

NEW SWHC

PLANNING

PLASTER WALL. HEATING AND COOLING.



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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.

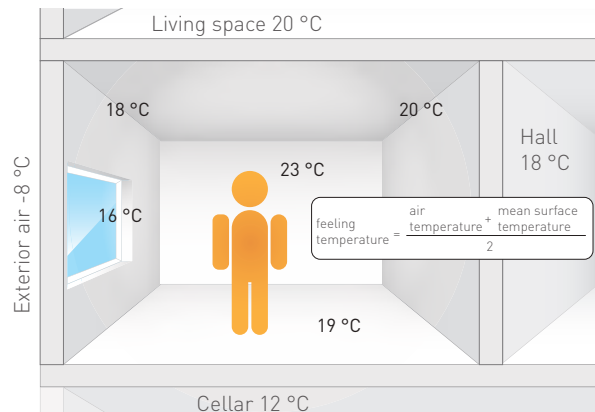
1.1 Comfort

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.

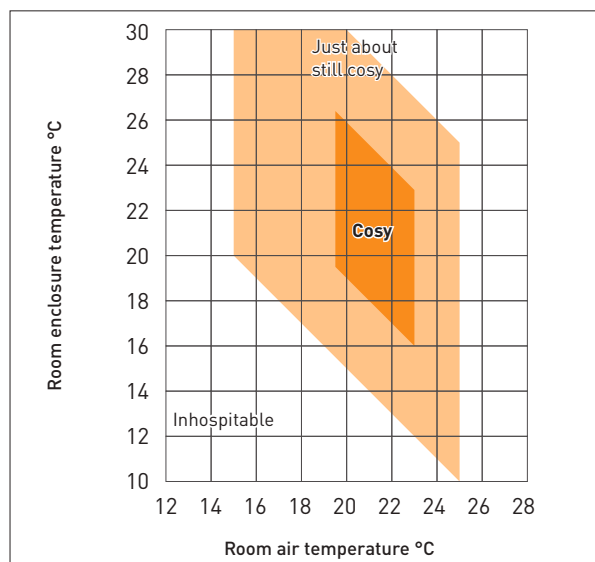
What makes people feel comfortable?

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

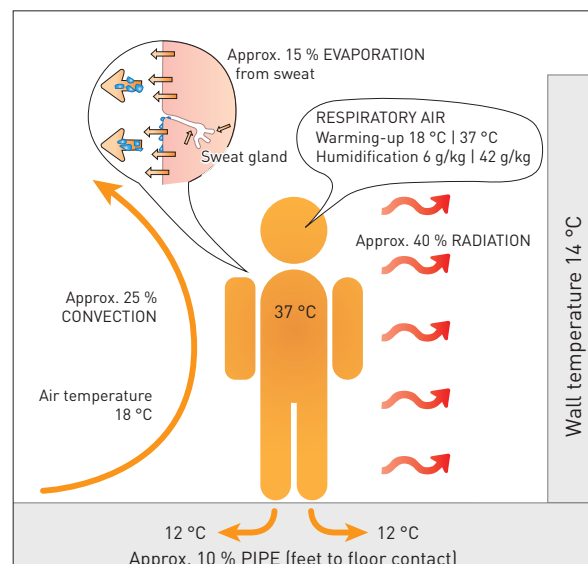
$$\text{Heat production} = \text{heat loss}$$



▲ Impact of the room on felt temperature



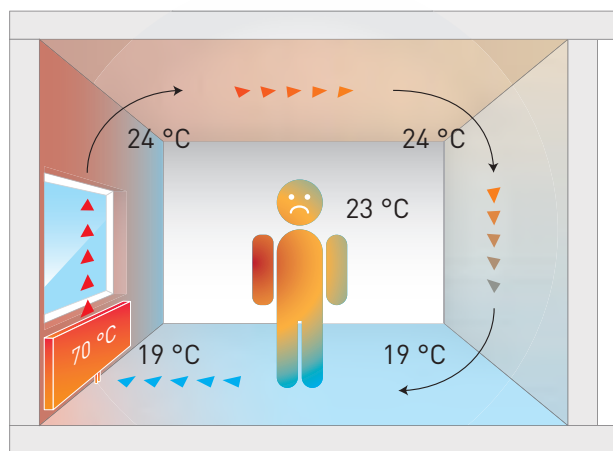
▲ Zone of cosiness



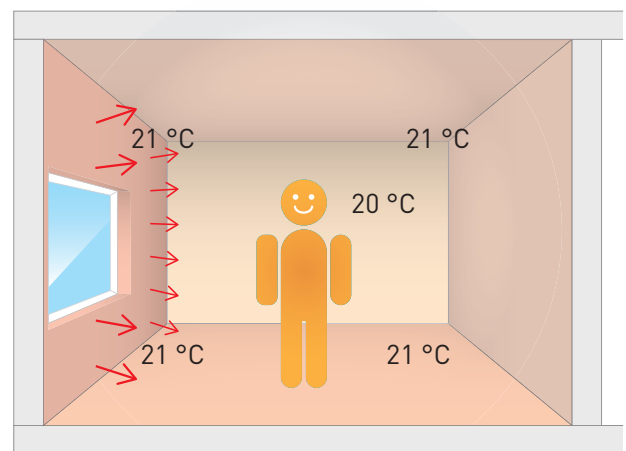
▲ Human heat balance

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

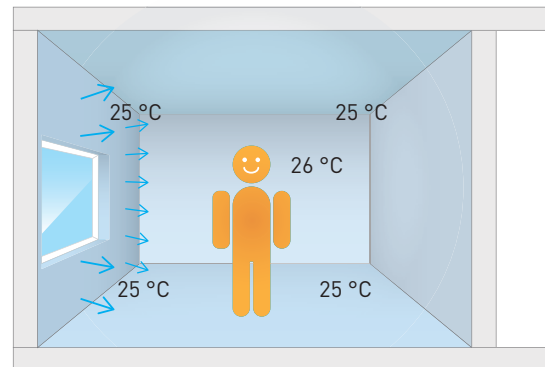
One reason for the frequent lack of satisfaction with air-conditioning systems is the inadequacy of the thermal ambient conditions in the air-conditioned rooms. Most frequently mentioned is the presence of uncomfortable forced air. Cooling via wall surfaces offers the advantage of gentle radiation exchange 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.

Cooling mode

Based on experience, cooling makes sense at a room temperature $\geq 26^\circ\text{C}$. To achieve a noticeable effect and suitably cool the body, a reduction of the ceiling surface temperature to approx. $19\text{--}22^\circ\text{C}$ is possible.



▲ Comfort with wall cooling

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.

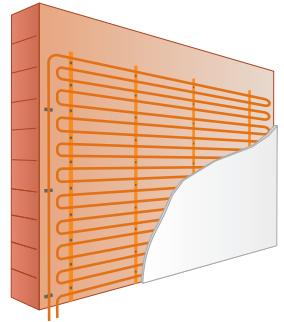
One of the major advantages of ceiling cooling/heating systems is the low additional investment costs. A single system is used for the cooling and heating modes: the same ceiling surface, same piping system and the same heating/cooling distribution manifold with supply lines and circulation pump. The 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.



