DESIGN & INSTALLATION

Wall

WALL HEATING
WALL COOLING
PLASTERED

EasyFlexWall

VBOOK7_EN | 05/2024

PDF

www.variotherm.com

VARIOTHERM

This is how

it's done ...

1 PRINCIPLES

Varioterm recommends a combination of floor, wall and ceiling. In general, walls offer the largest exchange area, which is why wall heating/cooling systems ensure that people can easily feel the radiant heat.

For hot summer days, we recommend wall and/or ceiling cooling. Instead of hot water, cooled water flows through the pipes at a temperature of 16–20 °C. Rooms are cooled to a comfortable temperature, in complete silence and without forced air.

	Heating	Cooling
Ceiling	⊕⊕	⊕⊕⊕
Wall	⊕⊕⊕	⊕⊕⊕
Floor	⊕⊕	⊕

▲ Which system areas are suitable for which needs?

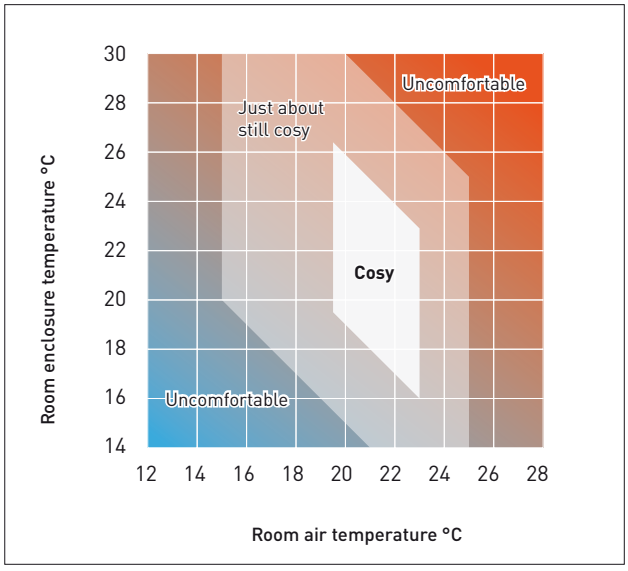
1.1 Comfort

Comfort is not only created through a certain air temperature in the room. The temperature of the surfaces enclosing the room is of equal importance. The felt temperature is roughly consistent with the arithmetic mean of both temperatures.

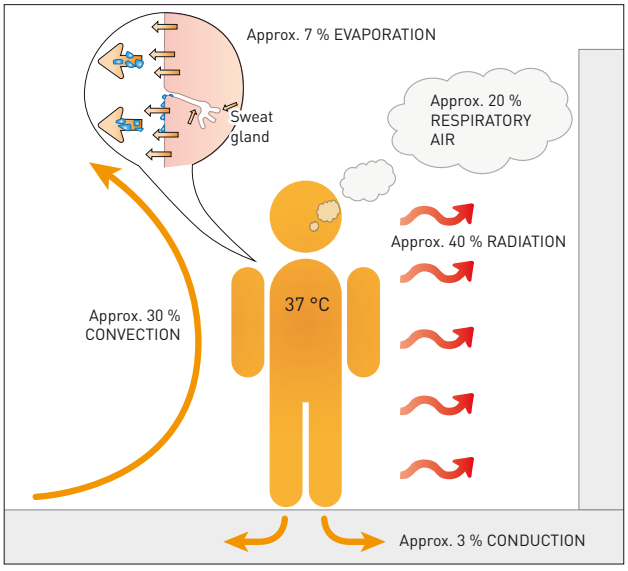
When does a person feel comfortable?
A person only feels comfortable when the basic equation of "thermal comfort" is optimally fulfilled:

heat generation = heat emission

Heat production = heat loss



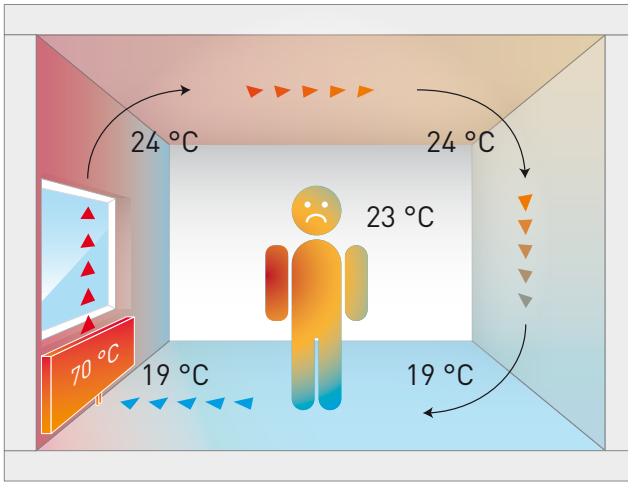
▲ Zone of cosiness



▲ Human heat balance

In this context, it is important that heat loss from the human body is as evenly distributed in all directions as possible. We feel uncomfortable if too much heat is lost in one particular direction (e.g. cold surfaces, draughts) or the heat loss is prevented in one direction (hot surfaces or vapour-tight, thick clothing).
The lower the inside air temperature is, the warmer the surrounding surfaces (wall surfaces, floor and ceiling, as well as doors and windows) must be to ensure cosiness.

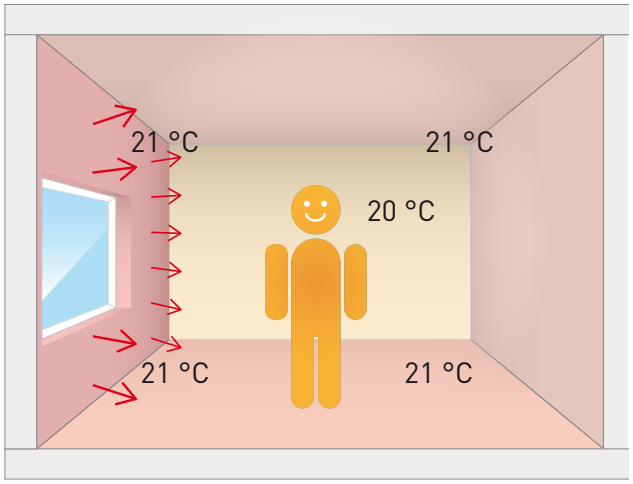
Compared to other heating systems, the EasyFlexWall significantly increase cosiness. The installation of surface heating on the inside of the exterior wall, especially under windows, can largely cancel out the unpleasant effects from the radiation exchange between your body and cold exterior walls and windows. You can set the room temperature lower than you would with convection heating, since radiant heat from the EasyFlexWall raises the perceived air temperature.



▲ Discomfort with radiators

1.2 Energy savings

A lowered room air temperature along with increased cosiness significantly minimises energy losses. The approximate heating cost savings per 1 °C lower room air temperature are approx. 6 %. The low room air temperature has the additional physiological advantage of significantly increasing the absorption of oxygen in the body.
The wall heating system is ideal for use with low-temperature energy sources such as condensing boilers, heat pumps and solar collectors because it operates with low surface and heating medium temperatures.
With Variotherm wall heating you can achieve energy savings of up to 30 % compared to conventional heating systems.



▲ Comfort with wall heating

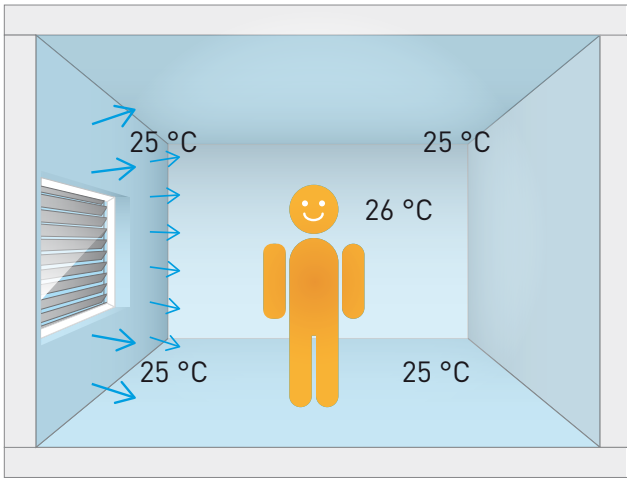
1.3 Design freedom

Due to the invisible wall heating/wall cooling, radiators or split-design units can be dispensed with during planning. This saves a lot of space and the interior can be designed freely.

1.4 Cooling

One reason for the frequent lack of satisfaction with air-conditioning systems is the inadequacy of the thermal ambient conditions in the air-conditioned rooms. Most frequently mentioned is the presence of uncomfortable forced air. Cooling via wall surfaces offers the advantage of gentle radiation exchange between the cooled wall surface and the human body. In addition, the room temperature is reduced to a comfortable level.

Effects of surface cooling on the room



▲ Comfort with wall cooling

When a wall surface is cooled, all warmer objects in the room (floor, interior walls, people, equipment, etc.) radiate heat into this cooled surface. This loss of heat through radiation leads to a reduction in the surface temperature of these objects, thus providing a cooling effect. The ambient air in the room is also cooled to a comfortable level.

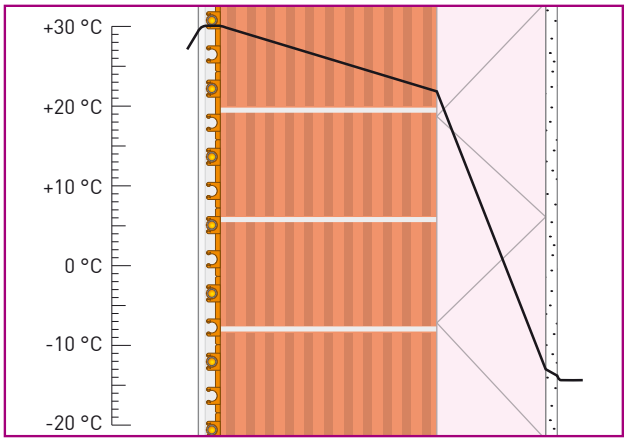
Cooling mode
Based on experience, cooling makes sense at a room temperature ≥ 26 °C. To achieve a noticeable effect and suitably cool the body, a reduction of the wall surface temperature to approx. 19–22 °C is recommended.

Economy
The necessary cooling performance can be better distributed with water than with air. The pumping costs for surface cooling systems are usually significantly lower than the costs incurred by using fans. A 100 percent coverage of the cooling load, as per VDI 2078 (calculation of the cooling load for air-conditioned rooms), is possible in buildings designed for low energy consumption with shadowing equipment and low internal loads.
One of the major advantages of wall cooling/heating systems is the low additional investment costs. A single system is used for the cooling and heating modes: the same wall surface, same piping system and the same heating/cooling distribution manifold with supply lines and circulation pump. The generation of cooling (chiller/heat pump/cooling from the floor and ground water) is planned in parallel to the heating unit. Many modern heat pumps already allow switching from heating to cooling mode – without major extra costs. Ambient sources of cooling (deep boreholes, ground collectors, wells ...) can also be used – at zero cost.

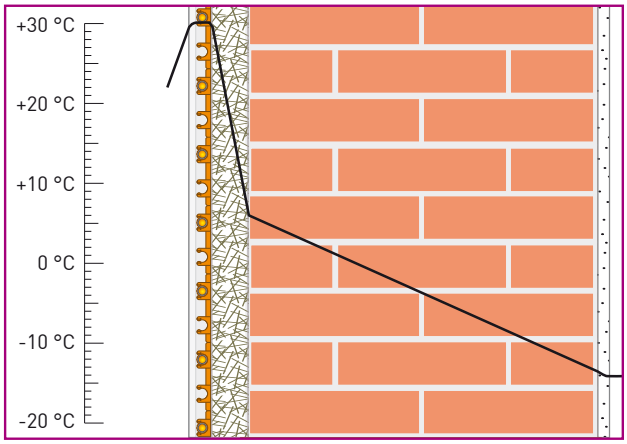
Combination of displacement ventilation and surface cooling
Surface cooling does not replace an air-conditioning system with regard to dehumidification and ventilation. Displacement ventilation is an air-conditioning system with low air exhaust speeds and laminar flow of the expelled air at the exhaust vents. Low turbulence in the air flow through the room is achieved through the type of ducting in the room, blowing of air at floor level at a slightly subnormal temperature and extraction of the exhaust air at the ceiling level. This type of displacement flow, known as "displacement ventilation" can achieve almost complete elimination of draughts. The combination of wall cooling and displacement ventilation allows significantly higher cooling performance to be achieved compared to using only a displacement ventilation system, without exceeding thermally comfortable air speeds. If the supplied air is dehumidified then low wall surface temperatures, and thus high radiant cooling performance, can be achieved without the formation of condensation, even on hot and humid days.

