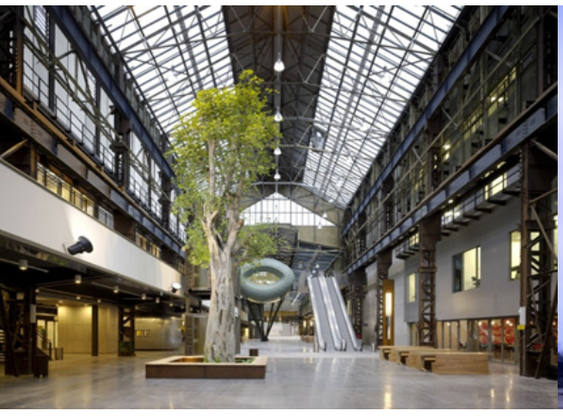
Concrete Core Cooling

Energiesparen und Klimaschutz serienmäßig

Radiant Heating Systems

Technical Manual

Issue July 2012



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Concrete Core Cooling

Contents

Design Manual

1.0 Introduction

The Purpose of this technical installation manual is to introduce and develop knowledge of consultants, architects, HVAC engineers and contractors with Wolf radiant Heating system.

In this manual the principle radiant heating system is explained besides introduced and recommend the methods of installation and attending subjects related to embedded pipe water based radiant heating system

1.1 Scope

This document contains technical information about Wolf PEXRT Radiant Heating systems.

Before engineering the system, read this document carefully to get familiar with the technical aspects and strictly observe the given indications and instructions. Make sure that you understand the operation of the system. If you do not understand any part of the information provided in this manual please contact **Wolf, Germany**.
Wolf provide procedures of installation, assessments and does not have responsibilities for any misuse or mistakes of third party engineering applied.

1.2 Contact

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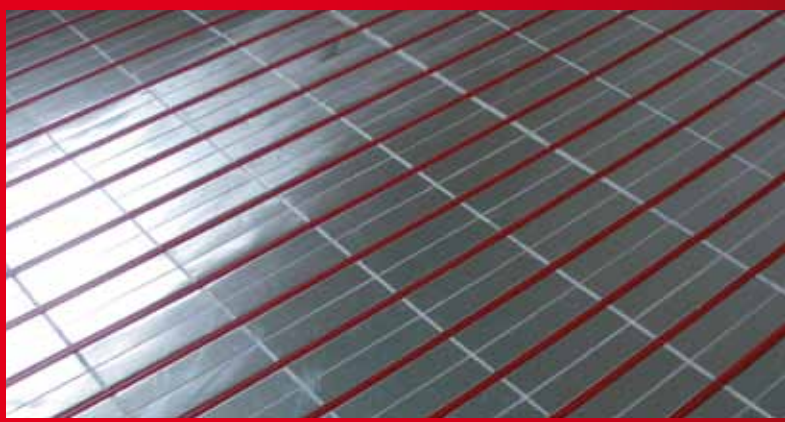
C3 PExRT

Stapler system

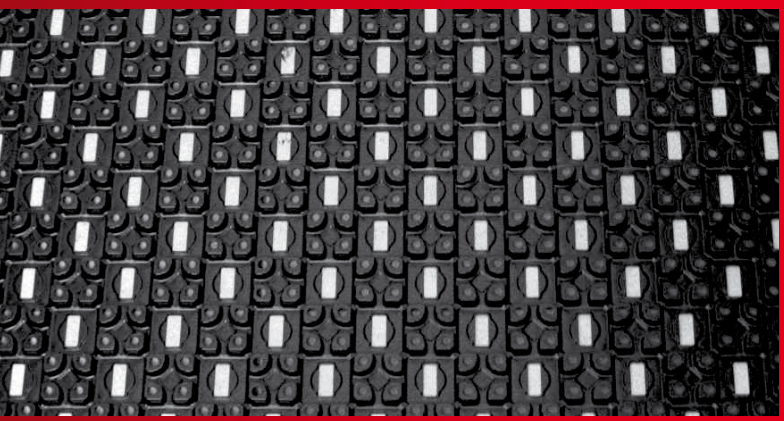
Stud system

Rail system

Dry construction



Renovation system



Wall heating

1. General facts on Radiant heating

In recent years, the concept of panel heating has become the leading heating system for residential and industrial buildings. What has been relatively complex back then can be created or retrofitted in nearly every building with minor effort today.

The clear advantages do not only include the comfortable sensation of warmth and the architectural freedom in terms of interior design, but moreover the focus is on the low supply temperature and the related energy savings.

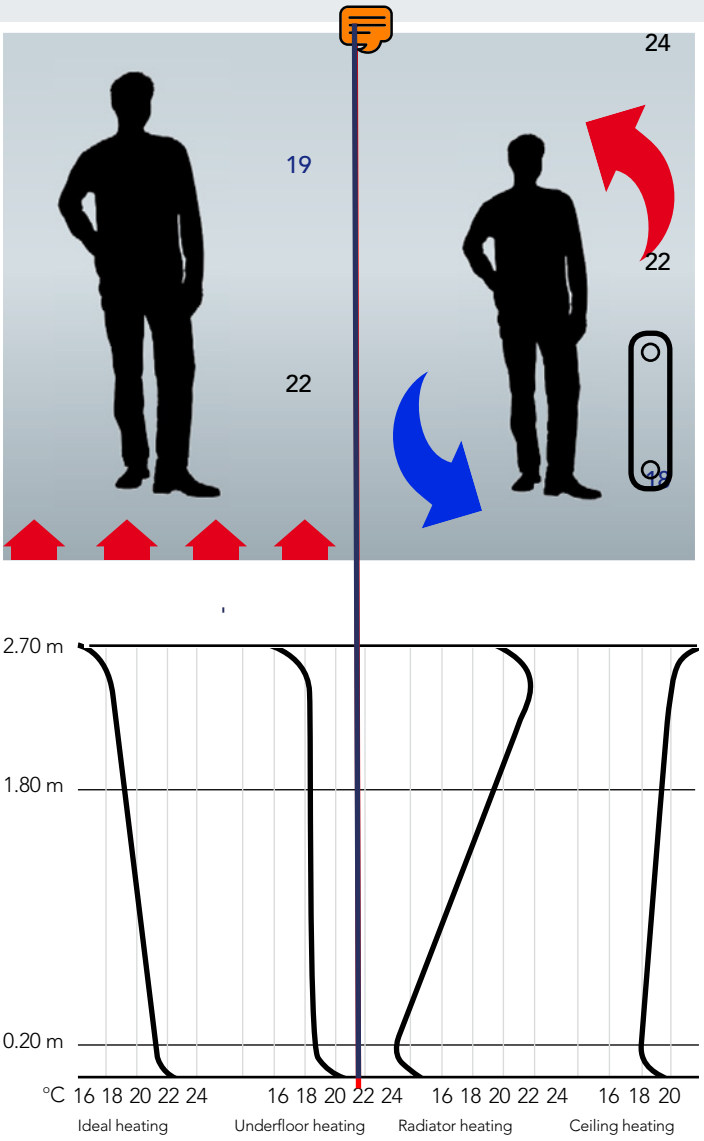
Low energy consumption means lower heating expenses and lower CO_2 emissions into the environment. Thus, regenerative energies and condensing boiler technology can be used ideally. Heat pump systems work extremely energetic and require low amounts of energy throughout the year.

The energy savings of panel heating result from the radiant heat, which is emitted from adjacent parts to the user. In order to achieve the same comfort as a conventional radiator heating, it is possible to reduce the room temperature by 1-2°C.

Reducing the room temperature by only 2°C already results in annual cost savings of up to 12%.

Another reason for the use of underfloor heating (UFH) is the comfortable sensation of warmth. The heat exchange between the human body and the surrounding surfaces, the temperature of which is distributed evenly and slightly below the body temperature, is felt as being particularly pleasant.

Lower room temperatures result in a higher humidity. The heat emitted draft-free in the room from bottom to top with an almost ideal temperature profile can only be achieved to this extent by underfloor heating. Furthermore, the low heat radiation prevents dust dispersion.



