Planning module

auroSTOR VIH S 750 - 2000, uniSTOR VIH R 750 - 2000

VIH S 750, VIH S 1000, VIH S 1500, VIH S 2000

International version

Inhaltsverzeichnis

1 Introduction 5
1.1 Solar energy – the energy source of the future 5
Radiation values 5
Solar technology, a cutting-edge technology for the future 5
Hot water generation with large solar systems 5
1.2 How a solar system for hot water generation works 6

2 Presentation of the system 7
2.1 System guide 7
System planning 7
Example application 8

3 Description of the unit 10
3.1 Product description auroSTOR VIH S solar cylinder 10
Special features 10
Product equipment 10
Potential applications 10
Technical data 11
3.2 Product description: uniSTOR VIH R domestic hot water cylinder 13
Special features 13
Product equipment 13
Potential applications 13
Technical data 14
3.3 Product description: 35 l/min solar pump unit 16
Special features 16
Product equipment 16
Potential applications 16
Technical data 16
Remaining feed head 18
3.4 Product description: 22 l/m solar pump unit 19
Special features 19
Product equipment 19
Potential applications 19
Technical data 20
Remaining feed head 20
3.5 Product description: Flow limiter 21
Special features 21
Product equipment 21
Potential applications 21
Technical data 22
3.6 Product description: auroMATIC 560/2 solar controller 23
Special features 23
Product equipment 23
Potential applications 23
Technical data 23
3.7 auroMATIC 620/3 product description 24
Equipment 24
Potential applications 24
Technical data 25
Dimension drawing and connection dimensions 25
3.8 Product description: auroTHERM VFK ... flat collectors 26
Special features 26
Product equipment 26
Technical data 27
Dimension drawings 28
Pressure losses 29
Hydraulic connection of the collector field for flat collectors 30
3.9 Product description: auroTHERM exclusive VTK 570/2 and VTK 1140/2 vacuum tube collectors 33
Special features 33
Product equipment 33
Dimension drawings 34
Pressure losses 34
Technical data 35
Hydraulic connection of the collector field for vacuum tube collectors 36

4 System design 40
4.1 Solar systems for hot water generation 40
4.2 Process of the system design 40
Planning step 1: Hot water demand 40
Planning step 2: Designing the solar system 41
Planning step 3: Selecting the collector installation type and checking the general parameters 43
Planning step 4: Dimensioning the domestic hot water cylinder 44

Inhaltsverzeichnis

5	**Component design**	**45**
5.1	Design of the solar components	45
	Design of the solar components	45
6	**Accessories**	**52**
6.1	On-roof mounting	52
6.2	Open air installation	53
6.3	General accessories	55
7	**Post-heating installations**	**58**
7.1	Post-heating installations	58
8	**System diagrams**	**59**
8.1	Overview of the system diagrams	59
8.2	System diagram 1	62
	Connection diagram	65
8.3	System diagram 2	66
	Connection diagram	69
8.4	System diagram 3	70
	Connection diagram	73
8.5	System diagram 4	74
	Connection diagram	77
8.6	System diagram 5	78
	Connection diagram	81

1 Introduction

1.1 Solar energy – the energy source of the future

Fig. 1: The power of the sun

For 5 billion years, the sun has been providing the earth with energy and it will continue to do so for many years to come. And what makes more sense than to make use of this energy. Just eight minutes of sunlight on the surface of the earth corresponds to the current annual energy consumption of the world. Compared with this potential, the available resources of fossil and atomic energy sources are low.

Radiation values

The radiated power of the sun that is received at ground level is known as global radiation. The level of direct and diffuse radiation is highly dependent on the season and local weather conditions. Diffuse radiation is caused by scattering, reflection and refraction of clouds and particles in the air. This can also be utilised for solar technology. If a cloudy day produces a proportion of diffuse radiation above 80%, 300 W/m² of solar radiation can still be measured.

The average radiation at a particular location can be read on the radiation map. As a rule of thumb, this is calculated to be approx. 1500 kWh/m²a, which corresponds to an energy content of 150 litres of oil. Basically, the sun's power provides sufficient radiation energy to generate hot water.

In addition to the intensity of the solar radiation, the design of the collector field also depends on the following factors:

- The hot water demand of the building
- The desired solar fraction
- The heat exchanger surface area of the selected cylinder
- The orientation and inclination of the roof

Ultimately, efforts must of course be made to attain the highest solar fraction as possible using a large collector surface.

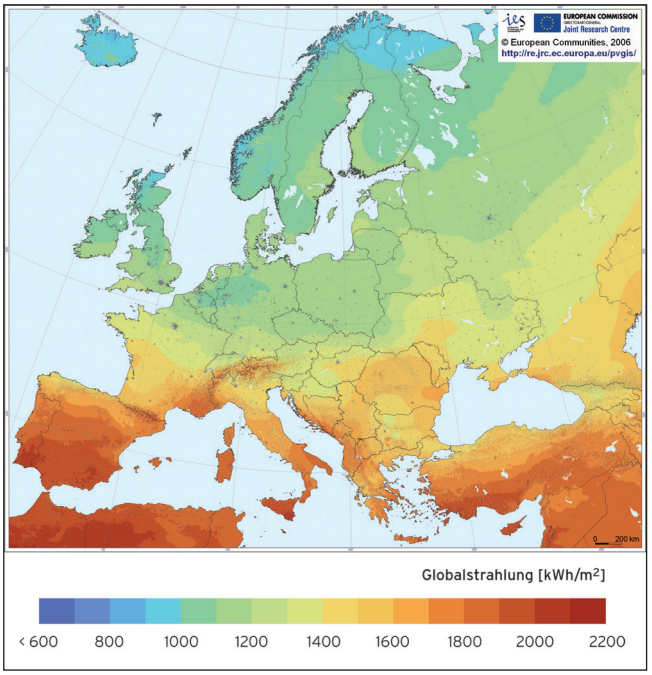


Fig. 2: The design of the collector surface based on the installation location

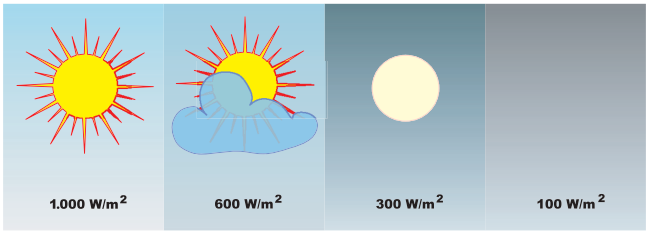


Fig. 3: Direct and diffuse radiation can be used

Solar technology, a cutting-edge technology for the future

A solar plant for hot water generation uses emission-free technology, which saves fossil fuel resources and reduces the impact on our environment.

Faced with continually increasing energy costs, it makes it so easy to make an active contribution to environmental protection, and at the same time, reduce the burden on your own purse. Today, modern solar technology can be integrated seamlessly into the building's design and gives you a good feeling of showering in an energy-efficient way everyday.

A solar plant for hot water generation is a low-maintenance, crisis-proof, and easily calculable investment in the future.

Hot water generation with large solar systems

Traditionally, Vaillant focuses on pioneering and efficient technology. Large solar systems hot water generation are a logical step towards using solar energy.

The components form the underlying structure of large solar systems with collector surfaces of at least 20 m^2. Setting up large collector surfaces requires domestic hot water cylinders, solar pump units, collectors and their corresponding controllers and accessories.

Good reasons for choosing solar systems:

- Environmental protection by saving resources and preventing CO_2 emissions
- Cost savings by reducing the oil, gas and electrical consumption
- Upgrading of the building
- High level of user identification with solar technology
- Less dependence on fossil fuels
- Low-maintenance
- Crisis-proof

1.2 How a solar system for hot water generation works

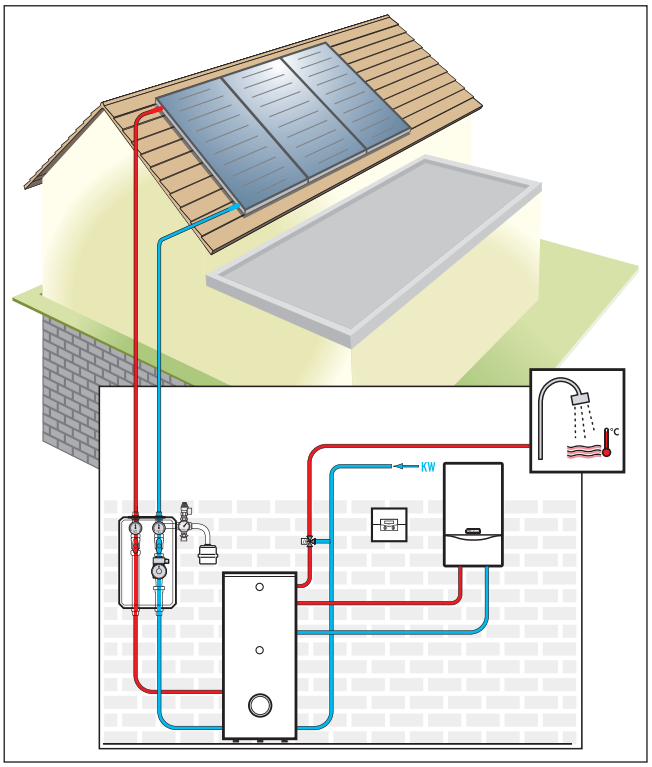


Fig. 4: System diagram – solar system for hot water generation using solar energy

The solar system for hot water generation consists of the following components:

- The domestic hot water cylinder;
- The solar pump unit, which transports heat and has the required safety features;
- The collector field, consisting of flat or tube collectors which absorb solar radiation and make it usable;
- The solar controller, which monitors, displays and controls all system functions.

The sun heats the absorber in the collector and the solar fluid that is circulating inside it. The circulation pump transports the solar fluid to the lower heat exchanger of the bivalent solar hot water cylinder, where it transfers its thermal energy to the drinking water in the cylinder.

The solar controller only ever switches on the circulation pump in the solar circuit when the temperature in the collector is higher than that in the lower part of the cylinder. The difference in temperature, which is usually set at between 5 K and 10 K, is measured by temperature sensors on the collector and on the bivalent solar hot water cylinder. If the difference in temperature falls below a certain threshold, e.g. 3 K, the controller switches the pump off again as a considerable energy yield is no longer expected and the pump should not consume power unnecessarily.

If there is insufficient solar radiation to heat the drinking water, the upper part of the cylinder is heated to the required set target temperature by a conventional heating system. This allows the solar system to be combined with various boilers, gas-fired wall-hung boilers, electric instantaneous water heaters or electrical heating rods. It is even possible to incorporate a swimming pool or a second cylinder into the solar system.

2 Presentation of the system

2.1 System guide

System planning

In order to find the best solution for the relevant object from the various options, precise planning is required. In doing so, in addition to the values required to design the system (hot water demand, heating load calculation, etc.), you must also pay attention to the demands that the customer places on their solar system.

The following information should help you to narrow down the possible system solutions using the object characteristics and to narrow down the preselection of the system. The following sections will provide you with more detailed information on the specific design of the individual system parts and components.

The following planning data and information are essential for selecting the most suitable components for the solar system:

- New build or modernisation
- Building usage type
- Hot water demand
- Room/space requirements for the system components

Systems for the solar hot water generation

The following overview illustrates the various different options that the solar system offers in order to help you adapt it to the relevant object in the best way possible.

You will find more detailed information about the Vaillant system components that are used in the application examples in the device-specific sections. These sections contain, for example, technical data and planning and installation information.

Using the reference to the system diagram, you can navigate quickly from the overview tables to the relevant system diagram in section 5 in order to access the detailed planning.

Presentation of the system

Example application

Multiple-occupancy house with central incorporation of a solar system

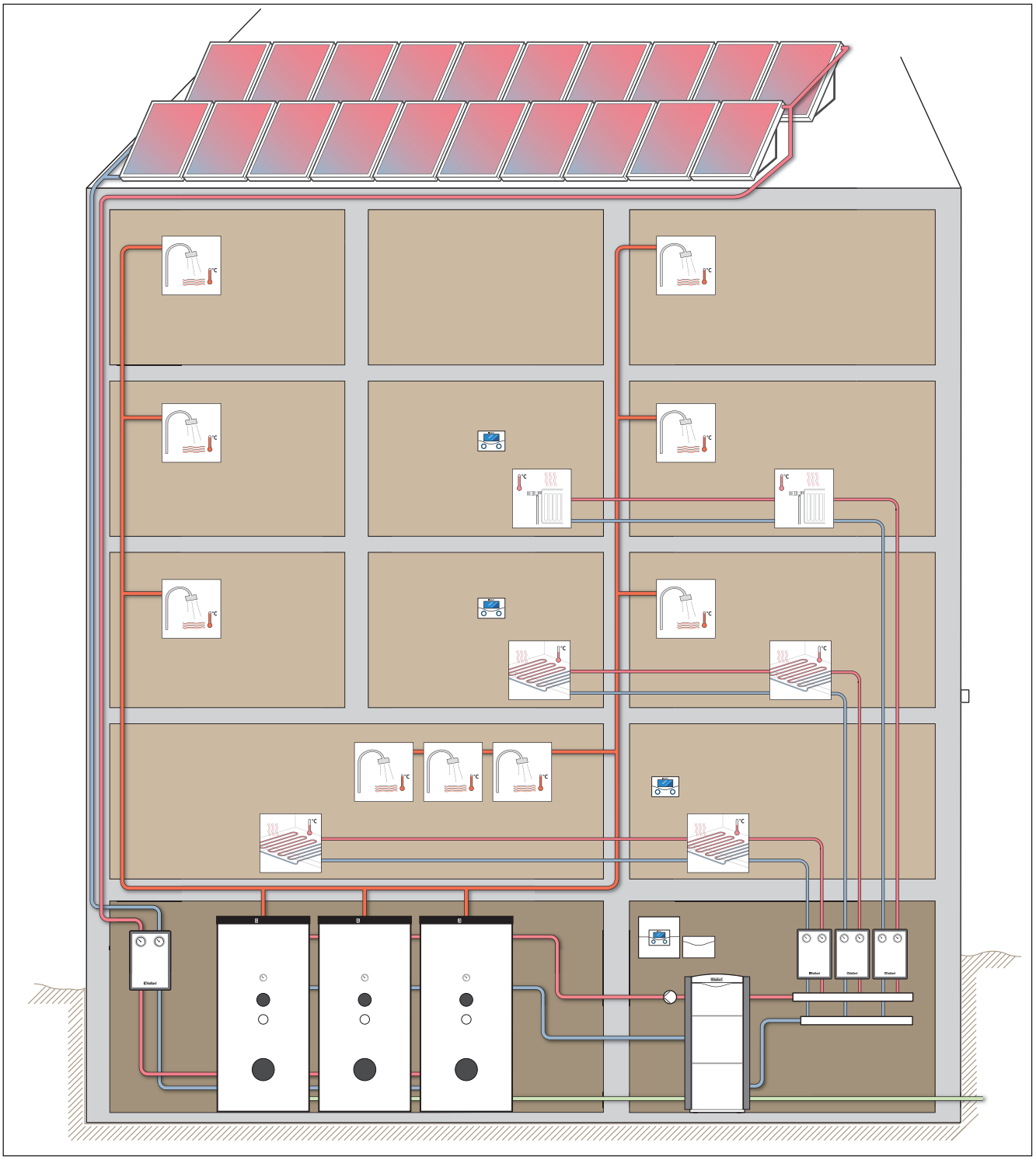


Fig. 5: Example application: Multiple-occupancy house with central incorporation of a solar system

Description

Sample design of a large solar system for hot water generation with Vaillant VFK solar collectors as a free-standing installation. The solar system is centrally integrated using a solar cylinder.

For reheating, a gas-fired condensing boiler or a gas-fired wall-hung high-efficiency boiler can be used.

Presentation of the system

Advantages/uses of the system	**Heat generation and hot water generation**				**System diagram**
Central hot water generation with solar support					
Matched components for large solar systems	ecoVIT exclusive gas-fired condensing boiler	auroSTOR VIH S cascades	Collectors in accordance with the system design	auroMATIC 620/3 solar control system	5 4
Matched components for large solar systems	ecoVIT exclusive gas-fired condensing boiler	uniSTOR VIH R auroSTOR VIH S	Collectors in accordance with the system design	auroMATIC 620/3 solar control system	2
Matched components for large solar systems	ecoTEC plus gas-fired wall-hung boilers ecoTEC exclusive gas-fired wall-hung boiler	auroSTOR VIH S auroSTOR VIH S cascade	Collectors in accordance with the system design	auroMATIC 620/3 solar control system calorMATIC 470/3 weather-controlled control system and VR 68/3 solar charging station	1 3

3 Description of the unit

3.1 Product description auroSTOR VIH S solar cylinder

Special features

- Bivalent hot water cylinder, indirectly heated
- Cylinder heat exchanger for the heating circuit and for the solar circuit
- Casing with removable white/grey plastic jacket

Product equipment

- Domestic hot water cylinder and both pipe heat exchangers enamelled on the hot water side with additional magnesium protection anode (750 and 1000 l) or external current anode (1500 and 2000 l)
- High-quality heat insulation fleece
- Option to connect to electrical heating rod
- Sleeve (R 1 1/2) for electrical heating cartridge

Potential applications

Indirectly heated solar hot water cylinder for solar-assisted hot water supply, for group or centralised supply at a mains overpressure of up to 7 bar.

Solar hot water cylinders are usually heated to approx. 80 °C. In areas where the water is very hard, we recommend heating the cylinder to no more than 60 °C; this is to avoid the increased risk of limescale formation and the frequent maintenance that this entails.

Fig. 6: auroSTOR VIH S 750 to 2000

Type designation	Article number
VIH S 750	0010014935
VIH S 1000	0010014936
VIH S 1500	0010014937
VIH S 2000	0010014938

Description of the unit

Technical data

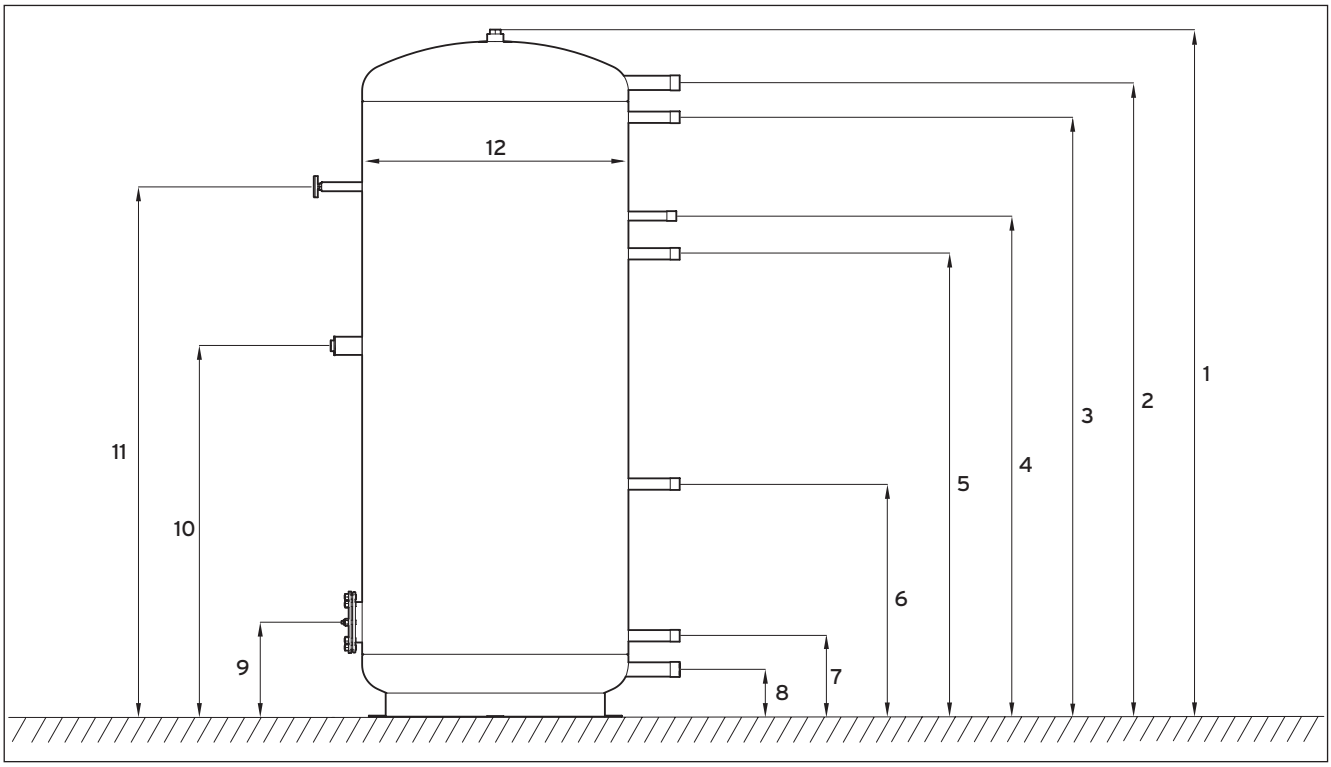


Fig. 7: VIH S dimensions and connection dimensions

Dimension	Unit	Tolerance	VIH S 750	VIH S 1000	VIH S 1500	VIH S 2000
1	mm	± 10	1745	2025	2020	2355
2	mm	± 10	1600	1880	1800	2135
3	mm	± 10	1500	1778	1680	2020
4	mm	± 10	1207	1485	1460	1800
5	mm	± 10	1095	1373	1180	1430
6	mm	± 10	690	690	935	1075
7	mm	± 10	240	240	300	350
8	mm	± 10	140	140	190	240
9	mm	± 10	280	280	460	510
10	mm	± 10	880	1100	1230	1150
11	mm	± 10	1472	1572	1480	1690
12	mm	± 10	790	790	1000	1100

Description of the unit

	Unit	VIH S 750	VIH S 1000	VIH S 1500	VIH S 2000
Dimensions/weight					
Net weight	kg	228	246	378	480
Weight (ready for operation)	kg	959	1112	1708	2372
Hydraulic connection					
Cold/hot water connection	–	R 1 1/4		R 1 1/2	
Solar flow/return connection	–	R1			
Circulation connection	–	R 3/4			
Cylinder output data					
Contents	l	731	866	1330	1892
Inner vessel	–	Steel, enamelled, with 2 magnesium protection anodes		Steel, enamelled, with 2 external current anodes	
Maximum operating pressure (cylinder)	MPa (bar)	0.7 (7)			
Maximum permissible operating temperature	°C	95			
Continuous hot water output *	kW/h	60	60	77	87
	l/h	1474	1474	1891	2138
Continuous hot water output **	kW/h	31	32	40	48
	l/h	761	786	982	1179
10-minute output ***	l/10 min	392	426	606	920
Standby energy consumption	KWh/24 hrs	2.26	2.45	3.15	4.35
Output characteristic figure NL ***	–	5	5.5	16	37
Heating circuit output data					
Maximum operating pressure (heating)	MPa (bar)	0.6 (6)			
Maximum hot water flow temperature	°C	115			
Heating area of the heat exchanger	m^2	2	2	3	4
Heating water of the heat exchanger	l	13.2	13.2	19.8	26.3

* Reheat temperature 80 °C, draw-off temperature 45°C, cold water inlet temperature 10 °C
** Reheat temperature 60 °C, draw-off temperature 45 °C, cold water inlet temperature 10 °C
*** Reheat temperature 80 °C, cylinder temperature 60 °C, draw-off temperature 45 °C, cold water inlet temperature 10 °C

3.2 Product description: uniSTOR VIH R domestic hot water cylinder

Special features

- Monovalent domestic hot water cylinder, indirectly heated
- High continuous hot water output

Product equipment

- Domestic hot water cylinder with high-quality enamelling
- High-quality heat insulation fleece
- Magnesium protection anode (750 and 1000 l) or external current anode (1500 and 2000 l)
- Pipe heat exchanger
- Inspection opening
- Circulation connection
- Option to connect to electrical heating rod

Potential applications

Indirectly heated domestic hot water cylinder for hot water supply, for group or centralised supply at a mains overpressure of up to 7 bar.

Domestic hot water cylinders are usually heated to approx. 80 °C. In areas where the water is very hard, we recommend heating the cylinder to no more than 60 °C; this is to avoid the increased risk of limescale formation and the frequent maintenance that this entails.

Fig. 8: uniSTOR VIH R 750 to 2000

Type designation	Article number
VIH R 750	0010014931
VIH R 1000	0010014932
VIH R 1500	0010014933
VIH R 2000	0010014934

Description of the unit

Technical data

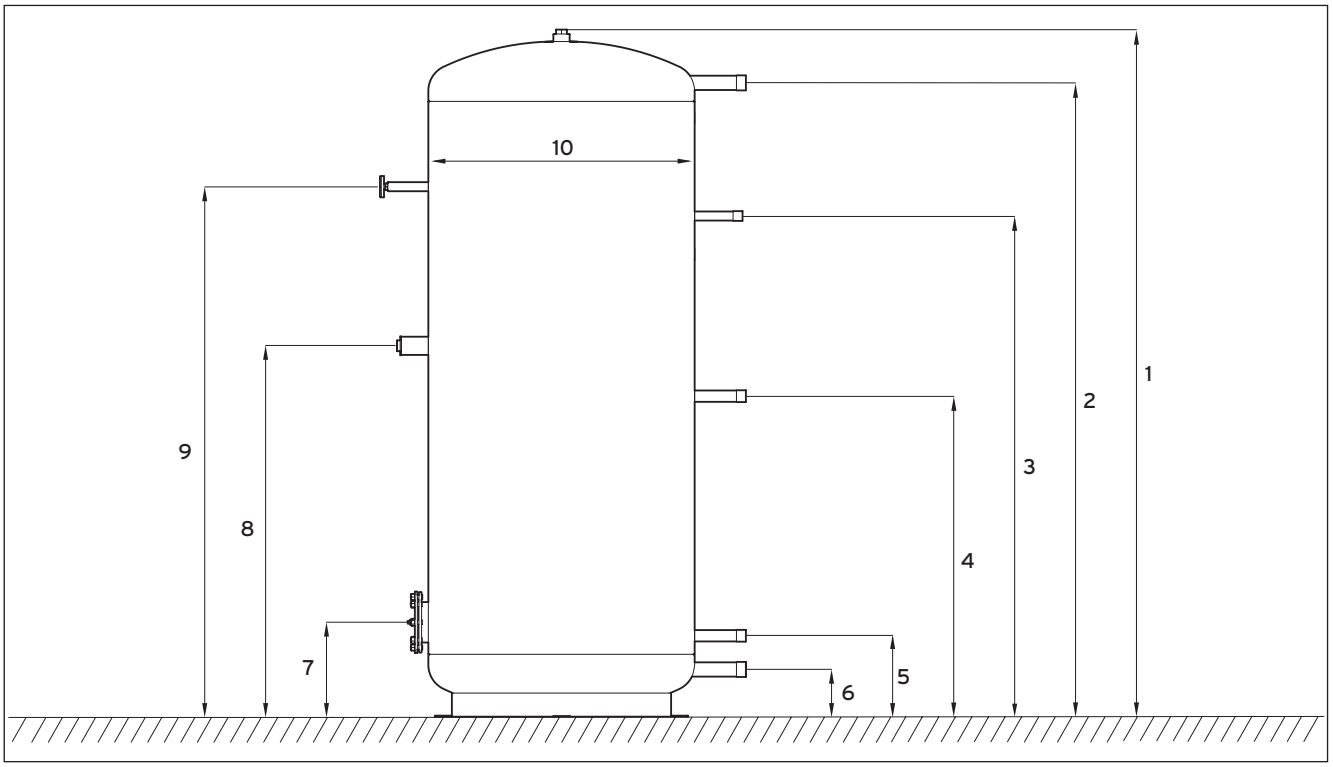


Fig. 9: VIH R dimensions and connection dimensions

Dimension	Unit	Tolerance	VIH R 750	VIH R 1000	VIH R 1500	VIH R 2000
1	mm	± 10	1755	2025	2020	2355
2	mm	± 10	1600	1880	1800	2135
3	mm	± 10	1207	1485	1460	1800
4	mm	± 10	690	950	1175	1360
5	mm	± 10	240	240	300	350
6	mm	± 10	140	140	190	240
7	mm	± 10	280	280	460	510
8	mm	± 10	880	1100	1230	1420
9	mm	± 10	1472	1572	1480	1690
10	mm	± 10	790	790	1000	1100

Description of the unit

	Unit	VIH R 750	VIH R 1000	VIH R 1500	VIH R 2000
Collector surface/weight					
Collector surface of suitable collectors	m^2	11 ... 16	14 ... 20	21 ... 30	28 ... 40
Net weight	kg	198	233	351	446
Weight (ready for operation)	kg	945	1107	1693	2355
Hydraulic connection					
Cold/hot water connection	–	R 1 1/4		R 1 1/2	
Solar flow/return connection	–	R1			
Circulation connection	–	R 3/4			
Cylinder output data					
Contents	l	747	875	1342	1909
Inner vessel	–	Steel, enamelled, with 2 magnesium protection anodes		Steel, enamelled, with 2 external current anodes	
Maximum operating pressure (cylinder)	MPa (bar)	0.7 (7)			
Maximum permissible operating temperature	°C	95			
Continuous hot water output *	kW/h	65	77	97	118
	l/h	1596	1891	2382	2898
Continuous hot water output **	kW/h	34	40	51	62
	l/h	835	982	1252	1523
10-minute output ***	l/10 min	716	1200	1285	1524
Standby energy consumption	KWh/24 hrs	2.26	2.45	3.15	4.35
Output characteristic figure NL ***	–	22	38	42	65
Heating circuit output data					
Heating area of the heat exchanger	m^2	2,25	3.0	4.0	5.0

* Reheat temperature 80 °C, draw-off temperature 45°C, cold water inlet temperature 10 °C
** Reheat temperature 60 °C, draw-off temperature 45 °C, cold water inlet temperature 10 °C
*** Reheat temperature 80 °C, cylinder temperature 60 °C, draw-off temperature 45 °C, cold water inlet temperature 10 °C

3.3 Product description: 35 l/min solar pump unit

Special features

- 13 m pump
- Connection to Vaillant standard control systems
- Volume flow display
- Integrated hydraulic and electrical assemblies

Product equipment

- Safety group with pressure gauge, filling cock and connection for the solar expansion vessel
- 1.5 m supply line to controller
- 13 m pump
- Air vent
- Wall-mounting base

Potential applications

The solar pump unit is specially designed for the operation of Vaillant solar plants with hot water generation and heating support.