1.5 Temperature variations/wall structure

Various different wall fittings at a wall surface temperature of 30 °C and a standard outdoor (air) temperature of -14 °C



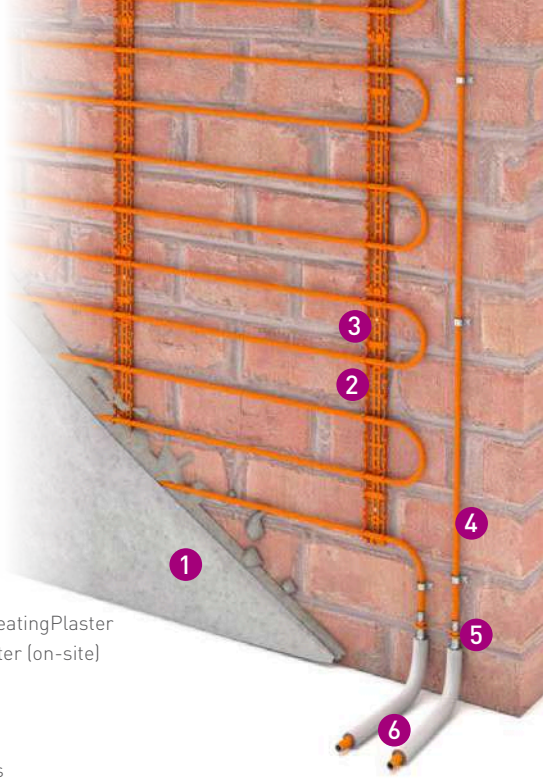
▲ New building example, structure from the inside out:
- 27 mm plaster incl. EasyFlexWall
- 300 mm vertically perforated bricks
- 150 mm thermal insulation
- exterior plaster/paint



▲ Old building example, structure from the inside out:
- 27 mm plaster incl. EasyFlexWall
- 50 mm wood-wool construction panel
- 2 × 250 mm NF bricks
- exterior plaster/paint

Advantages EasyFlexWall

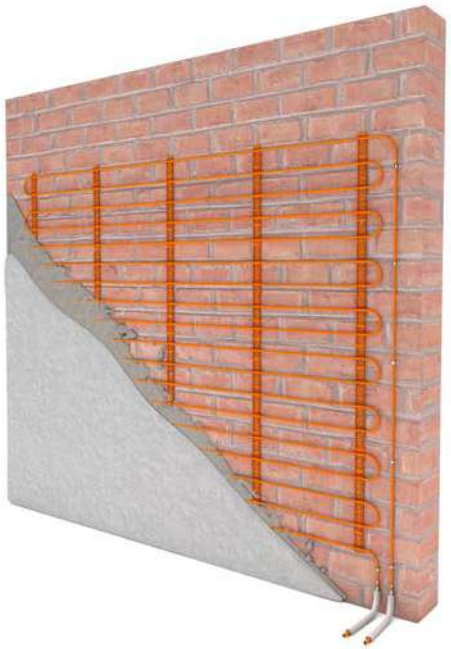
- As heating: large-surface, extremely energy-saving low-temperature system
- As cooling: silent, no draughts, saves energy
- Proven surface heating/cooling systems for plastered interiors
- Easy to locate the pipes using a pipe locator, thermofoil, or infrared camera
- IBO test mark of the Austrian Institute for Building Biology and Ecology



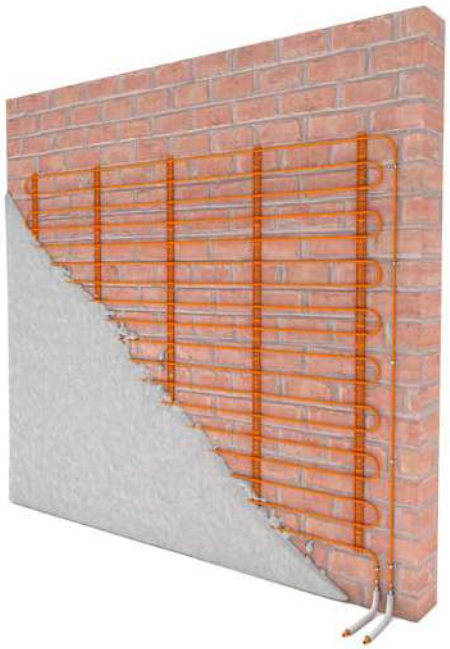
1. Plaster, e.g. EcoHeatingPlaster with finishing plaster (on-site)
2. VarioRail
3. ScrewFix
4. VarioProFile pipe
5. Press-fit couplings
6. Pre-insulated VarioModular pipe 16x2
   Alternative: Insulation hose

1.6 Description

The plastered wall heating / wall cooling system is an extremely energy-saving heating and cooling system. The pipe spacing distance is either 77 or 115 mm. Depending on the substructure, the VarioRails are mounted on the (exterior) wall using ScrewFix or nail anchors, and the VarioProFile pipe is mounted onto the VarioRails. Special retaining clamps are provided for fixing the return to the wall.



▲ EasyFlexWall EWHK77P/EWHK115P
(= with EcoHeatingPlaster)



▲ EasyFlexWall EWHK77/EWHK115

2 PRECONDITIONS

2.1 Warranty conditions

If installed or commissioned incorrectly, all claims on the basis of the manufacturer's warranty and guarantee become void.
This brochure (version dated 05/2024) is intended for authorised qualified personnel and constitutes part of our warranty!
All previous versions become invalid upon release of a new version! For the latest version please refer to the QR Code on the title page or www.variotherm.com.

Local, geographic and climatic regulations/standards for cooling, heating and electrical installations must be observed!

2.2 Information on standards

The validity of the standards referred to in these installation instructions was last checked on 24.04.2024.
If necessary, amendments to standards must be checked.

2.3 Transport/storage of goods

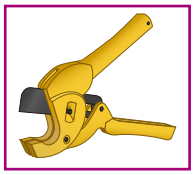
VarioProFile pipe 11,6x1,5
Leave the VarioModular pipes in the box as long as possible to avoid damage from dents and scratches. Damage of this kind has a detrimental effect on the creep behaviour.
The VarioModular pipes can be damaged by both atmospheric oxygen and UV rays and must not be stored outdoors.
At low temperatures (≤ 5 °C), the VarioModular pipe should be stored in heated rooms prior to processing.
To prevent the integrated VarioModular pipes being damaged during the construction phase by drilling or breaking work, clearly-visible warning labels must be affixed at appropriate points. Download in Service/Info Centre at www.variotherm.com.

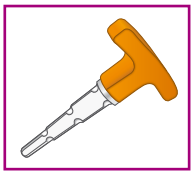
Pre-insulated VarioModular pipes
Same instructions as VarioProFile pipe 11.6x1.5.

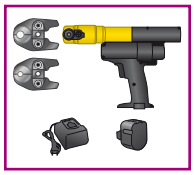
EcoHeatingPlaster
The EcoHeatingPlaster is supplied in 25 kg bags on pallets. Dry storage must be ensured until processing.
Maximum storage time 12 months from production date (see bag labelling).
Safety data sheet see www.variotherm.com (Service/Info Centre).

2.4 Tools

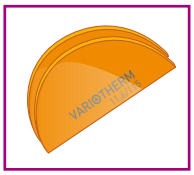
The following Variotherm tools are required/recommended for the installation work:


Pipe cutting pliers


Calibration and chamfering tool


Pressing tool

Bending model 11.6/77

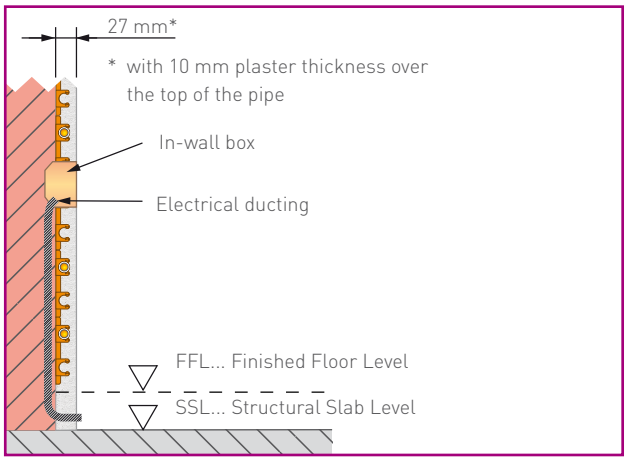


Bending model 11.6/115


Pipe uncoiler

2.5 Electrical installation / empty conduit

Before installing the EasyFlexWall, electrical ducting must be carried out. When installing the in-wall boxes, pay attention to the respective height level of the plaster.



▲ Section through the EasyFlexWall

2.6 Plaster substructure:

The plaster substructure must be tested in accordance with the ÖNORM B 3346, EN 13914-2 guidelines. The substructure must be frost-free, dust-free, non-water repellent (e.g. coatings, paints, etc.) but also not too absorbent, free from blistering, load-bearing, and free of loose particles.

Depending on the substructure and its absorbency, a spatterdash coat/primer should be applied over the entire surface to compensate absorbency.

Primer: BEFORE mounting the VarioRail and the VarioProFile pipe.
Spatterdash coat: AFTER mounting the VarioRail and the VarioProFile pipe.

The prerequisites for professional execution of the plastering work include:

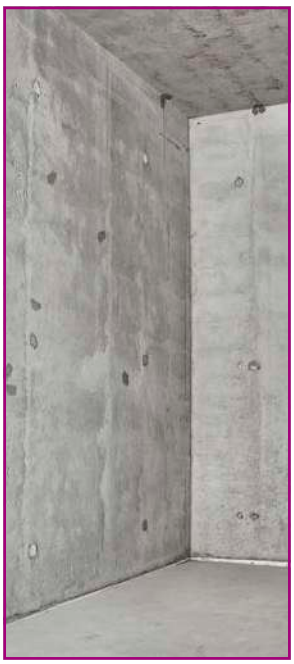
(1) Shell construction: material-compatible planning and execution
(2) Protection against moisture penetration (e.g. ÖNORM B 2204)
(3) Curing time of the building shell or brickwork: Compliance with the building-specific drying and curing times
(4) Measures for built-in elements: before plastering all metal parts at risk of corrosion must already be protected.
(5) Preparations:
- Even out defects and rough uneven areas
- Dry brush any efflorescence before laying the VarioProFile pipes
- Seal wall openings/joints in good time
- Finish any damaged areas
- Check old plasters for load-bearing capacity. Repair chipped areas.

The following standards must always be observed:
- Processing guideline for the plastering of wall heating systems of the ÖAP (Austrian Consortium for Plaster) (latest edition: www.oeap.at)
- ÖNORM B 2204
- EN 13914-2
- ÖNORM B 3346
- EN 998-1
- EN 1996

Typical substructures:

▲ Burnt bricks (vertically perforated bricks etc.)

▲ Aerated concrete blocks (Ytong etc.)



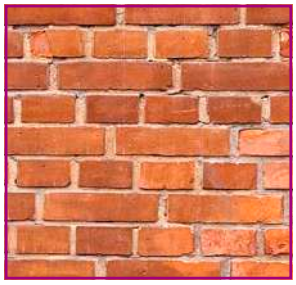
▲ Concrete

▲ Cement-bonded wood chip flue bricks

▲ CLT cross-laminated timber/solid wood walls

▲ Old plaster

▲ Concrete blockwork



▲ Solid bricks

▲ Old mixed brickwork

3 COMPONENTS & PROCESSING

3.1 VarioRail and fixing materials

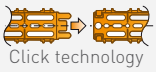
The **VarioRail** made of PE is used to slot in the VarioProFile pipe 11.6x1.5. It can be extended as required using a special click technology. Grid allows for 77 or 115 mm pipe spacing.

As a standard, the EasyFlexWall or VarioRail is installed up to a height of 2 metres* above the finished floor level (FFL).

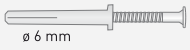
The VarioRails are fastened with **ScrewFix** or **nail anchors**.
Substructures for ScrewFix: Concrete masonry blocks, vertically perforated bricks (porous bricks), aerated concrete block.
Substructures for nail anchor: Concrete, solid bricks.

The plaster base or brickwork must be inspected before the VarioRails are mounted!
Areas in which the EasyFlexWall are to be installed must be even and dry. Their evenness must lie within the permissible range. Any uneven areas must be chipped off or evened out with an undercoat.
Further information on the plaster base inspection can be found in Section 2.6.

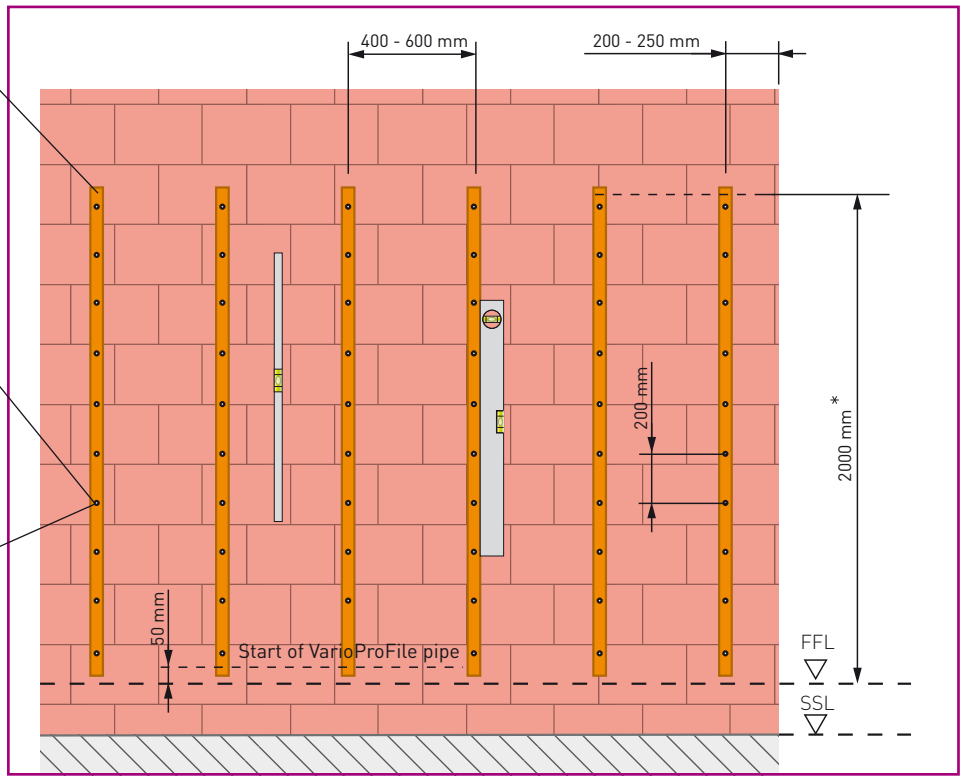
- VarioRail 11.6
- Part No.: V2722
- PKU: 1 m | Carton à 50 × 1 m
- Weight/PKU: 100 g
- Material: PE
- Panel thickness: 17 mm
- Pipe spacing: 77 or 115 mm



- ScrewFix
- Part No.: V2805
- PKU: 100 pcs.
- Weight/PKU: 540 g
- Dowel + screw
- For attaching the VarioRail and the retaining clamp (concrete masonry, vertical perforated brick [porous brick], aerated concrete brick)



- Nail anchor
- Part No.: V281
- PKU: 200 pcs.
- Weight/PKU: 1.3 kg
- For attaching the VarioRail and the retaining clamp (concrete, solid brick)

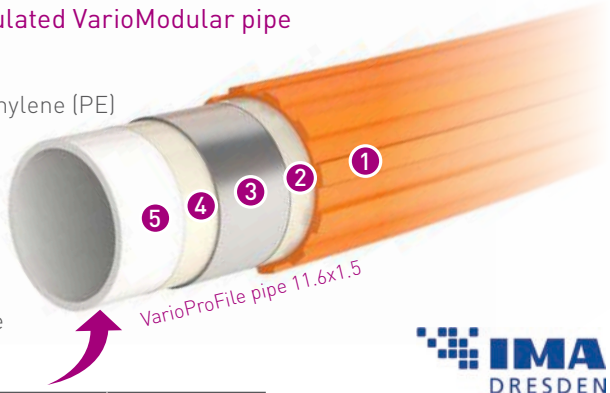


FFL... Finished Floor Level
SSL ... Structural Slab Level

* To optimise heating and cooling capacities, the EasyFlexWall can also be installed up to the ceiling. This also has a positive effect on the flow temperatures.