1.1 Installation methods for underfloor heating systems

The bifilar (helical) tube guidance

Bifilar installation

Properties:

- is mainly used for tight installation clearances and/or geometrically difficult rooms
- easy tube guidance as mostly installed at 90°
- even distribution of warmth
- bending radial are to be taken into account

Area of use:

- all building types

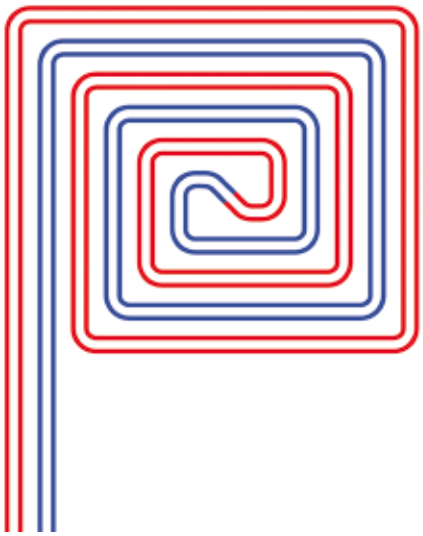


Fig.: Bifilar system

Meander installation

Properties:

- fast and easy installation option, particularly regarding rail installation
- starting with heating circuit at window and external wall
- slight temperature gradient between supply and return
- for installation in large window areas with upstream rim zone
- bending radius of the heating tube which is used must be observed, installation type for VA > 15

Area of use:

- all building types, primarily with industrial panel heating,

wall heating, concrete core activation, sprung floor heating

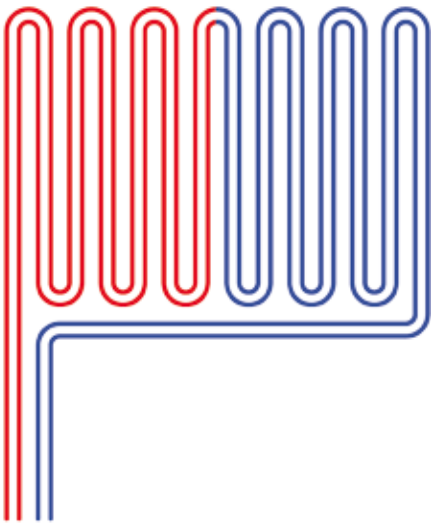


Fig.: Meander system

VA: Distance between two pipes in centimeter.

1.2 Expansion joints

Between heating screeds and walls, doorways and fixed installation building components such as columns and pillars, a peripheral separation through a marginal insulating strip must occur.

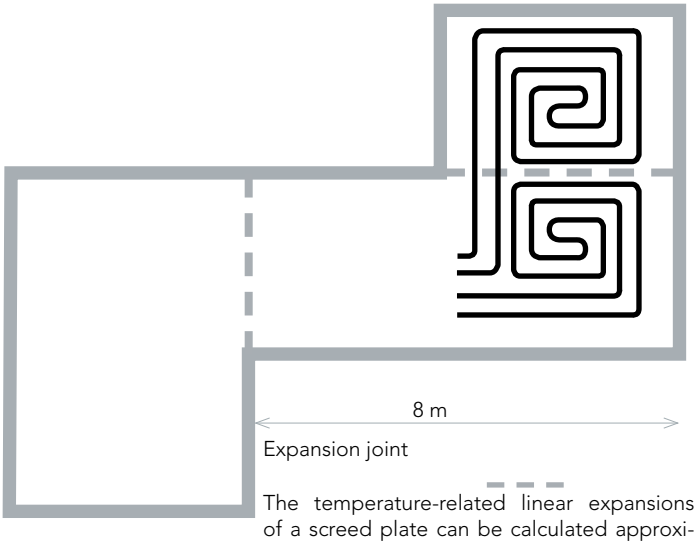
Furthermore, additional expansion joints according to DIN EN 1264-4 have to be installed for the following structural conditions:

- the screed surface > 40 m² or
- the lateral length > 8 m or
- side ratio a/b > 1/2
- if an expansion joint of a part is located beneath
- for geometrically strongly staggered screed surfaces

Basically, the construction planner has to develop a joint diagram that has to be presented to the executing company as part of the technical specifications.

Design and arrangement of the heating circuits

Heating circuits may not cross any expansion joints (see graphic). Connecting pipes which cross expansion joints, e.g. in doorways, are to be equipped with a 30 cm long joint protective tube.
As an accessory for the professional arrangement of expansion joints the expansion joint profile as well as an accompanying PE expansion strip are to be used.

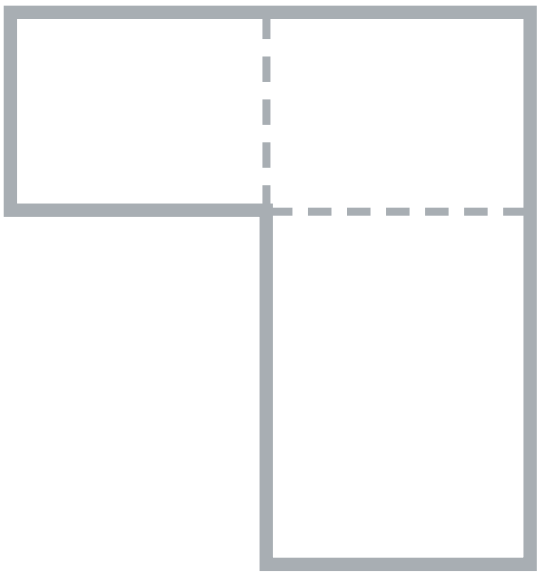


Expansion joint

The temperature-related linear expansions of a screed plate can be calculated approximately as follows:

$D l = l_o \times a \times D T$
D l = linear expansion (m)
l_o = plate length

a = coefficient of linear expansion (1/K)
DT = temperature differential (K)



Edge Marginal insulating strips

Art. no.	Unit
50.903.022	4x25 m

Extruded PE foam (CFC-free), for installation of self-leveling screeds without acoustic bridges / corresponds with DIN 18560. with PE film lug

Height 150 mm, thickness 8 mm

Fields of application:

- in buildings, for the acoustic decoupling and heat expansion of the heating screed
- Application to walls or to opening parts, such as door cases, supports, ...
- according to DIN 18560 part -2, marginal insulating strips have to allow for a movement of at least 5 mm for the heating screed

PE-expansion strips with T-stand

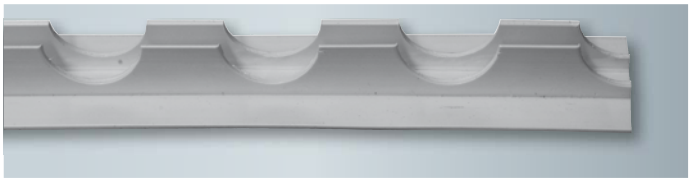
Art. no.	Unit
50.903.135	1.80 m

Self-adhesive PE-strip for screed separation in the door area and in large areas

Suitable for stud system

Dimensions: Dimensions: height 80 mm, thickness 10 mm, roll length 1,800 mm

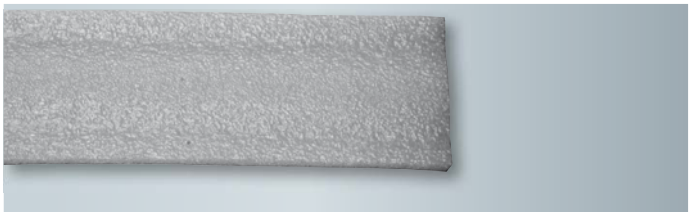
Expansion joint profile



Art. no.	Unit
50.903.026	20 m

For fixing the PE expansion strip, self-adhesive for standard-compliant manufacture of movement joints within heating screed according to DIN 18560

PE expansion strips



Art. no.	Unit
50.903.025	25 m

Extruded PE foam (CFC-free),

Dimensions: height 100 mm, thickness 10 mm, roll length 25 m

For insertion in the expansion joint profile and to be used for dry construction systems

1.3 Description of insulation materials

DIN V 4108-10	Fields of application for heat and footfall sound insulation
DES	Interior insulation under screed on ceilings or floor panels with sound insulation requirement
sm	Footfall sound insulation, medium compressibility
sg	Footfall sound insulation, low compressibility
DEO	Interior insulation on ceilings or floor panels, upper side, under screed without sound insulation requirement
dm	medium pressure load
ds	high pressure load

What requirements are made on insulation in Europe and Germany?