The solar pump unit is intended for use in solar circuits.

The solar pump unit must only be operated with the Vaillant **auroTHERMVFK** and **VTK** solar collectors.

The solar pump unit is only intended for heating water in the domestic hot water cylinder and buffer cylinder by means of solar coils.

The solar pump unit may only be operated with Vaillant ready-mixed solar fluid.

Technical data

Fig. 10: 35 l/m solar pump unit

Description of the unit

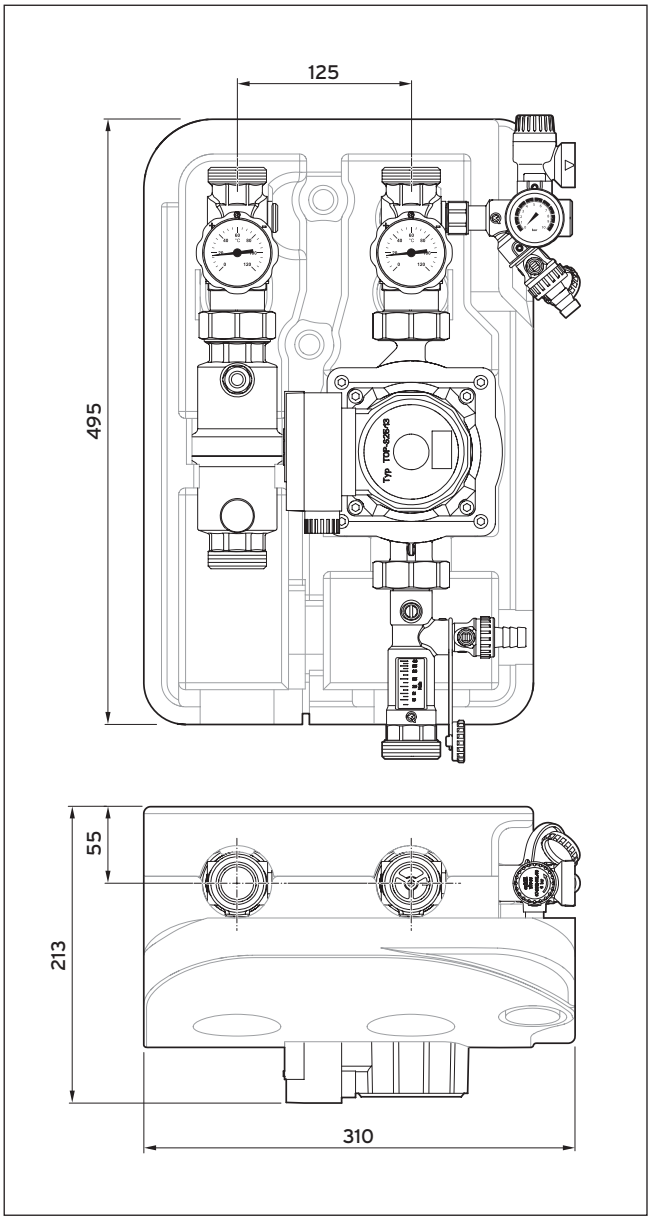


Fig. 11: Solar pump unit dimensions and connection dimensions

	Unit	
Solar pump unit		
Dimensions (W x H x D)	mm	310 x 495 x 213
Pipe diameter	mm	28
Pipe clearance	mm	125
Expansion relief valve	bar	6
Weight	kg	11
Type of installation	–	Wall-mounted
Pump		
Nominal speed	rpm	2680
Rated voltage	V, Hz	1~230, 50
Maximum current consumption	A	1.24
Level of protection	–	IPX4D
Insulation rating	–	H

Remaining feed head

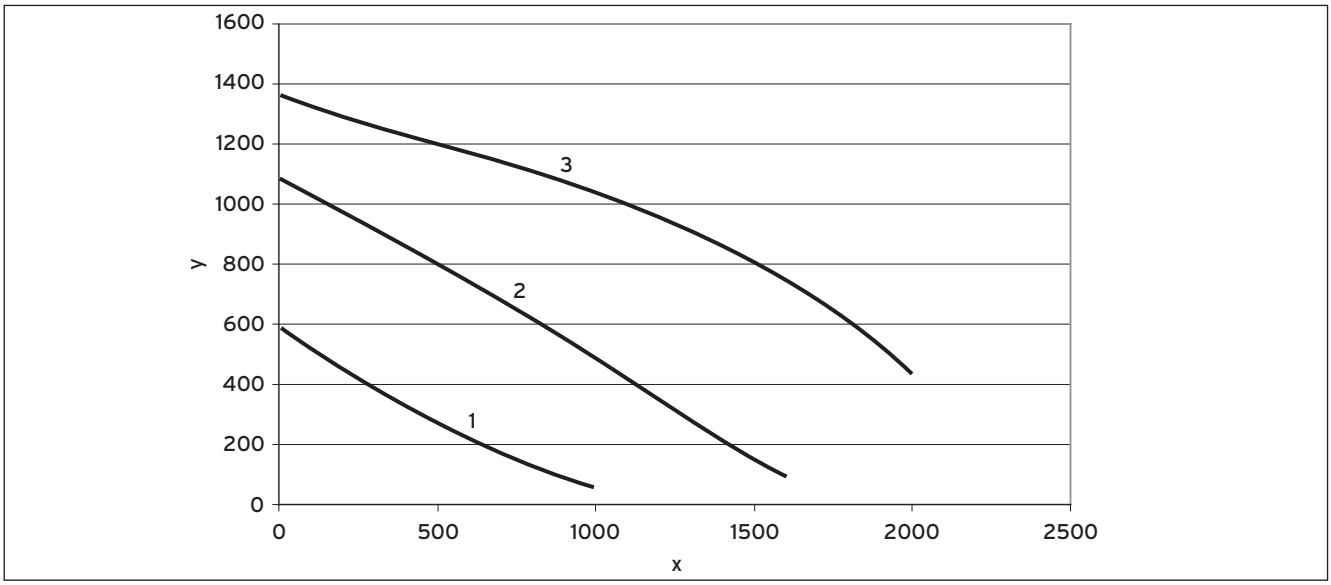


Fig. 12: Remaining feed head

1 Pump speed 1
2 Pump speed 2
3 Pump speed 3
x Volume flow [l/h]
y Remaining feed head [mbar]

3.4 Product description: 22 l/m solar pump unit

Special features

- Pre-assembled and pressure-tested unit
- System is quick and easy to install/ start up

Product equipment

- Three-stage circulation pump
- Two ball cocks with integrated non-return valve
- Two 1/2" combined filling and emptying valves
- Two thermometers
- One pressure gauge
- Flow rate display with flow rate limiter
- Expansion relief valve, 6 bar
- Air separator with air discharge valve
- Corrugated hose for connecting the diaphragm expansion vessel, with wall bracket and screwed connection
- Four compression fittings (22 mm) and four adapters for 18 mm diameter

Fig. 13: 22 l/min solar pump unit

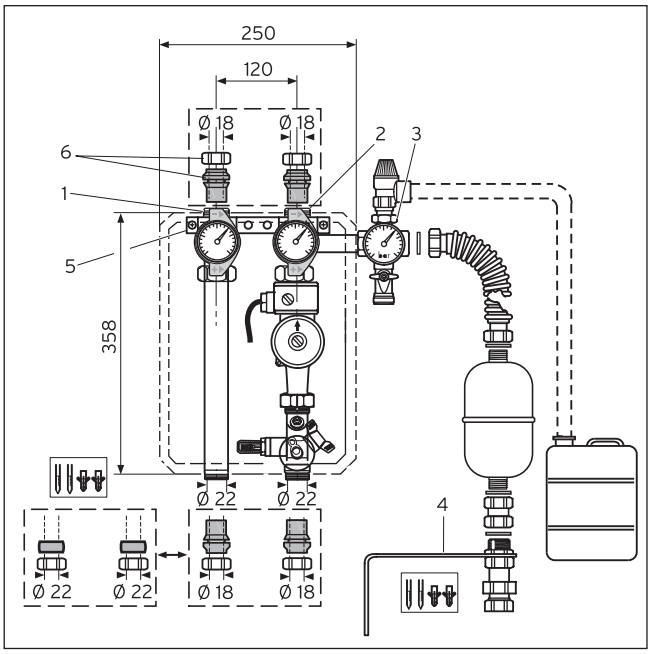
Potential applications

The solar pump unit can be used for volume flows of up to 22 l/min.

The solar pump unit can be used to operate solar systems with up to 40 flat collectors.

Technical data

22 l/m solar pump unit dimensions and connection dimensions



1 Supply pipe with stop cock, non-return valve and temperature indicator
2 Return pipe with non-return valve, flow rate limiter with combined filling and emptying valve, circulation pump and temperature indicator
3 Expansion relief valve with pressure gauge, filling cock and corrugated hose (DN 16) incl. wall bracket for solar expansion vessel
4 Wall bracket for expansion vessel with screwed connection
5 Fastening rail
6 Compression joint, 18 mm or 22 mm

Fig. 14: Dimensions and connection dimensions

Remaining feed head

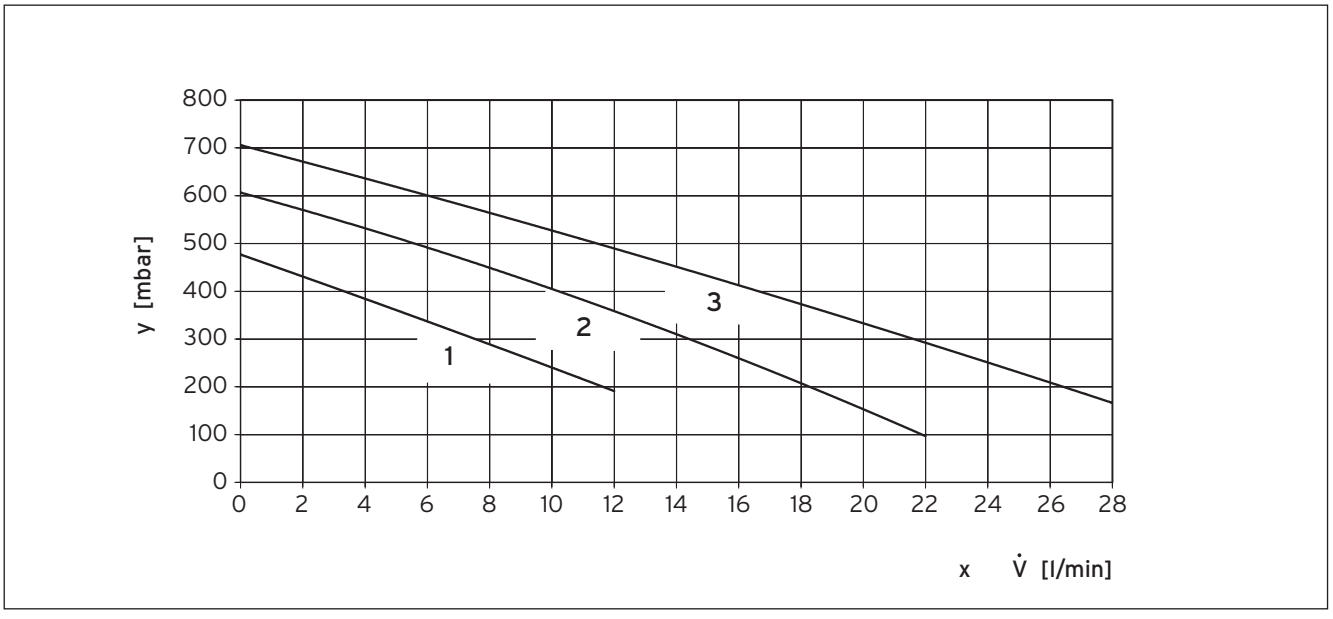


Fig. 15: Remaining feed head (Medium: Water, 20 °C)

1 Pump speed 1
2 Pump speed 2
3 Pump speed 3
x Volume flow [l/h]
y Remaining feed head [mbar]

3.5 Product description: Flow limiter

Special features

- Functional elements arranged on one side facilitate installation and operation
- The use of an integrated orifice plate allows the pressure loss to be measured accurately and kept proportional to the flow rate
- The Kv value of the integrated orifice plate can be seen on the attached identification plate
- Low pressure loss thanks to y-type valve
- Infinitely adjustable presetting, flow rate can be accurately checked via orifice plate

Product equipment

- Handwheel for presetting the volume flow
- Orifice plate for determining the flow rate by measuring differential pressure

Potential applications

The flow limiter is installed in the pipelines of solar systems with closed circuits and enables hydraulic balancing between the solar collectors.

Can be used in the solar flow and/or in the solar return.

Suitable for water and water/glycol solutions. Not suitable for aggressive or oil-containing media.

The calculated preset values are set using the handwheel and via a scale on the slider.

Can be used in weather-protected areas, inside and outside closed buildings.

Fig. 16: Flow limiter

Technical data

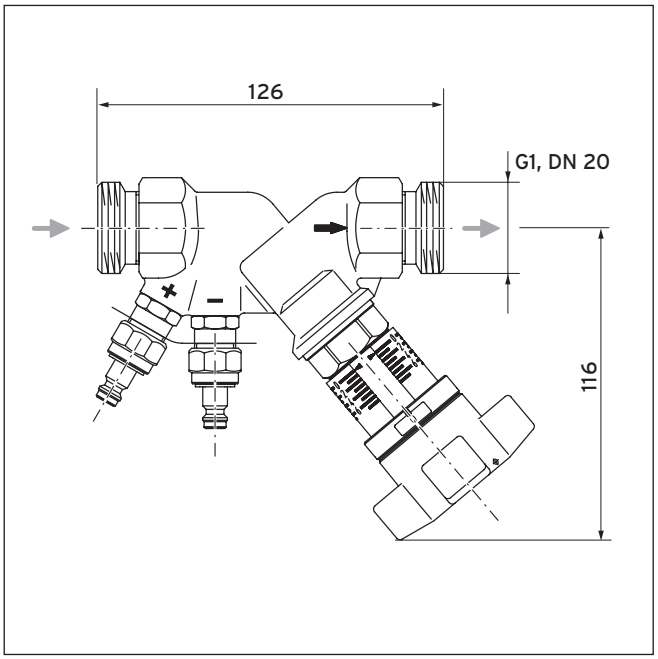


Fig. 17: Dimensions of flow limiter with clamping ring connection

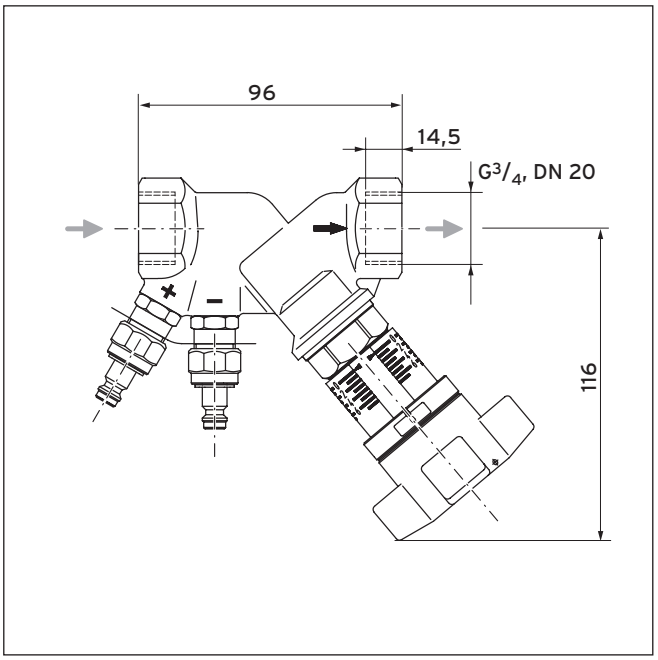


Fig. 18: Dimensions of flow limiter with inside thread

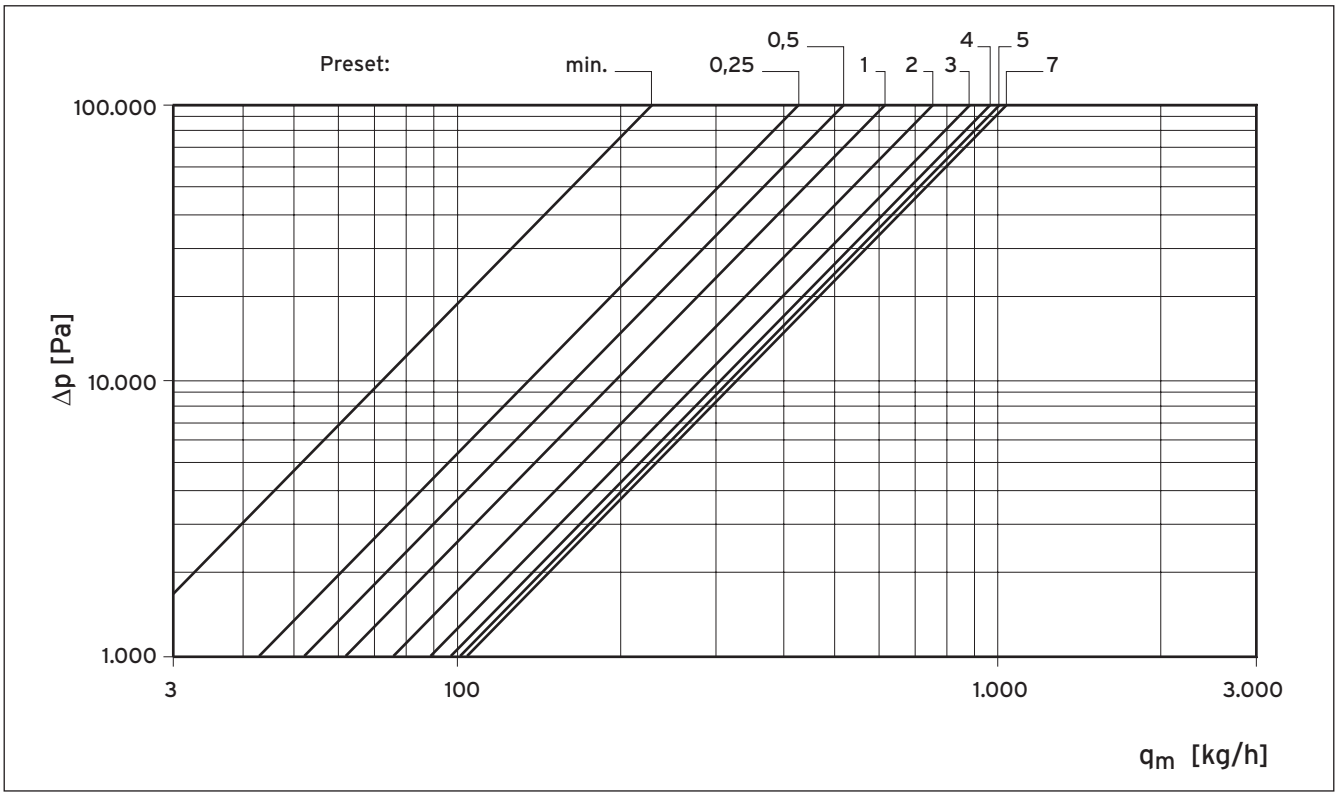


Fig. 19: Pressure loss diagram

The pressure loss diagram applies to the use of flow limiters in the flow/return, if the direction of flow is observed and the medium is in a fluid state.

3.6 Product description: auroMATIC 560/2 solar controller

Special features

- Differential pressure-controlled solar controller
- Vaillant "turn & click" operation
- Quick and safe installation with ProE system
- Wall-mounted controller
- Can control up to two collector fields (accessory VR 11 collector temperature sensor for second collector field required) or a collector field and a solid fuel boiler or circulation pump; option to connect a second cylinder or swimming pool
- Digital radio-controlled clock, weekly program, three heating times per day for time-dependent control of heating/hot water and circulation pump
- Economy, party and cylinder charging special functions
- Holiday programme
- Operating hours for the solar pump measured

Fig. 20: auroMATIC 560/3

Note
eBUS interface for connecting vrDIALOG 810 diagnostics software.

Product equipment

- 1x VR 11 collector temperature sensor
- 3x VR 10 standard sensor
- 1x C1/C2 connection cable

Potential applications

The auroMATIC 560/2 is a differential pressure-controlled controller for solar-assisted hot water generation with a demand-based post-heating function.

Three time periods per day for time-dependent control of the recharging function and three time periods per day for time-dependent control of the circulation pump (only possible in single-collector field systems) can be set.

Option to connect a Legionella protection pump for thermal disinfection.

Technical data

Technical data	Unit	auroMATIC 560/2
Operating voltage	V	230
Controller max. power consumption	W	10
Max. contact loading of the output relay	A	2
Shortest switching interval	min	10
Reserve power supply	h	30
Maximum permissible ambient temperature	°C	50
Sensor operating voltage	V	5
Minimum cross-section of the sensor lines	mm²	0.75
Height	mm	175
Width	mm	272
Depth	mm	55
Level of protection	–	IP 20
Protection class for the controller	–	II
Order no.	–	306767

3.7 auroMATIC 620/3 product description

Equipment

The control set comprises:
- auroMATIC 620/3 solar system controller
- An external sensor with radio-controlled signal receiver (DCF)
- A VR 11 collector sensor
- A VR 10 standard sensor (4 pcs)

Special features
- Combined solar and heating controller, weather-controlled. A controller for all heating and solar systems.
- Includes buffer manager
- Quick and safe installation with ProE system
- Vaillant "turn & click" operation
- Graphic display with solar yield display
- Plain text display with operating statuses and sensor diagnosis
- eBUS system interface
- Flow temperature regulation
- Operator control unit can also be used for remote control (wall-mounting base accessory required)
- Digital radio-controlled clock, weekly program, three heating times per day for time-dependent control of heating/hot water and circulation pump
- Bidirectional data exchange, display of boiler maintenance, fault heating and heating mode
- Grout drying function
- Regulated heating circuits individually configurable for fixed value controlling, increase in return flow or use as a cylinder charging circuit

Fig. 21: auroMATIC 620/3

- Special functions such as economy, party and single cylinder charging
- Holiday programme
- Display of sensor configurations/ sensor diagnosis
- Display of operating statuses/switching times
- Option to connect to teleSWITCH
- Cascade connection of up to eight modulating heat generators using a VR32 bus coupler possible; for cascades of 1- or 2-stage heat generators, the VR31 bus coupler is used.

Potential applications

Suitable for solar hot water generation and combination systems for solar heating support.

Description of the unit

Technical data

Technical data	Unit	auroMATIC 620/3
Operating voltage	V	230
Controller power consumption	W	8
Contact loading of the output relay	max. A	2
Shortest switching interval	min	15
Reserve power supply	h	40
Maximum permissible ambient temperature	°C	40
Sensor operating voltage	V	5
Minimum cross-section of the sensor lines	mm²	0.75
Height	mm	292
Width	mm	272
Depth	mm	75
Level of protection	–	IP 20
Protection class for the controller	–	II
Protection class for the sensor	–	III
Order no.	–	0020040076

Dimension drawing and connection dimensions

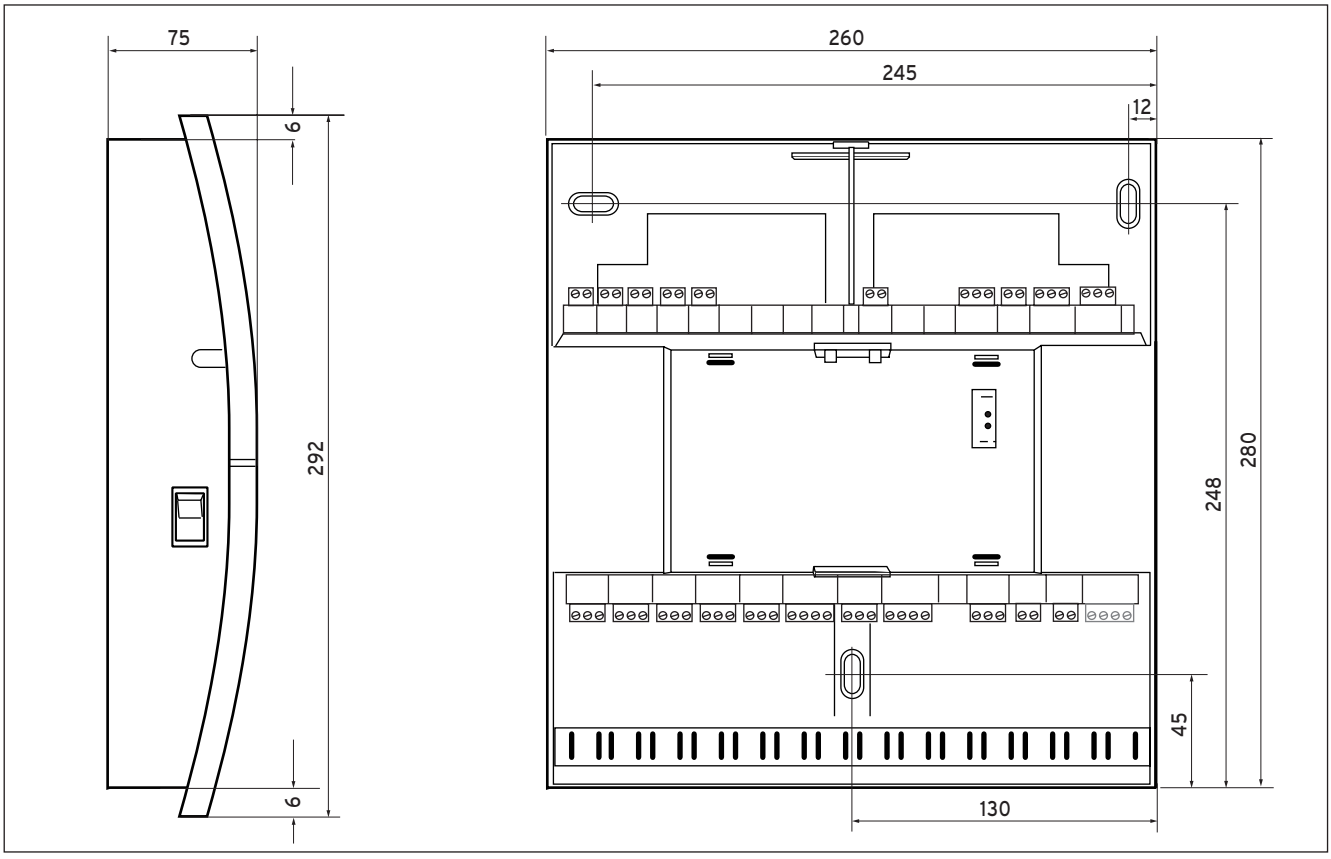


Fig. 22: Dimensions

3.8 Product description: auroTHERM VFK ... flat collectors

Special features

- Collector with homogeneous pane surface, 2.51 m² gross area
- Structured glass 3.2 mm (solar safety glass) with VFK 125/3 and VFK 145 V/H

- Clear anti-reflective glass 3.2 mm (solar safety glass) with VFK 155 V/H
- Solar hot water generation and heating support
- On-roof/in-roof mounting or flat roof installation
- Pitched roof support, façade and balcony installation possible
- auroTHERM VFK 125/3, VFK 145 V and auroTHERM VFK plus 155 V for vertical installation

- auroTHERM VFK 145 H and auroTHERM plus 155 H for horizontal installation
- Aluminium black frame, anodised

- Aluminium frame, silver anodised, with VFK 125/3

Note
Only use Vaillant solar fluid, otherwise the guarantee becomes void.

