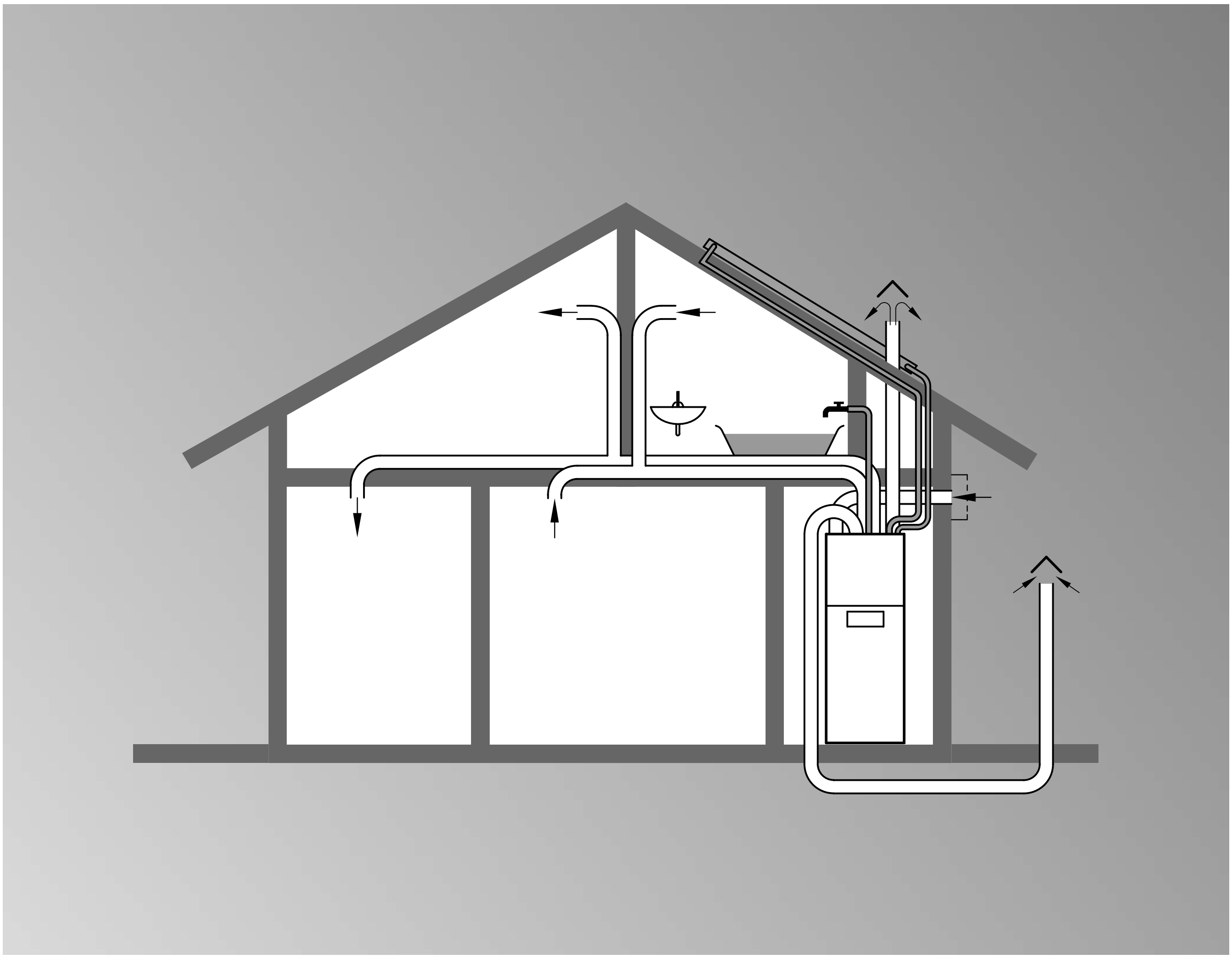
VITOTRES 343

Compact heating centre
for energy-efficient houses

Technical guide



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Vitotres 343

Compact device for energy-efficient houses with

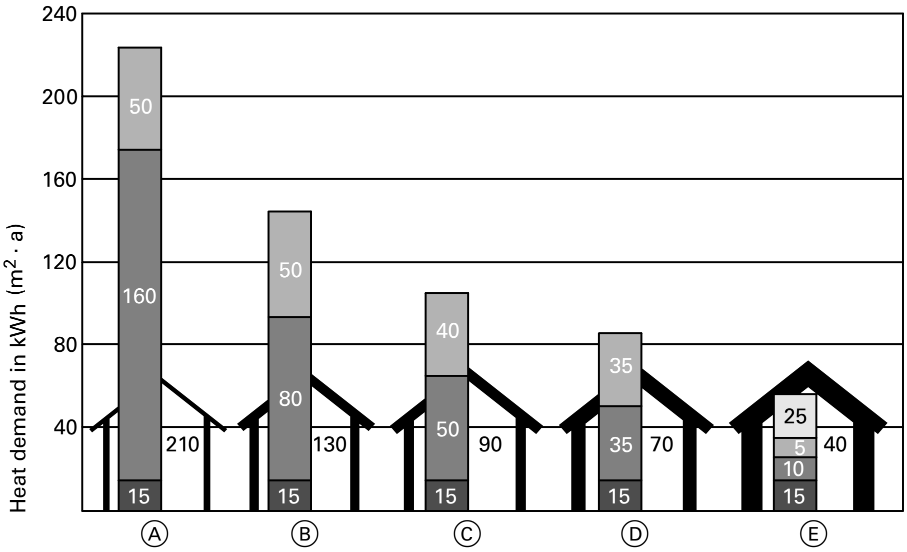
- Controlled domestic ventilation with heat recovery
- Exhaust air heat pump with 1.5 kW rated output for DHW loading and central heating
- DHW cylinder with 250 litres capacity
- Prepared for utilising solar energy

5822 282-1 GB 5/2004

Contents

1.1 The energy-efficient house

Development of heating demand subject to building standard
(detached house, 3 to 4 occupants, 150 m² floor area, A/V = 0.84)



Ⓐ Building stock
Ⓑ Buildings from 1984
Ⓒ Buildings from 1995
Ⓓ Low energy house (LEH)
Ⓔ Energy-efficient house

- Heat recovery proportion
- Ventilation heat loss (losses through air changes)
- Transmission heat loss (losses through building envelope)
- DHW heat demand

Over the past few years, major progress has been made in reducing heating demand. For example, in existing housing, the annual heating demand for a detached house exceeds 200 kWh/(m² · p.a.). Similar new buildings constructed in accordance with the Heat Loss Order (WSchV) 1995 [Germany], only require approx. 100 kWh/(m² · p.a.). Although there is no legal formula for low-energy houses (LEH), it can be assumed that a detached low-energy house in accordance with the EnEV [Germany] has a heat demand lower than 70 kWh/(m² · p.a.), and a multi-occupancy low-energy house a heat demand lower than 55 kWh/(m² · p.a.). For energy-efficient houses, the specific heating demand reaches a maximum of 15 kWh/(m² · p.a.).
Energy-efficient houses are the logical development of the low-energy building method. With this building method, transmission and ventilation heat losses are reduced to the extent that the heating demand is largely covered by solar irradiation as well as by internal heat sources such as, for example, the waste heat from domestic equipment.
The heating load in energy-efficient houses at approx. 10 W/m² is so low that the required residual heat (maximum average daytime heating load) can be provided by backing up the heating of the ventilation air for a regulated domestic ventilation system. This prepares the ground for the use of the compact Vitotres 343. This makes the use of static heating surfaces completely superfluous. This application requires a high thermal quality in the entire building envelope, including its windows. Correspondingly high surface temperatures ensure comfort, even when no compensating heating surfaces are installed near windows or outside walls. A small radiator in the bathroom can provide increased comfort.
Along with the thermal insulation and the absence of thermal bridges, the airtight nature of the building envelope is vital to the perfect function of the energy-efficient house. Only if infiltration and expulsion through leaks are generally minimised can the regulated ventilation with heat recovery function properly, the heating load be kept low and the occupant’s comfort be assured. The regulated domestic ventilation of an energy efficient house is essential for maintaining excellent air quality in the living space.
DHW heating represents a substantial proportion of the energy demand in an energy-efficient house. Subject to consumption, it can represent up to 60 % of its total energy demand.

1.2 Requirements of an energy-efficient house

The energy-efficient house standard is a vital basis for the efficient use of compact heating centres, such as Vitotres.
The following structural conditions must be maintained to achieve the energy-efficient house standard:

- Heating energy demand < 15 kWh/(m^2 · p.a.)[*1]
- Max. required heating load < 10 $\frac{W}{m^2}$[*1]
- Heat transfer coefficient U of the
  - building envelope U < 0.15 W/(m^2 · K), free of thermal bridges
  - window U < 0.80 W/(m^2 · K), in its installed state < 0.85 W/(m^2 · K)
- Orienting the main window areas south makes the maintenance of characteristic values easier, but is not an essential requirement (for example, if the outline planning restrictions make this impossible, etc.). Allow for the option of providing shade, to prevent the building from being overheated in summer.
- Air tightness n_{50} < 0.6/h
  This means that, with an over or under pressure inside the building of 50 Pa, less than 0.6 times the heated building air volume can ingress or be expelled. This is checked using the Blower-door test.

We recommend you implement design and sizing in accordance with the planning document of the PHPP[*2] .

1.3 Requirements regarding the energy centre of an energy-efficient house

The PHI Darmstadt[*3] has defined the following requirements for the energy centre of an energy-efficient house:

- the heat recovery of the regulated domestic ventilation system must exceed 75%
- the heat recovery and the ventilation air backup heating must be frost protected
- the ventilation air temperature must not be hotter than 52 °C to prevent dust being disturbed
- the sound pressure level of the ventilation equipment must be below 35 dB(A)
- for living spaces, a sound pressure level of 25 dB(A) and in domestic offices of 30 dB(A) must be ensured using commercially available silencers
- the power consumption of the ventilation system must be below 0.45 W/(m^3/h)
- the equipment must be able to create air changes of 0.7 times the room volume
- the internal and external leak rate of the equipment must be below 3%
- the volume flow of the equipment must be balanced
- the equipment must provide the DHW convenience to DIN 4753
- the ventilation equipment must provide the low standby losses of the building (< 5 W/K)

Vitotres meets or performs better than these requirements.

*[*1]Values relate to calculations in accordance with DIN 277 (living space calculation II. BV)*
*[*2]Energy-efficient house engineering pack. Source: www.passiv.de*
*[*3]Passivhaus-Institut, Rheinstr. 44/46, D-64283 Darmstadt*

5822 282 GB

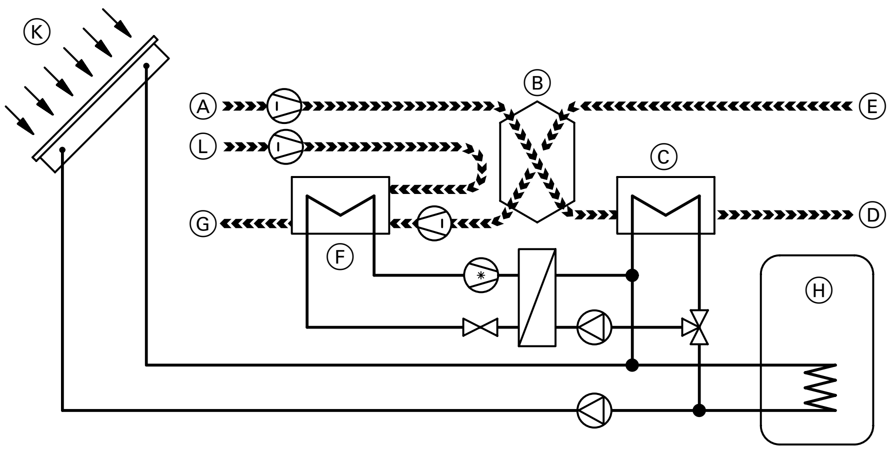
2.1 Function description

Vitotres offers controlled ventilation with heat recovery and includes a heat pump for heating a DHW cylinder and the building.

