EWHC SWHC

PLANNING

PLASTER WALL. HEATING AND COOLING.

VPLAN1 | e13818

www.variotherm.com

VARIOTHERM

TABLE OF CONTENTS

1 PRINCIPLES

Variotherm SystemWall and EasyFlexWall is a source of well-being. It provides heating through horizontal radiant heat instead of the ascending warm air provided by conventional heating systems. This avoids the permanent movement of air and the associated stirring up of dust. Rooms are evenly heated without different temperature zones in the heated rooms.
By the way, solar heat is also radiant heat.

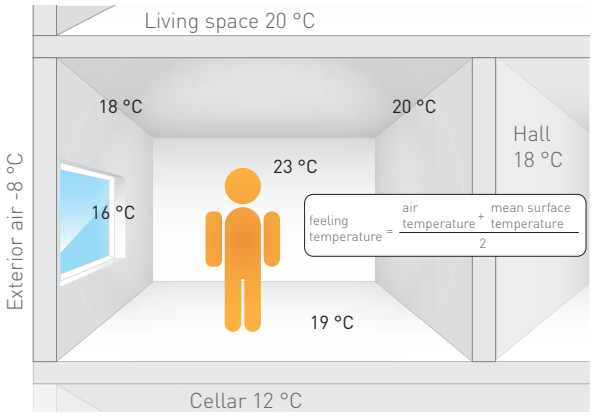
1.1 Comfort

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.

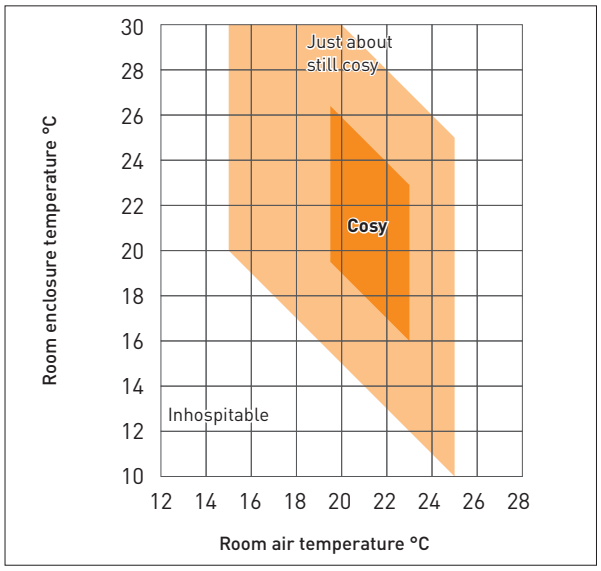
What makes people feel comfortable?

People feel comfortable when the following basic 'thermal comfort' equation holds:

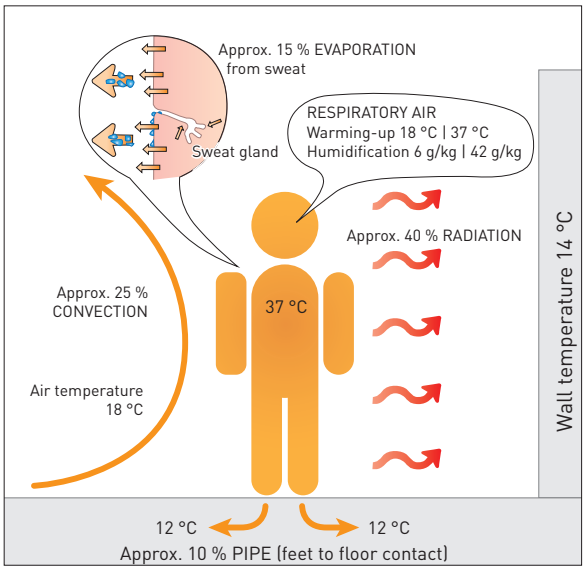
Heat production = heat loss



▲ Impact of the room on felt temperature



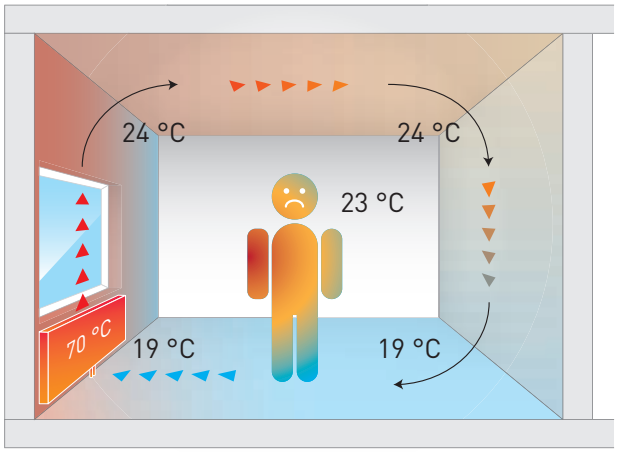
▲ Zone of cosiness



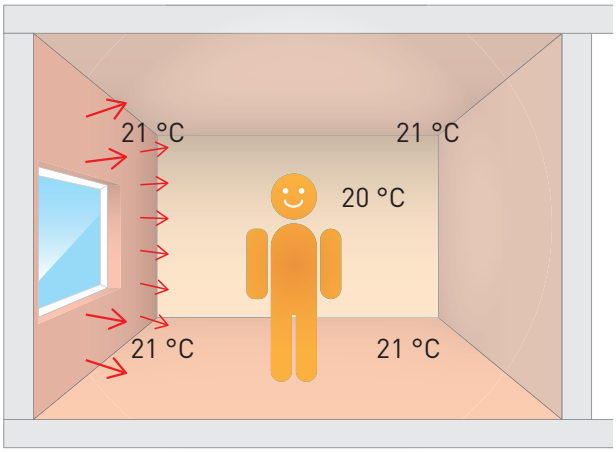
▲ Human heat balance

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 SystemWall and EasyFlexWall installations significantly increases cosiness. The installation of surface heating on an 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 raises the perceived air temperature.



▲ Discomfort with radiators



▲ Comfort with wall heating

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 6 %. The low room air temperature has the additional great 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.

1.3 Adapts to suit your home

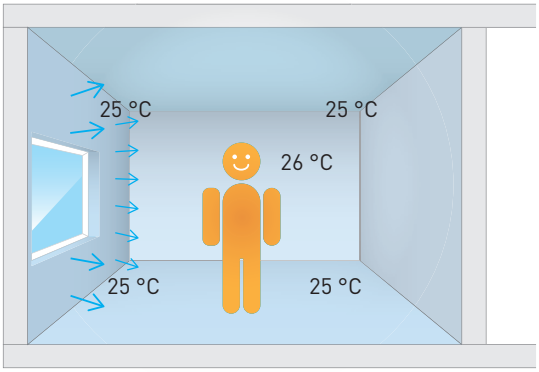
The Variotherm wall heating utilises the existing or intended exterior wall, either as an additional storage medium (if full exterior insulation is present) or as insulation. The wall heating surfaces can be individually adapted to suit the local situation (windows, doors etc.). Visible radiators under the windows are a thing of the past.

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

When a wall surface is cooled, all warmer objects in the room (floor, interior walls, persons, 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.



▲ Comfort with wall cooling

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 ceiling surface temperature to approx. 19–22 °C is possible.

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.

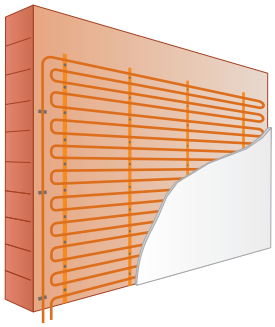
One of the major advantages of ceiling cooling/heating systems is the low additional investment costs. A single system is used for the cooling and heating modes: the same ceiling surface, same piping system and the same heating/cooling distribution manifold with supply lines and circulation pump. The 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 escaping 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 freedom from draughts. The combination of ceiling 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 ceiling surface temperatures, and thus high radiant cooling performance, can be achieved without the formation of condensation, even on hot and humid days.

1.5 Description and benefits of SystemWall and EasyFlexWall/Ceiling

The wall heating/cooling systems under plaster are extremely energy-saving systems for heating and cooling. Variotherm offers two plastered systems: SystemWall and EasyFlexWall, which differ in terms of the plasters and piping dimensions used. EasyFlexWall can be installed 1:1 on the ceiling, thereby also functioning as a pleasant ceiling cooling/heating system → EasyFlexCeiling.
Depending on the subsurface, the VarioBars are attached to the (outer) wall or ceiling using ScrewFix or nail anchors and the VarioProFile pipe is clamped into the VarioBars, starting from the heating manifold. Separate retaining clamps are provided for fastening the return to the wall. The plaster is applied after installation.

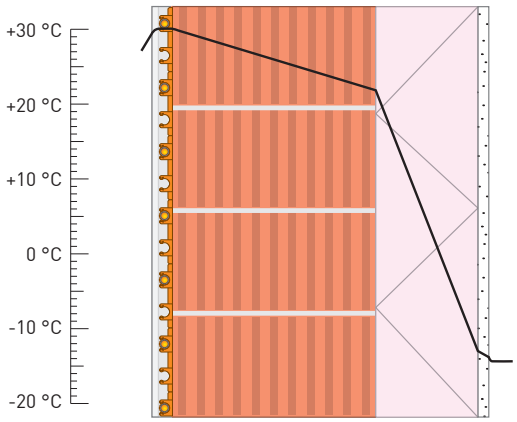


The advantages:

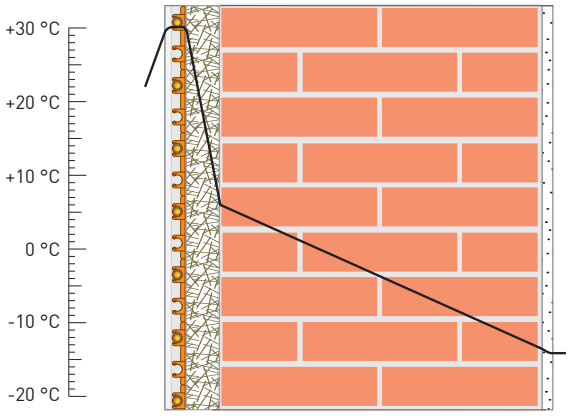
- Proven surface heating/cooling systems for plastered interior finishing
- EasyFlexWall installable 1:1 on ceiling (EasyFlexCeiling)
- Installation without connecting elements in the wall is possible
- Easy to locate using a pipe locator in the case of subsequent fastening
- Heating system: large-surface, extremely energy-saving low temperature system
- Cooling system: silent, no forced air, energy-efficient
- The SystemWall has been awarded the IBO quality seal by the Austrian Institute for Healthy and Ecological Building

1.6 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.



