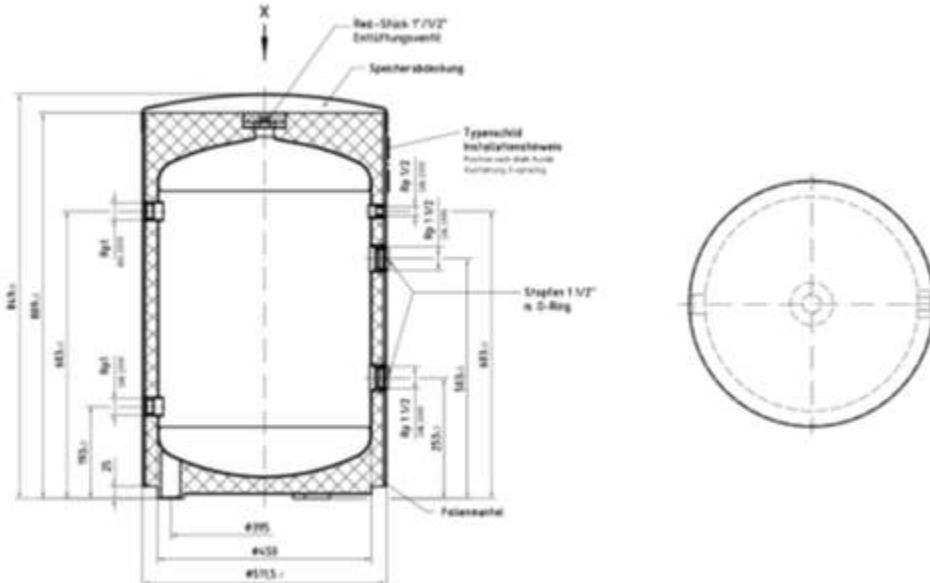


Fig.8.33: Dimensions of the PSW 100 free-standing buffer tank

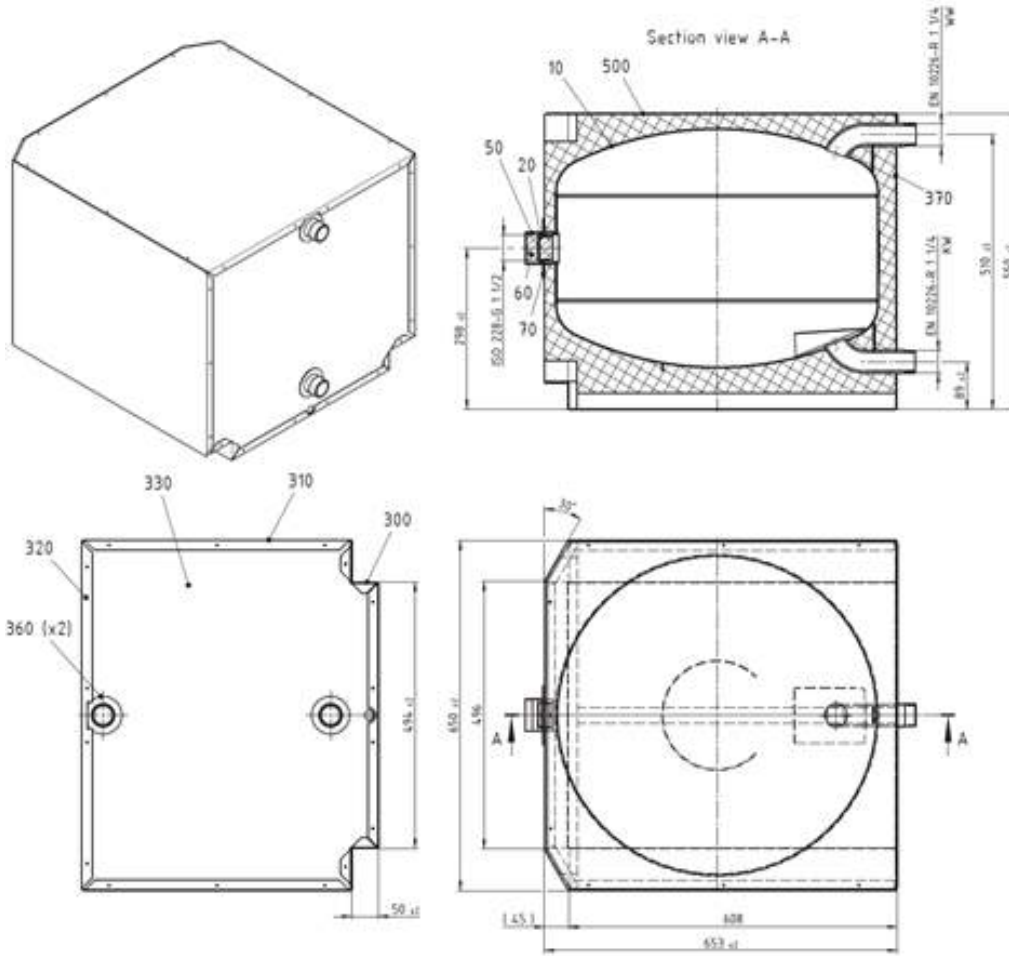


Fig.8.34: Dimensions of the PSP 100U buffer storage tank for the brine / compact heat pump

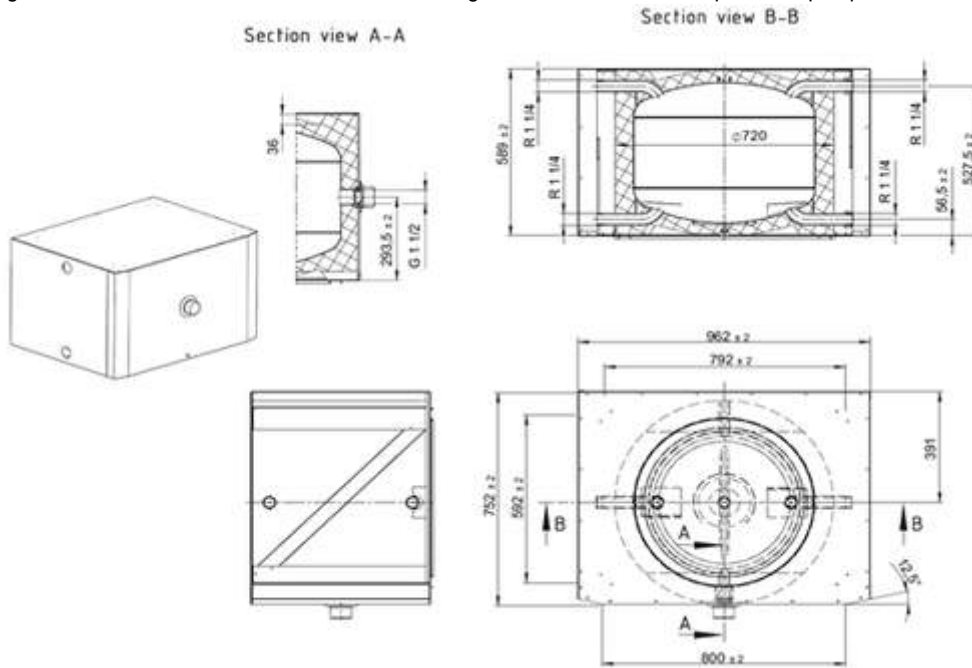


Fig.8.35: Dimensions of the PSP 120U buffer storage tank for indoor air / water heat pumps



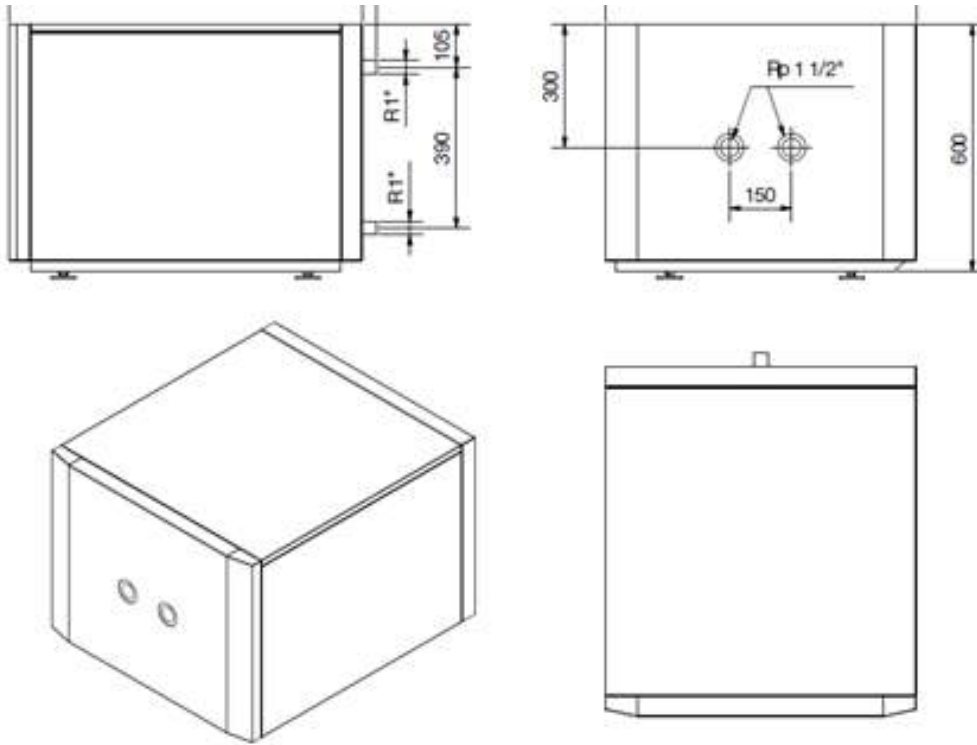


Fig.8.36: Dimensions of the PSP 140U buffer storage tank for indoor air / water heat pumps

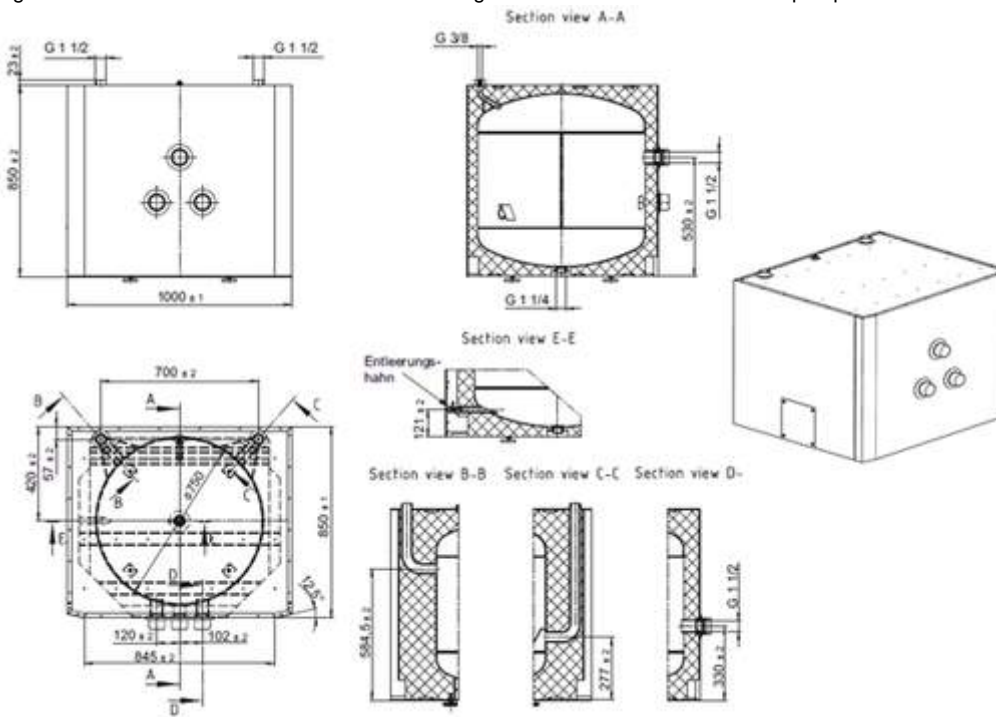


Fig.8.37: Dimensions of the PSP 300U storage tank below



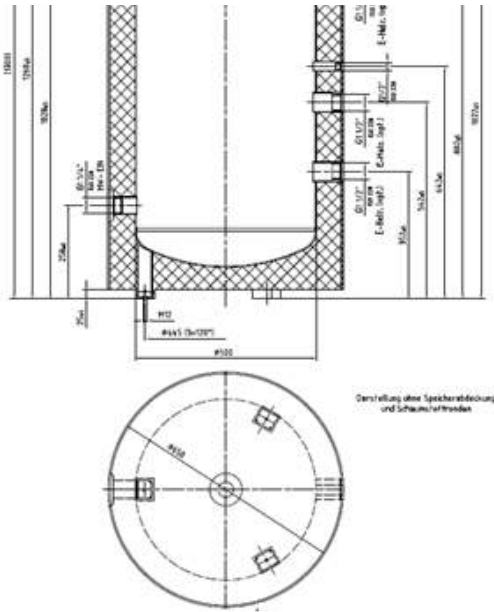


Fig.8.38: Dimensions of the PSW 200 buffer tank

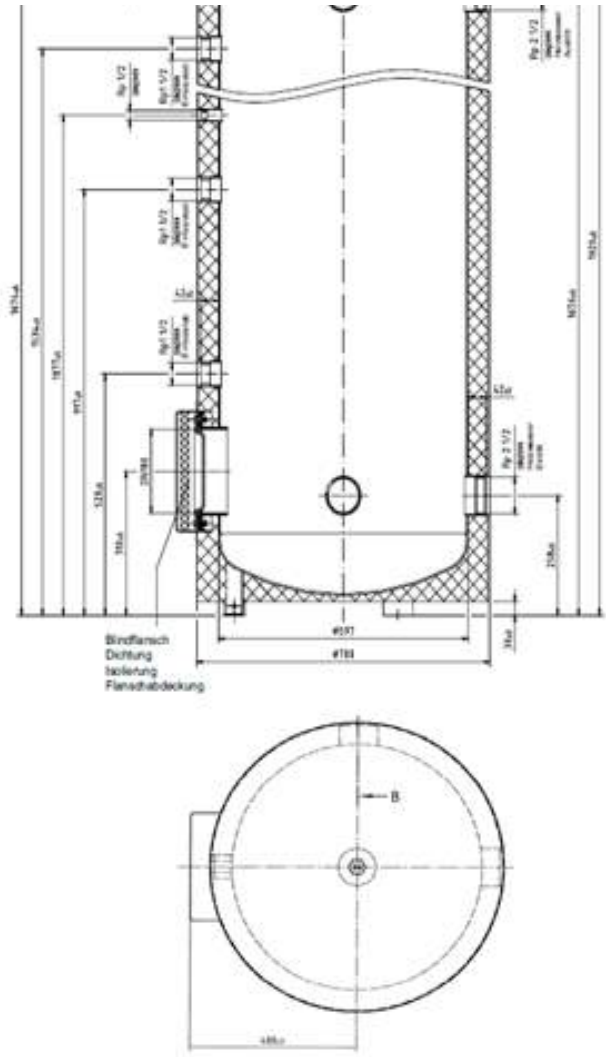
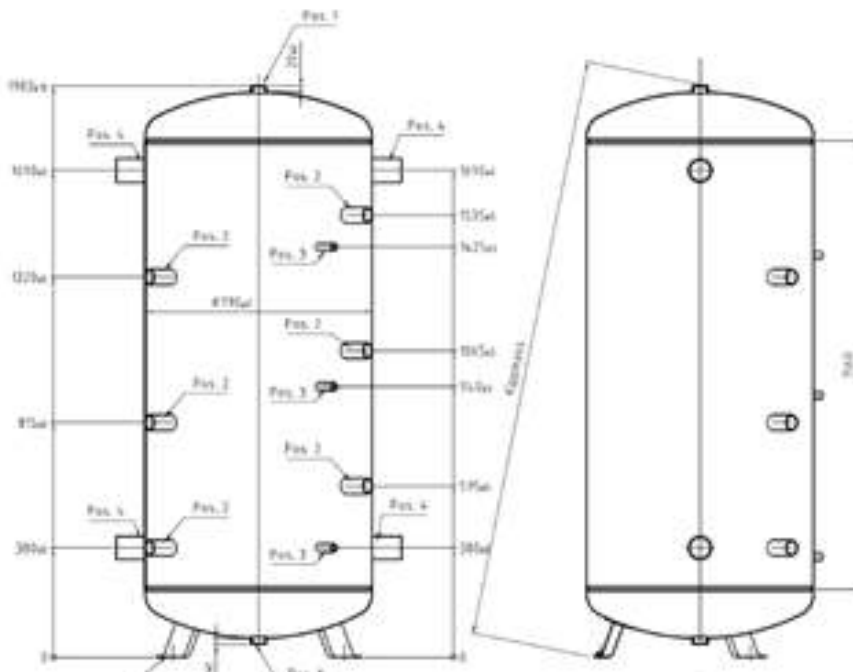


Fig.8.39: Dimensions of the PSW 500 buffer tank



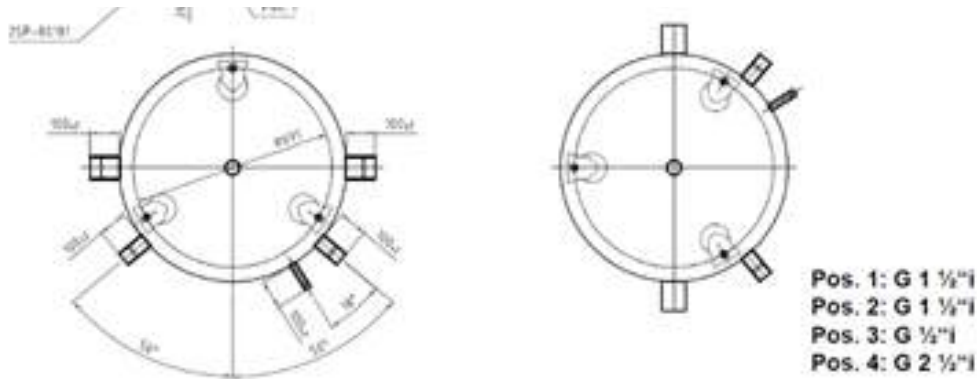


Fig.8.40: Dimensions of the PSW 1000 buffer tank

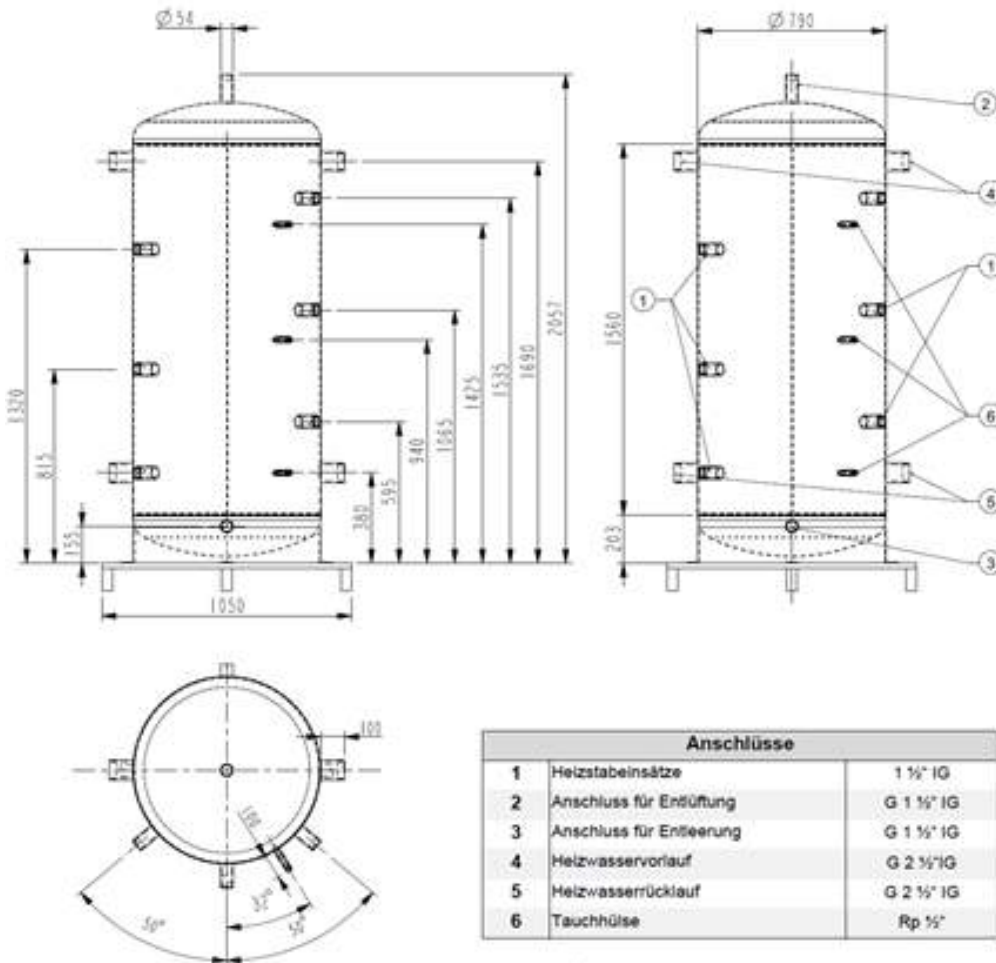


Fig.8.41: Dimensions of the cold storage tank PSP 1000K

8.7 Floor flow temperature limitation

Underfloor heating pipes and screeds must not be heated above 55 ° C. In order to ensure this, the maximum flow temperature must be limited in the case of bivalent system operation or when the buffer tank is externally loaded.

NOTE

If a mixer is used in the floor heating circuit or in bivalent-renewable operation, the mixer is closed if the temperature is too high. A safety temperature monitor (thermostat) prevents increased system temperatures due to mixer inertia or if the mixer fails.

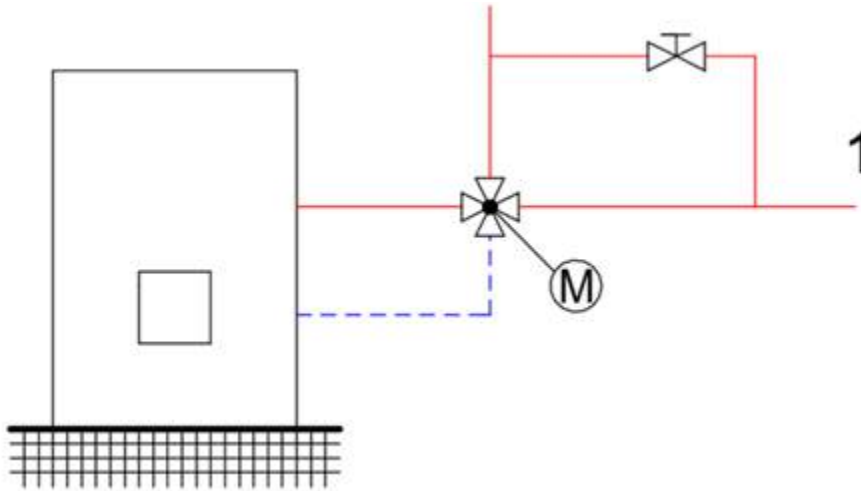


Fig. 8.42: Bypass circuit to protect the maximum. Flow temperature

8.8 Mixer for the bivalent fossil or regenerative operation of the heat pump

The mixer is closed when the heat pump is in operation only, is in the "0" or "closed" position (for the boiler) and directs the heating water from the heat pump past the boiler. This prevents unnecessary downtime losses. The mixer is to be dimensioned for the boiler output and the flow rate.