Fresh outside air Ⓐ is supplied via an external air filter (F7) and a supply line. After entry into the ventilation module, this ventilation air is pre-heated by countercurrent heat exchanger Ⓑ. Then, subject to the selected set temperature, the ventilation air is routed across ventilation air bank Ⓒ, through which hot heating water or cold water flows. Fresh ventilation air Ⓓ is routed through the channel system and distributed into the various living spaces. Exhaust air Ⓔ is extracted via a channel system from the areas where steam and odours are created (bathroom, WC, kitchen) and routed to the ventilation module. This exhausted air is cleaned by a filter (G4) inside the equipment. Heat is transferred to the ventilation air via countercurrent heat exchanger Ⓑ. Some of the residual energy from the cooled exhaust air is utilised by evaporator Ⓕ of a heat pump, which yields up to 1.5 kW heating energy from this process.

This severely cooled-down exhaust air is expelled from the building via expelled air channel Ⓖ. The volume flow balance ensures a constant ventilation and exhaust volume flow, independent of the prevailing static pressure.

To safeguard the minimum volume flow, the heat pump provides additional outside air terminal Ⓛ.
The heating energy gained by the heat pump will be – subject to demand – routed either to ventilation bank Ⓒ or to DHW cylinder Ⓗ, until the respective set temperatures have been reached. A multi-stage electric heater is provided as second heat source to ensure high DHW convenience. It is controlled subject to load. Vitotres is equipped with connection for solar panels Ⓚ to enable the utilisation of solar energy. All relevant control functions and Solar- Divicon are already integrated into Vitotres.
The control operates according to differential temperature and can be utilised for DHW heating and for indirect ventilation air backup heating.



2.2 Benefits at a glance

- Tower system for ventilation, heat and solar utilisation on a footprint of only 600 × 670 mm, fully assembled and wired.
- Ventilation with heat recovery, heat availability level higher than 80%.
- Exhaust heat pump with 1.5 kW output. Maximum temperatures: Heat pump 65 °C, heating element 70 °C.
- Integral electric heating rod with three-stage operation as backup heating for DHW and ventilation air (2, 4, 6 kW).
- Reversible heat pump operation for cooling function (1 kW).
- Integral connection for hydraulic heating system (bathroom radiators).
- Air supply filter at the inlet aperture and exhaust air filter inside the equipment.
- Connection of ventilation channels without thermal bridges.
- Energy-saving DC fans.
- Prepared for integration into a solar heating system. Hydraulic connections, Solar-Divicon and control unit are already integrated.
- Specification:
  – Performance factor (heating operation) > 4
  – Sound level < 35 dB(A)
  – Air volume flow 70-250 m^3/h.

2.3 Alternative use in buildings without energy-efficient standard

Vitotres may also be integrated into buildings which do not comply with the energy-efficient house standard. In such cases, Vitotres provides the regulated building ventilation. The advantage offered by Vitotres compared to conventional ventilations sytems (for example Vitovent 300) lies in the additional utilisation of the exhaust air energy for heating DHW and ventilation air. In addition, solar panels can also be easily connected.

A further decisive benefit is the option of active cooling of the ambient air (up to 1 kW).
With this form of application, the bulk of heating demand of the building will be provided by a separate heat source (e.g. a gas fired wall mounted boiler*1 or a heat pump) and a separate heat distribution system. That heat source would operate separately from Vitotres and could, for example, be installed in the attic.

The combination of Vitotres and conventional heat source ensures a comfortable atmosphere and simultaneous heating of DHW under the most favourable operational and cost conditions.

*1 *Observe the limitations on page 11.*

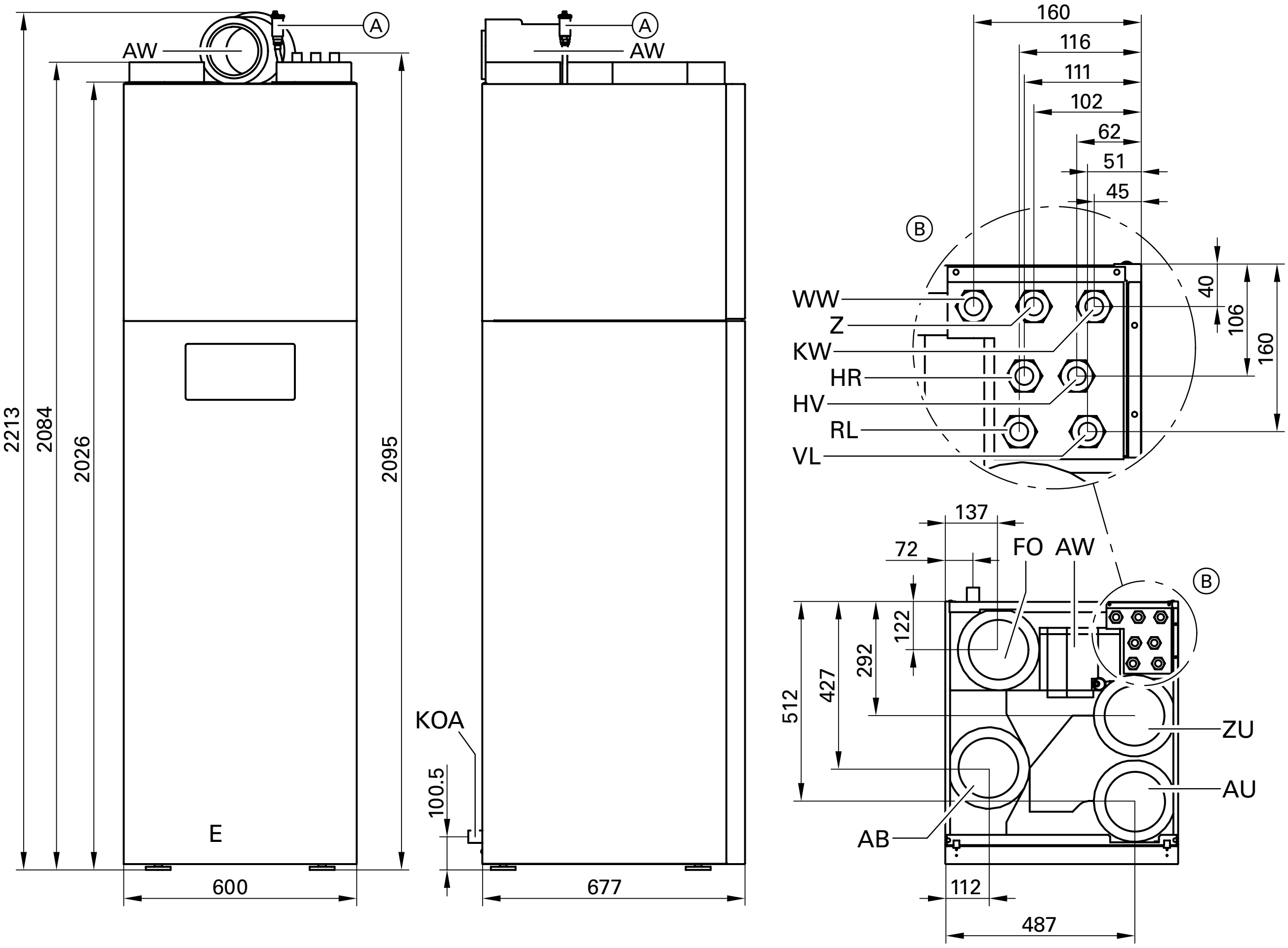
5822 282 GB

3.1 Specification

Complete equipment		
Length	mm	677
Width	mm	600
Height (excl. fan)	mm	2095
Height when tilted		
■ Boiler on a pallet	mm	2395
■ Boiler alone	mm	2085
Weight (empty)	kg	250
Rated voltage		3/N/PE 400 V~/50 Hz
Fuse (slow)	A	3 × 16
Protection		IP 20
Maximum output		
■ hydraulic	kW	7.3
■ via air (at a ventilation air volume flow of 210 m^3/h, ventilation air temp. 50 °C, room temp. 20 °C)	kW	2.3
Process medium fill volume	litres	20
Max. system pressure heating circuit/solar circuit	bar	3.5
Response pressure of the safety valve on the primary side	bar	4
Max. flow temperature – auxiliary heating circuit	°C	65
Minimum volume flow – auxiliary heating circuit	l/h	700
Pressure drop of the auxiliary heating circuit at minimum volume flow	mbar	175
Residual height – solar circuit	mbar	180
Heat recovery/ventilation module		
Sound pressure level (1 m in front of the equipment)	dB(A)	35
Air volume flow	m^3/h	70 to 250
Max. ventilation air compression at 250 m^3/h (without filter)	Pa	250
Max. exhaust air compression at 250 m^3/h	Pa	100
DC fan – expelled air	W	100
DC fan – outside air	W	100
Heat availability level of the heat recovery	%	> 80
Pressure drop – outside air filter box at 250 m^3/h	Pa	40
Max. permiss. pressure drop – outside air supply to the heat pump at 150 m^3/h	Pa	50
Max. ventilation air temperature (adjustable)	°C	52
Min. cooling temperature (adjustable)	°C	18
Heat pump module		
Lower application limit	°C	–15
Max. flow temperature	°C	65
Rated output	kW	1.5
Performance factor at L2/W35 °C		2.6
Performance factor at L7/W35 °C		2.8
Refrigerant fill/volume	kg	R 134 A/0.9
Max. cooling output	kW	1
Auxiliary heating element – electric (stepped)	kW	2/4/6
DHW cylinder		
Capacity	litres	250
Continuous DHW output	l/h	200
DHW performance factor N_L		1.5
Max. draw-off volume at the stated DHW performance factor N_L and DHW heating from 10 to 45 °C	litres/min	16.8
Max. system pressure	bar	10
Max. DHW temperature	°C	65
Cylinder protection		External current anode
Connections		
Outside air/ventilation air/expelled air/exhaust air	∅ mm	160
Outside air supply to the heat pump	∅ mm	125
Flow/return – auxiliary heating circuit		Multi-connect system sleeve DN 20
Flow/return – solar circuit		Multi-connect system sleeve DN 20
Cold water	R (fem.)	¾″
Domestic hot water	R (fem.)	¾″
DHW circulation	R (fem.)	¾″
Drain (overflow)	DN	32

5822 282 GB

3.2 Vitotres dimensions

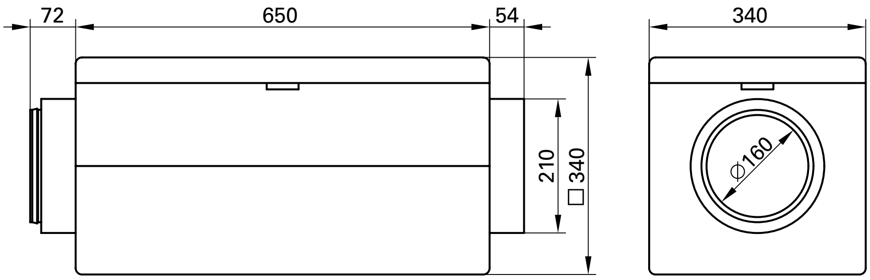


Key to symbols

AB Exhaust air
AU Outside air
AW Outside air to heat pump
E Drain (inside equipment, see page 19)
FO Expelled air
HR Heating return
HV Heating flow
KOA Condensate drain (flexible hose)
KW Cold water
RL Solar return
VL Solar flow
WW Hot water
Z DHW circulation
ZU Ventilation air