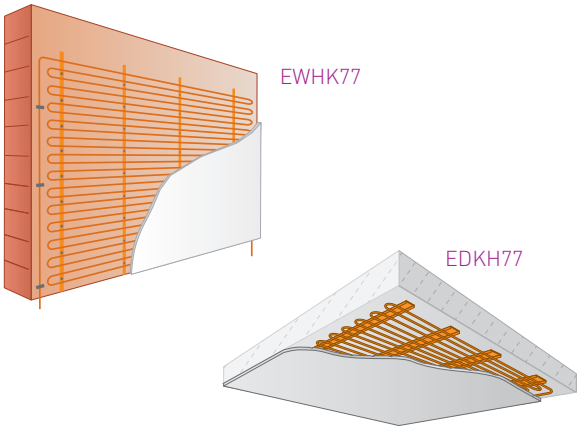
▲ New construction example, structure from left to right:
31 mm plaster incl. SystemWall
300 mm vertically perforated bricks
150 mm thermal insulation (EPS)
exterior plaster/paint

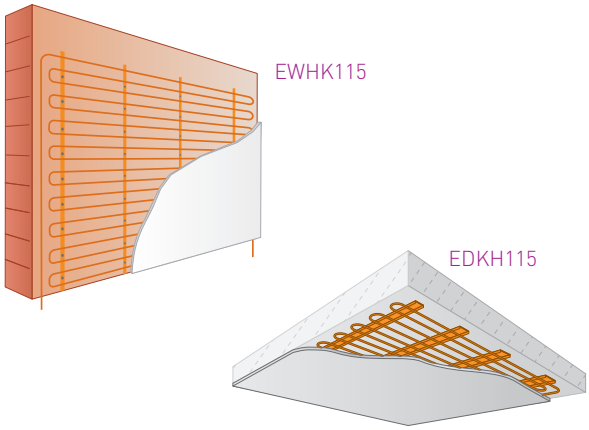


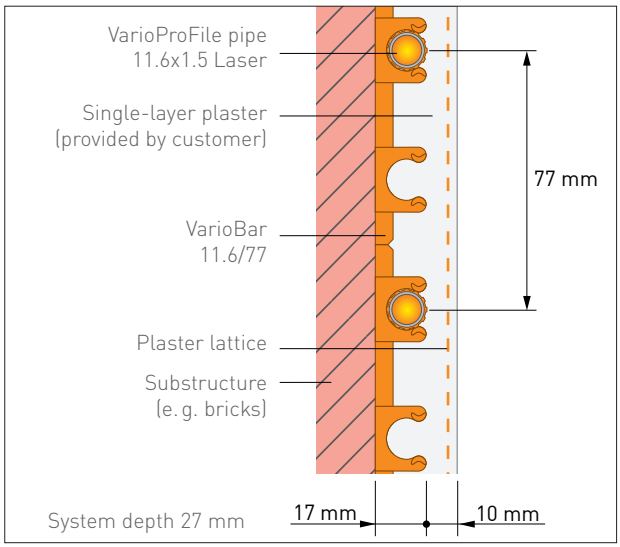
▲ Existing construction example, structure from left to right:
31 mm plaster incl. SystemWall
50 mm wood-wool construction panel
2 × 250 mm NF bricks
exterior plaster/paint

2 COMPONENTS

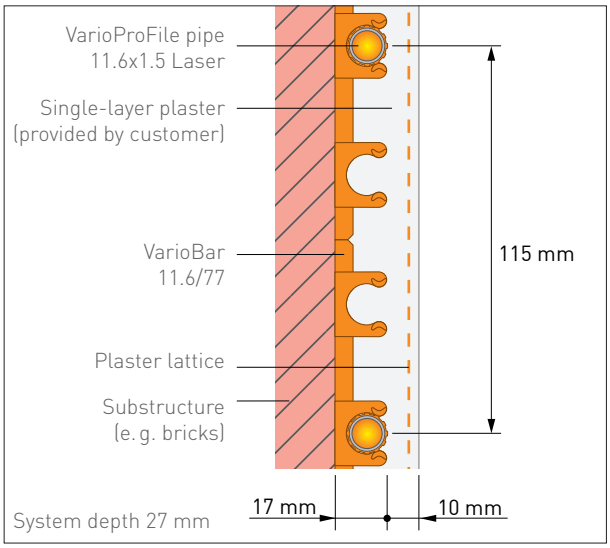
2.1 Overview – EasyFlexWall and EasyFlexCeiling







▲ Cross-section EWHK77: Plastering with single-layer plaster provided by costumer.



▲ Cross-section EWHK115: Plastering with single-layer plaster provided by costumer.

VarioProFile pipe 11.6x1.5 Laser PG 050

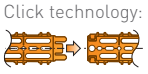
Profiled surface structure guarantees optimum heat transfer.
For details see chapter 2.3.

Part No.	PKU	Weight/PKU	Pallet
VP116L-100	100 m roll	7.3 kg	18 rolls
VP116L-300	300 m roll	21.7 kg	12 rolls
VP116L-500	500 m roll	36.2 kg	8 rolls

VarioBar 11.6/77 PG 010

VarioBar made of PE with a panel thickness of only 17 mm for latching the VarioProFile pipe 11.6x1.5 Laser. Can be extended to any length required using special click technology. Grid spacing 38.5 mm

Click technology:

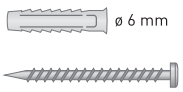


Part No.	PKU	Weight/PKU	Carton
V2722	1 m	100 g	50 × 1 m

ScrewFix

PG 010

Dowel + screw for attaching the VarioBar and the retaining clamp.
Subsurfaces: concrete masonry, vertically perforated brick (porous brick), aerated concrete brick



Part No.	PKU	Weight/PKU
V2805	100 pcs.	540 g

Nail anchor (alternatively to ScrewFix)

PG 010

for attaching the VarioBar and the retaining clamp.
Subsurfaces: concrete, solid brick.
Diameter 6 mm, length 60 mm

Part No.	PKU	Weight/PKU
V281	200 pcs.	1.3 kg

Retaining clamp

PG 010

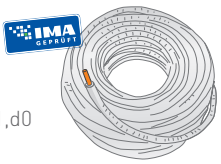
for affixing the VarioProFile pipe in the return of the wall heating/cooling

Part No.	PKU	Weight/PKU
V2801	50 pcs.	200 g

Pre-insulated 16x2 Variomodular pipe Laser

PG 130

- Aluminium multi-layer composite pipe 16x2 Laser (PE-RT/AL/PE-RT)
- No oxygen diffusion whatsoever
- 95 °C, 10 bar
- Insulation: Polyethylene soft foam
  Fire resistance as per EN 14313: C_L-s1,d0



Part No.	Insulation thickness	PKU	Weight/PKU
V1226	6 mm	100 m roll	14.0 kg
V1227	9 mm	100 m roll	14.9 kg

Bending model 11.6/77

PG 140

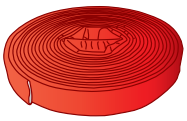
For VarioProFile pipe 11.6x1.5 Laser, pipe spacing 77 mm for easy manual bending

Part No.	PKU	Weight/PKU
V46	1 pce.	40 g

Insulation hose 4 mm

PG 130

for insulating the supply pipes of the heating/cooling distribution manifold to the respective heating/cooling surfaces.
Fire resistance as per EN 14313: E_L,d0



Part No.	PKU	Weight/PKU
Z24	10 m roll	170 g

Bending model 11.6/115

PG 140

For VarioProFile pipe 11.6x1.5 Laser, pipe spacing 115 mm for easy manual bending

Part No.	PKU	Weight/PKU
V47	1 pce.	80 g

Press-fit couplings

PG 100

TH press-fit contour, incl. galvanic isolation, visual monitoring of insertion depth, tested as per EN 21003

Part No.	Type	Press-fitting jaws	PKU	Weight/PKU
Z1320	16 x 16	TH16	1 pce.	50 g
Z1610	16 x 11,6	TH16 & TH11.6	1 pce.	45 g
Z1600	11.6 x 11.6	TH11.6	1 pce.	30 g

16 x 16
Z1320

16 x 11.6
Z1610

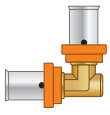
11.6 x 11.6
Z1600

Press-fit brackets 90°

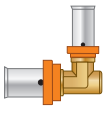
PG 100

TH press-fit contour, incl. galvanic isolation, visual monitoring of insertion depth, tested as per EN 21003

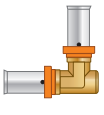
Part No.	Type	Press-fitting jaws	PKU	Weight/PKU
Z1370	16 x 16	TH16	1 pce.	50 g
Z1620	16 x 11.6	TH16 & TH11.6	1 pce.	45 g
Z1630	11.6 x 11.6	TH11.6	1 pce.	45 g



16 x 16
Z1370



16 x 11.6
Z1620



11.6 x 11.6
Z1630

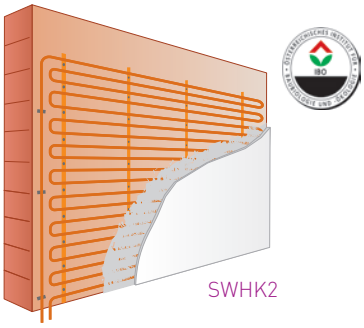
Cold shrink tape

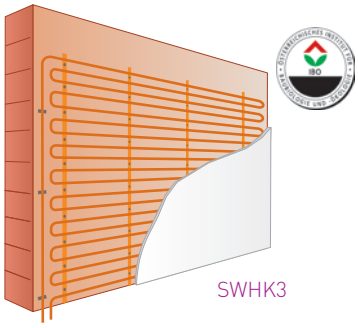
PG 100

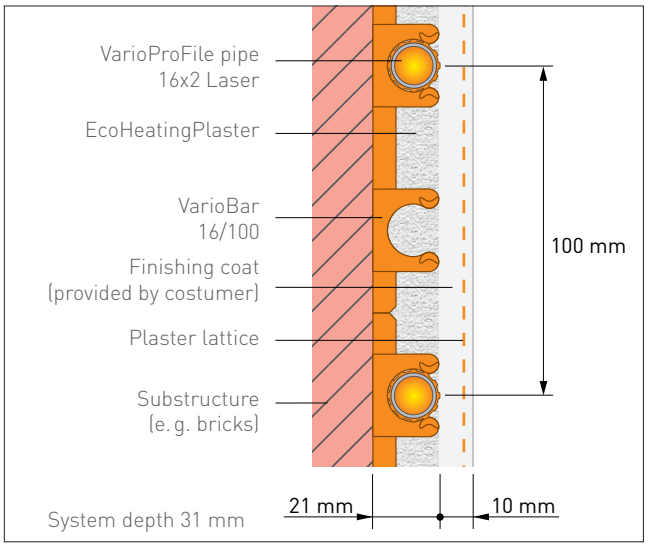
For optimum corrosion resistance of press-fit coupling connections as per ÖN H 5155.
Roll: 50 mm × 15 m, 1 roll is sufficient for approx. 35 press-fit coupling connections (with a 50 % overlap).