The mixer motor must have a running time between 60 and 240 seconds and is controlled by the heat pump manager (running time adjustable).

NOTE

The volume flows of the heat pump and the second heat generator must be coordinated with one another. It is particularly important to ensure that the outputs of the two heat generators are roughly the same (max. 25% deviation is permissible) in order to ensure energy-efficient and trouble-free operation.

8.8.1 Four-way mixer

The four-way mixer is generally recommended for bivalent fossil systems in combination with oil or gas boilers (e.g. MMB 25, MMB 32). When using a fixed-value boiler, the 4-way mixer adds the required heating energy to the flow of the heat pump as required (output level 3). If a sliding controlled boiler is used, weather-compensated, the 4-way mixer acts like a switch valve.

NOTE

In the case of a weather-compensated boiler, the heating curves of the two heat generators must be coordinated with one another.

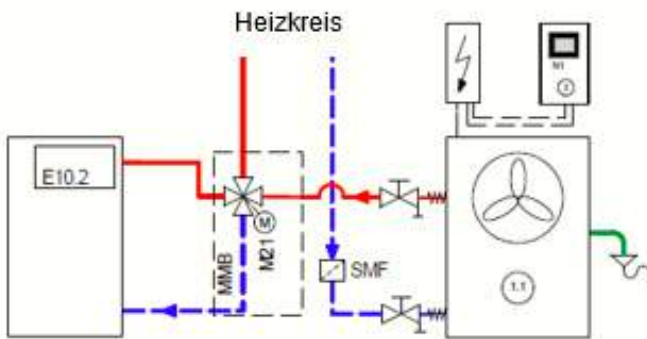


Fig.8.43: 4-way mixer for bivalent operation of the heat pump (oil or gas boiler)

8.8.2 Three-way mixer

The three-way mixer is used to control individual heating circuits and to integrate low-temperature or condensing boilers with burner control (e.g. "sliding boiler").

Lower temperatures may flow through these heat generators. The three-way mixer therefore serves as a switchover fitting. It is completely closed with pure heat pump operation (prevents standstill losses) and completely open with bivalent fossil systems.

In addition, the 3-way mixer is used for the use of renewable energies from buffer storage tanks, here the 3-way mixer regulates depending on the required flow temperature (heating operation or hot water requirement).

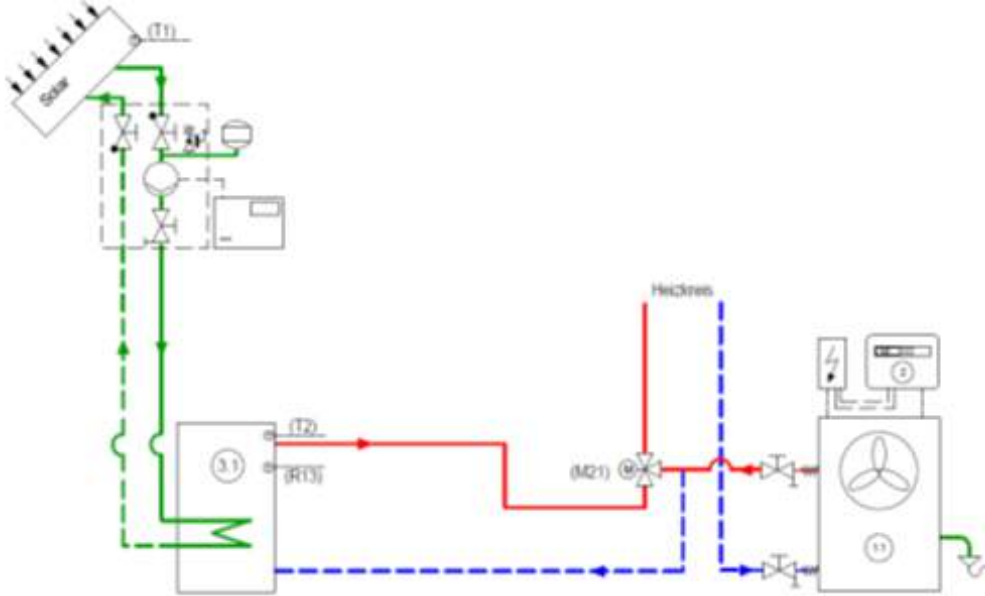


Fig.8.44: 3-way mixer for bivalent operation of the heat pump (switching example for heating operation with a solar thermal system)

NOTE

A 3-way solenoid valve is not recommended as it does not work reliably in this function and switching noises can be transferred to the heating system.

8.9 Water quality in heating systems

8.9.1 Stone formation

Stone formation in heating systems cannot be avoided, but is negligibly low in systems with flow temperatures below 60 ° C. With high-temperature heat pumps and especially with bivalent systems in the large output range (combination heat pump + boiler), flow temperatures of 60 ° C and more can be achieved. A preferred method of preventing stone formation is softening, as it permanently removes the alkaline earths (calcium and magnesium ions) from the heating system. Therefore, the fill and top-up water according to VDI 2035 - Sheet 1 should meet the following guideline values. The values of the total hardness can be taken from the table.

NOTE

The specific volume of a heating system must be determined before the system is filled.

Total heating capacity in [kW]	Total alkaline earths in mol / m ³ (Total hardness in ° dH)		
	20 l / kW	> 20 l / kW and 40 l / kW	> 40 l / kW
specific system volume in l / kW heating output			
50 specific water content heat generator 0.3l per kW	no	3.0 (16.8 ° dH)	<0.05 (0.3 ° dH)
50 specific water content heat generator < 0.3l per kW	3.0 (16.8 ° dH)	1.5 (8.4 ° dH)	
> 50 - 5200	2.0 (11.2 ° dH)	1.0 (5.6 ° dH)	
> 200 - 600	1.5 (8.4 ° dH)	<0.05 (0.3 ° dH)	
> 600	<0.05 (0.3 ° dH)		

Heating water, electrical conductivity dependent on heating output

Low-salt operation: > 10 µS / cm to > 100 µS / cm

salty operating mode: > 100 µS / cm to > 1500 µS / cm

Tab.8.10: Guide values for fill and top-up water according to VDI 2035

ATTENTION

When using fully demineralized water, make sure that the pH value does not fall below the minimum permissible value of 8.2 for steel (7.5 minimum permissible value for copper). Falling below this level can lead to the destruction of the heat pump (without aluminum alloy materials in the system: pH value 8.2 to 10.0, with aluminum alloys pH value 8.2 to 9.0).

8.9.2 Corrosion

For systems with an above-average specific system volume of 50 l / kW, VDI 2035 recommends the use of partially / fully demineralized water.

These measures (e.g. pH stabilizer) are taken to adjust the pH value of the heating water in order to minimize the risk of corrosion in the heat pump and in the heating system.

Regardless of legal requirements, the following limit values in the heating water used for various ingredients must not be exceeded or fallen below in order to ensure safe operation of the heat pump. To do this, a water analysis must be carried out before the system is commissioned. If the water analysis results in a "-" for a maximum of one indicator or an "o" for a maximum of two indicators, the analysis is to be assessed as negative.

Assessment criterion	Concentration range (mg / l or ppm)	stainless steel	copper
Bicarbonate (HCO ₃ ⁻)	<70	+	O
	70-300	+	+
	> 300	+	o / +
Sulfates (SO ₄ ²⁻)	<70	+	+
	70-300	+	O/-
	> 300	O	-
HCO ₃ ⁻ / SO ₄ ²⁻	<1.0	+	+
	> 1.0	+	O/-
electrical conductivity	<10 µS / cm	+	O
	10-500 µS / cm	+	+
	> 500 µS / cm	+	O
PH value	<6.0	O	O
	6.0-7.5	o / +	O
	7.5-9.0	+	+
	> 9.0	+	O
Ammonium (NH ₄ ⁺)	<2	+	+
	2-20	+	O
	> 20	+	-
Chloride ions (Cl ⁻)	<300	+	+
	> 300	O	o / +
Chlorine (Cl ₂)	<1	+	+
	1-5	+	O
	> 5	o / +	O/-
Hydrogen sulfide (H ₂ S)	<0.05	+	+
	> 0.05	+	O/-
Carbon dioxide (CO ₂)	<5	+	+
	5-20	+	O
	> 20	+	-

Nitrates (NO ₃ ⁻)	<100	+	+
	> 100	+	O
Iron (Fe)	<0.2	+	+
	> 0.2	+	O
Aluminum (Al)	<0.2	+	+
	> 0.2	+	O
Manganese (Mn)	<0.1	+	+
	> 0.1	+	O

Table 8.11: Limit values for the quality of heating water

Resistance of copper-brazed or welded stainless steel plate heat exchangers to substances contained in water:

Remarks

- "+" = usually good resistance
- "o" = Corrosion problems can arise, especially if several factors are rated "o"
- "-" = not to be used

i NOTE

The water quality must be checked again after 4 to 6 weeks, as it may change due to chemical reactions during the first few weeks of operation.

8.10 Impurities in the heating system

When installing a heat pump in existing or newly installed heating systems, the system must be flushed to remove deposits and suspended matter.

Dirt particles, magnetite, hematite and lime can reduce the heat emission, impede the flow, clog heat exchangers, valves, pipes and (electrical) components or block circulation pumps. This leads, for example, to unwanted safety shutdowns or, in the worst case, to total failure of the heat pump.

Oxygen penetration into the heating water forms oxidation products (rust). In addition, the heating water is often contaminated by residues of organic lubricants and sealants.

i NOTE

To ensure the required heating water quality over the long term, we recommend the use of so-called sludge and magnetite separators, which physically remove the metallic particles (rust) and the finest sludge caused by corrosion.

Dirt separators must always be installed in the heating return, either directly in front of the heat generator or in front of the generator circuit pump.

The above-mentioned causes can individually or jointly lead to a reduction in the performance of the heat exchanger in the heat pump. In this case, e.g. B. the maximum flow temperature is no longer reached. In such cases, the heat exchanger must be chemically cleaned. The cleaning agents should be used with caution because of their acidity. In case of doubt, the manufacturers of the chemicals should be consulted!

In general, the heat pump must be disconnected from the heating system before cleaning. For this purpose, shut-off valves should be provided in the flow and return to prevent the heating water from leaking. The cleaning takes place directly at the heating connections of the heat pump.

! ATTENTION

In order to avoid consequential damage to the heating system, the heat pump must be neutralized with suitable agents after cleaning.

In heating systems in which steel components are used (e.g. pipes, buffer storage, boilers, distributors, etc.), there is always the risk that corrosion will occur due to excess oxygen. This oxygen enters the heating system e.g. via valves, circulation pumps or plastic pipes. We recommend installing an air bubble separator to ensure permanent ventilation of the heating system. This must always be integrated into the heating flow.

i NOTE

In the case of "old systems" (diffusion-open heating systems), the heating system can be equipped with an electrophysical corrosion protection system (e.g. Elector system).

8.11 Integration of additional heat generators

8.11.1 Constantly regulated boiler (mixer control)

With this type of boiler, the boiler water is always heated to a fixed temperature (e.g. 70 °C) when enabled by the heat pump manager. The set temperature must be set so high that hot water can also be generated via the boiler if required.

The control of the mixer is taken over by the heat pump manager, who requests the boiler if necessary and adds enough hot boiler water to achieve the desired return temperature or hot water temperature.

The boiler is requested via the 2nd heat generator output of the heat pump manager and the operating mode of the 2nd heat generator is to be coded as "constant".

NOTE

When the special program 2nd heat generator is activated, the boiler is kept at operating temperature for a freely selectable number of hours (max. 99 hours) after a request in order to prevent corrosion due to short running times.

8.11.2 Sliding controlled boiler (burner control)

In contrast to a constantly regulated boiler, the slidingly regulated boiler directly supplies the heating water temperature corresponding to the outside temperature. The switching valve has no control function, but only the task of routing the heating water flow past the boiler circuit or through the boiler, depending on the operating mode. In pure heat pump operation, the heating water is routed past the boiler in order to avoid losses due to heat radiation from the boiler.

To do this, the control of the boiler is to be connected to the output of the 2nd heat generator of the heat pump manager and the operating mode of the 2nd heat generator to be coded as "sliding". The characteristic of the 2nd heat generator is set accordingly for the heat pump manager.

NOTE

With a bivalent system, no additional immersion heater for heating support (E10.1) can be controlled.

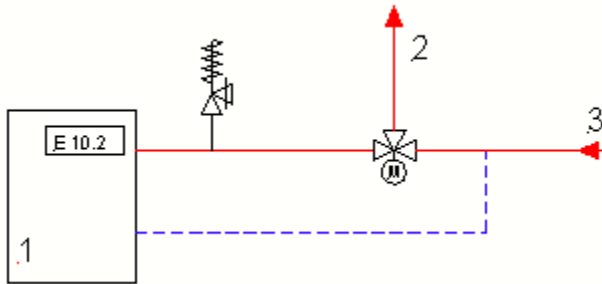


Fig.8.45: Circuit diagram for sliding controlled boiler operation

8.11.3 Regenerative heat generator

The heat pump manager provides its own operating mode to integrate regenerative heat generators such as solid fuel boilers or solar thermal systems. In the pre-configuration, the so-called "Bivalent-Regenerative" operating mode can be selected. In this operating mode, the heat pump heating system behaves like a monoenergetic system; in the event of regenerative heat accumulation, the heat pump is automatically blocked and the regeneratively generated heat is added to the heating system. The mixer outputs of the bivalence mixer are active.

If the temperature in the regenerative storage tank is sufficiently high, the heat pump is also blocked during hot water preparation or a swimming pool request.

The "bivalent-regenerative" function can be selected for all heat pumps up to the WPM Econ5 heat pump manager, provided that no 3rd heating circuit is used. Sensor R 13 is already in use here.

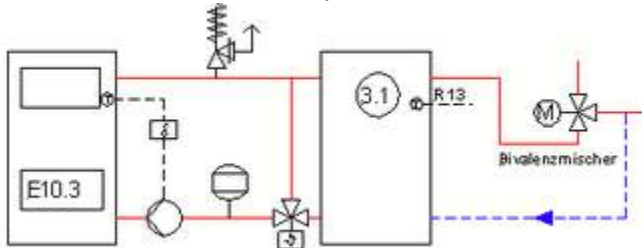


Fig. 8.46: Switching example for heating mode with a solid fuel boiler

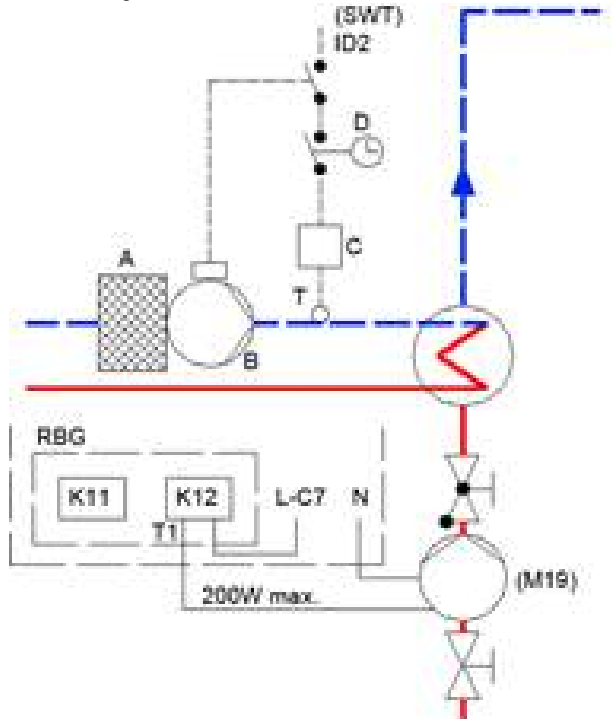
8.12 Swimming pool water heating

The hydraulic integration of the swimming pool water heating takes place parallel to the heating and hot water preparation. The swimming pool water is heated using a swimming pool heat exchanger (hydraulic integration, see Fig. 8.77, 8.78).

It is advisable to time control the swimming pool heating. The swimming pool request may only be forwarded to the heat pump manager if it is ensured that the swimming pool pump (M19) is running and the filter pump is switched on.

The transfer capacity of the heat exchanger must be related to the special features of the heat pump, e.g. max. flow temperatures of 55 °C and the minimum heating water throughput of the heat pump.

Not only the nominal output, but the structural design, the flow through the heat exchanger and the thermostat or sensor setting are decisive for the selection. In addition, the pool water design temperature (e.g. 27 °C) and the flow rate on the pool side must be taken into account when dimensioning.



A.	filter
B.	Filter pump
C.	Swimming pool controller (thermostat)
D.	Timer
M19	Swimming pool pump
RBG	Relay assembly

Fig. 8.47: Integration for swimming pool water heating with heat pumps with relay assembly

NOTE

The integration shown only applies to heat pumps with the WPM 2006/2007 heat pump manager.

NOTE

In heat pump heating systems in which the additional circulation pump M16 is not used (e.g. no distributor with no differential pressure, see chapter 8.4.3), this pump output can be used to control the swimming pool circulation pump. In the menu Settings - System Pump Control, only the setting ZUP for swimming pool has to be set to "Yes".

8.13 Integration of buffer storage tanks integrated in parallel using a demand sensor

In the case of heat pump systems that are operated with parallel buffer storage tanks, no clear statement can be made about the correct placement of the common return sensor due to the unclear flow conditions in the storage tank. It is possible to use an additional demand sensor R2.2 in addition to the return sensor R2 built into the heat pump. This can be activated during commissioning.

In all cases, the sequence of a request from the heat pump is the same. When the compressor and the additional circulation pump M16 are running, the return sensor R2 in the heat pump is evaluated. When the compressor and the additional circulation pump are not running, the demand sensor R2.2 is evaluated. If the demand sensor R2.2 reports a demand, the additional circulation pump M16 is started as before at a flushing time and the return sensor R2 is activated. If the return sensor R2 continues to recognize a request at the end of the flushing time, the compressor is started and the request is processed until the return sensor R2 has reached the return target temperature + hysteresis.

NOTE

Due to the inevitable mixing of flow and return in the parallel buffer storage, the heat pump must be operated with higher flow temperatures. Depending on the design of the storage tank, empirical values show a temperature loss of approx. 4 K in the flow to the

heating system. This leads to a loss of efficiency of approx. 2.5% per K.

Operation at the under application limit of the heat source

In order to achieve the maximum flow temperature specified in the device information, additional electrical heating should be installed after the buffer storage tank in order to avoid an increase in the return temperature.

8.14 Electronically controlled circulation pumps

8.14.1 Pump characteristics of electronically controlled pumps

Various electronically controlled heating circulation pumps are available for use in the heating circuit or for hot water preparation. Possible combinations of electronically controlled circulation pumps and hydraulic accessories in the generator circuit can be found in the following table.

Pump type	Nominal size	For accessories
UP 75-25PK	DN 25	KPV 25 DDV 25 WPG 25
UP 75-32PK	DN 32	DDV 32 WPG 32
UPH 80-25P	DN 25	DDV 25 KPV 25 WPG 25
UPH 90-25	DN 25	DDV 25 WPG 25
UPH 90-32	DN 32	DDV 32 DDV 40 WPG 32
UPH 120-32PK	DN 32	DDV 32 DDV 40 WPG 32
UPH 80-40F	DN 40	DDV 40 DDV 50
UPH 120-50F	DN 50	DDV 40 DDV 50

Tab.8.12: Electronically controlled circulation pumps for the heat generator circuit

Pump type	Nominal size	For accessories
UP 75-25PK	DN 25	WWM 25 MMH 25 WPG 25
UP 75-32PK	DN 32	WWM 32 MMH 32 WPG 32
UPE 70-25PK	DN 25	WWM 25 MMH 25 WPG 25
UPE 70-32PK	DN 32	WWM 32 MMH 32 WPG 32
UPE 100-25K	DN 25	WWM 25 MMH 25 WPG 25
UPE 100-32K	DN 32	WWM 32 MMH 32 WPG 32
UPE 120-32K	DN 32	WPG 32

UPH 120-32PK	DN 32	WPG 32
UPH 80-40F	DN 40	
UPE 120-50F	DN 50	WWM 50 MMH 50

Tab.8.13: Electronically controlled circulation pumps for the consumer circuit

ATTENTION

When installing electronically controlled circulation pumps in the generator circuit of an air / water heat pump with defrosting via circuit reversal, a flow switch is required that blocks the heat pump if the required minimum heating water flow rate is not reached. Otherwise there is a risk of damage to the heat pump during the defrosting process.

8.14.2 Conversion of existing systems

With commercially available electronically controlled circulation pumps, the volume flow or the speed of the pump is controlled via the pressure loss in the heating circuit. If the heating load drops in a building, the thermostatic valves of the heating circuit close and the pressure in the system increases. The electronically controlled circulation pump detects the pressure increase and regulates the volume flow accordingly (pressure constant control - p-c). This means that the minimum volume flow via the heat pump can no longer be guaranteed.

If the uncontrolled circulation pump has to be replaced with an electronically controlled circulation pump in an existing heating system with overflow valve, the hydraulic integration of the heat pump must be adapted. The minimum volume flow required in the device information of the heat pump must be ensured. There are the following options:

Installation of a distributor with no differential pressure

In this case, the existing overflow valve must be replaced by a double differential pressure-free distributor DDV (see Section 8.4.3). The DDV ensures the minimum volume flow even with closed heating circuits. The electronically controlled circulation pump is installed here as a circulation pump in the heating circuit. If the radiators are closed, the electronically controlled circulation pump reduces the volume flow. An additional circulation pump (M 16) is required for the constant volume flow in the generator circuit. This pump can either be controlled via the heat pump manager or operated at a constant speed.

Control of the additional M 16 circulation pump in the generator circuit via the heat pump manager

With the heat pump manager it is possible to control the electronically controlled circulation pump with a 0-10 volt or PWM (pulse width modulation) input signal. The prerequisite is that the electronically controlled circulation pump has a corresponding input signal. Depending on the required minimum volume flow and the circulation pump used, the corresponding parameters must be selected in the Pump control menu of the heat pump manager.

NOTE

In all cases, a hydraulic balance must be carried out after the conversion work has been completed and the controller settings of the heat pump manager checked.

The following table shows which energy-efficient, electronically controlled circulation pumps can replace previous uncontrolled circulation pumps.

Circulation pump Duration	Circulation pump New	comment
UP 60	UP 75-25PK	Coupling relay required
UP 80	UPH 90-25	Coupling relay required
UP 60-32	UP 75-25PK	Coupling relay required
UP 70-32	UPH 90-32	Coupling relay required

Tab.8.14: Recoding the circulation pump to electronic circulation pumps

For more information on the use of electronic pumps, including the electrical connection and characteristics, see Chapter 7.6 Energy-efficient circulation pumps

8.15 Hydraulic integration

The control of the heat pump system is identical for air, brine and water / water heat pumps, but the hydraulics differ in the integration of the heat source.

The integration schemes shown on the following pages are standard solutions for the most common applications. The individual components are controlled by the heat pump manager. In addition to the connection contacts, the dashed hydraulic components of the hot water distribution system can also be taken from the drawings. The maximum permissible heating water throughput must be observed (see Section 8.4).

Further integration schemes are available for download on the Internet.

8.15.1 Hydraulic integration for hot water preparation

There are basically two options for the hydraulic integration for hot water preparation.

NOTE

The hydraulic connections for hot water generation are independent of the operating mode (monovalent, monoenergetic, bivalent) or the heat source (air, brine, water). The integration is also independent of the hydraulic structure of the generating circuit of the heat pump system (overflow valve, DV or DDV).