3.2 VarioProFile pipe / Pre-insulated VarioModular pipe

1. Temperature-resistance polyethylene (PE) **with profiled surface structure**
2. Adhesive layer
3. Homogeneous and solid aluminium pipe
4. Adhesive layer
5. Raised-temperature-resistance polyethylene (PE-RT)



IMA DRESDEN

Technical data	11.6x1.5	(pre-insulated) 16x2
Pipe diameter	11.6 mm	16.0 mm
Pipe wall thickness	1.5 mm	2.0 mm
Aluminium pipe thickness	0.15 mm	0.18 mm
Water content	0.058 l/m	0.113 l/m
Special narrow bending radius (use a suitable bending device)	30 mm	40 mm
Max. operating temperature [t_{max}]	70 °C	70 °C
Short-term resistant [t_{mal}]	95 °C	95 °C
Max. operating pressure [p_{max}]	6 bar	6 bar
Linear expansion coefficient	2.3×10^{-5} [K^{-1}]	2.3×10^{-5} [K^{-1}]
Mean heat conduction coefficient [λ]	0.44 W/mK	0.45* W/mK
Heat transmission resistance	0.0034 m²K/W	0.0045* m²K/W

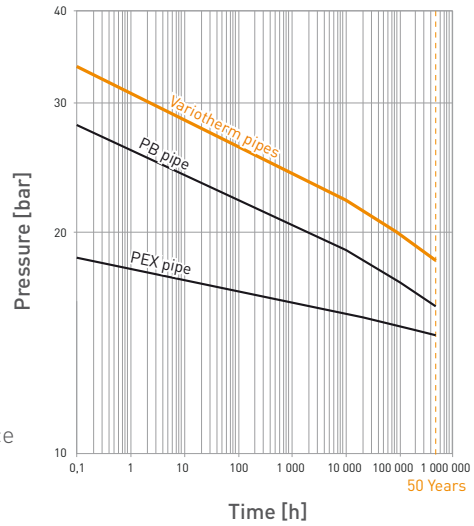
Pre-insulated VarioModular pipe 16x2 (supply pipe), Insulation thickness 6 or 9 mm

<< * Values without insulation

Advantages

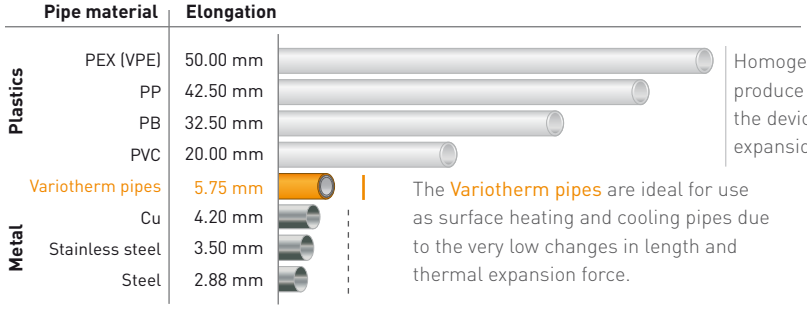
- Fully corrosion-free
- As light as a plastic pipe
- 10-year guarantee with certificate
- Optimum behaviour under long-term stress
- Profiled surface structure guarantees optimum heat transfer (10 % larger surface)
- Flexible, easy to bend, extremely good hydrostatic stability
- Resistant to hot water additives (inhibitors, antifreeze)
- Mirror-smooth inner surface – less pressure loss – no encrustation
- High pressure and temperature resistance
- 100 % oxygen diffusion-tight
- Lower linear coefficient of expansion, lower heat expansion forces
- Tested as per EN 21003

Creep behaviour



Elongation

with 10 m and temperature difference Δt 25 °C (e. g. 20 °C to 45 °C):



Homogeneous plastic pipes produce high stress levels in the device because of their expansion coefficient.

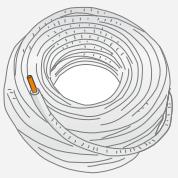
The Variotherm pipes are ideal for use as surface heating and cooling pipes due to the very low changes in length and thermal expansion force.

- VarioProFile pipe 11.6x1.5
- Part No.: VP116-100
- PKU: **Roll à 100 m**
  Pallet à 18 rolls
- Weight/PKU: 7.0 kg

- VarioProFile pipe 11.6x1.5
- Part No.: VP116-300
- PKU: **Roll à 300 m**
  Pallet à 12 rolls
- Weight/PKU: 18.0 kg

- VarioProFile pipe 11.6x1.5
- Part No.: VP116-500
- PKU: **Roll à 500 m**
  Pallet à 8 rolls
- Weight/PKU: 30.0 kg

- VarioProFile pipe 11.6x1.5
- Part No.: VP116-800
- PKU: **Roll à 800 m**
  Pallet à 5 rolls
- Weight/PKU: 44.8 kg

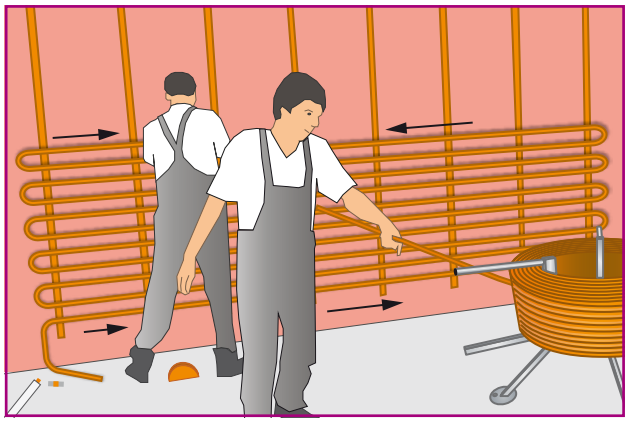


- Pre-insulated 16x2 Variomodular pipe
- Part No.:
  V1226 (**6 mm Insulation**)
  V1227 (**9 mm Insulation**)
- PKU: Roll with 100 m
- Weight/PKU:
  14.0 kg (6 mm Insulation)
  14.9 kg (9 mm Insulation)
- Insulation: Polyethylene soft foam
  Fire resistance as per EN 14313: CL-s1,d0

- Retaining clamp
- Part No.: V2801
- PKU: 50 pcs.
- Weight/PKU: 200 g
- For affixing the VarioProFile pipe in the return of the wall

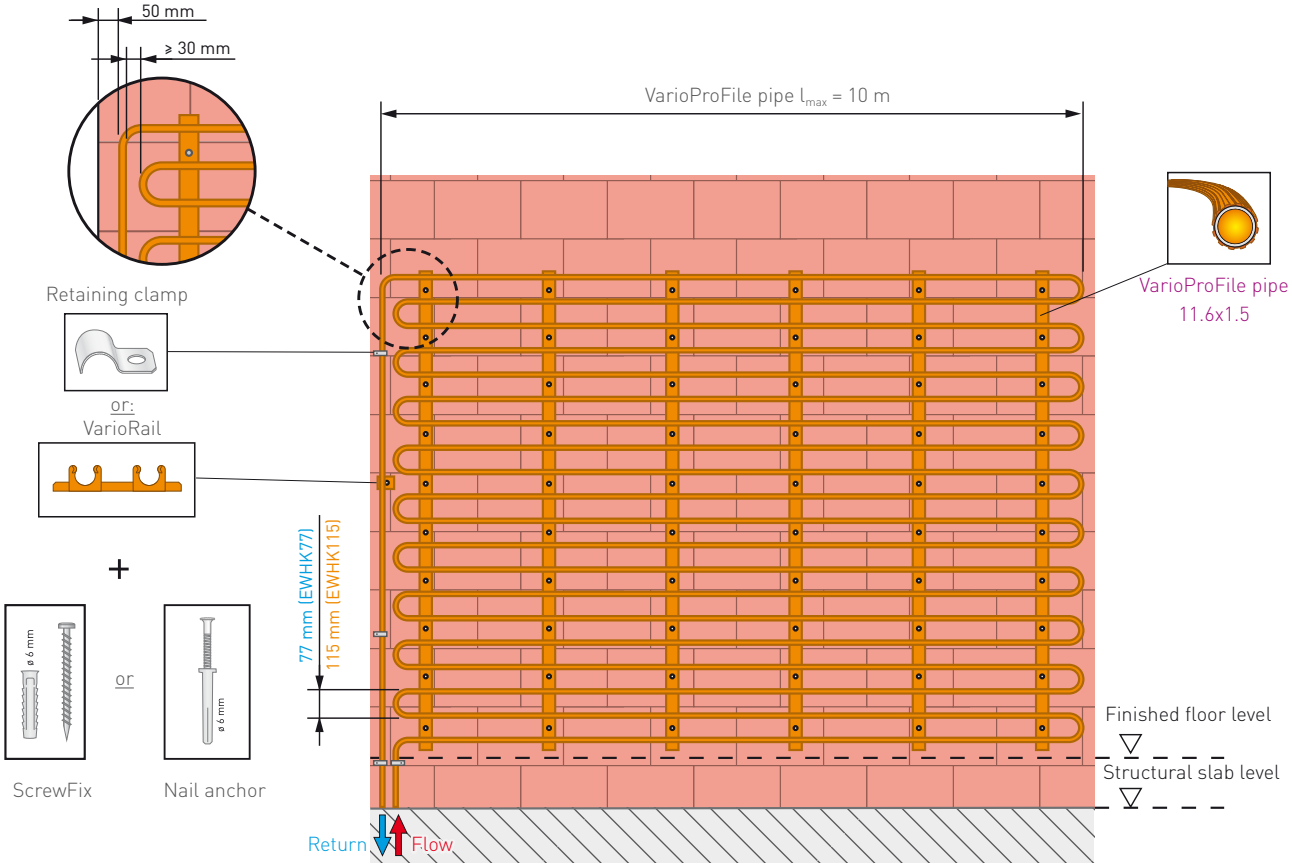
Installation

- Do not make any kinks in the pipe!
- With a room temperature of over +5 °C, the pipes can be bent manually without pre-warming
- Starting below, insert VarioProFile pipe (Flow) into VarioRail
- As pipe length guide, there are marks on every metre on the VarioProFile pipes (e.g. >I< 127 m)
- Lay without twisting, and use a pipe uncoiler.
- Distance between pipes: 77 resp. 115 mm (exceptions: sockets, windows etc.)
- Leave approx. 50 mm distance to adjacent walls



Maximum 11.6 mm pipe length per heating/cooling circuit
80 m (pay attention to the pump design!)

Pipe requirement	
EWHK77 (pipe spacing 77 mm)	13 m/m²
EWHK115 (pipe spacing 115 mm)	8.7 m/m²



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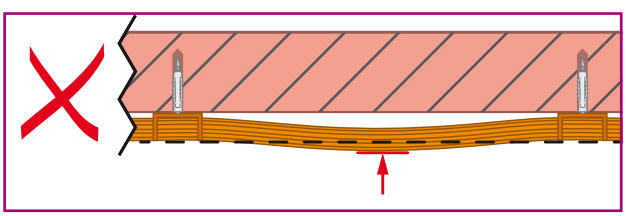
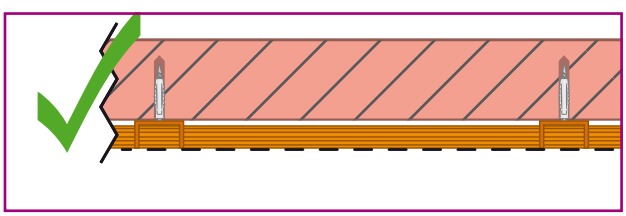
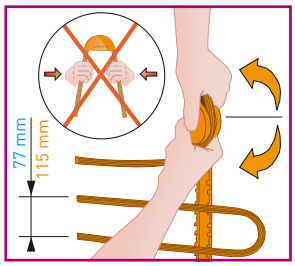




Bending small radii

Use the bending models 11.6/77 (EWHK77) or 11.6/115 (EWHK115) for the 180° return loops and 90° corners. During bending, the pipe must be securely positioned in the groove of the bending model. Manual bending without heating is possible at room temperatures above +5 °C. For lower temperatures, the VarioProFile pipe is pre-heated (store in a warm place).

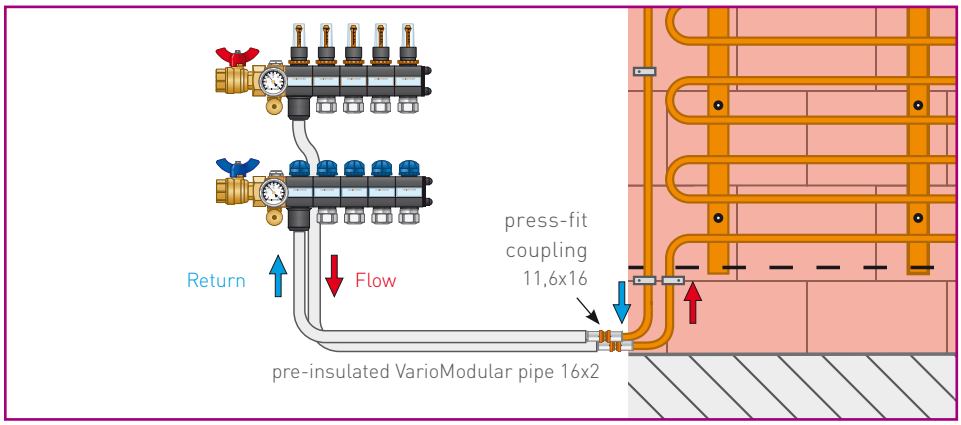
Caution! During bending, the technician's hands must be as close as possible to the bending model in order to prevent kinks from forming (visual inspection)! >>



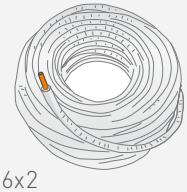
- Bending model 11.6/77
- Part No.: V46
- PKU: 1 pce.
- Weight/PKU: 40 g
- For pipe spacing 77 mm
- For easy, manual bending of 90/180° bends

- Bending model 11.6/115
- Part No.: V47
- PKU: 1 pce.
- Weight/PKU: 80 g
- For pipe spacing 115 mm
- For easy, manual bending of 90/180° bends