Part No.	PKU	Weight/PKU	Carton
Z1699	1 pce.	990 g	20 pcs.

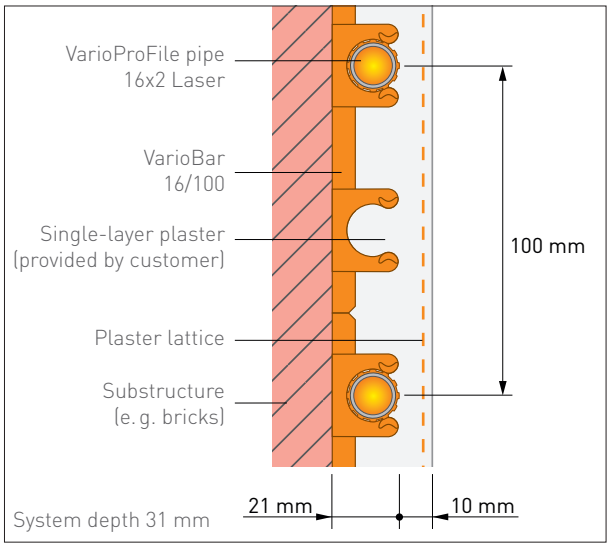
2.2 Overview – SystemWall







▲ Cross-section SWHK2: The wall heating/cooling surfaces are plastered with EcoHeatingPlaster as the (rough) base coat plaster, followed by application of the finishing coat containing the plaster lattice.



▲ Cross-section SWHK3: Plastering with single-layer plaster provided by costumer.

VarioProFile pipe 16x2 Laser PG 050

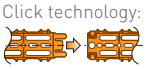
Profiled surface structure guarantees optimum heat transfer.
For details see chapter 2.3.

Part No.	PKU	Weight/PKU	Pallet
VP16L-100	100 m roll	10.2 kg	18 rolls
VP16L-300	300 m roll	30.6 kg	8 rolls
VP16L-500	500 m roll	51.0 kg	6 rolls

VarioBar 16/100 PG 010

VarioBar made of PE with a panel thickness of only 21 mm for latching the VarioProFile pipe 16x2 Laser. Can be extended to any length required using special click technology. Grid spacing 50 mm

Click technology:

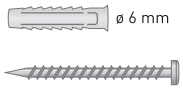


Part No.	PKU	Weight/PKU	Carton
V1610	1 m	120 g	50 × 1 m

ScrewFix

PG 010

Dowel + screw for attaching the VarioBar and the retaining clamp.
Subsurfaces: concrete masonry, vertically perforated brick (porous brick), aerated concrete brick



Part No.	PKU	Weight/PKU
V2805	100 pcs.	540 g

Retaining clamp

PG 010

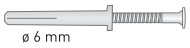
for affixing the VarioProFile pipe in the return of the wall heating/cooling

Part No.	PKU	Weight/PKU
V2801	50 pcs.	200 g

Nail anchor (alternatively to ScrewFix)

PG 010

for attaching the VarioBar and the retaining clamp.
Subsurfaces: concrete, solid brick.
Diameter 6 mm, length 60 mm

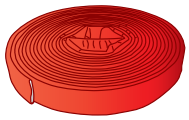


Part No.	PKU	Weight/PKU
V281	200 pcs.	1.3 kg

Insulation hose 4 mm

PG 130

for insulating the supply pipes of the heating/cooling distribution manifold to the respective heating/cooling surfaces.
Fire resistance as per EN 14313: E_L,d0



Part No.	PKU	Weight/PKU
Z24	10 m roll	170 g

Press-fit coupling 16x16

PG 100

TH press-fit contour, incl. galvanic isolation, visual monitoring of insertion depth.
Suitable press-fitting jaws: REMS TH16

Part No.	PKU	Weight/PKU
Z1320	1 pce.	50 g

Bending model 16/100

PG 140

For VarioProFile pipe 16x2 Laser, pipe spacing 100 mm for easy manual bending

Part No.	PKU	Weight/PKU
V41	1 pce.	65 g

EcoHeatingPlaster

PG 011

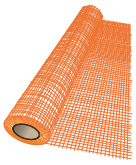
Special plaster for wall heating (flush-mounting, purely organic material, IBO certified), high heat conductivity, steam permeable, hygroscopic, shock resistant, good adhesive properties, suitable for machine plastering and manual application.
Consumption: 45 kg/m²

Part No.	PKU	Weight/PKU	Pallet
V270	1 bag	25 kg	42 bags

Paster lattice

PG 010

Special glass fibre cloth, reduces plaster tearing, 7 × 8 mm mesh size, maximum tensile load 2000 Nm/5 cm, tested as per DIN EN 12127 and DIN EN ISO 13934-1.

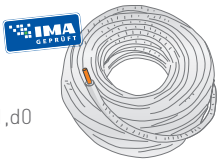


Part No.	PKU	Weight/PKU
V274	50 m² roll	8,6 kg

Pre-insulated 16x2 Variomodular pipe Laser

PG 130

- Aluminium multi-layer composite pipe 16x2 Laser (PE-RT/AL/PE-RT)
- No oxygen diffusion whatsoever
- 95 °C, 10 bar
- Insulation: Polyethylene soft foam
  Fire resistance as per EN 14313: C_L-s1,d0



Part No.	Insulation thickness	PKU	Weight/PKU
V1226	6 mm	100 m roll	14.0 kg
V1227	9 mm	100 m roll	14.9 kg

Press-fit bracket 90° 16x16

PG 100

TH press-fit contour, incl. galvanic isolation, visual monitoring of insertion depth.
Suitable press-fitting jaws: REMS TH16

Part No.	PKU	Weight/PKU
Z1370	1 pce.	50 g

Cold shrink tape

PG 100

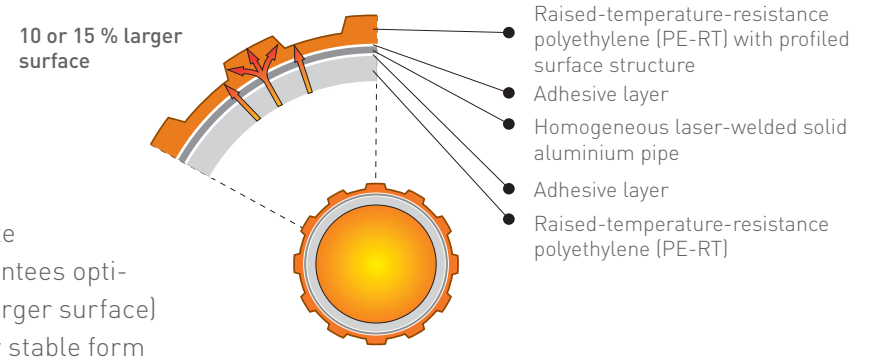
For optimum corrosion resistance of press-fit coupling connections as per ÖN H 5155.
Roll: 50 mm × 15 m, 1 roll is sufficient for approx. 35 press-fit coupling connections (with a 50 % overlap).

Part No.	PKU	Weight/PKU	Carton
Z1699	1 pce.	990 g	20 pcs.

2.3 VarioProFile pipe 11.6x1.5 and 16x2 Laser

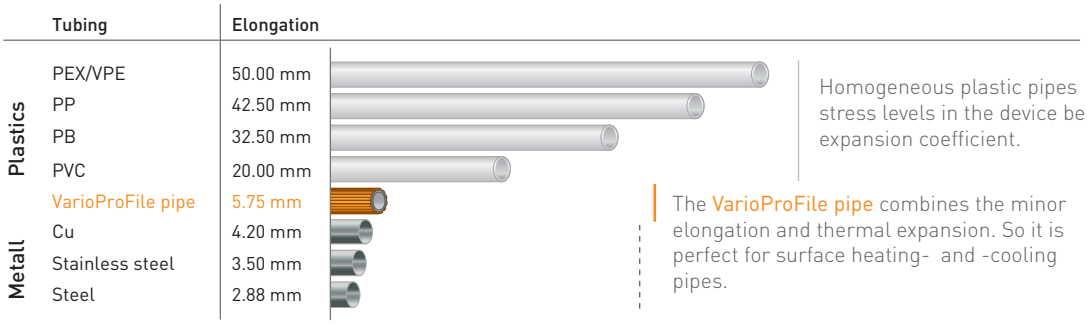
Advantages

- Fully corrosion-free
- Optimum creep behaviour
- Just as light as a plastic pipe
- 10-year guarantee with certificate
- Profiled surface structure guarantees optimum heat transfer (10 or 15 % larger surface)
- Flexible, easy to bend, extremely stable form
- Resistant to hot water additives (inhibitors, antifreeze)
- Mirror-smooth inner surface – less pressure loss – no encrustation
- High pressure and temperature resistance (10 bar, +95 °C)
- 100 % oxygen diffusion-tight
- Low linear coefficient of expansion, low heat expansion forces
- Tested as per EN 21003 (IMA Dresden), SKZ A 397



Elongation

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



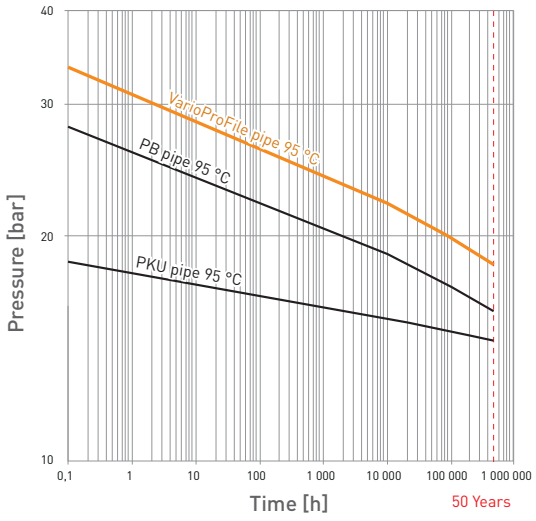
Homogeneous plastic pipes produce high stress levels in the device because of their expansion coefficient.

The VarioProFile pipe combines the minor elongation and thermal expansion. So it is perfect for surface heating- and -cooling pipes.