8.15.1.1 Hot water generation via 3-way switch valve (YM 18)

A pump is used for heating and hot water preparation. The hot water preparation takes place via a 3-way switch valve. The valve is controlled via output M 18.

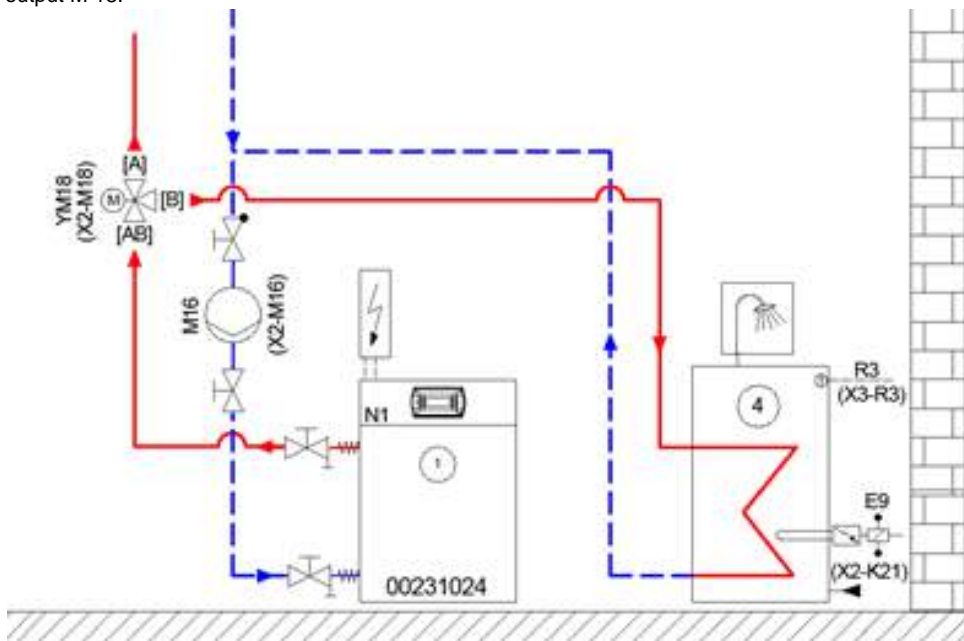


Fig.8.48: Hot water generation via 3-way valve

NOTE

It must be ensured that the 3-way switch valve used for switching to hot water generation is a tightly closing valve (note the leakage rate and the short positioning time of the motor).

advantage

- Only one high-efficiency circulation pump required for heating and hot water preparation (3-way switch valve cheaper than 2 high-efficiency circulation pumps)

disadvantage

- With different pressure losses in the consumer circuits, different water throughputs arise
- If the circulation pump M 16 fails, neither the heating nor the hot water generation is available

Controller settings

The following settings must be made in the "Settings" menu at the installer level:

- M16 for heating => yes (standard setting)
- M16 for hot water => yes



NOTE

If the heating and hot water preparation takes place exclusively via the circulation pump (M13), the selection "M16 Function M13" must be made in the "Pump control" settings.

8.15.1.2 Hot water generation using an additional circulation pump (M 18)

A circulation pump is used for heating and hot water.

NOTE

Incorrect circulation must be excluded by tightly closing non-return flaps in the generator and hot water circuit.

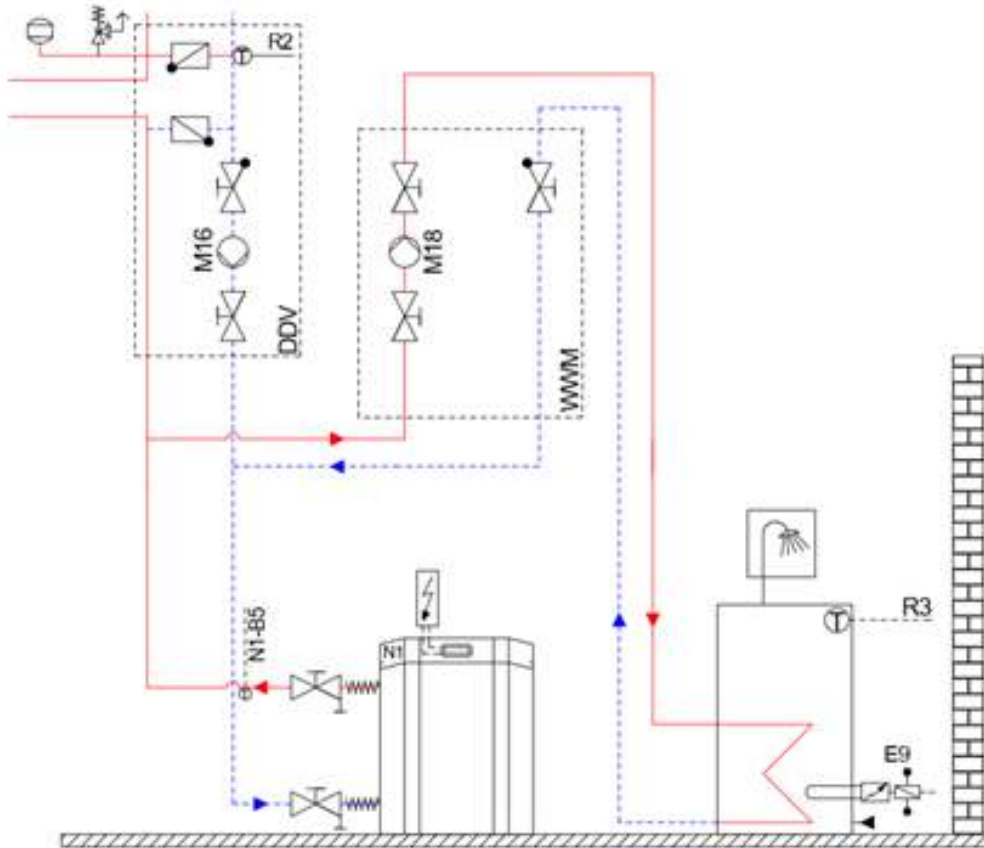


Fig. 8.49: Hot water generation via the M 18 circulation pump with non-return valves in the generator and hot water circuit

advantages

- Pumps can be designed for optimal water throughput, taking into account different pressure losses.
- Increased system safety through the use of two independent circulation pumps

disadvantage

- An additional high-efficiency circulation pump usually causes higher investment costs than a 3-way switch valve.
- Non-return valves can become leaky due to contamination, which leads to incorrect circulation (higher energy consumption and lower drinking water temperatures).

Controller settings

In the "Settings" menu at the installer level, the following settings are preset or adjusted:















- M16 for heating => "yes"
- M16 for hot water => "no"









8.15.2 Legend

	Heat pump
--	-----------

1.1	Air Water heatpump
1.2	Brine / water heat pump
1.3	Water / water heat pump
1.7	Split air / water heat pump
2	Heat pump manager
	Row cache
3.1	Regenerative storage
	Hot water tank
	Swimming pool heat exchanger
13.	Heat source
14th	Compact distributor
E9	Flange heating
E10	Second heat generator (2nd WE)
E10.1	Electric immersion heater
E10.2	Oil / gas boiler
E10.3	Solid fuel boiler
E10.4	Central storage tank (water)
E10.5	Solar system
F7	Safety temperature monitor
K20	Contactora 2nd heat generator
K21	Contactora immersion heater hot water
N1	Heating controller
N12	Solar controller (not included with the WPM)
M11	Primary pump heat source
M13	Heating circulation pump
M15	Heating circulation pump 2nd heating circuit
M16	Additional circulation pump
M18	DHW charging pump
M19	Swimming pool circulation pump
R1	Outside wall sensor
R2	Return sensor
R3	Hot water sensor
R5	2nd heating circuit sensor
R9	Flow sensor
R12	Defrost end sensor
R13	Sensor 3rd heating circuit / storage tank regenerative
SMF	Mud flaps
TC	Room temperature controller

EV	Electrical distribution
KW	Cold water
WW	Hot water
MA	Mixer open
MZ	Mixer closed
Y13	3-way switch valve

	thermostatically controlled valve
	Three-way mixer
	Four-way mixer
	Expansion tank
	Safety valve combination
	Temperature sensor
	leader
	Rewind
	Heat consumer
	Shut-off valve
	Stop valve with check valve
	Stop valve with drainage
	Circulation pump
	Overflow valve

	Three-way switch valve with actuator
	Two-way valve with actuator
	Safety temperature monitor
	High-performance deaerator with microbubble separation
	Electric immersion heater (pipe heating)
	Mud flaps
	Expansion tank
	thermostat

NOTE

The following hydraulic connections are schematic representations of the functionally necessary components and serve as an aid for planning to be carried out. They do not contain all of the safety devices required in accordance with DIN EN 12828, components to keep the pressure constant and any additional shut-off devices required for maintenance and service work.

NOTE

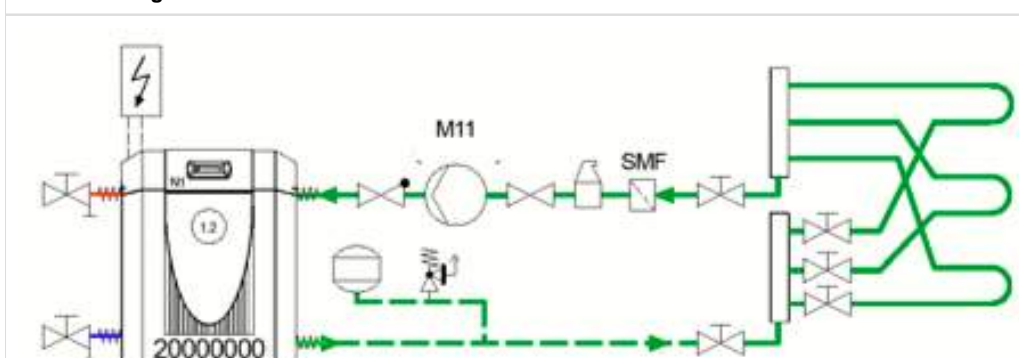
The actual electrical connection of the individual heat pump types can be found in the electrical documentation for the heat pump.

8.15.3 Integration of the heat source

The primary pump heat source M11 transports the environmental heat gained to the evaporator of the heat pump. With air / water heat pumps, this task is performed by the fan built into the heat pump.

The integration of the heat source earth or groundwater is shown in the following figures.

Heat source ground



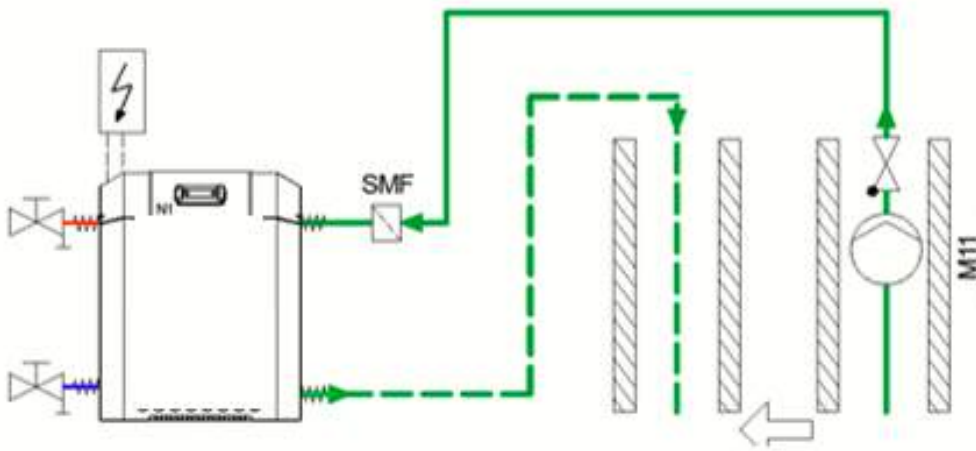
Each brine circuit must be provided with a shut-off valve for venting the heat source. Brine circles must all be of the same length in order to ensure an even flow and extraction capacity of the brine circles. Filling and venting devices are to be installed at the highest point on the site.

Fig.8.50: Schematic representation of the integration of brine / water heat pumps

A high-performance ventilator must be installed at the highest and warmest possible point in the brine circuit.
 If possible, the brine circulating pump of the heat source system should be installed outside the building and protected from rain.
 If it is installed in a building, it must be insulated so that it is vapor diffusion-proof in order to prevent condensation and ice formation. In addition, soundproofing measures may be necessary.

Heat source groundwater

Legend:



Two wells are required for the extraction of groundwater, a "delivery well" and a "absorption well". The well must be in the direction of the groundwater flow. The underwater pump and well heads must be sealed airtight.

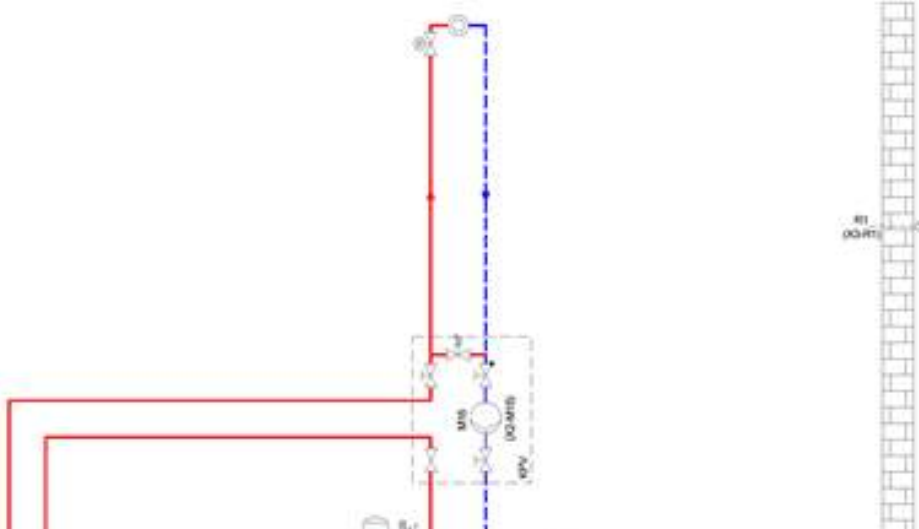
1.2 Brine / water heating pump
 1.3 Water / water heat pump
 M11 primary pump for brine or groundwater
 N1 heat pump manager
 Heat

Fig.8.51: Schematic representation of the integration of water / water heat pumps

8.15.4 Monovalent heat pump heating system

A heating circuit with overflow valve

configuration	setting
Mode of operation	monovalent
1. Heating circuit	Heat
2nd heating circuit	no
Hot water	no
swimming pool	no
In systems with individual room controls (TC), the overflow valve must be set in such a way that, in conjunction with an	



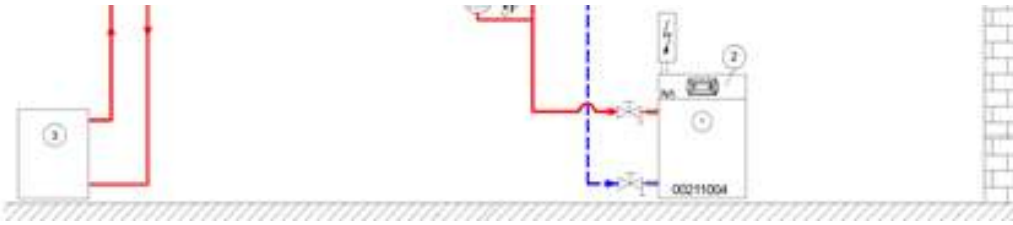
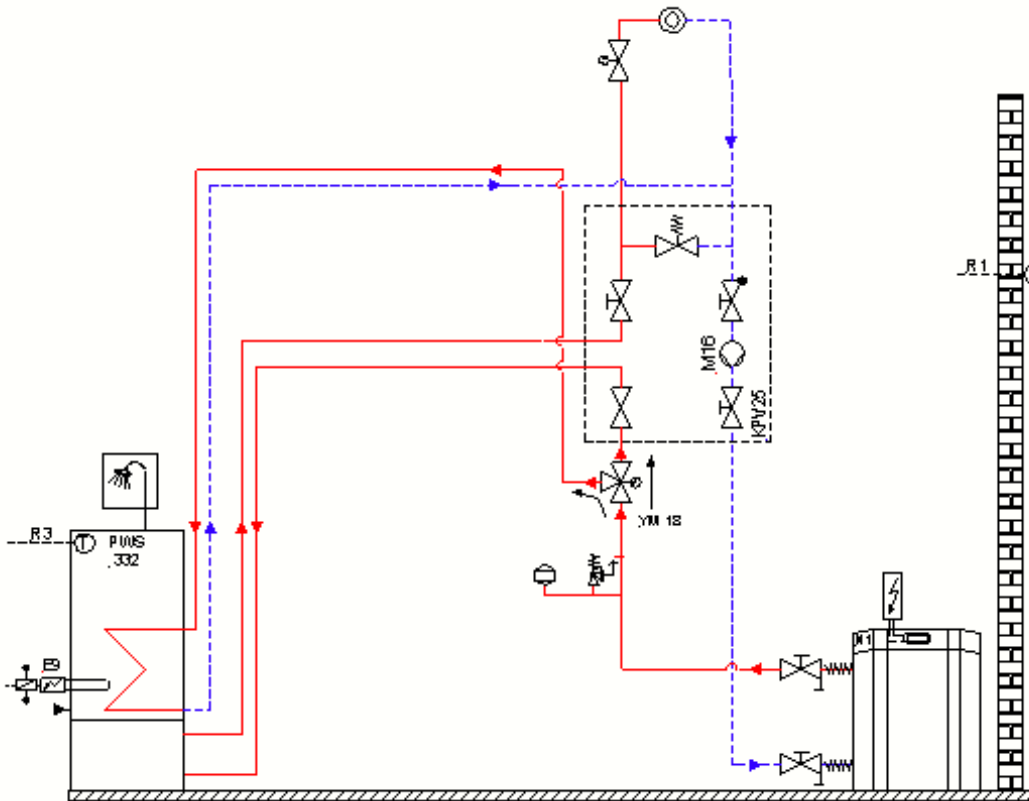


Fig.8.52: Integration scheme for monovalent heat pump operation with a heating circuit and row buffer storage tank (a minimum buffer volume of 10% of the nominal throughput must be ensured by a row buffer storage tank or other suitable measures)

uncontrolled heating pump (M16), the minimum heating water throughput is ensured in all operating situations.

For systems in connection with electronically controlled circulation pumps (Section 8.15), these must either be set to constant Delta p (constant pressure) or, if possible, the control line must be connected directly to the heat pump manager. The row buffer storage tank increases the circulated volume and guarantees the required minimum running times of the compressor if only individual rooms require heat (e.g. bathroom).

A heating circuit with overflow valve and hot water preparation with combination storage tank PWS



configuration	setting
Mode of operation	monovalent
1. Heating circuit	Heat
2nd heating circuit	no
Hot water	yes with feeler
Flange heating	Yes
swimming pool	no
<p>The combination tank PWS consists of a 100l buffer and a 300l hot water tank, which are hydraulically and thermally separated from each other.</p> <p>The water heating takes place with the additional circulation pump</p>	

Fig.8.53: Integration scheme for monovalent heat pump operation with one heating circuit, in-line buffer storage and hot water preparation.

(M16) and closing changeover valve (YM18), via an integrated tubular heat exchanger.

NEW: Electrical connection with WPM Touch

Electrical connection of monovalent heat pump heating systems

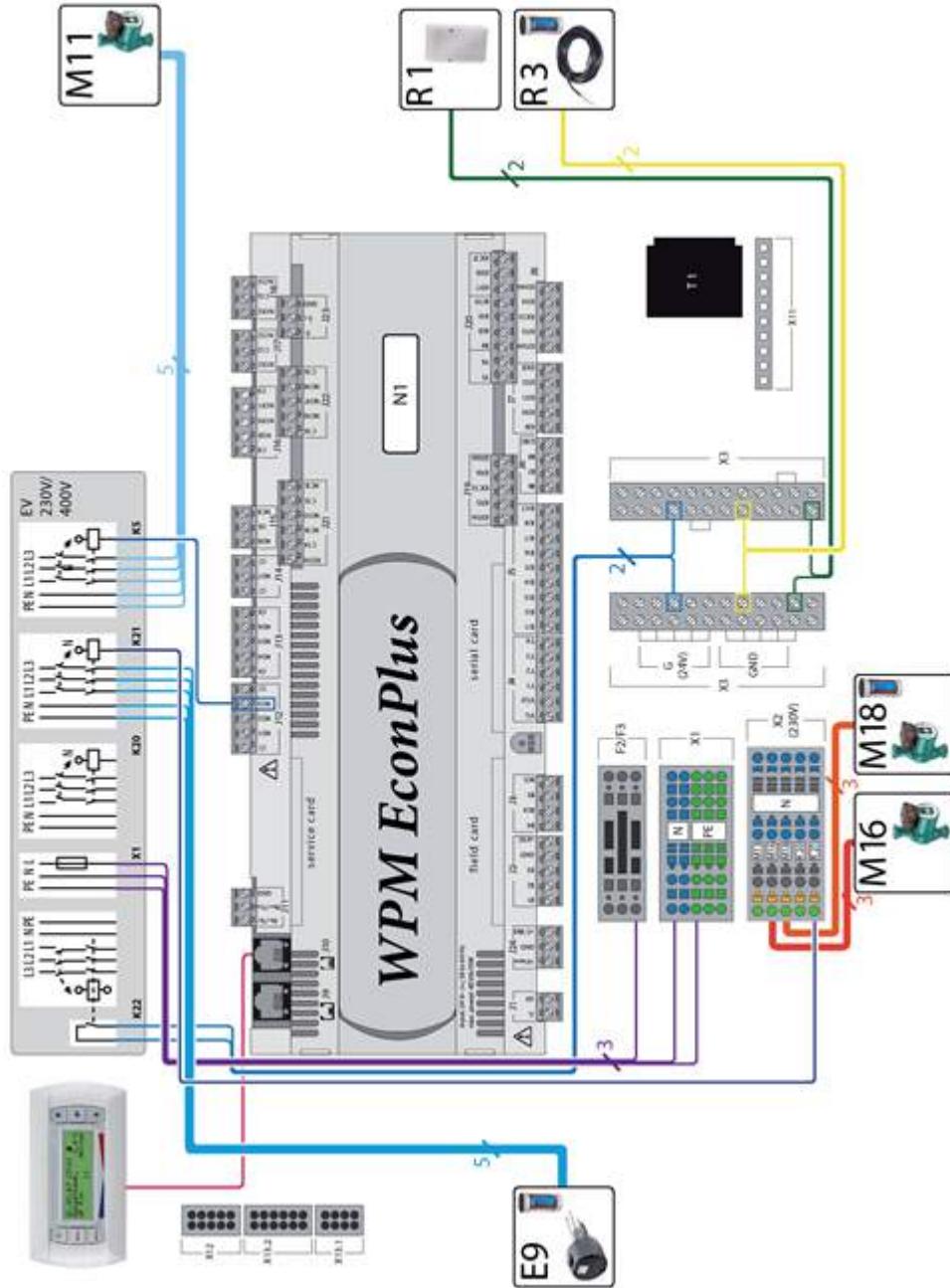


Fig. 8.54: Connection diagram for the WPM EconPlus heat pump manager for monovalent systems with one heating circuit and hot water generation via a switch valve.

The 4-core supply line for the power section of the heat pump is led from the heat pump meter via the EVU contactor (if required) into the heat pump (3L / PE ~ 400V, 50Hz). Protection according to the current consumption information on the nameplate, by a 3-pole circuit breaker with C characteristics and common tripping of all 3 tracks. Cable cross-section according to DIN VDE 0100.