Product equipment

- Highly selective coated aluminium-copper absorber (serpentine)
- Low mounting height
- Low weight

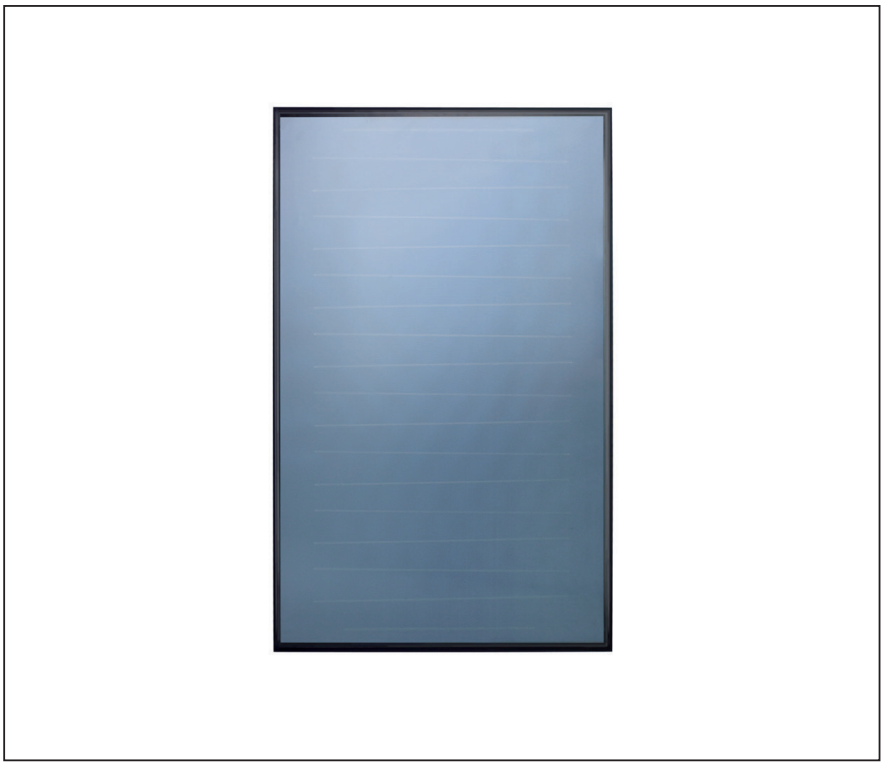


Fig. 23: auroTHERM VFK 145 V

Fig. 24: auroTHERM plus VFK 155 H

Description of the unit

Technical data

	Unit	VFK 125/3	VFK 145 H/V	VFK 155 H/V
Absorber type	–	Serpentine	Horizontal/vertical serpentine	
Dimensions of vertical collectors (L x W x H)	mm	2033 x 1233 x 80		
Dimensions of horizontal collectors (L x W x H)	mm	–	1233 x 2033 x 80	
Weight	kg	38		
Liquid volume	l	1.85	2.16 (H) 1.85 (V)	
Max. permissible operating pressure	bar	10		
Shutdown temperature	°C	118	171	175
Gross area	m²	2.51		
Aperture surface area	m²	2.35		
Absorber surface area	m²	2.33		
Absorber	mm	Aluminium (vacuum-coated) 0.5 x 1178 x 1978		
Coating	–	High selective (black)	High selective (blue)	
		α = 90% ϵ = 15%	α = 95% ϵ = 5%	
Glass covering	mm	3.2		
Glass type	–	Safety clear glass	Solar safety glass (prismatic structure)	Solar safety glass (anti-reflective coating)
Transmission	%	τ = 91		τ = 96
Back wall insulation	mm W/m²K	40 λ = 0.035		
Edge insulation	–	None		Available
Radiation angle correction factor $K_e(50°)$	–	0.92	0.82 (H) 0.87 (V)	0.89
Radiation angle correction factor (diffuse)	–	0.968	0.885 (H) 0.906 (V)	0.892 (H) 0.911 (V)
Efficiency η_0	%	75.2	80.1 (H) 79.1 (V)	82.7 (H) 83.2 (V)
Heat capacity	Ws/m²K	6030	6640 (H) 6030 (V)	9537 (H) 8430 (V)
Absorber surface area conversion factor	–	0.747	0.806 (H) 0.798 (V)	0.851 (H) 0.842 (V)
Aperture surface area conversion factor	–	0.753	0.798 (H) 0.790 (V)	0.842 (H) 0.833 (V)
Absorber surface area heat loss factor (k_1)	W/m²K	3.930	3.829 (H) 3.757 (V)	3.859 (H) 2.352 (V)
Aperture surface area heat loss factor (k_1)	W/m²K	3.893	3.793 (H) 3.721 (V)	3.818 (H) 2.327 (V)
Absorber surface area heat loss factor (k_2)	W/m²K²	0.018	0.016	0.018 (H) 0.049 (V)
Aperture surface area heat loss factor (k_2)	W/m²K²	0.018	0.016	0.018 (H) 0.049 (V)
Max. wind load	kN/m²	1.6		
Max. standard snow load	kN/m²	5.0		
On-roof installation angle	°	15 - 75		
Flat roof installation angle	°	30, 45, 60		

Dimension drawings

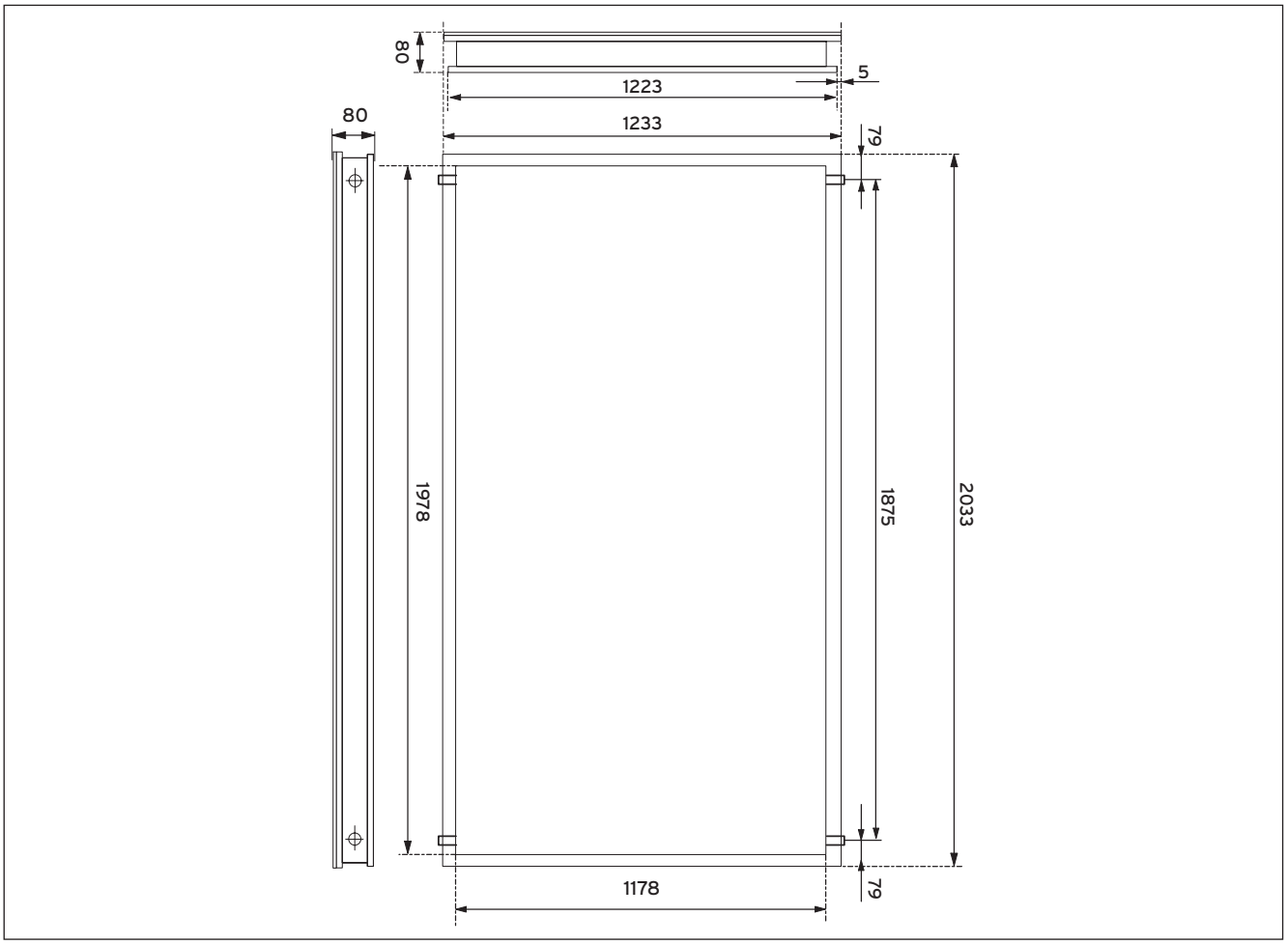


Fig. 25: auroTHERM VFK 145 V and VFK 155 V

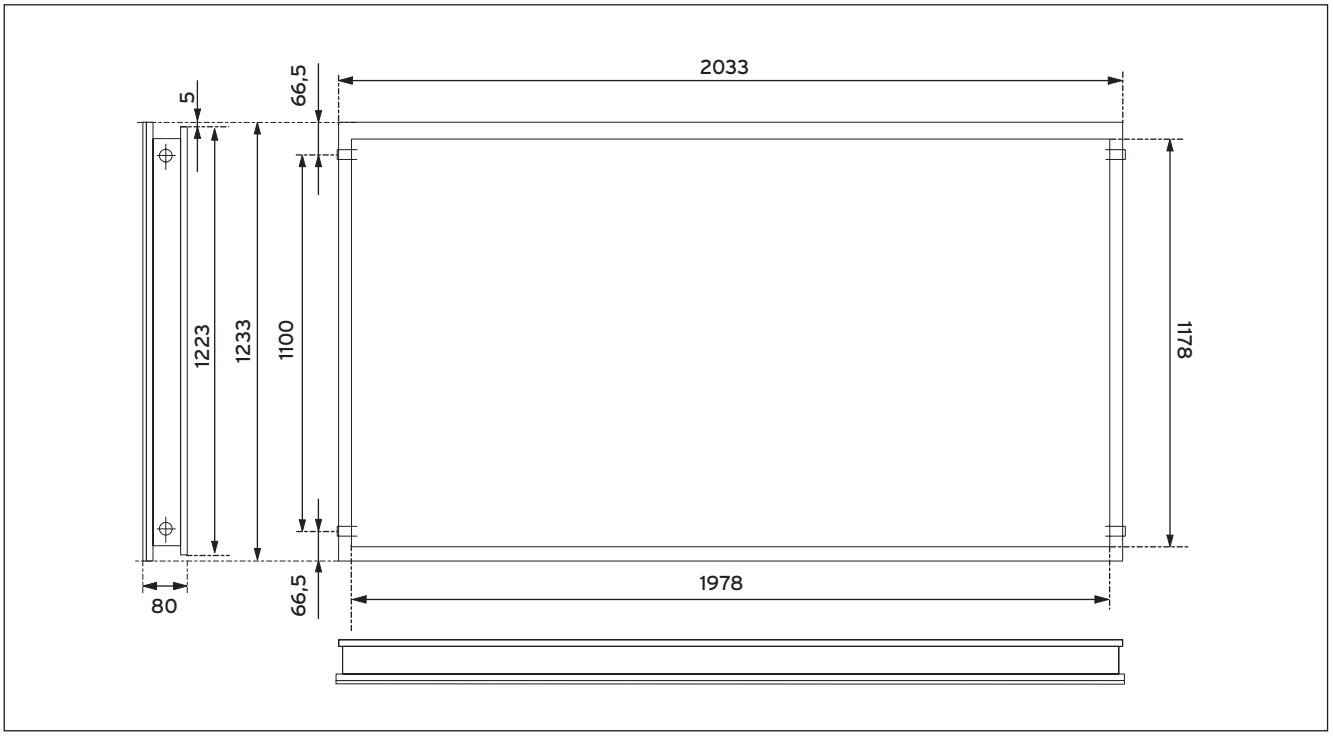


Fig. 26: auroTHERM VFK 145 H and VFK 155 H

Pressure losses

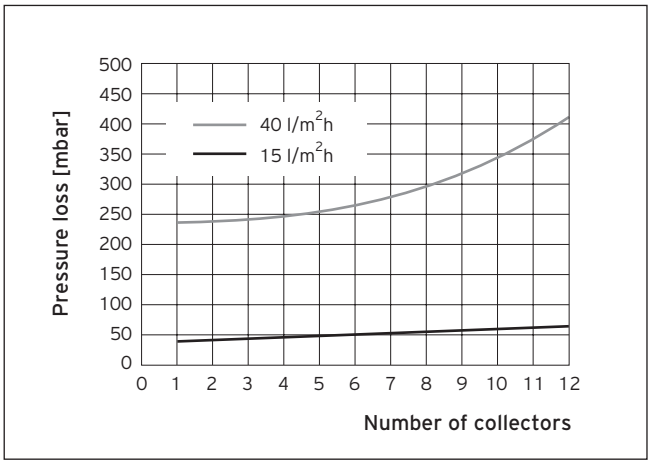


Fig. 27: auroTHERM VFK 145 V and VFK 155 V

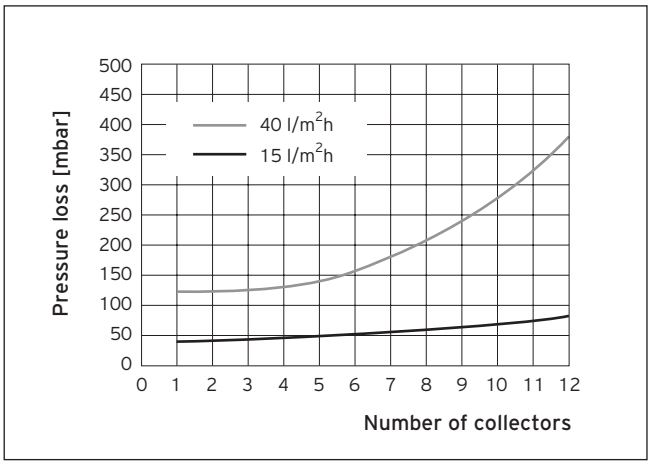


Fig. 28: auroTHERM VFK 145 H and VFK 155 H

Hydraulic connection of the collector field for flat collectors

Alignment of the auroTHERM VFK flat collectors

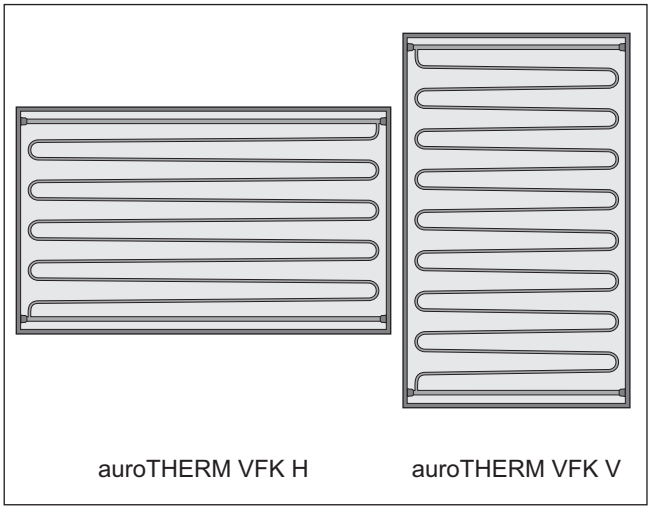


Fig. 29: auroTHERM VFK H and VFK V

auroTHERM VFK H and auroTHERM VFK V

auroTHERM VFK H (H = horizontal) and auroTHERM VFK V (V = vertical) flat collectors differ hydraulically in the arrangement of the serpentine.

In auroTHERM VFK H collectors, the serpentine runs from top to bottom along the shorter side of the collector.

In auroTHERM VFK V collectors, the serpentine runs from top to bottom along the longer side of the collector.

The allows both types of collector to be completely emptied. In the event of stagnation and a build-up of vapour, this enables the collector to "empty" quickly and prevents the resulting high temperatures from having too harsh an effect on the solar circuit and the frost protection agent. Furthermore, this also prevents the air bubbles from forming in the collector serpentine.

Note
Horizontal flat collectors must not be installed vertically.
Vertical flat collectors must not be installed horizontally.

Connection options for flat collectors

auroTHERM VFK flat collectors each have four side-mounted connections. They are hydraulically coupled to each other by two horizontally running header lines.

Between each pair of header lines runs a serpentine with a comparatively small cross section, which allows a turbulent flow with efficient heat transfer to develop inside it.

The four connections offer many connection options:

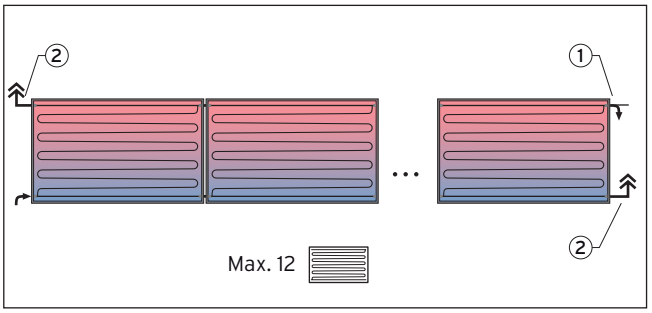


Fig. 30: Collector field with connection on both sides

1 Solar sensor
2 Manual bleeding device

If the connections are on both sides, the flow and return of the collector row are not located on the same side. This type of connection enables several collectors to be coupled thanks to the low pressure losses in the header lines.

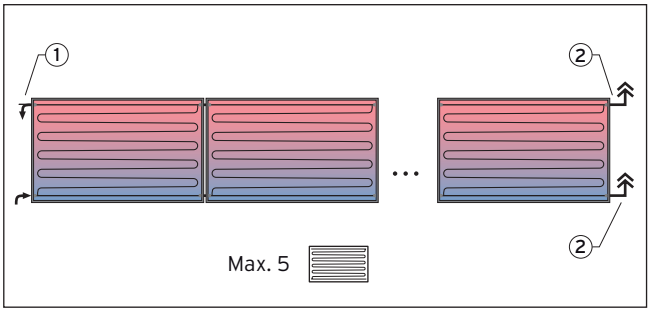


Fig. 31: Collector field with one-sided connection

1 Solar sensor
2 Manual bleeding device

Flat collectors can also be connected on one side. In a one-sided connection, the flow and return of the collector row are located on the same side, which saves on piping and facilitates installation.

Note
One-sided connection only allows a maximum of five collectors to be coupled. The flow through one-sided connections is generally slightly poorer than when there are connections located on both sides.

Connection of the collector field

The number of collectors has an effect on the volume flow of the collector field. The more collectors are connected, the greater the circulating total volume flow needs to be in order to be able to transport the heat to the cylinder.

The number of collectors and the connections between them have an effect on the pressure loss in the individual fields and the field as a whole.

With hydraulic connections, care must therefore be taken to ensure that the maximum volume flow and the maximum possible pressure loss in the solar pump unit are not exceeded.

Depending on whether the collectors are connected on one side or on opposite sides, a maximum of 12 collectors can be coupled in series together with the 35 l/min solar pump unit or the 22 l/min solar pump unit.

If more collectors are required, parallel connection of several separate fields (coupled collectors, max. 12 units per field) is normally used. However, only rows with the same number of collectors can be connected in parallel. As far as possible, ensure that the flow and return are kept the same length as parallel lines and also that they have the same number of elbows in order to guarantee an even flow.

Calculate the pressure loss and check that the pipeline, the pump and the expansion vessel are correctly dimensioned.

The combination of series and parallel connection, as well as one-sided connection and connection on both sides, enables the collector field to be individually tailored to the roof conditions and technical possibilities.

Note
When using solar pump units with volume-flow adjustment, check the flow in the collector circuit using the system's flow rate meter. If necessary, set the pump speed required to achieve or exceed the necessary volume flow.

Series connection

The flow of the first collector field forms the return of the second, etc. This means that the total volume flows through every collector field. The piping required is minimal. In comparison with parallel connection, an advantage of series connection is that even unsymmetrical systems in which the number of collectors per row varies are provided with an even flow.

Parallel connection

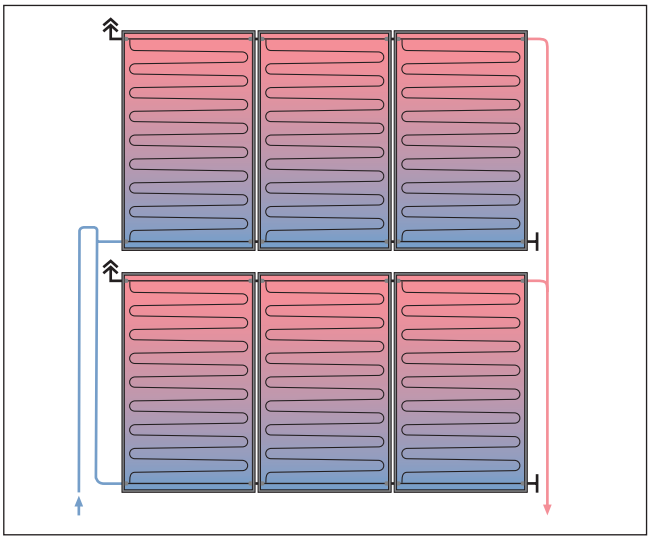


Fig. 32: Parallel arrangement for two collector fields of auroTHERM VFK V flat collectors

Parallel arrangement for two collector fields of auroTHERM VFK V flat collectors

Only part of the total volume flow goes through each parallel-connected collector field and each parallel-connected collector. The pressure loss in a collector sub-field is the same as that in the whole field. Very little piping is required within a field. Slightly more piping is required between the individual fields.

However, only rows with the same number of collectors can be connected in parallel. As far as possible, ensure that the flow and return are kept the same length as parallel lines (Tichelmann system) and also that they have the same number of elbows in order to guarantee an even flow.

In order to avoid the additional piping required in a Tichelmann connection whilst still ensuring an even flow through the collector rows, the rows can be connected with the flow limiter.

Note
In all systems, the collector temperature sensor must always be installed in the flow connection piece with thermowell of the warmest collector, i.e. in the upper pipe connection of the collector through which flow passes last. The flow connection piece with thermowell is part of the hydraulic connection set.

Connection examples of large solar systems with auroTHERM VFK flat collectors

Rows	Connection	Collectors	Installation sets	Connection sets	Solar pump unit	Operating mode
Quantity		Total no. of pieces	Quantity	QuantityAdja-cent		
5	One side	25	5	20	35 l/min	Low Flow
2	Opposite	12	2	10	35 l/min	Low Flow

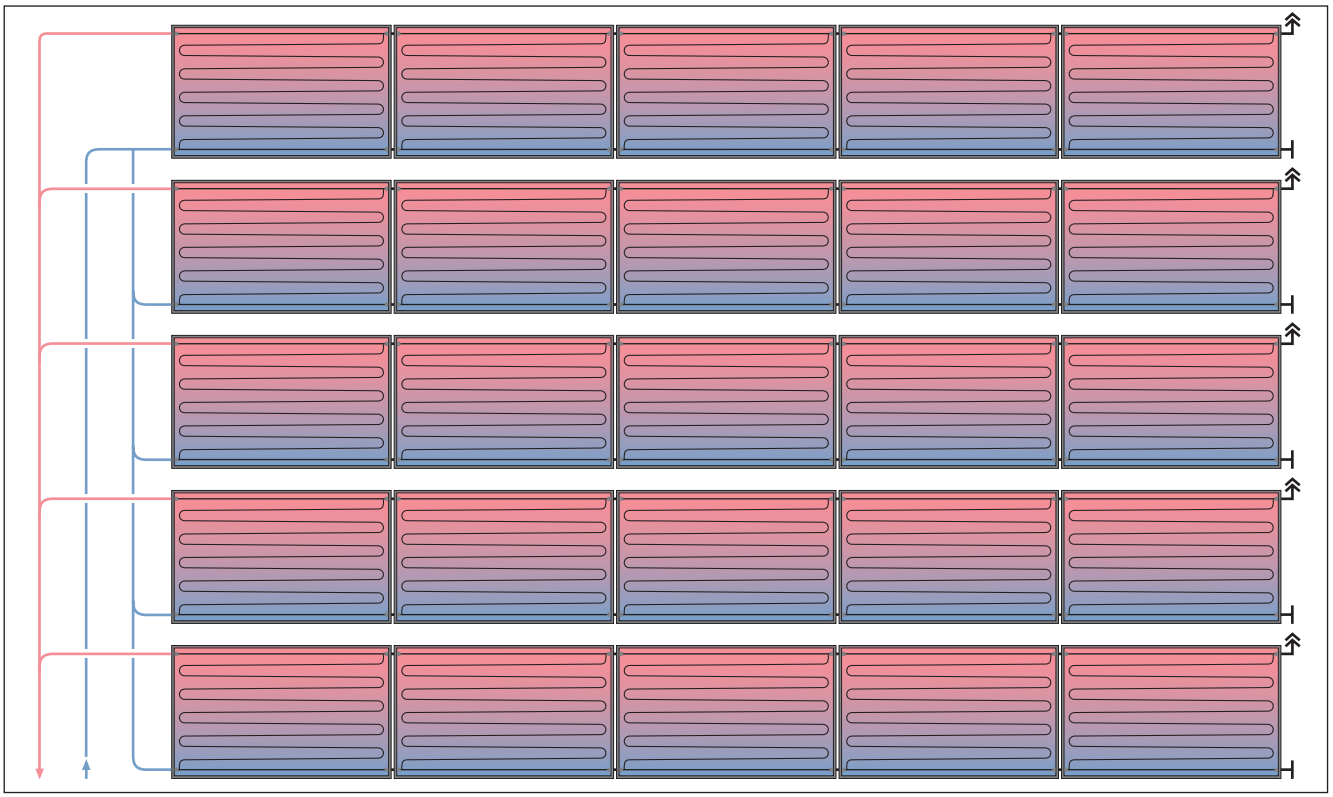


Fig. 33: Connection diagram with 25 collectors in parallel, connection on one side; volume flow 881 l/h

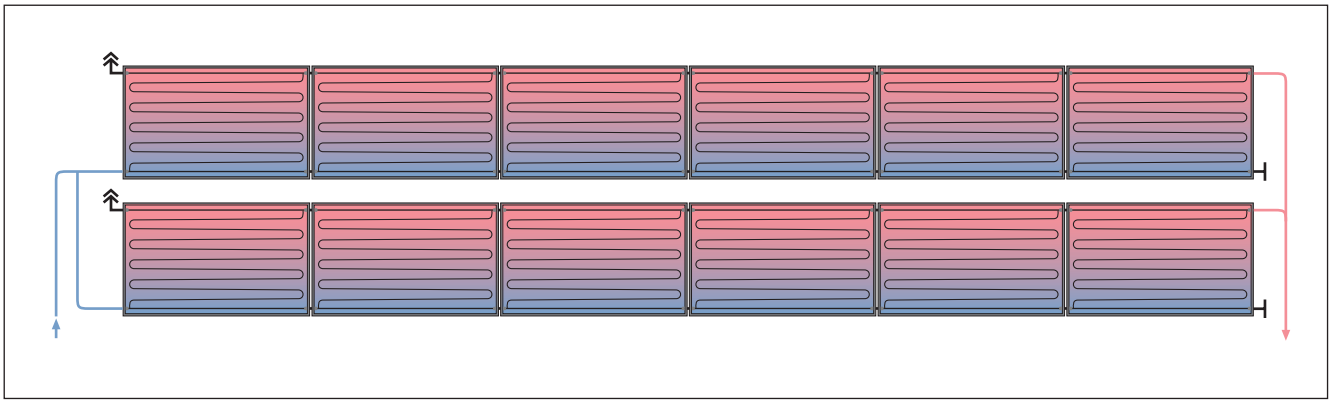


Fig. 34: Connection diagram with 12 collectors in two rows, connection on opposite sides; volume flow 423 l/h

Note
With large collector fields, use the pump characteristic line to check whether the pressure loss in the collector field, pipeline and components of the solar pump resulting at nominal flow can be overcome.