Technical data

Pipe diameter:	11.6 mm	16 mm
Pipe wall thickness:	1.5 mm	2 mm
Aluminium pipe thickness:	0.15 mm	0.18 mm
Roll length:	100, 300 and 500 m	
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}:	95 °C	
Short-term resistant t_{mal}:	110 °C	
Max. operating pressure p_{max}:	10 bar	
Linear expansion coefficient:	2.3×10^{-5} [K^{-1}]	
Mean heat conduction coefficient λ:	0.44 W/mK	0.45 W/mK
Heat transmission resistance R_λ:	0.0034 m²K/W	0.0045 m²K/W

Creep behaviour



2.4 Variotherm EcoHeatingPlaster (for SystemWall – SWHK2)

The Variotherm EcoHeatingPlaster has been developed for use as a **base coat plaster** for the system wall heating/cooling (SWHK2), for a plastering thickness (incl. heating pipe) of up 25 mm. It is a natural construction material, with excellent environmentally-friendly characteristics verified by the IBO 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 (SWHK2)

Components

Plaster sand, additives, trass. What is trass? Volcanic tuff prepared in a drying and grinding process. The main components of these "pozzolana" substances are silicic acids (water insoluble) 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

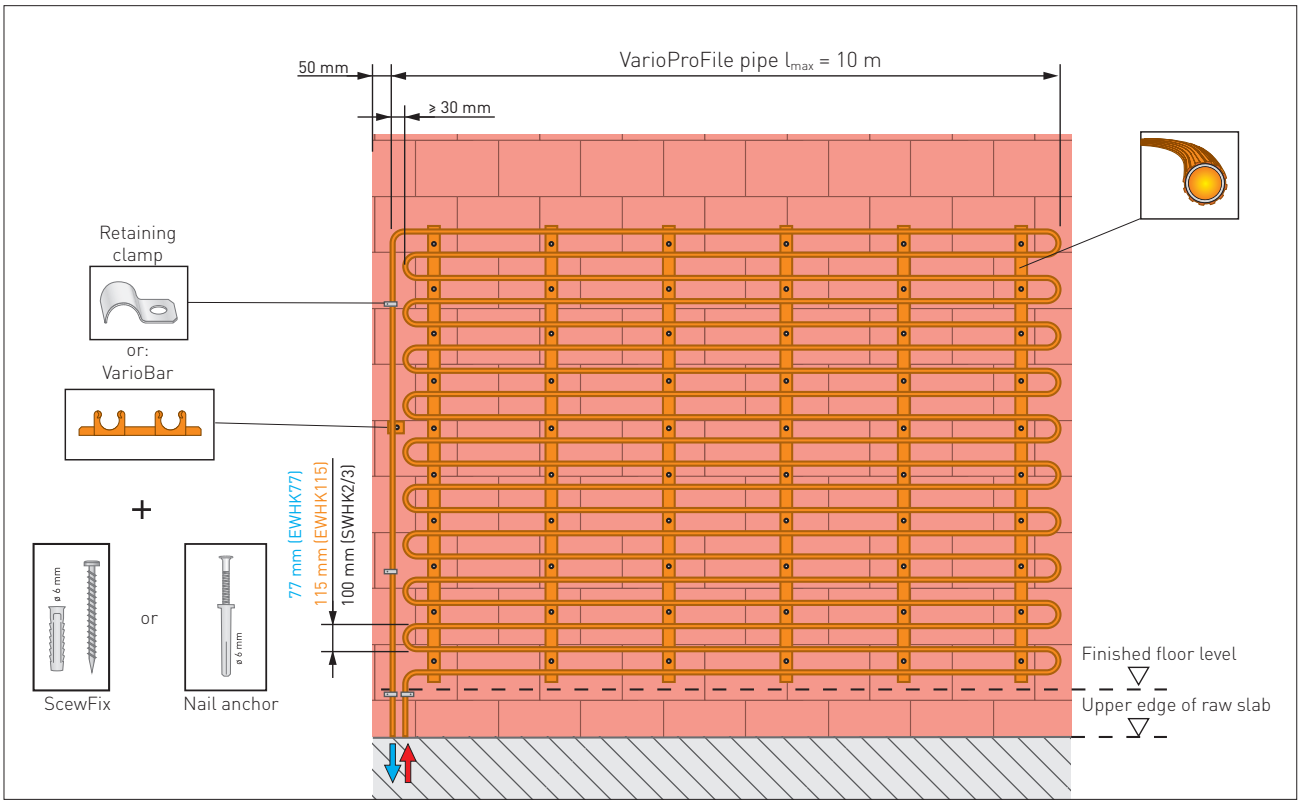
Maximum grain size:	2 mm
Compressive strength (28d):	> 3 N/mm²
Flexural strength (28d):	> 1 N/mm²
Thermal conductivity λ:	0.82 W/mK
Acid capacity (m value):	12.4
Oven-dry density (28d):	approx. 1500 kg/m³
Fresh mortar bulk density:	approx. 1700 kg/m³
Water requirement:	approx. 5–6 litres per bag (25 kg)
Material consumption:	approx. 45 kg/m² (SWHK2)
Minimum plaster thickness:	10 mm
Maximum plaster thickness:	25 mm
Packaging:	25 kg per bag; 42 bags per EU pallet

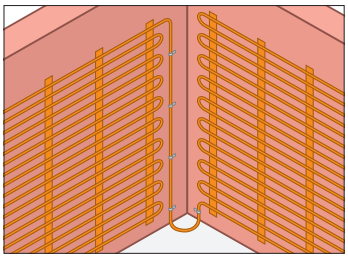
Safety data sheet "EcoHeatingPlaster", available from www.variotherm.com/en/service/info-centre.html

3 PIPING

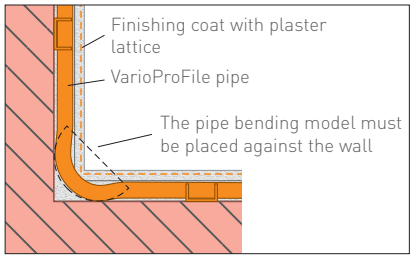
3.1 General

	SWHK2/3	EWHK77	EWHK115
Pipe spacing	100 mm	77 mm	115 mm
Dimension VarioProFile pipe	16x2	11.6x1.5	11.6x1.5
Pipe requirement per 1 m² wall heating surface	10 m/m²	13 m/m²	8.7 m/m²
Max. pipe length per heating circuit incl. supply	120 m	80 m	80 m

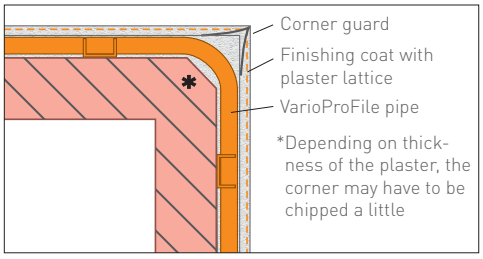




▲ Example inner corner

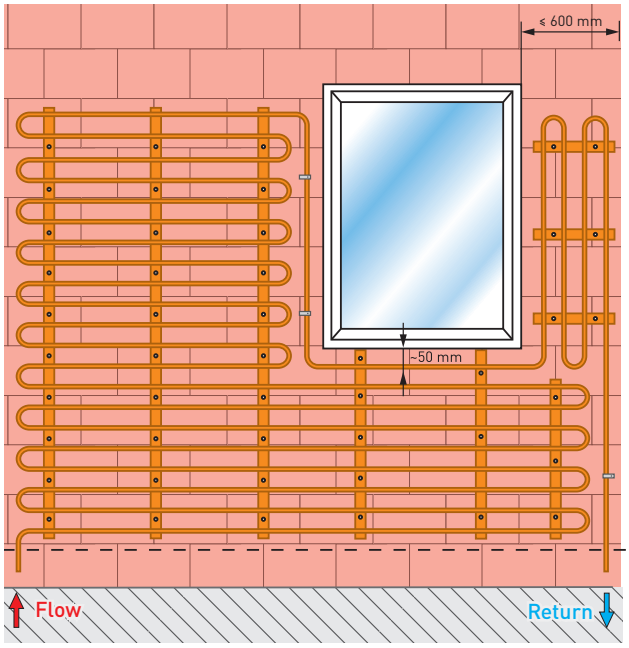


▲ Special case inner corner

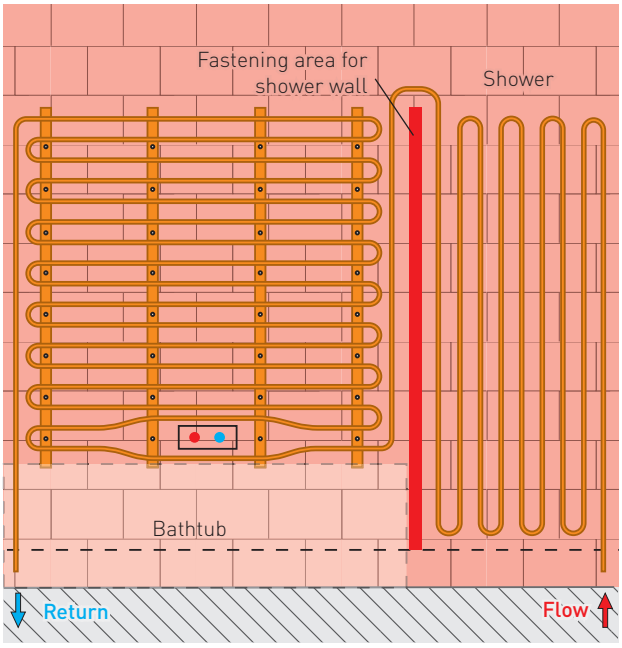


▲ Special case outside corner

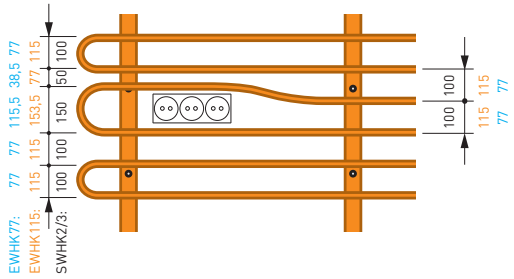
3.2 Pipe installation with assemblies



▲ Example for window area

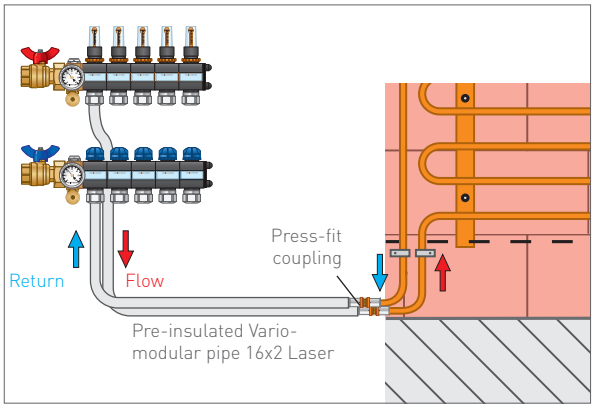


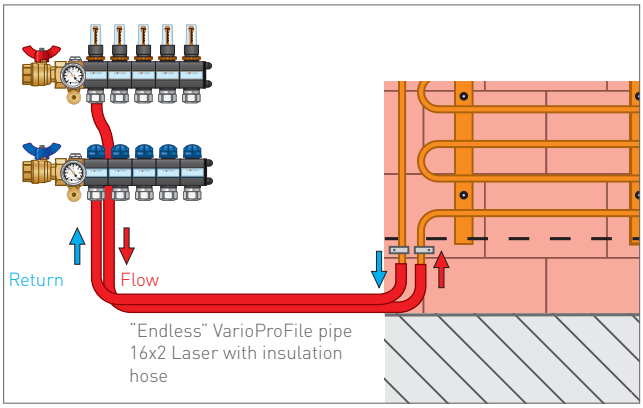
▲ Example for bathroom



A section-wise smaller/bigger spacing is permissible for assemblies (sockets, windows etc.).