The U-values for building insulation are specified by EN 1264. The heat insulation requirements for Germany are based on the EnEV regulations and may partially exceed the values according to EN 1264. The specific heat loss of a building is calculated by the architect or energy advisor **on the basis of the total thermal shell.** The resulting energy rating is documented in an energy performance certificate. The U-values of the corresponding components can be found in the energy passport and are obligatory for the construction companies.

Insulating film

Designation MP System insulation film	Insulation thickness [mm]	lambda [W/mK]	R.Ib [m²K/W]	Comment
Insulating film	4		0.081	Ceiling above heated rooms (pursuant to EN 1264)
Additional insulation EPS	30	0.040	0.750	U-value: 1.33 W/m²
Insulating film	4		0.081	For ceilings above unheated rooms or ground soil when the groundwater level is ≥ 5 m, the value should be increased (pursuant to EN 1264)
Additional insulation EPS	50	0.040	1.250	
Insulating film	4		0.081	Ceiling against external air according to EnEV
Additional insulation EPS				according to Energy performance certificate

Insulation roll 30-2 and studded panel 30-2

Designation MP System insulation roll	Insulation thickness [mm]	lambda [W/mK]	R.Ib [m²K/W]	Comment
Insulation roll	30-2	0.040	0.750	Ceiling above heated rooms (pursuant to EN 1264)
Studded panel 30-2				U-value: 1.33 W/m²
Insulation roll	30-2	0.040	0.750	For ceilings above unheated rooms or ground soil when the groundwater level is ≥ 5 m, the value should be increased (pursuant to EN 1264)
Additional insulation EPS	20	0.040	0.500	
Insulation roll	30-2	0.040	0.750	Ceiling against external air according to EnEV
Additional insulation EPS		0.040		according to Energy performance certificate

EN 1264 or EnEV?

The German EnEV is the implementation of the generally accepted European norm 1264, which specifies the minimum requirements concerning building insulation.

However, requires buildings located in the Federal Repub-lic of Germany to have partially stronger insulation through the comprehensive observation of the heating energy re- quirement in the building. While the insulation values of the components are taken into account in EN 1264, in the EnEV the overall energy balance of the building forms the basis.

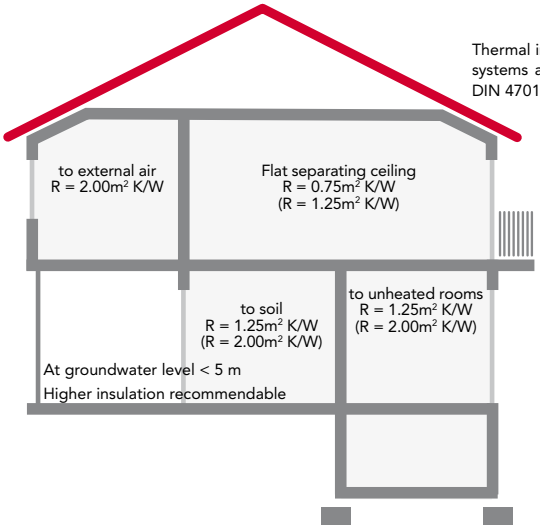
In this context please comply with the specific regulations relating to the construction project!

This regulation summarizes and replaces the thermal insulation and heating systems regulations. This offers the advantage that when focusing on the total energy requirement a less efficient insulation can be compensated for by a highly efficient heating system, and vice versa. The most important requirement of the EnEV with concern to new buildings is the so-called annual primary energy requirement in comparison with a standardized reference building with the same dimensions and geometry and specified technical properties.

According to reference of the EnEV to the relevant DIN, DIN EN and ISO regulations, as well as the applicable technical regulations, we provide express reference to possible updates and changes which may not yet have come into force at the date of printing of this technical manual.

Please note the following regulations:

- EN 1264
- EnEV
- DIN 4108
- DIN 4701
- DIN V 18599
- EN ISO 6946:2008-04 as DIN 1996-11 Components – Heat transmission resistance and heat transmission coefficient – Calculation procedure
- EN ISO 7345 as DIN 1996-01 Heat insulation – Physical parameters and definitions
- EN ISO 9346 as DIN 1996-08 Heat insulation – Mass transport – Physical parameters and definitions
- EN 12524 – Construction materials and products – Thermal insulation properties – Tabulated measured values



Thermal insulation regulations for panel heating systems according to DIN EN 1264 part 4 and DIN 4701 part 2 (minimum requirements)

Important!

Take planning instructions for insulation according to the EnEV into consideration!

Example:

According to EnEV reference property: story ceiling against external air: U = 0.28 W (m²xK) Insulation roll 30-2 WLG 040 + 110 mm EPS WLG 040.
Floor panel against soil and ceiling to unheated rooms U = 0.35 W (m²K) Insulation roll/studded panel 30-2 WLG 040 + 80 mm EPS 040.

Overview of insulation materials

General insulation materials

Insulation thickness	Polystyrene Mineral fiber		PUR, extr. EPS		ESP, Mineral fiber		ESP, extr. PS Mineral fiber		PUR	
WLG	030 λ ≤ 0.030 W/(m◊K		030 λ ≤ 0.030 W/(m◊K		040 λ ≤ 0.040 W/(m◊K		035 λ ≤ 0.035 W/(m◊K		025 λ ≤ 0.025 W/(m◊K	
1/Λ mm	R-value* m² · K/W	1/Λ W/(m² · k)	R-value* m² · K/W	1/Λ W/(m² · k)	R-value* m² · K/W	1/Λ W/(m² · k)	R-value* m² · K/W	1/Λ W/(m² · k)	R-value* m² · K/W	1/Λ W/(m² · k)
10	0.222	2,551	0.333	1.988	0.250	2,381	0.286	2,193	0.40	1.745
15	0.333	1.988	0.500	1.493	0.375	1.835	0.429	1.669	0.60	1.299
20	0.444	1.629	0.666	1.196	0.500	1.493	0.571	1.350	0.80	1.031
25	0.555	1.379	0.833	1.997	0.625	1.258	0.714	1.131	1.00	0.855
30	0.666	1.196	1.000	0.855	0.750	1.087	0.857	0.974	1.20	0.730
25	0.777	1.056	1.166	0.749	0.875	0.957	1.000	0.855	1.40	0.637
40	0.888	0.945	1.333	0.665	1.000	0.855	1.143	0.762	1.60	0.565
45	1.000	0.855	1.500	0.599	1.125	0.772	1.286	0.687	1.80	0.508
50	1.111	0.781	1.666	0.545	1.250	0.704	1.429	0.625	2,00	0.461
55	1.222	0.718	1.833	0.499	1.375	0.647	1.571	0.574	2,20	0.422
60	1.333	0.665	2,000	0.461	1.500	0.599	1.714	0.531	2,40	0.389
65	1.444	0.620	2,166	0.428	1.625	0.557	1.857	0.493	2,60	0.361
70	1.555	0.580	2,333	0.400	1.750	0.521	2,000	0.461	2,80	0.337
75	1.666	0.545	2,500	0.375	1.875	0.489	2,143	0.432	3.00	0.315
80	1.777	0.514	2,666	0.353	2,000	0.461	2,286	0.407	3.20	0.297
85	1.888	0.486	2,833	0.333	2,125	0.436	2,429	0.385	3.40	0.280
90	2,000	0.461	3.000	0.315	2,250	0.413	2,571	0.365	3.60	0.265
95	2,111	0.438	3.166	0.300	2,375	0.393	2,714	0.347	3.80	0.252
100	2,222	0.418	3.333	0.285	2,500	0.375	2,857	0.331	4.00	0.240
105	2,333	0.400	3.500	0.272	2,625	0.358	3.000	0.315	4.20	0.229
110	2,444	0.383	3.666	0.261	2,750	0.342	3.143	0.302	4.40	0.219
115	2,555	0.367	3.833	0.250	2,875	0.328	3.286	0.289	4.60	0.210
120	2,666	0.353	4.000	0.240	3.000	0.315	3.429	0.278	4.80	0.201
125	2,777	0.339	4.166	0.231	3.125	0.303	3.571	0.267	5.00	0.193
130	2,888	0.327	4.333	0.222	3.250	0.292	3.714	0.257	5.20	0.186
135	3.000	0.315	4.500	0.214	3.375	0.282	3.857	0.248	5.40	0.180
140	3.111	0.305	4.666	0.207	3.500	0.272	4.000	0.240	5.60	0.173