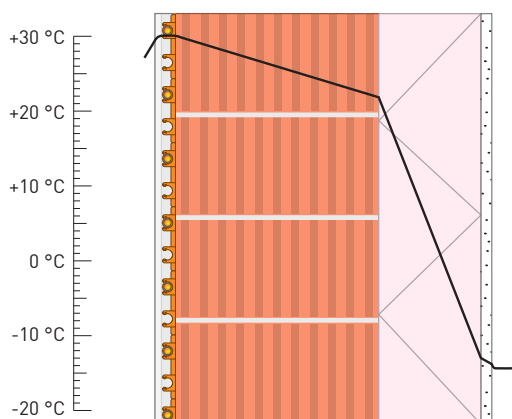
The advantages:

- 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

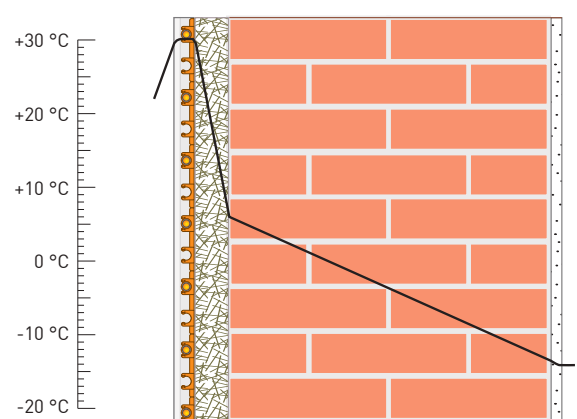


1.6 Temperature variations/wall structure

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



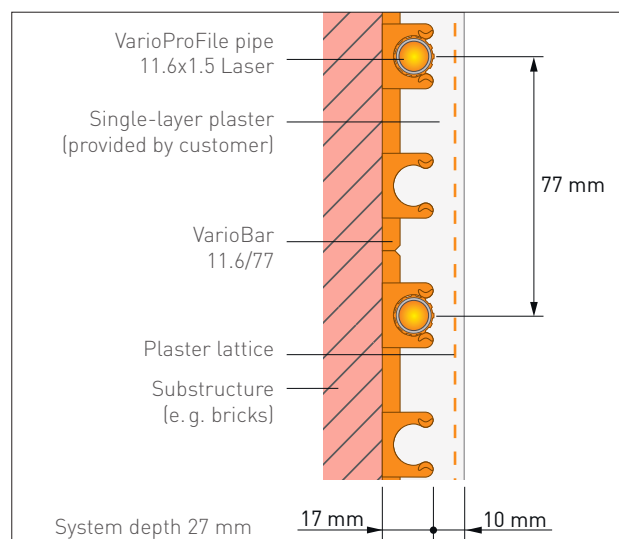
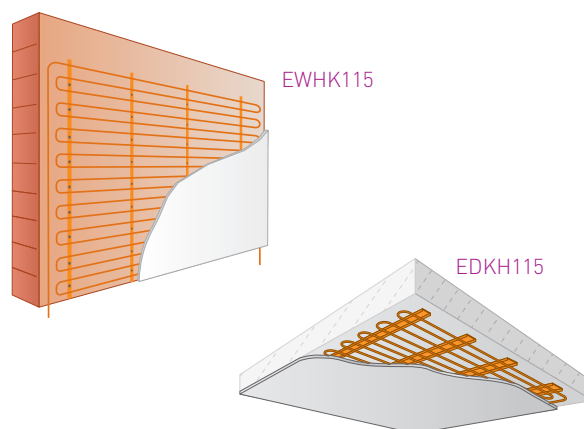
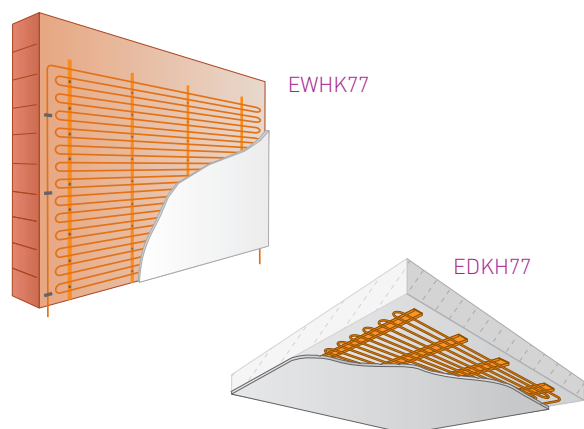
- ▲ New construction example, structure from left to right:
- 31 mm plaster incl. SystemWall
 - 300 mm vertically perforated bricks
 - 150 mm thermal insulation (EPS)
 - exterior plaster/paint



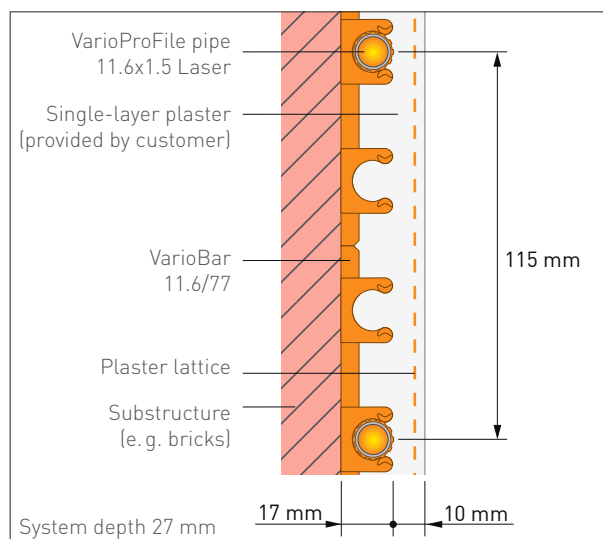
- ▲ Existing construction example, structure from left to right:
- 31 mm plaster incl. SystemWall
 - 50 mm wood-wool construction panel
 - 2 x 250 mm NF bricks
 - exterior plaster/paint

2 COMPONENTS

2.1 Overview – EasyFlexWall and EasyFlexCeiling



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



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

VarioProFile pipe 11.6x1.5 Laser

PG 050

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

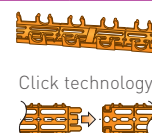


Part No.	PKU	Weight/PKU	Pallet
VP116L-100	100 m roll	7.3 kg	18 rolls
VP116L-300	300 m roll	21.7 kg	12 rolls
VP116L-500	500 m roll	36.2 kg	8 rolls

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:

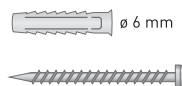
Part No.	PKU	Weight/PKU	Carton
V2722	1 m	100 g	50 × 1 m

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

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

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

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

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

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

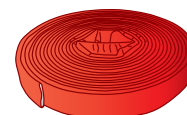


Part No.	Insulation thickness	PKU	Weight/PKU
V1226	6 mm	100 m roll	14.0 kg
V1227	9 mm	100 m roll	14.9 kg

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



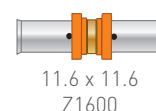
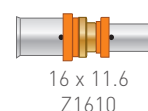
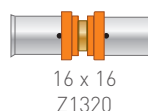
Part No.	PKU	Weight/PKU
Z24	10 m roll	170 g

Press-fit 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

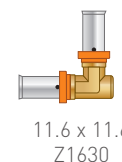
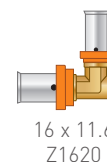
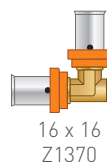