3.9 Product description: auroTHERM exclusive VTK 570/2 and VTK 1140/2 vacuum tube collectors

Special features

- Vacuum tube collector with direct flow
- Collector tube with double-glass construction
- Solar-assisted hot water generation and heating assistance
- Complies with hail resistance test in accordance with EN 12975-2
- Possible to change tubes when system is ready for operation (dry connection)
- On-roof mounting or flat roof installation
- Pitched roof support possible with VTK 1140/2

Note
Only use Vaillant solar fluid, otherwise the guarantee becomes void.

Product equipment

- CPC mirror with ceramic coating, highly efficient and weather-resistant
- Durable aluminium nitride absorber with highly selective coating
- Carrying handles (2) for easy transportation
- Installation and solar protection film
- Barium getter for vacuum loss detection
- Stainless steel register

Fig. 35: auroTHERM exclusive VTK 1140/2

Description of the unit

Dimension drawings

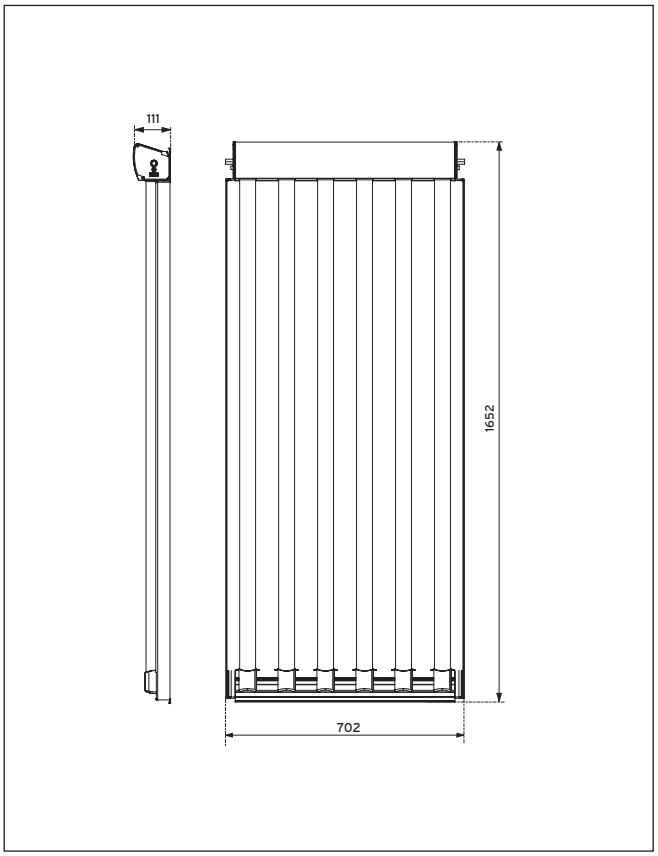


Fig. 36: VTK 570/2 dimension drawing

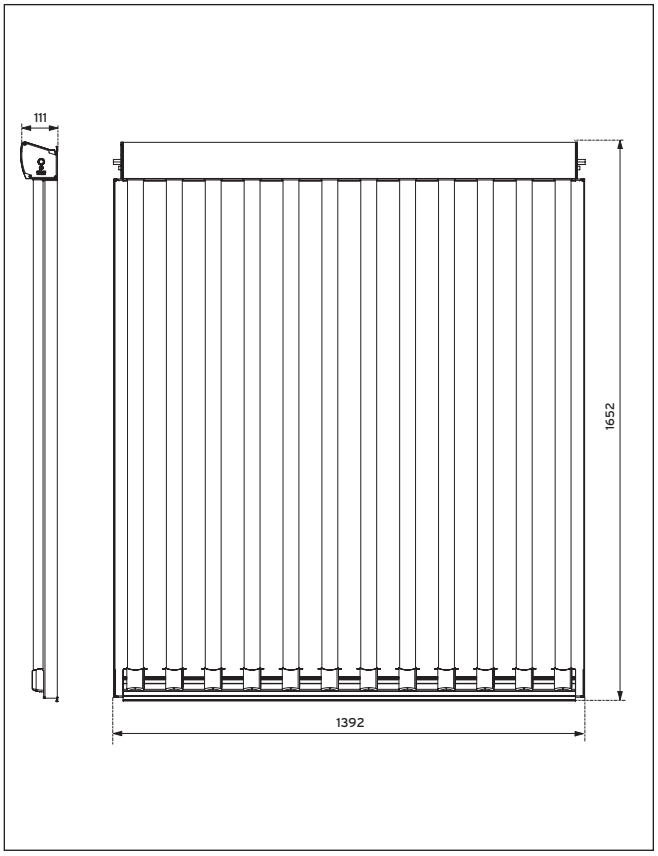


Fig. 37: VTK 1140/2 dimension drawing

Pressure losses

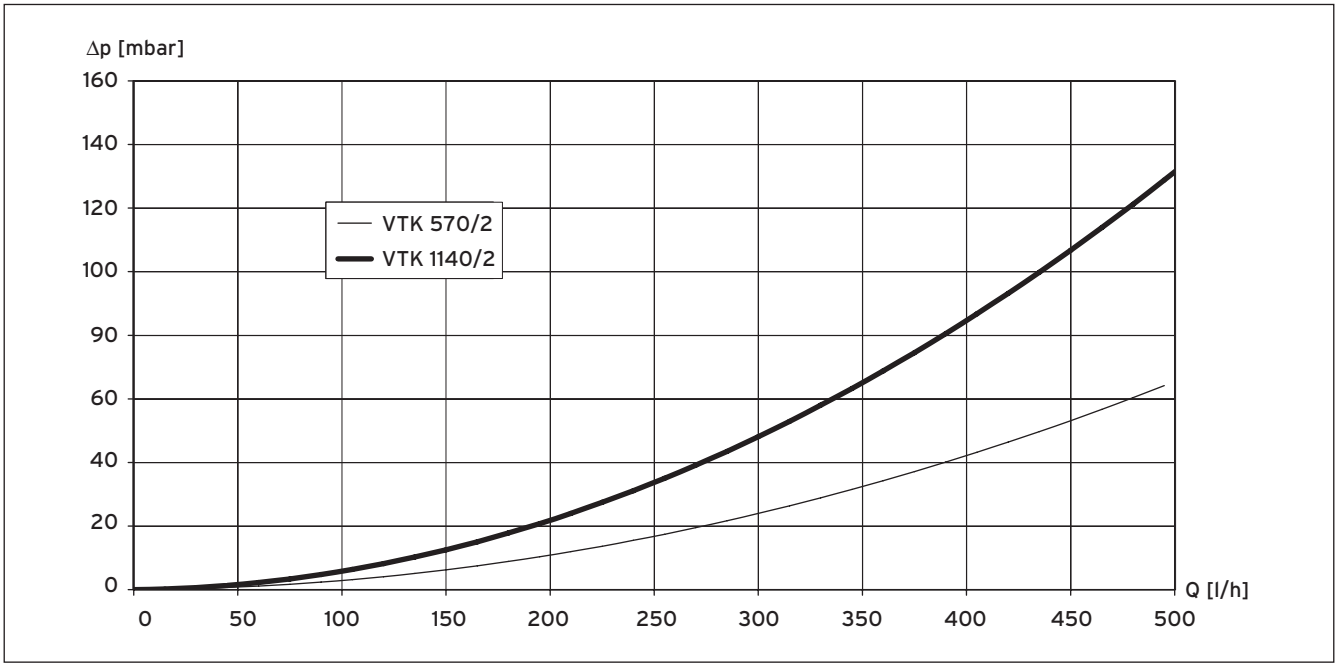


Fig. 38: Pressure loss diagram for auroTHERM exclusive VTK 570/2 and VTK 1140/2 tube collectors

Description of the unit

Technical data

	Unit	VTK 570/2	VTK 1140/2
Number of tubes	–	6	12
η_0 (Aperture), DIN4757-4 or EN12975	%	64.2	
c_1 with wind, or on aperture	W/(m²k)	0.885	
c_2 with wind, or on aperture	W/(m²k²)	0.001	
$K_{\vartheta,trans}$ (50°), or on aperture	–	1	
$K_{\vartheta,long}$ (50°), or on aperture	–	0.9	
Yield forecast (location: Würzburg, 5 m² aperture, 300 litre cylinder, 4 people)	kWh/m²a	586	
Peak output per collector module W_{peak}	W	642	1278
Area-related heat capacity c	kJ/(m²k)	8.3	
Volume flow (per m² of collector surface)	l/(m²h)	24	
Minimum volume flow in the solar circuit	l/h	180	
Absolute pressure in the high vacuum	bar	10^{-5} mbar (= 10^{-8} bar)	
Alpha absorber absorption	–	> 93.5% (see also ITW test report)	
Epsilon absorber emission	–	< 6% (see also ITW test report)	
Grid dimensions (length x height x depth)	m	0.7 x 1.65 x 0.11	1.39 x 1.65 x 0.11
Gross area	m²	1.16	2.30
Aperture surface area	m²	1.0	2.0
Absorber surface area	m²	1.0	2.0
Collector capacity	l	0.9	1.8
Weight	kg	19	37
System overpressure, max. permissible	bar	10	
Shutdown temperature, max.	°C	272	
Connection width, flow/return	mm	15	
Material for the tube collector	–	Al/1.4301/glass/silicone/PBT/EPDM/TE	
Material for glass tubes	–	Borosilicate 3.3	
Material for selective absorber layer	–	Aluminium nitride	
Glass tubes (outer diameter/inner diameter/wall thickness/tube length)	–	47 / 37 / 1.6 / 1500	
Colour (plastic parts)	–	Black	
Thermal shock test	ITW test number	02COL282	
Hail impact test in accordance with DIN EN 12975-2	TÜV test number	435/142448	
Type approval number	–	01-228-770	
Max. wind load	kg/Nm²	1.2	
Max. standard snow load	kg/Nm²	5	
On-roof installation angle	°	15-75	
Flat roof installation angle	°	30, 45, 60	

Hydraulic connection of the collector field for vacuum tube collectors

Hydraulic connection of the tubes in the collector

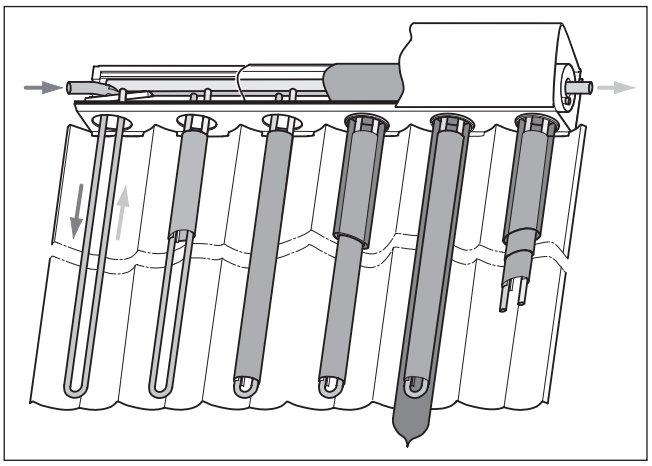


Fig. 39: Design of the auroTHERM exclusive VTK 570/2

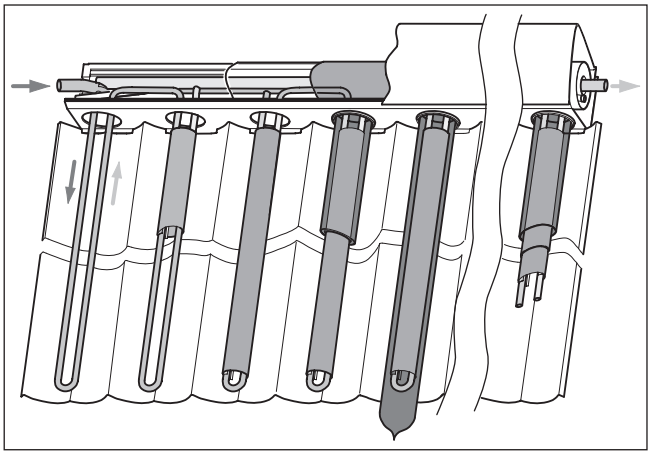


Fig. 40: Design of the auroTHERM exclusive VTK 1140/2

The solar fluid flows through the individual tubes in U pipes, which go out from the distributor pipe and end in the header pipe.

In the auroTHERM exclusive VTK 570/2 collector, all tubes and U pipes are connected in parallel to the distributor and one sixth of the volume flow flows through each one. This means that each individual tube has the same hydraulic resistance.

In the auroTHERM exclusive VTK 1140/2 collector, each pair of U pipes or pair of tubes is connected in series. The total volume flow through the collector is divided into six equal partial volume flows with equal pressure losses.

In terms of concept and technical properties, the VTK 1140/2 tube collector corresponds to two VTK 570/2 collectors connected in series.

Connection options of the tube collectors

In the auroTHERM exclusive VTK 570/2 and VTK 1140/2 tube collectors, the collector connections are located at the top right and top left of each of the header boxes. This allows several VTK 570/2 and/or VTK 1140/2 collectors to be connected side by side in series quickly and easily. Practical compression fittings are used as connectors.

In both collectors, the flow and return can be laid as desired. Correspondingly, the pipes in the header box function either as a distributor or as a collector.

The collector temperature sensor (VR 11) can also be positioned on either side of the collector or collector field. The sensor must always be placed in the flow.

Note
Always install the collector temperature sensor in the collector of the collector field through which flow passes last.

Connection of the collector field

The number of collectors has an effect on the volume flow of the collector field. The more collectors are connected, the greater the circulating total volume flow needs to be in order to be able to transport the heat to the cylinder.

The number of collectors and the connections between them have an effect on the pressure loss in the individual fields and the field as a whole.

With hydraulic connections, care must therefore be taken to ensure that the maximum volume flow and the maximum possible pressure loss in the solar pump unit are not exceeded.

Calculate the pressure loss and check that the pipeline, the pump and the expansion vessel are correctly dimensioned.

Note
When using solar pump units with volume-flow adjustment, check the flow in the collector circuit using the system's flow rate meter. If necessary, set the pump speed required to achieve or exceed the necessary volume flow.

Series connection

The flow of the first collector field forms the return of the second, etc. This means that the total volume flows through every collector field. The piping required is minimal. In comparison with parallel connection, an advantage of series connection is that even unsymmetrical systems in which the number of collectors per row varies are provided with an even flow.

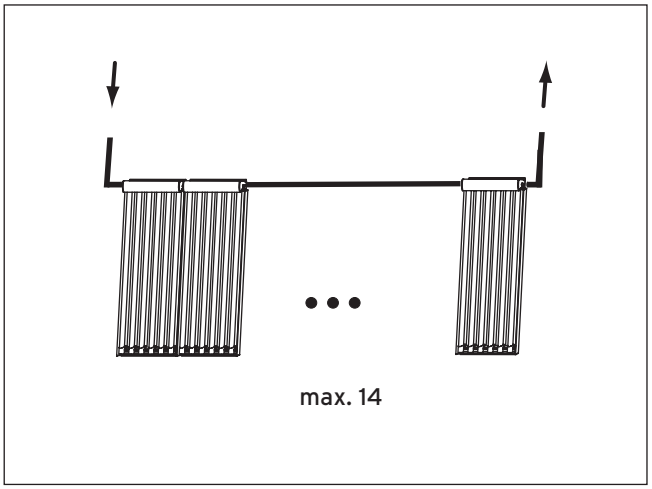


Fig. 41: auroTHERM exclusive VTK 570/2 series connection

auroTHERM exclusive VTK 570/2 series connection – a maximum of 14 VTK 570/2 units (corresponding to an aperture surface area of 14 m²) may be connected in series.

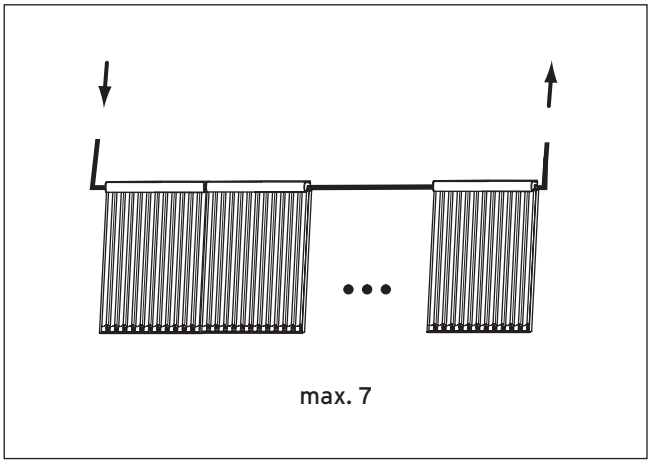


Fig. 42: auroTHERM exclusive VTK 1140/2 series connection

auroTHERM exclusive VTK 1140/2 series connection – a maximum of seven VTK 1140/2 units (corresponding to an aperture surface area of 14 m²) may be connected in series.

Parallel connection

Only part of the total volume flow goes through each parallel-connected collector field and each parallel-connected collector. The pressure loss in a collector sub-field is the same as that in the whole field. Very little piping is required within a field. Slightly more piping is required between the individual fields.

However, only rows with the same number of collectors can be connected in parallel. As far as possible, ensure that the flow and return are kept the same length as parallel lines (Tichelmann system) and also that they have the same number of elbows in order to guarantee an even flow.

In order to avoid the additional piping required in a Tichelmann connection whilst still ensuring an even flow through the collector rows, the rows can be connected with the flow limiter.

In a Tichelmann connection, the additional piping required should be located in the cooler return of the collector in order to minimise heat losses.

Note
In all systems, the collector temperature sensor must always be installed in the flow connection piece with thermowell of the warmest collector, i.e. in the upper pipe connection of the collector through which flow passes last. The flow connection piece with thermowell is part of the hydraulic connection set.

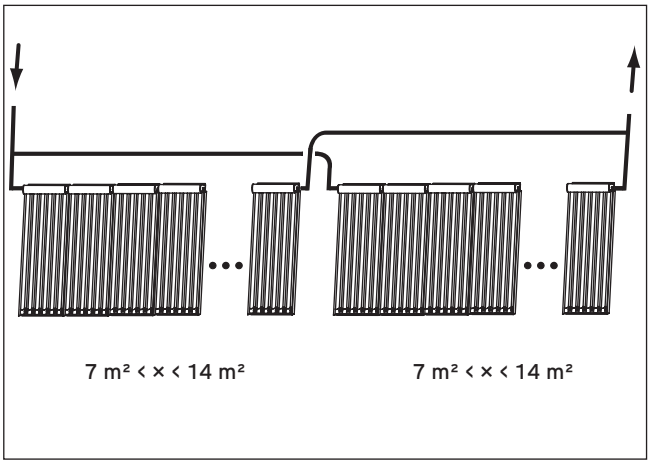


Fig. 43: auroTHERM exclusive VTK 570/2 parallel connection

Parallel connection (hereVTK 570/2) – for aperture surface areas larger than 14 m², several collector fields must be arranged in parallel and connected hydraulically in parallel. Always connect as many collectors as possible in series.

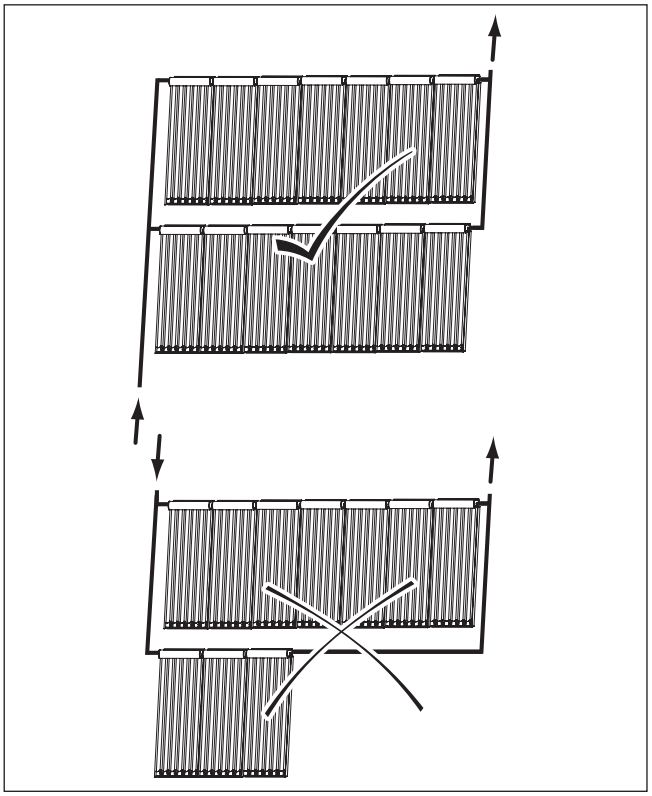


Fig. 44: auroTHERM exclusive VTK parallel connection

In parallel-connected collector fields, each individual field needs to have the same aperture surface area.

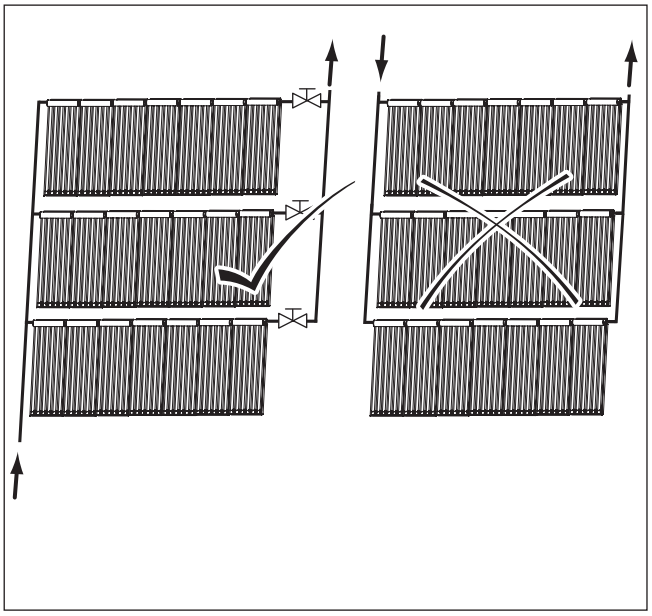


Fig. 45: auroTHERM exclusive VTK parallel connection

When there are three or more parallel-connected collector fields, a stop valve must be fitted in the flow of each one (hot side).

Connection examples

The ability to combine the auroTHERM exclusive VTK 570/2 and VTK 1140/2 tube collectors with each other in any way offers a large number of combination options and design possibilities. In comparison with flat collectors, an advantage of tube collectors is that the collector surface can be selected precisely to the nearest square metre.

Note
With large collector fields, use the pump characteristic line to check whether the pressure loss in the collector field, pipeline and components of the solar pump resulting at nominal flow can be overcome.

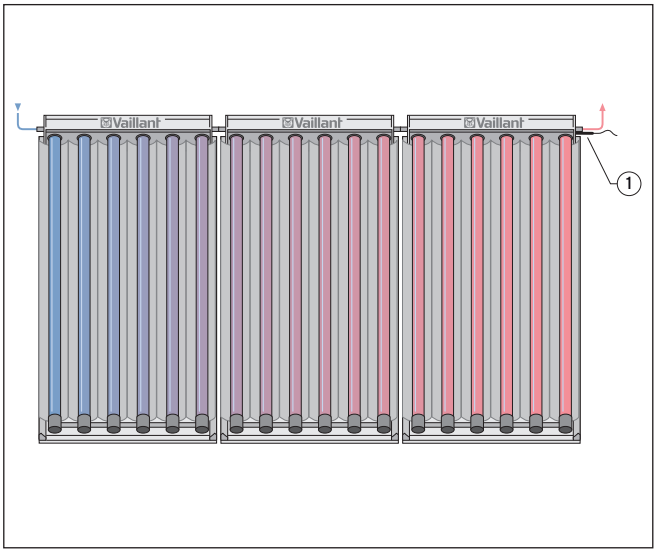


Fig. 46: Series connection of three auroTHERM exclusive VTK 570/2 units

1 Solar sensor

Series connection of three auroTHERM exclusive VTK 570/2 units side by side. Positioning the collector temperature sensor in the flow of the collector field.

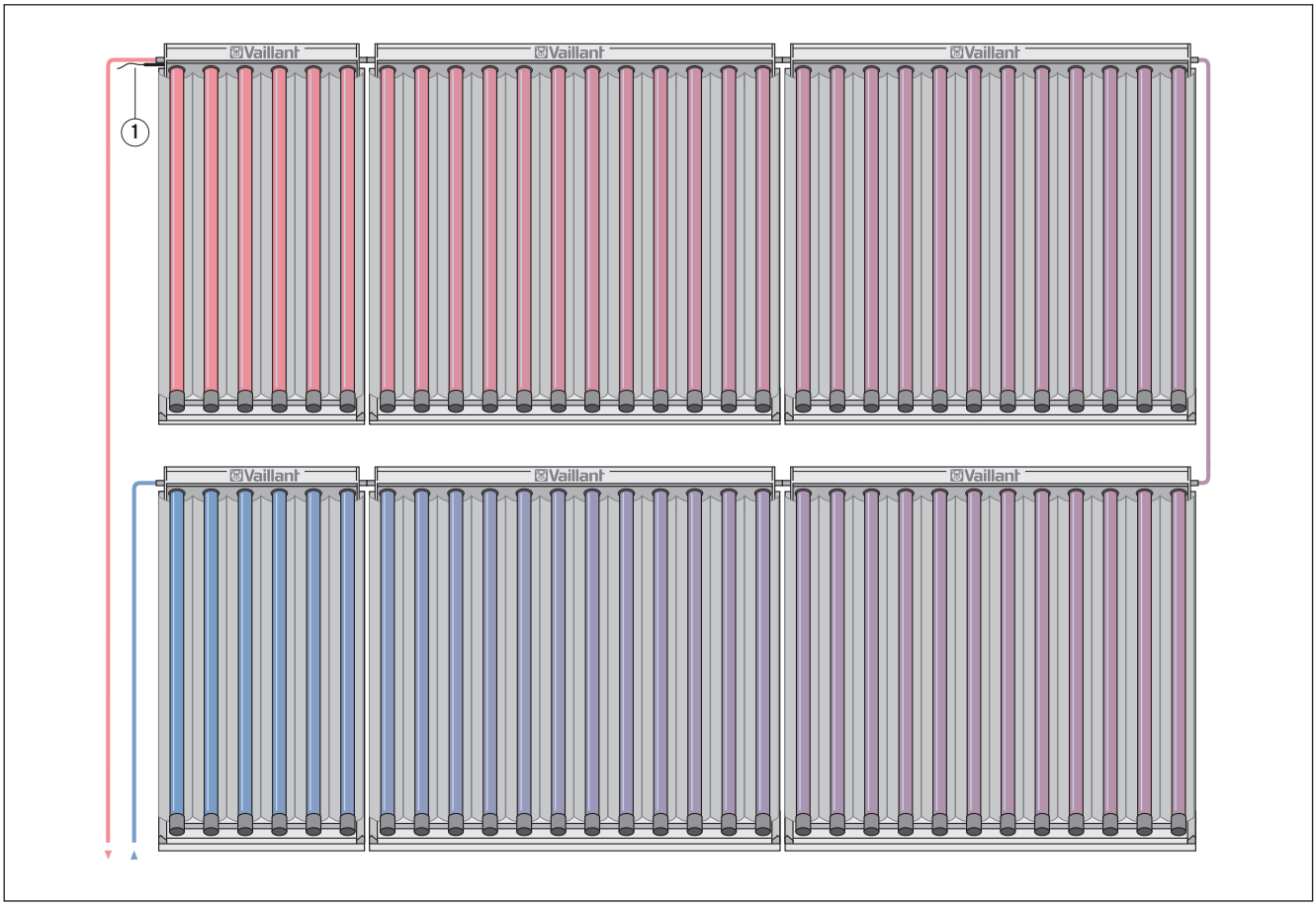


Fig. 47: Series connection of two auroTHERM exclusive VTK 570/2 and four auroTHERM exclusive VTK 1140/2 units

1 Solar sensor

Series connection of two auroTHERM exclusive VTK 570/2 and four auroTHERM exclusive VTK 1140/2 units. Positioning the sensor in the flow of the collector through which flow passes last.

Note
The collectors are arranged in several rows one above the other by connecting the sub-fields in series. This ensures and even flow through the collector field.