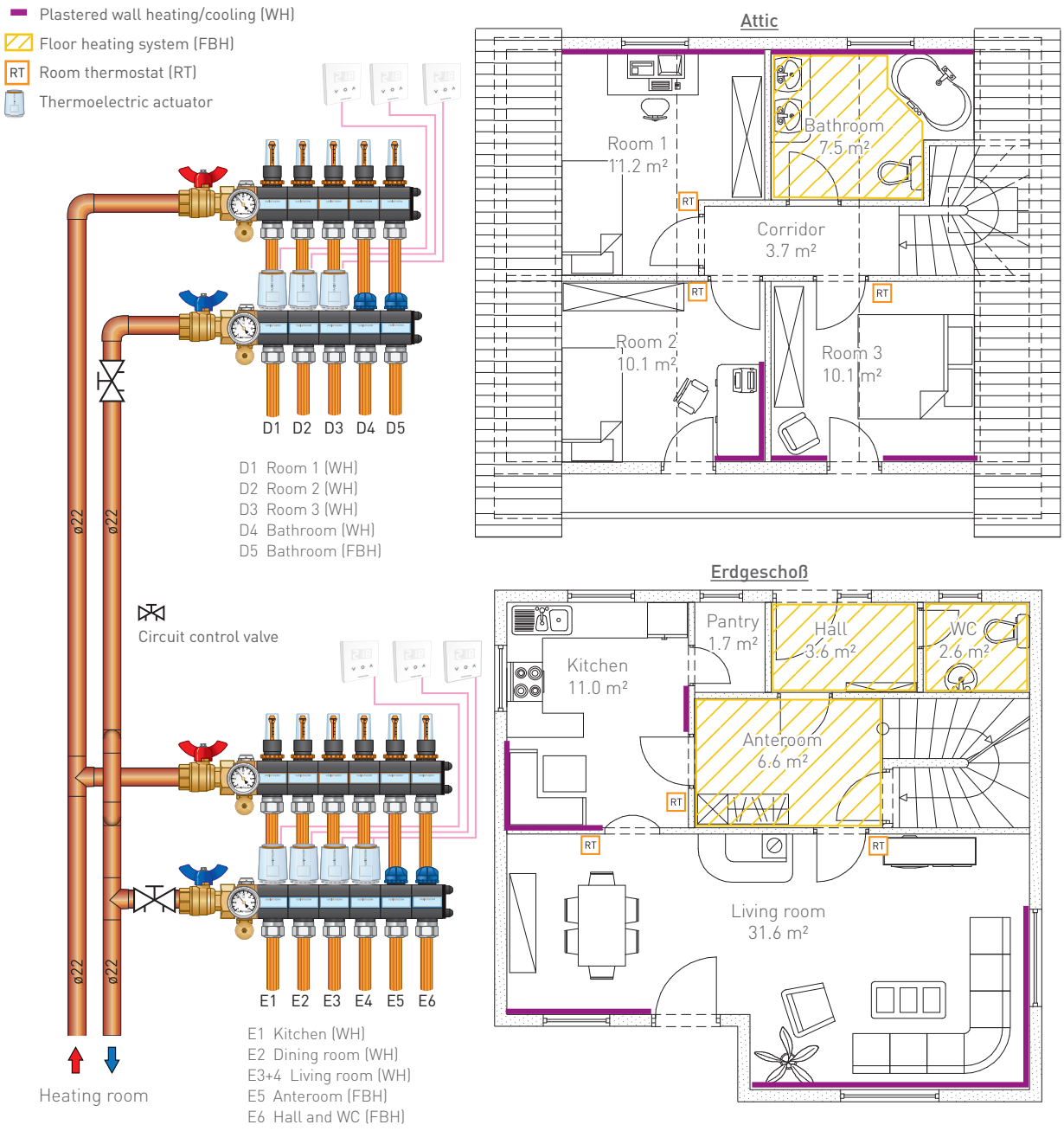
3.3 Supply pipe



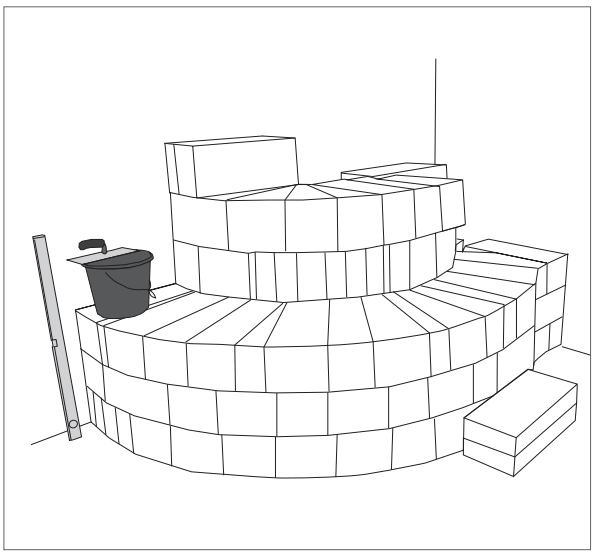


3.4 Single-family house example

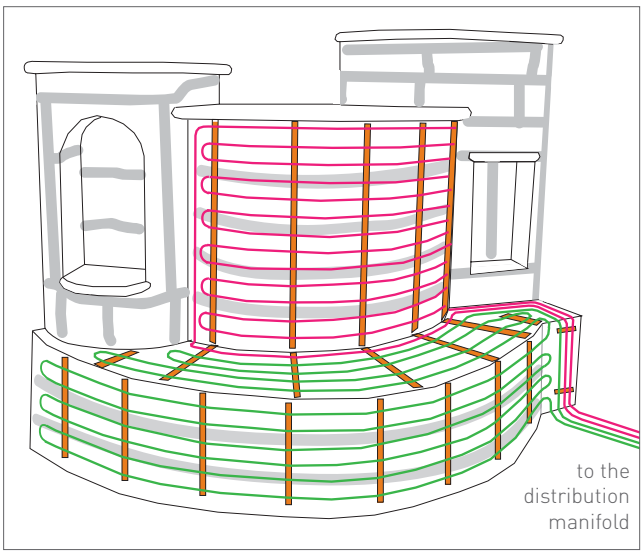
In the example provided, the heating system has been adapted to suit the rooms: A floor heating system is planned for tiled rooms (anterooms, toilet, bathroom) and wall heating surfaces are planned for the living rooms, work rooms and bedrooms. A room thermostat for controlling the room temperature is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



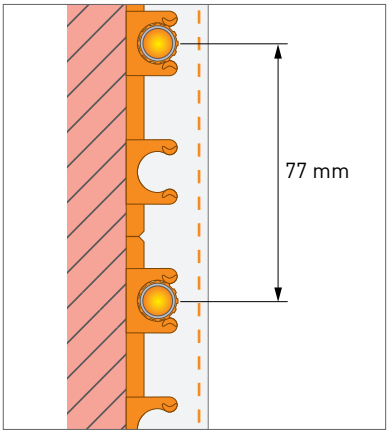
3.5 EasyFlexWall as 'designer heating'

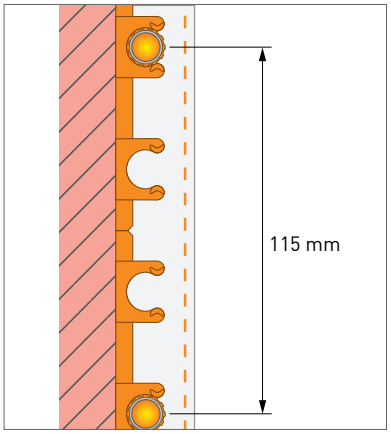


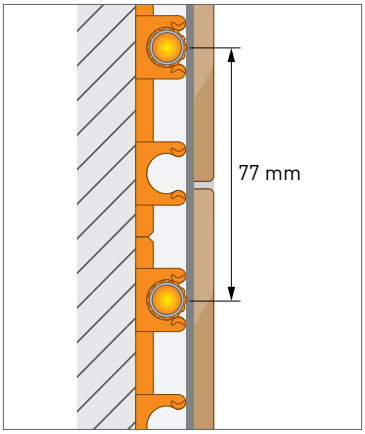
▲ Building a substructure (e.g. with porous concrete)



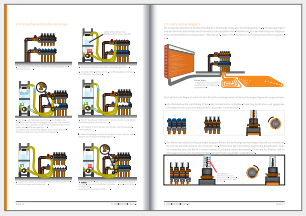
▲ Installing the VarioProFile pipe







Caution: The plaster must be compatible with the planned flow and surface temperature of the EasyFlexWall in the long term!



<< Details regarding the system and heating circuit pipes and the room temperature control are provided in the DISTRIBUTION and CONTROL planning and installation instructions.