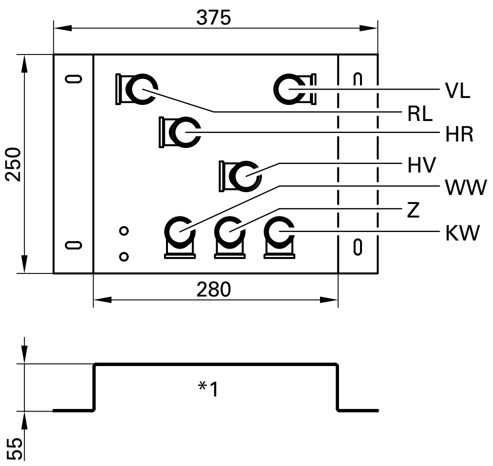
Ⓐ Quick-acting air vent valve with flexible connection line
Ⓑ Hydraulic connections

3.3 Dimensions – outside air filter box



Material:	EPP in black
Material thickness:	50 mm
Thermal conductivity:	0.042 W/(m·K)
Filter type:	Slide-in filter as pocket filter Class F7 (pollen filter)

3.4 Dimensions – connection panel



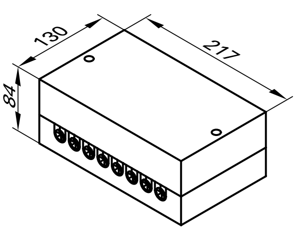
HR Heating return
HV Heating flow
KW Cold water
RL Solar return
VL Solar flow
WW Hot water
Z DHW circulation

Note
All connection brackets can be rotated on the connection panel to make the on-site pipe connections easier.
All connections R ¾″ fem. thread

[1]Illustration without connecting bracket.

3.5 Dimensions – electrical junction box

The electrical junction box is already connected to Vitotres 343 with a 1 m long cable.

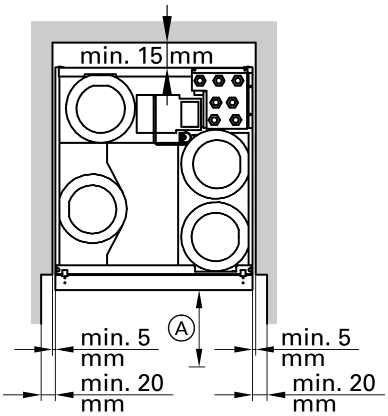


5822 282 GB

4.1 Location and installation conditions

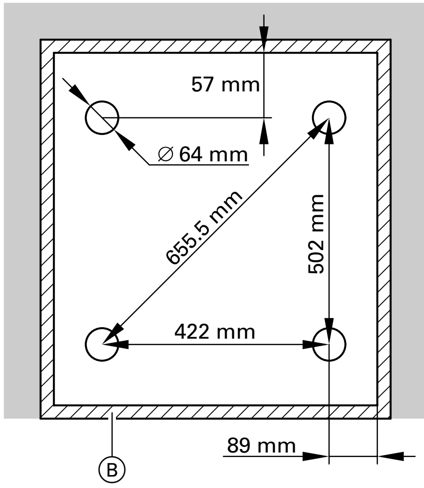
Installation room requirements

Clearances
View from above



Ⓐ Clearance min. 1000 mm
Ⓑ Partition joint with edge insulation strip as part of the floor construction

Pressure points



- Required room height min. 2400 mm (2500 mm recommended).
  Maintain a space of 1000 mm depth in front of the equipment for operating and service purposes.
- Total weight incl. DHW filling: 500 kg.
- Each pressure point (with an area of 3215 mm^2 each) is loaded with 125 kg.

  ⚠ *Observe the permissible floor load.*
- This equipment is suitable for installation, for example, in place of a kitchen unit.
- The installation room must be dry and safe from the risk of frost.
- Permissible ambient temperatures
  – during operation
  max. +35 °C
  min. + 2 °C
  – during storage and transport
  max. +60 °C
  min. –25 °C

5822 282 GB

Ventilation system

⚠ ***Safety instruction***
*This equipment must **not** be operated with **open flue boilers** and/or an **unenclosed, open flue combustion facility** (e.g. open fireplace).*

Doors to the boiler room(s) must be airtight and must be kept closed.

Note
*Do not interconnect **extractor fans and dryers with waste air expulsion** into the pipework of the ventilation equipment. Design cooker hoods and extractors as recirculating or expulsion extractors. Extractors which expel air to the outside, must be equipped with their own outside air supply.*

- The design and implementation of the ventilation system must meet the criteria for energy-efficient houses.

- Observe the location of the air connectors (see equipment top view on page 8) and sizing (see page 7).

- For the outside air supply of the heat pump, we recommend the use of a ground energy exchanger (see page 14). Size the ground energy exchanger for a volume flow of 150 m^3/h. A filter G4 will be sufficient, if a ground energy exchanger is connected to the additional outside air terminal. Provide a filter F7 for reasons of hygiene, if a ground energy exchanger should be used upstream of the outside air channel which is routed via the heat exchanger. The pressure drop in the ground energy exchanger may be a max. of 50 Pa.

- When using a ground energy exchanger for outside air and outside air supply of the heat pump, install a motor-driven damper downstream of the tee piece and upstream of the fan for the outside air supply of the heat pump.
  For information regarding the sizing of the ground energy exchanger, see page 7.

- Never locate the outside air inlet immediately above ground level (to VDI 6022 at 3 m height). To prevent ingress of humidity (driving rain, turbulent snowfall) and icing up of the inlet grille, it would be advantageous to locate the inlet underneath a roof overhang or similar. Expelled air should freely blow away and not be directed against building structures/parts. To prevent a "short circuit" between the fresh air and the expelled air connector (problem: transfer of odours between expelled and outside air), position these in separate locations with a different orientation of inlet and exhaust aperture.

- Filter the outside air via the filter box supplied with filter F7 (see ventilation equipment pack); exhaust air filter G4 is integrated in the equipment.

- We recommend the use of filters in all exhaust air apertures. These are, for example, offered as pre-filters upstream of the exhaust air valves, and may be simply changed by the user (remove cover grille). Exhaust apertures in kitchens must be equipped with a grease filter. We recommend the use of filters made from stainless steel wool (grease condensation). Note the resulting pressure drop. The exhaust air filters also must be replaced or cleaned regularly.

- Install silencers for ventilation and exhaust air immediately upstream or downstream of the equipment. Select an insert silencer which brings the sound level inside the living space lower than 25 dB(A) or in domestic offices lower than 30 dB(A). Set telephony silencers between rooms to limit sound transmission between different rooms.

- Subject to the location of the inlet and outlet apertures for outside and exhaust air, install silencers to protect the outside against noise pollution. This may be appropriate, if walkways (arcades, development paths, etc.) are located near the in/outlet apertures.

- Route equipment lines flexibly inside a flexible pipe to provide an anti-vibration separation.

- Do not let lines sag, to prevent the accumulation of condensate.

- Thermally insulate any parts of the air distribution system which are routed through unheated areas, with vapour-tight material.

- **In case of installation inside the thermally insulated building envelope (temperature inside the installation location approx. room temperature):**
  Carefully thermally insulate the outside and exhaust air lines with suitable material (vapour-tight) (to prevent condensation and saturation of the thermal insulation). Install this equipment as near to the thermal insulated building envelope to keep these pipe sections as short as possible. Thermal losses through these pipe sections lead to a significant reduction of efficiency. Therefore, size the thermal insulation not only in accordance with the prevention of dew, but with a minimum thickness of 100 mm.

  In case of installation outside the thermally insulated building envelope (installation room free from the risk of frost):
  Thermally insulate the ventilation air and exhaust air lines up to the point where they penetrate through the building envelope (at least 100 mm). Thermal losses from these pipe sections significantly reduce the efficiency; therefore keep them as short as possible. For that reason, install the equipment as near to the thermal building envelope as possible.

- Arrange the ventilation air outlets (wide angle nozzle or plate valve) so that draughts and short circuit flow patterns in the living space are prevented. We recommend the installation of wide angle nozzles (arranged approx. 150 mm below the ceiling), since users will not block these with furniture.

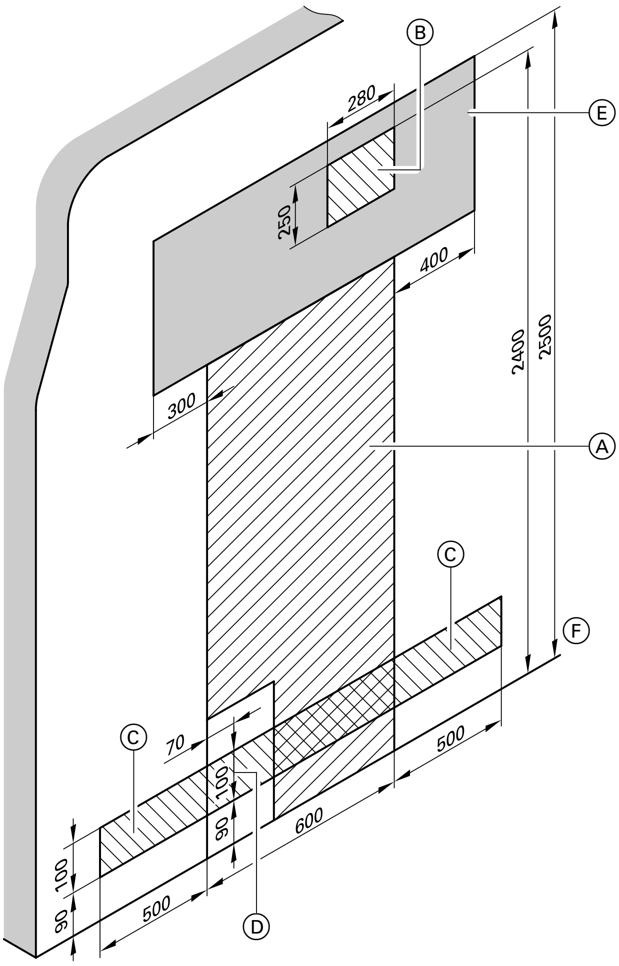
- Design the channel network as short as possible, using the smallest number of duct/channel profiles (low pressure drop, easy cleaning).

- **The overall pressure drop of the air channel network must not exceed 100 Pa either for the ventilation air or the exhaust air.**

- Size the air channel network for a maximum volume (required air volume to deliver the maximum heating load at –14 °C outside temperature and 20 °C room temperature).

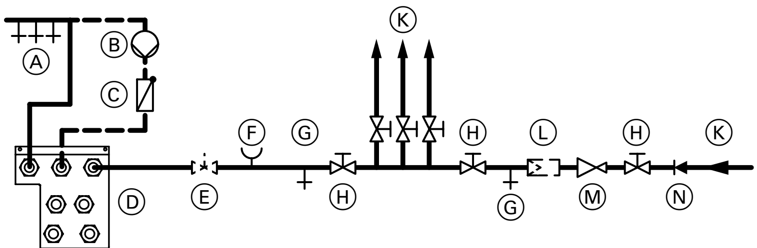
- Heating load or heat demand are calculated per room to EN 12831.

Primary and secondary connections



Ⓐ Vitotres dimensions
Ⓑ Installation location of the connection panel
Ⓒ Possible position (centre pipe) of the on-site drain connection DN 32 for condensate with a wall clearance of ≧ 45 mm
Ⓓ Position (centre pipe) of the on-site drain connection DN 32 for condensate with a wall clearance of 15 mm
Ⓔ Possible installation location of the electrical junction box (permanently connected to Vitotres)
Ⓕ Top edge – finished floor

For connecting the secondary side, observe DIN 1988 and DIN 4753.