Press-fit brackets 90°

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



Cold shrink tape

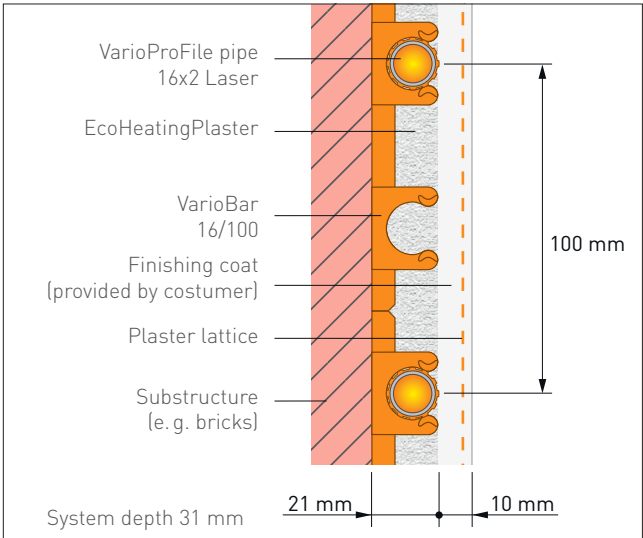
PG 100

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

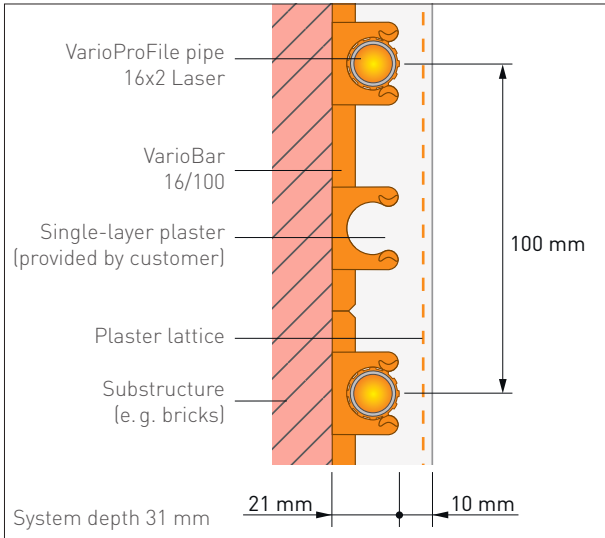


Part No.	PKU	Weight/PKU	Carton
Z1699	1 pce.	990 g	20 pcs.

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 customer.

VarioProFile pipe 16x2 Laser

PG 050

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

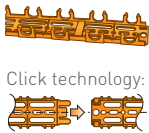


Part No.	PKU	Weight/PKU	Pallet
VP16L-100	100 m roll	10.2 kg	18 rolls
VP16L-300	300 m roll	30.6 kg	8 rolls
VP16L-500	500 m roll	51.0 kg	6 rolls

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



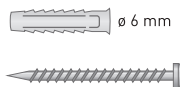
Part No.	PKU	Weight/PKU	Carton
V1610	1 m	120 g	50 × 1 m

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

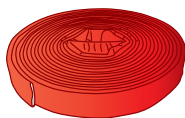


Part No.	PKU	Weight/PKU
V281	200 pcs.	1.3 kg

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

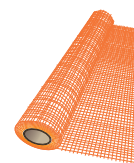


Part No.	PKU	Weight/PKU	Pallet
V270	1 bag	25 kg	42 bags

Paster lattice

PG 010

Special glass fibre cloth, reduces plaster tearing, 7 x 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 m ² 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 x 15 m, 1 roll is sufficient for approx. 35 press-fit coupling connections (with a 50 % overlap).



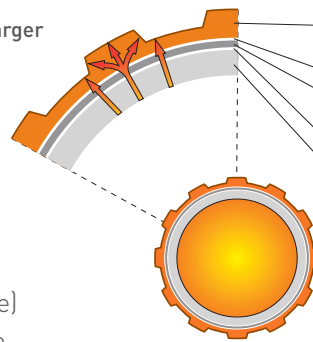
Part No.	PKU	Weight/PKU	Carton
Z1699	1 pce.	990 g	20 pcs.

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 21 003 (IMA Dresden), SKZ A 397

10 or 15 % larger surface



- Raised-temperature-resistance polyethylene (PE-RT) with profiled surface structure
- Adhesive layer
- Homogeneous laser-welded solid aluminium pipe
- Adhesive layer
- Raised-temperature-resistance polyethylene (PE-RT)



Elongation

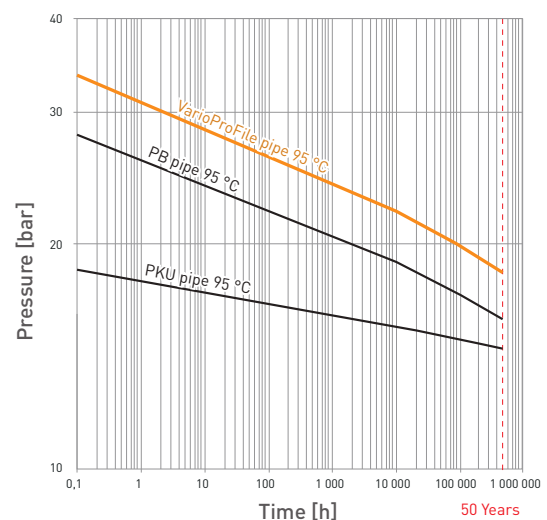
with 10 m and temperature difference Δt 25 °C (e.g. 20 °C to 45 °C):

	Tubing	Elongation	
Plastics	PEX/VPE	50.00 mm	Homogeneous plastic pipes produce high stress levels in the device because of their expansion coefficient.
	PP	42.50 mm	
	PB	32.50 mm	
	PVC	20.00 mm	
	VarioProFile pipe	5.75 mm	
Metall	Cu	4.20 mm	The VarioProFile pipe combines the minor elongation and thermal expansion. So it is perfect for surface heating- and -cooling pipes.
	Stainless steel	3.50 mm	
	Steel	2.88 mm	

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_{mat} :	110 °C	
Max. operating pressure p_{max} :	10 bar	
Linear expansion coefficient:	$2.3 \times 10^{-5} [K^{-1}]$	
Mean heat conduction coefficient λ :	0.44 W/mK	0.45 W/mK
Heat transmission resistance R_{λ} :	0.0034 m ² K/W	0.0045 m ² K/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 to 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