The 3-core supply line for the heat pump manager (N1) is routed into the heat pump (devices with integrated heat pump manager) or to the later installation location of the wall-mounted heat pump manager. The supply line (L / N / PE ~ 230V, 50Hz) for the heat pump manager must

be connected to permanent voltage and for this reason must be tapped in front of the EVU blocking contactor or connected to the household electricity, as otherwise important protective functions are out of order during the EVU blocking .

In systems with hot water generation and a switch valve (YM18), the connection is made at terminal M18.

8.15.5 Compact design heat pumps

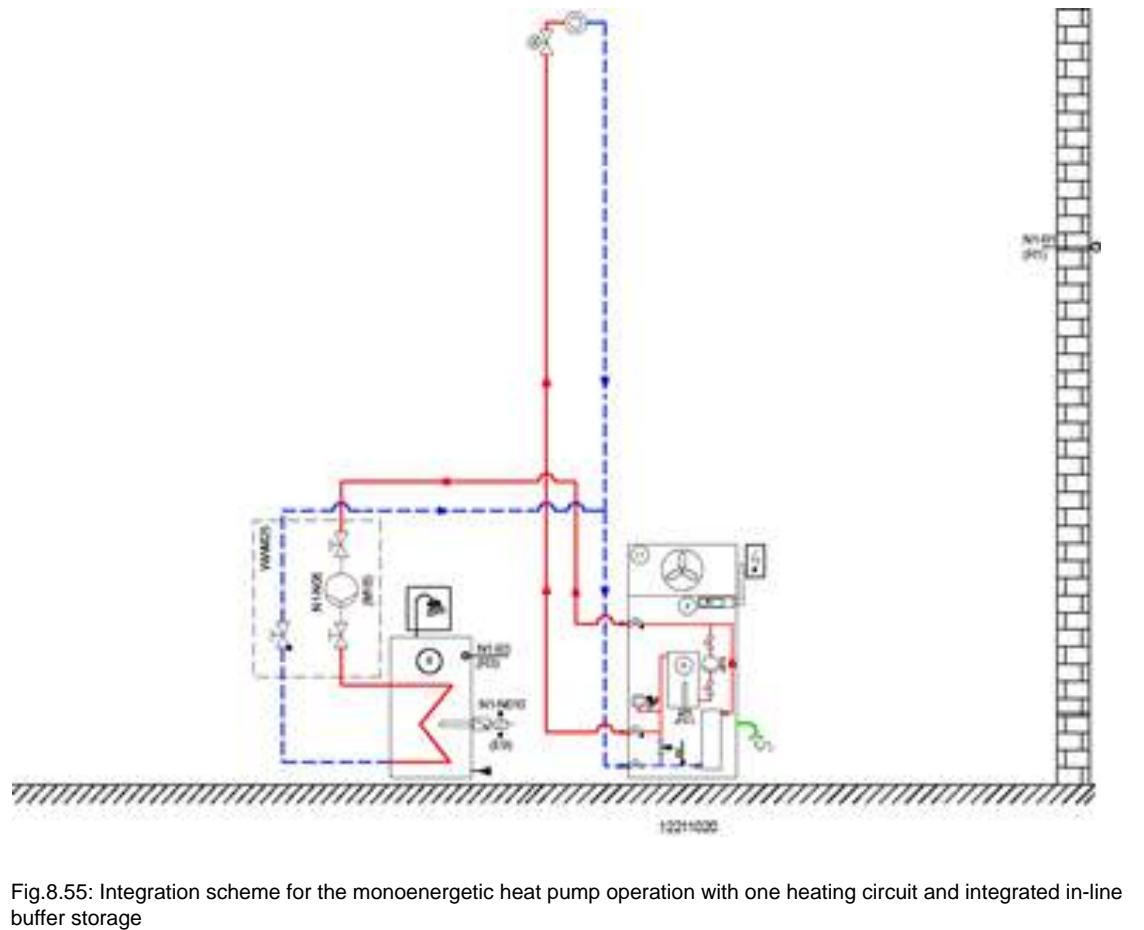
Air / compact heat pump LIK 8TES	configuration	setting
	Mode of operation electric heating	Additional heating in the buffer
	1. Heating circuit	Heat
	2nd heating circuit	no
	Hot water	yes with feeler
	Flange heating	Yes
	swimming pool	no
<p>With compact heat pumps, the system components for the heat source and an unmixed heating circuit are integrated.</p> <p>DHW heating is optional.</p>		

Fig.8.55: Integration scheme for the monoenergetic heat pump operation with one heating circuit and integrated in-line buffer storage

Brine / compact heat pump	configuration	setting
	Mode of operation	Monovalent
	1. Heating circuit	Heat
	2nd heating circuit	no
	Hot water	yes with feeler
	Flange heating	Yes
	swimming pool	no

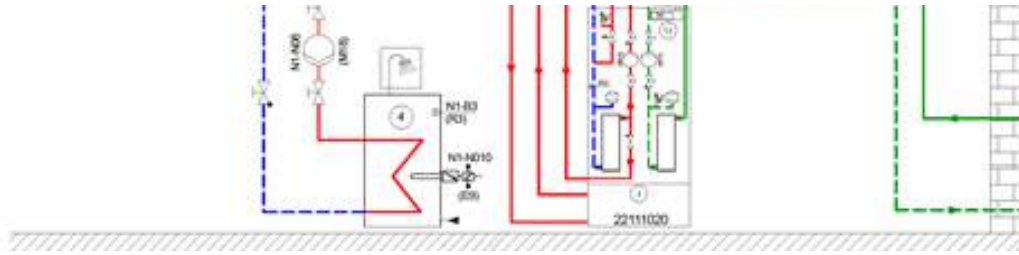


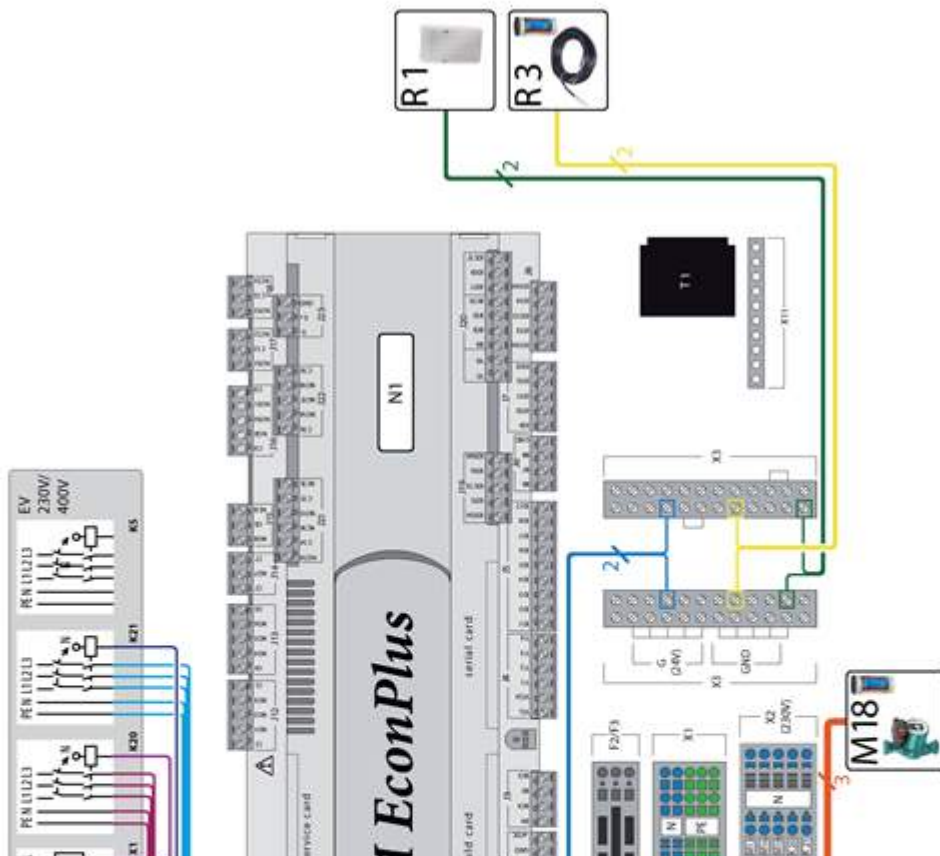
Fig.8.56: Integration scheme for monovalent heat pump operation with one heating circuit and an underlay buffer

Thanks to the integrated structure-borne noise decoupling, the brine / compact heat pump can be connected directly to the heating system.

The free compression of the integrated brine pump is designed for a maximum probe depth of 80 m (DN 32). In the case of larger probe depths, the free compression must be checked and, if necessary, a DN 40 pipe must be used.

NOTE
Compact heat pumps cannot be used for bivalent systems.

Electrical connection of the heat pumps in compact design



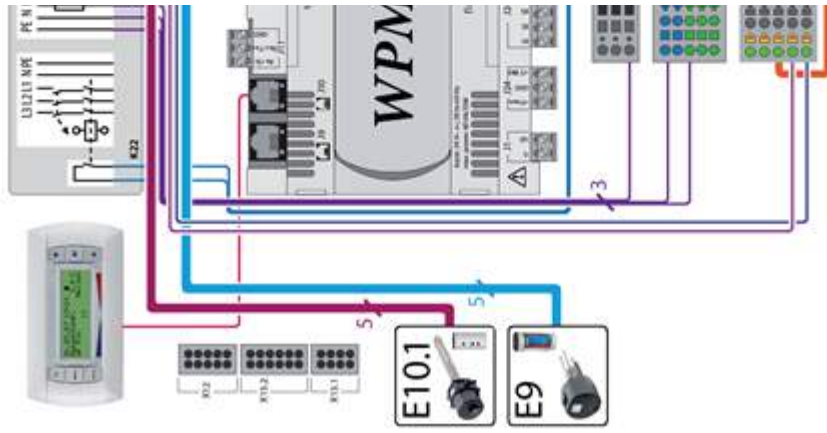


Fig. 8.57: Heat pump manager connection diagram for compact heat pumps with one heating circuit and hot water preparation

The 4-core supply line for the power section of the heat pump is led from the heat pump meter via the EVU contactor (if required) into the heat pump (3L / PE ~ 400V, 50Hz). Protection according to the current consumption information on the nameplate, by a 3-pole circuit breaker with C characteristics and common tripping of all 3 tracks. Cable cross-section according to DIN VDE 0100.

The 3-core supply line for the heat pump manager (N1) is routed into the heat pump (devices with integrated heat pump manager) or to the later installation location of the wall-mounted heat pump manager. The supply line (L / N / PE ~ 230V, 50Hz) for the heat pump manager must be connected to permanent voltage and for this reason must be tapped in front of the EVU blocking contactor or connected to the household electricity, as otherwise important protective functions are out of order during the EVU blocking.

8.15.6 Package for heating and hot water preparation, high-efficiency heat pump with Hydro-Tower (HPL package)

Monoenergetic heat pump heating system with one heating circuit	configuration	setting
	Mode of operation electric heating	Pipe heating Heat
	1. Heating circuit	Heat
	2nd heating circuit	no
	Hot water	yes with feeler
	Flange heating	Yes
	swimming pool	no
<p>Fig.8.58: Integration scheme of an air / water heat pump installed outdoors with Hydro-Tower HWK 332 Econ</p>	<p>The Hydro-Tower with integrated WPM EconPlus heat pump manager enables a high-efficiency air / water heat pump installed outside to be connected quickly and easily to a heating system with an unmixed heating circuit. The following components are</p>	

installed to save space and wired ready for use.

A 60/100 liter buffer tank and a 200/300 liter hot water tank with overflow valve or DDV (HWK 230 / HWK 332) are installed.

Bivalent heat pump system with boiler for support

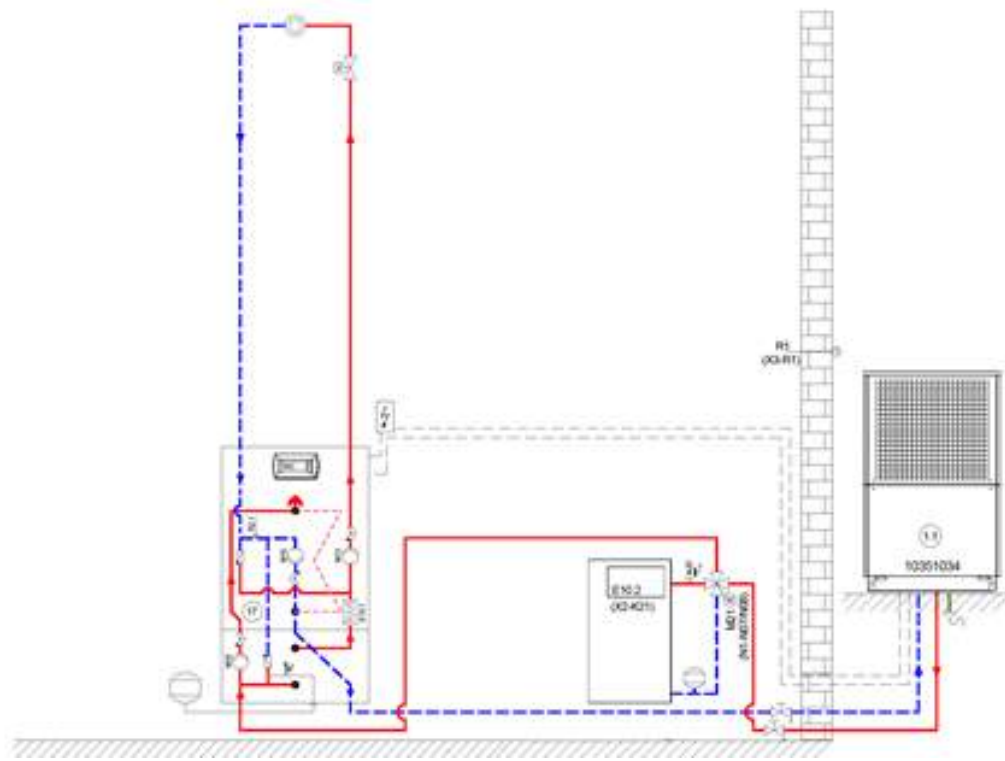


Fig.8.59: Integration scheme for a bivalent operating mode with boiler and Hydro-Tower HWK 332 Econ

configuration	setting
Mode of operation	Bivalent HP + boiler
1. Heating circuit	Heat
2nd heating circuit	no
Hot water	yes with feeler
Flange heating	Yes
swimming pool	no

The hydraulic decoupling of the generator and consumer circuit takes place via the integrated double differential pressure-free distributor

⚠ ATTENTION
The integration scheme is tailored to the requirements of the heat pump and the controller logic. If other heat generators such as oil, gas or wood boilers are integrated in the system, these requirements must be agreed with

Electrical connection of the heat pumps with Hydro-Tower HWK 230 / HWK 332

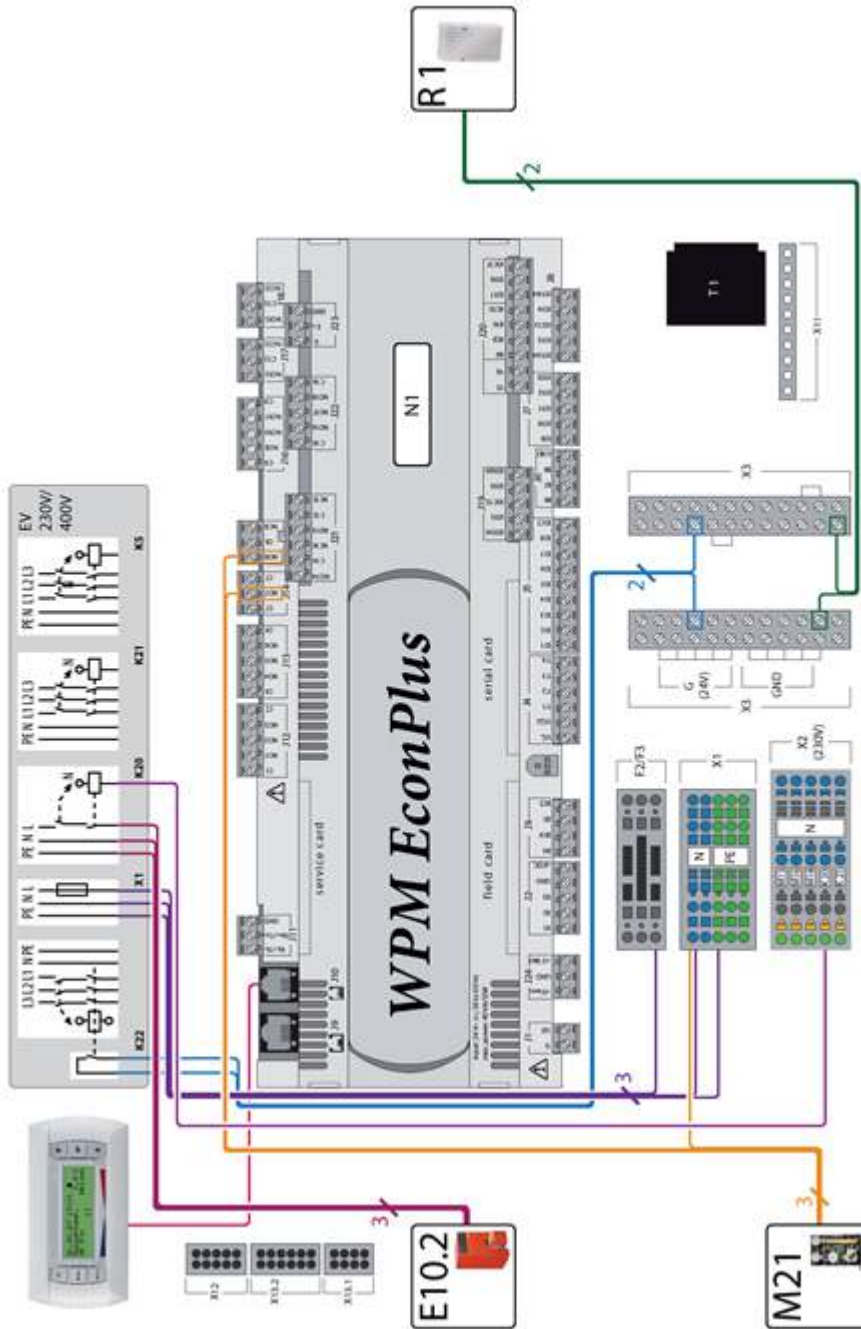


Fig. 8.60: Connection diagram for WPM EconPlus heat pump manager for bivalent systems with HWK 332 hydro tower

The 4-core supply line for the power section of the heat pump is led from the heat pump meter via the EVU contactor (if required) into the heat pump (3L / PE ~ 400V, 50Hz). Protection according to the current consumption information on the nameplate, by a 3-pole circuit breaker with C characteristics and common tripping of all 3 tracks. Cable cross-section according to DIN VDE 0100.

The 3-core supply line for the heat pump manager (N1) is routed into the heat pump (devices with integrated heat pump manager) or to the later installation location of the wall-mounted heat pump manager. The supply line (L / N / PE ~ 230V, 50Hz) for the heat pump manager must be connected to permanent voltage and for this reason must be tapped in front of the EVU blocking contactor or connected to the household electricity, as otherwise important protective functions are out of order during the EVU blocking .

8.15.7 Monoenergetic heat pump heating system

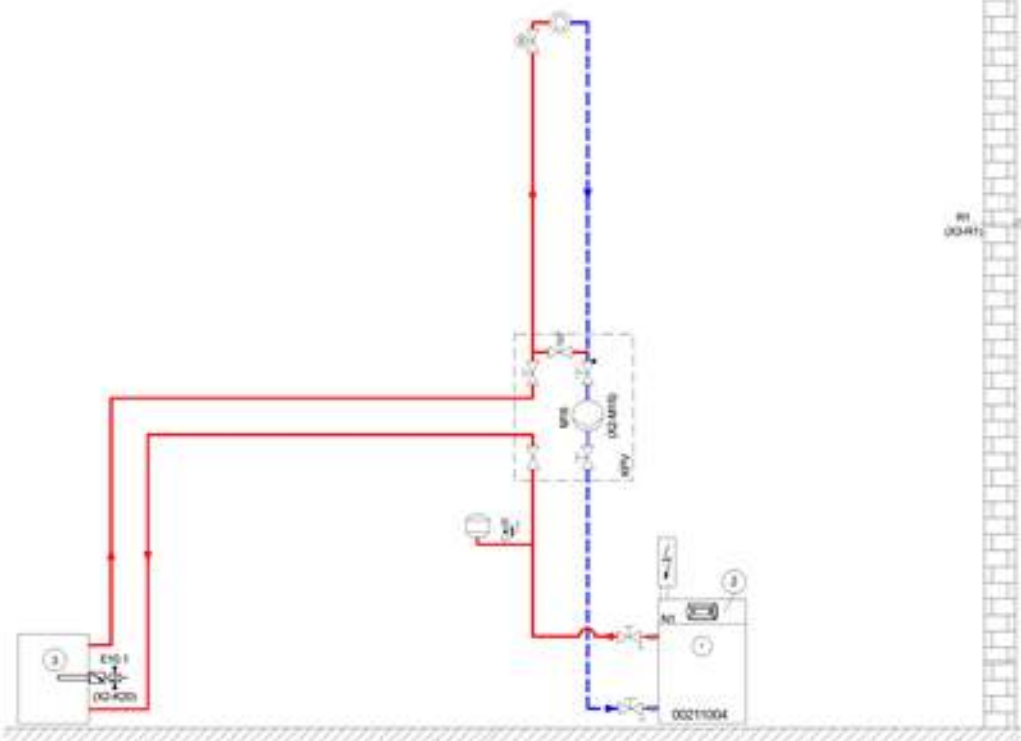
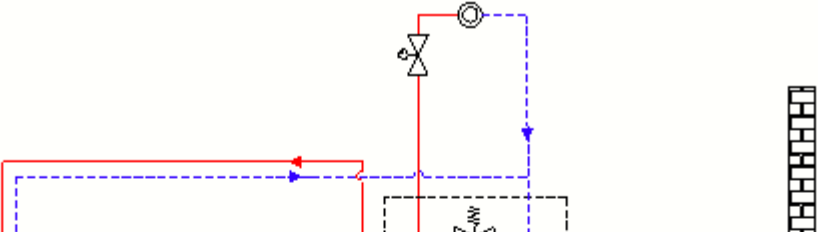
A heating circuit with overflow valve	configuration	setting
	Mode of operation	Additional heating in the buffer
electric heating		1. Heating circuit
2nd heating circuit	no	Hot water
swimming pool	no	<p>Ensuring the heating water throughput via an overflow valve, which must be set by the installer during commissioning.</p> <p>The use of the compact distributor KPV 25 with overflow valve is recommended for heating systems with surface heating and a heating water flow of max. 1.3 m³/H.</p> <p>If an electric heater is installed in the buffer storage, it must be protected as a heat generator in accordance with DIN EN 12828.</p> <p>Manual draining must be provided for heat pumps that are installed at risk of frost.</p>

Fig.8.61: Integration scheme for monoenergetic heat pump operation with one heating circuit and Row cache

A heating circuit with overflow valve and distributor without differential pressure	configuration	setting
	Mode of operation	Additional heating in the buffer
electric heating		1. Heating circuit