1.4 Insulation thickness variants according to DIN EN 1264

Insulation options according to DIN 1264-4 (residential construction)					
1. Flat separation ceilings to rooms, required: Rλ ≥ 0.75 m² x K/W					
	Increased heat insulation				
System panel, and/or Roll	PUR/PE	Insulation roll	Insulation roll	Studded panel	Insulating film
Thickness (mm)	20+5 (WLG 025)	25-2 (WLG 045)	30-2 (WLG 040)	30-2 (WLG 040)	4.0
Additional insulation (mm)	20 EPS (WLG 040)				EPS (WLG 040)
Rλ (m² K/W)	0.80	1.05	0.75	0.75	0.75
Total thickness of the insulation (mm)	45	45	30	30	30

2. Cellar ceilings and rooms towards unheated rooms or those heated at intervals, as well as surfaces towards soil					
	required: Rλ ≥ 1.25 m² x K/W				
			Increased heat insulation		
System panel, and/or Roll	Insulation roll	Insulation roll	PUR	Studded panel	Insulating film
Thickness (mm)	25-2 (WLG 045)	30-2 (WLG 040)	53 (WLG 025)	30-2 (WLG 040)	4.0
Additional insulation	20 PUR (WLG 025)	20 EPD (WLG 040)		20 EPD (WLG 040)	50 EPD (WLG 040)
Rλ (m²*K/W)	1.35	1.25	2,20	1.25	1.25
Thickness of the insulation (mm)	45	50	53	50	50

3. Ceiling towards external air, external temperature -5°C > Td > -15°C, required: Rλ ≥ 2.00 m² x K/W					
			Increased heat insulation		
System panel, and/or Roll	Insulation roll	Insulation roll	PUR	Studded panel	Insulating film
Thickness (mm)	30-2 (WLG 040)	30-2 (WLG 040)	20	30-2 (WLG 040)	4.0
Additional insulation	50 EPS (WLG 040)	40 PUR (WLG 025)	40 EPS (WLG 040)	40 PUR (WLG 025)	80 EPS (WLG 040)
Rλ (m²*K/W)	2,00	2,35	2,25	2,35	2,00
Thickness of the insulation (mm)	80	70	60	70	80

Insulation panel

Dimensions	Art. no.	Unit
20 mm	51.903.024	24 units / 24 m²
30 mm	51.903.022	16 units / 16 m²
40 mm	51.903.025	12 units / 12 m²
50 mm	51.903.020	9 units / 9 m²
60 mm	51.903.021	8 units / 4 m²

EPS insulation panel (DEO) as sub-insulation for MP insulation rolls / insulation film made from Styrofoam with WLG 040 according to DIN EN 13163, compressive stress at 10 % compression > 100 kPa.

Additional insulation EPS DEO			
Type WLG 040 compressive stress = 100 kPa (at 10% compression) for areas subject to medium levels of pressure			
Thickness (mm)	$R_{\lambda Ins}$	U-value (W/m²K)	Dimensions l x w mm
20	0.50	2,00	1,000 x 500
30	0.75	1.33	1,000 x 500
40	1.00	1.00	1,000 x 500
50	1.25	0.80	1,000 x 500
60	1.50	0.66	1,000 x 500

Screed types

Designations of screed types					
Screed type	Cement screed CT		Calcium sulfate screed CAF		
Bending tensile strength	CT F4	CT F5	CAF F4	CAF F5	CAF F7
Distributed load					
= 2 kN/m²	40 mm	45 mm	40 mm	30 mm	30 mm
= 3 kN/m²	50 mm	65 mm	50 mm	45 mm	40 mm
= 4 kN/m²	60 mm	70 mm	60 mm	50 mm	45 mm
= 5 kN/m²	65 mm	75 mm	65 mm	55 mm	50 mm

Screed additive, powder

Designation/Dim.	Art. no.	Unit
Screed additive, normal	50.903.123	10 kg
Screed additive, low	50.903.223	20 kg

Processing aid for conventional cement and calcium sulfate screeds. To increase screed thickness, to improve bending and pressure tensile strength.

50.903.123

Minimum construction height: 45 mm, yield 145 m² at 65 mm

50.903.223

Minimum construction height: 35 mm, yield: 400 m² at 45 mm

Processing aid for conventional cement and calcium sulfate screeds

Fields of application:

Powder-based processing aid for creating cement and calcium sulfate screeds:

- Floating screeds on insulation or separating layer according to DIN 18353 and 18560
- Heating screeds
- Screeds on balconies and terraces
- Screeds in wet areas
- Calcium sulfate screeds for indoor areas only.

Product characteristics:

- Plasticizing
- Improvement of workability
- Even screed matrix
- No de-mixing of the screed mortar
- Improved bending tensile strengths (up to F5)
- Improved pressure tensile strengths (up to C30)
- Increased binding agent utilization

Requirements of the surface:

General:

- The surface has to be load-bearing and sufficiently firm; with damp rising from the surface, sealing according to DIN 18195 is a compulsory requirement.

With bonded screeds:

- The surface has to be free of dust, grease, oil and loose objects.
- Primer coat must be provided by contractor.
- Sinter and separating layers are to be removed either by milling or by shot blasting.
- In general the requirements of DIN 18353 and DIN 18560 apply as well as the generally recognized professional regulations.

Technical data:

- Basis powder, not hazardous
- Material consumption, cement screed:
- Turn approx. 0.4% of cement weight

Calcium sulfate screed:

Turn approx. 0.4% of binding agent weight

Processing time approx. 120 min. at + 20 °C, water addition, see below.

All stated values are approximate values. They depend on both the binding agent and the construction site conditions.

Orientation formula:

Cement screed (C30-F5):

- 50 kg cement CEM I 32,5R
- 200 gr. Additive
- 250 kg sand 0-8 mm according to EN 13139
- Limit water addition to max. W/Z 0.40 (total water!)

Calcium sulfate screed (C30-F5):

- 75 kg Calcium sulfate binding agent CAB30
- 300 gr. Additive
- 250 kg sand 0-8 mm according to EN 13139
- Limit water addition to max. W/Z 0.35 (total water!)

Processing guideline:

- To mix the screed mortar regular screed mixers are used.
- After the first sand has been added to the machine, the additive then follows, then add the binding agent, then add the water and the remaining sand, mixing time at least 3 minutes!
- Add the screed mortar in the usual way, compact, remove and plane. Mechanical planing is recommended.
- It is necessary to protect setting screed against direct sunlight and draft air (with cement screed at least 72 hours, with calcium sulfate screed at least 48 hours).
- The standard DIN/EN regulations and the valid ZDB data sheets are to be observed.

Storage:

- Can be stored for 12 months (dry, protected against UV light)

Important information:

- The production of the screed mortar must follow the general construction technology regulations!