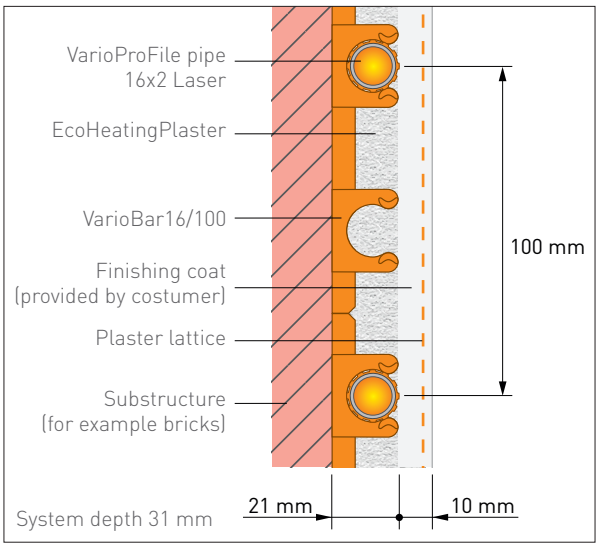
4 PLASTER

4.1 Plastering with EcoHeatingPlaster (SWHK2)

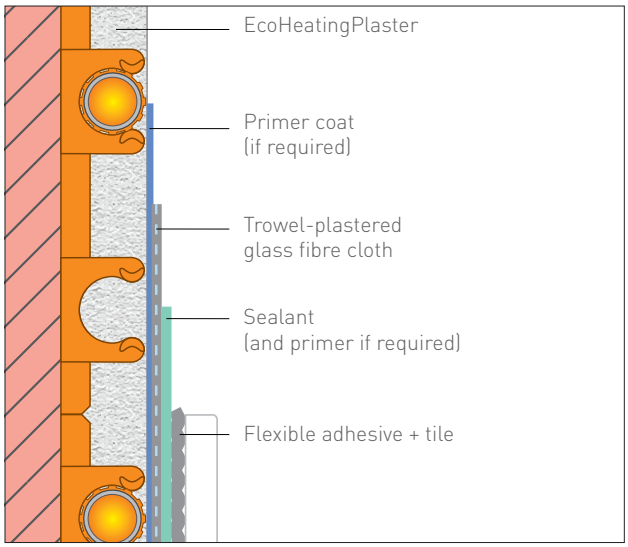
The Variotherm EcoHeatingPlaster (for details see also chapter 2.4) is used as a **base coat plaster** for the system wall heating/cooling (SWHK2), with plastering thicknesses (incl. heating pipe) of up to 25 mm. It is applied up to the soffit. **Fine plastering** follows on-site with approx. 10 mm pipe covering.

Examples for finishing coat on Variotherm EcoHeatingPlaster:

	Oven-dry density (28d)	Compressive strength	Product examples	Maximum grain size	Min. drying time EcoHeatingPlaster	Inserted Variotherm plaster lattice	Max. flow temperature
Lime plaster, lime cement plaster	⩾ 1200 kg/m³	< 3 N/mm²	maxit ip 20, Baumit MPI 30	Depending on products	6 to 9 hours (hardening)	Yes	55 °C
Lime gypsum plaster	⩾ 1200 kg/m³	< 3 N/mm²	maxit ip 23 F, Baumit MPI 26	1.0 mm	7 days	Yes	45 °C



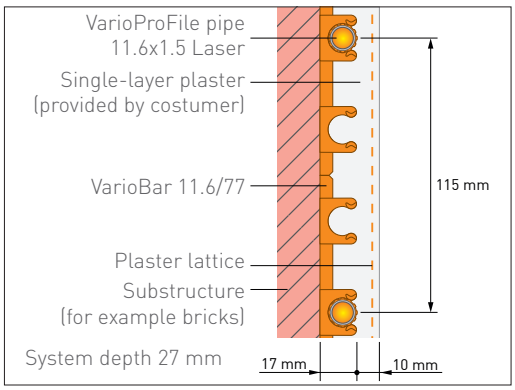
▲ Example for SWHK2



▲ Example for tiles – loading group W3/W4

4.2 Plastering with single-layer plaster (SWHK3, EWHK/EDKH)

- **Single-layer plasters require the manufacturer's approval for use with wall/ceiling heating/cooling systems.**
- Observe the manufacturer's guidelines for plastering
- Oven-dry density (28d): ⩾ 1250 kg/m³
- Pipe covering: ⩾ 10 mm
- The plaster must be compatible with the planned flow and surface temperature.



▲ Example EasyFlexWall EWHK115

5 THERMAL/COOLING PERFORMANCE

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 (valid since June 2013). 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).

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		Θ_{int}	A_R	Φ_{Te}	Φ_T	Φ_V	$\Phi_{Netto/m²}$	$\Phi_{Netto/m²}$	Φ_{Netto}	Φ_{RH}	Φ_{HL}
Nr.	Bezeichnung	°C	m²	W	W	W	W	W	W	W	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
00.001.004	Bad	24.0	12.26	300	324	459	64	22	783	0	783

▲ 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

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 heating or cooling load into the Variotherm dimensioning software. It can be found in our Professional Area at *www.variotherm.com/profi*.

Dimensioning of Variotherm Heating Systems

Building project: _____ ZIP: _____ City: _____ Date: _____ Processed by: _____

No.	Room name	Floor space A [m²]	Maximum length of DCH or SH L [m]	Heating load Q [W]	Supplement heating load Suppl. [%]	Heating load incl. Supplement Q+Suppl. [W]	Room temp. ti [°C]	Heat transfer system	Floor covering FH [d/λ]	Dimensioning temperature tfl/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
1	Room 1	12,50		566	10%	623	20	SystemWall SWHK2		40/30	4,98	m²	SWHK2	1	6,00	m²	SWHK2	127	- 16 x 2		17	0,31	65	•1
2	Room 2	14,50		655	10%	721	20	SystemWall SWHK2		40/30	5,76	m²	SWHK2	1	7,00	m²	SWHK2	155	- 16 x 2		12	0,45	76	•1
3	Kitchen	12,00		610	10%	671	20	SystemWall SWHK2		40/30	5,37	m²	SWHK2	1	6,50	m²	SWHK2	142	- 16 x 2		14	0,38	71	•1
4	Living room	25,00		1250	10%	1.375	22	SystemWall SWHK2		40/30	13,35	m²	SWHK2	2	7,00	m²	SWHK2	67	- 16 x 2		13	0,32	63	•1
5	WC	2,50		187	10%	206	20	SystemWall SWHK2		40/30	1,65	m²	SWHK2	1	2,50	m²	SWHK2	107	-			0,02	27	•1
6	Anteroom	10,50		650	10%	715	20	SystemWall SWHK2		40/30	5,72	m²	SWHK2	1	6,00	m²	SWHK2	35	- 16 x 2		15	0,30	65	(•1)
7	Bath room	8,50		590	10%	649	24	SystemWall SWHK2		40/30	7,91	m²	SWHK2	1	9,00	m²	SWHK2	89	- 16 x 2		20	0,43	64	•1

Summary of the heating systems

Amount	Unit	Heating system	Type	Pipe / Heating element
51,0	m²	System wall heating	SWHK2	510,0 lfm
	m²	System wall heating	SWHK3	
	m²	Modular wall heating	MSW	
	m²	EasyFlex wall heating	EWH77F	
	m²	EasyFlex wall heating	EWHK77	
	m²	EasyFlex wall heating	EWHK115	
	m²	Modular ceiling heating	MSD/MRD	
	m²	Screed floor heating	RA10	
	m²	Screed floor heating	RA15	
	m²	Screed floor heating	RA20	
	m²	Screed floor heating	RA25	
	m²	Screed floor heating	RA30	
	m²	Compact floor heating	RA10	
	m²	Compact floor heating	RA20	
	m	Skirting heating	HL mini	
	m	Skirting heating	HL Ia	
	m	Skirting heating	HL IIa	
	m	Skirting heating	HL IIIa	
	m	Ducted channel heating	BKH1 mini	
	m	Ducted channel heating	BKH1	
	m	Ducted channel heating	BKH2 mini	
	m	Ducted channel heating	BKH2	

Summary of pipe length by line

Line	Room	m ø 16	m ø 11,6
1	Room 1	77,0	
2	Room 2	82,0	
3	Kitchen	79,0	
4	Living room	166,0	
5	WC	25,0	
6	Anteroom	75,0	
7	Bath room	110,0	
8			
9			
10			
11			
12			
13			
TOTAL			614,0

Line	Room	m ø 16	m ø 11,6
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			

Summary of the floor heating surface area

Screed floor heating m²
Compact floor heating m²

Summary of loads

Total heating load 4.508 W

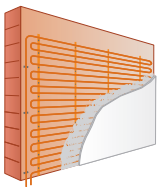
	tfl/tr	Number of heating circuits	Flow quantity manifold [kg/h]	Max. pressure loss + 0,1 mWC for manifold [mWC]	Manifold notation according to drawing
Distribution manifold •1	40/30	7	494	0,55	
Distribution manifold •2					
Distribution manifold •3					
Distribution manifold •4					
Distribution manifold •5					
When all distribution manifolds are fed via one pump, the following applies:					
Total flow quantity:			494	kg/h	
Maximum pressure loss from distribution manifold incl. 0.1mWC for max. opened valve			0,55	mWC	

▲ Variotherm dimensioning software example for heating

5.3 Heat output tables

- **Only valid with usage of EcoHeatingPlaster (oven-dry density 28d = 1500 kg/m³)**
- Pipe spacing 100 mm
- Finishing plaster thickness of 10 to 15 mm above pipe apex

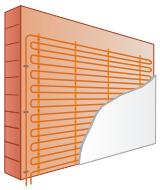
SystemWall
SWHK2



t_f/t_r [°C]	t_{mH} [°C]	Heat output [W/m²] at room temperature ...					T_0 [°C] (at T_r = 20 °C)
		... 15 °C	... 18 °C	... 20 °C	... 22 °C	... 24 °C	
30/20	25.0	100	65	42	20	–	25
30/25	27.5	121	85	62	41	20	27
35/25	30.0	142	106	83	62	40	29
35/28	31.5	154	118	95	74	52	30
35/30	32.5	162	127	104	82	61	30
37.5/32.5	35.0	183	148	125	103	82	32
40/30	35.0	183	148	125	103	82	32
40/35	37.5	204	169	146	123	103	34
45/35	40.0	225	190	167	144	124	36
45/40	42.5	246	210	187	164	144	38
50/40	45.0	267	231	208	185	164	40
50/45	47.5	288	251	229	206	186	42
55/45	50.0	310	272	250	228	208	44

- **Only valid with usage of plaster provided by costumer (oven-dry density 28d ≥ 1250 kg/m³)**
- Pipe spacing 100 mm
- Pipe coverage approx. 10 mm above pipe apex

SystemWall
SWHK3



t_f/t_r [°C]	t_{mH} [°C]	Heat output [W/m²] at room temperature ...					T_0 [°C] (at T_r = 20 °C)
		... 15 °C	... 18 °C	... 20 °C	... 22 °C	... 24 °C	
30/20	25.0	90	58	37	18	–	23
30/25	27.5	108	76	56	36	18	25
35/25	30.0	127	95	74	55	36	27
35/28	31.5	138	107	85	66	46	28
35/30	32.5	146	114	93	74	54	29
37.5/32.5	35.0	164	133	112	92	73	30
40/30	35.0	164	133	112	92	73	30
40/35	37.5	183	152	131	110	92	32
45/35	40.0	202	171	150	129	111	34
45/40	42.5	221	189	168	148	129	36
50/40	45.0	240	207	187	166	147	38
50/45	47.5	259	225	206	185	167	40
55/45	50.0	279	244	225	205	187	41