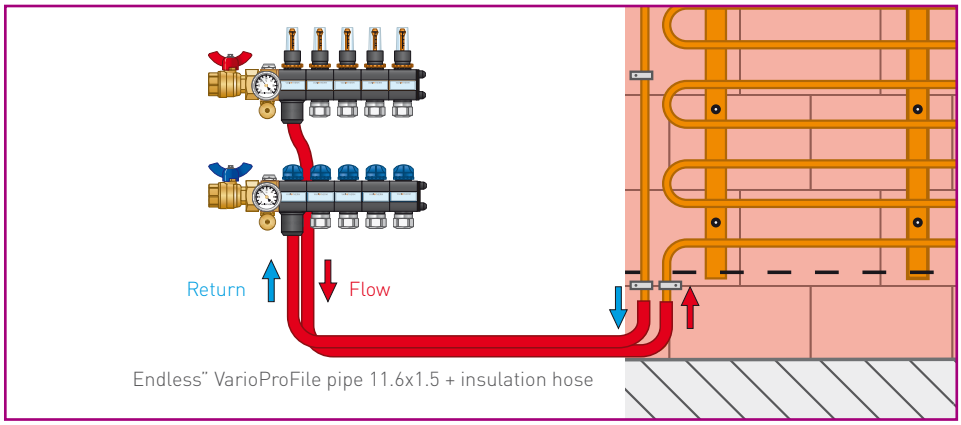
Supply line



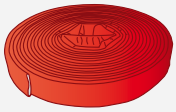
▲ Variant with pre-insulated VarioModular pipe 16x2 with press-fit coupling connection 11.6x16



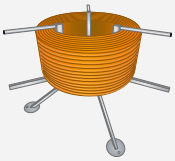
- Pre-insulated VarioModular pipe 16x2
- Part No.:
  V1226 (**6 mm insulation**)
  V1227 (**9 mm insulation**)
- PKU: roll à 100 m
- Weight/PKU:
  14.0 kg (6 mm insulation)
  14.9 kg (9 mm insulation)
- Insulation: Polyethylene soft foam, fire resistance as per EN 14313: CL-s1,d0



▲ Variant with Insulation hose 4 mm: "Endless" VarioProFile pipe 11.6x1.5

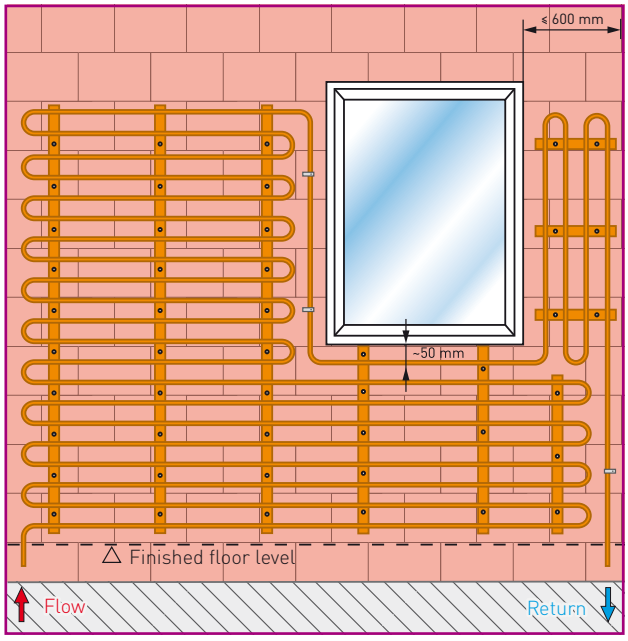


- Insulation hose
- Part No.: Z24
- PKU: roll à 20 m
- Weight/PKU: 170 g
- Insulation: 4 mm
- Fire resistance as per EN 14313: EL,d0

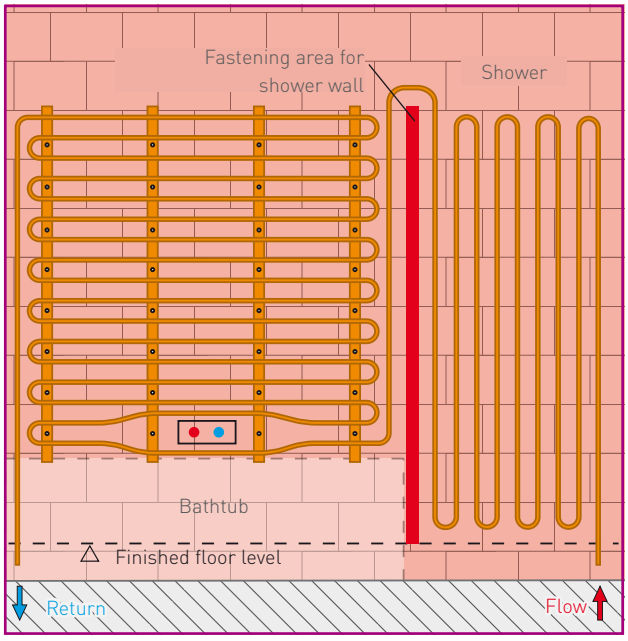


- Pipe uncoiler
- Part No.: W002
- PKU: 1 pce.
- Weight/PKU: 16.3 kg
- For twist-free unrolling of Variotherm pipes
- Ball bearing
- Fixable adjusting feet
- for rolls 100, 300, 500 and 800 m

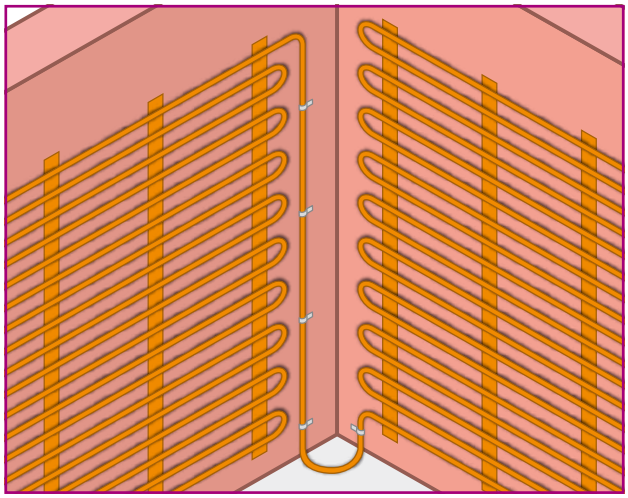
Special pipe laying



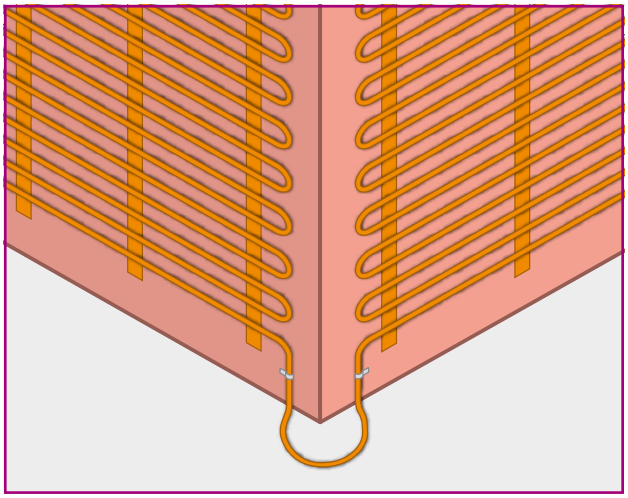
▲ Example for window area



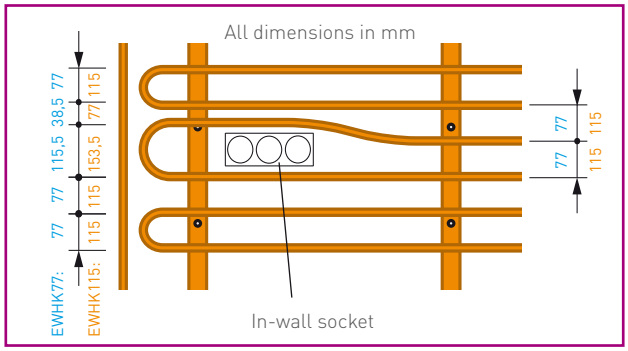
▲ Example for bathroom



▲ Special case inner corner

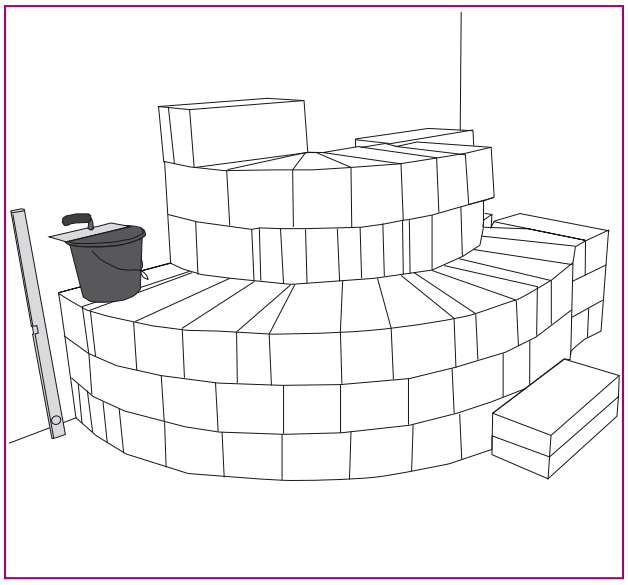


▲ Special case outside corner

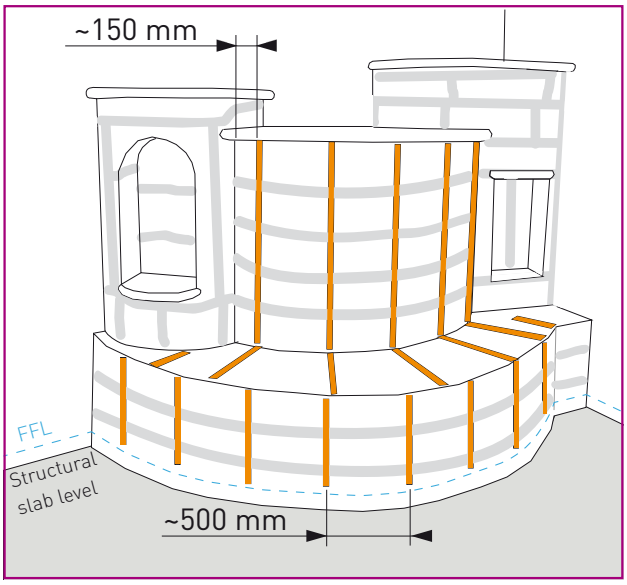


▲ For installations (sockets, windows, etc.), a smaller/larger section-wise spacing is permissible.

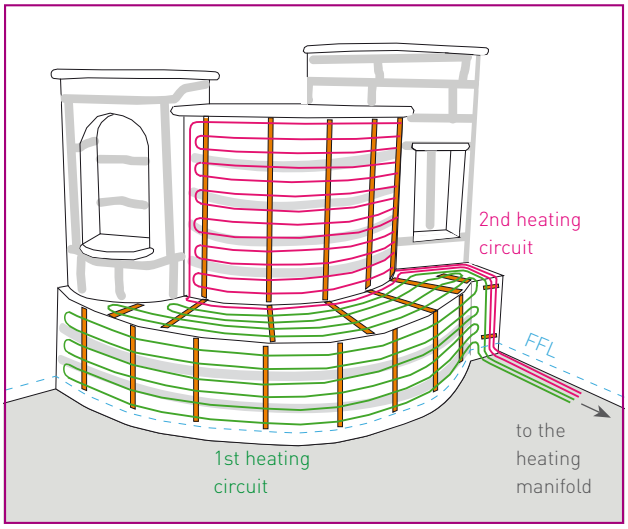
EasyFlexWall as a cosy corner / cosy bench



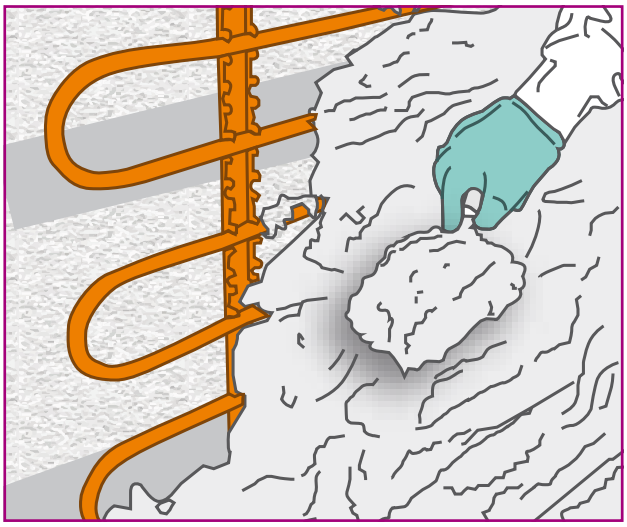
▲ First, build the substructure (e. g. with porous concrete)



▲ Install the VarioRails
(FFL ... Finished Floor Level)



▲ Install the VarioProFile pipe 11.6x1.5



▲ For instructions on plastering, see chapter 4

▲ Completed cosy bench

- Calibration and chamfering tool
- Part No.: W042
- PKU: 1 pce.
- Weight/PKU: 140 g
- For calibrating and chamfering the Variotherm pipes

- Pipe cutting pliers
- Part No.: W037
- PKU: 1 pce.
- Weight/PKU: 230 g
- For trimming the Variotherm pipes
- Replacement blade: W0371

- AkkuPress Mini
- Part No.: W019
- PKU: 1 pce.
- Weight/PKU: 9.9 kg
- Incl. sheet steel case, Press-fitting jaws TH16 Mini & TH11,6 Mini, 2 pcs. Li-Ion batteries + charger

- Press-fitting jaw TH11,6 Mini
- Part No.: W031
- PKU: 1 pce.
- Weight/PKU: 1.5 kg

- Press-fitting jaw TH16 Mini
- Part No.: W032
- PKU: 1 pce.
- Weight/PKU: 1.6 kg

- Press-fit couplings 11.6x11.6
- Part No.: Z1600
- PKU: 1 pce.
- Weight/PKU: 30 g
- Press-fit contour: TH(11.6)

- Press-fit couplings 16x11.6
- Part No.: Z1610
- PKU: 1 pce.
- Weight/PKU: 45 g
- Press-fit contour: TH(11.6 & 16)

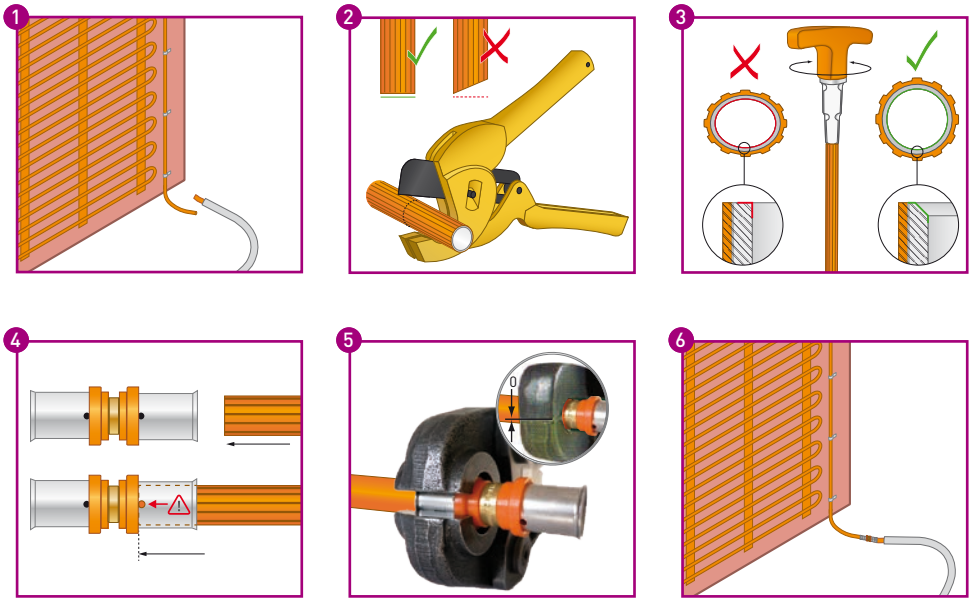
- Cold shrink tape
- Part No.: Z1699
- PKU: 1 pce. | Carton à 20 pcs.
- Weight/PKU: 990 g
- Roll: 50 mm × 15 m
- 1 roll is sufficient for approx 35 press-fit coupling connections (with a 50 % overlap)

3.3 Press-fit couplings / Pressing tools

If the pre-insulated VarioModular pipe was selected as the supply line variant, the VarioProFile pipes 11.6x1.5 and the pre-insulated VarioModular pipe 16x2 (supply line) are pressed together using a press-fit coupling 16x11.6. For processing residual pipe lengths or for repairs, the VarioProFile pipes 11.6x1.5 can be permanently and securely connected to each other using a press-fit coupling 11.6x11.6. A lasting, secure connection is only guaranteed if original Variotherm system components are used:

- VarioProFile pipes or pre-insulated VarioModular pipes
- Variotherm calibration and chamfering tool
- Variotherm press-fit couplings and Variotherm pressing tools

The press-fitting pliers and drive unit must be checked at least once a year for correct operation by REMS or an authorised REMS customer service workshop.