2. The C3 PExRT under floor heating systems

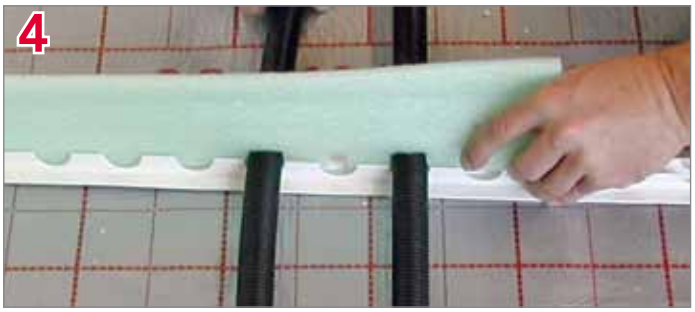
2.1 The stapler system

The best know installation method for panel heating is the stapler system. Installation possibilities and straightforward handling make this type of installation an ‚all rounder' for underoof heating systems. the secure hold of the stapler needles is guaranteed and the system rounded off in connection with the C3 PExRT insulating roll and flm.

- Fix the marginal insulating strips to the adjacent walls.

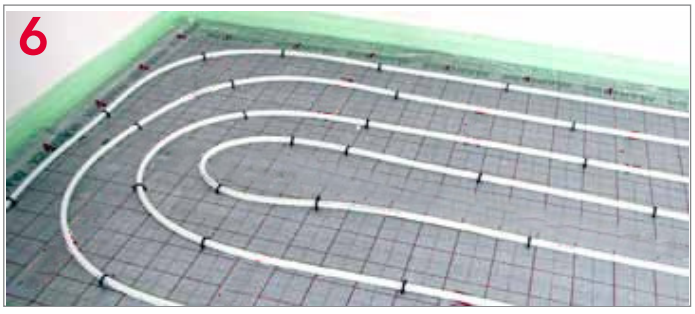
- Roll out the insulation roll on the sub-insulation and fix them together.
- In this context comply with insulation regulations according to DIN EN 4108 and the EnEV

- Unwind the tube with the help of the uncoiling reel.
- Fasten it in place with the stapler device.
- With flow screeds the tubes are to be fastened at smaller intervals.
- The specified minimum bend radii are to be complied with.



- Fitting of the expansion joints according to DIN EN 1264-4.

- Connection of the tubes to the steel distributor

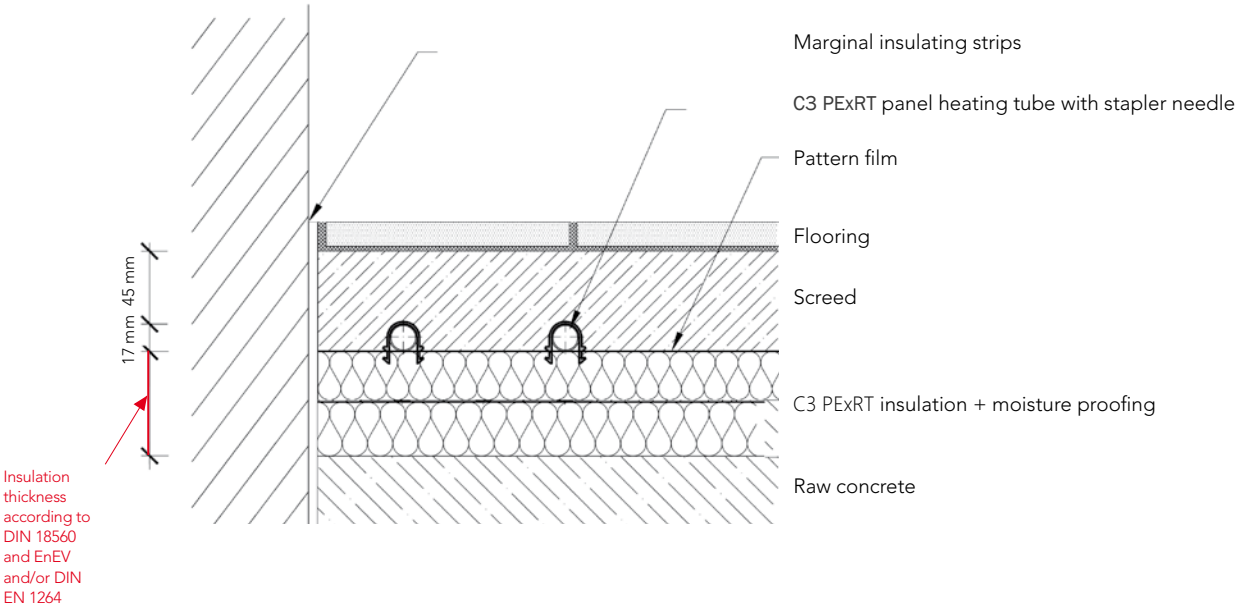


- Completed surface area with the stapler system in bifilar tube guidance

C3 PExRT Stapler system

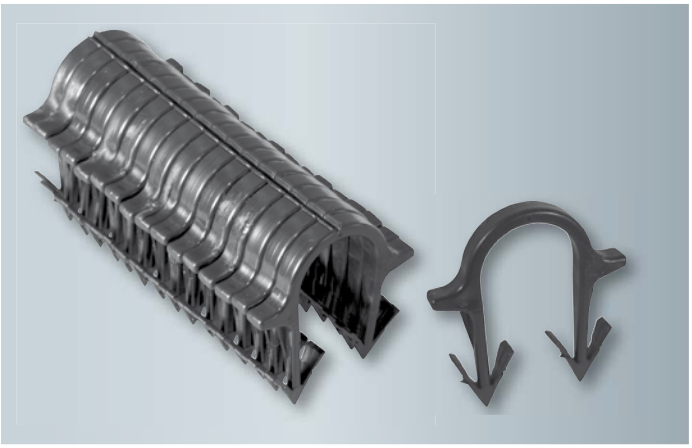
For heating old and new buildings, industrial buildings and passive homes
System suitable for panel heating and cooling, for cement, anhydrite and flow screed

System cross-section



System components

Stapler needles, stored



Dimensions	Art. no.	VE
	50.903.021	1000 units

Technical data:

Material	PE
Length	4 cm
Barb	Flexible
VPE	1,000 units, stored
Article no.	50.903.021

Tube supports to attach heating tubes onto the insulation, length 40 mm, stored for the stapler device due to welding

Insulation roll

Product composition/material	Styrofoam/EPS (expanded polystyrene), HFC and CFC-free; Hotmelt adhesive; Lamination: HDPE fabric with LDPE coating
Format	10,000 x 1,000 (reeled goods)
Configuration	EPS-T reeled goods
Packaging	Reel in PE bag
Fields of application	Footfall sound insulation under floating screed
CE – Designation key	EPS-EN 13163-T4-L1-W1-S1-PA-BS50-DS(N)5-SD30-CP2

Insulation roll and composite panel with woven fabric WLG 040			
Product	Insulation roll 20-2	Insulation roll 25-2	Insulation roll 30-2
	Art. no. 50903034	Art. no. 50903252	Art. no. 50903020
Nominal thickness dL in mm	20	25	30
Compressibility in mm	2	2	2
Thermal conductivity DIN V 4108-10	0.045 W/mK	0.045 W/mK	0.040 W/mK
Heat conductivity resistance	0.50 m²KW		0.75 m²KW
Rigidity group	30	30	20
Footfall sound improvement	26 dB	26 dB	28 dB
Working load	5 kPa	4 kPa	5 kPa
Material	EPS Polystyrene	EPS Polystyrene	EPS Polystyrene
Valid norm	EN 13163, DIN V 4108-10	EN 13163, DIN V 4108-10	EN 13163, DIN V 4108-10
Designation according to norm	EPS-EN13163-T4-L1-W1-S1-P3-BS50-DS(N)5-SD30-CP2	EPS-EN13163-T4-L1-W1-S1-P3-BS50-DS(N)5-SD30-CP2	EPS-EN13163-T4-L1-W1-S1-P3-BS50-DS(N)5-SD30-CP2
Field of application according to DIN 4108-10	DES sg	DES sg	DES sg
Quality checked	CE/FIW	CE/FIW	CE/FIW
Fire behavior according to EN 18560	Class E	Class E	Class E
Construction material class according to DIN 4102	B2	B2	B2
Film material	PP-fabric	PP-fabric	PP-fabric
Moisture proofing according to DIN 18560	Yes	Yes	Yes
Film overlapping	30 mm	30 mm	30 mm
Area/VPE L x W in mm per roll	10 m² 10,000 x 1,000		10 m² 10,000 x 1,000
Composite panel/VPE L x W in mm per folding panel			2 m² / 10 m² 2,000 x 1,000