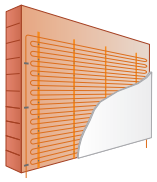
t_{mH} = mean heating circuit water temperature = $\frac{t_f + t_r}{2}$ [°C]

T_0 = mean surface temperature [°C]

T_r = room temperature [°C]

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

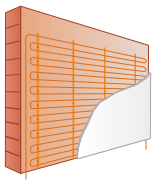
- Only valid with usage of plaster provided by costumer (oven-dry density 28d ⩾ 1250 kg/m³)
- **Pipe spacing 77 mm**
- Pipe coverage approx. 10 mm above pipe apex



EasyFlexWall
EWHK77

t_f/t_r [°C]	t_{mH} [°C]	Heat output [W/m²] at room temperature ...					T_0 [°C] (at T_r = 20 °C)
		... 15 °C	... 18 °C	... 20 °C	... 22 °C	... 24 °C	
30/20	25.0	91	58	37	17	–	24
30/25	27.5	110	77	56	37	17	26
35/25	30.0	130	97	76	57	35	28
35/28	31.5	142	109	87	67	47	28
35/30	32.5	150	117	95	75	55	29
37.5/32.5	35.0	170	137	115	94	76	31
40/30	35.0	170	137	115	94	76	31
40/35	37.5	189	157	136	115	95	33
45/35	40.0	209	177	156	134	115	35
45/40	42.5	230	197	175	153	134	36
50/40	45.0	251	217	195	173	153	38

- Only valid with usage of plaster provided by costumer (oven-dry density 28d ⩾ 1250 kg/m³)
- **Pipe spacing 115 mm**
- Pipe coverage approx. 10 mm above pipe apex



EasyFlexWall
EWHK115

t_f/t_r [°C]	t_{mH} [°C]	Heat output [W/m²] at room temperature ...					T_0 [°C] (at T_r = 20 °C)
		... 15 °C	... 18 °C	... 20 °C	... 22 °C	... 24 °C	
30/20	25.0	71	45	29	13	–	24
30/25	27.5	86	60	44	29	13	25
35/25	30.0	102	76	60	45	27	27
35/28	31.5	111	85	69	53	36	27
35/30	32.5	118	92	75	59	43	28
37.5/32.5	35.0	134	108	90	74	60	29
40/30	35.0	134	108	90	74	60	29
40/35	37.5	149	124	107	90	75	30
45/35	40.0	165	139	123	105	90	33
45/40	42.5	181	155	138	120	105	34
50/40	45.0	198	171	154	136	120	35

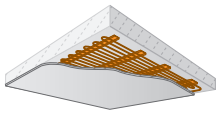
t_{mH} = mean heating circuit water temperature = $\frac{t_f + t_r}{2}$ [°C]

T_0 = mean surface temperature [°C]

T_r = room temperature [°C]

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

- Only valid with usage of plaster provided by costumer (oven-dry density 28d ≥ 1250 kg/m³)
- **Pipe spacing 77 mm**
- Pipe coverage approx. 10 mm above pipe apex



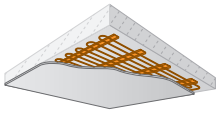
EasyFlexCeiling
EDKH77

Chart valid with ceiling height 2.5–3.5 m.

t_v/t_r [°C]	t_{mH} [°C]	Heat output [W/m²] at room temperature …					T_0 [°C] (at T_r = 20 °C)
		… 15 °C	… 18 °C	… 20 °C	… 22 °C	… 24 °C	
30/20	25.0	57	39	28	17	–	24
30/25	27.5	72	54	43	31	20	26
35/25	30.0	86	68	57	45	34	28
35/28	31.5	94	77	66	54	43	28
35/30	32.5	100	85	72	60	48	29
37.5/32.5	35.0	114	97	86	74	62	31
40/30	35.0	114	97	86	74	62	31

Do not exceed t_{mH} = 35 °C because of reasons of comfort!

- Only valid with usage of plaster provided by costumer (oven-dry density 28d ≥ 1250 kg/m³)
- **Pipe spacing 115 mm**
- Pipe coverage approx. 10 mm above pipe apex



EasyFlexCeiling
EDKH115

Chart valid with ceiling height 2.5–3.5 m.

t_v/t_r [°C]	t_{mH} [°C]	Heat output [W/m²] at room temperature …					T_0 [°C] (at T_r = 20 °C)
		… 15 °C	… 18 °C	… 20 °C	… 22 °C	… 24 °C	
30/20	25.0	44	31	22	13	–	24
30/25	27.5	56	42	33	25	16	25
35/25	30.0	67	53	44	36	27	27
35/28	31.5	73	60	52	43	33	27
35/30	32.5	77	65	56	47	37	28
37.5/32.5	35.0	90	76	67	58	49	29
40/30	35.0	90	76	67	58	49	29

Do not exceed t_{mH} = 35 °C because of reasons of comfort!

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

T_0 = mean surface temperature [°C]

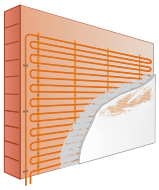
T_r = room temperature [°C]

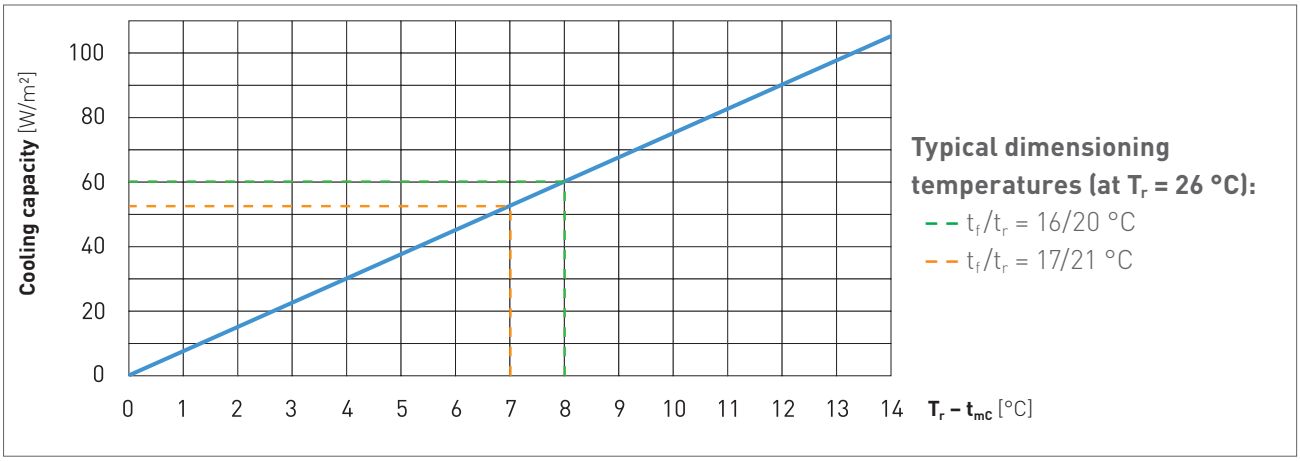
t_f/t_r = flow/return temperature [°C]

5.4 Cooling performance

- **Only valid with usage of EcoHeatingPlaster (oven-dry density 28d = 1500 kg/m³)**
- Pipe spacing 100 mm
- Finishing plaster thickness of 10 to 15 mm above pipe apex

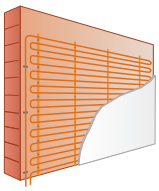
SystemWall
SWHK2

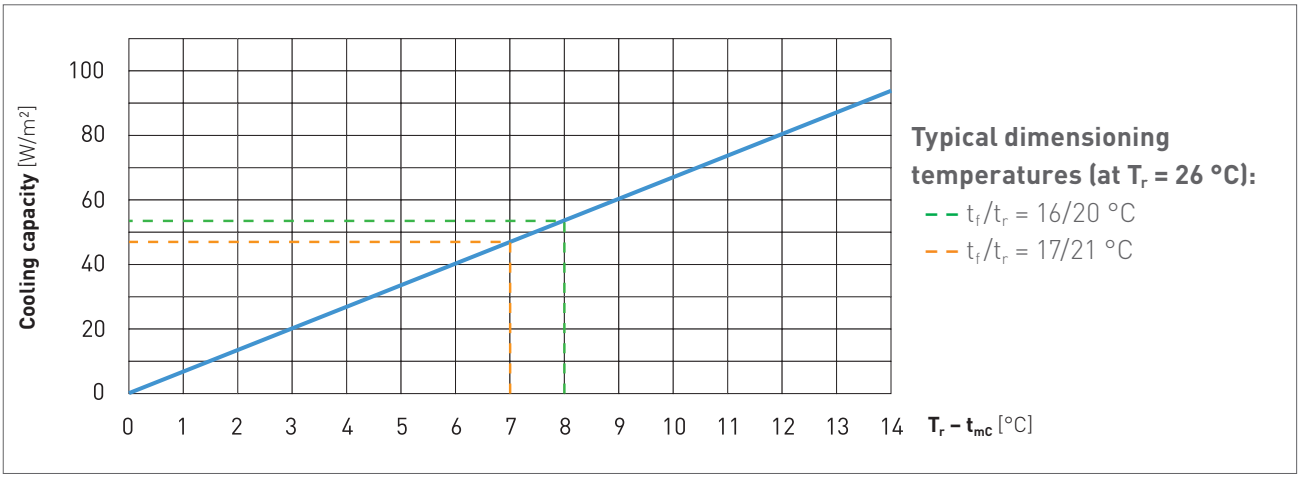




- **Only valid with usage of plaster provided by costumer (oven-dry density 28d ≥ 1250 kg/m³)**
- Pipe spacing 100 mm
- Pipe coverage approx. 10 mm above pipe apex

SystemWall
SWHK3





t_{mC} = mean cooling circuit water temperature = $\frac{t_f + t_r}{2}$ [°C]

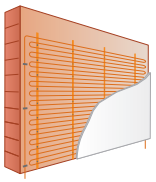
T_0 = mean surface temperature [°C]

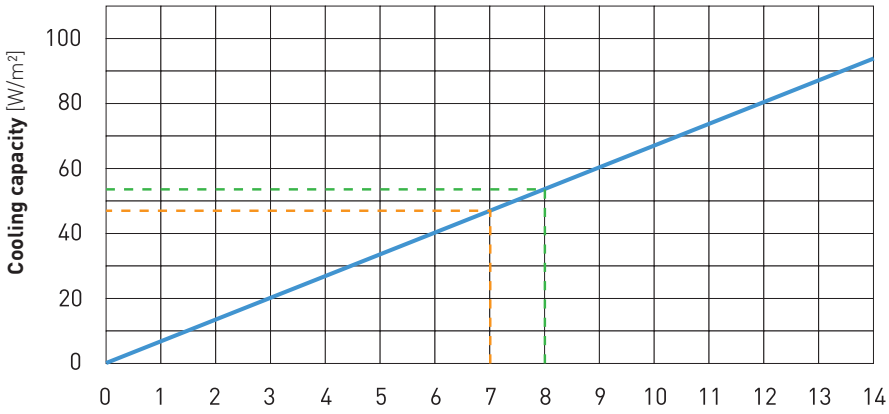
T_r = room temperature [°C]