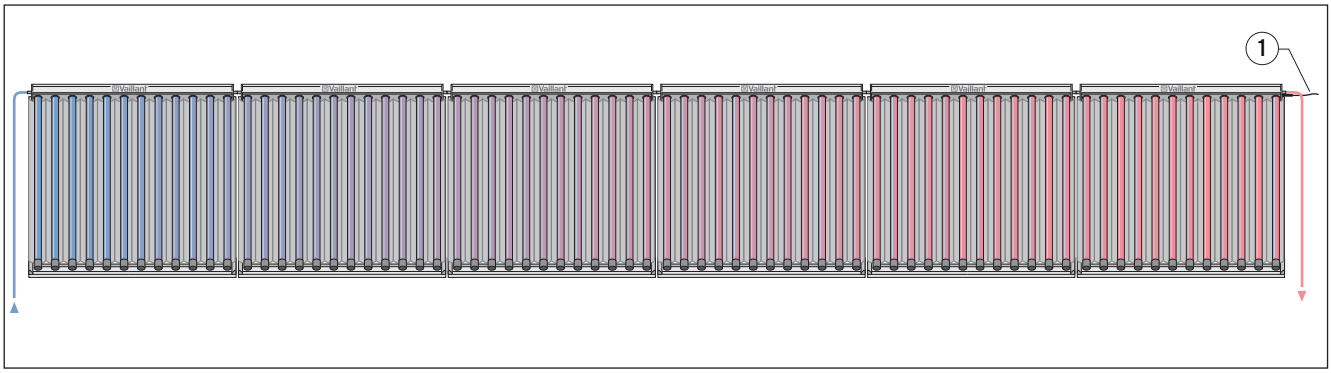


Fig. 48: Series connection of six auroTHERM exclusive VTK 1140/2 units

1 Solar sensor

Series connection of six auroTHERM exclusive VTK 1140/2 units. Positioning the sensor in the flow of the collector through which flow passes last.

4 System design

4.1 Solar systems for hot water generation

Completely different rules apply for dimensioning solar systems than for designing conventional hot water systems.

Solar systems are set up as additional systems that use the severely fluctuating solar energy supply as efficiently as possible, and store it when necessary, in order to reduce the amount combustion fuel required by the conventional system.

Numerous parameters need to be taken into account when designing a solar system:

- The heat demand for hot water generation and, if necessary, the heat demand for a circulation system
- The weather at the place of installation
- The orientation and inclination of the collector surface
- The system configuration
- The desired degree of annual solar cover
- The general and feeding conditions stipulated by law

4.2 Process of the system design

The solar system is designed in four planning steps:

1. Calculating the hot water demand
2. Designing the solar system
3. Selecting the collector installation type and checking the general parameters
4. Dimensioning the domestic hot water cylinder
5. Designing the solar components (see section on component design)

The planning steps 1 to 4 are described in detail in the following sections.

Planning step 1: Hot water demand

The most important parameters when designing solar systems for hot water generation are the hot water demand and the incorporation, if present, of circulation losses.

One way of determining the hot water demand in existing buildings is to place a water meter in the cold water connection of the drinking water heater.

If this is not possible or too difficult, the empirical values according to the number of persons and other consumers can be used to make an estimate.

Proactive planning should also take any foreseeable changes in consumption, e.g. caused by the family growing or occupants moving away, into account.

The daily energy demand for hot water generation is calculated from the daily drinking water demand using the following formula:

$Q = m \cdot c \cdot \Delta T$

Where:

Q = heat in Wh

m = mass [kg] (for water: 1 kg ≈ 1 l)

c = heat capacity [Wh/kgK]

(for water: c ≈ 1.16 Wh/kgK)

ΔT = temperature difference between hot and cold water in K

The annual energy demand for hot water generation is calculated by multiplying the daily consumption by 365.

Example calculation for hot water energy demand

The aim is to calculate the daily hot water energy demand of a six-person household, including the hot water demand of a suitable washing machine (20 l/d).

It is assumed that the average hot drinking water demand is 40 l (45 °C) per person.

Calculation:

m = 6 · 40 l + 1 · 20 l

c = 1.16 Wh/kgK

ΔT = 35 K

This results in:

Q = ((6 · 40 l) + (1 · 20 l)) · 1.16 Wh/kgK · 35 K

Q = 10,556.00 Wh = 10.56 kWh

The required hot water energy demand is therefore 10.56 kWh per day. Multiplied by 365, this results in an annual energy demand of 3,852.94 kWh.

Building type(as per VDI 6002 Part 1 and Part 2)	Average hot water consumption in litres for each permanent resident per day (PR*d) and with a hot water temperature of 60 °C
Residential property	22 l/(PR*d)
Student hall of residence	20 l/(PR*d)
Retirement home	33 l/(PR*d)
Hospital	33 l/(PR*d)
Standard indoor swimming pool Sophisticated swimming pool	22 l/(PR*d) 35 l/(PR*d)

Hot water demand in multiple-occupancy houses

If there are no measurements available, an estimated daily hot drinking water demand of 20-25 l per person or 70 l per accommodation unit at a temperature level of 60 °C can be used for multiple-occupancy houses. Diversity factors must be identified and included. The hot water consumption in the summer months is relevant to solar systems, as during this time there is the greatest risk of overheating and a low load is to be expected due to holiday times.

When calculating the heat demand for hot water generation, not only the amount of energy required to generate hot water but also the cylinder losses and circulation losses must be taken into account.

If there is a secondary circulation line, significant circulation losses can occur depending on its length and level of heat insulation. In branched systems, these losses can be several times greater than the hot water consumption. Circulation losses should be reduced as much as possible. This can be done by fitting a timer, for example, or better still by using a time- and thermostatically controlled circulation breaker. It is usually worthwhile installing these devices as the energy savings are considerable.

The aim is to calculate the additional energy demand per day for the circulation.

It is assumed that there is a 15-m long secondary circulation line with a pump, the running time of which is limited to eight hours a day by a timer.

Calculation:

Q_{dem} = 15 m · 10 W/m · 8 h = 1200 Wh

Q = 10,556.00 Wh = 10.56 kWh

This corresponds to a hot water consumption of 30 l/d and can be calculated as an additional person. If a timer is not used, the daily heat losses are equal to the consumption of three people.

In multiple-occupancy houses (of at least six flats) the heat loss in fully insulated secondary circulation lines is between 50 W and 140 W per flat. An average of 100 W per flat should be calculated for new builds.

Requirements for drinking water hygiene

When designing a solar system – as with any other system for generating hot water – requirements for drinking water hygiene must be satisfied. At temperatures of 30-50 °C, germs (e.g. Legionella) multiply extremely well.

Observing the VDI 6023 on drinking water hygiene is especially important in Germany.

Requirements for preventing Legionella multiplication are listed in the DVGW Worksheet W551. This defines domestic hot water cylinders with a capacity of over 400 l or systems in which the volume in the hot water pipe up to the furthest draw-off point is over 3 l as large systems.

In large systems such as these, the hot water in the standby section of the cylinder must be kept at a constant temperature of 60 °C for thermal disinfection purposes. The entire cylinder volume intended for drinking water is heated to 60 °C once a day. The lowest temperature in the entire drinking water network (also in the circulation return) must be a maximum of 5 K below the outlet temperature of the cylinder.

Planning step 2: Designing the solar system

Next, the collector type, collector surface and the suitable solar pump unit are selected.

A rough design of the solar system for hot water generation is possible using the following rules of thumb.

Multiple-occupancy houses: Approx. 1 m² collector surface per accommodation unit

For 25% solar cover, a collector surface of 0.5 m² is used per 50 l of daily drinking water demand at 60 °C. For 50% cover, a collector surface of 1 m² is used per 50 l of drinking water demand (60 °C).

Multiple-occupancy houses: 30-80 l cylinder volume per 1 m² of collector surface

The required cylinder volume is 30-50 litres per metre of collector field for 25% solar cover and 50-70 litres per metre of collector field for 50% cover. In multi-storey dwellings, a daily hot water demand of 70 litres per accommodation unit at 60 °C can be assumed. As a result, a collector surface of approx. 1 m² is assumed per accommodation unit and a cover of 35-45% is achieved.

Medium-sized and large solar systems for hot water generation

Solar-thermal systems are divided into small (for single- and dual-occupancy houses), medium-sized and large systems, depending on their area of application.

The planning criteria for medium-sized and large systems are more or less the same as those for small systems.

Specific criteria in terms of maximum efficiency apply to "really" large systems with a collector surface of 50 m² or greater; such systems are most often found in public or communal properties.

It is also possible to quickly and approximately dimension medium-sized and small systems:

- If the number of people in a multiple-occupancy house is fixed, it is relatively easy to carry out a quick estimation of the possible system size using the reference value of 1-1.5 m² of collector surface per person.
- If only the number of accommodation units is fixed but not their occupation, an initial estimate can be calculated using 2.5 people per accommodation unit.

System size	Collector surface area	PrivateRecommended cover (possible alternatives)	SharedRecommended cover (possible alternatives)
Small system	< 20 m^2	High	High
Medium-sized system	20 m^2-50 m^2	Medium (high)	Medium (high/low)
Large system	> 50 m^2		Low (medium)

System size and recommended solar yields

Yield	Yield[%]	Specific collector surface [m^2coll/p]
Low	< 30	< 0.5
Medium	30 - 50	1
High	> 50	1.5

Solar yield and specific collector surfaces

Detailed design with maximum efficiency

These days, large systems are usually designed using computer-assisted simulation programs. Using a simulation is the only way to enable the complex interaction between the actual hot water consumption, cylinder temperature and solar-system yield to be evaluated and optimised.

Computer simulations are time-consuming, however, and are not yet necessary for preliminary quotations. In this case, it is often sufficient to state an approximate maximum collector surface which will ensure that the system works in the most efficient way.

Procedure

Systems operating at maximum efficiency should only generate as much solar yield as is actually used. The planner must pay particular attention to hot water consumption in the summer and the maximum possible solar coverage at the place of installation.

In general, the hot water consumption in a multi-storey dwelling is lower than in a single-occupancy house/ dual-occupancy house. Should the planner not have any reliable measurements for this, the average value of 22 l/p • d at 60 °C water temperature calculated in VDI 6002 Part 1 can be used as a good basis for planning.

The following example is intended to show how to calculate the maximum collector surface for a system operating at maximum efficiency without surplus yield:

Dimensioning the collector surface in large systems – Example: Preheating system

Values available: 100 persons, hot water generation consumption 22 l/ p • d (60 °C), specific collector yield 3.5-4 kWh (as per VDI 6002) per m² of aperture and day

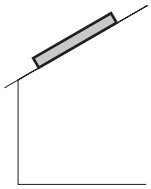
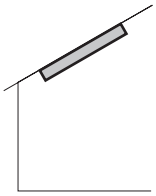
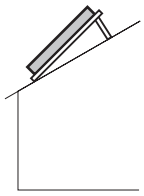
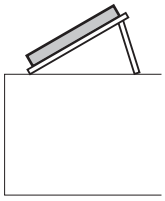
Solution: Calculate the energy required per day to generate hot water

Q = 100 p • 22 kg/(p • d) • 1.16 Wh/ kg • K • 47 K (cold water 10-15 °C) = 120 kWh

A = 120 kWh/3.7 kWh/(m² • d) = **32 m² effective collector surface**

After the size of the system has been calculated in this way and tailored to customer requirements, the second planning step is to use a computer simulation program to optimise the system in detail. This processes simulates and evaluates the system using the value calculated in the quick calculation.

Planning step 3: Selecting the collector installation type and checking the general parameters

Pitched roof			Flat roof/open air installation
			
On-roof installation	In-roof mounting	Pitched roof support	Flat roof/open air installation

Note
The only installation options for the VTK 570/2 and 1140/2 tube collectors are on-roof mounting, pitched roof support and flat roof installation.

Types of installation for collectors

Depending on the structural conditions, it is possible to install the collectors on the rooftop, integrated into the roof, or as an open air installation.

On-roof and in-roof mounting is available for installation on pitched roofs. For flat roofs, open air installation can be used. There is a complete range of accessories available for all three installation variants.

Special features of the Vaillant on-roof mounting system:
- Fast, simplified installation
- Two roof anchor types for all common types of tile
- Hanger bolt for special cases
- Pre-assembled fixing elements for the collector rail and the collector on the roof anchors for shorter installation time
- Also suitable for low roof pitches
- Minimum roof incline > 15°
- Vertical installation

Fig. 49: On-roof mounting with vertical collectors

Fig. 50: Vertical flat roof installation

For on-roof mounting, the collectors are installed over the roof covering on special retainers (roof anchors), which are guided outwards by the rafters or the roof batten between the roof tiles. The supply line consists of a copper pipe with UV-proof and weatherproof heat insulation. This is guided through the ventilation tiles on the inside of the roof. The roof skin is not affected because the collector is located outside. Heat losses are slightly greater than with the in-roof mounting.

Open air installation is carried out on flat roofs or on other level surfaces. Heat losses are higher in comparison to in-roof and on-roof mounting.

Note
The collector(s) must be able to withstand the maximum wind and snow loads at the place of installation. The regulations according to DIN EN 1991-1-4 must be observed in this regard.
Vaillant provides "wind load calculation" software for calculating the necessary loads accurately.

Special features of the Vaillant mounting system for flat roof installation:
- Fast installation thanks to pre-assembled, hinged frame system
- Angle adjustments for 30°, 45° and 60° for optimum incline angles
- Simple hydraulic connection to the collectors
- Possible to install on almost any roof surface without causing damage
- Optimum weighting of the framework using load plates; as a result the roof skin is not affected
- The load plates can be installed quickly and without tools

Note
During installation, the roof skin remains unchanged, if load plates (Vaillant accessories) are used for securing. It is essential to use building protection mats under the load plates.

In principle, pitched roof support uses on-roof mounting for which the incline of the collectors can be increased by 20° or 30° by the mounting system. As a result, incline angles which produce a high yield can be achieved, even for low inclined roofs. The mounting system can be combined with all Vaillant flat collectors.

Special features of the Vaillant pitched roof support:
- Angle adjustments of 20° and 30° – to enable high yields to be achieved on low-inclined roofs
- Two roof anchor types for all common types of tile
- Hanger bolt for special cases
- Vertical installation

Planning step 4: Dimensioning the domestic hot water cylinder

Hot water is consumed mostly in the mornings and evenings, when the sun has not yet risen or has already set. Days can also alternate between being cloudy (= low solar radiation) and being very sunny (= high solar radiation). It is the job of the solar cylinder to temporarily balance the heat supplied by the collector and the hot water demand. For optimum comfort and energy efficiency, the cylinders used in solar systems are significantly larger than those used in conventional heating systems.

The reliability of supply is guaranteed by reheating, in which the upper part of the cylinder is reheated to the set target temperature as necessary. To use the solar energy effectively, the lower part of the cylinder is kept at the lowest possible temperature. If hot water is removed from the cylinder, cold drinking water flows automatically into the lower part of the cylinder. A distinct temperature stratification develops.

The size of the solar cylinder used depends on the hot water demand, user behaviour, and the surface area of the collector(s) selected.

The cylinder volume

Owing to the fact that the cylinder volume is heavily dependent on the consumption profile, the cylinder can only be designed in detail using computer simulation.

According to VDI 6002, the values shown in the graph below are regarded as the primary design guidelines for the corresponding system usage levels:

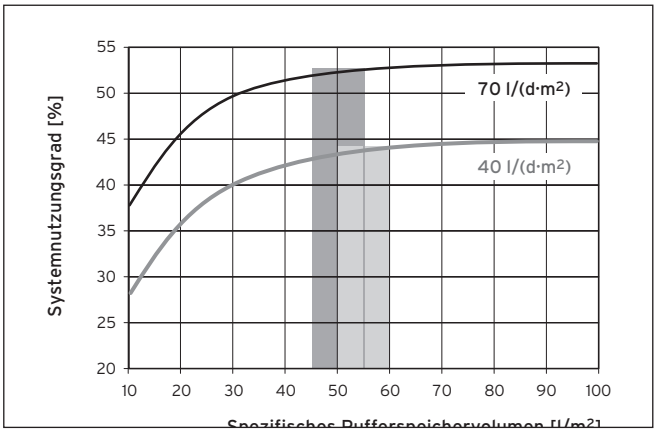


Fig. 51: Efficiency level of the solar system depending on the specific cylinder volume

It is recommended that you check the suitability of the selected cylinder with regard to
- The heat exchanger surface area required for the solar system
- The nominal $_{output}$ required as a standby cylinder

This information can be taken from the technical data of the cylinder.

For increased comfort, install an additional collector field or select a slightly smaller domestic hot water cylinder. The additional costs for the additional collector are low in comparison with the total costs of the system. If the installation room for the cylinder is too small (e.g. ceiling height is too low), you can select a smaller domestic hot water cylinder.

Note
To dimension the cylinder correctly, the following rule applies: The steadier the draw-off profile, the smaller the cylinder volume required. When the draw-off profile is very steady, as is typical in multi-occupancy houses, the solar heat is normally removed from the cylinder immediately after being generated. The cylinder volume required is therefore smaller. If the cylinder is too large, it will distribute too little heat over too much water and this can lead to customer dissatisfaction. When dimensioning the domestic hot water cylinder, less is more!
Do not attempt to make up for the collector surface being too small by over-dimensioning the cylinder. A cylinder, however large it may be, does not generate energy. If the cylinder does not heat up, either add more collectors or reduce the size of the cylinder.

5 Component design

5.1 Design of the solar components

Design of the solar components

Safety

Solar systems impose particular requirements in terms of operational safety. The measures required are specified in DIN EN 12977. These include not only common expansion relief valves but also the intrinsic safety of the system. Intrinsic safety means that the system can restart itself following a downtime without additional intervention by the operator.

For example, if the cylinder reaches its maximum temperature due to a high level of solar radiation – caused by low usage – the controller must switch off the solar circuit. The temperatures in the collector may rise until they reach shutdown temperature, at which vapour can accumulate in the collector.

In this situation, solar fluid must not leak out of the expansion relief valve or out of an air vent, as this would result in there being insufficient levels of solar fluid in the system once it had cooled down, thus requiring it to be topped up manually.

The level of intrinsic safety required is achieved by the expansion vessel accommodating not only the solar fluid, which has expanded due to the increase in temperature, but also the volume displaced by the build-up of vapour in the collector. This prevents the expansion relief valve from opening.

Design of the expansion vessel

Key for the following calculation steps:

V_n	Nominal volume of the expansion vessel in litres
V_e	Expansion volume in litres
V_v	Volume of vapour in litres
V_p	Volume of vapour in the pipeline in litres
V_{WR}	Water reserve in litres
P_f	Pressure factor (dimensionless)
V_S	System volume in litres
V_C	Collector volume in litres
V_P	Pipeline volume incl. fittings in litres
V_{HE}	Heat exchanger volume in litres
SV_{max}	Maximum spread of vapour in metres = length of pipeline containing vapour
VO_{max}	Maximum vapour output of the collectors in W/m²
A_{coll}	Collector aperture surface area in m²
q_{Pipe}	Heat loss of the pipeline in W/m
p_d	Maximum system discharge pressure in bar
p_i	Filling pressure (initial pressure) of the system in bar
p_p	Gas pre-charge pressure (nitrogen cushion) in the expansion vessel in bar
p_{stat}	Static pressure in bar
h	Static height in m

The nominal volume V_n required for the expansion vessel is calculated by multiplying the total volume displaced (expansion volume V_e + volume of vapour V_v) plus the water reserve V_{WR} by the pressure factor P_f.

Vn = (V e + V v + V WR) * Pf

The procedure for calculating the individual values is shown step by step below.

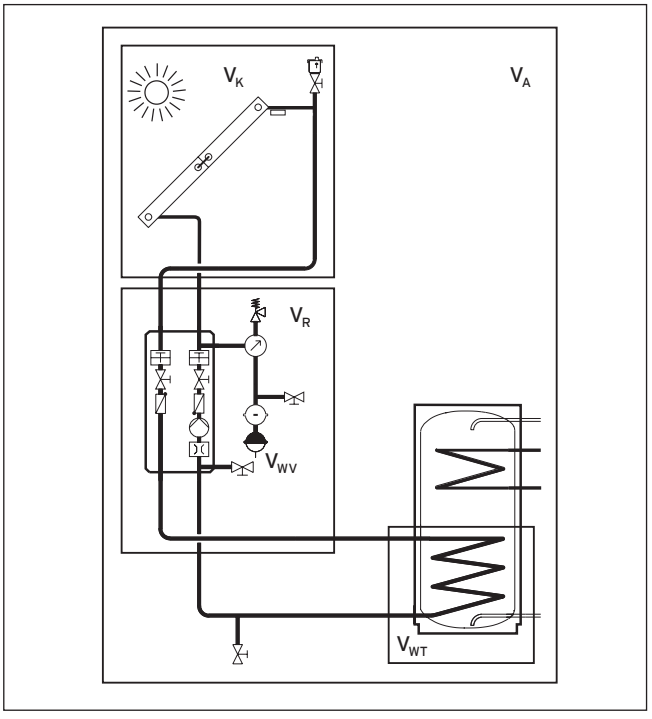


Fig. 52: Design of the expansion vessel

Step 1:

Calculate the system volume V_S

The total system volume V_S of the collector circuit as a sum of all the components is calculated by multiplying the content of the components by the number of respective components:

Components	Contents
1. Collectors (V_K)	
auroTHERM VFK 145 H auroTHERM plus VFK 155 H	2.16 l/pc
auroTHERM VFK 145 V auroTHERM plus VFK 155 V	1.85 l/pc
auroTHERM exclusive VTK 570/2	0.90 l/pc
auroTHERM exclusive VTK 1140/2	1.80 l/pc
2. Pipelines (V_R)	
Flexible collector connector, DN 12, 1 m	0.145 l/pc
Flexible collector connector, DN 16, 1 m	0.265 l/pc
Solar flexible pipe, 2 in 1 DN 16, 2 × 0.265 l/m	0.53 l/m
Solar flexible pipe, 2 in 1 DN 20, 2 × 0.36 l/m	0.72 l/m
Cu 12 × 1 pipe	0.08 l/m
Cu 15 × 1 pipe	0.13 l/m
Cu 18 × 1 pipe	0.20 l/m
Cu 22 × 1 pipe	0.30 l/m
Cu 28 × 1.5 pipe	0.50 l/m
Cu 32 × 1.5 pipe	0.80 l/m
3. Installations (V_{WV} and V_{WT})	
W_{WV} expansion vessel water trap	≥ 3 l
W_{WT} heat exchanger volume	
auroSTOR VIH S 750/1000/1500/2000	13.2 l/13.2 l/19.8 l/26.3 l
uniSTOR VIH R 750/1000/1500/2000	14.2 l/19.8 l/26.3 l/32.9 l
Further installations, e.g. in-line vessel	

V_S also corresponds to the amount of solar fluid required.

VS = V C + V P + V HE+ VWR

Water reserve VWR

When filling the system, an equilibrium is created between the solar fluid pressure and gas pressure in the diaphragm of the expansion vessel; the expansion vessel takes up the so-called water reserve V_{WR}. The purpose of the water reserve is to offset the volume loss caused by purging during start-up and ensure that there is an overpressure at the highest points of the system in winter when system temperatures are very low. The water reserve V_{WR} is approx. 4% of the system volume and at least 3 l.

V WR = 0.04 * V S

Step 2:

Calculate the expansion volume V_e

The expansion volume V_e resulting from the fluctuations in temperature (typically approx. -20 °C to 130 °C) is approx. 8.5% of the total content of the system V_S when using the Vaillant frost protection agent (ready mixed).

V e = 0.085 * V S

Step 3:

Calculate the volume of vapour V_v

The volume of vapour V_v to be accommodated by the expansion vessel consists of the content of the collector V_C and the volume of vapour in the pipeline V_p.

V v = V C+ V p

Volume of vapour in the pipeline V p

The amount of vapour generated during stagnation requires the greatest expansion volume. In addition to the volume of vapour in the collector V_C, the volume of vapour in the pipeline V_p must also be considered.

V_p is calculated using the maximum vapour output of the collectors VO_{max} and the heat loss of the pipelines q_{Pipe}, while determining the maximum spread of vapour in metres SV_{max}.

SVmax = VOmax *A coll / q Pipe

V p = SVmax* piping contents/m

The heat loss in commercially available copper pipelines with 100% heat insulation can be estimated at 25-30 W/m. Depending on the collector design and arrangement, the vapour output can be estimated at 100-200 W/m²; for effectively vaporising flat collectors with two-sided connection also up to 60 W/m².

Depending on the collector design, collector arrangement, pipe routing and spread of vapour, at a minimum the pipeline over the collector level, and at a maximum the total pipeline volume, must therefore be taken into consideration when calculating V_p.

Step 4:

Calculate the pressure factor and the correct system pressure settings

The pressure factor comes from the pressure ratios in the collector circuit.

Pf = (pd + 1) / (p d - p i)

System discharge pressure pd

The system discharge pressure p_d corresponds to approx. 90% of the operating pressure at the expansion relief valve – at the 6-bar expansion relief valves fitted in Vaillant solar pump units, this means p_d = 5.4 bar.

Correct gas pre-charge pressure pp of the expansion vessel

The gas pre-charge pressure p_p of 2.5 bar in the expansion vessel (pressure as delivered) must be adjusted to the static height of the system during start-up in an uncoupled state.

The static pressure p_{stat} corresponds approximately to the static height h between the collector field and the expansion vessel; a static height of 10 m corresponds to approx. 1 bar.

p p = pstat = h * 0.1

Note
All Vaillant expansion vessels are delivered with a gas pre-charge pressure of 2.5 bar. Deviations from the optimum gas pre-charge pressure in the expansion vessel always reduce the usable volume of the expansion vessel. This can result in operating faults.

Filling pressure pi

Upon start-up, the filling pressure (initial pressure) pi must be adjusted to the static height + 0.5 bar (overpressure required at the collector).

p i = pstat+ 0.5 bar

p i > 2.0 bar

p p adjusted to pstat

Step 5:

Calculate the nominal volume V_n of the expansion vessel

The nominal volume of the expansion vessel is calculated using the previous steps.

V n = (V e+ V v+ V WR) * Pf

Note
To increase the heat losses in the pipeline between the solar pump unit and the expansion vessel and thereby protect the diaphragm of the expansion vessel as much as possible against excess temperature, this pipeline must not be insulated. Furthermore, a wall-mounted expansion vessel should only be installed with the connection facing upwards.

Values available: Solar system with 16 VFK 145 V collectors, 22 x 1.30-m copper pipe and VIH S 2000 cylinder, static height 14 m

Step 1:

Calculate the system volume VS

Collector volume VC = 16 x VFK 145 V = 16 x 1.85 l = 29.6 l

Pipeline volume VP = 40 m x copper pipe 22 x 1 = 12 l

Heat exchanger volume VHE = VIH S 2000 = 26.3 l

Water reserve V WR = 3.0 l, as V WR < 0.04 * V S

V S = 70.9 l

Step 2:

Calculate the expansion volume Ve

V e = 0.085 * V S = 6.0265 l

Step 3:

Calculate the volume of vapour Vv

Collector volume V C = 29.6 l

Max. spread of vapour SVmax = VOmax *A coll / q Pipe = (60 W/m² x 37.6 m²)/30 W/m = 75.2 m

Vaporising volume in pipeline V p = 40 x 0.3 = 12 l

V v = 29.6 l + 12 l = 41.6 l

Step 4:

Calculate the pressure factor

p d = 5.5 bar (90% operating pressure of the expansion relief valve, but at least -0.5 bar)

p p = 1.4 bar (gas pre-charge pressure in expansion vessel adjusted to a static height of 14 m)

p i = 2.0 bar (0.5 bar over p p , but at least 2.0 bar)

Pf = (5.5 + 1) / (5.5 - 2) = 1.85 bar

Step 5:

Calculate the nominal volume V n of the expansion vessel

V n = (6.0265 l + 41.6 l + 3) *1.85 bar = 93.66 l

Result: A 100-l expansion vessel

Note
If the pre-charge pressure in the expansion vessel is not released at 1.4 bar, this will result in a system pressure of 2.5 bar. This in turn will result in a pressure factor of 2.17 bar and the selected expansion vessel will no longer be adequate. Always adjust the required pre-charge pressure in the expansion vessel.

Necessity of in-line vessels

Expansion vessel diaphragms for sustained temperatures of > 70 °C are not permitted in accordance with DIN 4807/2. It is therefore mandatory to install an expansion vessel in the solar return. It may also be necessary to install an in-line vessel or a temperature cycler, or extend the piping.

An in-line vessel is always required if the collector creates more vapour than the amount that is able to recondense in the adjoining pipelines to the solar pump unit. To improve heat emission, in-line vessels must never be thermally insulated.

Note
Vaillant recommends installing an in-line vessel in every system.

Calculating the pipe network for the collector circuit

To obtain the optimum heat emission from the collectors, they must have a minimum volume flow per m^2 of the collector surface flowing through them. The total volume flow in the collector circuit is also directly dependent on the collector surface.

A minimum volume flow of 15 l per m2 of collector surface must be achieved.

The flow speed must be approx. 0.3-0.4 m/s in order to ensure that air bubbles are transported to the central air vent at the lowest point in the return.

The flow speed must not, however, exceed 0.5-0.6 m/s in order to prevent high pressure losses and high power consumption by the pump.