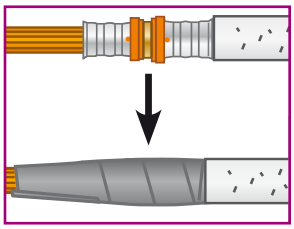
▲ Push on the press-fit coupling until it reaches the stop

▲ Pressing. The press-fitting jaw must close fully.

▲ Ready connected EasyFlexWall

The relevant operating instructions for the pressing tools are included with the appliances.

Corrosion prevention measures/ dew-point monitoring
The connecting elements are to be protected (after the pressure test) in accordance with EN 1264 and compliance with ÖN H 5155 (e.g. with Z1699 cold shrink tape). This measure is also a prerequisite for effective dew-point monitoring in the case of cooling (see also Chapter 3.6)



3.4 EcoHeatingPlaster

The Variotherm EcoHeatingPlaster has been developed for use as a **base coat plaster** for the EasyFlex wall heating/cooling (EWHK77P, EWHK115P), for a plastering thickness (incl. heating pipe) of up to 25 mm. It is a natural material, with excellent environmentally-friendly characteristics verified by the IBO (Austrian Institute for Building Biology and Ecology) quality seal.

Advantages

- Purely organic material
- Permeable to water vapour
- Hygroscopic
- Shock resistant
- Good adhesive properties
- Premixed hydraulic dry mortar. Classification: GP, PM2, W3
- High thermal conductivity – about 10–25 % better than "normal" plasters
- Good heat storage properties due to the extremely high oven-dry density of 1500 kg/m³
- Good condensation properties with cooling function
- Smooth application – suitable for machine and manual application (e. g. plaster machine G4)
- Guaranteed heat dissipation values for the whole system

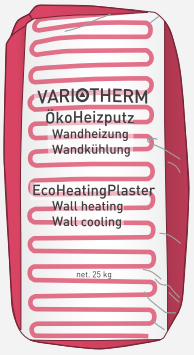
Components

Plaster sand, additives, trass. What is trass? Volcanic tuff prepared in a drying and grinding process. The main components are silica and clay. Apart from water, no other additives need to be added at the construction site. The plaster cures hydraulically. Only air and water are required for curing.

Technical data

Maximum grain size:	2 mm
Compressive strength (28d):	> 3 N/mm²
Flexural strength (28d):	> 1 N/mm²
Thermal conductivity λ:	0.82 W/mK
Acid capacity (m value):	12.4
Oven-dry density (28d):	approx. 1500 kg/m³
Fresh mortar bulk density:	approx. 1700 kg/m³
Water requirement:	approx. 5–6 litre per bag (25 kg)
Material consumption:	approx. 34 kg/m²
Minimum plaster thickness:	10 mm
Maximum plaster thickness:	25 mm
Maximum flow temperature:	55 °C
Packaging:	25 kg per bag; 42 bags per EU pallet
Maximum length of storage:	12 months from the production date (see stamp on the bag

Safety data sheet "EcoHeatingPlaster", available from www.variotherm.com/en/service/info-centre.html

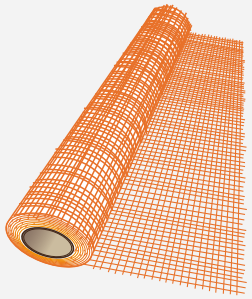


- EcoHeatingPlaster
- Part No.: V270
- PKU: 1 bag | Pallet à 42 bags
- Weight/PKU: 25 kg
- purely organic material
- IBO certified

>> For more information on applying the EcoHeatingPlaster and plaster lattice, see chapter 4.

3.5 Plaster lattice

The plaster lattice is integrated into the skim coat/finish coat plaster to effectively reduce the risk of cracking. Special glass fibre cloth, 6 × 6 mm mesh size, maximum tensile load 2000 Nm/5 cm, tested as per DIN EN 12127 and DIN EN ISO 13934-1. See also Chapter 4.2.

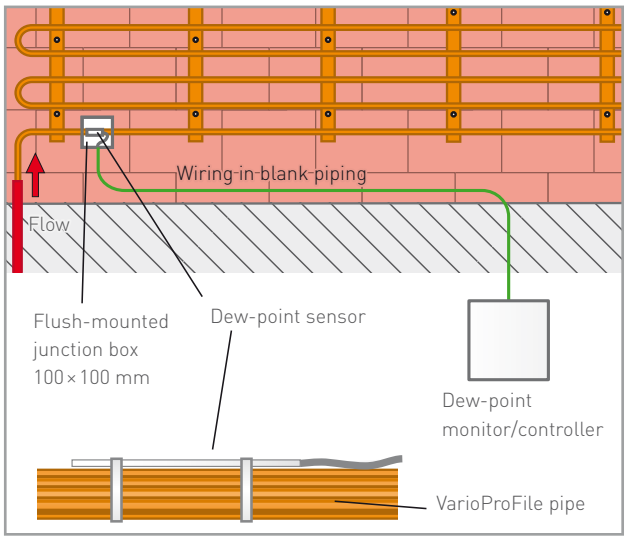


- Plaster lattice 6 × 6 mm
- Part No.: V274
- PKU: Roll à 50 m²
- Weight/PKU: 8.6 kg
- Special glass fibre cloth

3.6 Dew-point monitor (on-site)

The dew-point sensor is fitted to the part of the pipe that is expected to dew first. This is normally the case on the flow inlet.
Care must be taken that there is a good thermal transition between the pipe and the sensor (use heat-conducting paste if necessary).
The supply pipes must be sufficiently fixed.

For further information on the dew point, see also Chapter 5.4.

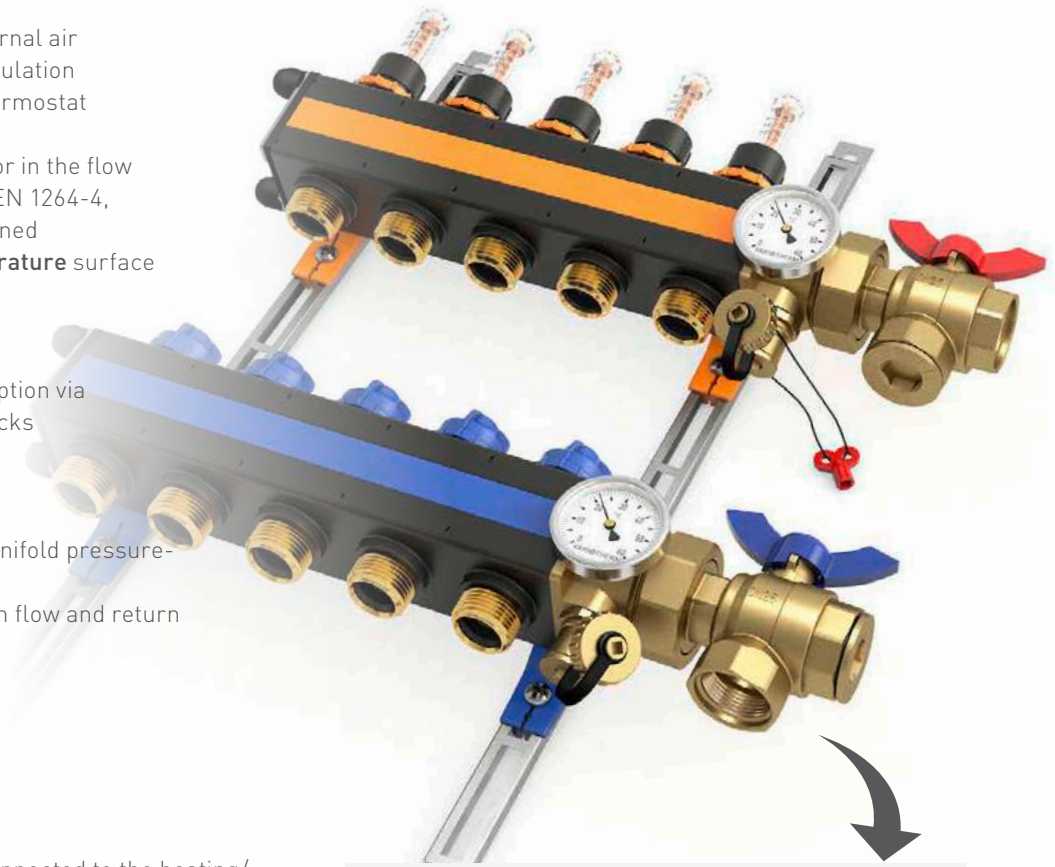


▲ Example Dew-point monitor (cooling)

3.7 VarioManifold

Advantages

- Plastic manifold with internal air chambers for thermal insulation
- Flexible conversion to thermostat operation
- Pre-settable flow indicator in the flow (10-160 l/h) according to EN 1264-4, viewing glass can be cleaned
- Optimised for **low-temperature** surface heating/cooling
- Detachable 3 port valves on the flow and return
- Venting option, flushing option via rotatable fill and drain cocks
- Modular construction
- Absolutely oxygen-tight
- Designation labels
- All parts self-sealing, manifold pressure-tested
- Variable distance between flow and return bars



Pressure test

Once all circuits have been connected to the heating/cooling manifold, the system can be filled downstream of the manifold and pressurised. The pipes must be kept under water pressure prior to completion work (Screed, filling, painting, wallpapering, tiling), so that any damage becomes immediately visible. (Please see Chapter 6.1 for the protocol Leak-tightness test).

For details regarding the system and heating circuit pipes and the room temperature control please refer to the VBOOK9 planning and installation instructions, "DISTRIBUTION and CONTROL"

PDF

4 PLASTERING

4.1 Types of plaster

The most common types of plaster are mineral plasters. There are however, relevant differences:

Lime-cement plasters
- Main components lime, cement, sand.
- High strength and therefore well suited for surfaces subject to heavy use.
- Open to diffusion and ensuring a good indoor climate.
- Insensitive to moisture
- High thermal conductivity (λ = 0.5-0.85 W/mK)
- Dry bulk density 1400–1700 kg/m³

Clay plasters
- Main components clay, sand.
- Naturally regulating properties, as clay can absorb and release moisture.
- Open to diffusion and ensuring a good indoor climate.
- Low strength and therefore less suitable for surfaces subject to heavy use.
- Very high thermal conductivity (λ = 0.6–1.1 W/mK)
- Dry bulk density 1300–1900 kg/m³

Lime plasters
- Main components: lime, sand.
- Has similar diffusion-open and regulating properties as clay plaster.
- Is not as hard as lime-cement plaster and is therefore less suitable for surfaces subject to heavy use.
- Suitable for wet rooms.
- High thermal conductivity (λ = 0.4–0.8 W/mK)
- Dry bulk density 1300–1450 kg/m³

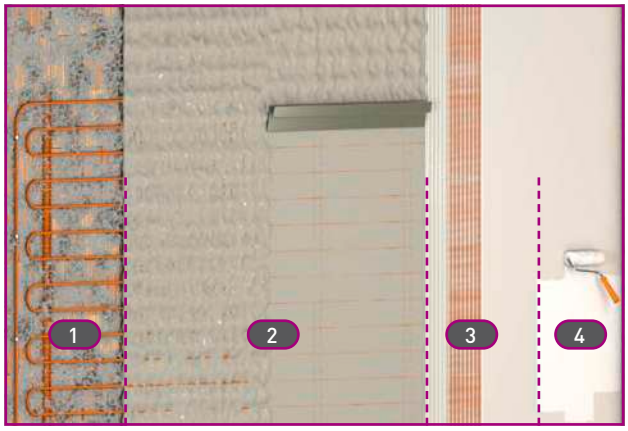
Gypsum plasters
- Main components gypsum, (lime), sand.
- Dries quickly
- Not suitable for wet rooms or surfaces subject to heavy use
- Low thermal conductivity (λ = 0.3–0.7 W/mK)
- Dry bulk density 800–1400 kg/m³

Variotherm EcoHeatingPlaster
- Main components like lime-cement plaster, but additionally with trass (see also Section 3.4)
- Properties like lime-cement plaster, but with improved dry bulk density (1500 kg/m³) for optimum heat transfer.
- Optimum moisture regulation thanks to trass
- High thermal conductivity (λ = 0.82 W/mK)

4.2 Plastering the EasyFlexWall

As soon as all pipes have been properly laid and checked for leaks, plastering can begin. As the EasyFlexWall usually has a total plaster thickness of 27 mm, it is usually plastered in two or more layers.