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

- Only valid with usage of plaster provided by costumer (oven-dry density 28d ≥ 1250 kg/m³)
- **Pipe spacing 77 mm**
- Pipe coverage approx. 10 mm above pipe apex

EasyFlexWall
EWHK77

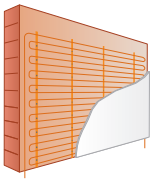


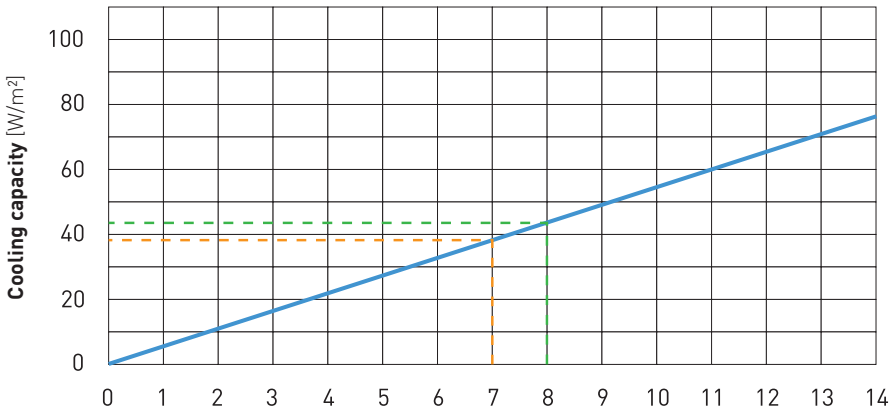


Typical dimensioning temperatures (at T_r = 26 °C):
- – – t_f/t_r = 16/20 °C
- – – t_f/t_r = 17/21 °C

- Only valid with usage of plaster provided by costumer (oven-dry density 28d ≥ 1250 kg/m³)
- **Pipe spacing 115 mm**
- Pipe coverage approx. 10 mm above pipe apex

EasyFlexWall
EWHK115





Typical dimensioning temperatures (at T_r = 26 °C):
- – – t_f/t_r = 16/20 °C
- – – t_f/t_r = 17/21 °C

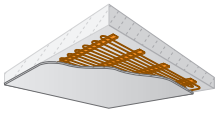
t_{mc} = mean cooling circuit water temperature = $\frac{t_f + t_r}{2}$ [°C]

T_o = mean surface temperature [°C]

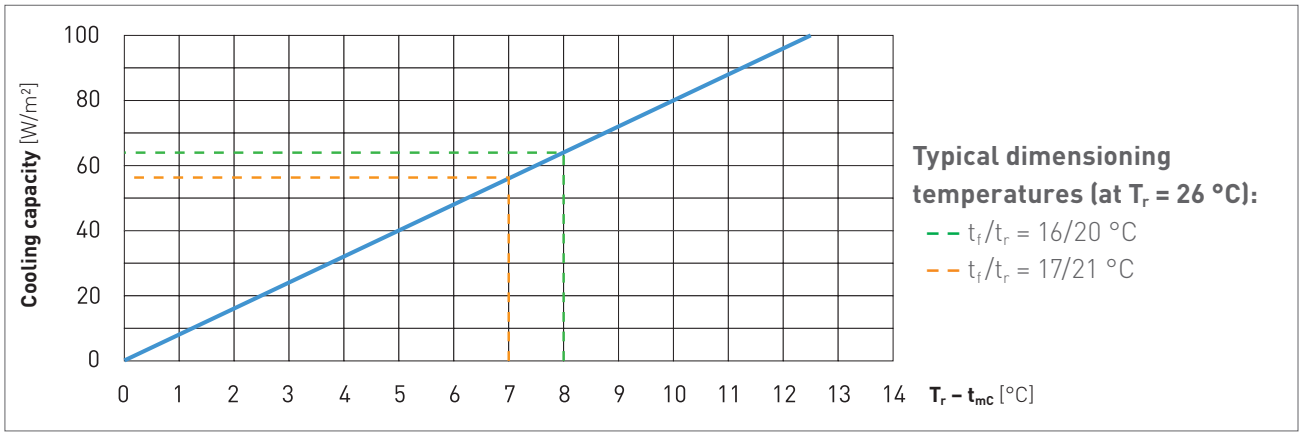
T_r = room temperature [°C]

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

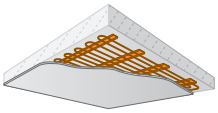
- Only valid with usage of plaster provided by costumer (oven-dry density 28d ⩾ 1250 kg/m³)
- **Pipe spacing 77 mm**
- Pipe coverage approx. 10 mm above pipe apex



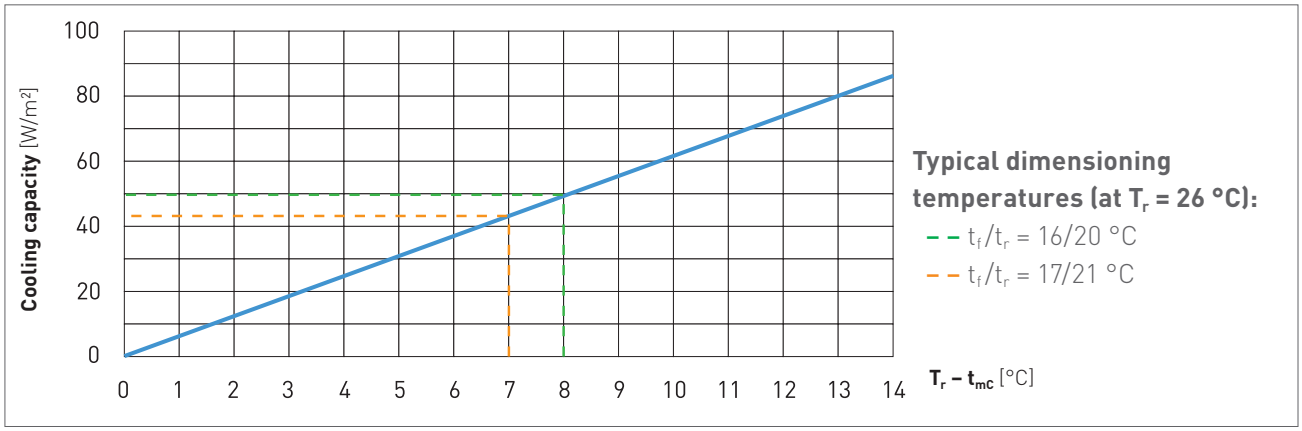
EasyFlexCeiling
EDKH77



- Only valid with usage of plaster provided by costumer (oven-dry density 28d ⩾ 1250 kg/m³)
- **Pipe spacing 115 mm**
- Pipe coverage approx. 10 mm above pipe apex



EasyFlexCeiling
EDKH115



t_{mc} = mean cooling circuit 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/return temperature [°C]

5.5 Surface condensation

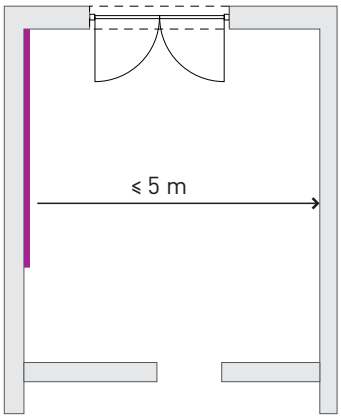
The surface temperature must not reach or fall below the dew point temperature! The mean surface temperature T_0 corresponds approximately to the return temperature tr.

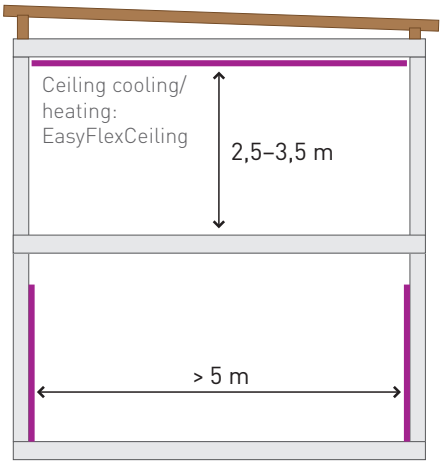
Relative humidity [%rF]	Room temperature [T_r]				
	24 °C	25 °C	26 °C	27 °C	28 °C
70 %	18.0	19.0	20.0	21.0	22.0
60 %	15.5	16.5	17.5	18.5	19.2
50 %	13.0	14.0	15.0	15.8	16.8
40 %	9.8	10.5	11.5	12.5	13.2

6 ARRANGEMENT OF THE SURFACES

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

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





Estimated values for dimensions:
~ 40 % wall surface or 50–60 % ceiling surface of the room area for heating
~ 70–80 % wall/ceiling surface of the room area for cooling

Caution: Observe the heating/cooling load calculation for precise dimensioning of the area required!

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 3 °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.

Issues relating to furniture:
Since the radiant heat should penetrate into the living area, 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.
Alternatively, ceilings are ideal for use as cooling and heating surfaces because the radiant surfaces are not impeded by room furnishings.
Tip: Beds (especially the bedheads) should not be placed directly in the radiation area of wall heating elements.

ENJOY THE COMFORT & SAVE ENERGY

That's why our customers love us:
Heating and cooling optimised for COMFORT in all rooms!
Fast and friendly service, ANSWERS backed up with expertise!
Always in tune with the latest technology, INNOVATION guaranteed!
Everything CLEAR and SIMPLE, in writing of course!
PROFESSIONALISM at all times, from the first contact to the reference list!

VARIOTHERM SINCE 1979

Variotherm is an Austrian model plant with hundreds of partners in Austria, Europe and around the world.

IMA DRESDEN

ÖSTERREICHISCHES INSTITUT FÜR BAUBIOLOGIE UND -ÖKOLOGIE IBO

Austria's Leading Companies 2014

ÖSTERREICHISCHER GEPRÜFTE QUALITÄT GÜTEZEICHEN 13.370 CERTIFIED QUALITY MUSTERBETRIEB

EWHC
SWHC

VARIOTHERM HEIZSYSTEME GMBH
GÜNSELSDORFER STRASSE 3A
2544 LEOBERSDORF
AUSTRIA
Phone: 0043 22 56 - 648 70-0
Fax: 0043 22 56 - 648 70-9
office@variotherm.com www.variotherm.com