Ⓐ Hot water
Ⓑ DHW circulation pump
Ⓒ Spring-loaded check valve
Ⓓ Hydraulic connection array of Vitotres (top view)
Ⓔ Flow regulating valve
Ⓕ Pressure gauge connection
Ⓖ Drain valve
Ⓗ Shut-off valve
Ⓚ Cold water
Ⓛ Drinking water filter
Ⓜ Pressure reducer
Ⓝ Non-return valve/pipe separator

- The water connections are located at the r.h. top of the equipment (see top view of the equipment on page 8).
- Only fill Tyfocor G-LS or LS (frost protection down to –28 °C) into the internal hydraulic circuit and into the optional auxiliary heating circuit. **Never** dilute the process medium with water.
- When operating Vitotres **without** external hydraulic circuits (auxiliary heating circuit, solar panel), adjust the diaphragm expansion vessel inlet pressure to 1.5 bar and the system pressure to 1.7 bar.
- Design the auxiliary heating circuit as single pipe circuit or install an overflow valve (minimum circulation volume 700 litres/h).
- Equip the auxiliary heating circuit on site with a circulation pump **(with check valve),** with a diaphragm expansion vessel and a Tyfocor-resistant air vent valve.
- If, in addition to the auxiliary heating circuit, a **solar circuit** is connected, install a **common** diaphragm expansion vessel, which must be sized in accordance with the details on page 16.
- **Never use zinc-plated/galvanised** pipes for the auxiliary heating circuit and the solar circuit.
- Permissible primary system operating pressure (Vitotres with auxiliary heating circuit and/or solar circuit): 3.5 bar.
- The solar circuit pump is integrated into Vitotres.
- Equip the DHW circulation pipe with a circulation pump and a check valve.
- Provide anti-scalding protection for DHW temperatures > 60 °C.
- A safety valve with visible outlet of the blow-off line (to DIN 1988) on the DHW side, and a shut-off and drain valve are integrated in the equipment.
- A safety valve is installed into the primary and secondary side of the equipment.
- A common drain with siphon for the safety valve on the secondary side and for condensate from the heat exchanger has been integrated into the equipment. For this drain line, provide a connection DN 32 to the domestic waste water system.

5822 282 GB

Electrical connections

- All external electrical connections of the equipment (including sensor leads) are terminated in the separate junction box. The junction box is factory-equipped with a permanent electrical connection to Vitotres in the form of a cable approx. 1 m long.

- The junction box may be installed at a height of 2 to 2.5 m up to 0.3 or 0.4 m adjacent to the equipment (see page 12). All on-site power supply cables and sensor leads must be terminated inside this box. When installing the equipment in corners or niches, ensure the easy accessibility of the junction box for maintenance work.

- Never secure the junction box on the Vitotres casing. Install the junction box so that the cable entries are located at the bottom of the casing.

- Route the following cables/leads to the junction box:
  - Mains power supply
  - Room temperature sensor
  - Pump of the auxiliary heating circuit (if installed)
  - DHW circulation pump (if installed)
  - External shutdown of the electric heater (if installed)
  - Collector temperature sensor (if installed)
  - Relay for controlling the damper in the outside air supply of the heat pump.

- Make the mains power supply connection as permanently installed cable 5 × 2.5 mm^2 (e.g. type NYM), and protect it with a breaker of 3 × 16 A (minimum contact separation 3 mm).

- As sensor leads we recommend the use of a screened cable (e.g. J-Y(St)Y, 2 × 0.8 mm^2, max. length 10 m). Room temperature sensor leads should be chased into the wall.

  Note
  Never route LV cables immediately next to 230/400 V cables.

  For cable runs > 10 m use a larger cross-section or terminate several cores together.

- Observe the following requirements for the installation location of the room temperature sensor:
  - in the overflow range (see page 23) on an internal wall, approx. 1.5 m from the floor
  - **not** near windows and doors
  - **not** near heat sources (direct sunlight, fireplace, TV set, etc.)
  - install the room temperature sensor on a flush box.

- Control the motor for the damper of the ground energy exchanger (optional) via an on-site relay (24 V–/25 mA, with a protective diode in accordance with the details provided by the relay manufacturer). Do not install the relay inside the Vitotres junction box. Maximum length of the connecting cable between the junction box and the relay 500 mm.

- The electric heater in Vitotres may be switched OFF by an external zero volt contact (N/C) to be installed on site. The contact must be suitable for 230 V~, and meet the VDE guidelines (or local regulations).

Operating tips

- Never disconnect the equipment for longer periods from the mains supply or at the mains isolator, otherwise:
  - there will be no frost protection
  - the DHW cylinder will not be protected against corrosion (the power supply of the external current anode will be interrupted)
  - the house will not receive its basic ventilation.

  When heating, ventilation or DHW heating are not required for a longer period of time (e.g. during a holiday), we recommend you activate the holiday program. At this setting, the basic ventilation of the house, frost protection and corrosion protection of the DHW cylinder are ensured.

- **Note**
  This equipment is **not** suitable for screed drying.

  When using this equipment for drying the building (during the first year of use), expect a higher level of condensation and more severe filter contamination than normal. Ensure the condensate drains off properly during that phase; for this, regularly check the drain connection and the Vitotres condensate drain.

- Change the air filter twice annually. A severely contaminated filter and all other faults are reported in the control unit display.

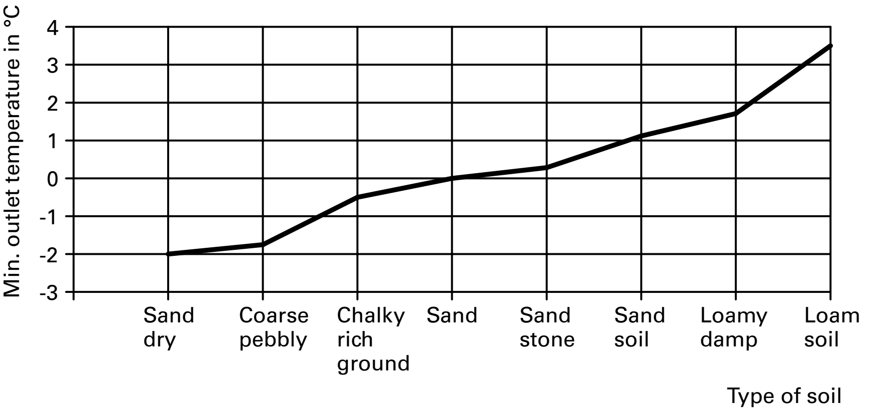
- If the system is operated in exhaust mode only during summer, hygiene dictates a change of the outside air filter before bringing the system fully into use again.

4.2 Sizing the ground energy exchanger (GEE)

Requirements of the ground energy exchanger

Pipe diameter (recommendation)	DN 200
Required length (guide valve)	Approx. 0.2 m per m^3 transported air volume (transported air volume – ventilation equipment and heat pump max. 300 m^3/h, heat pump only max. 150 m^3/h)
Required length with a frost-free inlet	Min. 0.3 m per m^3 air volume (subject to type of soil, see diagram below)
Max. permissible pressure drop	Up to 50 Pa
Material	Pipes made from PVC, PE, clay or concrete
Installation depth	Approx. 0.2 m below frost limit (1.2 to 1.5 m depth)
Outside air inlet	Min. 1.2 m above ground level
Installation fall	2% to the lowest point of the condensate drain

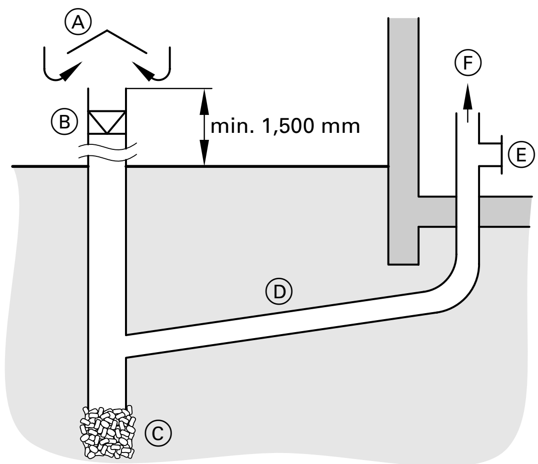
Minimum outlet temperature depending on type of soil (result from an annual simulation)
Length of the ground energy exchanger 0.3 m/m^3 air volume, depth of installation 1.2 m and pipe diameter DN 200)



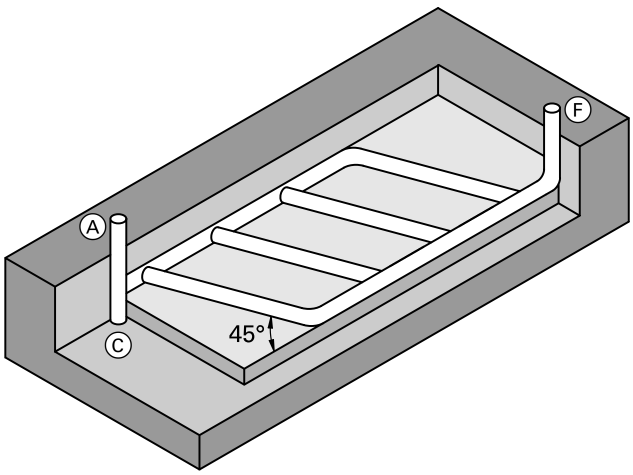
We recommend the use of a ground energy exchanger for supplying the outside air to the heat pump. This ensures that the Vitotres heat pump receives a supply of frost-free air even at outside temperatures below zero, which enables the heat pump to operate with a correspondingly good performance factor.
To protect the ground energy exchanger against contamination, install a ventilation air filter class G4 at the air inlet aperture. Ensure the entry into the building is implemented free from thermal bridges and airtight.
If, as shown in the installation example, a dewatering system (draining element Ⓒ) is used, then the ground energy exchanger should not be installed in an area influenced by groundwater. Furthermore, the routing and dewatering method shown in the installation example is only then appropriate, if the ground energy exchanger is only connected to the outside air supply of the heat pump. If the fresh air routed into the building also should be preheated by the ground energy exchanger, dewater the ground energy exchanger via a siphon (hygiene, prevention of radon being introduced from the ground). In this case, install a filter F7 in front of the inlet.
To save excavation costs, we recommend the installation of the ground channel in the wider excavation of the building. The pipework must be absolutely sound (butt welding or welding sleeves).

Installation example

Cut-away



Top view



Ⓐ Inlet aperture
Ⓑ Filter (G4 or F7, see text)
Ⓒ Draining element (use only for the outside air supply to the heat pump)
Ⓓ Observe 2% fall
Ⓔ Cleaning aperture
Ⓕ For supplying outside air to the heat pump in Vitotres

5822 282 GB

4.3 Solar panel connection and calculating the diaphragm expansion vessel

A maximum of 5 m^2 Vitosol 100 flat collectors or 3 m^2 Vitosol 200/250/300 tube collectors can be connected to Vitotres 343.*1
Provide pipework from the collector area to the Vitotres connection panel on site. Vitotres is fully prepared for the connection of the solar circuit. Provide thermal insulation for the pipework in a material which is capable of withstanding temperatures up to 185 °C. This also applies to the use of fixing clamps.

Connect a suitably sized diaphragm expansion vessel to the pipework to be installed. If an auxiliary heating circuit is connected to Vitotres, include that in your calculations too.
A safety valve, a solar circuit pump and the relevant control functions are already integrated into Vitotres.