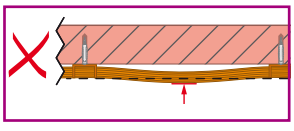
Typical procedure for plastering the EasyFlex wall heating/cooling:
1. Check and prepare the plaster base. If necessary apply spatterdash coat/primer (Section 2.6)
2. Apply down the first layer of plaster to the Vario-Rails / top of the pipe, e.g. Variotherm EcoHeating-Plaster.
3. Apply the second layer of plaster/filler up to a total pipe coverage of 10 mm – incl. plaster lattice within the outermost third of the surface.
4. Finishing work (sanding, painting, etc.)

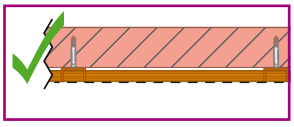


Due to different plaster types and manufacturers' guidelines, this planning and installation guide deals mainly with plastering in combination with Variotherm EcoHeatingPlaster. Other plasters are applied in a similar way, but may differ in certain details. The respective manufacturer's instructions must be observed here!

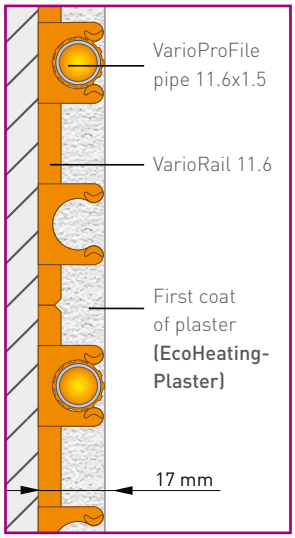
1 Check and prepare the plaster base

Depending on the substructure and its absorbency, a spatterdash coat/primer should be applied over the entire surface to compensate absorbency. See in this context Section 2.6.





2 Applying the 1st coat of plaster (e.g. Variotherm EcoHeatingPlaster)



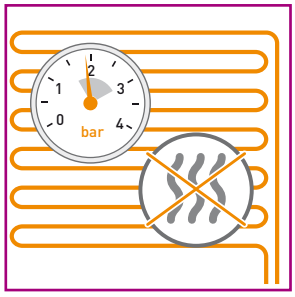
General Information

- An air, plaster base, and material temperature of above +5 °C must be maintained during the plastering work and for at least 2 days afterwards.
- The VarioProFile pipes are not heated during plastering but pressurised (1.5 to 3 bar).
- Proper curing requires sufficient air exchange but dehumidification must not be too rapid.
- Rapid heating of the Variotherm EcoHeatingPlaster or the use of dehumidification systems is not permissible.
- If there is any risk of too rapid drying, the EcoHeatingPlaster surface must be kept moist accordingly.

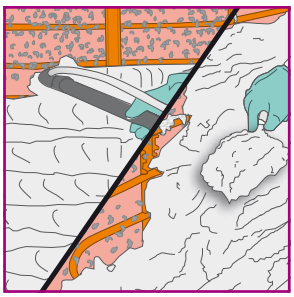
Mixing water

Water from the municipal water supply can be used for tempering. Water from other sources must be checked accordingly. The temperature of the tempering water must not exceed 25 °C. Mix 25 kg of EcoHeatingPlaster with 5–6 litres of water.

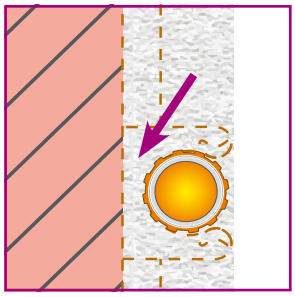
Example for plaster machine for EcoHeatingPlaster	
Plaster machine:	G4
Worm drive:	D6-3
Nozzle:	for interior plaster
Tube:	inner diameter 25 mm



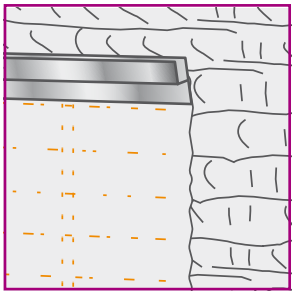
Leak-tightness test according to Section 6.1. Then maintain operating pressure, but do not preheat!



Machine or manual application of the first coat of plaster



First coat of plaster also behind the VarioProFile pipe!

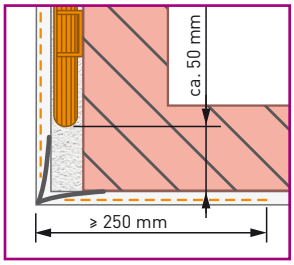


Skim down the first coat of plaster to the level of the VarioRail above the top of the pipe!

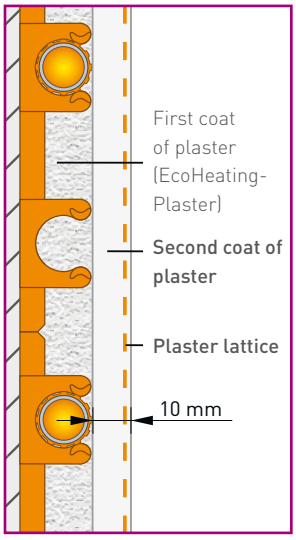
Prior to applying the second coat of plaster: Processes such as the required drying or hardening of the first coat of plaster must always be checked by the processor/plasterer and adjusted to the product of the second coat (observe manufacturer's instructions!).

Notes on corner guards

Protruding corners can be protected with corner guards. These are installed after the first coat of plaster (e.g. EcoHeatingPlaster).
The corner guards are applied to the outer plaster layer using a suitable adhesive (e.g. adhesive mortar). They are covered by the second coat, whereby the mesh of the corner guard serves as a reinforcement of the immediate area. The plaster lattice (– – –) is inserted from both sides up to the edge.



3 Applying the 2nd coat of plaster



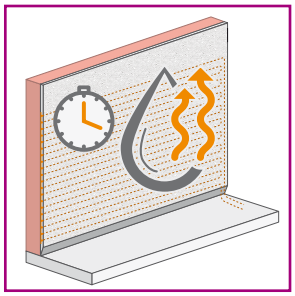
The **second coat of plaster is applied on site according to the manufacturer's instructions** on the first coat of plaster.

General Information:

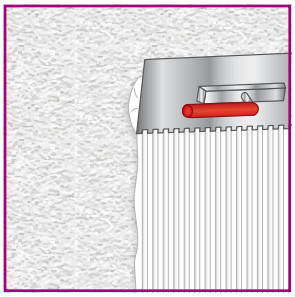
- The plaster thickness including the integrated plaster lattice is usually 10 mm over the top of the pipe.
- To improve the interior climatic properties, Variotherm recommends the use of clay, lime or lime-cement plasters/levelling compounds with:
  - Dry bulk density ≥ 1200 kg/m³
  - Maximum grain size: 1.2 mm
  - Compressive strength: < 3 N/mm²
- A "wet-on-wet"/"fresh-in-fresh" application of the second coat of plaster is possible if the first and second coats of plaster are the same product (no EcoHeatingPlaster!). With this special application, it is particularly important to follow the manufacturer's instructions exactly! Especially with regard to layer thicknesses and drying times!

3a Variant with skim coat

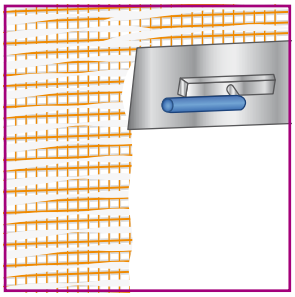
Skim coat products can be used in combination with Variotherm EcoHeatingPlaster.



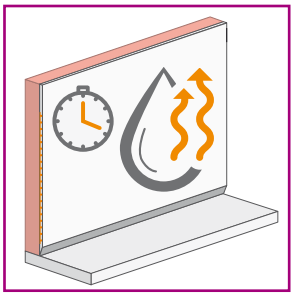
Allow EcoHeatingPlaster to dry (1 day/mm plaster application).



Apply skim coat according to manufacturer's instructions and the plaster lattice[1] ...



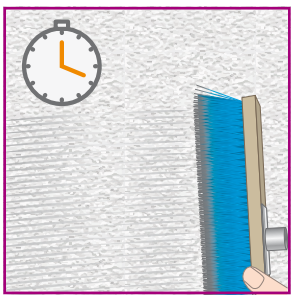
... work in and cover all sides with levelling compound.



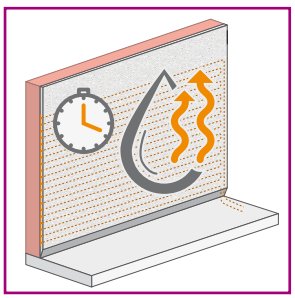
Drying time according to manufacturer's instructions

3b Variant with finish coat plaster

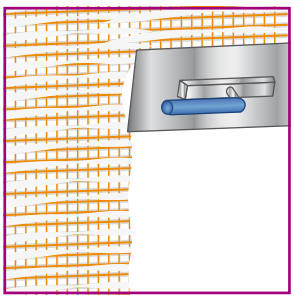
Finish coat plasters can be used in combination with Variotherm EcoHeatingPlaster.



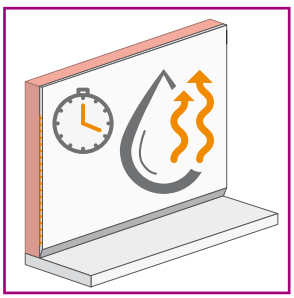
Allow EcoHeatingPlaster to set (6–9 hours) and roughen the surface slightly. **Do not damage the VarioProFile pipe!**



Allow EcoHeatingPlaster to dry (1 day/mm plaster application).



Apply finish coat plaster according to manufacturer's instructions and insert plaster lattice[1] close to the surface.

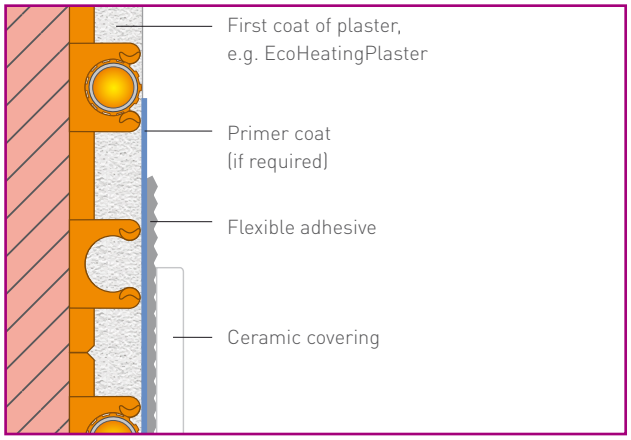


Drying time according to manufacturer's instructions

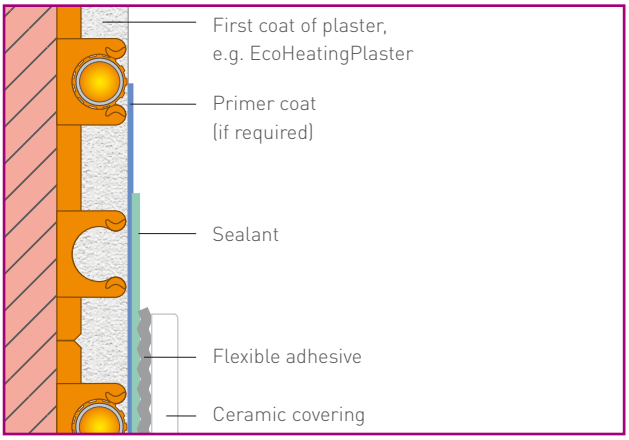
[1] A correctly applied plaster lattice can effectively reduce the risk of cracking.

3c Laying ceramic coverings (instead of a second coat of plaster)

Ceramic coverings, such as tiles, can be applied directly on the first coat of plaster (e.g. EcoHeatingPlaster) The first coat of plaster must be fully dried before applying the ceramic coverings. Preheating according to the preheating protocol (see Section 6) is recommended prior to applying the ceramic coverings. The respective moisture classes (loading groups W1 to W6) must be observed for the application of ceramic coverings.



▲ Example for loading classes W1/W2



▲ Example for loading classes W3/W4

Use of primer and sealing system (compound sealing):

Stress group according to ÖN B 3407		Primer	Sealing system
W1	Residential sector: living rooms, corridors, toilets, offices and the like	Not required (cement flexible adhesive mortar)	Not required
W2	Residential sector: kitchen and rooms with similar usage Commercial sector: toilet systems	Not required (cement flexible adhesive mortar)	Not required
W3	Wall and floor surfaces without drainage (e.g. bathroom with shower tub higher than 20 mm above floor covering), toilet systems without floor drainage, porch	In addition to sealing system if recommended by the manufacturer	Required
W4	Wall and floor surfaces with drainage (e.g. shower with flush drain at the same level as the floor)		
W5	Swimming bath area, shower systems, industrial kitchen ...		
W6	Exterior surfaces	EasyFlexWall cannot be used!	

Product examples[1] for primer or sealing system (compound sealing):

Manufacturer		Primer	Sealing system W3	Sealing System W4 (confirm W5 with manufacturer!)
ARDEX	Ardex	Not required	S1–K Plus	Ardex 8+9
CIMSEC	Cimsec	Grundierung	Dichtflex	2K Abdichtung CL69
MUREXIN	Murexin	Primer LF1	Fluid foil 1KS	Fluid foil 2KS
SCHÖNOX	Schönox	Not required	Schönox HA Pro	1K DS Premium
KEMA	Kema	Kemagrund S	Hidrostop DP	Hidrostop Vario
Ceresit	Ceresit	CT 17 Primer	CL 51 Express 1-K	CL 50, CL 69 Ultra-tight

[1] Please observe the relevant manufacturer's instructions

4 Finishing work (sanding, painting, etc.)

Preheating according to Section 6.2 is recommended prior to starting the finishing work.
The manufacturer's instructions must be observed!

5 HEATING/COOLING PRACTICE

5.1 Calculation of the heating and cooling load

The EN 12831 standard with the respective national annex applies to the heating load calculations for the heated rooms.
Every room is considered individually. For the outside temperature, the locally acquired and standardised outdoor temperature T_{ne} is used.

Variotherm also conducts cooling load calculations (subject to a fee) according to the new VDI 2078 guideline. For calculation purposes, precise information must be provided on the building and the rooms to be cooled (U-values with layer composition, shading, internal loads). This is the precondition for useful, accurate results.

5.2 Variotherm Dimensioning software

Key values for individual heating/cooling circuits (the amount of water, pressure loss, number of circuits, allocation of the manifolds etc.) can be quickly and easily calculated by inputting the cooling or heating load into the Variotherm dimensioning software. It can be found in our Professional Area at:
www.variotherm.com/professional.