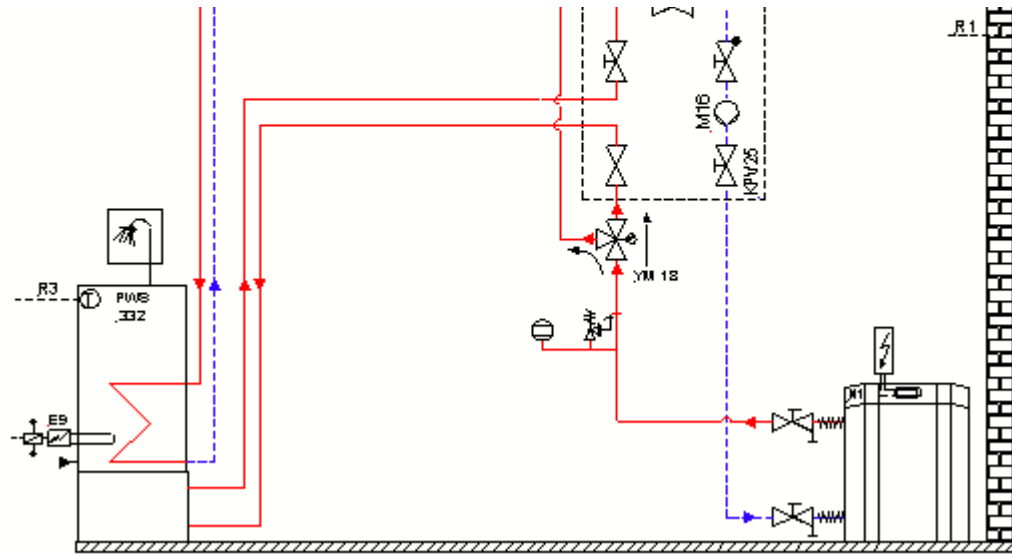
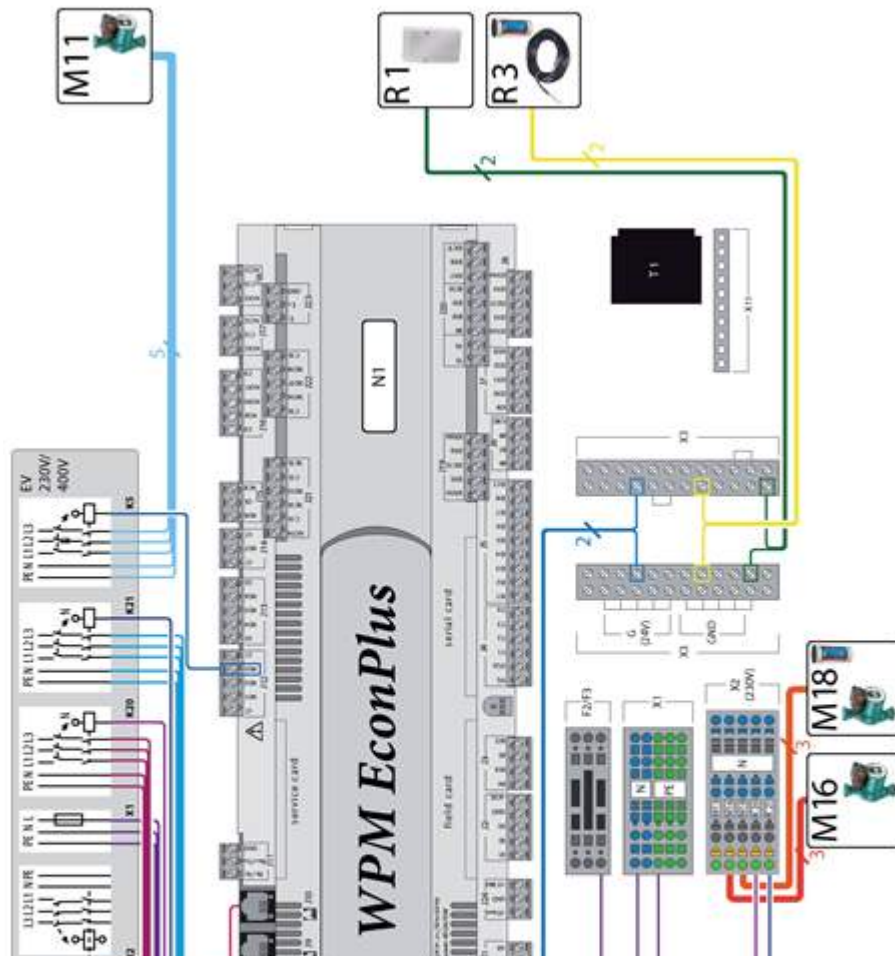


Fig.8.62: Integration scheme for the monoenergetic heat pump operation with one heating circuit, row buffer storage and hot water preparation

2nd heating circuit	no
Hot water	yes with feeler
Flange heating	Yes
swimming pool	no

Ensuring the heating water throughput via an overflow valve, which must be set by the installer during commissioning. Hot water is generated with the additional circulation pump (M16) and tightly closing switchover valve (YM18) via an integrated tubular heat exchanger with 3.2 m² exchanger surface.

Electrical connection of monoenergetic heat pump heating systems



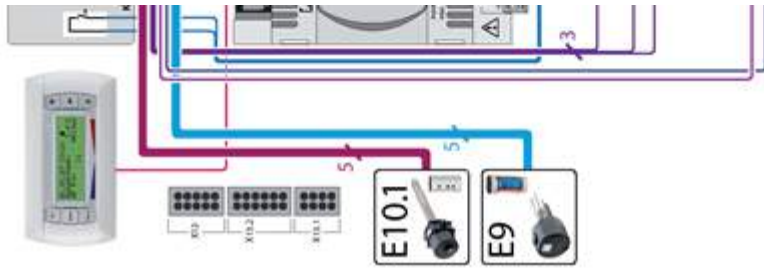


Fig. 8.63: Connection diagram for WPM EconPlus heat pump manager for monoenergetic systems with one heating circuit and hot water preparation.

The 4-core supply line for the power section of the heat pump is led from the heat pump meter via the EVU contactor (if required) into the heat pump (3L / PE ~ 400V, 50Hz). Protection according to the current consumption information on the nameplate, by a 3-pole circuit breaker with C characteristics and common tripping of all 3 tracks. Cable cross-section according to DIN VDE 0100.

The 3-core supply line for the heat pump manager (N1) is routed into the heat pump (devices with integrated heat pump manager) or to the later installation location of the wall-mounted heat pump manager. The supply line (L / N / PE ~ 230V, 50Hz) for the heat pump manager must be connected to permanent voltage and for this reason must be tapped in front of the EVU blocking contactor or connected to the household electricity, as otherwise important protective functions are out of order during the EVU blocking .

When using air / water heat pumps, the connection of the primary pump M11 is not required.

In systems with hot water generation and a switch valve (YM18), the connection is made at terminal M18.

A heating circuit with a double differential pressure-free distributor

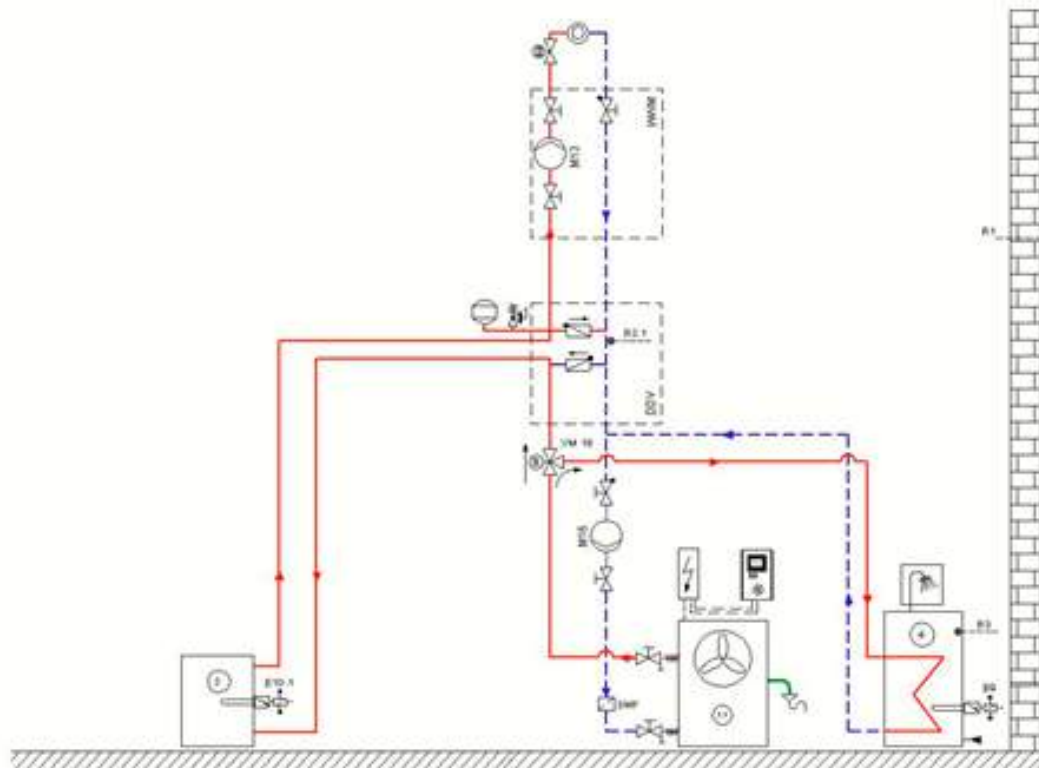


Fig.8.64: Integration scheme for monoenergetic heat pump operation with one heating circuit, Row buffer storage and hot water preparation

configuration	setting
Mode of operation electric heating	Addition al heating in the buffer
1. Heating circuit	Heat
2nd heating circuit	no
Hot water	yes with feeler
Flange heating	Yes
swimming pool	no
Ensuring the heating water throughput via a double differential pressure-free distributor.	
The use of the double differential pressure-free distributor DDV is recommended for connecting all heat pumps. The circulation pump (M16) in the generator circuit is only in operation when the	

compressor is running in order to avoid unnecessary running times. The hot water generation is carried out with the additional circulation pump (M16) and closing changeover valve (YM18).

Two heating circuits with a distributor with no differential pressure

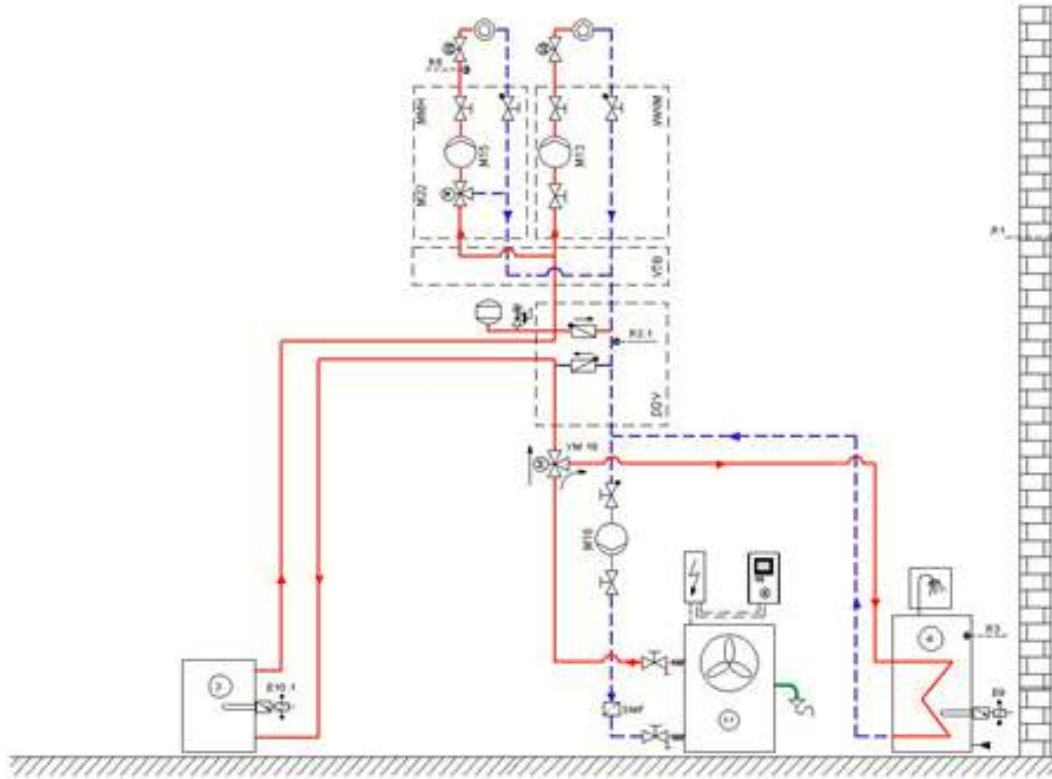


Fig.8.65: Integration scheme for monoenergetic heat pump operation with two heating circuits, Row buffer storage and hot water preparation

configuration	setting
Mode of operation electric heating	Additional heating in the buffer
1. Heating circuit	Heat
2nd heating circuit	Heat
3rd heating circuit	no
Hot water	yes, with feeler
Flange heating	Yes
swimming pool	no
<p>For systems in connection with electronically controlled circulation pumps, the additional circulation pump (M16) must either be set to constant Delta p (constant pressure) or, if possible, the control line must be connected directly to the heat pump manager.</p> <p>If the control line of the electronically controlled circulation pumps is connected to the heat pump manager, the characteristics of the circulation pumps can be set in stages or manually in the "Settings" - "Pump control" menu.</p>	

NEW: Electrical connection with WPM Touch

Electrical connection of monoenergetic heat pump heating systems

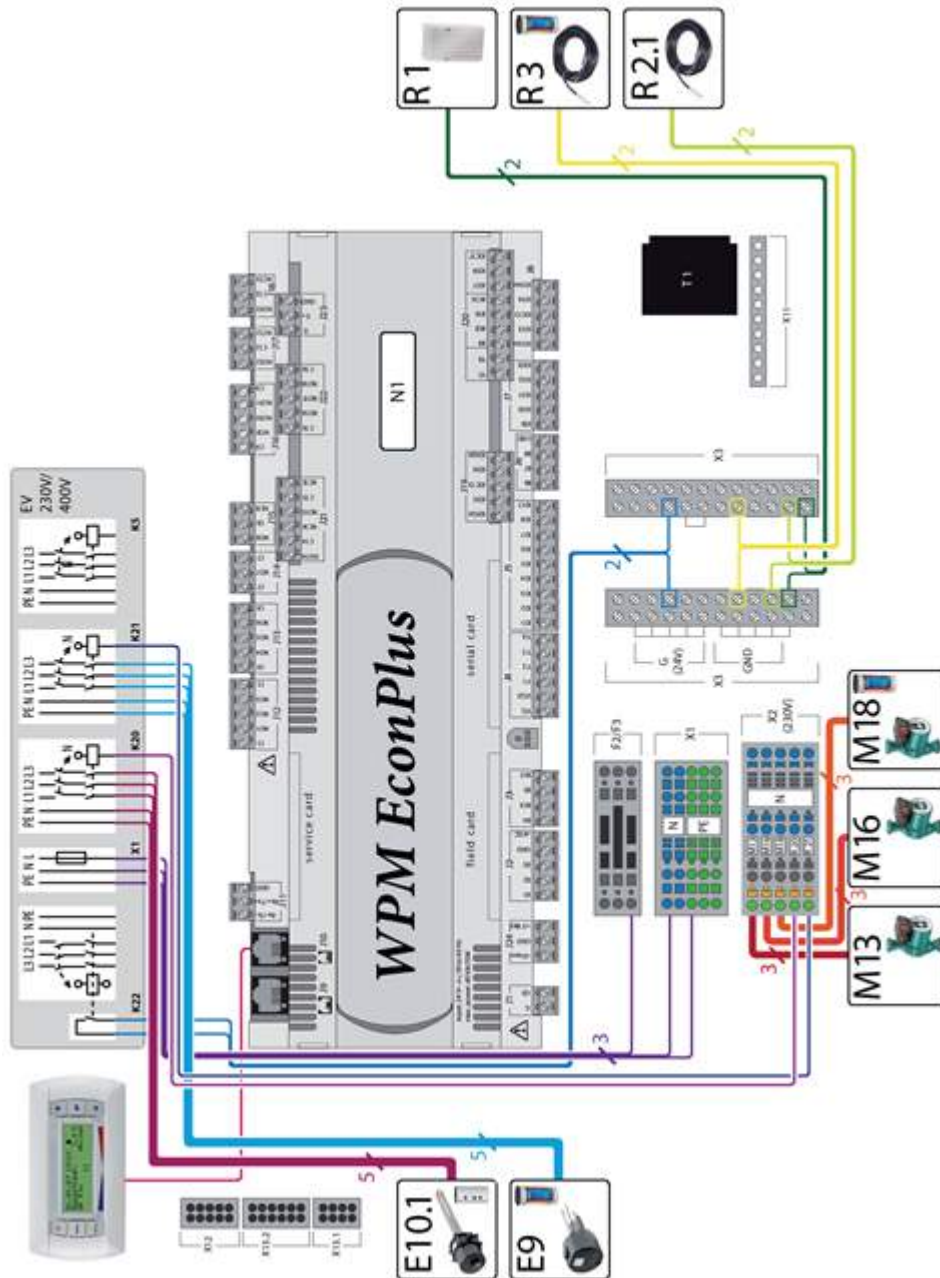


Fig. 8.66: Connection diagram for the WPM EconPlus heat pump manager for monoenergetic systems with two heating circuits and hot water preparation

The contactor (K20) for the immersion heater (E10) is to be designed for monoenergetic systems (2nd heat exchanger) according to the heating output and to be provided by the customer. The control (230VAC) takes place from the heat pump manager via terminals X1 / N and J13 / NO 4.

The contactor (K21) for the flange heater (E9) in the hot water storage tank must be designed according to the heating output and provided on site. The control (230VAC) takes place from the heat pump manager via terminals X1 / N and J16 / NO 10.

When using brine or water / water heat pumps, the primary pump (M11) must also be connected.

In systems with hot water generation and a switch valve (YM18), the connection is made at terminal M18.

8.15.8 Bivalent heat pump heating system

2. Heat generator for heating support with DDV (same volume flows for both heat generators)	config uration	setting	
	Mode of operation Bivalent WP + 2nd WE		
	1. Heating circuit	Heat	
	2nd heating circuit	no	
	Hot water	no	
	swimming pool	no	
<p>Fig.8.67: Integration scheme for bivalent heat pump operation with a heat generator, a heating circuit and a series of buffer tanks</p>	<p>The control of the mixer (M21) is taken over by the heat pump manager, which requests the 2nd heat generator if necessary and adds enough heating water to achieve the desired return temperature. The mixer closes at a return temperature of 65 ° C and thus protects the heat pump from excessively high return temperatures.</p> <p>The boiler is requested via the 2nd heat generator output of the heat pump manager.</p> <p>The mode of operation of the 2nd heat generator can be coded as "sliding" if no hot water generation is activated.</p>		

NOTE
This integration is only to be used if the volume flow of the 2nd heat generator **Smaller or equal** corresponds to the

volume flow of the heat pump.

2. Heat generator for heating support with DDV (different volume flows for both heat generators)

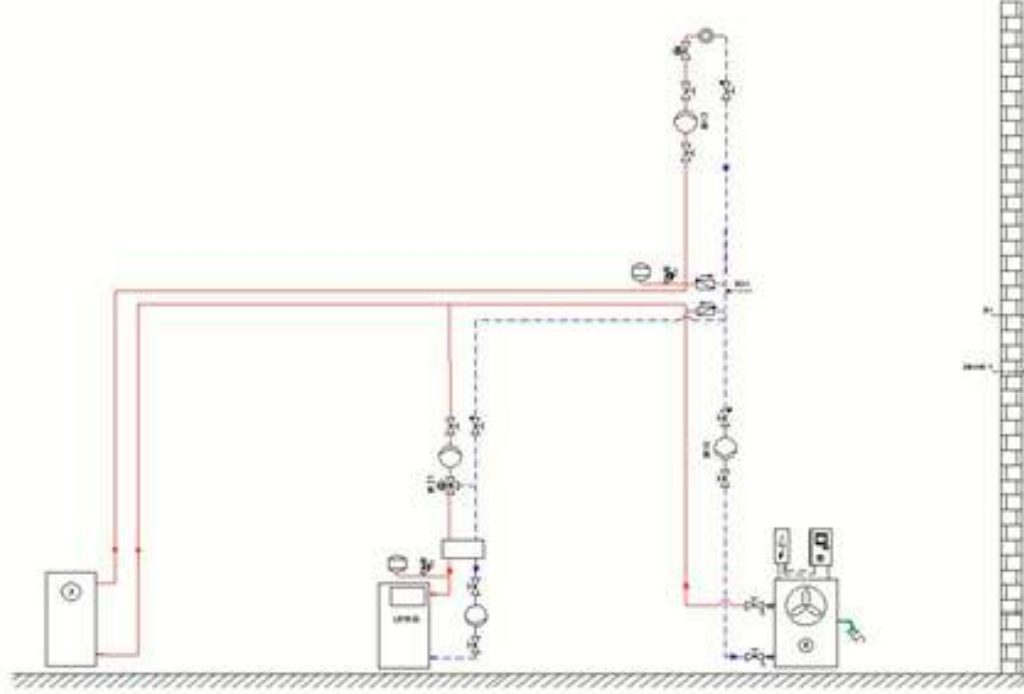
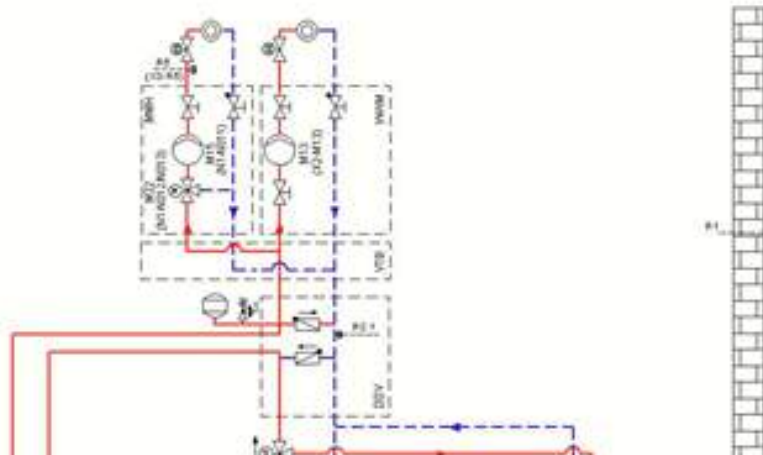


Fig.8.68: Integration scheme for bivalent heat pump operation with heat generator integrated in parallel

configuration	setting
Mode of operation	Bivalent WP + 2nd WE
1. Heating circuit	Heat
2nd heating circuit	no
Hot water	no
swimming pool	no
<p>This integration is only to be used if the volume flow of the 2nd heat generator greater than the volume flow of the heat pump.</p> <p>The boiler is requested via the 2nd heat generator output of the heat pump manager.</p> <p>The mode of operation of the 2nd heat generator must be set weather-compensated.</p>	

Boiler to support heating and water heating



configuration	setting
Mode of operation electric heating	Bivalent WP + 2nd WE
1. Heating circuit	Heat
2nd heating circuit	Heat
Hot water	yes with feeler
	Yes

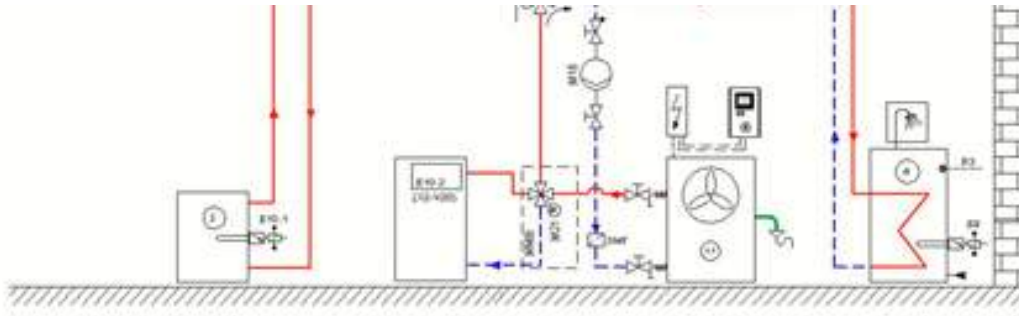


Fig. 8.69: Integration scheme for bivalent heat pump operation with boiler, two heating circuits, row buffer storage and hot water preparation.