A guideline value for reasonable pressure loss in the pipe is **1.5-2 mbar/m.**

This "Low Flow" operation of 15 l/m^2h is usually proposed for large systems, at which an area-related flow rate of 30 to 40 l/m^2h is intended to develop in the absorber pipe in order to ensure a turbulent flow.

Minimum volume flows and minimum pipe cross sections in the collector circuit

The following tables contain the minimum volume flows of 15 l/m^2h required in the collector circuit and the recommended minimum cross sections for the pipelines in the collector circuit when using flat or tube collectors. The basis for the size of the cross sections is the assumption that at nominal flow, a maximum of a third of the remaining feed head of the pump at pump speed 2 accumulates as pressure loss in the collector field itself. Sufficient remaining feed head must be available with the selected pipe cross section and specified pipe length.

Note
A minimum volume flow of 3 l/min must be ensured in every solar system with Vaillant collectors in order to achieve efficient purging.

Component design

Number of collectors	Net area	ConnectionNo. of rows x collector quantity for connection:		Minimum flow rate15 l/m²h (Low Flow)	Recommended cross section for copper pipe with a total pipe length of:	
Quantity	**m²**	**One side**	**Opposite sides**	**l/h**	**20 m**	**50 m**
10	23.5	2 x 5 * / 5 x 2 *	1 x 10 / 2 x 5 / 5 x 2	353	22 x 1	22 x 1
11	25.8		1 x 11	387	22 x 1	22 x 1
12	28.2		1 x 12 / 2 x 6 / 3 x 4 / 4 x 3	423	22 x 1	22 x 1
20	47		4 x 5 / 5 x 4	705	22 x 1	28 x 1.5
24	56,4		2 x 12 / 4 x 6 / 6 x 4, etc.	846	28 x 1.5	28 x 1.5
32	75.2		4 x 8, etc.	1128	28 x 1.5	28 x 1.5
* Only with parallel field connection						

Number of collectorsVTK 570/2	Number of collectorsVTK 1140/2	Net area	Two parallel collector fieldsin series	Recommended volume flow	Recommended cross section for copper pipe with a total pipe length of:	
Quantity	**Quantity**	**m²**		**l/h**	**20 m**	**50 m**
2	10	22	2 x 1 / 2 x 5	420	18 x 1	22 x 1
	12	24	2 x 6	480	22 x 1	22 x 1
2	12	26	2 x 1 / 2 x 6	480	22 x 1	22 x 1
	14	28	2 x 7	480	22 x 1	22 x 1

Pressure loss in the pipelines in the solar circuit

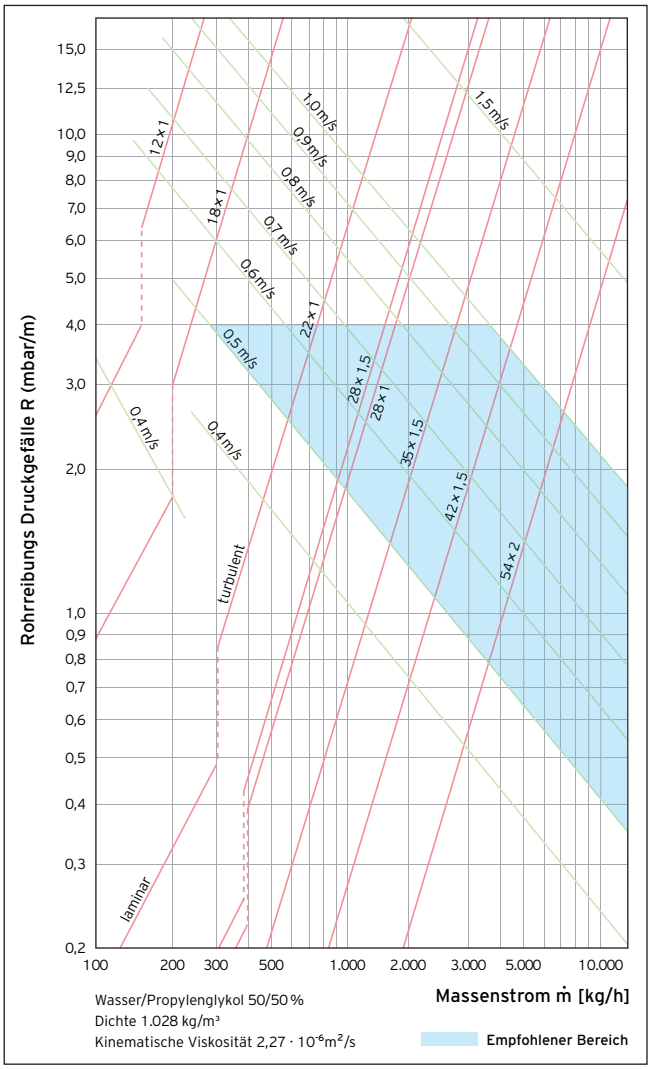


Fig. 53: Pressure losses in copper pipelines at 50 °C with Vaillant solar fluid

Pressure losses in copper pipelines at 50 °C with Vaillant solar fluid

For more accurate dimensioning of large solar systems, a pipe network calculation must be made, which often results in smaller pipe diameters than those given in the guideline values. For energy reasons, the pressure loss per metre of pipeline should not exceed 1.5 mbar within the collector circuit. If the pump is permitted to consume more energy, the pressure loss in the collector circuit can also be increased accordingly. To prevent noise generation and material erosion, however, the flow speed in the pipelines should not exceed 0.7 m/s.

Note
In large solar systems with several collector sub-fields, there should be the same pressure loss per metre in the main pipeline as there is in the branching pipelines. The cross section therefore needs to be adjusted when dimensioning the pipes in the branching pipelines. All components should have the same nominal diameter as the respective pipeline.

Note
When using an automatic air separator system, the flow speed in the pipelines should not fall below 0.4 m/s to enable any trapped air bubbles to be transported to the air separator after start-up.

To calculate the total pressure loss, the pressure losses in the pipes must be added to the pressure losses that occur at elbows, formed sections and mixer valves. In practice, this is normally a case of adding 30-50%. The actual pressure losses may deviate considerably depending on the piping; precise calculation of the estimate is therefore preferred.

The total pressure loss in the collector circuit consists of:

- Pressure loss in the collector (sub-)fields
- Pressure loss in the pipeline, incl. elbows and formed sections
- Pressure loss of components, such as the heat exchanger, solar pump unit, stop cocks and mixer valves, etc.

= total pressure loss

Selecting the solar pump unit and pump speed

The pump in the collector circuit must be able to overcome the sum of all the pressure losses in the collector circuit and provide the volume flow required at the same time. Use the relevant pump diagram to select the pump.

The volume flow in the collector circuit is usually 15 l/m²h in large solar systems. It can be adjusted using three pump speeds. The adjustment is made in a slightly preheated state of approx. 40 °C. The pump is switched on by hand. Starting with the lowest pump speed, the volume flow is read at the flowmeter and the pump speed is increased – if necessary – until the required volume flow has been reached or exceeded.

Note
For energy reasons, reducing the volume flow at the flowmeter is not recommended. It is nevertheless useful in the context of measurement-related fine tuning, monitoring and evaluation. For reasons of saving energy, the pump speed should always be reduced before restricting the volume flow.

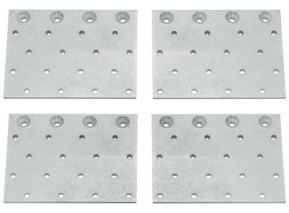
Note
When using solar flexible pipe with a basic length of more than 15 m, the pressure loss must always be calculated separately.

General information about laying the pipelines

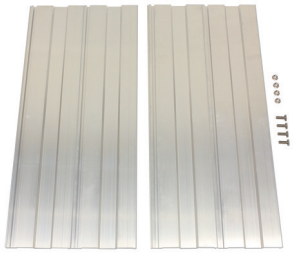
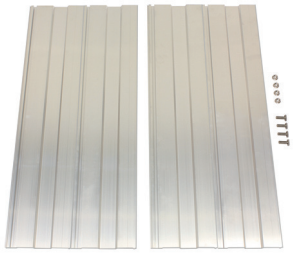
- Due to the high maximum temperatures, the thermal expansion of pipelines in the solar circuit is significantly greater than expected from the empirical values for the heating system. To prevent the expansion forces from causing damage, the corresponding compensation measures when planning and laying the solar circuit pipelines must be observed.
- As temperatures in the collector can reach > 220 °C, only high-temperature-resistant materials may be used. We recommend that pipelines are hard soldered or that Vaillant flexible pipes are used.
- Avoid air bubbles. Observe the relevant installation and operating instructions.
- As far as possible, lay collector circuit pipelines on a gradient to prevent air bubbles from forming.
- Install a combined filling and emptying valve at the lowest point of the system.
- Connect the pipeline to the house's equipotential bonding network.

6 Accessories

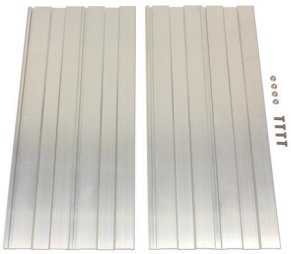
6.1 On-roof mounting

Accessories	Designation	Order no.
	Set of roof anchors (4) (hanger bolts) for installing collectors side by side, for auroTHERM exclusive/auroTHERM plus/auroTHERM Four hanger bolts with nuts, four anchor upper parts incl. retainers, universal usage **Note:** Set of rails is essential	0020067277
	Set of roof anchors (2) (hanger bolts) for installing collectors one above the other, for auroTHERM exclusive/auroTHERM plus/auroTHERM Two hanger bolts with nuts, two anchor upper parts incl. retainers, universal usage **Note:** Set of rails is essential	0020087855
	Set of roof anchors (2) type P (e.g. Frankfurt tile) for installing collectors one above the other, for auroTHERM exclusive/auroTHERM plus/auroTHERM Two roof anchors incl. retainers, black anodised **Note:** Set of rails is essential	0020067274
	Set of roof anchors (4) type P (e.g. Frankfurt tile) for installing collectors side by side, for auroTHERM exclusive/auroTHERM plus/auroTHERM Four roof anchors incl. retainers, black anodised **Note:** Set of rails is essential	0020067273
	Set of roof anchors (2) type S for low installation height with flat roofing (shingle, slate, etc.), for installing collectors one above the other, for auroTHERM exclusive/auroTHERM plus/auroTHERM Two roof anchors incl. retainers, black anodised, height of roof anchors without retainer: 44 mm **Note:** Set of rails is essential	0020080147
	Set of roof anchors (4) type S for low installation height (shingle, slate, etc.), for installing collectors side by side, for auroTHERM exclusive/auroTHERM plus/auroTHERM Four roof anchors incl. retainers, black anodised, height of roof anchors without retainer: 44 mm **Note:** Set of rails is essential	0020080145
	Set of rails (2) for on-roof mounting **(horizontal collector)**, aluminium, black anodised, **for auroTHERM plus/auroTHERM**	0020059898
	Set of rails (2) for on-roof mounting **(vertical collector)**, aluminium, black anodised, **for auroTHERM plus/auroTHERM**	0020059899
	Set of rails (2) for on-roof mounting, aluminium **for auroTHERM exclusive VTK 570/2**	0020076780
	Set of rails (2) for on-roof mounting, aluminium **for auroTHERM exclusive VTK 1140/2**	0020076781
	Long lower section (4), for rafter mounting with set of type P roof anchors, for auroTHERM exclusive/auroTHERM plus/auroTHERM, on-roof mounting Type P roof anchors essential, four long lower sections, 16 bolts **Note:** Lower section can be used as an alternative to the lower bracket of the type P roof anchor for more flexible rafter mounting. The lower section enables the rafter to be variably adjusted to the roof tile trough.	0020080177

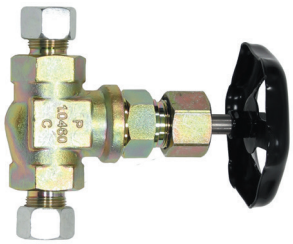
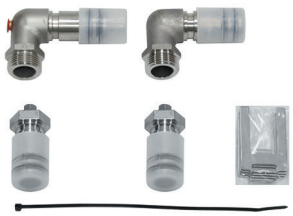
6.2 Open air installation

Accessories	Designation	Order no.
Open air installation for auroTHERM exclusive VTK 570/2 and VTK 1140/2		
	Installation set (1) for open air/flat roof installation, one frame for 30°, 45° and 60° inclines, **for auroTHERM exclusive** Aluminium, pre-assembled, incl. retainers, rail connectors **Note:** Two racks for the first collector and one rack for every additional collector in a series are required. The rack is supplied without anchor bolts for attaching it to the roof. For direct attachment to the roof (observing the permitted concrete grade), the accessory order no. 0020146025 can be ordered at the same time. Set of rails is essential.	0020137776
	Load plates (2) for installation frames for open air/flat roof installation Allows installation without damaging the roof skin. Two plate halves are put together to form a plate for each rack support (four plate halves for two load plates). Load plate dimensions: Length 875 mm, width 403 mm. For auroTHERM collectors **Note:** The necessary ballast must be calculated specifically for each application.	0020137768
	Anchor bolts (2) for installation frames for open air/flat roof installation 2 anchor bolts, incl. M10 nuts **Note:** The set can be used for a rack with two bolting points. Observe the permitted concrete grade: At least C20/25 and at most C50/60 in accordance with EN 206-1:2000-12.	0020146025
	Set of rails (2) for open air/flat roof installation, aluminium, **for auroTHERM exclusive VTK 570/2**	0020092560
	Set of rails (2) for open air/flat roof installation, aluminium, **for auroTHERM exclusive VTK 1140/2**	0020092561
	Bottom rail for open air installation/2, **for auroTHERM exclusive VTK** For connecting several loading plates in a rack and minimising the loading weights.	0020160642
	Guy rope for open air installation 10 m wire rope attaching a flat roof rack, (2) per rack. **Note:** Attachment only works in combination with the bottom rail (00201060642). This combination can reduce loading weights.	0020160658
Open air installation for auroTHERM plus/auroTHERM – Horizontal collector		
	Installation set (1) for open air/flat roof installation (horizontal collector), one frame for 30°, 45° and 60° inclines, **for auroTHERM plus/auroTHERM** Aluminium, pre-assembled, incl. retainers, rail connectors **Note:** Two racks for the first collector and one rack for every additional collector in a series are required. The rack is supplied without anchor bolts for attaching it to the roof. For direct attachment to the roof, the accessory order no. 0020146025 can be ordered at the same time. Set of rails is essential.	0020137775
	Load plates (2) for installation frames for open air/flat roof installation Allows installation without damaging the roof skin. Two plate halves are put together to form a plate for each rack support (four plate halves for two load plates). Load plate dimensions: Length 875 mm, width 403 mm. For auroTHERM collectors **Note:** The necessary ballast must be calculated specifically for each application.	0020137768
	Anchor bolts (2) for installation frames for open air/flat roof installation 2 anchor bolts, incl. M10 nuts **Note:** The set can be used for a rack with two bolting points. Observe the permitted concrete grade: At least C20/25 and at most C50/60 in accordance with EN 206-1:2000-12.	0020146025

Accessories

Accessories	Designation	Order no.
	Set of rails (2), aluminium (horizontal collector), **for auroTHERM plus/auroTHERM**	0020092559
	Bottom rail for open air installation H/2, **for auroTHERM plus/auroTHERM** For connecting several loading plates in a rack and minimising the loading weights.	0020160635
	Guy rope for open air installation 10 m wire rope attaching a flat roof rack, (2) per rack. **Note:** Attachment only works in combination with the bottom rail (00201060642). This combination can reduce loading weights.	0020160658
Open air installation for auroTHERM plus/auroTHERM – Vertical collector		
	Installation set (1) for open air/flat roof installation (vertical collector), one frame for 30°, 45° and 60° inclines, **for auroTHERM plus/auroTHERM** Aluminium, pre-assembled, incl. retainers, rail connectors **Note:** Two racks for the first collector and one rack for every additional collector in a series are required. The rack is supplied without anchor bolts for attaching it to the roof. For direct attachment to the roof, the accessory order no. 0020146025 can be ordered at the same time. Set of rails is essential.	0020137774
	Load plates (2) for installation frames for open air/flat roof installation Allows installation without damaging the roof skin. Two plate halves are put together to form a plate for each rack support (four plate halves for two load plates). Load plate dimensions: Length 875 mm, width 403 mm. For auroTHERM collectors **Note:** The necessary ballast must be calculated specifically for each application.	0020137768
	Anchor bolts (2) for installation frames for open air/flat roof installation 2 anchor bolts, incl. M10 nuts **Note:** The set can be used for a rack with two bolting points. Observe the permitted concrete grade: At least C20/25 and at most C50/60 in accordance with EN 206-1:2000-12.	0020146025
	Set of rails (2), aluminium (vertical collector), **for auroTHERM plus/auroTHERM**	0020092558
	Bottom rail for open air installation V/2, **for auroTHERM plus/auroTHERM** For connecting several loading plates in a rack and minimising the loading weights.	0020160628
	Guy rope for open air installation 10 m wire rope attaching a flat roof rack, (2) per rack. **Note:** Attachment only works in combination with the bottom rail (00201060642). This combination can reduce loading weights.	0020160658

6.3 General accessories

Accessories	Designation	Order no.
Fitting		
	Stop valve (2-way) for parallel connection **for auroTHERM exclusive VTK/2** – **Note:** In parallel connection, a stop valve must be provided for every row after the third parallel row.2 x cutting ring (15 mm) – 2 x cap nut	0020076784
Installation set		
	VTK/2 installation set (basic module) for on-roof mounting and open air installation For collector field, order one per row – For flat-sealing installation1 x connection fitting – 2 x heat insulation – 1 x instructions	0020143704
	– VTK/2 installation set (expansion module) for additional collectors, side by side for on-roof mounting and open air installation1 x connection fitting – 1 x heat insulation – 1 x cover panel for collector housing – 2 x rail connectors	0020076779
	– VFK installation set (basic module for first collector) vertical/horizontal/on-roof mounting, pitched roof support, open air/flat roof installation2 x dummy plugs incl. manual bleeding device – 1 x 90° flow connection piece (with thermowell for collector temperature sensor DN 16, G 3/4) – 1 x 90° return connection piece DN 16 (G 3/4) – 4 x retaining clips – Installation manual	0020143692
	– VFK installation set (expansion module) for additional collector, side by side2 x hydraulic connectors – 4 x retaining clips – 2 x rail connectors – (Not to be used with pitched roof support, supported façade/balcony mounting, open air/flat roof installation. The relevant rail connectors are enclosed with the relevant roof anchors or racks.)	002055181
	Carrying aids (2) for VFK collectors: Handles for transporting the collectors easily **for auroTHERM plus/auroTHERM**	0020039688

Accessories

Accessories	Designation	Order no.
Solar fluid		
	Solar fluid, ready mixed, 20 l can High-performance solar fluid (ready mixed) with frost protection for temperatures down to -28 °C. Contents 20 l **Note:** Only in combination with Vaillant collectors	302498
Vessels		
	Solar in-line vessel, 5 l Recommended for use with collector fields > 10 m²	302405
	Solar in-line vessel, 12 l Recommended for use with collector fields > 10 m²	0020048752
	Solar in-line vessel, 18 l Recommended for use with collector fields > 10 m²	0020048753
	Solar expansion vessel plus (18 litres) incl. in-line vessel Solar expansion vessel combined with in-line vessel for solar systems up to 10 bar. Three-chamber vessel up to 100 °C. Solar expansion vessel, 18 l capacity In-line vessel, 6 l capacity, pre-charge pressure 2.5 bar For auroTHERM	0020059912
	Solar expansion vessel plus (25 litres) incl. in-line vessel Solar expansion vessel combined with in-line vessel for solar systems up to 10 bar. Three-chamber vessel up to 100 °C. Solar expansion vessel, 25 l capacity In-line vessel, 10 l capacity, pre-charge pressure 2.5 bar For auroTHERM	0020059914
	Solar expansion vessel plus (35 litres) incl. in-line vessel Solar expansion vessel combined with in-line vessel for solar systems up to 10 bar. Three-chamber vessel up to 100 °C. Solar expansion vessel, 35 l capacity In-line vessel, 12 l capacity, pre-charge pressure 2.5 bar For auroTHERM	0020065939
	Solar expansion vessel, 18 litres Resistant to solar fluid, for systems up to 10 bar, pre-charge pressure 2.5 bar, wall-mounted For auroTHERM	302097
	Solar expansion vessel, 25 litres Resistant to solar fluid, for systems up to 10 bar, pre-charge pressure 2.5 bar, wall-mounted For auroTHERM	302098
	Solar expansion vessel, 35 litres Resistant to solar fluid, for systems up to 10 bar, pre-charge pressure 2.5 bar, wall-mounted For auroTHERM	302428

Accessories

Accessories	Designation	Order no.
	Solar expansion vessel, 50 litres Resistant to solar fluid, for systems up to 10 bar, pre-charge pressure 2.5 bar, floor-standing For auroTHERM	302496
	Solar expansion vessel, 80 litres Resistant to solar fluid, for systems up to 10 bar, pre-charge pressure 2.5 bar, floor-standing For auroTHERM	302497
	Solar expansion vessel, 100 litres Resistant to solar fluid, for systems up to 10 bar, pre-charge pressure 2.5 bar, floor-standing For auroTHERM	0020020655
	Solar expansion vessel, 150 litres Resistant to solar fluid, for systems up to 10 bar, pre-charge pressure 2.5 bar, floor-standing For auroTHERM	0020159509
	Solar expansion vessel, 200 litres Resistant to solar fluid, for systems up to 10 bar, pre-charge pressure 2.5 bar, floor-standing For auroTHERM	0020159510
	Installation set For floor-standing solar expansion vessels	0020077250
Tool		
	Safety belt Personal protective equipment for working on the roof in accordance with the EU directive 89/686/EEC. Personal protective equipment against falling	302066
	Professional solar filling and purging device Professional filling and purging unit for clean and easy start-up or maintenance of solar systems. Installed on a trolley.	0020145705

7 Post-heating installations

7.1 Post-heating installations

You can use the following heat generators as post-heating installations for the solar system.

	Vaillant boiler	Nominal output in kW
	**Vaillant geoTHERM heat pumps** geoTHERM exclusive geoTHERM plus geoTHERM VWL	5.9 to 63.6
	**Vaillant renerVIT pellet boiler**	3.4 to 28.0
	**Vaillant condensing unit** ecoVIT icoVIT ecoTEC ecoCRAFT	2.4 to 280
	**Vaillant non-condensing unit** atmoTEC turboTEC atmoCRAFT atmoVIT iroVIT	4.8 to 160

8 System diagrams

8.1 Overview of the system diagrams

System diagram 1

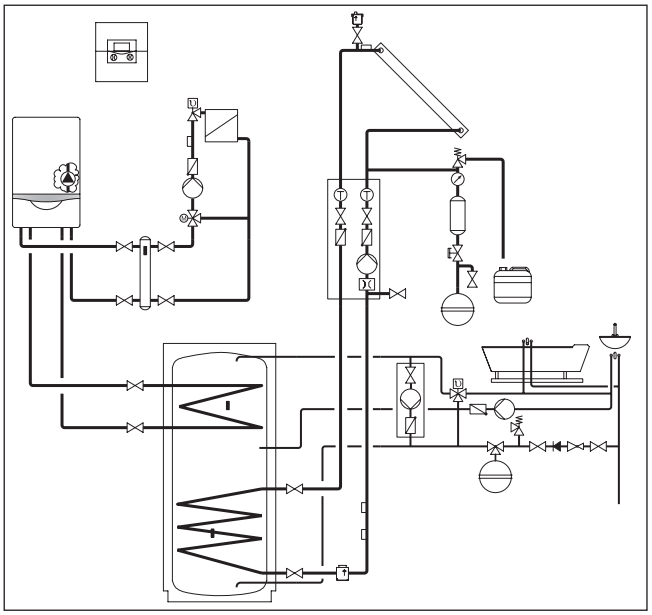


Fig. 54: System preview 1

The system preview is used to select the appropriate heating system. Observe the relevant system diagram for the detailed planning.

System description

This system diagram is suitable for solar hot water generation.

- Gas-fired wall-hung boiler as a heat generator
- Heating control via a weather-controlled **auroMATIC 620/3** solar system controller
- Hot water generation via an **auroSTOR VIH S** domestic hot water cylinder
- Solar hot water generation via VFK solar collectors; the solar system is integrated using the **solar pump unit twin-line (solar pipe group) – 22 l/min**

System diagram 2

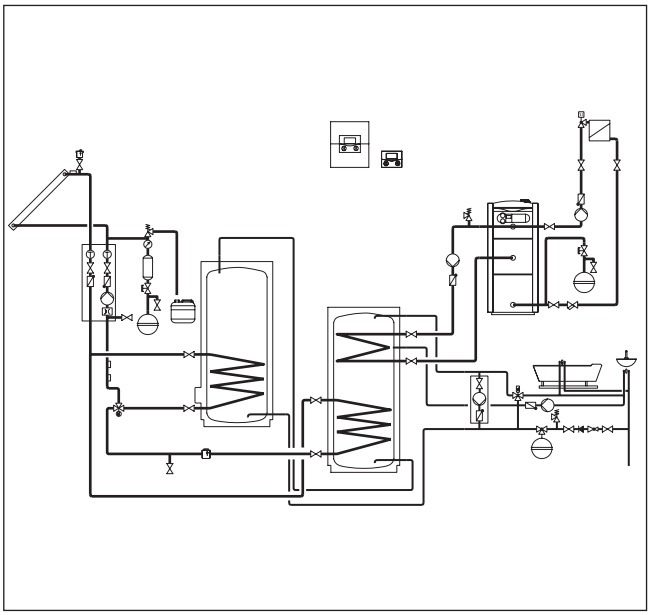


Fig. 55: System preview 2

The system preview is used to select the appropriate heating system. Observe the relevant system diagram for the detailed planning.

System description

This system diagram is suitable for a heating installation with two regulated heating circuits.

- Heat generator for gas-fired wall-hung boiler or condensing unit (oil/gas)
- Two regulated heating circuits
- Heating control via a weather-controlled **auroMATIC 620/3** solar system controller
- Hot water generation via the **uniSTOR VIH R** and **auroSTOR VIH S** domestic hot water cylinders in cascade
- Solar hot water generation via VFK ... VD solar collectors; the solar system is integrated using the 35 l/min solar pump unit

System diagram 3

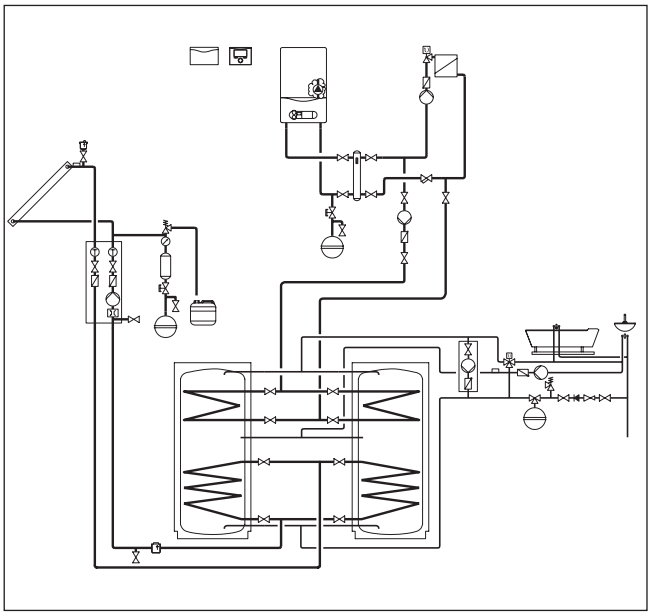


Fig. 56: System preview 3

The system preview is used to select the appropriate heating system. Observe the relevant system diagram for the detailed planning.

System description

This system diagram is suitable for a hot water installation.

- Heat generator for gas-fired wall-hung boiler or condensing unit (oil/gas)
- Heating control via a weather-controlled **auroMATIC 620/3** solar system controller
- Hot water generation using the **auroSTOR VIH S** domestic hot water cylinder in cascade
- Solar hot water generation via VFK solar collectors; the solar system is integrated using the **solar pump unit twin-line (solar pipe group) – 22 l/min**

System diagram 4

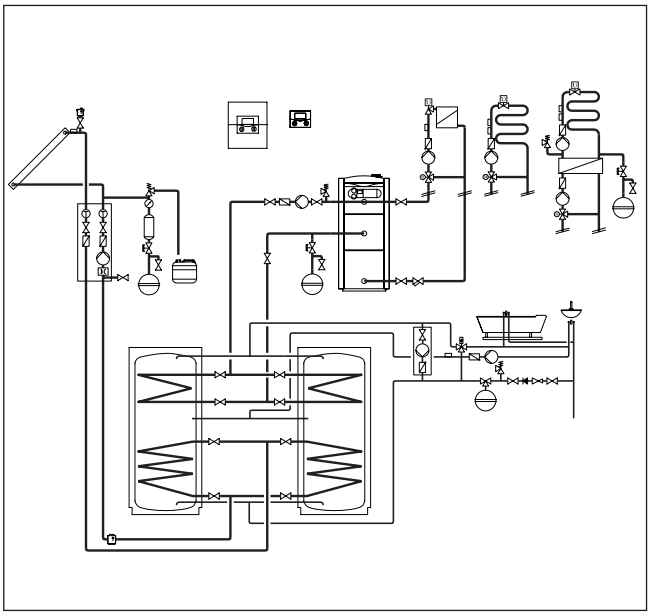


Fig. 57: System preview 4

The system preview is used to select the appropriate heating system. Observe the relevant system diagram for the detailed planning.