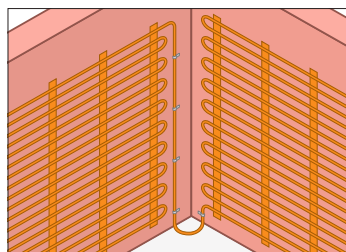
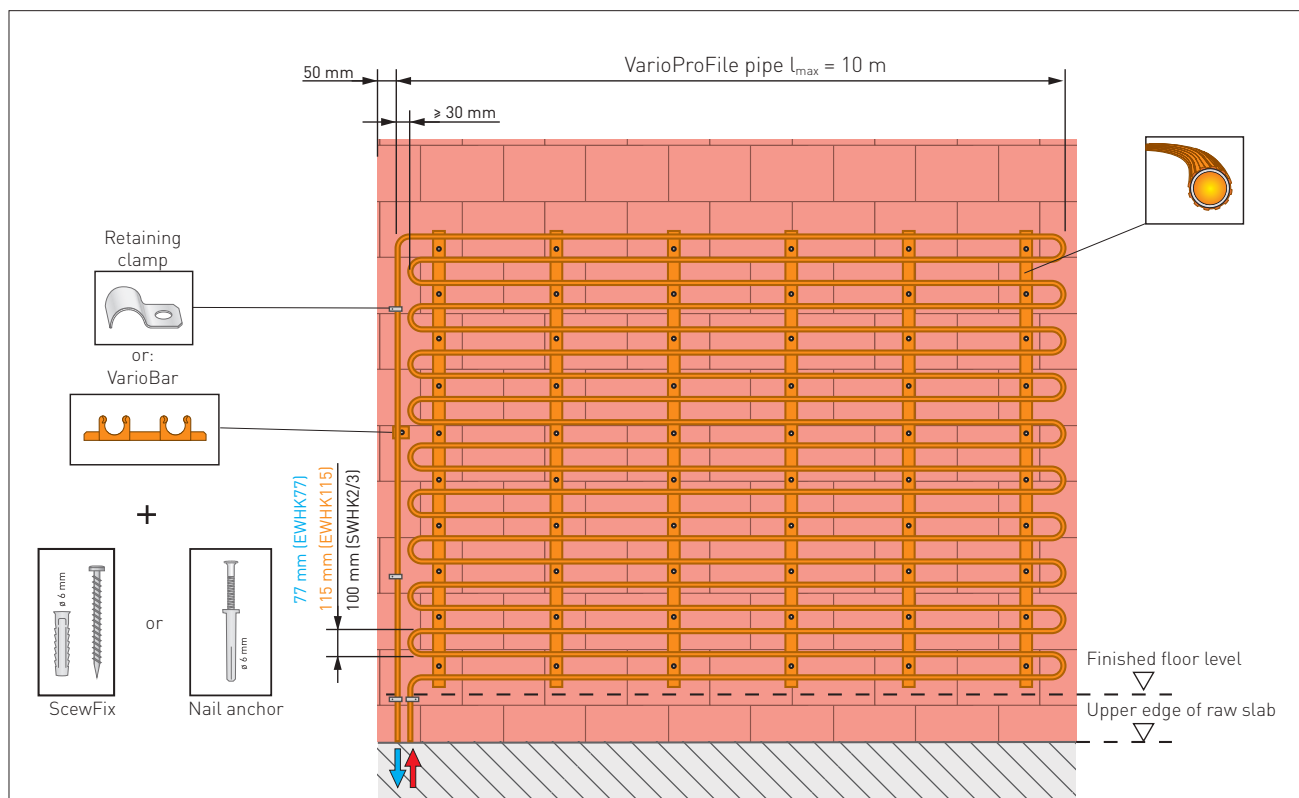
Maximum grain size:	2 mm
Compressive strength (28d):	> 3 N/mm ²
Flexural strength (28d):	> 1 N/mm ²
Thermal conductivity λ :	0.82 W/mK
Acid capacity (m value):	12.4
Oven-dry density (28d):	approx. 1500 kg/m ³
Fresh mortar bulk density:	approx. 1700 kg/m ³
Water requirement:	approx. 5–6 litres per bag (25 kg)
Material consumption:	approx. 45 kg/m ² [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

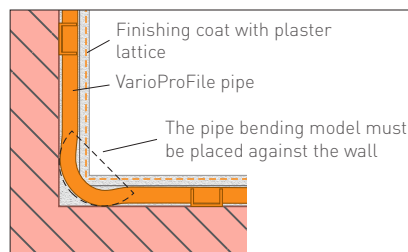
3 PIPING

3.1 General

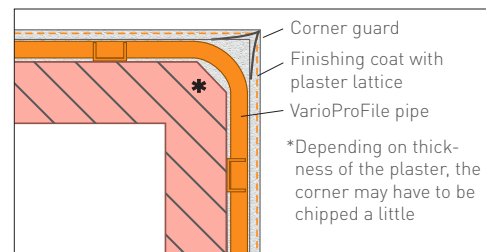
	SWHK2/3	EWHK77	EWHK115
Pipe spacing	100 mm	77 mm	115 mm
Dimension VarioProFile pipe	16x2	11.6x1.5	11.6x1.5
Pipe requirement per 1 m ² wall heating surface	10 m/m ²	13 m/m ²	8.7 m/m ²
Max. pipe length per heating circuit incl. supply	120 m	80 m	80 m