To achieve the required flow capacity, it is necessary to calculate the pressure drop of the pipework including the collector area. A residual head of 180 mbar is available.

With regard to implementation, calculation and limits of application, the technical guide, the datasheet, the service instructions and the installation instructions of the relevant solar heating systems as amended apply.

*1 *The maximum collector area mentioned in the Vitosol technical guide, which relates to the volume of the DHW cylinder, does not apply to Vitotres 343. These values can be exceeded, as Vitotres offers several redundant temperature sensors. The use of an additional high limit safety cut-out is also no required.*

Design and effect of the diaphragm expansion vessel

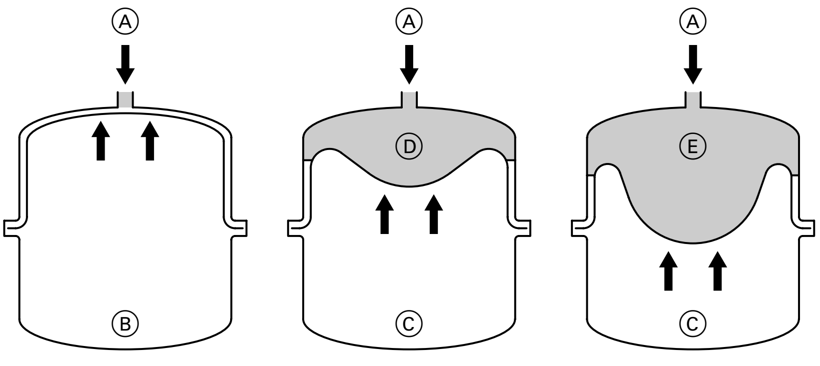
A diaphragm expansion vessel is a closed expansion vessel whose gas chamber (nitrogen filling) is separated from the liquid chamber (process medium) by a diaphragm and whose inlet pressure is subject to the system head.

Note
The inlet pressure must be adjusted as follows: 1.5 bar + 0.1 × static head.
The water seal should be 0.01 to 0.02 × liquid content of the complete system, but no less than three litres.

To safely prevent steam being created during the operating phase, collectors must indicate a pressure of at least 1.5 bar in their cold state. The inlet pressure of the expansion vessel will then be 0.1 × higher than static head h. In hot conditions, the system pressure rises by approx. 1 to 2 bar. Maximum shutdown temperature figures:

- Vitosol 100,
  type s/w2.5: 211 °C
  type 5DI: 185 °C
- Vitosol 200: 300 °C,
- Vitosol 250: 286 °C,
- Vitosol 300: 150 °C.

To ensure that no process medium can escape from the safety valve, the expansion vessel must be sufficiently large to accommodate the content of the collector when steam forms (stagnation). To protect the diaphragm against unacceptably high temperatures (generally ≦ 70 °C), we recommend the installation of a stratification cylinder (mostly required for systems installed under the roof). A generally applicable formula for calculating the required container size cannot be provided. However, the cylinder volume should be at least 50% of the system volume.

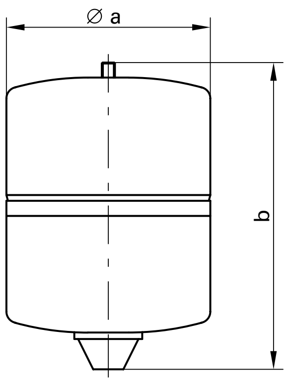


As delivered condition (3 bar inlet pressure) | Solar heating system filled, without heat effect | Under maximum pressure with the highest process medium temperature

Ⓐ Process medium
Ⓑ Nitrogen filling
Ⓒ Nitrogen buffer
Ⓓ Safety water seal (min. 3 litres)
Ⓔ Safety water seal

4.3 Solar panel connection and calculating the diaphragm expansion vessel

Specification of the solar expansion vessels (see Vitosol accessory)



Contents litres	Operating pressure bar	∅ a mm	b mm	Connection R	Weight kg
18	10	280	370	¾"	7,5
25	10	280	490	¾"	9,1
40	10	354	520	¾"	15,0

Table for calculating Cu pipe content

Pipe dimension	litres/m	ml/m
15 × 1 mm	0.14	140
18 × 1 mm	0.20	200
22 × 1 mm	0.30	300

Calculating the diaphragm expansion vessel

The nominal capacity of the expansion vessel is calculated according to the equation

$$V_N = \frac{(V_v + V_2 + z \cdot V_k) \cdot (p_e + 1)}{p_e - p_{st}}$$

Whereby

V_N = nominal capacity of the diaphragm expansion vessel (MAG) in litres

V_v = Safety water seal (here process medium) in litres
$V_v = V_A \cdot (0.01 \ldots 0.02)$ in litres
(min. 3 litres)

V_A = Liquid content of the entire system

V_2 = Increase in volume when the system heats up
$V_2 = V_A \cdot \beta$
β = Expansion quotient ($\beta = 0.13$ for Viessmann process medium from –20 to 120 °C)

p_e = Permissible end pressure in bar (ü)
$p_e = p_{si} - 0.1 \cdot p_{si}$
p_{si} = safety valve blow off pressure

p_{st} = Nitrogen inlet pressure of DEV in bar (ü)
$p_{st} = 1.5\ \text{bar} + 0.1\ \frac{\text{bar}}{\text{m}} \cdot h\ [\text{m}]$
h = Static head of the system in m Difference in height between the Vitotres pressure gauge and the highest point of the solar heating system

z = Number of collectors

V_k = Collector capacity in litres

Calculation example

System comprising:
1 Vitosol 100, type 5DI with 4.2 litres

Total liquid capacity of the system:
V_A = 22 litres
Static head: h = 4 m
Permissible final pressure: p_e = 3.6 bar (ü)
(Safety valve blow off pressure: 4 bar)

$$V_N = \frac{(V_v + V_2 + z \cdot V_k) \cdot (p_e + 1)}{p_e - p_{st}}$$

$V_v = V_A \cdot 0.015$
= 0.33 litres, selected 3 litres (see l.h. column)

$V_2 = V_A \cdot \beta$
= 2.86 litres

$p_{st} = 1.5\ \text{bar} + 0.1 \cdot 4$
= 1.9 bar

$$V_N = \frac{(3 + 2.86 + 1 \cdot 4.2) \cdot (3.6 + 1)}{3.6 - 1.9}$$

= 27.22 litres

The next largest expansion vessel, i.e. 40 litres, should be chosen.

4.4 Installation of an auxiliary heating circuit

An additional hydraulic heating circuit can be connected to Vitotres.

The use of an additional radiator may be sensible for two reasons: to increase the comfort and the room temperature in a bathroom or for supplying additional heat, which cannot be supplied via the ventilation air. Increasing the ventilation air flow beyond that which is sensible from a hygiene point of view (30 m^3/h per person) is not recommended, otherwise the relative humidity in the ventilated areas would drop too low.

A constant, adjustable flow temperature can be provided for the flow of the auxiliary heating circuit. The heating periods can be selected at random on the Vitotres control unit.

Design temperatures:

Underfloor heating system	45 °C (max. 60 °C)
Radiator heating system	55 °C (max. 70 °C)

Both design temperatures ensure operation with the integral heat pump. Up to 7.5 kW output can be achieved via the hydraulic heating circuit. Of that, 6 kW is provided by the electric heater.

Note
There is no ventilation air heating, when the auxiliary heating circuit is operated.

Design the auxiliary heating circuit as single pipe heating circuit or with overflow valve (minimum circulating volume 700 litres/h), and fill with Tyfocor G-LS or LS.
Equip the auxiliary heating circuit on site with a Tyfocor-resistant circulation pump (with check valve), with a diaphragm expansion vessel and a Tyfocor-resistant air vent valve.

Provide a suitably sized ***common*** *diaphragm expansion vessel (see page 15) when simultaneously connecting solar panels.*

4.5 System type

Functions

Note
The figure on page 19 complements the function description.

Ventilation

The Vitotres compact device offers a central domestic ventilation system with heat recovery ① in accordance with energy-efficient house criteria.
The heat recovery is bypassed when temperatures inside the house are too high (summer bypass ②). The control is implemented according to the difference between the selected set temperature and the actual temperature measured at room temperature sensor ③ in the lead room. This lead room should be approximately representative of the average temperature of the living unit. It is therefore measured in the core of the building, generally in a hallway, see page 23). Arrange the room temperature sensor so that it is free from interference. Avoid direct solar irradiation onto the room temperature sensor. Erroneous control patterns may also be caused by the room temperature sensor being heated by heating surfaces (e.g. through a bathroom wall).

Ground energy exchanger

A ground energy exchanger (GEE) can be installed on the outside air side of the ventilation equipment.
A ground energy exchanger for frost protection is not required. The equipment is fitted with internal frost protection. Provide a filter G4 ㉙ for outside air supply ④ to the heat pump. We recommend the use of a ground energy exchanger ⑤.

Central heating

The compact device heats the house by heating ventilation air ⑥. For this, heat pump ⑦ is used, which utilises the residual energy in expelled air ⑧ downstream of heat recovery ①.
Three-way valve ⑨ diverts the heat pump to ventilation air bank ⑩ to provide central heating.
The requirement for central heating is triggered by the difference between the selected set room temperature and the actual room temperature measured by room temperature sensor ③ in the lead room.
If, at very low outside temperatures, the output of heat pump ⑦ is insufficient, then electric heater ⑪ can be started manually or automatically.

DHW heating

The DHW heating through heat pump ⑦ has priority over central heating. Heating demand is signalled via 3 cylinder temperature sensors ⑫ and the control unit, which regulates heat pump ⑦ via three-way valve ⑨ to load DHW cylinder ⑬. The heat pump raises the flow temperature to the value required for DHW heating.

In case of higher demand, the DHW is backed up by electric heater ⑪.
The control unit switches the heating flow via three-way valve ⑨ to ventilation bank ⑩, if the actual value measured at cylinder temperature sensors ⑫ is higher than the set value selected at the control unit. Where a high DHW demand is anticipated, install an instantaneous water heater ㉘ for DHW into the DHW line downstream of Vitotres during the system installation. In that case, the DHW backup by electric heater ⑪ is suppressed by the control unit.

Cooling operation

The ventilation air ⑥ of the ventilation equipment can be cooled by the heat pump ⑦. This is controlled by the difference between the selected set temperature and the actual temperature measured by the room temperature sensor ③.
Ensure the component surface is free from condensation.

Solar heating system

The equipment is prepared for connection of a solar heating system for DHW heating. Apart from installing solar panels ⑭, only an expansion vessel ⑮ and a collector temperature sensor ⑯ must be connected.

The solar heating system will be regulated via a two-point controller integrated into the control unit, which compares the collector temperature with the temperature at lower cylinder temperature sensor ⑫.

Auxiliary heating circuit

A hydraulic heating circuit ⑰ (e.g. for a bathroom radiator) can be connected. This heating circuit is unsuitable for providing the basic home temperature. For a selectable period (e.g. 30 minutes in the morning), heat pump ⑦ provides the flow temperature set at the control unit. On-site heating circuit pump ⑱ is started by the control unit.
The external heating circuit is filled with Tyfocor G-LS or LS process medium and is protected by the internal safety valve with 4 bar.