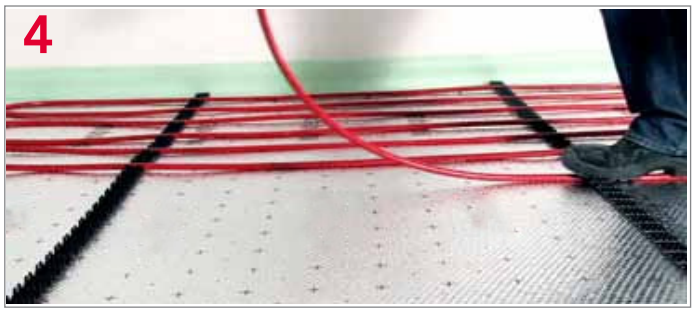
2.2 The rail system

The C3 PExRT rail system convinces thanks to its straightforward installation. The installation of the pipes is completed with the help of the self adhesive fixing rail which offers a secure hold on almost every standard surface. The advantage of the rail system is the possibility that it offers to change the tubes subsequently without damaging the insulation. The rail system can be combined with all kinds of insulation and films.

- Fix the marginal insulating strips to the adjacent walls.

- Roll out the insulation film on the sub-insulation and fix them together.
- In this context comply with insulation regulations according to DIN EN 4108 and the EnEV

- Removal of the protective film and subsequent sticking of the **C3 PExRT** universal waling to the insulation film and/or Insulation roll
- Ensure that the surface is free of dust.

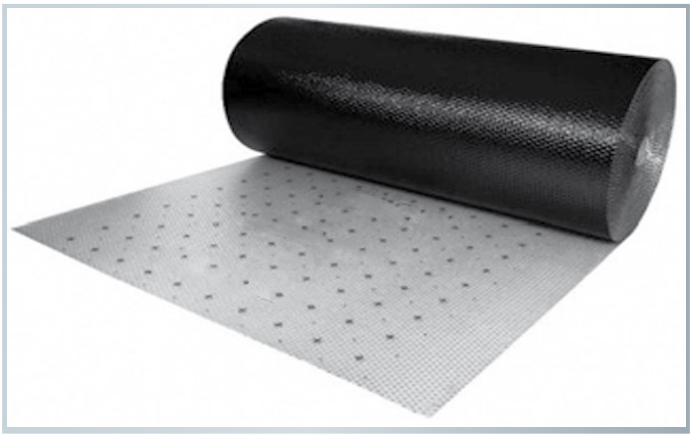


- Unwind the tube with the help of the uncoiling reel.
- Clipping the tube in the rail. Attachment of the expansion joints

- Connection of the tubes to the steel distributor

- Completed surface area with the rail system in meandering tube guidance

Insulating film



Dimensions	Art. no.	Unit
50.903.019		75 m^2

The insulation film is used as separating layer between screed and insulation material. On the one hand the film prevents the penetration of liquid screed e.g. flow screed in the footfall and thermal insulation. Furthermore, the film is equipped with a heat reflecting layer, which reflects the released heat in one direction only. The insulation film has insulation and footfall sound properties due to the integrated air bubble traps.

Material properties:

Multilayer air cushion film: PE/PET met/PE black
Heat emitting attributes due to vaporized film with aluminum reflector coating
Grid printing for rapid installation: grid clearance 10 cm
max. Pressure load: 10 kN/m^2
R λ > 81 x 10^{-3} m^2 K/W

Water vapor permeability
(Gravimetric) DIN 53122-1 / DIN 53122-A lower than < = 1 g/m^2, at 23° and 85% room humidity
Dimensions / VE: length: 60 m
Width: 1.25 m / 75 m^2
Requirement with overlapping: 1.1 sq. m. / m^2-FB

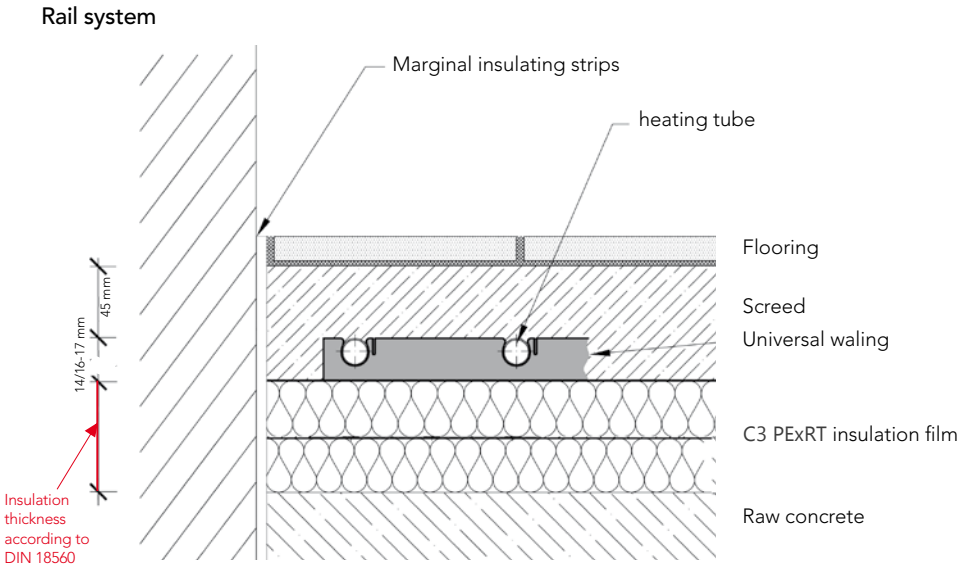
Universal waling

Technical data fixing rail:

Material	very stable profile rail made from PP
Tube dimension	16 and 17
Dimensions	1 m x 0.038 m (endlessly expandable)
Grid	5.0 cm
Weight VE	approx.18 Kg
Requirement	1 m / m^2 (with flow screed approx. 2 m / m^2)
VE	100 m
Art. no.	50.903.036

For exact tube guidance when installing heating tubes of 16 x 2.0 mm and 17 x 2.0 mm for wall and underfloor heating, at intervals of 5 cm, self-adhesive for secure attachment, can be extended without limit through press fastening system.

System cross-section



C3 PExRT rail system

- Can be combined with all insulations and insulation thicknesses
- Rapid installation through click-attachments
- With incorrect installation the tube can be installed without damaging the sub-insulation
- Usable for tube dimensions 14, 16-17, 20
- 5 cm grid, rail length 1 m – endless expansion possible through click system
- Complete footfall sound decoupling
- Self adhesive with very high adhesive effect
- No predetermined breaking points
- Installation to the wall and ceiling possible using screws and dowels

Fields of application

- Highly suitable for wall heating systems
- Floor heating and cooling with cement, anhydrite and flow screed
- Ceiling heating and cooling
- Spacer with industrial panel heating

Installation examples:

- Affixing of the rail at a distance of 0.7 m to max. 1 m (lower distances with flow screed)
- Ensure wall clearance with meander system is approx. 0.8 m