Flange heating	
swimming pool	no

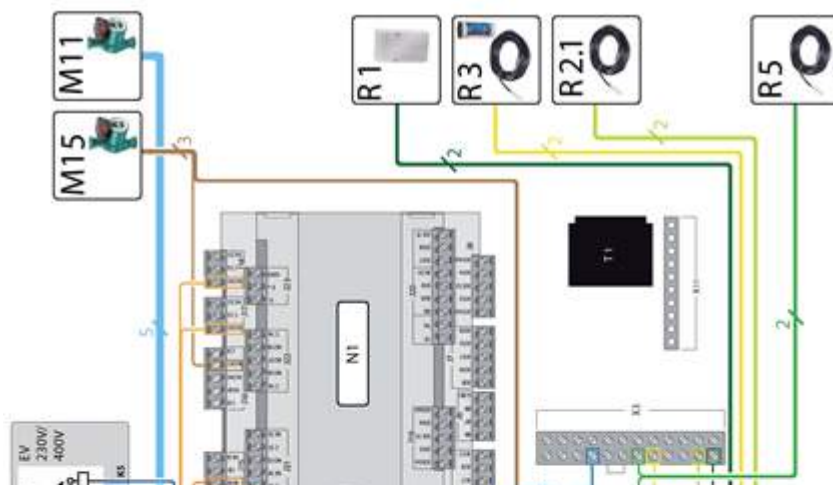
The boiler can also be requested for hot water preparation in order to achieve higher hot water temperatures.

The M21 mixer closes at a return temperature of 65 °C and thus protects the heat pump from excessively high return temperatures.

If a flange heater is also installed in the hot water storage tank, the boiler is only used for reheating and thermal disinfection if it is currently active for heating.

NOTE
This integration is only to be used if the volume flow of the 2nd heat generator **S** **maller or equal** corresponds to the volume flow of the heat pump.

Electrical connection of bivalent heat pump heating systems



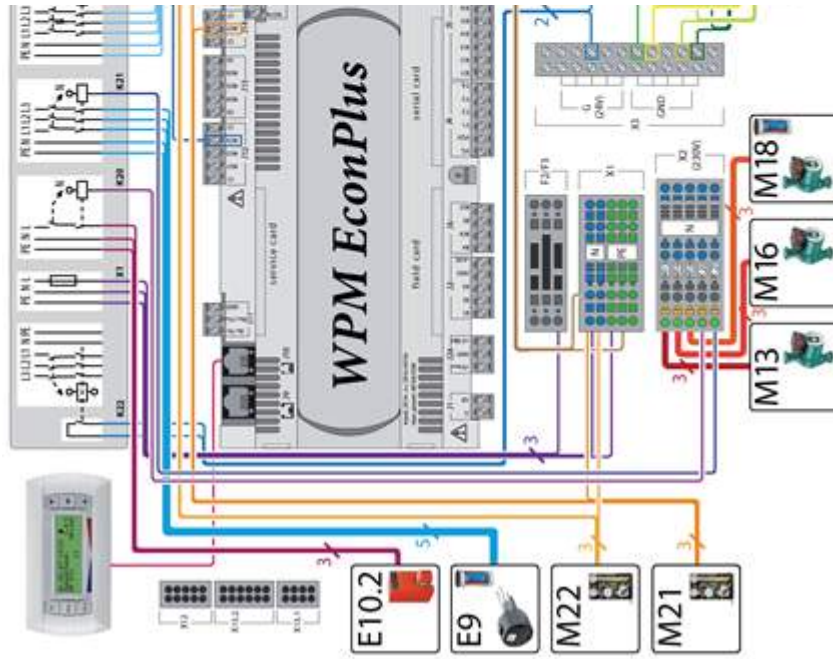


Fig. 8.70: Connection diagram for the WPM EconPlus heat pump manager for bivalent systems with one heating circuit and constant or variable control Boiler.

Constantly regulated boiler

The control of the mixer is taken over by the heat pump manager, who requests the boiler if necessary and adds enough hot boiler water to achieve the desired return temperature or hot water temperature. The boiler is requested via the 2nd heat generator output of the heat pump manager and the operating mode of the 2nd heat generator is to be coded as "constant".

Slidably regulated boiler

Condensing boilers can also be operated via their own weather-compensated burner control. If necessary, the boiler is requested via the 2nd heat generator output, the mixer is opened completely and the full volume flow is run through the boiler. The mode of operation of the 2nd heat generator is to be coded as "sliding". The heating curve of the burner control is set according to the heating curve of the heat pump.

When using air / water heat pumps, the connection of the primary pump M11 is not required.

In systems with hot water generation and a switch valve (YM18), the connection is made at terminal M18.

8.15.9 Integration of renewable heat sources

Regenerative support from heating	configuration	setting
	<p>Mode of operation</p> <p>electric heating</p> <p>Solar control</p>	<p>bivalent</p> <p>regenerative</p> <p>Addition al heating in the buffer</p> <p>yes (external or WP with WPM Touch)</p>

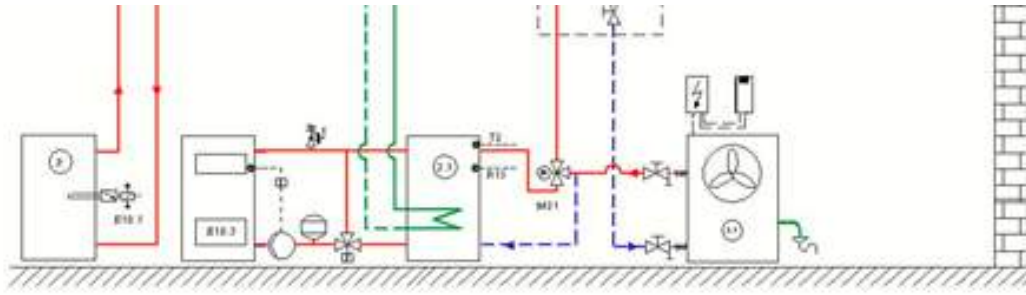


Fig. 8.71: Integration scheme for the bivalent regenerative heat pump operation with solid fuel boiler and solar thermal in the regenerative storage, a heating circuit with in-line buffer storage

1. Heating circuit	Heat
2nd heating circuit	no
Hot water	no
swimming pool	no
In addition to the solid fuel boiler, the regenerative storage tank (3.1) can also be loaded using additional heat generators. The buffer volume is to be dimensioned according to the specifications of the solid fuel boiler manufacturer or solar thermal system.	

Regenerative support for heating and hot water preparation

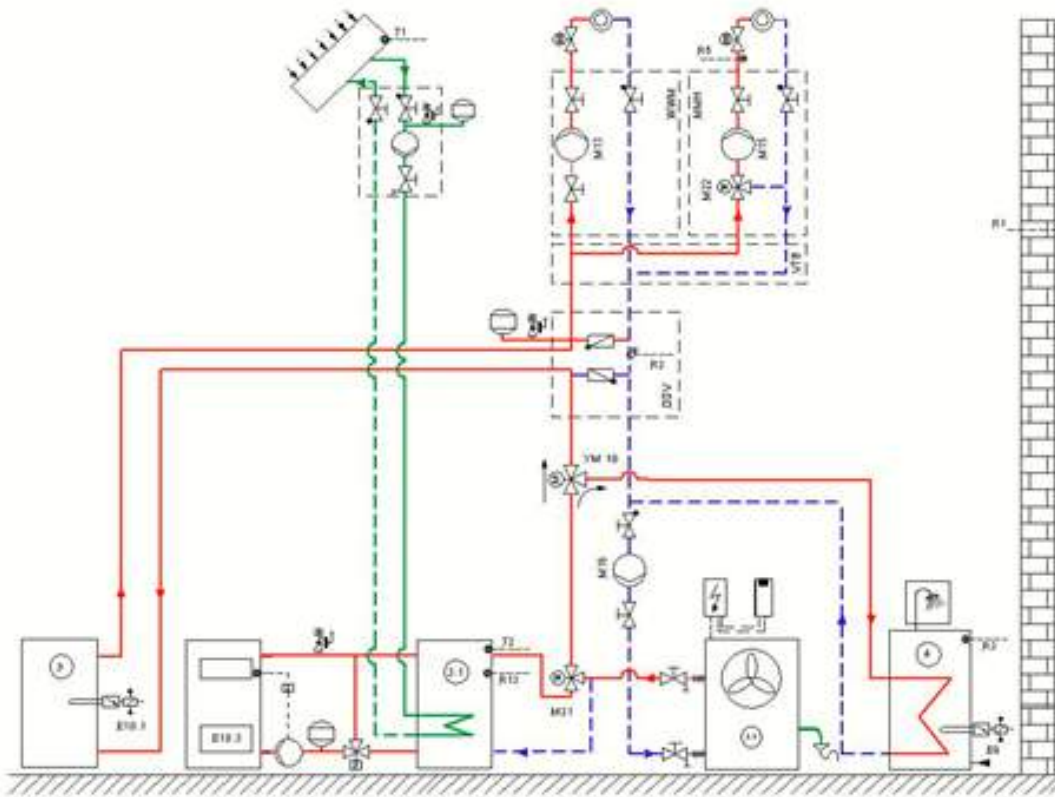


Fig. 8.72: Integration scheme for the bivalent regenerative heat pump operation with solid fuel boiler and solar thermal in the regenerative storage tank, two heating circuits with in-line buffer storage and hot water preparation

configuration	setting
Mode of operation	bivalent regenerative
electric heating	Addition heating in the buffer
Solar control	yes (external or WP with WPM Touch)
1. Heating circuit	Heat
2nd heating circuit	Heat
Hot water	yes with feeler
Flange heating	Yes
swimming pool	no
If the temperature level in the regenerative storage tank is sufficiently high, the heat pump	

is blocked and the energy from the regenerative storage tank is used for heating, hot water or, if necessary, swimming pool requirements.

The water heating takes place with the additional circulation pump (M16) and tightly closing switchover valve (YM18).

Electrical connection of bivalent-regenerative heat pump heating systems

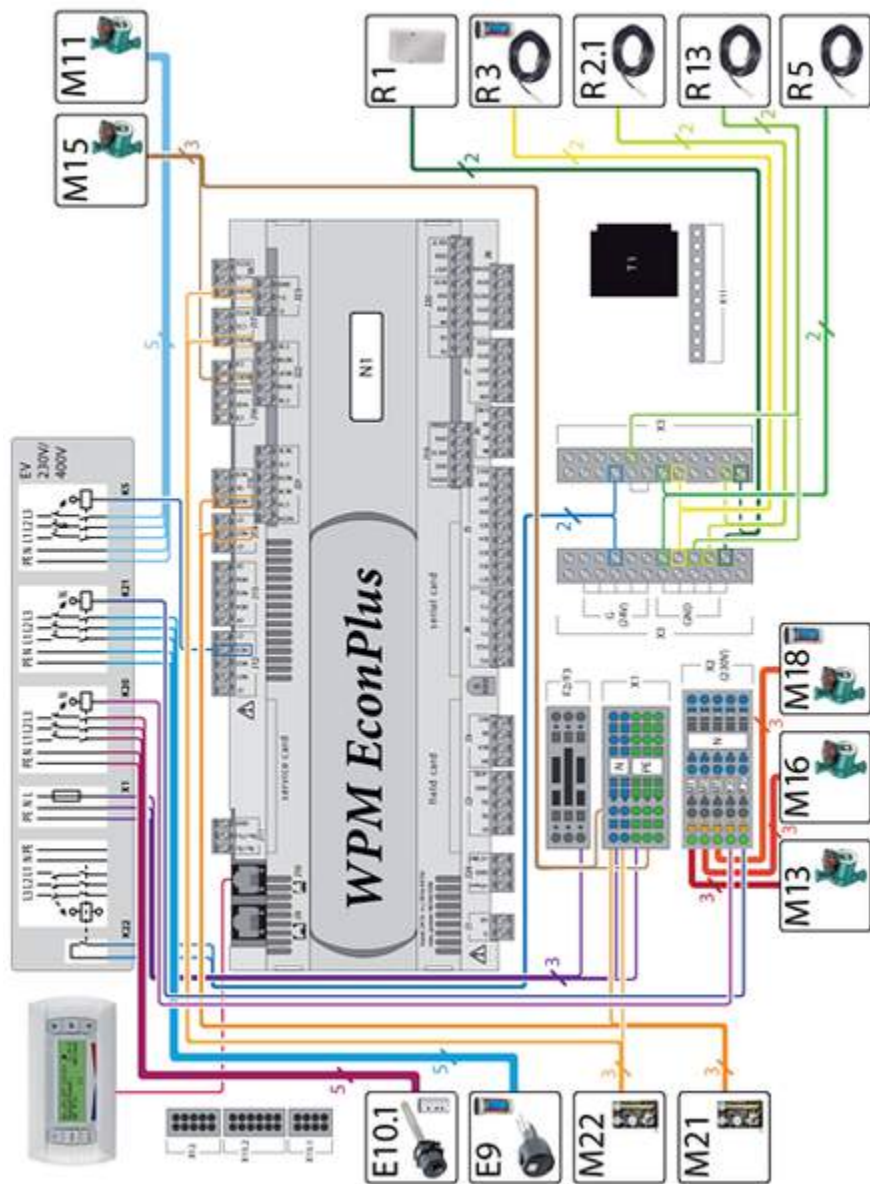


Fig. 8.73: Connection diagram for the WPM EconPlus heat pump manager for bivalent-renewable systems with two heating circuits and hot water preparation.

The 4-core supply line for the power section of the heat pump is led from the heat pump meter via the EVU contactor (if required) into the heat pump (3L / PE ~ 400V, 50Hz). Protection according to the current consumption information on the nameplate, by a 3-pole circuit breaker with C characteristics and common tripping of all 3 tracks. Cable cross-section according to DIN VDE 0100.

The 3-core supply line for the heat pump manager (N1) is routed into the heat pump (devices with integrated heat pump manager) or to the later installation location of the wall-mounted heat pump manager. The supply line (L / N / PE ~ 230V, 50Hz) for the heat pump manager must be connected to permanent voltage and for this reason must be tapped in front of the EVU blocking contactor or connected to the household electricity, as otherwise important protective functions are out of order during the EVU blocking.

When using air / water heat pumps, the connection of the primary pump M11 is not required.

In systems with hot water generation and a switch valve (YM18), the connection is made at terminal M18.

Solar support for water heating

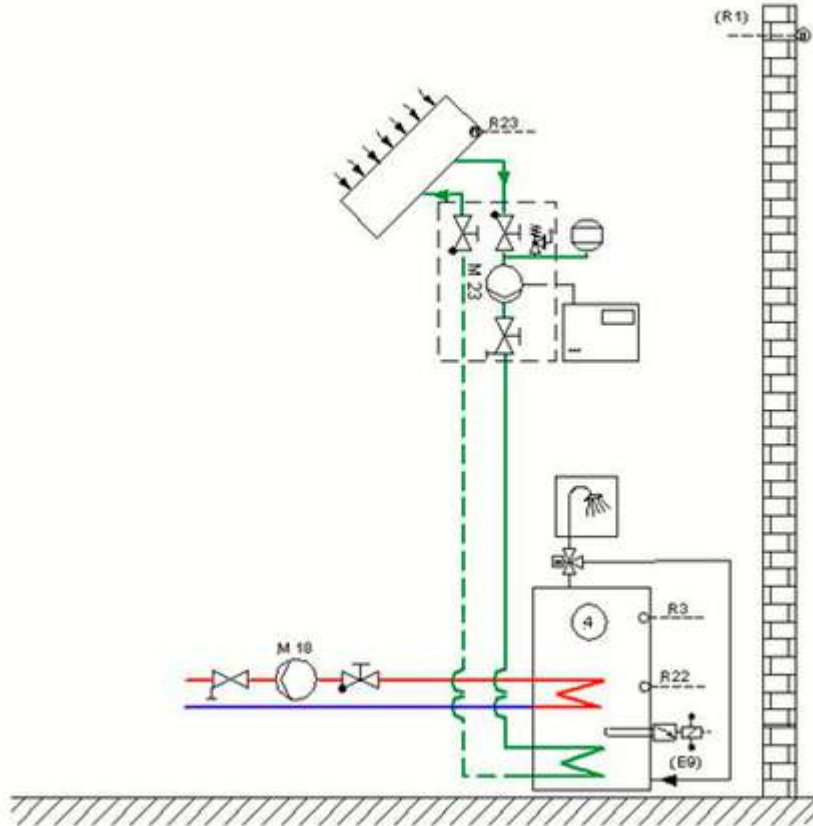


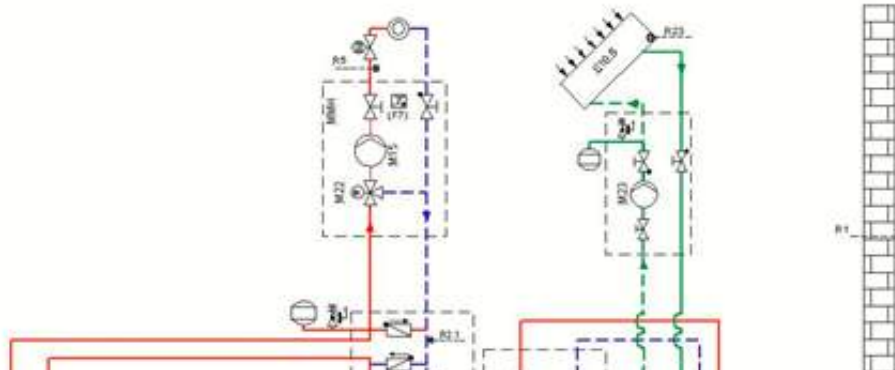
Fig. 8.74: Integration scheme (without safety fittings) of the heat pump with solar hot water support in connection with a solar station.

A solar station enables solar support for hot water preparation.

Functionality:
The WPM Touch heat pump manager or, alternatively, a solar thermal controller expands the existing heat pump manager with a solar controller. This controls the circulation pump M23 in a solar station. If the temperature at sensor R23 and

Hot water storage tank R22 if there is a sufficiently large temperature difference, hot water is generated via the solar thermal collectors. The hot water generation of the heat pump only comes into play if the target hot water temperature at sensor R3 is not reached.

External heating support and solar support hot water



configuration	setting
Mode of operation	Addition
electric heating	Heat in the buffer
1. Heating circuit	Heat
2nd heating circuit	Heat
	no

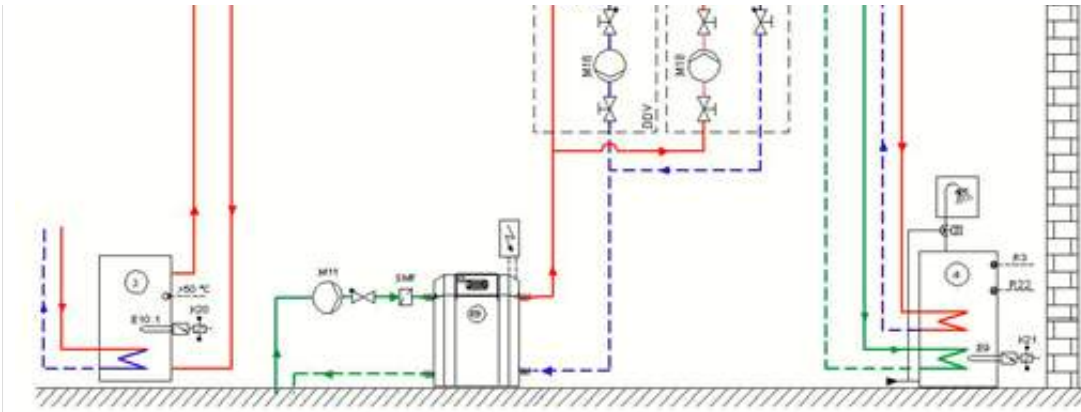


Fig.8.75: Integration scheme for the monoenergetic heat pump operation, row buffer storage with external heating support and hot water preparation (the hydraulics are only suitable for brine / water or water / water heat pumps)

3rd heating circuit	
Hot water	yes through feelers
Flange heating	Yes
swimming pool	no

Heating support
The return sensor must be attached exactly to the position shown in order to prevent the heat pump from being switched on when the storage tank is loaded. The universal buffer storage PSW 500 has a flange connection for installing the RWT 500 solar heat exchanger. A safety temperature monitor and 3-way mixer must be used for surface heating systems.

With permanent loading temperatures of over 50 °C, the heat pump must be blocked for hot water and swimming pool preparation via an additional thermostat (ID3).