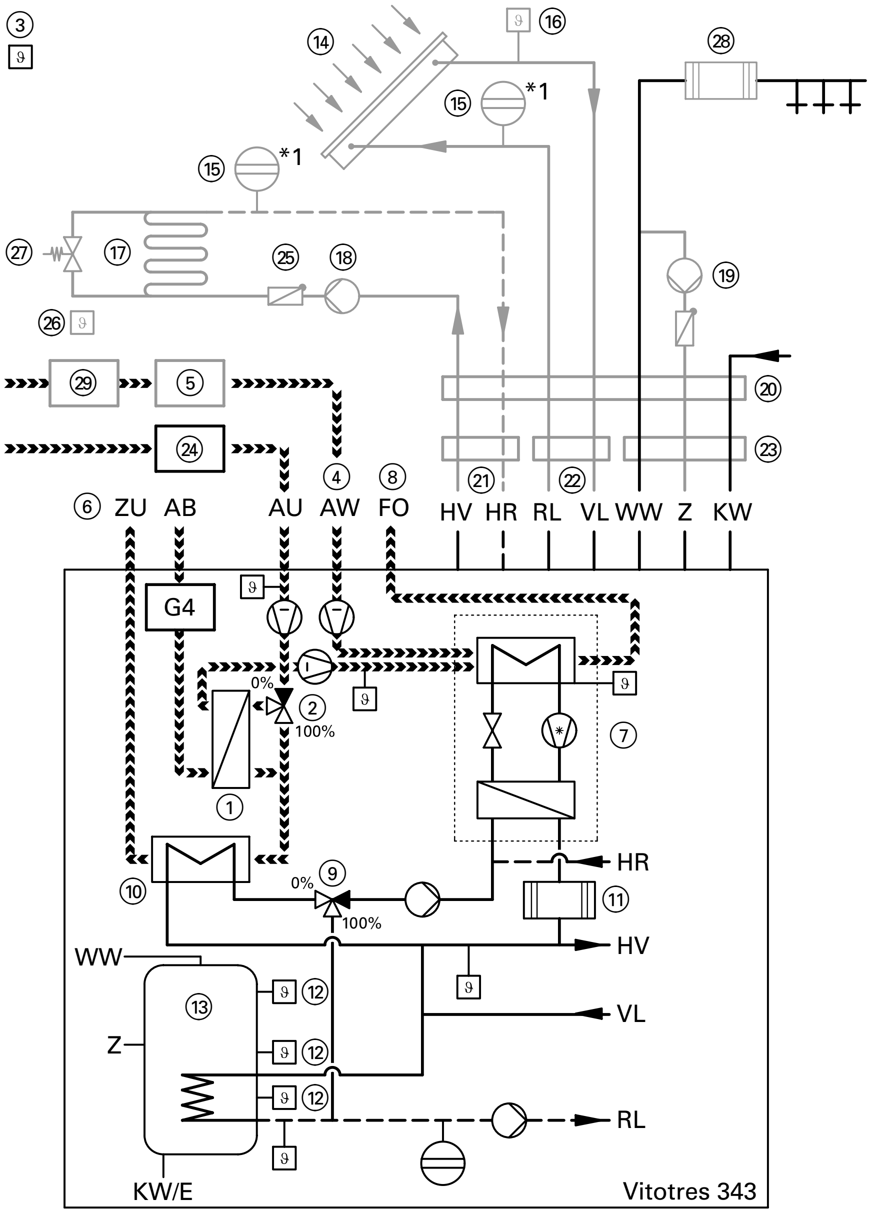
Electric radiator

If no external heating circuit is connected, the control unit time switch, which controls the auxiliary heating circuit relay, can be used to control a contactor/mains switch of another heat source (electric radiator).

⚠ ***Safety instruction***
The externally connected electric radiator must be thermostatically controlled and protected in its own right.
Vitotres provides no monitoring of this external device.

5822 282 GB

System design



AB Exhaust air
AU Outside air
AW Outside air supply to the heat pump
E Drain
FO Expelled air
HR Heating return
HV Heating flow
KW Cold water
RL Solar return
VL Solar flow
WW Hot water
Z DHW circulation
ZU Ventilation air
››› Air routing

[1]Alternatively in the solar circuit or auxiliary heating circuit.

① Heat recovery
② Summer bypass
③ Room temperature sensor
④ Outside air supply to the heat pump
⑤ Ground energy exchanger
⑥ Ventilation air
⑦ Air heat pump
⑧ Expelled air
⑨ Three-way valve
⑩ Ventilation air bank
⑪ Electric heater
⑫ Cylinder temperature sensors
⑬ DHW cylinder

Positions ⑭ to ㉗ are explained on page 20.

Required equipment

Item	Description	Number	Part no.
	Vitotres 343	1	Z002 366
③	Room temperature sensor	1	Standard delivery
㉔	Outside air filter F7	1	Standard delivery
	Accessories		
⑤	Ground energy exchanger	1	on-site
⑮	Diaphragm expansion vessel (only required for the options solar circuit and auxiliary heating circuit; only required once if both options are utilised)	1	See Vitoset price list
⑳	Connection panel	1	7159 985
㉙	Outside air filter G4	1	on-site
	Accessory for DHW circulation option		
⑲	DHW circulation pump	1	See Vitoset price list
㉓	DHW circulation extension	1	7169 387
	Accessory for solar circuit option		
⑭	Solar panels up to 5 m^2 Vitosol 100 or up to 3 m^2 Vitosol 200/250/300	according to requirements	See Vitotec price list
⑯	Collector temperature sensor	1	7814 617
㉒	Solar circuit extension	1	7169 386
	Accessory for auxiliary heating circuit option		
⑰	Universal radiator or underfloor heating system	according to requirements	See Vitoset price list
⑱	Heating circuit pump	1	See Vitotec price list
㉑	Heating circuit extension	1	7169 385
㉕	Check valve	1	See Vitoset price list
㉖	Room thermostat	1	See Vitoset price list
㉗	Overflow valve	1	on-site

5.1 Sizing

The following sizing information applies exclusively to energy-efficient houses.

We recommend you let a design engineer size the air distribution system. For this, short paths within the air distribution system and even room flow rates are desirable. Possible higher thermal losses of individual rooms must be taken into consideration in the final planning stages and should be compensated through matching volume flow patterns.

Calculating the basic air change or the average air change volume

This is calculated via the fresh air supply demand of occupants (30 m^3/h per person). The ventilation flow should be distributed across all rooms, so that two occupants can occupy a normal room for a longer period and with good air quality, whilst internal doors are shut and no additional ventilation via windows is required. This applies particularly to domestic offices and bedrooms. As first rule of thumb, 40 m^3/h can be applied. Since generally, not all rooms are simultaneously occupied by two occupants, the air volume in less occupied zones may possibly be reduced to the minimum air change rate.
The minimum air change rate is 0.3 h^{-1} independent of the occupancy (expulsion of noxious matter and odours).

The distribution of the exhaust air volume flow to the rooms from which air is exhausted is generally derived from the following table.
In many cases, the exhaust air volume can be reduced if the exhaust air condition results in substantially greater values than the ventilation air condition. For example, the volume flow from a room, from which air is extracted can be reduced provided the air change rate in that room is higher than 2 h^{-1} (empirical value). The balance must be maintained for the whole living unit. Consequently the exhausted air volume must be increased in the reverse case (ventilation air condition greater than the exhaust air condition), making the ventilation and exhaust air flow equal.

The air volume hygienically necessary (30 m^3/h per person) is applied as sizing criterion for the overall volume flow and not the air volume required for delivering heat. If the latter is higher than the former, the additional output must be provided by static heating surfaces, otherwise there will be a risk of the ambient air becoming too dry. However, it would be sensible to slightly match the volume flow in individual rooms in the final planning stage, to compensate for possibly higher thermal losses in individual rooms.

Room	**Essential minimum air rate for the ventilation equipment in 24 hour operation** [m^3/h]
Kitchen	60
Kitchenette	40
Bath (WC poss.)	20
WC	20

Calculation example

Given:
Detached house with 4 occupants
Exhaust air areas: kitchen, bathroom, shower, WC

Fresh air requirement		**Exhaust air requirement**	
Number of occupants Fresh air requirement per person [m^3/h]	4 30	Kitchen Bath Shower WC	40 40 20 20
Total fresh air requirement [m^3/h]	120	Total exhaust air requirement [m^3/h]	120

Result: Adjust Vitotres to a basic air change of 120 m^3/h.

Average air change

Apart from day ventilation, Vitotres can also be adjusted for other operating stages (party or night ventilation). For this, ensure that the average air change will not drop below 0.3.

The average air change results from the average value of the air volume flow supplied during the day, divided by the volume of the building to be ventilated.

Calculation example
Given: Building volume 338 m^3/h, basic Vitotres air changes adjusted to 120 m^3/h.

Operating mode	Factor relative to standard operation	Air volume flow [m^3/h]	Air change [1/h]	**Case 1** Daily runtime [h]	**Case 1** Air volume flow [m^3/24 h]	**Case 2** Daily runtime [h]	**Case 2** Air volume flow [m^3/24 h]
Party ventilation (maximum)	1.33	160	0.47	0	0	4	640
Day ventilation (basic air change)	1.00	120	0.35	24	2880	0	0
Night ventilation (reduced)	0.67	80	0.24	0	0	20	1600
				Air volume flow [m^3/h]	120	Air volume flow [m^3/h]	93
				Average air change [1/h]	0.35	Average air change [1/h]	0.28

Result: In case of predominantly reduced operation (case 2), the required average air change of 0.3 cannot be achieved.

5822 282 GB

Ventilation air, exhaust air and overflow area

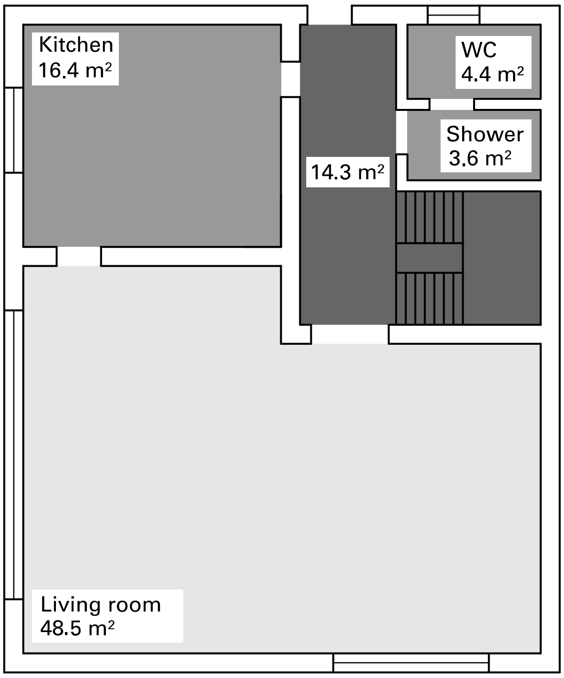
After determining the volume flow for basic ventilation, calculate the air change rates for the individual ventilation air and exhaust air areas. For this purpose, the accommodation or utility unit to be ventilated is segregated into ventilation air and exhaust air sections. Generally, all rooms should be ventilated either via ventilation air or exhaust air (except overflow areas). This also applies to smaller or box rooms. For this, usually a small aperture in the air channel is sufficient.