▲ Example inner corner



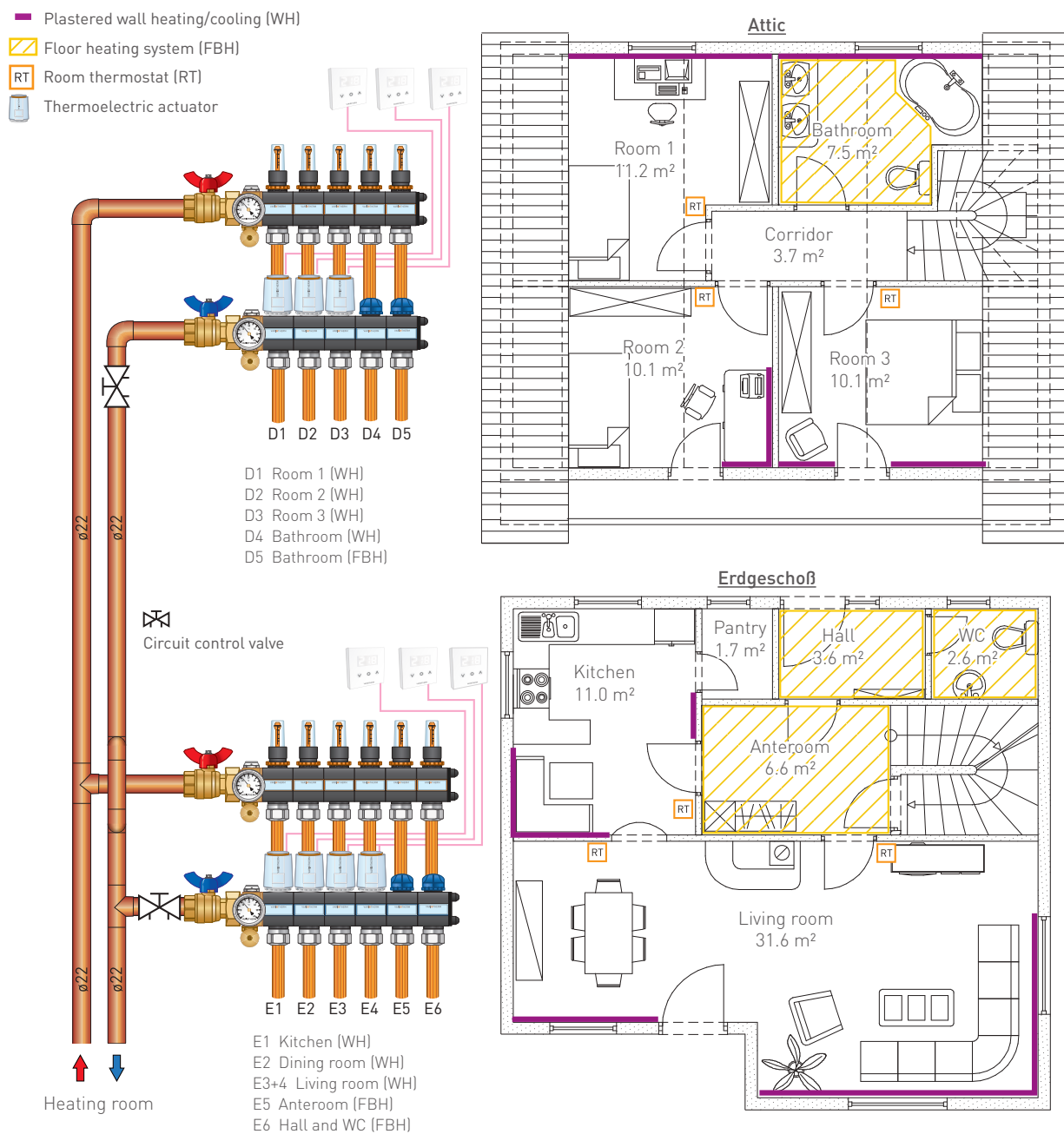
▲ Special case inner corner



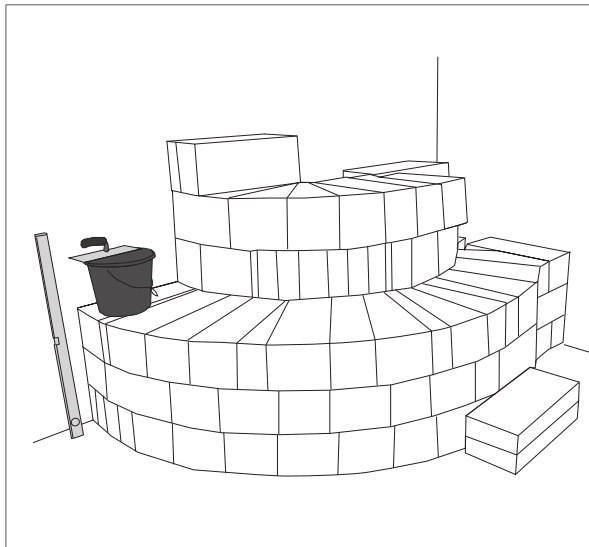
▲ Special case outside corner

3.4 Single-family house example

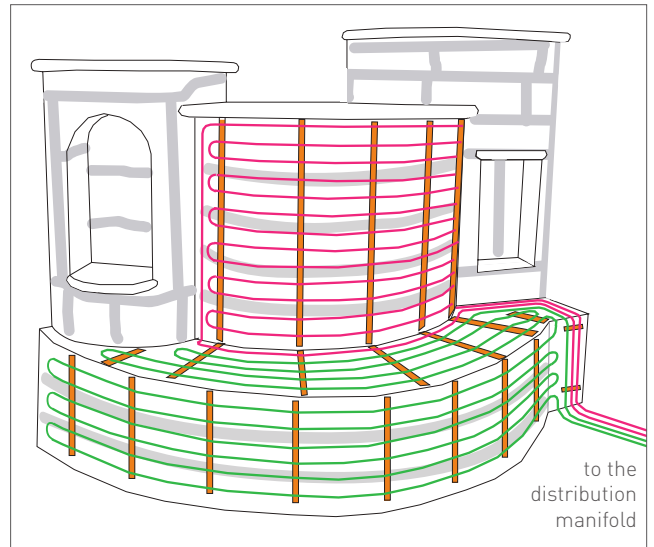
In the example provided, the heating system has been adapted to suit the rooms: A floor heating system is planned for tiled rooms (anterooms, toilet, bathroom) and wall heating surfaces are planned for the living rooms, work rooms and bedrooms. A room thermostat for controlling the room temperature is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



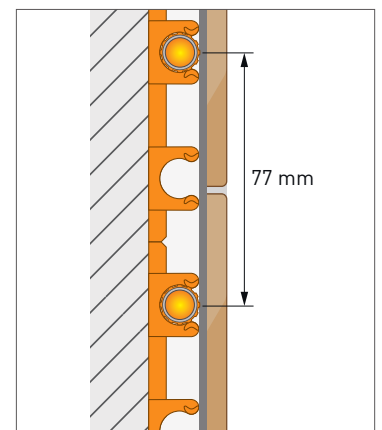
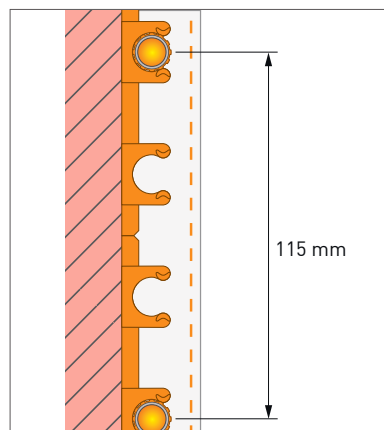
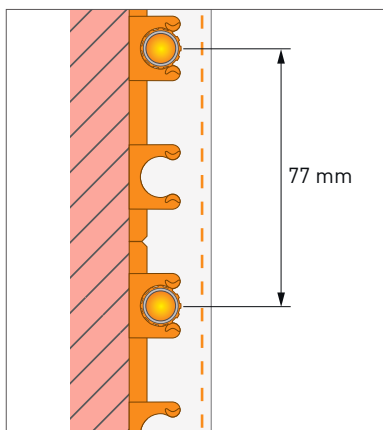
3.5 EasyFlexWall as 'designer heating'



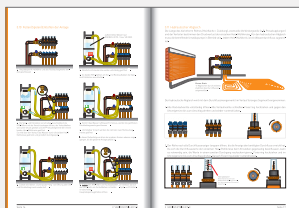
▲ Building a substructure (e.g. with porous concrete)



▲ 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.