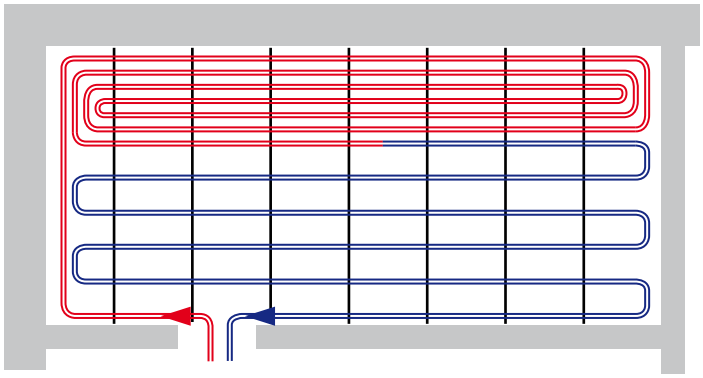


Fig.: Meander installation with marginal zone

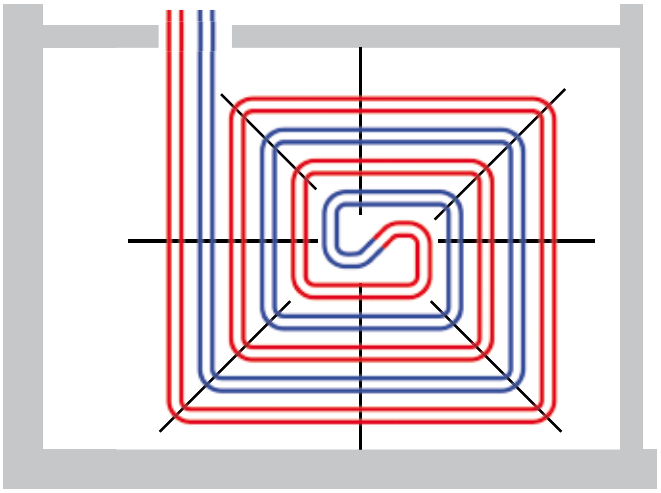
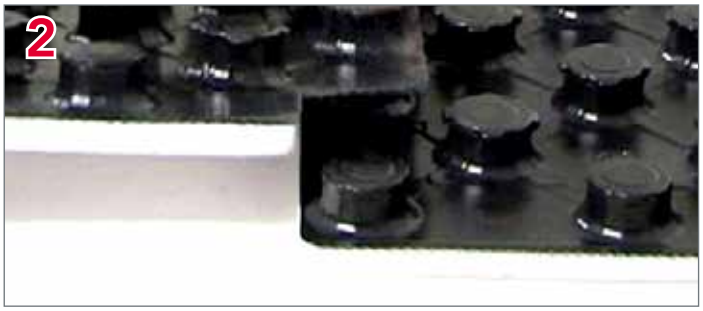


Fig.: Bifilar installation

2.3 The stud system

The studded panel system allows for fast, easy and effective installation with ‚one man' installation. Through extended system components it is possible for all installation options to be optimally integrated, including within architecturally difficult buildings. Connection elements guarantee an efficient and almost waste-free installation.

- Fix the marginal insulating strips to the adjacent walls

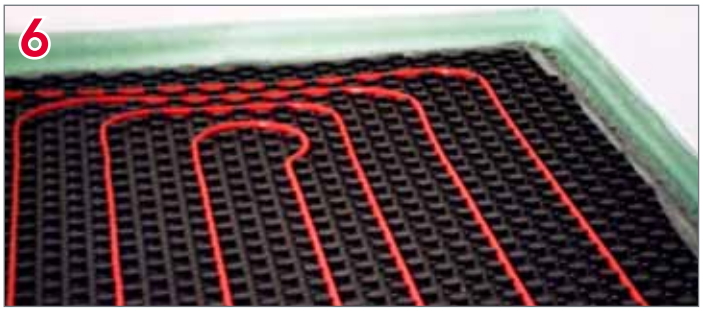


- Installation and connection of the panels through straightforward pressing of the push studs onto the receptor studs
- In this context comply with insulation regulations according to DIN EN 4108 and the EnEV

- Sealing of the studded panels in the edge areas with PE sealing strips

- The workman uses his feet to press the heating tube in between the studs

- Connection to the steel distributor



- Completed surface area with the stud system with bifilar tube guidance

Properties

C3 PExRT studded panel system

- Completion according to the studded panel deep drawing procedure
- Increased step safety through sub foam layer and reinforced plastic coating
- Practical, waste-free installation through the ‚stud on stud' principle
- Completely secure hold of the heating pipe thanks to stud design
- Tube spacing in 50 mm grid
- One panel for several tube dimensions
  The special structure of the studs enables the flexible use of the studded panel system for heating tubes with dimensions of 14 to 17 mm
- Tube fasteners enable secure diagonal installation

Studded panel Premium NP 11 and studded panel without INsulation

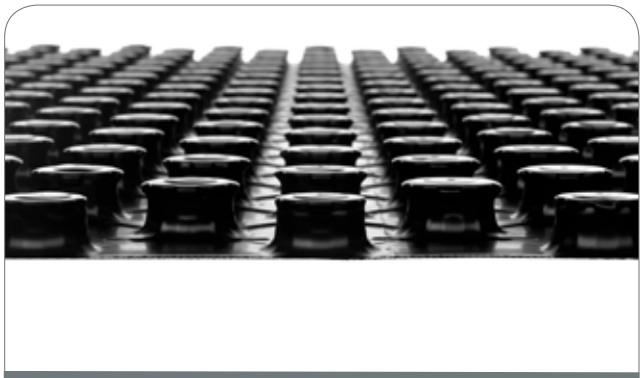
- Ideal for low construction heights, e.g. for the renovation of old buildings
- Installation on thermal and footfall sound insulation
- Suitable for cement, anhydrite and flow screed

Premium NP 30-2 studded panel

- Highest level of tread resistance
- Optimum noise/sound insulation
- Studded panel made from deep draw, 1 mm thick polystyrene film
- Installation on thermal and footfall sound insulation
- Suitable for cement, anhydrite and flow screed

Standards

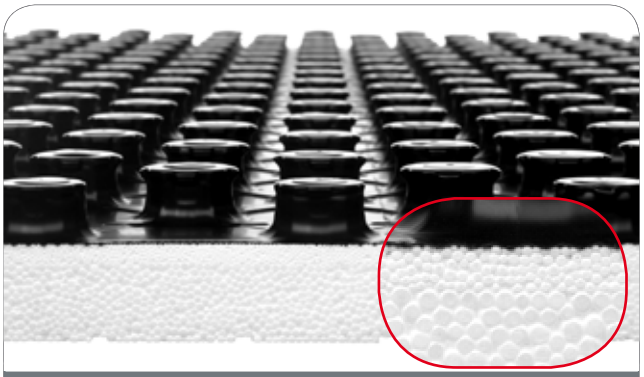
The Premium 30-2 studded panel corresponds with application according to DIN EN 13163 (interior insulation on floor panels and ceilings under screeds, DIN 4108-10). EPS insulation panels incl. deep draw film according to DIN 18560.