The following are part of the ventilation section, e.g.
- Living rooms
- Bedrooms
- Children's rooms
- Dining rooms

The following are part of the exhaust air section, e.g.
- Kitchen
- Bathrooms
- WC
- Domestic offices

The following are part of the overflow section, e.g.
- Hallways
- Stairwells

Ground floor



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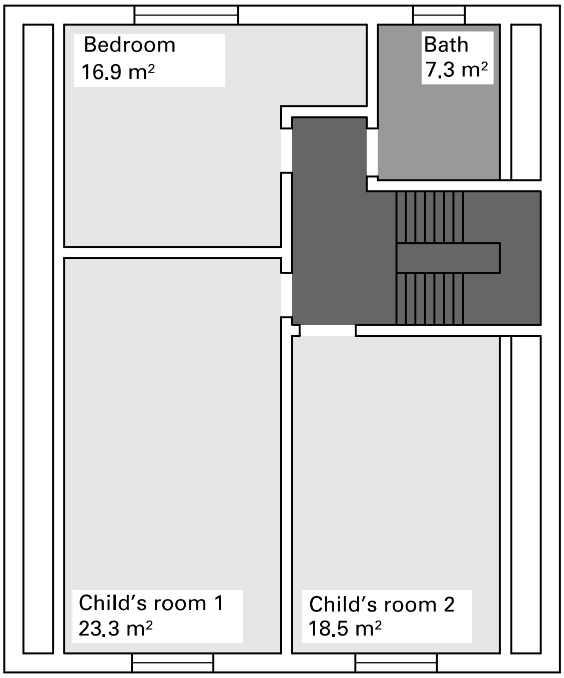


5822 282 GB

Air volume flow segregation

The air volume flow is distributed to the individual rooms based on the ventilation air volume hygienically necessary (number of occupants × 30 m^3/h).
If this results in an air change rate of less than 0.3 h^{-1}, apply a ventilation air volume flow > (building volume × 0.3 h^{-1}). In that case, the air volume flow will be distributed to individual rooms subject to the number of occupants who generally stay in those rooms.

For example, for rooms frequently occupied by two persons (e.g. living room), an air volume flow of 40 m^3/h is applied. For rooms predominantly occupied by only one person (e.g. child's room), an air volume flow of 20 m^3/h is applied.
The remainder of the calculated ventilation air flow is then distributed to the other ventilated rooms.

For the regular exhaust air volume flow for windowless rooms to DIN 1946-6, see the table below.
To enable odours to be removed quickly, a volume flow of 40-60 m^3/h is recommended for kitchens.

Room	Air volume flow for rooms without windows to DIN 1946-6 for a runtime of ≧ 12 h/d [m^3/h]
Kitchen – constant ventilation (basic ventilation)	40
Bath (WC poss.)	40
WC	20

Example:
Residential building with 4 occupants

Ventilation areas

Ventilation areas	Floor area [m^2]	Volume [m^3]	Ventilation air volume flow [m^3/h]
Living room	48.8	122	40
Bedroom	16.8	42	40
Nursery 1	23.2	58	20
Nursery 2	18.4	46	20
Total ventilation areas	**107.2**	**268**	**120**

Exhaust air areas

Exhaust air areas	Floor area [m^2]	Volume [m^3]	Exhaust air volume flow [m^3/h]	Air change [1/h]
Kitchen	16.4	41	40	0.98
Shower	3.6	9	20	2.22
WC (EG)	4.4	11	20	1.82
Bath	7.2	18	40	2.22
Total exhaust air areas	**31.6**	**79**	**120**	

If

$$\text{air change rate of the entire building} = \frac{\text{Ventilation air volume flow required for hygiene}}{\text{Total ventilated air volume} + \text{total exhaust air volume}}$$

then for this example, we have

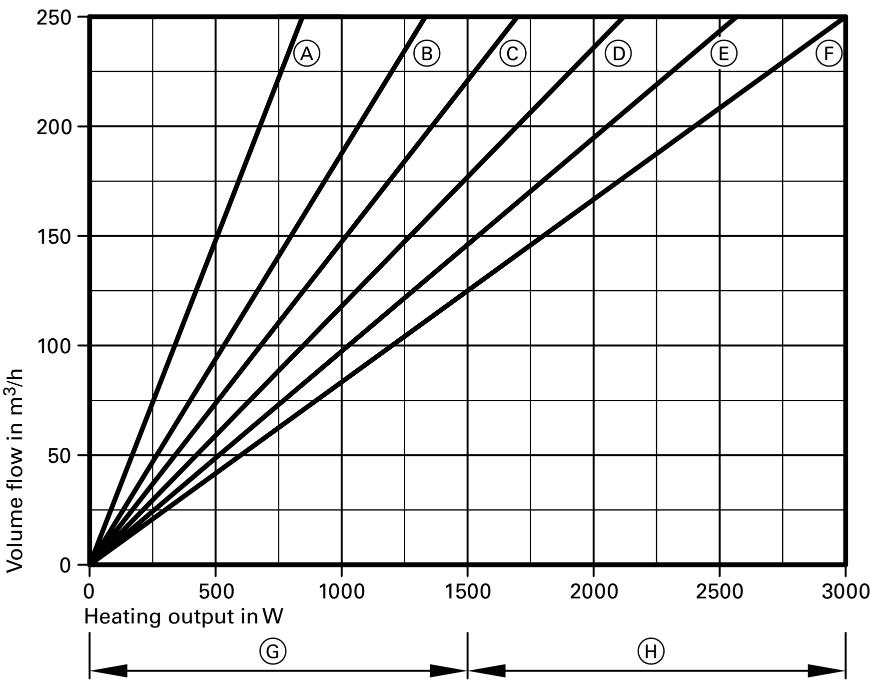
$$\text{air change rate of the entire building} = \frac{4 \text{ occupants} \cdot 30 \text{ m}^3/\text{h}}{268 \text{ m}^3 + 79 \text{ m}^3} = 0.35 \text{ 1/h}$$

Therefore, the air change rate for the entire building is substantially higher than the required minimum air change rate of 0.3 1/h.

5822 282 GB

Air volume flow and heating load

Guide values for the heating output of Vitotres 343 at various ventilation air temperatures and 20 °C room temperature



The ventilation air volume flow calculated in the previous chapter can, subject to the selected ventilation air temperature, cover only a certain heating load. Where a generally higher heating load is required, the equipment will increase the volume flow up to the value selected for party ventilation (max. 250 m³/h).
The adjacent diagram shows the dependency of the transported heating output on the volume flow and the ventilation air temperature.
The heat pump can, subject to the outside air temperature, provide a heating output*1 of up to 1500 W; any higher requirement will be covered by starting the internal electric heater. Check for each room, where values approach the available limits, whether the specific room heat requirements can be covered by the selected volume flow. Where that is not the case, increase the volume flow or the ventilation air temperature, alternatively cover the heat demand by means of an additional heat source.

**1Operating point:
Outside air 7 °C, ventilation air 50 °C.*

Ⓐ Ventilation air temperature 30 °C
Ⓑ Ventilation air temperature 35 °C
Ⓒ Ventilation air temperature 40 °C
Ⓓ Ventilation air temperature 45 °C
Ⓔ Ventilation air temperature 50 °C
Ⓕ Ventilation air temperature 55 °C

Ⓖ Heating output provided by the heat pump
Ⓗ Heating output provided by the electrical heater

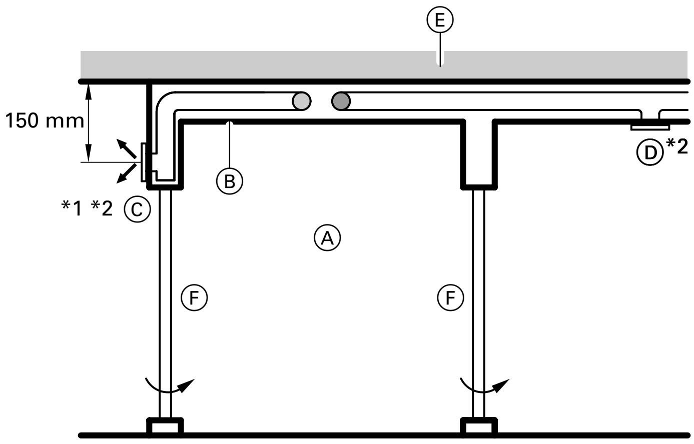
Calculating the heating output

Heating output [W] = Ventilation volume flow [m³/h] · (ventilation air temperature [°C] – room temperature [°C]) · 0.34

5.2 Air routing

Routing air into rooms

Running pipework with suspended ceilings (section)



*[*1]Use wide angle nozzles for this installation location.*
*[*2]Alternative installation options for exhaust air apertures.*

Ⓐ Overflow area
Ⓑ Suspended ceiling
Ⓒ Ventilation air
Ⓓ Exhaust air
Ⓔ Ceiling
Ⓕ Door

▪ Ventilation air (light grey)
■ Exhaust air (dark grey)

The air is distributed by Vitotres to the living space (ventilation air) or from the wet areas to the ventilation and extraction device (exhaust air) via an air distribution system with flat channels or circular tubes together with matching tees, silencers, cleaning and air apertures.

To prevent flow noise development and pressure drops, observe the following:

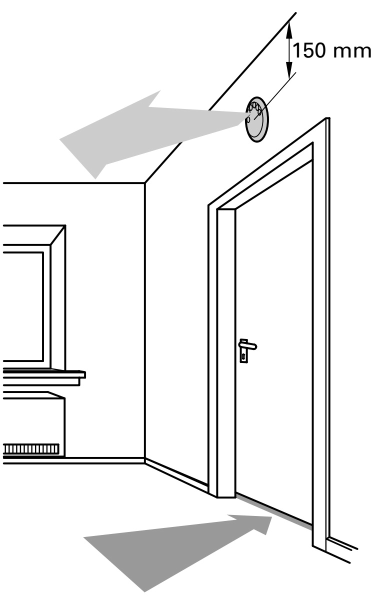
- Symmetrical pipework design
- Short runs, few bends
- The ventilation pipework takes priority over the heating, domestic hot water and drainage network to avoid complicated pipe runs
- Select a sufficiently large pipe diameter
- Construct the central rising and falling lines with circular pipe DN 160 to reduce the pressure drop.

Pipe material

- Utilise smooth pipes (folded spiral seam)
- Smooth pipes prevent dust accumulation and unnecessary pressure drop
- The pipe material should be corrosion resistant, non-hygroscopic and non-combustible.

Connect all pipe joints using plug-in connectors and make these connections airtight with cold sealing tape.

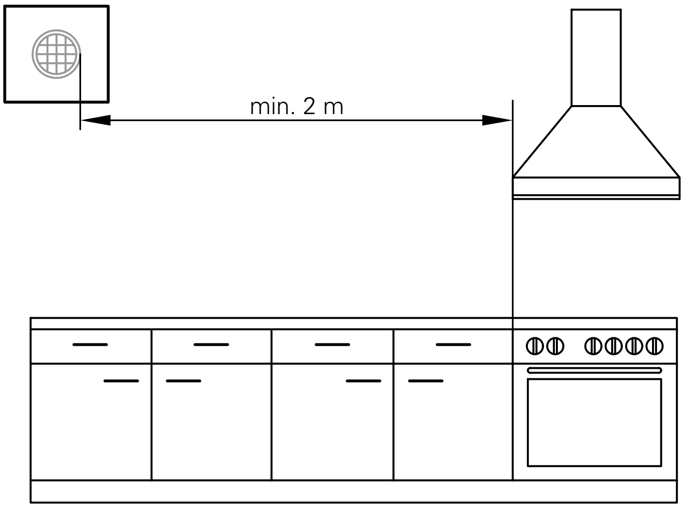
Routing air inside rooms



Create a physical air interconnection for the air flow from the ventilation air into the exhaust air areas. A gap of 15 mm height above the entire door width is sufficient for a volume flow up to 40 m^3/h. As rule of thumb, the pressure drop should not exceed 1 Pa. This corresponds to a flow velocity in the unobstructed cross-section of less than 1 m/s. Where internal doors are sealed well, noise attenuated overflow apertures can be built into the internal wall or into the door (on-site).
We recommend the use of wide angle nozzles.