NOTE
If the wood boiler mainly covers the heating requirements of the building, the heat pump is blocked and is therefore not available for hot water preparation. Alternatively, a hydraulic system with

regenerative storage can be used (see chapter 8.15.9)

Electrical connection for external heating and solar hot water support

NEW: Electrical connection with WPM Touch

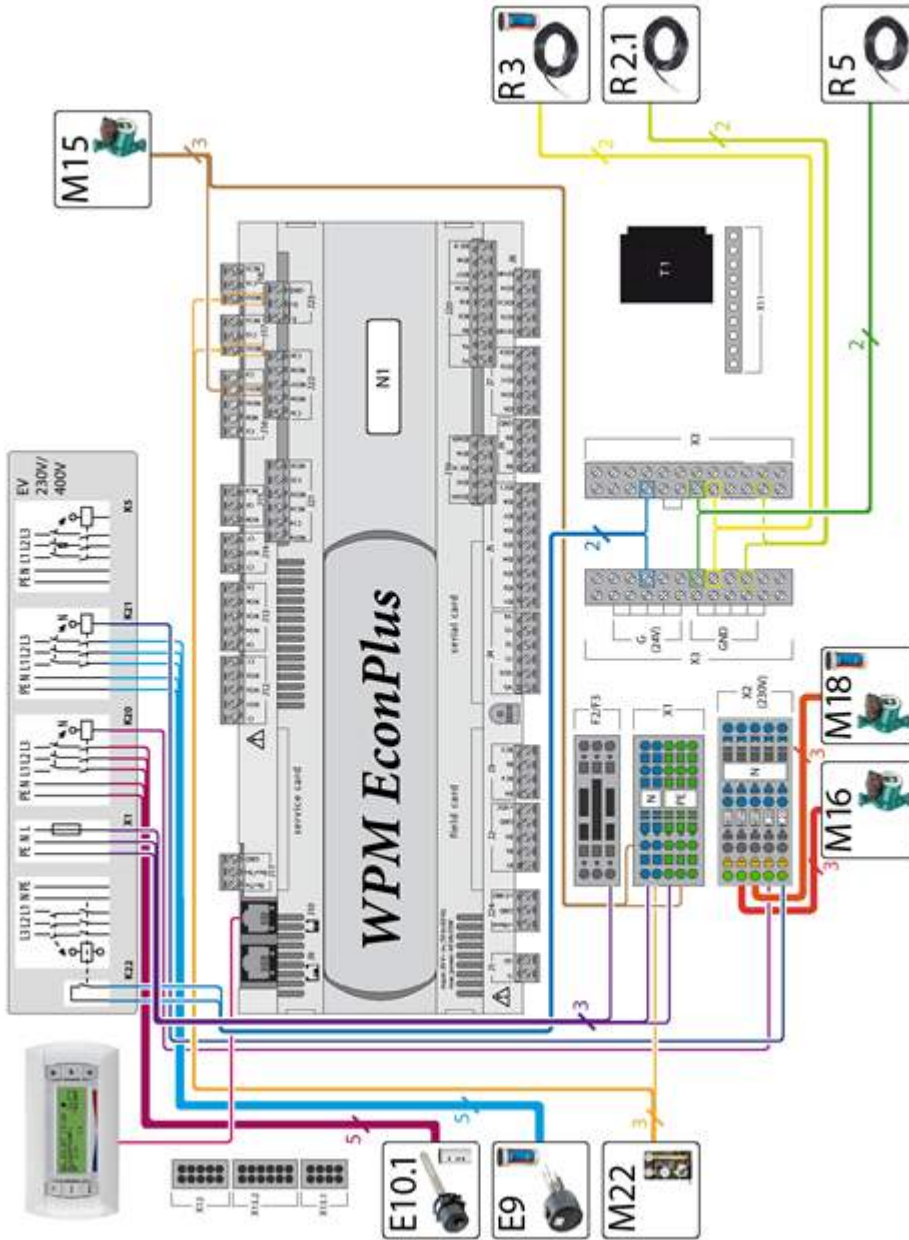


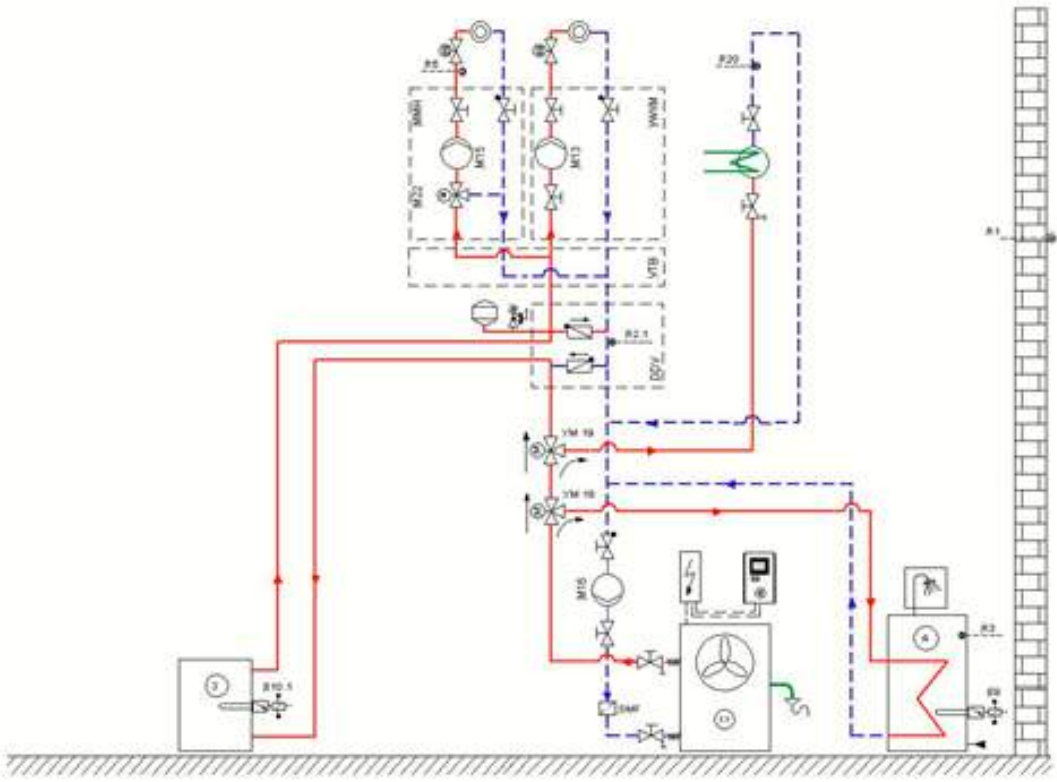
Fig. 8.76: WPM EconPlus heat pump manager for bivalent systems with one heating circuit and constant or variable controlled boiler

The 4-core supply line for the power section of the heat pump is led from the heat pump meter via the EVU contactor (if required) into the heat pump (3L / PE ~ 400V, 50Hz). Protection according to the current consumption information on the nameplate, by a 3-pole circuit breaker with C characteristics and common tripping of all 3 tracks. Cable cross-section according to DIN VDE 0100.

The 3-core supply line for the heat pump manager (N1) is routed into the heat pump (devices with integrated heat pump manager) or to the later installation location of the wall-mounted heat pump manager. The supply line (L / N / PE ~ 230V, 50Hz) for the heat pump manager must be connected to permanent voltage and for this reason must be tapped in front of the EVU blocking contactor or connected to the household electricity, as otherwise important protective functions are out of order during the EVU blocking .

When using air / water heat pumps, the connection of the primary pump M11 is not required.

8.15.10 Swimming pool heating

Heating, hot water and swimming pool heating	configuration	setting
 <p>Fig. 8.77: Integration scheme for monoenergetic heat pump operation with two heating circuits, hot water and swimming pool heating</p>	Mode of operation electric heating	monoenergetic Additional heating in the buffer
	1. Heating circuit	Heat
	2nd heating circuit	Heat
	3rd heating circuit	no
	Hot water	yes with feeler
	Flange heating	Yes
	swimming pool	yes with feeler
<p>The hot water is generated with the additional circulation pump (M16) and tightly closing switchover valve (YM18).</p> <p>The swimming pool request is made with the R 20 sensor, the swimming pool heating with the additional circulation pump (M16) and tightly closing changeover valve (YM19). Alternatively, a swimming pool circulation pump (M19) can be used instead of a switch valve (YM 19) (not shown in the adjacent integration diagram).</p>		
Heating, hot water and swimming pool heating via regenerative storage	configuration	setting
		bivalent

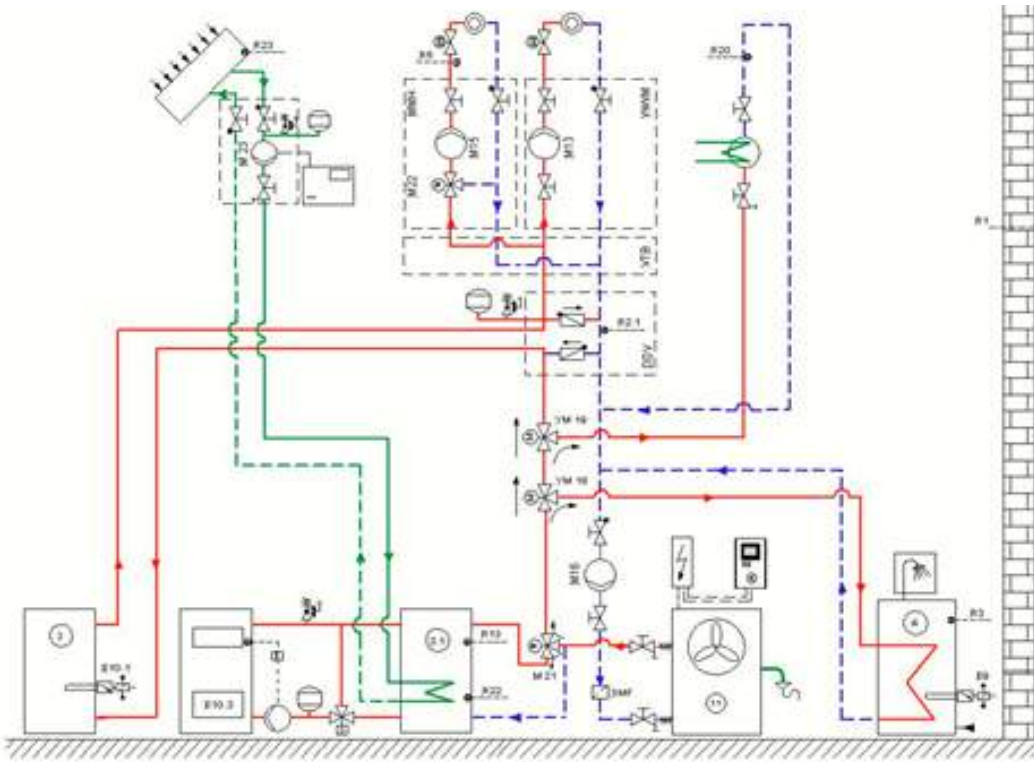


Fig. 8.78: Integration scheme for monoenergetic heat pump operation with two heating circuits, hot water and swimming pool heating

Mode of operation	regenerative
electric heating	Additional heating in the buffer
1. Heating circuit	Heat
2nd heating circuit	no
3rd heating circuit	no
Hot water	yes with feeler
Flange heating	Yes
swimming pool	yes with feeler

If the temperature level in the regenerative storage tank (3.1) is sufficiently high, the heat pump is blocked and the energy from storage 3.1 is used for heating, hot water or swimming pool requirements.

NOTE
Mixer control M 21 is active when heating water is prepared via the regenerative storage tank.

When there is a demand for hot water or a swimming pool, the M 21 mixer receives a "permanent open" command

Electrical connection for heating, hot water and swimming pool preparation via regenerative storage

NEW: Electrical connection with WPM Touch

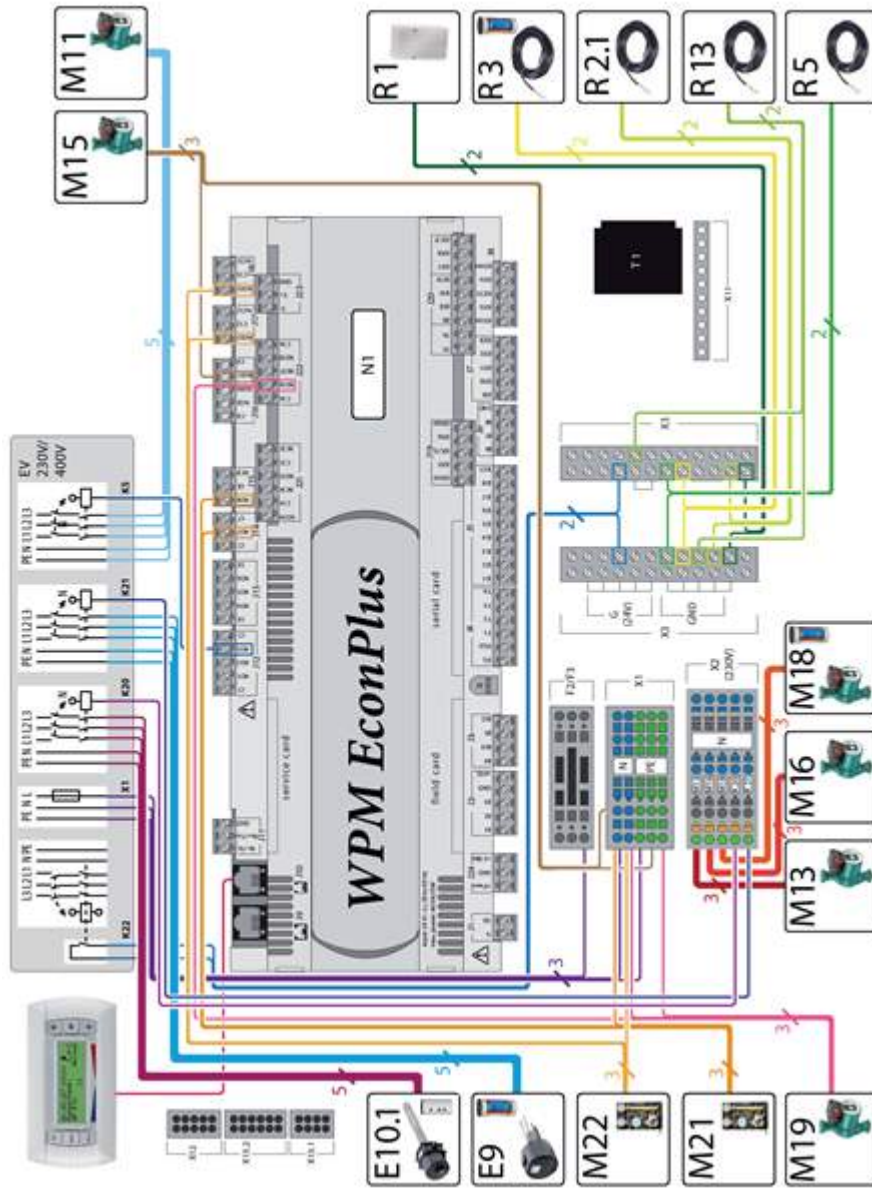


Fig. 8.79: WPM EconPlus heat pump manager for bivalent systems with one heating circuit and constant or variable controlled boiler

The 4-core supply line for the power section of the heat pump is led from the heat pump meter via the EVU contactor (if required) into the heat pump (3L / PE ~ 400V, 50Hz). Protection according to the current consumption information on the nameplate, by a 3-pole circuit breaker with C characteristics and common tripping of all 3 tracks. Cable cross-section according to DIN VDE 0100.

The 3-core supply line for the heat pump manager (N1) is routed into the heat pump (devices with integrated heat pump manager) or to the later installation location of the wall-mounted heat pump manager. The supply line (L / N / PE ~ 230V, 50Hz) for the heat pump manager must be connected to permanent voltage and for this reason must be tapped in front of the EVU blocking contactor or connected to the household electricity, as otherwise important protective functions are out of order during the EVU blocking .

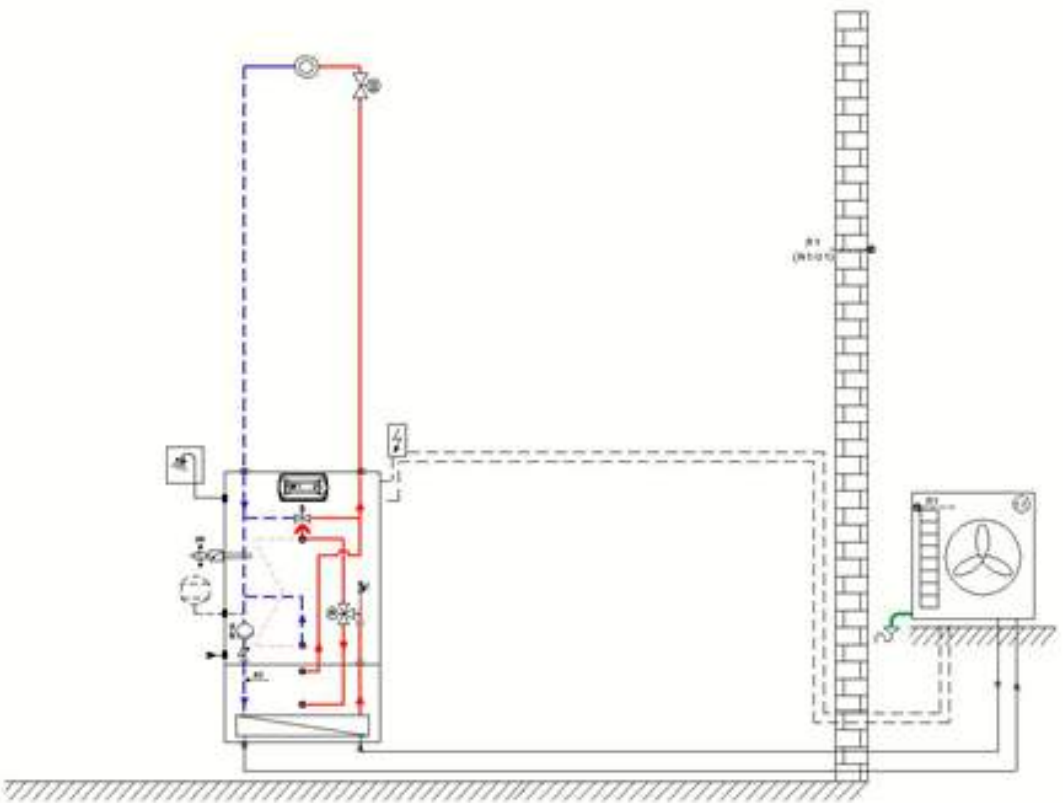
When using air / water heat pumps, the connection of the primary pump M11 is not required.


In systems with hot water generation and a switch valve (YM18), the connection is made at terminal M18.

8.15.11 Integration of the split air / water heat pump (Splydro)

Mono-energetic operation

setting

 <p>Fig.8.80: Integration scheme for the monoenergetic heat pump operation of a split air / water heat pump with one heating circuit and hot water preparation (outside temperature-based control)</p>	configuration	
	Mode of operation electric heating	monoenergetic Pipe heating Heating + hot water
	1. Heating circuit	Heat
	2nd heating circuit	no
	Hot water	yes through feelers
	swimming pool	no
<p>In all split air / water heat pumps, in addition to an electrical pipe heater (E10.1) for heating support and hot water preparation, a circulation pump is also integrated in the indoor unit.</p> <p>In addition, a 1.5 kW flange heater (E9) is integrated for thermal disinfection for hot water preparation.</p> <p>The circulation pump (M16) functions via the changeover valve either as a heating circulation pump or as a hot water charging pump.</p>		

	configuration	setting
	Mode of operation	bivalent HP + boiler
	1. Heating circuit	Heat
	2nd heating circuit	no

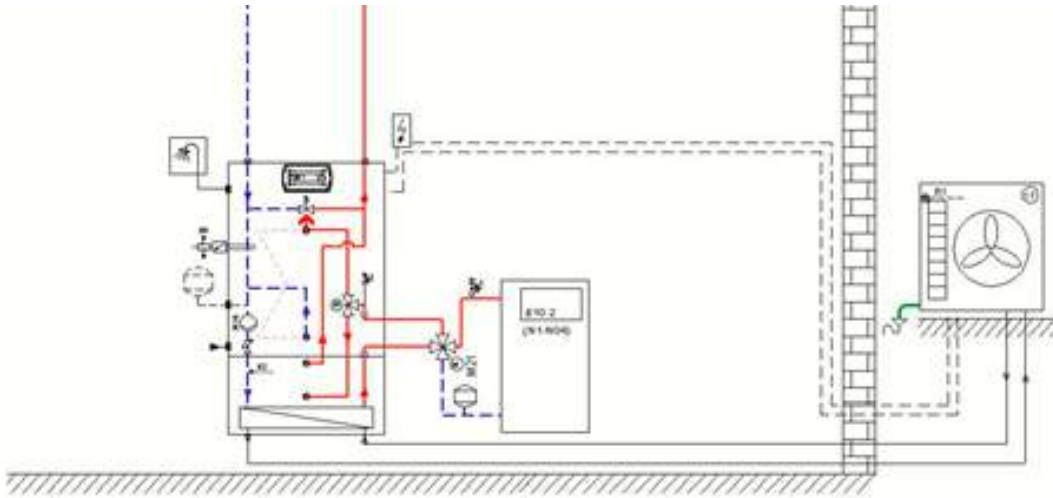


Fig.8.81: Integration scheme for the bivalent heat pump operation of a split air / water heat pump with one heating circuit and an existing boiler (oil / gas)

Hot water	yes through feelers
swimming pool	no

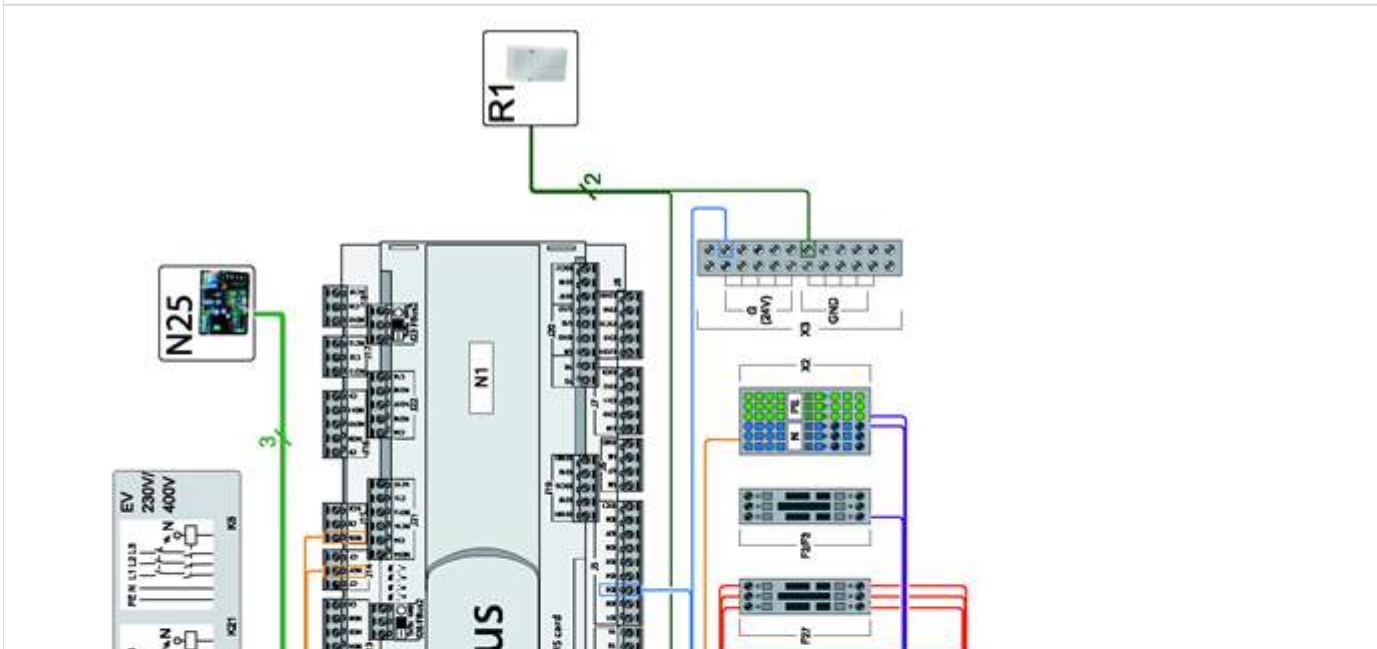
In all split air / water heat pumps, in addition to an electrical pipe heater (E10.1) for heating support and hot water preparation, a circulation pump is also integrated in the indoor unit.

In addition, a 1.5 kW flange heater (E9) for thermal disinfection is integrated for hot water preparation.

The circulation pump (M16) functions via the changeover valve either as a heating circulation pump or as a hot water charging pump.

In the case of bivalent systems, the pipe heating (E 10.1) is deactivated. In this case, the control signal of the pipe heating is used to control the boiler.