Übersicht der Bauteile

Code	Bezeichnung	U-Wert W/m²K	Rges m²K/W	Rsi m²K/W	Rse m²K/W	R-Baut m²K/W
AF01	Außenfenster	1.100	0.909	0.130	0.040	0.739
AT01	Außentür	1.700	0.588	0.130	0.040	0.418
AW01	Außenwand	0.220	4.545	0.130	0.040	4.375

Raum Nr.	Bezeichnung	Θ_{Int} °C	A_R m²	Φ_{Te} W	Φ_T W	Φ_V W	$\Phi_{Netto/m²}$ W	$\Phi_{Netto/m²}$ W	Φ_{Netto} W	Φ_{RH} W	Φ_{HL} W
Haus, EG			180.88	5427		3396			9160	0	9160
00.001.001	Eltern	20.0	29.10	833	833	501	46	15	1335	0	1335
00.001.002	Kinder	20.0	20.49	762	762	343	54	19	1106	0	1106
00.001.003	Vorraum	20.0	24.40	571	571	409	40	14	980	0	980

▲ Extract from a heating load calculation

Bezeichnung	Fläche m²	Kühllast W	Kühllast W/m²	t_{Raum} °C	$t_{op. Raum}$ °C
Schlafzimmer	21.70	-1601	-73.76	24.0	23.9
Wohnen, Kochen, Essen	84.50	-2906	-34.39	24.0	24.8
Wirtschaftsraum	13.00	-455	-35.01	24.0	24.6
WC	4.60	-73	-15.89	24.0	24.1
Corridor + Stiege	29.40	-1822	-61.96	24.0	25.4
Lounge + Stiege	22.00	-459	-20.85	24.0	24.3
Küche II (Pantry)	30.50	-956	-31.35	24.0	24.8
Vorraum	10.00	-239	-23.94	24.0	24.5
Küche II (Pantry)	14.00	-414	-29.55	24.0	24.6
Gästezimmer 1	23.50	-613	-26.08	24.0	24.6
Flur + Stiege	12.40	-342	-27.59	24.0	24.6
Gästezimmer 2	28.70	-746	-25.98	24.0	24.5
	294.30	**-10625**	**-36.10**		

▲ Extract from a cooling load calculation

Dimensioning of Variotherm Heating Systems

Building project: Mustermann ZIP: 2544 City: Leobersdorf Date: Processed by: AS

No.	Room name	Floor space A [m²]	Maximum length Trench/Skirting Heating L [m]	Heating load Q [W]	Supplement heating load Suppl. [%]	Heating load incl. Supplement Q+Suppl. [W]	Room temp. ti [°C]	Heating system	Floor covering [kN] or pipe covering [mm]	Dimensioning temperature tf/tr [°C]	Mathematical Dim.	Unit	Type	Practical No. of circuits	Dim.	Unit	Type	Residual performance	FH to (Ti=20) [°C]	Supply pipe	Supply line length per circuit [m]	Pressure loss per circuit [mWC]	Flow quantity per circuit [kg/h]	Distribution manifold number	Calculation of pressure loss and flow rate (see manual)
G.F.	Room 1	12,50		566		566	20	EasyFlexWall		35/28	8,20	m²	EWHK115	2 1	5,00	m²	EWHK77	304	-			1,14	54	•1	
G.F.	Room 2	14,50		655		655	20	EasyFlexWall		35/28	9,49	m²	EWHK115	2 1	6,00	m²	EWHK77	389	-			1,88	65	•1	
G.F.	Kitchen	12,00		610		610	20	EasyFlexWall		35/28	8,84	m²	EWHK115	2 1	4,90	m²	EWHK77	243	-			1,07	53	•1	
G.F.	Living room	25,00		1250		1250	22	EasyFlexWall		35/28	23,58	m²	EWHK115	4 1	5,00	m²	EWHK77	90	-			0,75	42	•1	
G.F.	WC	2,50		187		187 13	20	EasyFlexWall		35/28	2,15	m²	EWHK77	1 1	2,00	m²	EWHK77	-13	-			0,10	22	•1	
G.F.	Anteroom	10,50		650		650	20	EasyFlexWall		35/28	9,42	m²	EWHK115	2 1 1 1 1	4,30	m²	EWHK77	98	-			0,74	47	•1	

▲ Variotherm dimensioning software example for heating

Dimensioning of Variotherm Cooling Systems

Building project: Mustermann ZIP: 2544 City: Leobersdorf Date: Processed by: AS

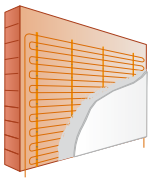
No.	Room name	Floor space A [m²]	Cooling load Q [W]	Supplement cooling load Suppl. [%]	Cooling load incl. Supplement Q+Suppl. [W]	Room temp. ti [°C]	Cooling system	Floor covering [kN] or pipe covering [mm]	Dimensioning temperature tf/tr [°C]	Mathematical Dim.	Unit	Type	Practical No. of circuits	Dim.	Unit	Type	Residual performance	FH to (Ti=20) [°C]	Supply pipe	Supply line length per circuit [m]	Pressure loss per circuit [mWC]	Flow quantity per circuit [kg/h]	Distribution manifold number	Calculation of pressure loss and flow rate (see manual)
G.F.	Room 1	12,50	638		638 98	26	EasyFlexWall		16/20	11,81	m²	EWHK77	2 1	5,00	m²	EWHK77	-98	-			1,29	59		
G.F.	Room 2	14,50	740		740 92	26	EasyFlexWall		16/20	13,69	m²	EWHK77	2 1	6,00	m²	EWHK77	-92	-			2,11	70		
G.F.	Kitchen	12,00	612		612 83	26	EasyFlexWall		16/20	11,33	m²	EWHK77	2 1	4,90	m²	EWHK77	-83	-			1,22	58		
G.F.	Living room	25,00	1275		1275 195	26	EasyFlexWall		16/20	23,61	m²	EWHK77	4 1	5,00	m²	EWHK77	-195	-			1,29	59		
G.F.	WC	2,50	128		128 20	26	EasyFlexWall		16/20	2,36	m²	EWHK77	1 1	2,00	m²	EWHK77	-20	-			0,12	24		
G.F.	Anteroom	10,50	536		536 71	26	EasyFlexWall		16/20	9,92	m²	EWHK77	2 1 1 1 1	4,30	m²	EWHK77	-71	-			0,87	51		

▲ Variotherm dimensioning software example for cooling

5.3 Heat output

- **Only valid with usage of EcoHeatingPlaster (oven-dry density = 1500 kg/m³)**
- Pipe spacing 77 and 115 mm
- Finishing plaster thickness of 10 to 15 mm above pipe apex

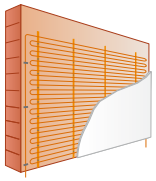
EasyFlexWall
EWHK77P | EWHK115P



t_f/t_r [°C]	t_{mH} [°C]	Heat output [W/m²] at room temperature T_r ...										T_0 [°C] (at T_r = 20 °C)	
		... 15 °C		... 18 °C		... 20 °C		... 22 °C		... 24 °C			
		77 mm	115 mm	77 mm	115 mm	77 mm	115 mm	77 mm	115 mm	77 mm	115 mm	77 mm	115 mm
30/20	25.0	97	75	62	48	39	31	18	13	–	–	25	24
30/25	27.5	117	92	82	64	59	47	39	31	18	13	28	27
35/25	30.0	139	109	103	81	81	64	60	48	37	28	30	29
35/28	31.5	151	118	116	90	93	73	71	56	50	38	30	29
35/30	32.5	160	126	125	98	101	80	80	63	58	46	31	30
37.5/32.5	35.0	181	143	146	115	123	96	100	79	81	64	33	31
40/30	35.0	181	143	146	115	123	96	100	79	81	64	33	31
40/35	37.5	202	159	167	132	145	114	123	96	101	80	35	32
45/35	40.0	223	176	189	148	166	131	143	112	123	96	37	35
45/40	42.5	246	193	210	165	187	147	163	128	143	112	38	36
50/40	45.0	268	211	232	182	208	164	185	145	163	128	40	37

- **Only valid with usage of plaster provided by costumer (oven-dry density ≥ 1250 kg/m³)**
- Pipe spacing 77 und 115 mm
- Pipe coverage approx. 10 mm above pipe apex

EasyFlexWall
EWHK77 | EWHK115



t_f/t_r [°C]	t_{mH} [°C]	Heat output [W/m²] at room temperature T_r ...										T_0 [°C] (at T_r = 20 °C)	
		... 15 °C		... 18 °C		... 20 °C		... 22 °C		... 24 °C			
		77 mm	115 mm	77 mm	115 mm	77 mm	115 mm	77 mm	115 mm	77 mm	115 mm	77 mm	115 mm
30/20	25.0	91	71	58	45	37	29	17	13	–	–	24	24
30/25	27.5	110	86	77	60	56	44	37	29	17	13	26	25
35/25	30.0	130	102	97	76	76	60	57	45	35	27	28	27
35/28	31.5	142	111	109	85	87	69	67	53	47	36	28	27
35/30	32.5	150	118	117	92	95	75	75	59	55	43	29	28
37.5/32.5	35.0	170	134	137	108	115	90	94	74	76	60	31	29
40/30	35.0	170	134	137	108	115	90	94	74	76	60	31	29
40/35	37.5	189	149	157	124	136	107	115	90	95	75	33	30
45/35	40.0	209	165	177	139	156	123	134	105	115	90	35	33
45/40	42.5	230	181	197	155	175	138	153	120	134	105	36	34
50/40	45.0	251	198	217	171	195	154	173	136	153	120	38	35

t_{mH} = mean hot water temperature = $\frac{t_f + t_r}{2}$ [°C]

T_0 = mean surface temperature [°C]

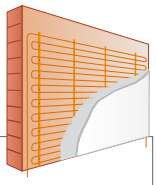
T_r = room temperature [°C]

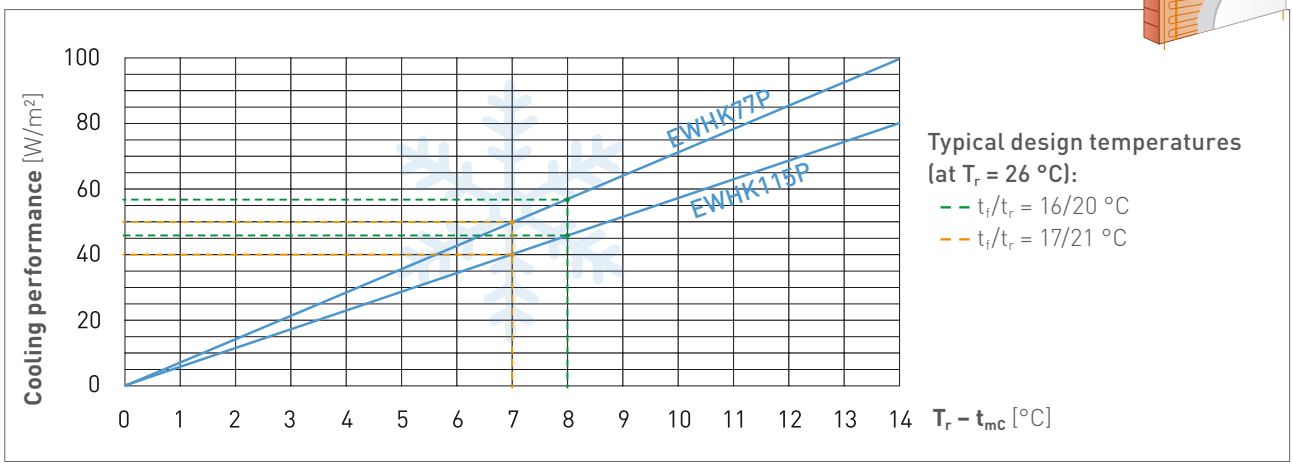
t_f/t_r = flow temperature / return temperature [°C]

5.4 Cooling performance

› **Only valid with usage of EcoHeatingPlaster (oven-dry density = 1500 kg/m³)**
› Pipe spacing 77 and 115 mm
› Finishing plaster thickness of 10 to 15 mm above pipe apex

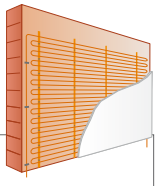
EasyFlexWall
EWHK77P | EWHK115P

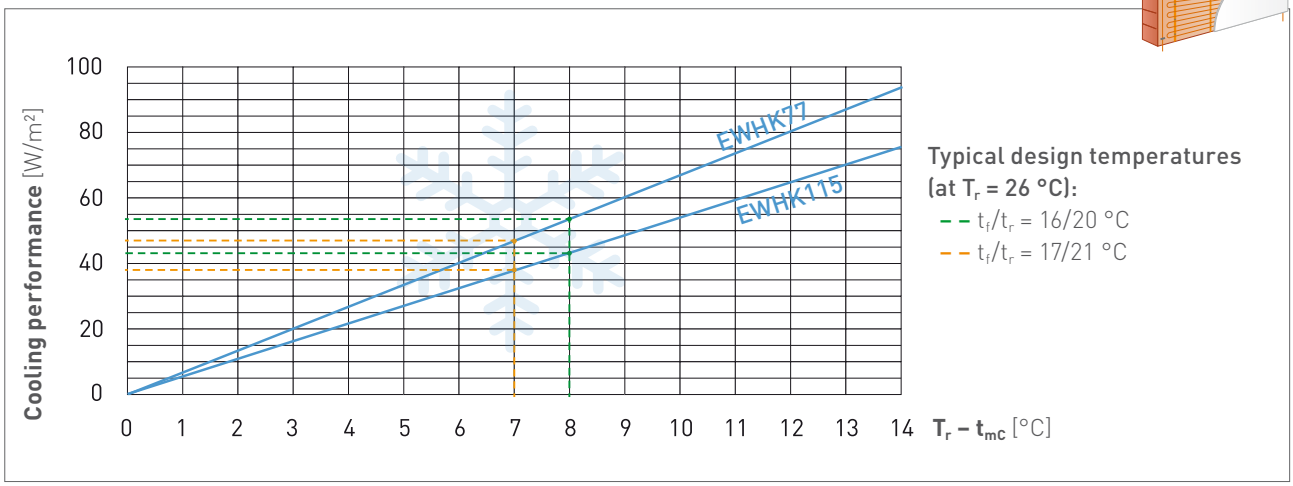




› **Only valid with usage of plaster provided by costumer (oven-dry density ≥ 1250 kg/m³)**
› Pipe spacing 77 und 115 mm
› Pipe coverage approx. 10 mm above pipe apex

EasyFlexWall
EWHK77 | EWHK115





t_{mc} = Mean cooling water temperature = $\frac{t_f + t_r}{2}$ [°C]

T_r = Room temperature [°C]

t_f/t_r = Flow temperature / Return temperature [°C]

Relative humidity [%rF]	Room temperature T_r [°C]				
	24	25	26	27	28
80 %	20.3	21.3	22.3	23.3	24.2
70 %	18.2	19.1	20.1	21.1	22.0
60 %	15.8	16.7	17.6	18.6	19.5
50 %	12.9	13.9	14.8	15.7	16.6
40 %	9.6	10.5	11.4	12.2	13.1

Dew-point temperature [°C]

The flow temperature must be selected in such a way or it must be ensured that the surface temperature of the EasyFlexWall and the pipe never reaches or falls below the dew-point temperature at any point. Whereby the mean surface temperature T_0 corresponds approximately to the return flow temperature t_r.