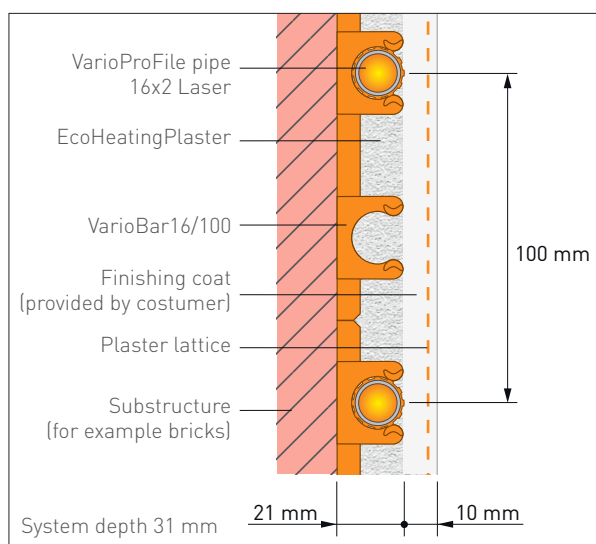
4 PLASTER

4.1 Plastering with EcoHeatingPlaster (SWHK2)

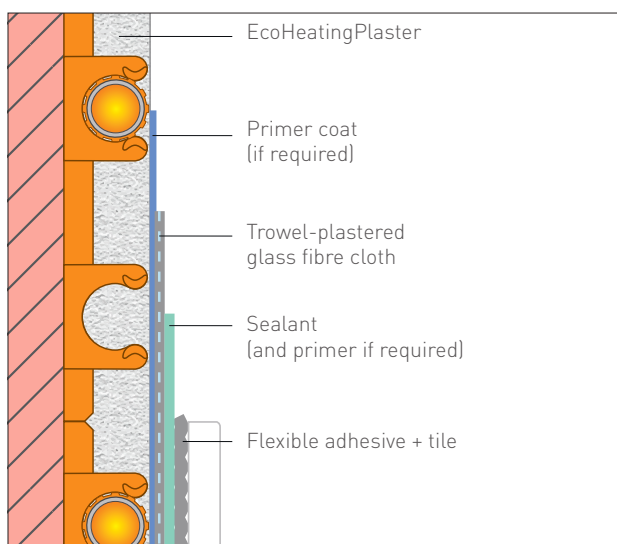
The Variotherm EcoHeatingPlaster (for details see also chapter 2.4) is used as a **base coat plaster** for the system wall heating/cooling (SWHK2), with plastering thicknesses (incl. heating pipe) of up to 25 mm. It is applied up to the soffit. **Fine plastering** follows on-site with approx. 10 mm pipe 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	$\geq 1200 \text{ kg/m}^3$	$< 3 \text{ N/mm}^2$	maxit ip 20, Baunit MPI 30	Depending on products	6 to 9 hours (hardening)	Yes	55 °C
Lime gypsum plaster	$\geq 1200 \text{ kg/m}^3$	$< 3 \text{ N/mm}^2$	maxit ip 23 F, Baunit MPI 26	1.0 mm	7 days	Yes	45 °C



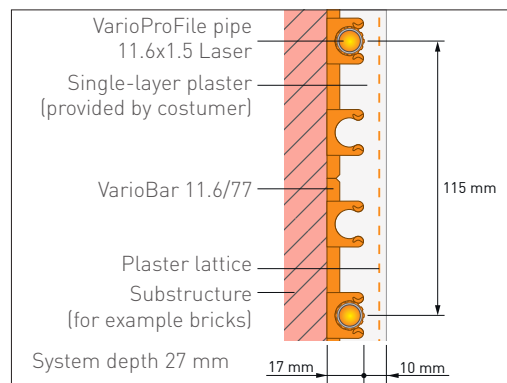
▲ Example for SWHK2



▲ 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): $\geq 1250 \text{ kg/m}^3$
- Pipe covering: $\geq 10 \text{ mm}$
- The plaster must be compatible with the planned flow and surface temperature.

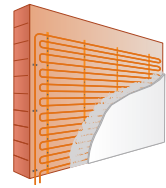


▲ Example EasyFlexWall EWHK115

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

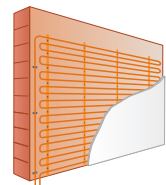
SystemWall
SWHK2



t_f/t_r [°C]	t_{mH} [°C]	Heat output [W/m²] at room temperature ...					T_o [°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_o [°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]

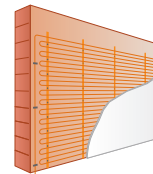
T_r = room temperature [°C]

T_o = mean surface temperature [°C]

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

- Only valid with usage of plaster provided by costumer (oven-dry density $28d \geq 1250 \text{ kg/m}^3$)
- **Pipe spacing 77 mm**
- Pipe coverage approx. 10 mm above pipe apex

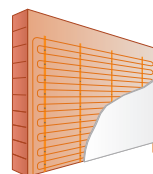
EasyFlexWall
EWHK77



t_i/t_r [°C]	t_{mH} [°C]	Heat output [W/m²] at room temperature ...					T_o [°C] (at $T_r = 20^\circ\text{C}$)
		... 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 $28d \geq 1250 \text{ kg/m}^3$)
- **Pipe spacing 115 mm**
- Pipe coverage approx. 10 mm above pipe apex

EasyFlexWall
EWHK115



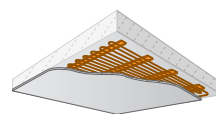
t_i/t_r [°C]	t_{mH} [°C]	Heat output [W/m²] at room temperature ...					T_o [°C] (at $T_r = 20^\circ\text{C}$)
		... 15 °C	... 18 °C	... 20 °C	... 22 °C	... 24 °C	
30/20	25.0	71	45	29	13	–	24
30/25	27.5	86	60	44	29	13	25
35/25	30.0	102	76	60	45	27	27
35/28	31.5	111	85	69	53	36	27
35/30	32.5	118	92	75	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

$$t_{mH} = \text{mean heating circuit water temperature} = \frac{t_i + t_r}{2} \text{ [}^\circ\text{C]} \\ t_r = \text{room temperature [}^\circ\text{C]}$$

$$T_o = \text{mean surface temperature [}^\circ\text{C]}$$

$$t_i/t_r = \text{flow/return temperature [}^\circ\text{C]}$$

- Only valid with usage of plaster provided by costumer (oven-dry density $28d \geq 1250 \text{ kg/m}^3$)
- **Pipe spacing 77 mm**
- Pipe coverage approx. 10 mm above pipe apex



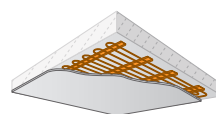
EasyFlexCeiling
EDKH77

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_o [°C] (at $T_r = 20^\circ\text{C}$)
		... 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 $t_{mH} = 35^\circ\text{C}$ because of reasons of comfort!

- Only valid with usage of plaster provided by costumer (oven-dry density $28d \geq 1250 \text{ kg/m}^3$)
- **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_o [°C] (at $T_r = 20^\circ\text{C}$)
		... 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 $t_{mH} = 35^\circ\text{C}$ because of reasons of comfort!

$$t_{mH} = \text{mean heating circuit water temperature} = \frac{t_i + t_r}{2} \text{ [}^\circ\text{C]} \\ T_r = \text{room temperature [}^\circ\text{C]}$$

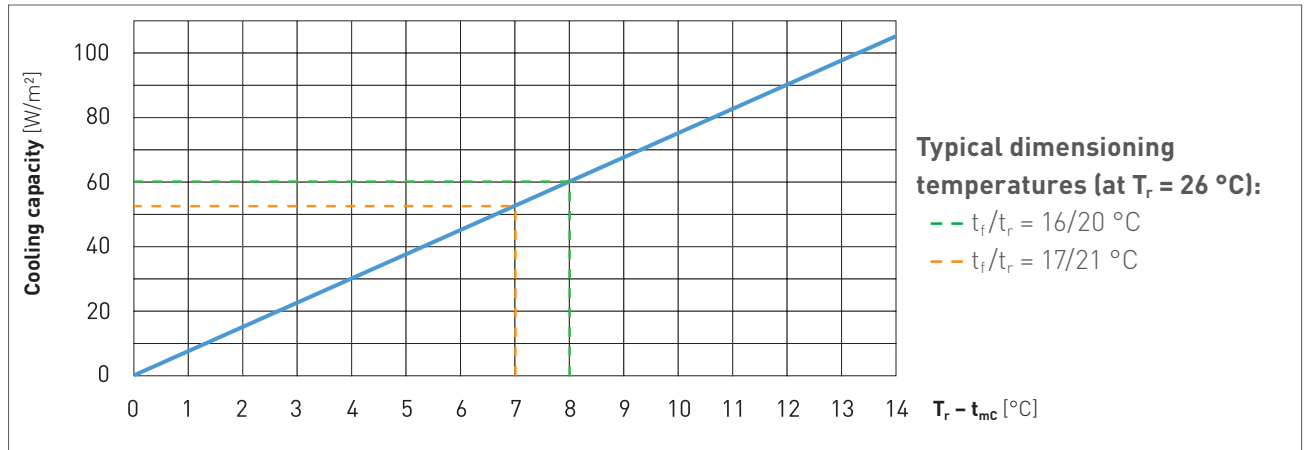
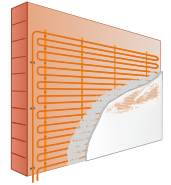
$$T_o = \text{mean surface temperature [}^\circ\text{C]}$$