5822 282 GB

Air extraction from kitchens



Because of greasy vapours and contamination it cannot be recommended that cooker hoods are connected to the exhaust air duct. Cooker hoods are designed for substantially larger volume flows (approx. 500 m^3/h).
Route the exhaust air from cooker hoods outdoors or utilise recirculating cooker hoods with grease filters to prevent energy losses.
When using cooker hoods, take suitable steps to provide a separate ventilation air supply into the kitchen to prevent the creation of negative pressure. Never extract the kitchen air to Vitotres immediately next to the cooker hood.

Silencer

Location	Installation recommended	Installation required
Outside air supply to the ventilation module	×	
Outside air supply to the heat pump	×	
Expelled air	×	
Central ventilation air		×
Ventilation air – living room child’s room domestic office bedroom	× × × ×	
Exhaust air - bathroom WC kitchen utility room		× × × ×
Central exhaust air	×	

Pipework insulation

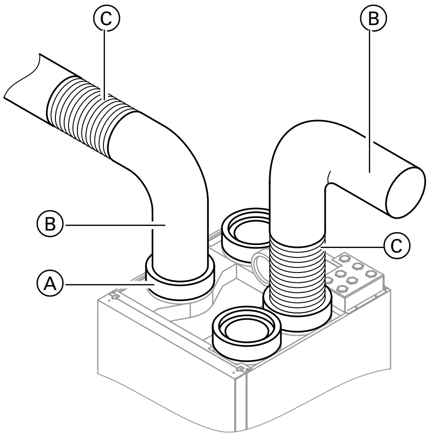
For optimum operation of the Vitotres with heat recovery, thermal losses from the pipework must be kept to a minimum. Insulate ventilation and exhaust air pipes in unheated areas (min. 50 mm).

Keep pipework lengths from the equipment to the wall outlet through the insulated building envelope as short as possible (for this, see also section 4.1).

In all cases, thermally insulate outside air and expelled air pipes/ducts (min. 20 mm) against condensation and provide an external vapour barrier.
For heated areas, we recommend a thermal insulation of at least 50 mm. Suitable installation material could be, for example Armaflex.

Insulate carefully and in accordance with current standard practice. Seal all butt joints with adhesive, isolate all ceiling and wall outlets by using insulating strips and avoid gaps.

5.3 Vitotres connection



Ⓐ Connector (standard delivery)
Ⓑ 90° pipe bend DN 160
Ⓒ Flexible pipe DN 160
(flexible channel or pipe)

Connect the air distribution system of the building in accordance with local conditions, either

- with smooth and rigid 90° bends to the connector.
  Make the connection to the existing air distribution systems with a flexible pipe of at least 100 mm length (anti-vibration).

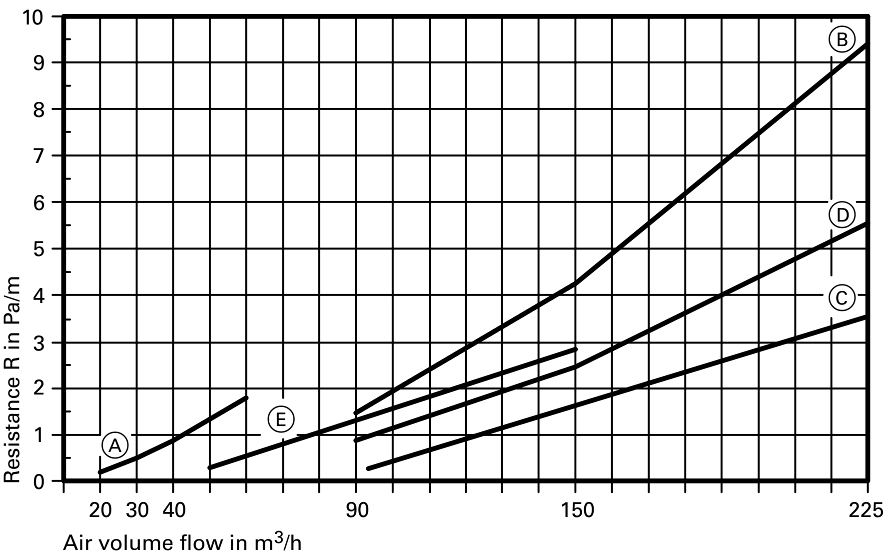
or

- with a flexible pipe of at least. 100 mm length (anti-vibration) to the connector.
  Make the connection to the existing air distribution system with smooth and rigid 90° bends.

Please note
To prevent flow noise, use only rigid pipes as 90° bends.

5.4 Pressure drop and flow velocities

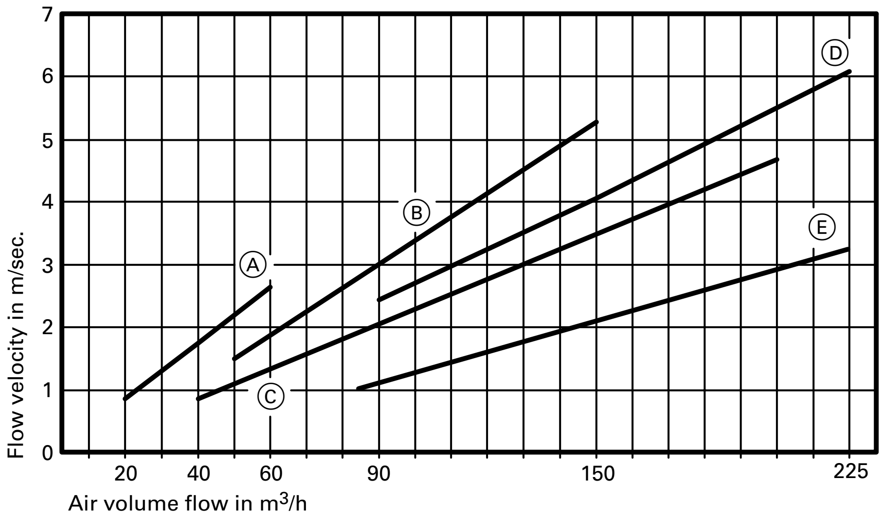
Pressure drop of different pipework systems



Ⓐ Pipework (flat)100, flexible
Ⓑ Pipework (flat)150, flexible
Ⓒ Pipework (round) DN 160
Ⓓ Pipework (flat) 150, rigid
Ⓔ Pipework (circular) DN 100

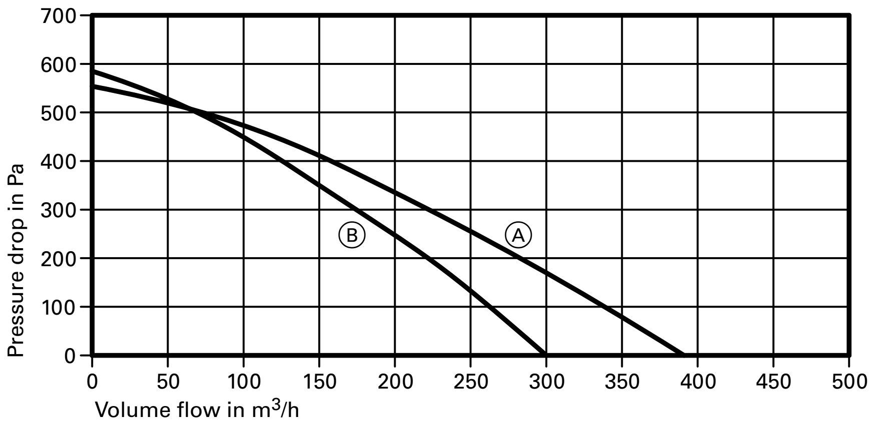
5822 282 GB

Flow velocity – volume flow diagram of different pipework systems



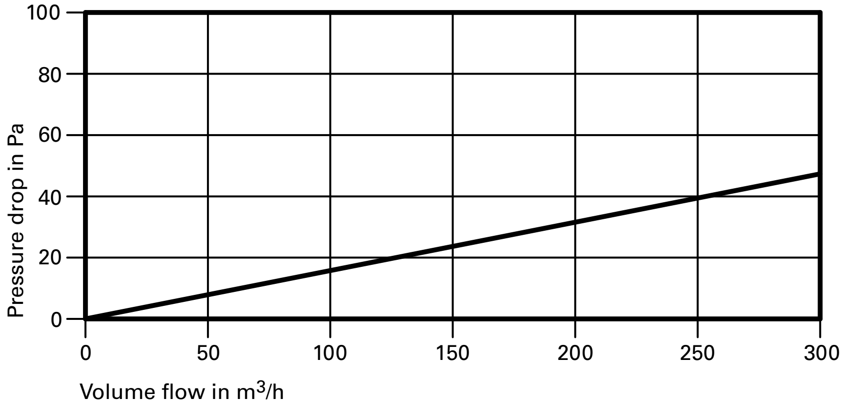
Ⓐ Pipework (flat) 100
Ⓑ Pipework (circular) DN 100
Ⓒ Pipework (round) DN 125
Ⓓ Pipework (flat) 150
Ⓔ Pipework (circular) DN 160

Ventilator curves – ventilation module



Ⓐ Ventilation air (without filter)
Ⓑ Exhaust air

Pressure drop diagram – outside air filter box (with outside air inlet aperture)



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6.1 Form for designing air volume flow patterns for Vitotres 343

Project: ______________________________

____

Ventilation areas

Ventilation area	**Volume flow guide value*1 [m³/h]**	**Number**	**Ventilation air volume flow [m³/h]**
Living room			
Bedroom			
Dining room			
Study			
Child's room 1			
Child's room 2			
Total ventilation areas			

*1 *With 1 person occupying the room: 20 m³/h, for 2 occupants: 40 m³/h.*
See also page 24.

Exhaust air areas

Exhaust air area	**Volume flow guide value*2 [m³/h]**	**Number**	**Exhaust air volume flow, calculated [m³/h]**
Kitchen			
Bath (WC poss.)			
WC			
Utility room			
Total exhaust air areas			

*2 *See page 24.*

5822 282 GB

6.2 Glossary

Air change
A measure for the air changes which identifies how often air in a building is completely changed every hour.

Basic air change
Air change required to maintain hygienic conditions and ambient air quality for normal activities of occupants.

Blower door test
Procedure for testing the air tightness of buildings.

Energy-efficient house
Houses with a heating energy requirement < 15 kWh/(m^2 · a) and a necessary heating load < 10 W/m^2.

Exhaust air
Air extracted from the room by the ventilation system.

Exhaust aperture
See exhaust valve

Exhaust valve
Aperture through which exhaust air is removed from the room.

Expelled air
Air expelled to the outside.

Filters
Separation of contamination from air streams.

Ground energy exchanger (GEE)
A pipework system laid underground to utilise energy or cold stored in the ground to precondition outside air channelled to the ventilation equipment.

Heat recovery
Steps required for reusing the thermal energy of air being extracted from a room.
The heat which would otherwise be lost through the exhaust air is recovered and added to the ventilation air intake.

Outside air
All air drawn in from the outside.

Overflow area
No ventilation and exhaust air apertures are installed in the overflow area.
The air flows across this area from ventilation areas into exhaust air areas.

Party mode
The air changes required for maintaining hygienic conditions and the quality of ambient air with high occupancy rates or high air contamination (e.g. through smoking).

Reduced mode
Air change required to maintain hygienic and ambient air quality for low levels of activities of occupants or during their absence.

Standard mode
See basic air change

Ventilation air
The total air volume flowing into a room.

Ventilation air valve
See ventilation air aperture

Ventilation aperture
Aperture through which ventilation air is supplied to a room.

Ventilation heat loss
That proportion of the annual heat demand attributable to the heating of the air changed within the building.

Volume flow balance
(physically correct: mass flow balance)
Automatic fan influence, which constantly maintains the ventilation air and exhaust air balance.

Printed on environmentally friendly,
chlorine-free bleached paper

Subject to technical modifications.

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