System description

This system diagram is suitable for a heating installation with solar hot water generation.

- Heat generator for condensing unit (oil/gas)
- Heating control via a weather-controlled **auroMATIC 620/3** solar system controller
- Hot water generation using the **auroSTOR VIH S** domestic hot water cylinder in cascade
- Solar hot water generation via VFK solar collectors; the solar system is integrated using the **solar pump unit twin-line (solar pipe group) – 22 l/min (35 l/min)**

System diagram 5

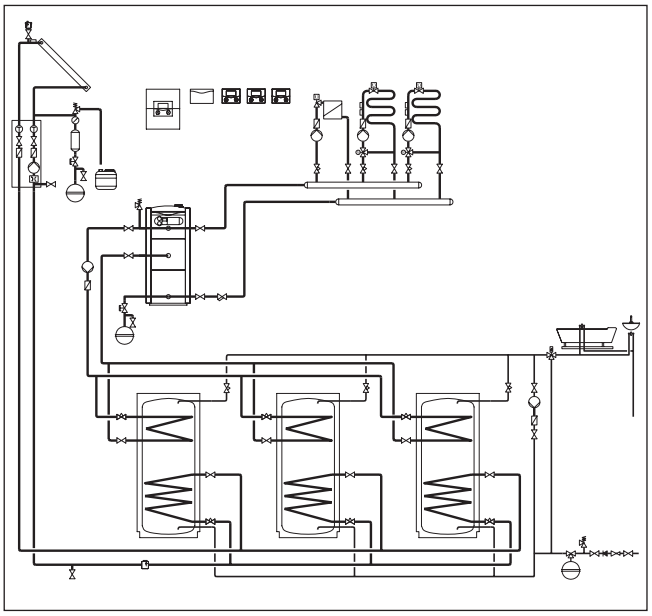


Fig. 58: System preview 5

The system preview is used to select the appropriate heating system. Observe the relevant system diagram for the detailed planning.

System description

This system diagram is suitable for a heating installation with solar hot water generation.

- Heat generator for condensing unit (oil/gas)
- Heating control via a weather-controlled **auroMATIC 620/3** solar system controller
- Hot water generation using the **auroSTOR VIH S** domestic hot water cylinder in cascade
- Solar hot water generation via VFK solar collectors; the solar system is integrated using the **solar pump unit twin-line (solar pipe group) – 22 l/min (35 l/min)**

8.2 System diagram 1

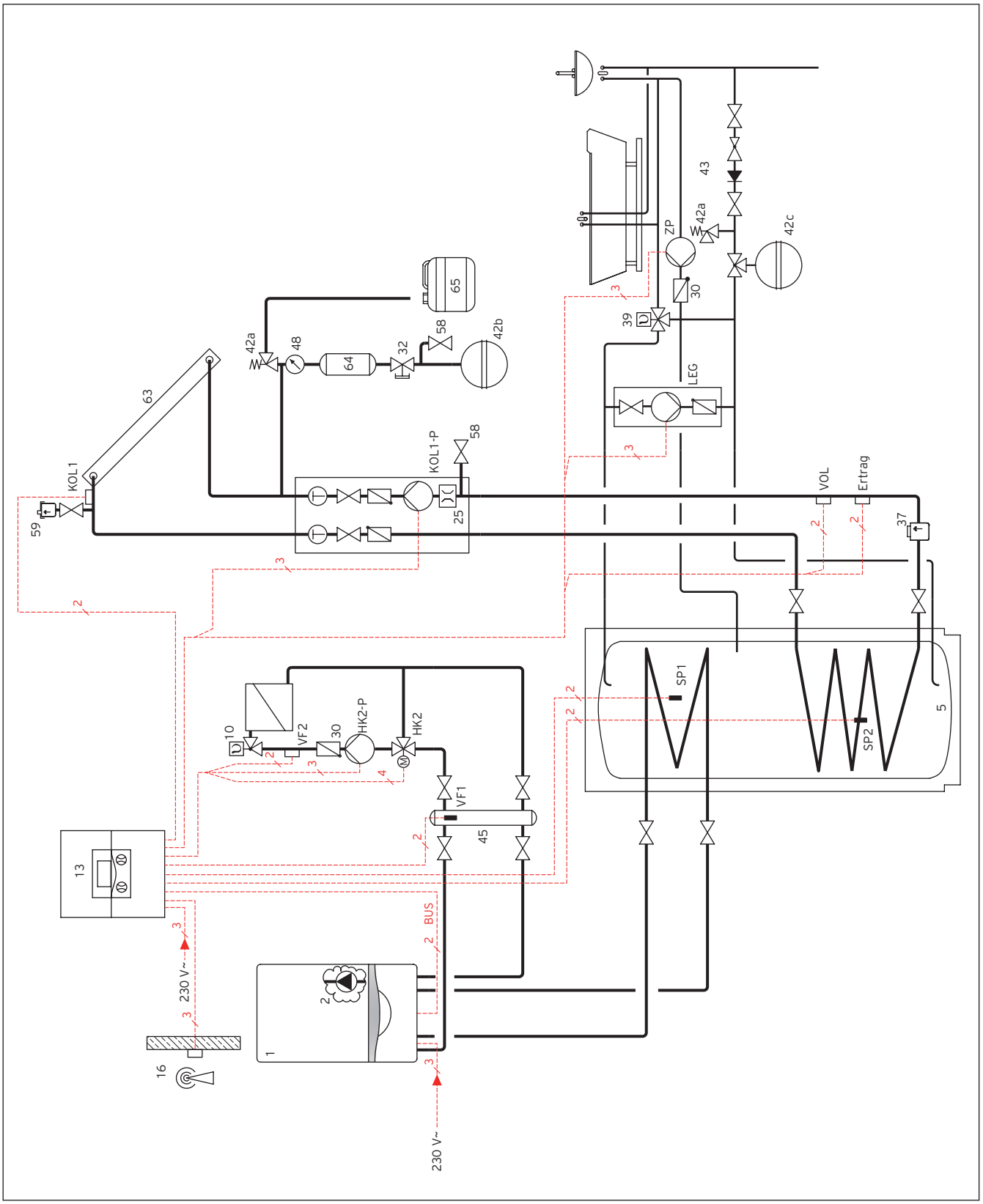


Fig. 59: System diagram

Note
Caution: Schematic diagram. This system diagram does not include all the shut-off and safety devices necessary for professional installation. All applicable standards and directives must be observed.

System diagrams

System description

This system diagram is suitable for solar hot water generation.

- Gas-fired wall-hung boiler as a heat generator
- Heating control via a weather-controlled **auroMATIC 620/3** solar system controller
- Hot water generation via an **auroSTOR VIH S** domestic hot water cylinder
- Solar hot water generation via VFK solar collectors; the solar system is integrated using the **solar pump unit twin-line (solar pipe group) – 22 l/min**

Planning instructions

Note
Also observe the planning instructions about auroFLOW plus systems.

- Cascade solution for high heating and hot water demand
- Heating installation with radiator heating circuits
- System temperature and heating times can be individually adjusted in the regulated heating circuits.
- Additional regulated heating circuits can be added to the heating installation with additional VR 60/3 expansion modules.
- Observe the maximum height of 6 m.

Item	Designation	Quantity	Order No./Notes
1	ecoTEC plus gas-fired wall-hung boiler heat generator	1	Optional
2	Heating pump	1	Internal
5	auroSTOR VIH S solar hot water cylinder	1	Optional
10	Thermostatic radiator valve	x [1)]	On-site
13	auroMATIC 620/3 weather-controlled solar system controller	1	0020080463
16	External sensor/DCF receiver	1	Included in item 13
25	Solar pump unit	1	Optional
30	Non-return valve	x [1)]	On-site
32	Cap valve	1	On-site
37	Solar air separator	1	302 418
39	Thermostat mixing valve	1	On-site
42a	Solar expansion relief valve Expansion relief valve (drinking water)	1 1	Included in item 25 Included in item 43
42b	Solar diaphragm expansion tank	1	Optional For information about the design and order number, see the section "Accessories"
42c	Diaphragm expansion tank – drinking water	1	On-site
43	Safety group – drinking water connection	1	305827
45	Low loss header	1	Optional
48	Pressure gauge	1	Included in item 25
58	Fill and drain valve	x [1)]	On-site
59	Solar automatic air vent with lock	1	302019
63	VFK solar collector	x [1)]	Optional For information about the design and order number, see the section "Description of the unit"
64	Solar in-line vessel	1	Optional For information about the design and order number, see the section "Accessories"
65	Collecting container	1	On-site
x [1)]Quantity and dimension can be chosen according to the system			

System diagrams

Item	Designation	Quantity	Order No./Notes
Yield	Yield temperature sensor	1	On-site Optional For information about the design and order number, see the section "Accessories"
HK2-P	Heating circuit pump or pipe group with mixer	1	On-site
HK2	Heating circuit mixer (3-way mixer, only with on-site pump)	1	Not necessary for pipe group with mixer or on-site
KOL1	Collector sensor for collector field 1	1	Included in item 13
KOL1-P	Solar pump for collector field 1	1	Included in item 25
LEG	Anti-legionella function assembly	1	302 076
SP1 SP2	Cylinder temperature sensor	2	Included in item 13
VF1 VF2	VR 10 flow temperature sensor	2	Included in item 13
VOL	Flow sensor for measuring heat	1	0020095183
ZP	Circulation pump	1	On-site
x [1)]Quantity and dimension can be chosen according to the system			

System diagrams

Connection diagram

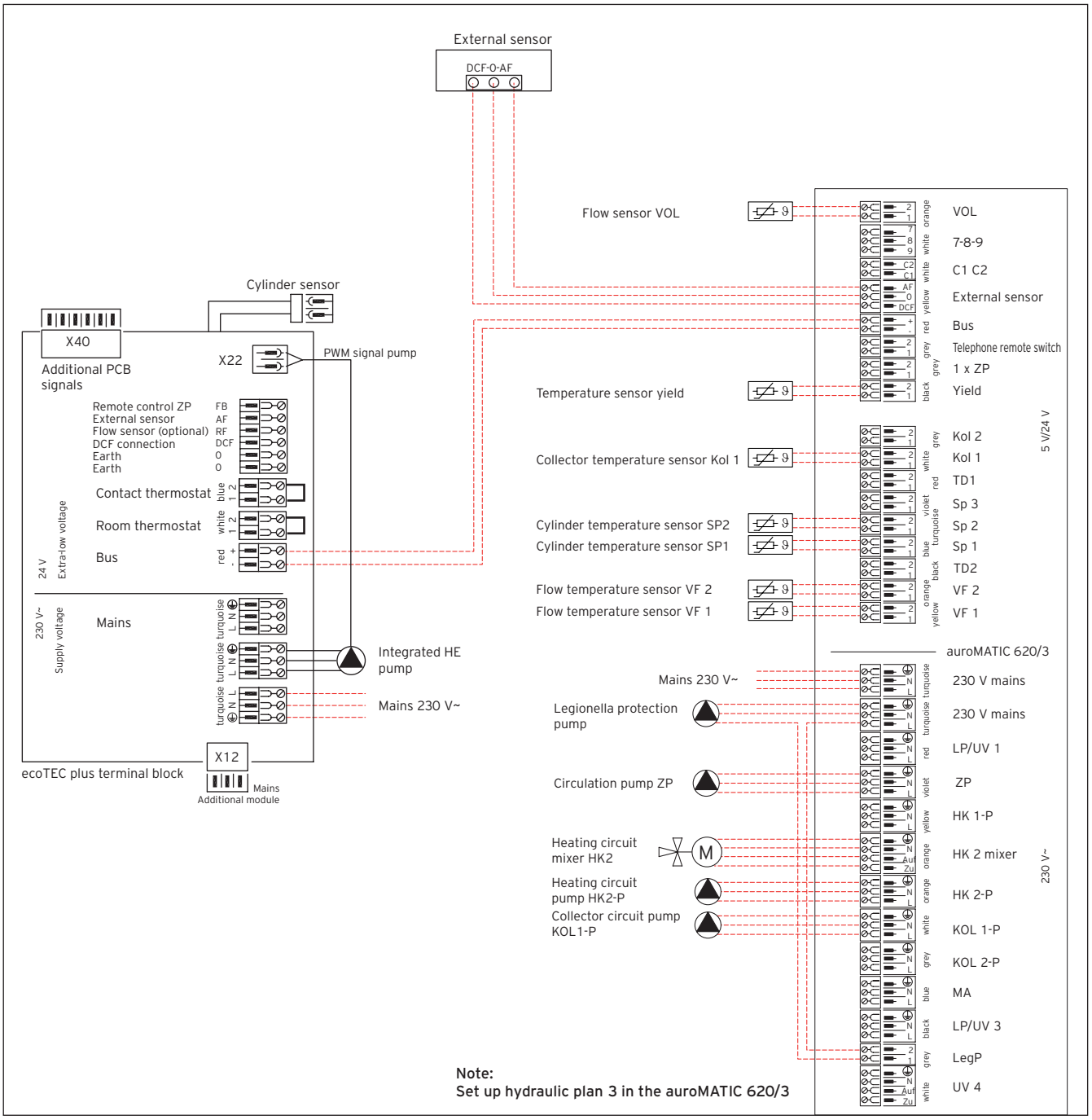


Fig. 60: Connection diagram

8.3 System diagram 2

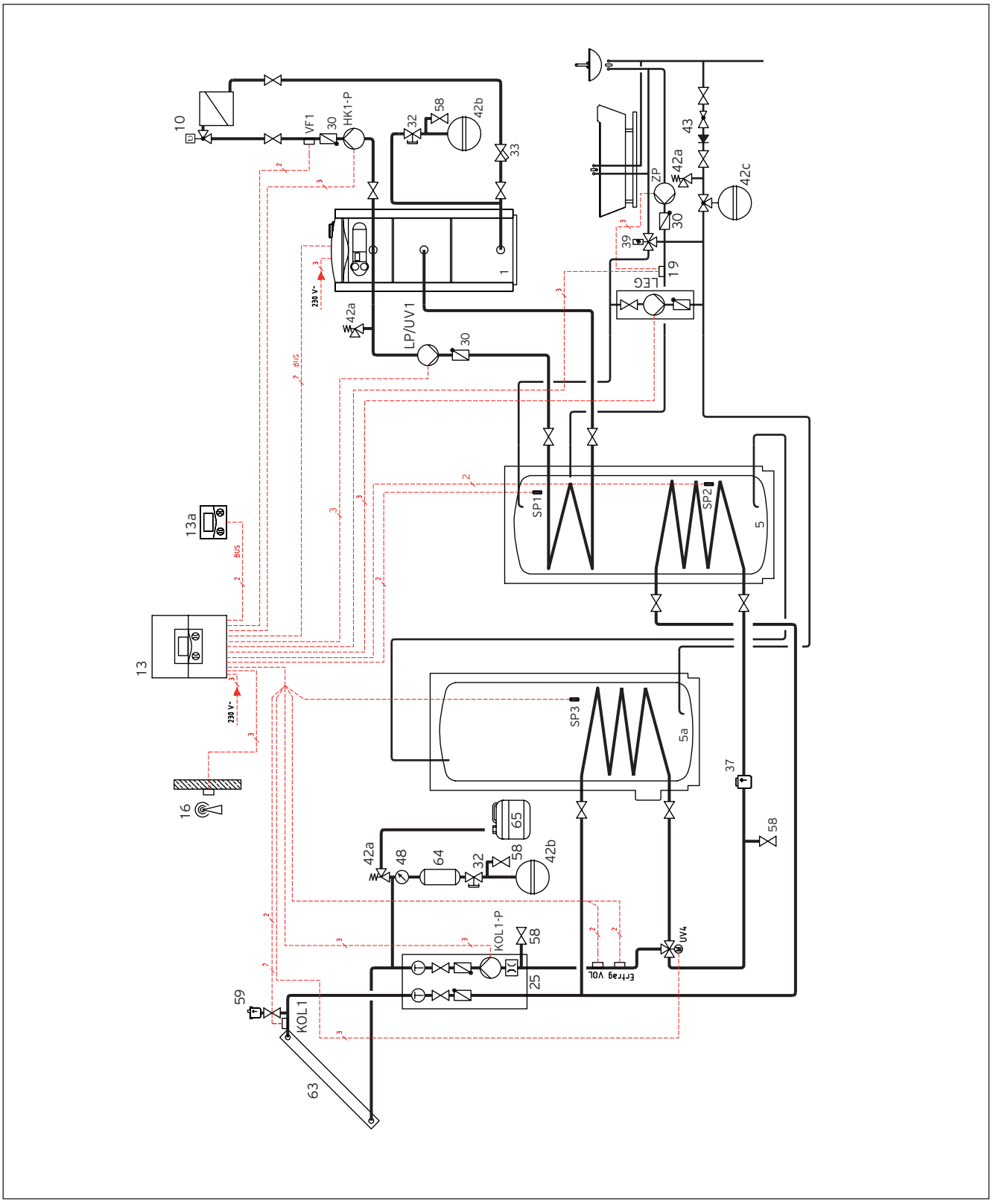


Fig. 61: System diagram

Note
Caution: Schematic diagram. This system diagram does not include all the shut-off and safety devices necessary for professional installation. All applicable standards and directives must be observed.

System diagrams

System description

This system diagram is suitable for a heating installation with two regulated heating circuits.

- Heat generator for gas-fired wall-hung boiler or condensing unit (oil/gas)
- Two regulated heating circuits
- Heating control via a weather-controlled **auroMATIC 620/3** solar system controller
- Hot water generation via the **uniSTOR VIH R** and **auroSTOR VIH S** domestic hot water cylinders in cascade
- Solar hot water generation via VFK ... VD solar collectors; the solar system is integrated using the 35 l/min solar pump unit

Planning instructions

- Cascade solution for high heating and hot water demand
- Heating installation with radiator heating circuits
- System temperature and heating times can be individually adjusted in the regulated heating circuits.
- Additional regulated heating circuits can be added to the heating installation with additional VR 60/3 expansion modules.

Item	Description	Quantity	Order No./Notes
1	ecoVIT exclusive gas-fired condensing boiler heat generator	1	Optional
5	auroSTOR VIH S solar hot water storage tank	1	Optional
5a	uniSTOR VIH R domestic hot water cylinder	1	Optional
10	Thermostatic radiator valve	x [1)]	On-site
13	auroMATIC 620/3 solar control	1	0020080463
13a	VR 90/3 remote control unit	1	0020040079
16	External sensor	1	Included in item 13
19	Maximum thermostat	1	009642
25	Solar pump unit	1	Optional
30	Non-return valve	x [1)]	On-site
32	Cap valve	x [1)]	On-site
33	Dirt trap	x [1)]	On-site
37	Air separator	1	On-site
39	Thermostat mixing valve	1	On-site or 302040
42a	Solar expansion relief valve Expansion relief valve (drinking water) Expansion relief valve (heating)	1 1 1	Included in item 25 Included in item 43 307591
42b	Solar diaphragm expansion tank Diaphragm expansion tank (heating)	1 1	Optional; for information about the design and order number, see the section "Accessories" On-site
42c	Diaphragm expansion tank – drinking water	1	On-site
43	Safety group – drinking water connection	1	305827
48	Pressure gauge	1	On-site Included in item 25
58	Fill and drain valve	x [1)]	On-site
59	Solar automatic air vent with lock	1	302019
63	VFK solar collector	x [1)]	Optional For information about the design and order number, see the price list
64	Solar in-line vessel	1	Optional For information about the design and order number, see the section "Accessories"
65	Collecting container	1	0020145563
Yield	Yield temperature sensor	1	Included in item 13
x [1)]Quantity and dimension can be chosen according to the system			

System diagrams

Item	Description	Quantity	Order No./Notes
HK1-P	Heating circuit pump	1	Optional For information about the design and order number, see the price list
KOL1-P	Collector circuit pump	1	Included in item 25
KOL1	Collector sensor	1	Included in item 13
LEG	Anti-legionella function assembly	1	302 076
LP/UV1	Cylinder charge pump	1	On-site
SP1 SP2 SP3	Cylinder temperature sensor	3	Included in item 13
UV4	Motorised 3-way valve, collector circuit	1	On-site
VF1	Flow temperature sensor	1	Included in item 13
VOL	Volume flow sensor	1	0020095183
ZP	Circulation pump	1	On-site
x [1)]Quantity and dimension can be chosen according to the system			

System diagrams

Connection diagram

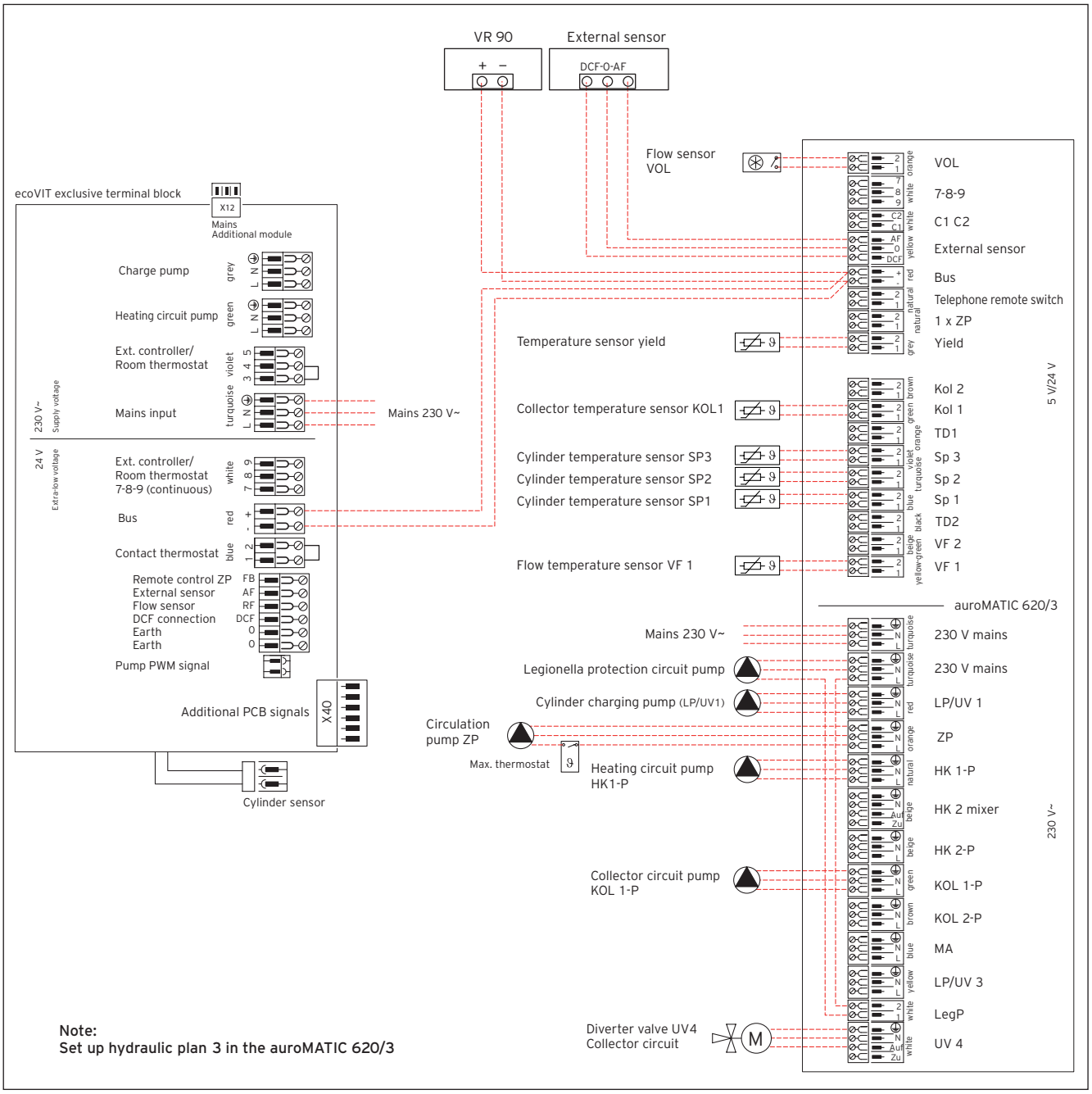


Fig. 62: Connection diagram

8.4 System diagram 3

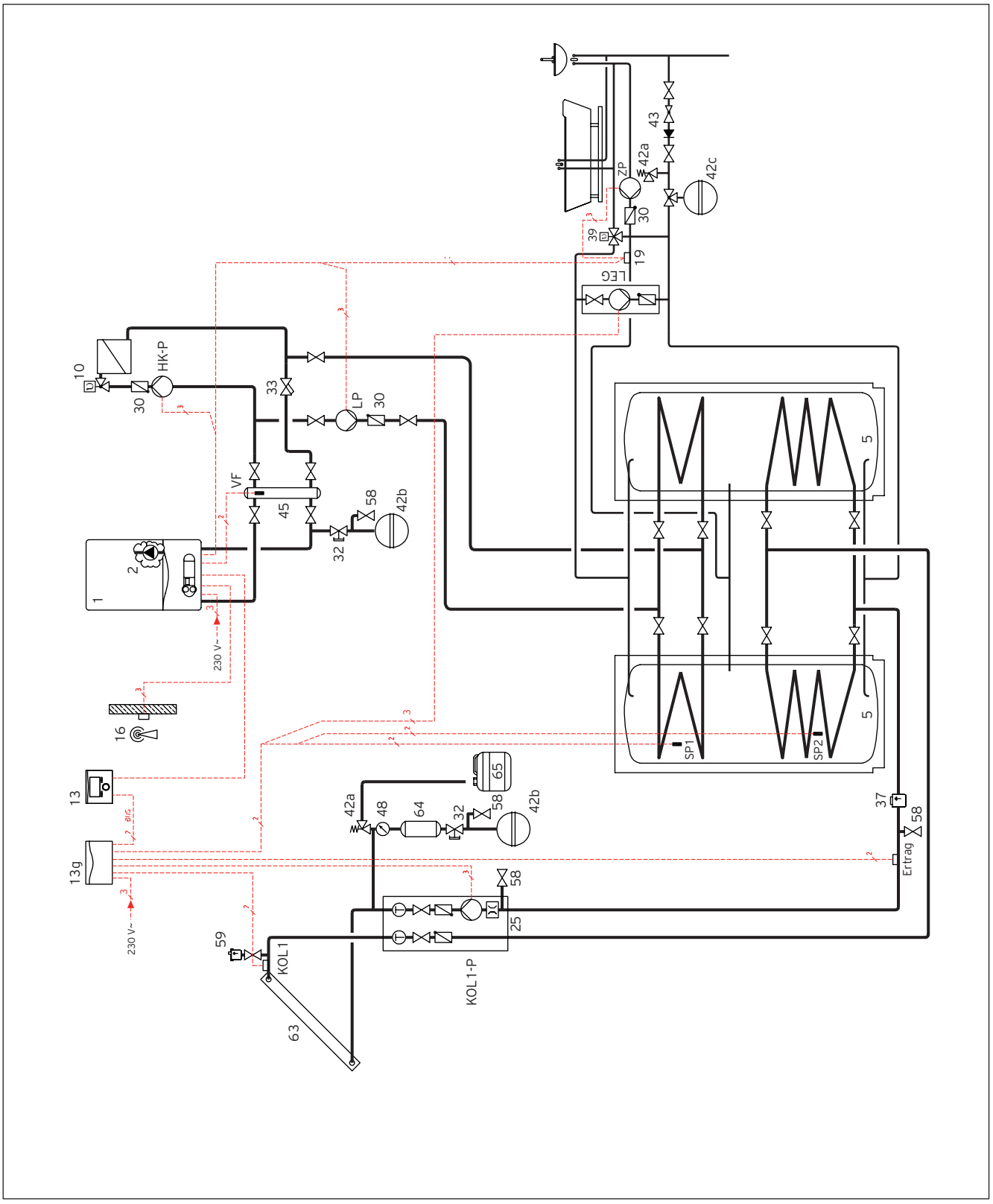


Fig. 63: System diagram

Note
Caution: Schematic diagram. This system diagram does not include all the shut-off and safety devices necessary for professional installation. All applicable standards and directives must be observed.