$$t_i/t_r = \text{flow/return temperature [}^\circ\text{C]}$$

5.4 Cooling performance

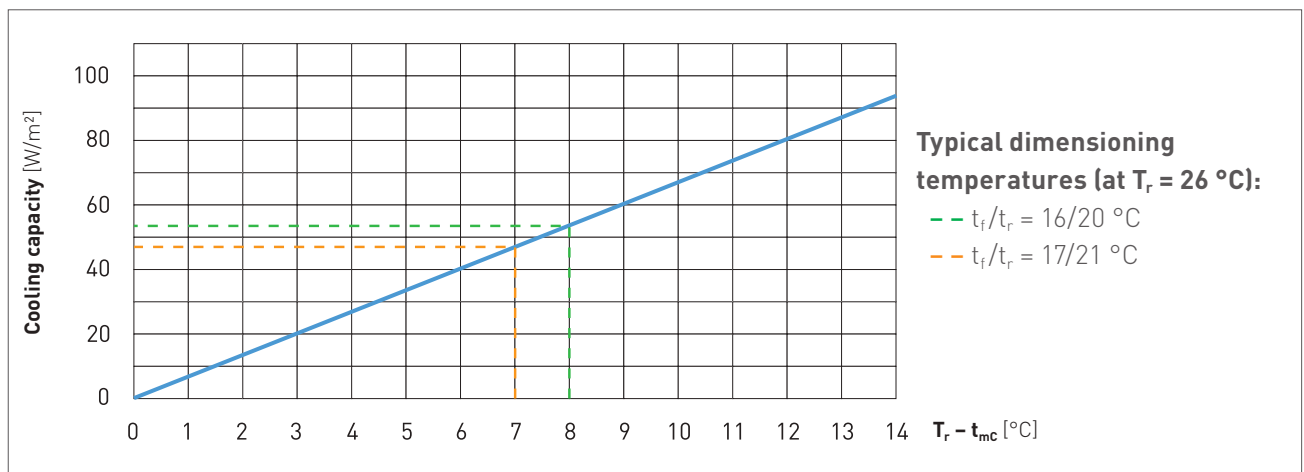
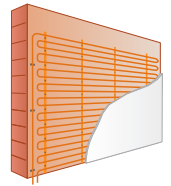
- Only valid with usage of EcoHeatingPlaster (oven-dry density $28d = 1500 \text{ kg/m}^3$)
- Pipe spacing 100 mm
- Finishing plaster thickness of 10 to 15 mm above pipe apex

SystemWall
SWHK2



- Only valid with usage of plaster provided by costumer (oven-dry density $28d \geq 1250 \text{ kg/m}^3$)
- Pipe spacing 100 mm
- Pipe coverage approx. 10 mm above pipe apex

SystemWall
SWHK3



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

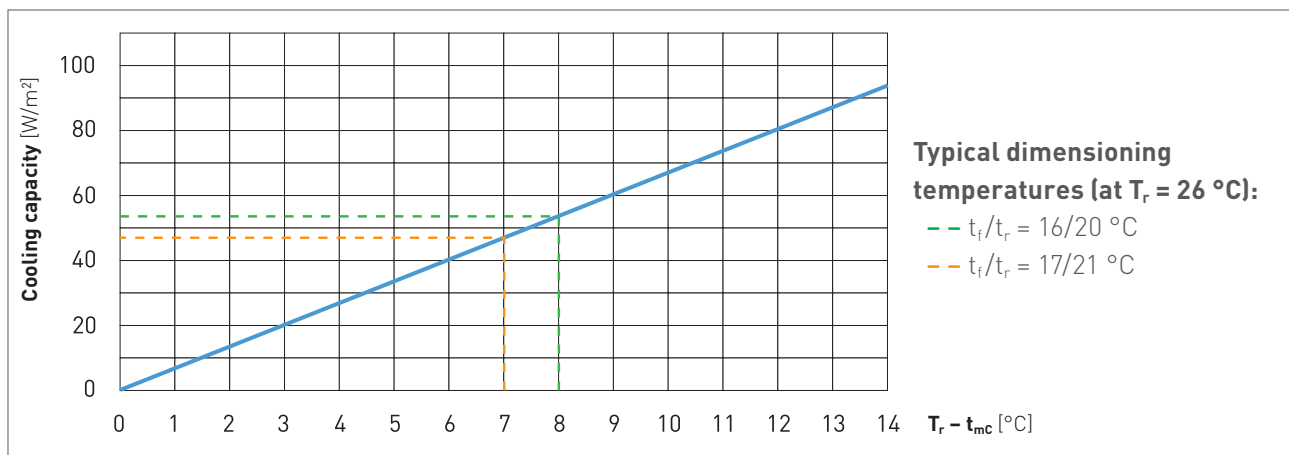
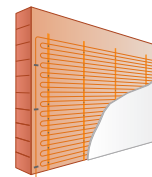
T_r = room temperature [°C]

T_o = mean surface temperature [°C]

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

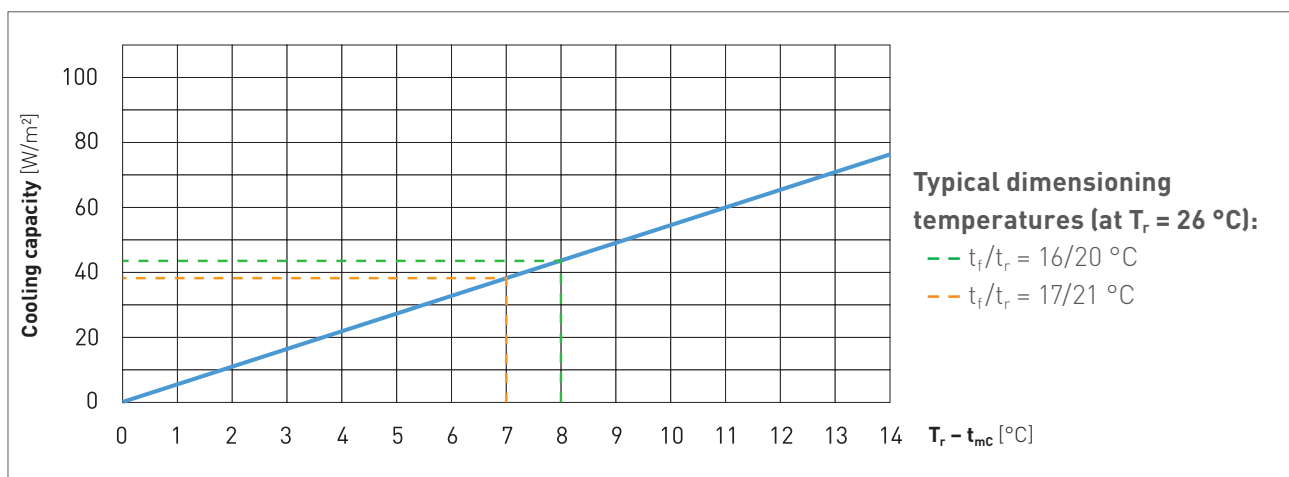
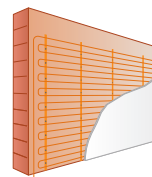
- Only valid with usage of plaster provided by costumer (oven-dry density $28d \geq 1250 \text{ kg/m}^3$)
- **Pipe spacing 77 mm**
- Pipe coverage approx. 10 mm above pipe apex