Condensation can form on the pipes and surfaces if the flow temperature selected is too low. Control measures must be taken to prevent this (e.g. dew-point monitor, see also chapter 3.6).

5.5 Arrangement of the surfaces

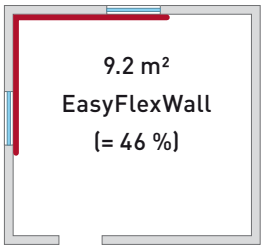
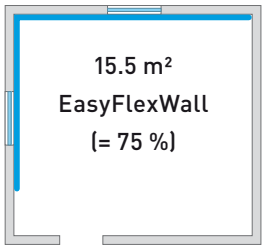
Wall heating installations are used for heating occupied areas. For this reason, they should be evenly installed over the interior sides of exterior walls. At normal ceiling heights up to 3 m in buildings with good thermal insulation, designing the EasyFlexWall to a maximum height of 2 m above the finished floor level is sufficient. For a ceiling height of more than 3 m, (e. g. halls, stairwells, therapy areas) the wall heating installations must be designed higher than 2 m.

Experience has shown that radiant heat can be felt at a distance of up to 5 m from the heated wall. In larger rooms it is therefore advantageous to install a wall heating system on two opposing walls because the radiance effect on the body declines in proportion to the square of the distance.

With a good arrangement of the radiant heating surfaces and U-values (exterior wall) of ≤ 0.3 W/m²K, the room air temperature can be reduced by up to 2 °C while retaining the same perceived temperature (comfort).
Seating and glass surfaces (e. g. windows) must be taken into consideration when choosing the arrangement of wall heating surfaces.

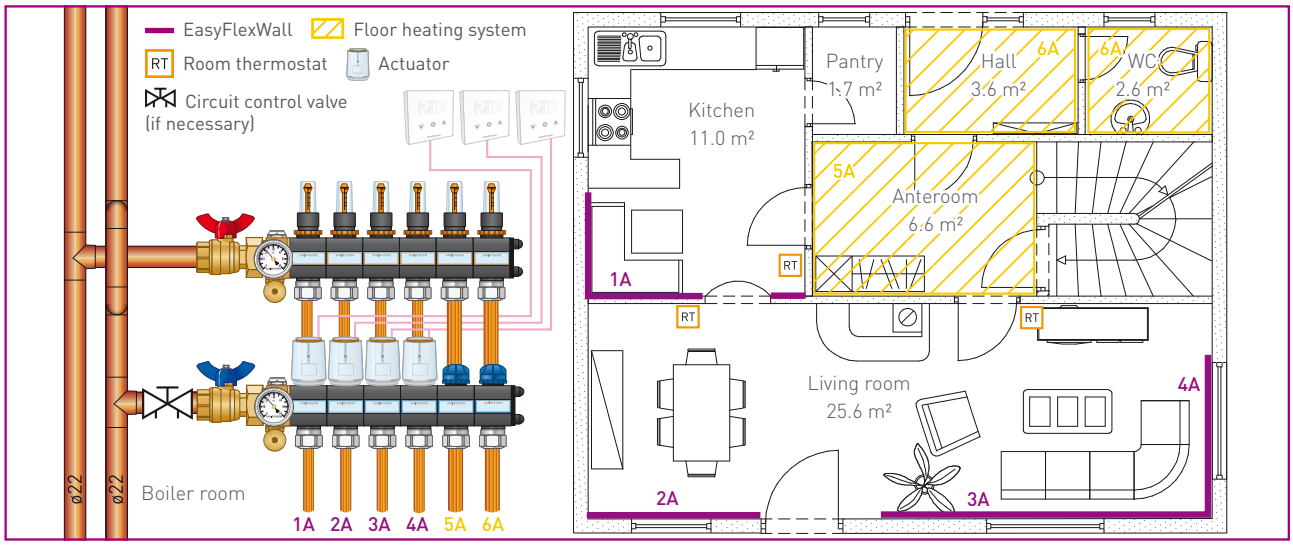
Furniture
Since the radiant heat should radiate into the living spaces, this is to be taken into consideration in the furniture planning. Wall fittings, full bookcases, built-in cupboards etc. should not be planned in front of wall heating systems. Desks, chests of drawers, open seats, small boxes, kitchen corner banks, pictures etc. usually present no problem. General rule of thumb: maximum of 15 % furnished area.
Tip: Beds (especially an open headboard) should not be placed directly in the radiation area of wall heating elements.

Guide values for dimensioning[1] the EasyFlexWall:

40 to 50 % of the room floor area	70 to 80 % of the room floor area
+ Heating o Cosy cooling effect	+ Cooling + Heating + Energy saving due to lower flow temperature
Example, 20 m² area:	Example, 20 m² area:
	

If the wall is dimensioned for heating, experience has shown that it still achieves a good cooling effect if this surface is used for cooling in summer. Conversely, the flow temperature can be reduced in winter when heating if the wall area is dimensioned for cooling. This saves energy!

Combination of heating systems
In the example below, the heating system has been adapted to suit the rooms: A floor heating system is planned for tiled rooms and wall heating surfaces are planned in the remaining rooms. A room thermostat for controlling the room temperature is planned for the kitchen, dining area and living room (influence of external heat sources from kitchen appliances, south-facing glass surfaces and tile stoves).

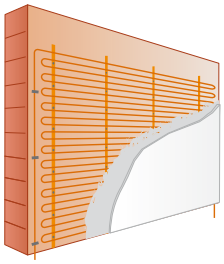


▲ Combination of heating systems, example single-family house (ground floor)

[1] Observe the heating/cooling load calculation for precise dimensioning of the area required!

5.6 Pressure loss

Example: The pressure loss of a 6 m² EasyFlex wall heating EWHK77P (pipe spacing 77 mm, with EcoHeatingPlaster) is to be calculated. The desired flow/return temperature is 35/28 °C resulting in a heat output of 93 W/m² at a room temperature of 20 °C.
Supply pipe: pre-insulated VarioModular pipe 16x2



Calculation of the flow rate ω from the pressure loss diagram:
Q = 558 W (93 W/m² × 6 m²)
ΔT = 7 K (t_v – t_r = 35 K – 28 K)
c = 1.163 Wh/kgK (Specific heat capacity of water)
m = Q ÷ c ÷ ΔT
= 558 W ÷ 1.163 Wh/kgK ÷ 7 K = 68.5 kg/h (l/h)

$$Q = \dot{m} \times c \times delta\,T$$

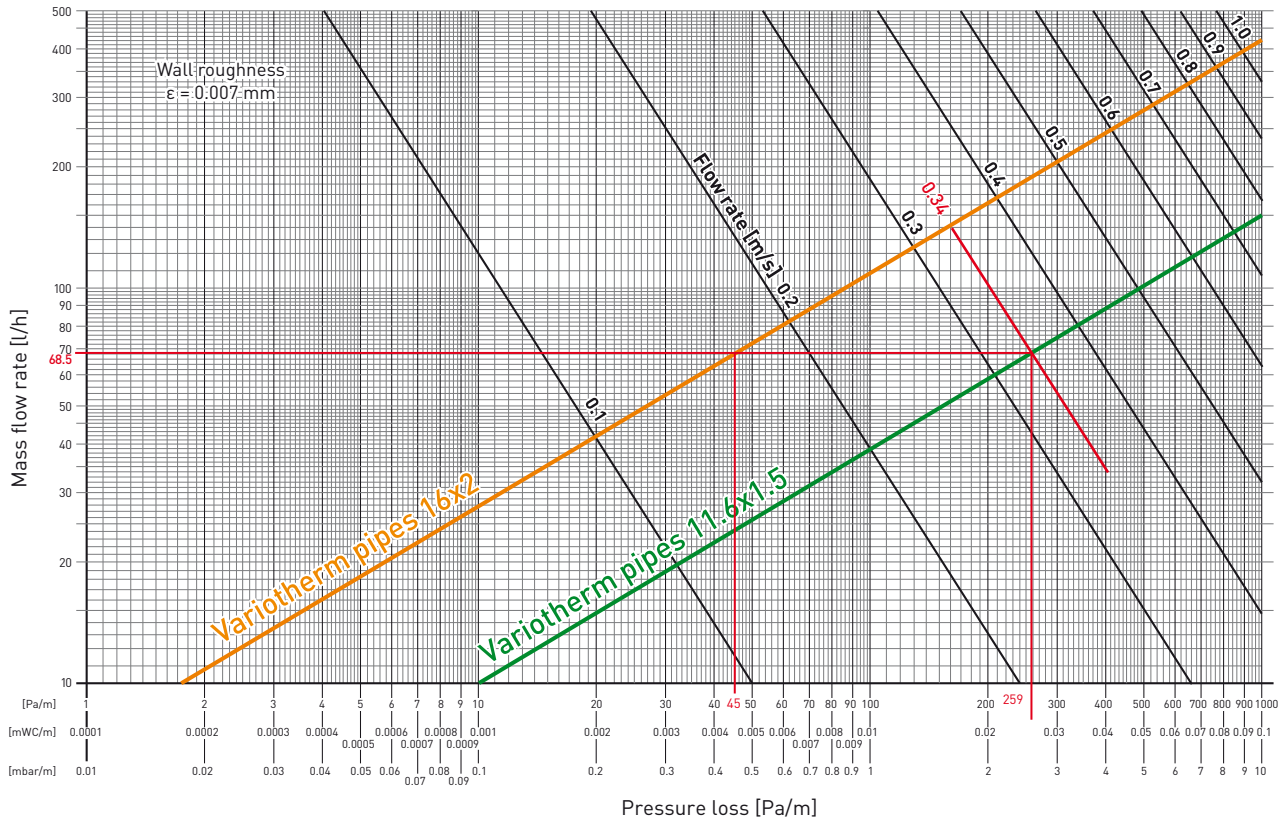
Maximum flow rate per cooling/heating circuit of the VarioManifold:
160 l/h

Press-fit coupling	Coefficient of resistance ζ (Zeta)
11.6 × 11.6	7.2
16 x 11.6	6.9

68.5 l/h results, according to the diagram, in:
Flow rate ω = 0,34 m/s
Pressure loss (Variotherm pipe 11.6x1.5) = 259 Pa/m
Pressure loss (Variotherm pipe 16x2) = 45 Pa/m

- **Δp for 6 m² EasyFlexWall:** 259 Pa/m × 78 m (at EWHK77: 13 m/m² × 6 m²) = **20 202 Pa**
- **Δp for 15 m pre-insulated VarioModular pipe 16x2:** 45 Pa/m × 15 m = **675 Pa**
- **Δp for 2 pcs. press-fit couplings 16x11,6:** ζ × ρ/2 × ω² = 6.9 × 500 kg/m³ × (0.34 m/s)² = 399 Pa × 2 pcs. = **798 Pa**

Δp_{Total} = 20 202 Pa + 675 Pa + 798 Pa **= 21 675 Pa = 2.17 mWC**



6 PROTOCOLS

6.1 Leak-tightness test in accordance with EN 1264-4

After installation and before plaster work is carried out, the circuits of the Variotherm EasyFlexWall must be checked for leak-tightness by means of a water pressure test. The test pressure should be min. 4 bar and max. 6 bar. Due to the initial pipe expansion, it may be necessary to re-pump the test pressure. If there is a risk of freezing, appropriate measures should be taken, e. g. use of antifreeze and controlling the building's temperature.

During the application of the plaster (finishing work), the pressure in the pipes must be reduced to operating pressure.

Construction project: _____

Building owner/occupant: _____

Client: _____

Heating installer: _____

Architect: _____

Others: _____

- Installation of pipe connections finished on: _____
- Pressure test started on: _____ with test pressure ____ bar
- Pressure test finished on: _____ with test pressure ____ bar
- Start of plaster work on: _____
- System pressure during the completion work was _____ bar
- The system water was treated (e.g. per ÖNORM H 5195-1) ☐ Yes ☐ No
- Antifreeze was added to the system water ☐ Yes ☐ No
- The system was checked for leak-tightness on: _____ and approved

Approval:

Building owner/Occupant/Client	Construction management/Architect	Heating installation technician

6.2 Functional heating (in compliance with EN 1264-4 or BVF[1])

The functional heating serves as verification and proof of the creation of a defect-free installation for the heating installer after the plastering work has been completed.
Before starting functional heating, the following drying times must be observed, depending on the layer thickness and binder of the plaster:
1 day per 1 mm layer thickness, or in accordance with the manufacturer's instructions!
The maximum calculated flow temperature must be maintained for at least 1 day.
The flow temperature (heating water) of the EasyFlexWall must not exceed the maximum permissible temperature according to the plaster manufacturer at any time!

Construction project: _____

Building owner/occupant: _____

Client: _____

Heating installer: _____

Architect: _____

Others: _____

Preheating of the Variotherm EasyFlexWall

- Type of plaster / make: 1 Coat of plaster: _____ 2. Coat of plaster: _____
  Completion of the finishing work on: 1. Coat of plaster: _____ 2. Coat of plaster: _____
- Preheating started with constant max. calculated flow temperature: _____ | tv = ____°C
- End of functional heating: _____
  If there is a risk of freezing, appropriate measures should be taken, (e. g. frost protection mode).
- The rooms were ventilated without draughts and all windows and external doors closed after switching off the surface heating and cooling system: ☐ Yes ☐ No
- The system was approved for further construction work at an outside temperature of ____ °C.
  ☐ The system was out of operation ☐ The plaster was heated with a flow temperature of ____ °C.

When switched off after the preheating phase, the EasyFlexWall must be protected against draughts and from cooling down too quickly until it has cooled down completely.

Approval:

Building owner/Occupant/Client	Construction management/Architect	Heating installation technician

6.3 Commissioning

The flow temperature (heating water) of the EasyFlexWall must not exceed the maximum permissible temperature according to the plaster manufacturer at any time! The main stop valves at the distribution station and the heating circuit shut-offs must be opened. The entire system must be well vented. The circulation pump can be switched on after venting. After commissioning, a Variotherm surface heating/cooling system can be considered to be maintenance-free. (Subject to technical changes.)

[1] BVF = Bundesverband Flächenheizungen und Flächenkühlungen e.V.

NOTES

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