System diagrams

System description

This system diagram is suitable for a hot water installation.

- Heat generator for gas-fired wall-hung boiler or condensing unit (oil/gas)
- Heating control via a weather-controlled **auroMATIC 620/3** solar system controller
- Hot water generation using the **auroSTOR VIH S** domestic hot water cylinder in cascade
- Solar hot water generation via VFK solar collectors; the solar system is integrated using the **solar pump unit twin-line (solar pipe group) – 22 l/min**

Planning instructions

- Cascade solution for high hot water demand

Item	Designation	Quantity	Order No./Notes
1	ecoTEC gas-fired wall-hung boiler heat generator	1	Optional
2	Circulation pump	1	Included in item 1
5	auroSTOR VIH S solar hot water cylinder	2	Optional
10	Thermostatic radiator valve	x [1)]	On-site
13	calorMATIC 470/3 weather compensator	1	0020171208
13g	VR 68/3 solar module	1	0020139855
16	External sensor	1	Included in item 13
19	Maximum thermostat	1	009642
30	Non-return valve	x [1)]	On-site
32	Cap valve	x [1)]	On-site
33	Dirt trap	x [1)]	On-site
37	Air separator	1	On-site
39	Thermostat mixing valve	1	On-site or 302040
40	Heat exchanger	1	On-site
42a	Solar expansion relief valve Expansion relief valve (drinking water)	1 1	Included in item 25 Included in item 43
42b	Solar diaphragm expansion tank Diaphragm expansion tank (heating)	1 1	Optional; for information about the design and order number, see the section "Accessories" On-site
42c	Diaphragm expansion tank – drinking water	1	On-site
43	Safety group – drinking water connection	1	305827
45	Low loss header	1	Optional
48	Pressure gauge	1	On-site Included in item 25
58	Fill and drain valve	x [1)]	On-site
59	Solar automatic air vent with lock	1	302019
63	VFK solar collector	x [1)]	Optional For information about the design and order number, see the price list
64	Solar in-line vessel	1	Optional For information about the design and order number, see the section "Accessories"
65	Collecting container	1	0020145563
Yield	Yield temperature sensor	1	Included in item 13
HK-P	Heating circuit pump	1	Optional For information about the design and order number, see the price list
KOL1-P	Collector circuit pump	1	Included in item 25
KOL1	Collector sensor	1	Included in item 13
x [1)]Quantity and dimension can be chosen according to the system			

System diagrams

Item	Designation	Quantity	Order No./Notes
LEG	Anti-legionella function assembly	1	302 076
LP	Cylinder charge pump	1	On-site
SP1 SP2	Cylinder temperature sensor	2	Included in item 13g
VF	Flow temperature sensor	1	Included in item 13g
ZP	Circulation pump	1	On-site
x [1)]Quantity and dimension can be chosen according to the system			

System diagrams

Connection diagram

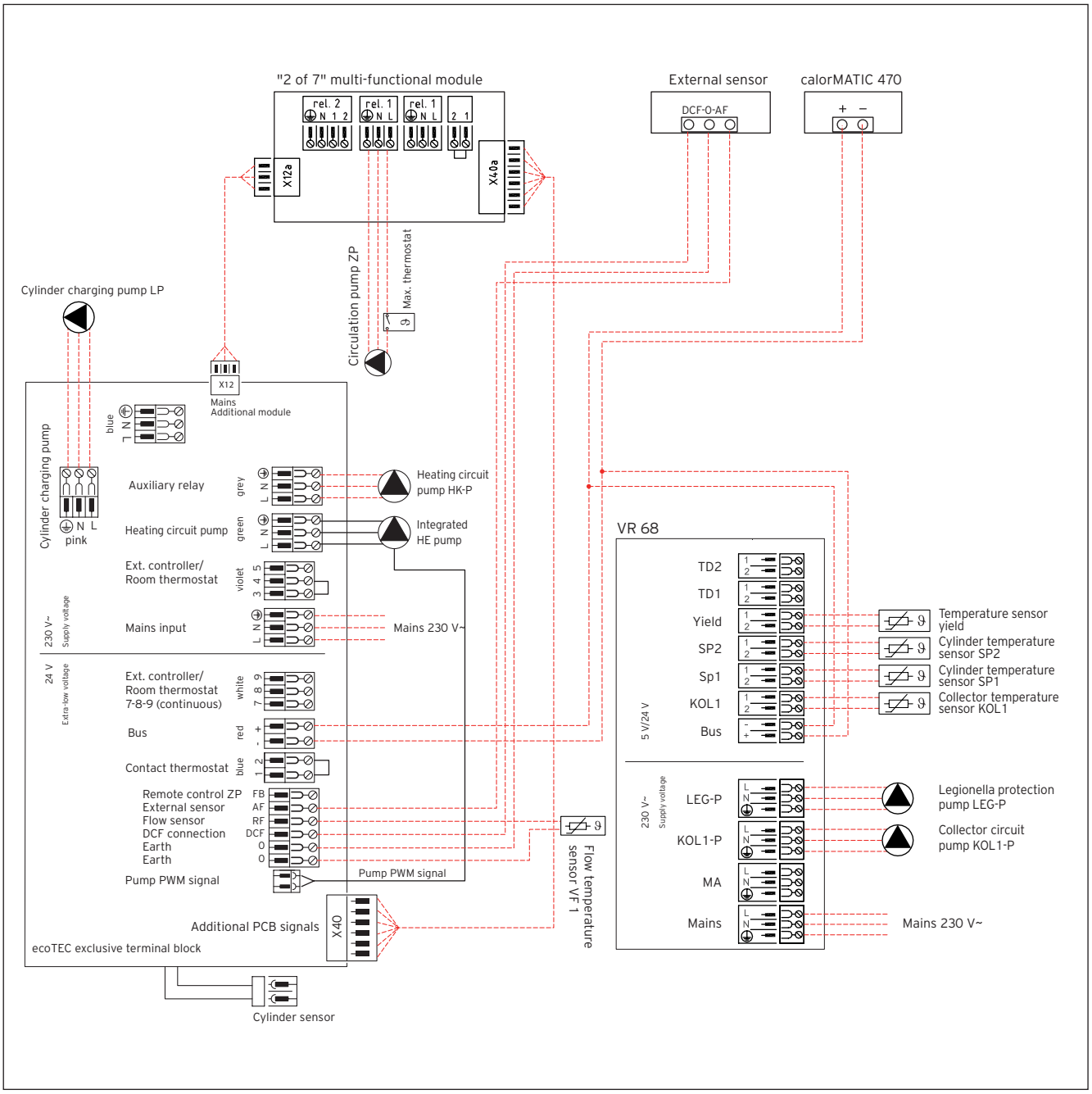


Fig. 64: Connection diagram

8.5 System diagram 4

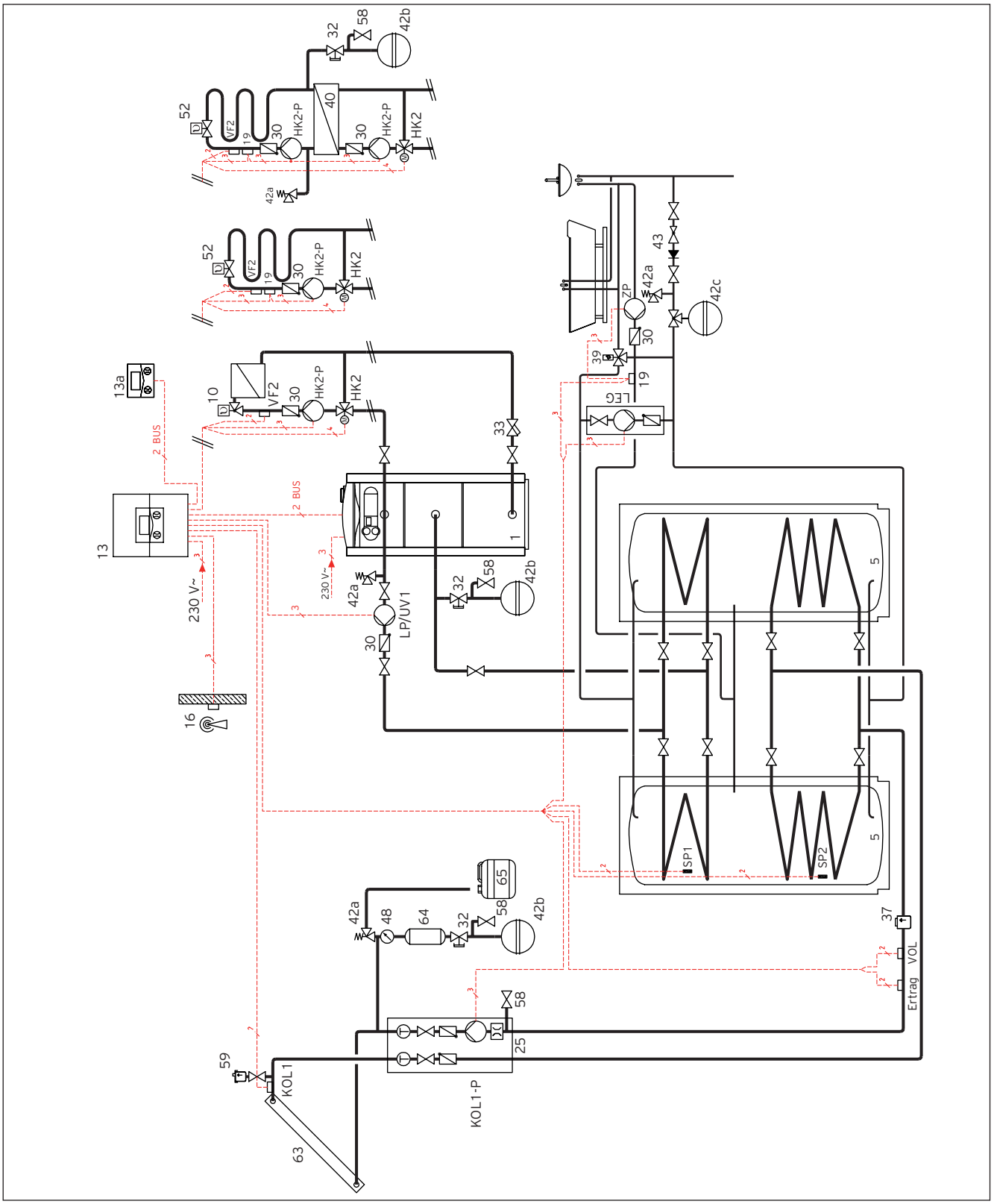


Fig. 65: System diagram

Note
Caution: Schematic diagram. This system diagram does not include all the shut-off and safety devices necessary for professional installation. All applicable standards and directives must be observed.

System diagrams

System description

This system diagram is suitable for a heating installation with solar hot water generation.

- Heat generator for condensing unit (oil/gas)
- Heating control via a weather-controlled **auroMATIC 620/3** solar system controller
- Hot water generation using the **auroSTOR VIH S** domestic hot water cylinder in cascade
- Solar hot water generation via VFK solar collectors; the solar system is integrated using the **solar pump unit twin-line (solar pipe group) – 22 l/min (35 l/min)**

Planning instructions

- Cascade solution for high hot water demand

Item	Designation	Quantity	Order No./Notes
1	ecoVIT exclusive gas-fired condensing boiler heat generator	1	Optional
5	auroSTOR VIH S solar hot water cylinder	2	Optional
10	Thermostatic radiator valve	x [1)]	On-site
13	auroMATIC 620/3 solar control	1	0020080463
13a	VR 90/3 remote control unit	1	0020040079
16	External sensor	1	Included in item 13
19	Maximum thermostat	1	009642
25	Solar pump unit	1	Optional
30	Non-return valve	x [1)]	On-site
32	Cap valve	x [1)]	On-site
33	Dirt trap	x [1)]	On-site
37	Air separator	1	On-site
39	Thermostat mixing valve	1	On-site or 302040
40	Heat exchanger	1	On-site
42a	Solar expansion relief valve Expansion relief valve (drinking water) Expansion relief valve (heating)	1 1 1	Included in item 25 Included in item 43 307591
42b	Solar diaphragm expansion tank Diaphragm expansion tank (heating)	1 2	Optional; for information about the design and order number, see the section "Accessories" On-site
42c	Diaphragm expansion tank – drinking water	1	On-site
43	Safety group – drinking water connection	1	305827
48	Pressure gauge	1	On-site Included in item 25
52	Individual room control valve	x [1)]	On-site
58	Fill and drain valve	x [1)]	On-site
59	Solar automatic air vent with lock	1	302019
63	VFK solar collector	x [1)]	Optional For information about the design and order number, see the price list
64	Solar in-line vessel	1	Optional For information about the design and order number, see the section "Accessories"
65	Collecting container	1	0020145563
Yield	Yield temperature sensor	1	Included in item 13
HK2-P	Heating circuit pump	4	Optional For information about the design and order number, see the price list
x [1)]Quantity and dimension can be chosen according to the system			

System diagrams

Item	Designation	Quantity	Order No./Notes
HK2	Heating circuit mixer (3-way mixer, only with on-site pump)	3	Optional For information about the design and order number, see the price list
KOL1-P	Collector circuit pump	1	Included in item 25
KOL1	Collector sensor	1	Included in item 13
LEG	Anti-legionella function assembly	1	302 076
LP/UV1	Cylinder charge pump	1	On-site
SP1 SP2	Cylinder temperature sensor	2	Included in item 13
VF2	Flow temperature sensor	3	Included in item 13/13b
VOL	Volume flow sensor	1	0020095183
ZP	Circulation pump	1	On-site
x [1)]Quantity and dimension can be chosen according to the system			

System diagrams

Connection diagram

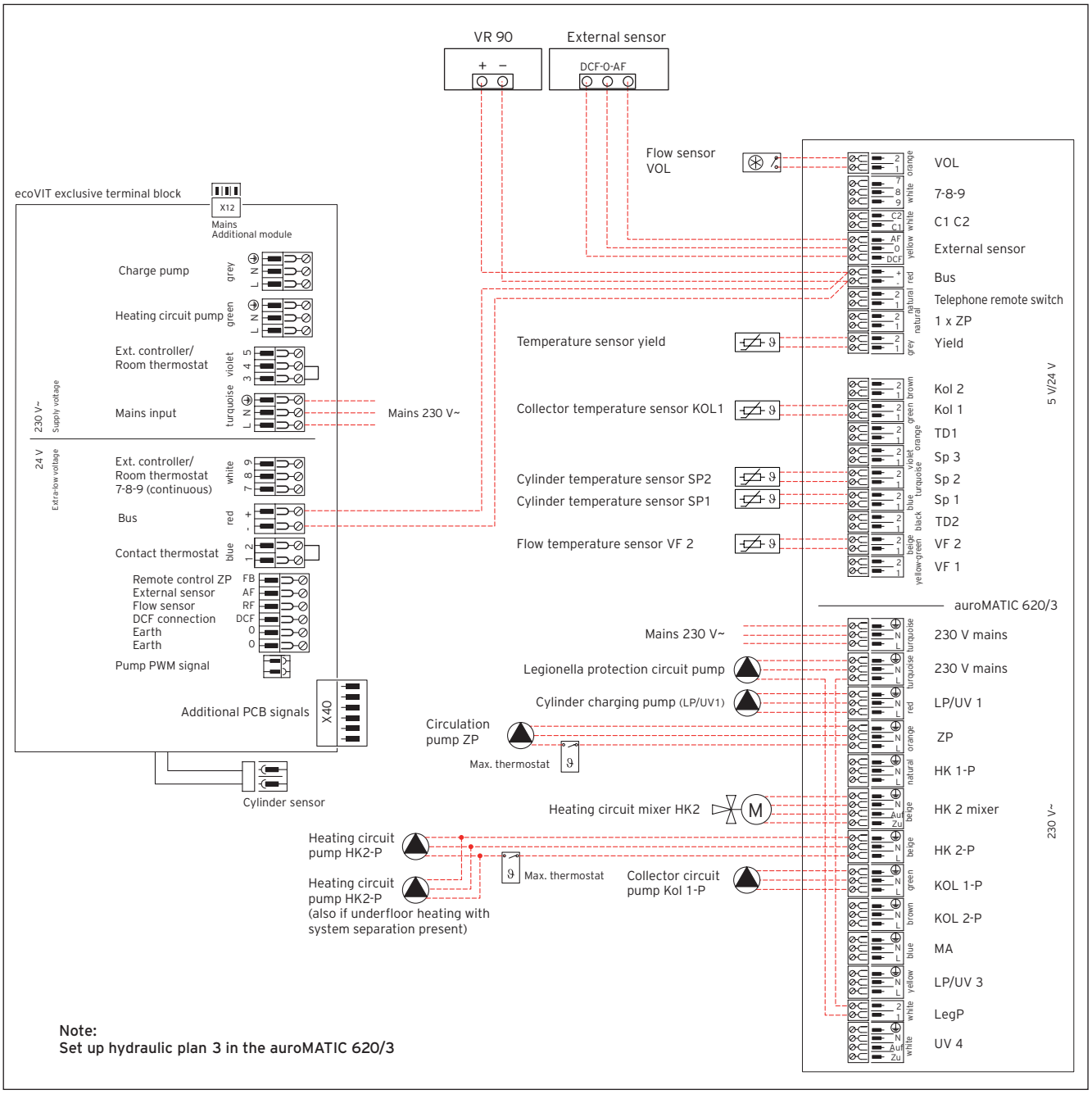


Fig. 66: Connection diagram

8.6 System diagram 5

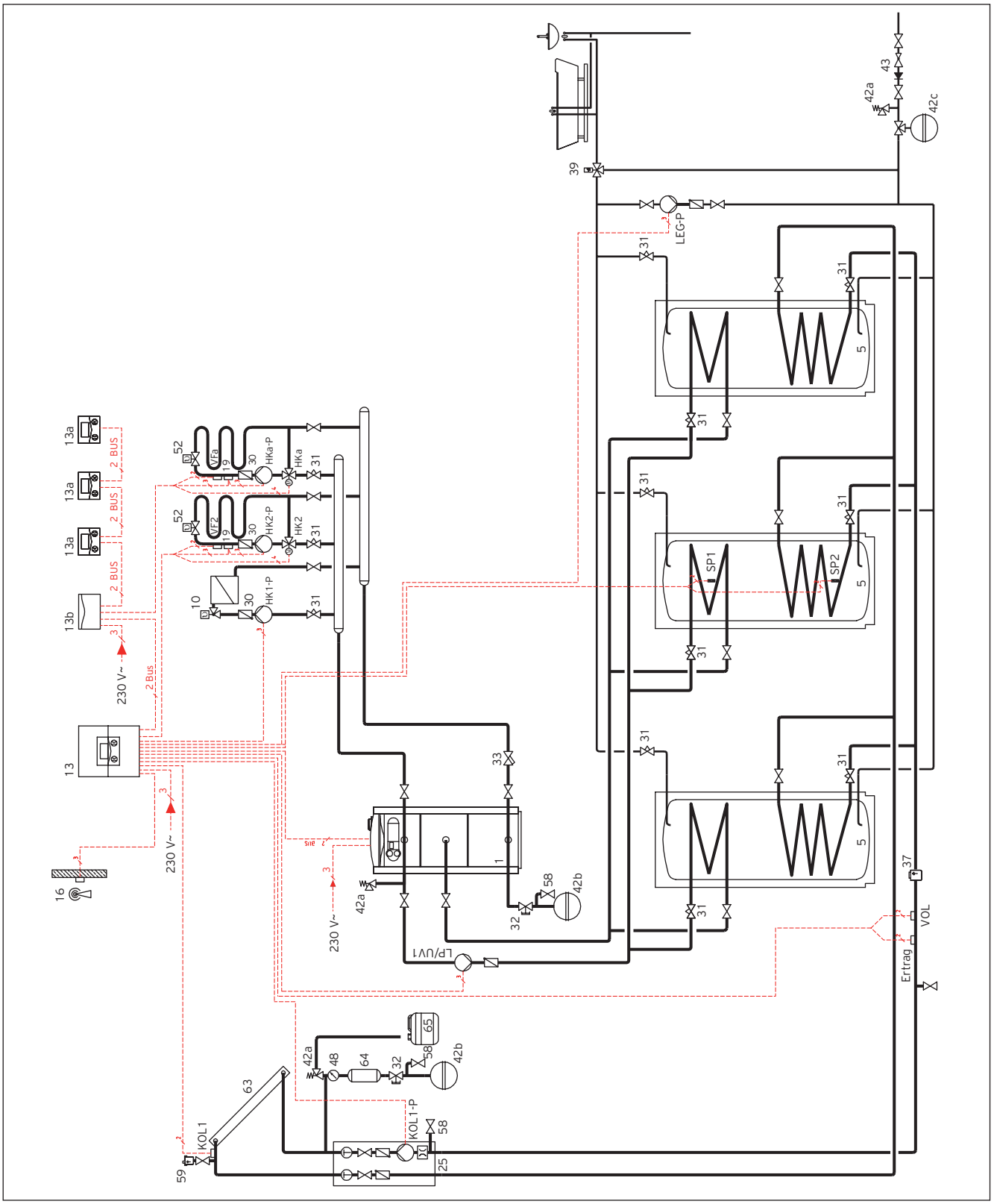


Fig. 67: System diagram

Note
Caution: Schematic diagram. This system diagram does not include all the shut-off and safety devices necessary for professional installation. All applicable standards and directives must be observed.

System diagrams

System description

This system diagram is suitable for a heating installation with solar hot water generation.

- Heat generator for condensing unit (oil/gas)
- Heating control via a weather-controlled **auroMATIC 620/3** solar system controller
- Hot water generation using the **auroSTOR VIH S** domestic hot water cylinder in cascade
- Solar hot water generation via VFK solar collectors; the solar system is integrated using the **solar pump unit twin-line (solar pipe group) – 22 l/min (35 l/min)**

Planning instructions

- Cascade solution for high hot water demand

Item	Designation	Quantity	Order No./Notes
1	ecoVIT exclusive gas-fired condensing boiler heat generator	1	Optional
5	auroSTOR VIH S solar hot water cylinder	3	Optional
10	Thermostatic radiator valve	x [1)]	On-site
13	auroMATIC 620/3 solar control	1	0020080463
13a	VR 90/3 remote control unit	3	0020040079
13b	VR 60/3 mixer module	1	306782
16	External sensor	1	Included in item 13
19	Maximum thermostat	1	009642
25	Solar pump unit	1	Optional
30	Non-return valve	x [1)]	On-site
31	Control valve	x [1)]	On-site
32	Cap valve	2	On-site
33	Dirt trap	x [1)]	On-site
37	Air separator	1	On-site
39	Thermostat mixing valve	1	On-site or 302040
42a	Solar expansion relief valve Expansion relief valve (drinking water) Expansion relief valve (heating)	1 1 1	Included in item 25 Included in item 43 307591
42b	Solar diaphragm expansion tank Diaphragm expansion tank (heating)	1 1	Optional; for information about the design and order number, see the section "Accessories" On-site
42c	Diaphragm expansion tank – drinking water	1	On-site
43	Safety group – drinking water connection	1	305827
48	Pressure gauge	1	On-site Included in item 25
52	Individual room control valve	x [1)]	On-site
58	Fill and drain valve	x [1)]	On-site
59	Solar automatic air vent with lock	1	302019
63	VFK solar collector	x [1)]	Optional For information about the design and order number, see the price list
64	Solar in-line vessel	1	Optional For information about the design and order number, see the section "Accessories"
65	Collecting container	1	0020145563
Yield	Yield temperature sensor	1	Included in item 13
HK1-P HK2-P HKa-P	Heating circuit pump	1	Optional For information about the design and order number, see the price list
x [1)]Quantity and dimension can be chosen according to the system			

System diagrams

Item	Designation	Quantity	Order No./Notes
HK2 HKa	Heating circuit mixer (3-way mixer, only with on-site pump)	1	Optional For information about the design and order number, see the price list
KOL1-P	Collector circuit pump	1	Included in item 25
KOL1	Collector sensor	1	Included in item 13
LEG-P	Anti-legionella function assembly	1	302 076
LP/UV1	Cylinder charge pump	1	On-site
SP1 SP2	Cylinder temperature sensor	2	Included in item 13
VF2	Flow temperature sensor	1	Included in item 13
VFa	Flow temperature sensor	1	Included in item 13b
VOL	Volume flow sensor	1	0020095183
x [1)]Quantity and dimension can be chosen according to the system			

System diagrams

Connection diagram

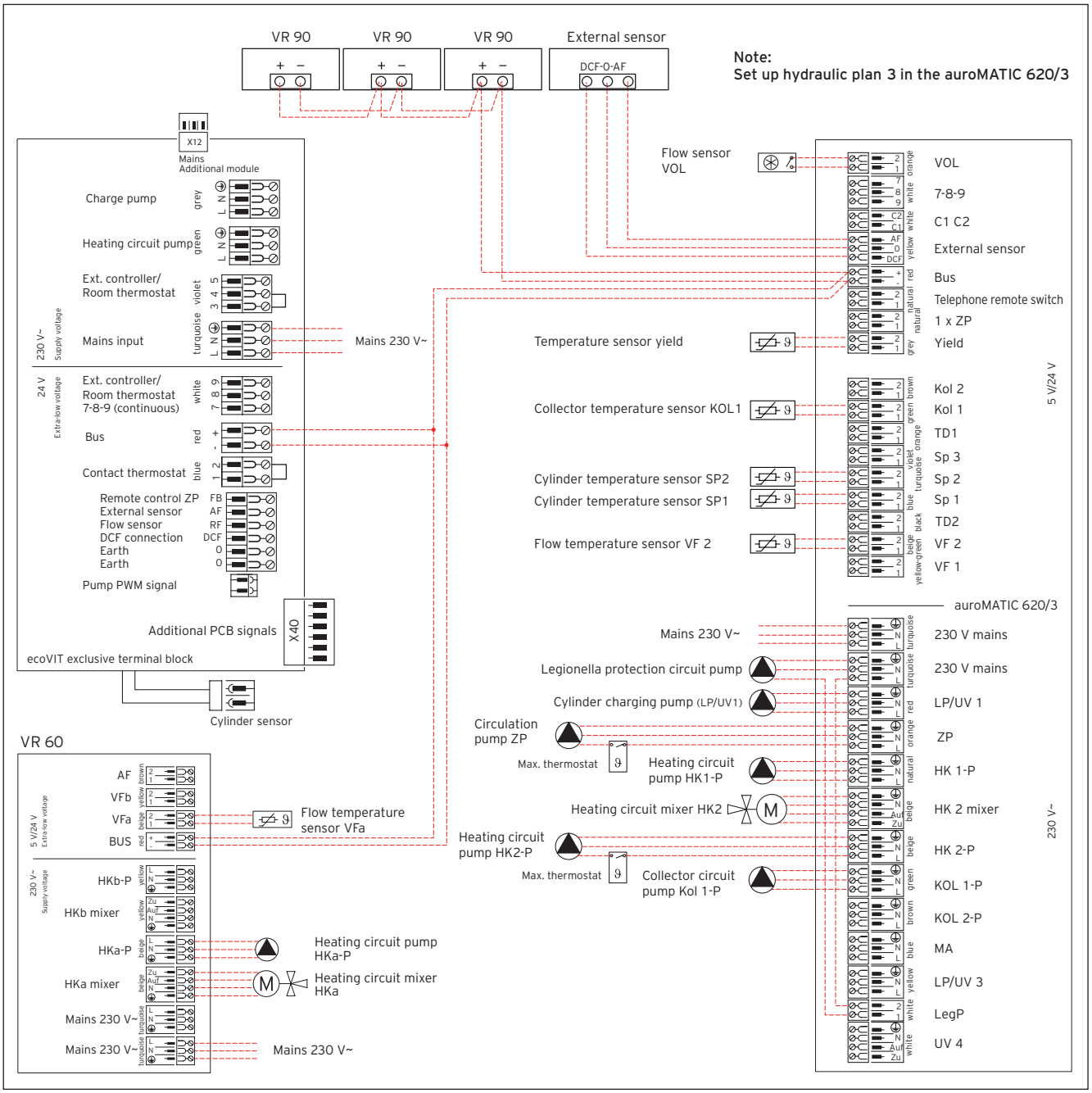


Fig. 68: Connection diagram

Vaillant GmbH
Berghauser Str. 40 ▮ D-42859 Remscheid
Telefon +49 21 91 18-0 ▮ Telefax +49 21 91 18-28 10
info@vaillant.de ▮ www.vaillant.de

0020173099_00 • Planungsmodule Large Solar Systems • 02/14 • Technische und inhaltliche Änderungen vorbehalten • Angaben ohne Gewähr