EasyFlexWall
EWHK77



- Only valid with usage of plaster provided by costumer (oven-dry density $28d \geq 1250 \text{ kg/m}^3$)
- **Pipe spacing 115 mm**
- Pipe coverage approx. 10 mm above pipe apex

EasyFlexWall
EWHK115



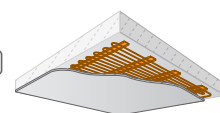
$$t_{mc} = \text{mean cooling circuit water temperature} = \frac{t_f + t_r}{2} \text{ [°C]}$$

T_r = room temperature [°C]

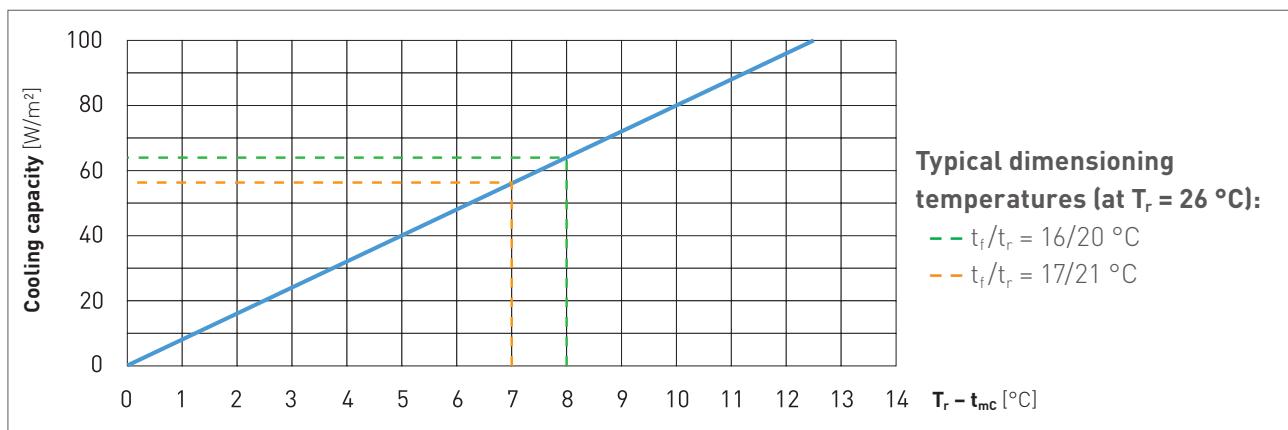
T_o = mean surface temperature [°C]

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

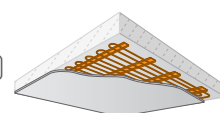
- Only valid with usage of plaster provided by costumer (oven-dry density $28d \geq 1250 \text{ kg/m}^3$)
- **Pipe spacing 77 mm**
- Pipe coverage approx. 10 mm above pipe apex



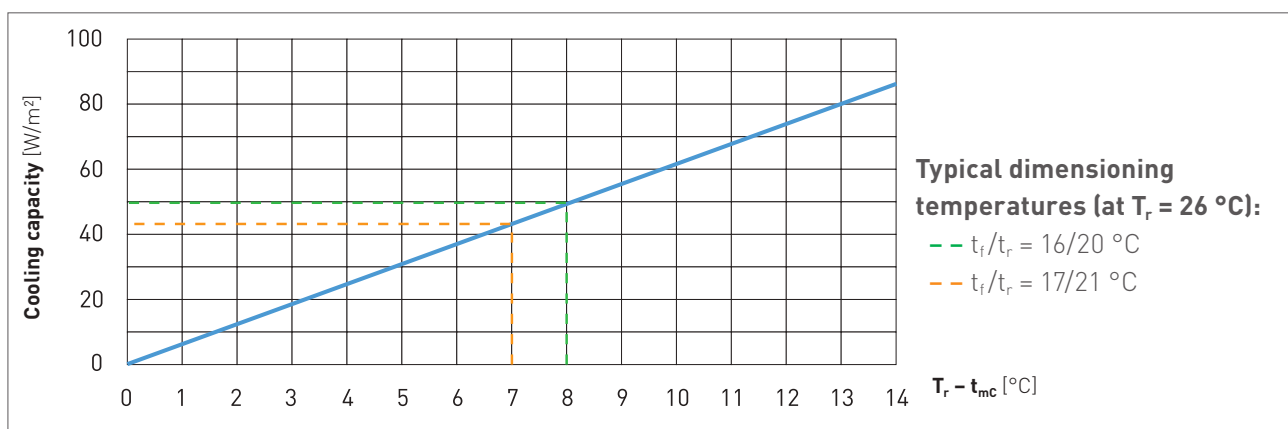
EasyFlexCeiling
EDKH77



- Only valid with usage of plaster provided by costumer (oven-dry density $28d \geq 1250 \text{ kg/m}^3$)
- **Pipe spacing 115 mm**
- Pipe coverage approx. 10 mm above pipe apex



EasyFlexCeiling
EDKH115



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

T_r = room temperature [°C]

T_0 = mean surface temperature [°C]

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

5.5 Surface condensation

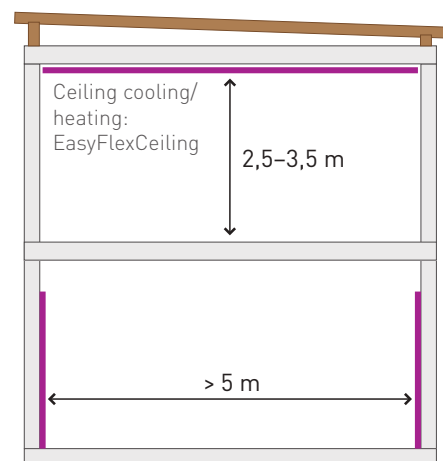
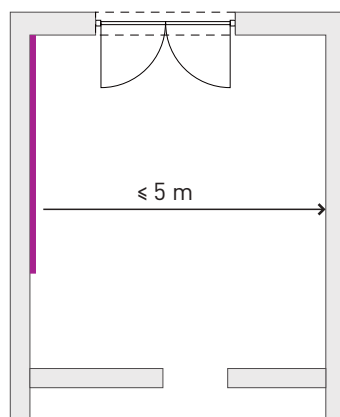
The surface temperature must not reach or fall below the **dew point temperature**! The mean surface temperature T_0 corresponds approximately to the return temperature t_r .

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 $\leq 0.3 \text{ W/m}^2\text{K}$, 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.

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