Electrical connection Splydro - bivalent operation



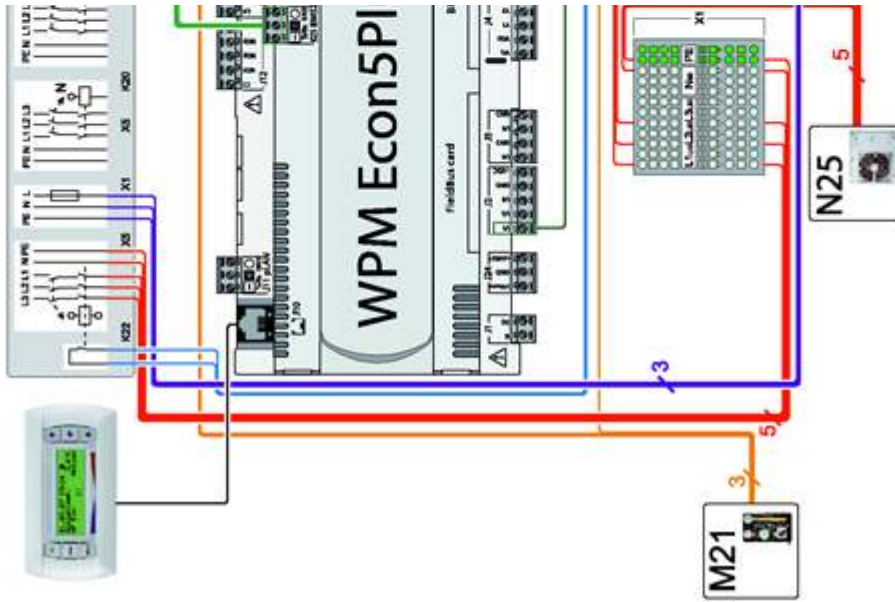


Fig.8.82: WPM EconPlus heat pump manager for bivalent systems with one heating circuit and constant or variable controlled boiler

Constantly regulated boiler

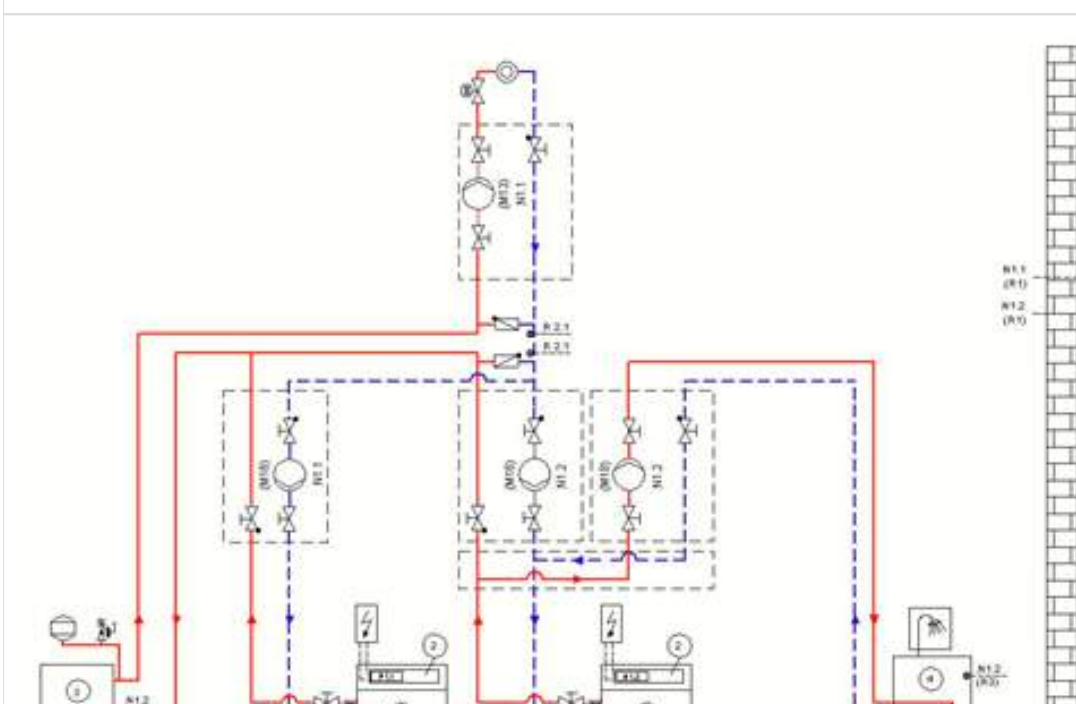
The control of the mixer is taken over by the heat pump manager, who requests the boiler if necessary and adds enough hot boiler water to achieve the desired return temperature or hot water temperature. The boiler is requested via the 2nd heat generator output of the heat pump manager and the operating mode of the 2nd heat generator is to be coded as "constant".

Slidably regulated boiler

Condensing boilers can also be operated via their own weather-compensated burner control. If necessary, the boiler is requested via the 2nd heat generator output, the mixer is opened completely and the full volume flow is run through the boiler. The mode of operation of the 2nd heat generator is to be coded as "sliding". The heating curve of the burner control is set according to the heating curve of the heat pump.

8.15.12 Parallel connection of heat pumps

Double differential pressure-free manifold



configuration	setting	
Heat pump	1.1	1.2
Mode of operation	no	Additional heating in the buffer
Pipe heating		
1. Heating circuit	Heat	Heat
2nd heating circuit	no	Hot water
Hot water	no	yes through feelers
swimming pool	no	no

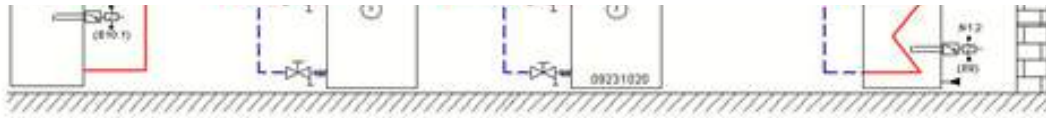


Fig. 8.83: Integration scheme for the parallel connection of heat pumps, series buffer storage with a double differential pressure-free distributor and hot water preparation

The hot water is only produced by a heat pump.

With brine / water heat pumps, each heat pump has its own brine circulating pump. A common geothermal probe or geothermal collector system is used as a heat source.

Parallel connection of heat pumps with the same operating mode

By connecting heat pumps in parallel, a higher heating or cooling requirement can be covered.

The use of a higher-level master control is recommended when several heat pumps are connected in parallel. This means that even compressor runtimes are achieved, even when different heat pumps are combined in one system.

Alternatively, two heat pumps with the same heat source can be connected in parallel **without a superordinate regulation** possible through the existing heat pump manager:

- The same heating curves are set for all heat pump managers.
- Heat pumps that are also used for hot water and swimming pool preparation should be set in such a way that the return target temperature is 1 K lower.

Parallel connection of heat pumps with different operating modes (heating / cooling)

Our project planning team is at your disposal for the cascading of heat pumps with special requirements (parallel connection of heat pump systems for heating and cooling) to the control system

8.15.13 Return increase

DHW heating via heat pump	configuration	setting
	Heat pump	Bivalent
	1. Heating circuit	Heat
	2nd heating circuit	(optional)
	Hot water	Yes, with a feeler
	swimming pool	no
System hydraulics with 1 heating circuit, hot water preparation, bivalent heat generator, buffer storage.		
DHW heating via the boiler	configuration	setting

Fig.8.84: Integration scheme with row buffer storage, hot water storage and bivalent heat generator

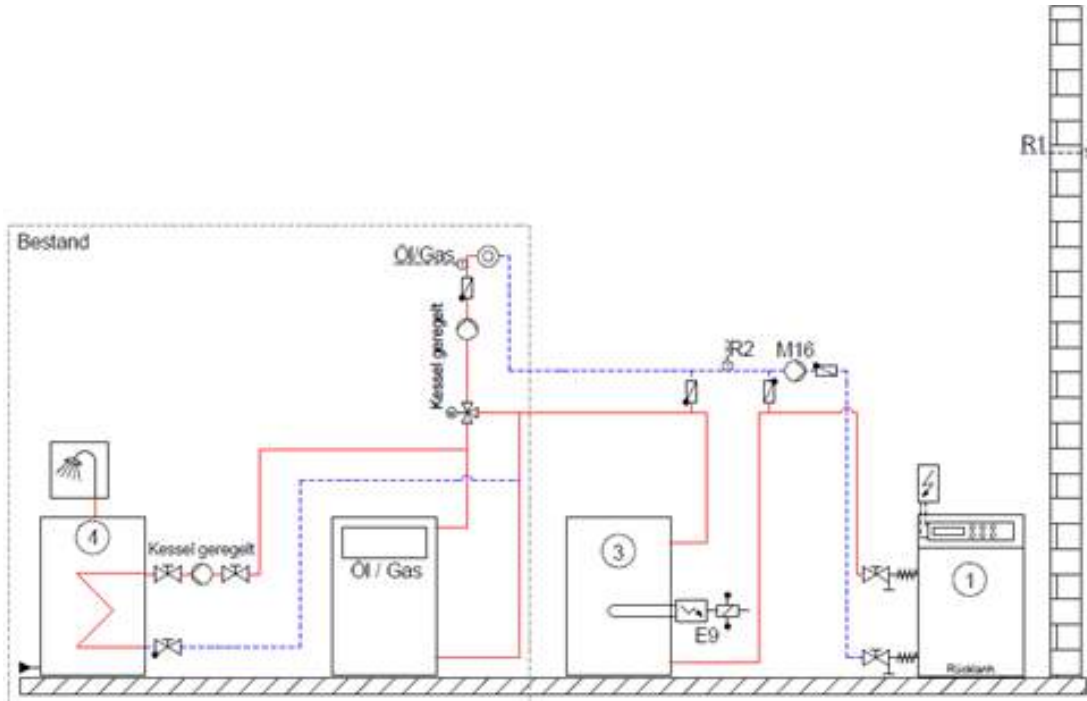


Fig.8.85: Integration scheme with row buffer storage, hot water storage and bivalent heat generator

Heat pump	Bivalent
1. Heating circuit	Heat
2nd heating circuit	(optional)
Hot water	Yes, with a feeler
swimming pool	no
System hydraulics with 1 heating circuit, hot water preparation, bivalent heat generator, buffer storage	

Hot water preparation via fresh water station

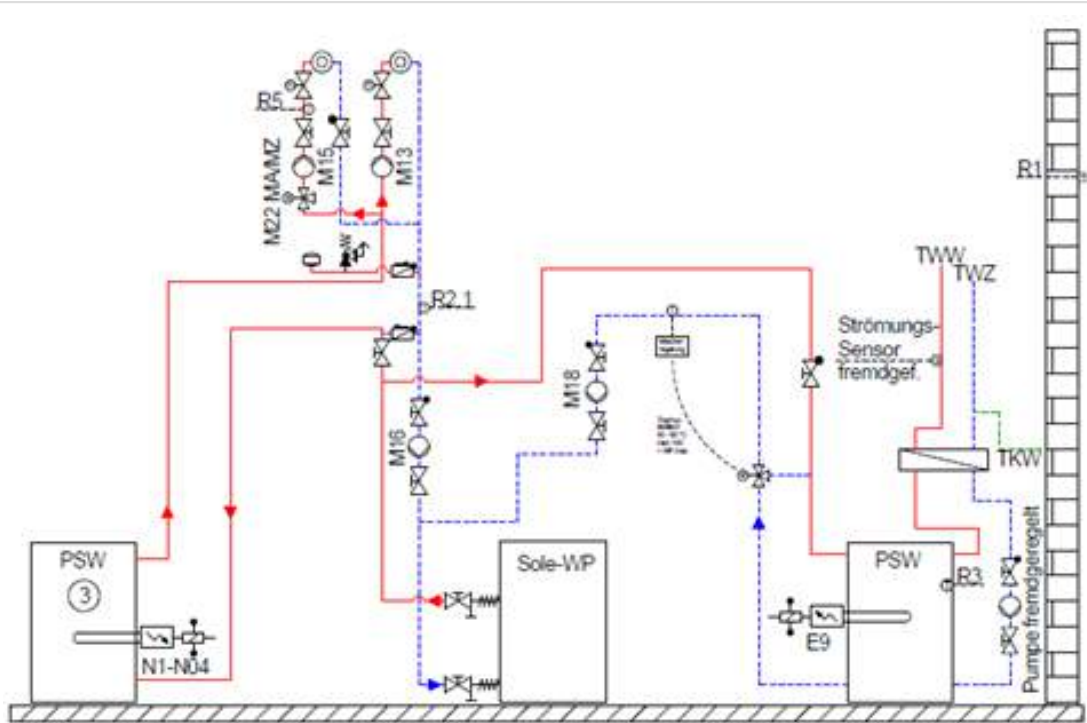


Fig.8.86: Integration scheme with buffer storage for heating, hot water preparation with fresh water station

configuration	setting
Heat pump	Mono-energetic
1. Heating circuit	Heat
2nd heating circuit	Heat
Hot water	Yes, with a feeler
swimming pool	no
System hydraulics with 2 heating circuits, buffer storage with electric immersion heater, hot water preparation via fresh water station.	

8.15.14 Reheating according to DVGW 551

Reheating according to DVGW 551

configuration	setting
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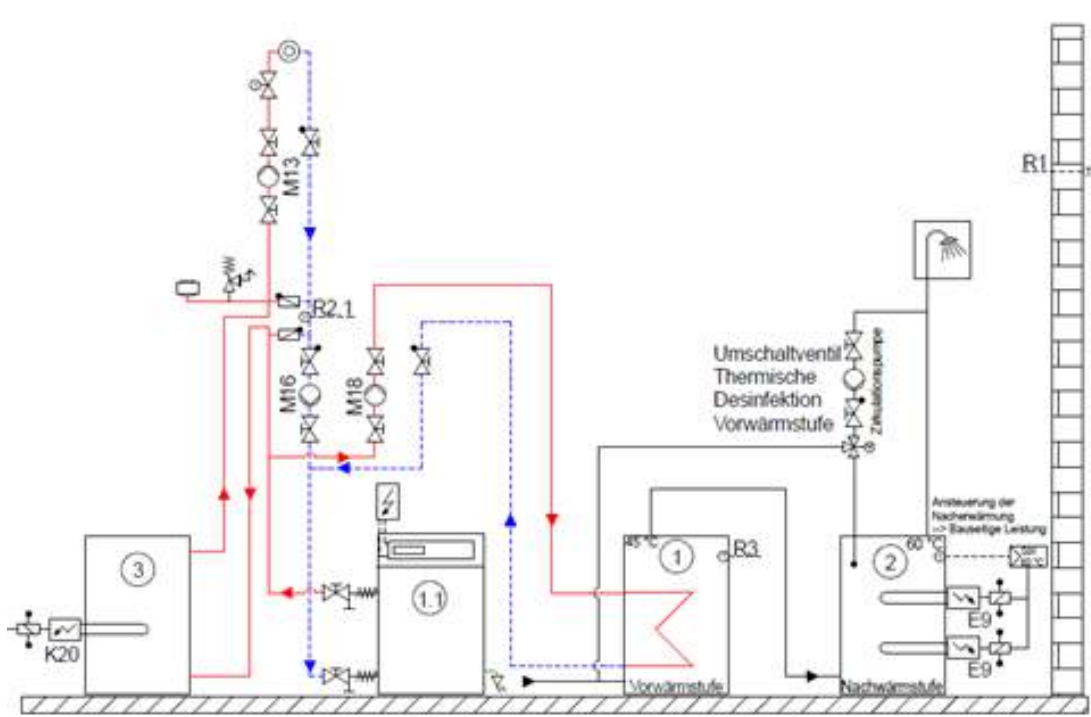


Fig. 8.87: Integration scheme with buffer storage, pre- and post-heating stage for thermal disinfection

Heat pump	Monoenergetic
1. Heating circuit	Heat
2nd heating circuit	(optional)
Hot water	Yes, with a feeler
swimming pool	no
System hydraulics with 1 heating circuit, buffer storage with electric immersion heater, pre- and post-heating stage for thermal disinfection.	

8.15.15 Hydraulic integration system M / M Flex

One heating circuit with hot water preparation

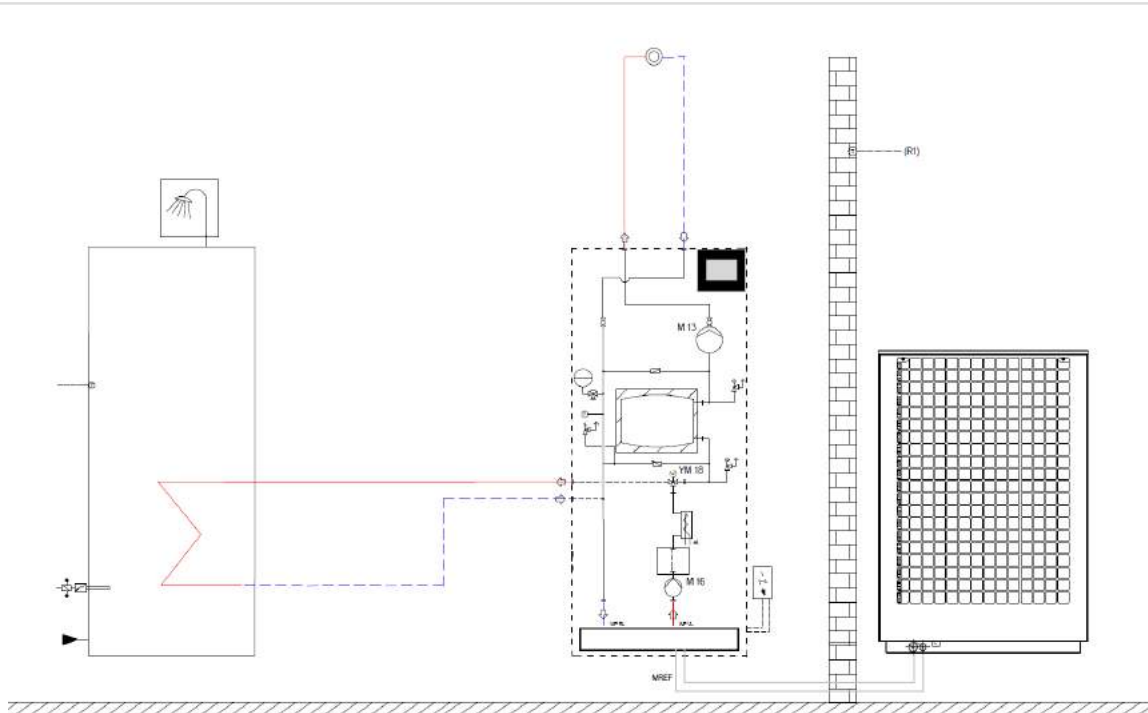


Fig. 8.88: Integration scheme with integrated buffer storage, generator and consumer circuit and hot water storage tank

configuration	setting
Heat pump	Monoenergetic
1. Heating circuit	Heat
2nd heating circuit	(optional)
Hot water	Yes, with a feeler
swimming pool	no
System hydraulics with heat source module, hydraulic module (integrated generator and consumer circuit, buffer storage and pipe heating)	

and hot water storage.

Bivalent with two heating circuits and hot water preparation

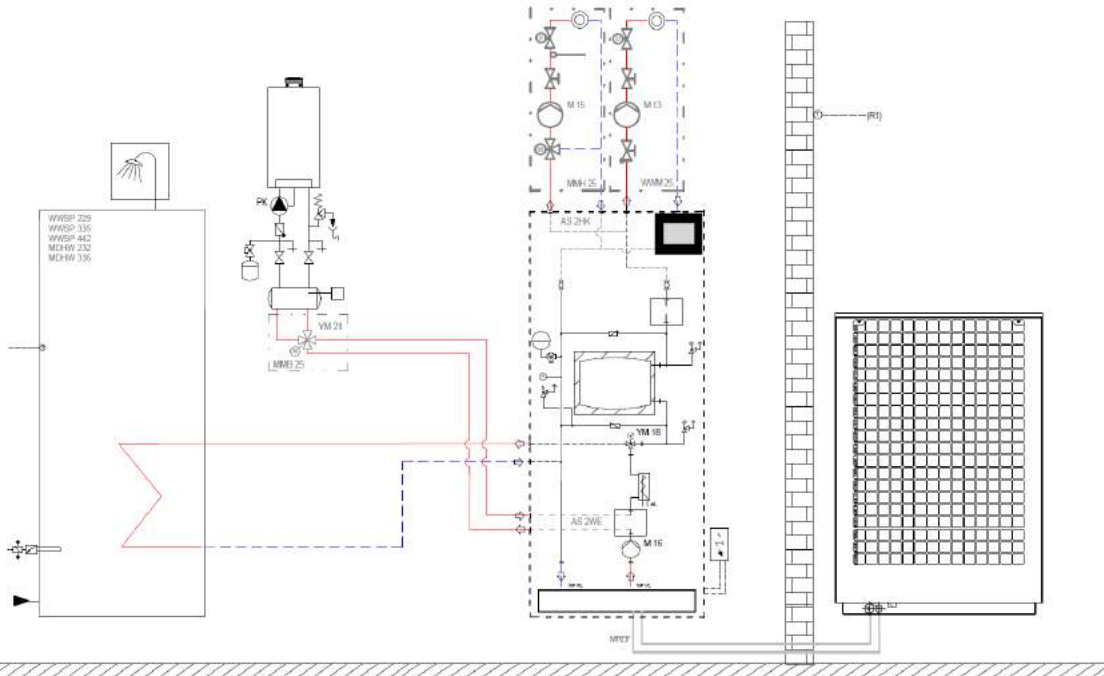


Fig. 8.89: Integration scheme with integrated buffer storage tank, generator and consumer circuits, hot water storage tank and bivalent heat generator

configuration	setting
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Heat pump	bivalent
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1. Heating circuit	Heat
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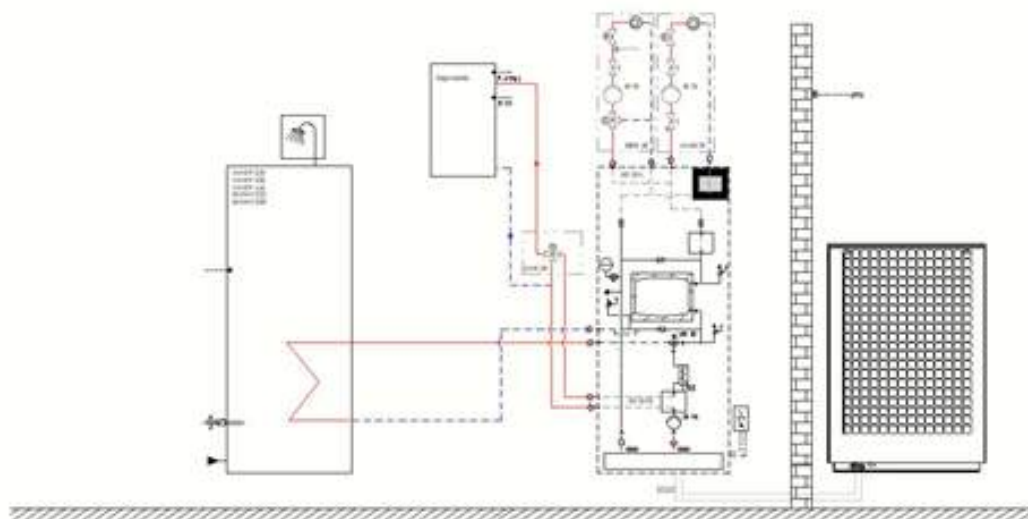
2nd heating circuit	Heat
---------------------	------

Hot water	Yes, with a feeler
------------------	--------------------

swimming pool	no
----------------------	----

System hydraulics with heat source module, hydraulic module (integrated generator and consumer circuit, buffer storage and pipe heating), hot water storage and bivalent heat generator.

Bivalent-renewable with one heating circuit and hot water preparation



configuration	setting
---------------	---------

Heat pump	bivalent
------------------	----------

1. Heating circuit	Heat
--------------------	------

2nd heating circuit	(optional)
---------------------	------------

Hot water	Yes, with a feeler
------------------	--------------------

swimming pool	no
----------------------	----

System hydraulics with heat source

Fig. 8.90: Integration scheme with integrated buffer storage, generator and consumer circuit, hot water storage and bivalent-regenerative storage

module, hydraulic module (integrated generator and consumer circuit, buffer storage and pipe heating), hot water storage and bivalent-regenerative storage.

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