Studded panel without insulation

Studded panel Premium NP 11

Post-coated polystyrene hard foam (EPS) Thermal insulation panel



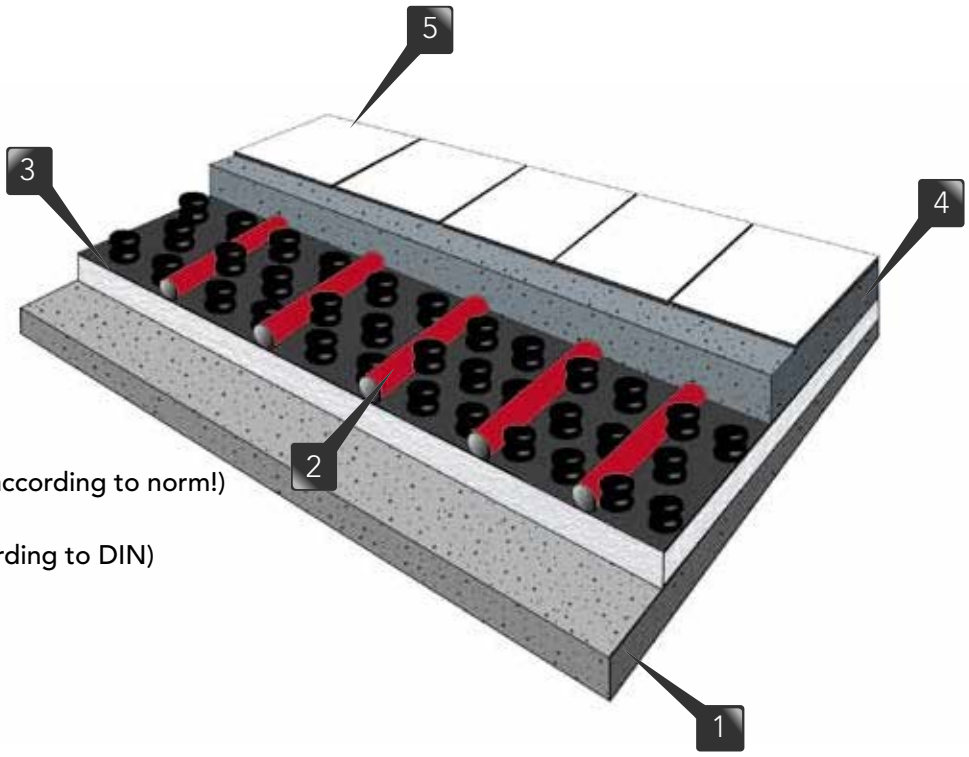
Premium NP 30-2 studded panel

Post-coated polystyrene hard foam (EPS) panel with highest level of footfall sound insulation

Technical data

Designation	Studded panel without insulation	Premium studded panel	
		NP 11	NP 30-2
Panel format	1450 x 850 mm	1450 x 850 mm	1450 x 850 mm
Usable dimension of panel	1400 x 800 mm	1400 x 800 mm	1400 x 800 mm
Usable area of panel	1.12 m²	1.12 m²	1.12 m²
Installation grid (tube clearance)	50 mm	50 mm	50 mm
Nominal width of insulation dL	none	11 mm (manufactured thickness)	30-2 mm
Total thickness with tube holder	19.9 mm	31 mm	50 mm
Total stud height	19.9 mm	19.8 mm	19.8 mm
Tube diameter	14-17 mm	14-17 mm	14-17 mm
Designation according to DIN 13163	-	EPS-EN13163-T1-L1-W1-S1-P3-DS(N)5-DLT(1)5-BS250-CS(10)150	EPS-EN13163-T4-L1-W1-S1-P3-BS50-DS(N)5-SD30-CP2
Application type according to DIN 4108-10	none	DEO	DESsg
Construction material class according to DIN 4102-1	B2	B2	B2
Construction material class according to EN 13501-1	E	E	E
Gross density	-	> 30 kg/m³	-
Footfall sound improvement level	-	-	28 dB
Rigidity group EN 13163	-	-	SD 20
Thermal conductivity group	-	35 W/m²K	40 W/m²K
Thermal conductivity resistance	-	0.31 m²K/W	0.75 m²K/W
Thermal dimensional stability	80 °C	80 °C	80 °C
max. Working load		75 kPa (7,500 kg/m²)	5 kPa (500 kg/m²)
Bending resistance	-	≥ 250 kPa	≥ 100 kPa
Moisture proofing according to DIN 18560	Polystyrene (PS) 1 mm	Polystyrene (PS) 0.6 mm	Polystyrene (PS) 0.6 mm
Standard color polystyrene film	Black	Black	Black
Packaging unit per carton	13 units = 14.56 m²	13 units = 14.56 m²	6 units = 6.72 m²
Dimensions of carton (W x D x H)	-	1,510 x 280 x 860 mm	1,510 x 280 x 860 mm

System cross-section



1 Raw concrete

2 Heating tube

3 Studded panel
(observe insulation thickness according to norm!)

4 Screed (screed thickness according to DIN)

5 Surface cover

Accessories

Offsetting element for doorway	
Format	1,400 x 200 mm
Installation grid (tube clearance)	50 mm
Pipe	14 – 17 mm
Polystyrene film thickness	0.60 mm
Packaging unit per carton	14 units

Offsetting element without EPS insulation, ideal for door intersections

Tube fastener	
Delivery format	10 strips of 4 units: perforated
Installation grid (tube clearance)	50 mm
For tubes	14 – 17 mm
Polystyrene film thickness	0.60 mm
Packaging unit per carton	40 units

Tube fastener for tube installation, including below 45° degrees

Stud system

Insulation strip		
Panel format / Effective usable area	1,400 x 150 mm	
Effective usable area per deep draw component	0.21 m²	
Nominal thickness of the insulation	10 mm	35 mm
Packaging unit per carton	20 units	10 units

EPS insulation strips without deep draw component, ideal for door intersections and in front of distributors

Connection element	
Panel format / Effective usable area	1,400 x 150 mm
Effective usable area per deep draw component	0.21 m²
Nominal thickness of the insulation	14 – 17 mm
Polystyrene film thickness	0.60 mm
Packaging unit per carton	26 units

Connecting element guarantees safe and perfect connection of the cut studded panels

PE-expansion strips with T-stand	
Unit	2 m

Self-adhesive PE-strip for screed separation in the door area and in large areas

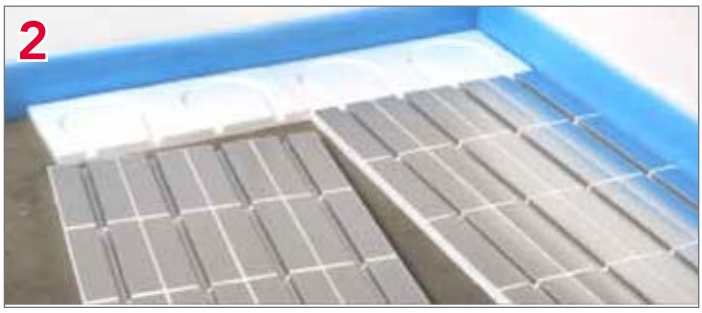
PE sealing strip	
Unit	2 m

Round cord made from PE for sealing the edge insulation strip and the expansion joints between the studs.

2.4 The dry construction system

The dry construction system, with low floor structure and low weight has key advantages in new buildings and old buildings. The system responds to different temperature requirements very quickly, making low inlet temperatures possible, which has a positive impact on the energy balance. An ideal addition for condensing and low-temperature boilers, heat pumps, solar systems and geothermal systems.

- Attach the expansion strip along the walls, columns or staircase on even and clean swept bare floor.
- If necessary, install a separating layer and/or moisture barrier.



- Install the baffles and elements according to the installation plan in complete format with sealed joints, taking the room geometry into account.
- Required transition pieces can be cropped with ease and fitted in the center of the panel.

- Fill in spaces with the filling and distribution element.
- Individual tube layouts can be subsequently cut out using the hot cutting device.

- Install the heating tube starting from the distributor in the Ω-conduct of the heat conducting channels.
- It is only possible to use an aluminum composite tube in dimension 16x2 as a heating tube.

- Next, cover the entire area with PE film as a sliding coat in overlapping format.
- As a load distributing layer the dry screed panels can now be fitted according to the manufacturer's instructions.

- Connection to the distributor

Requirements of the supporting surface

To be able to install the C3 PExRT dry construction system, the following requirements must exist: the sub-structures have to be dry and firm, they must also be rigid and free of cracks, dirt and release agents must also have been removed. The dry construction elements must be positioned flat and making full contact with the surface as the load distributing area in the dry construction cannot compensate for any uneven areas. If such evenness is not provided then measures such as leveling or other adjustments are necessary. In the case of considerable construction heights or many tube lines, corresponding steps are to be taken.

This can occur using dry fill material or earth-moist insulation, depending on requirements, other permitted and certified adjustment work can be completed according to the technical regulations. To prevent damage from rising damp, appropriate moisture barriers and/or films are to be used. e.g. bitumen or plastic sheeting with corresponding certification. In this case compliance with the requirements of DIN 18650-5 is necessary.

Line	Reference	Gage as limit value in mm with measurement point distances in m from high point to high point.				
4	Ready finished surface with increased requirements, e.g. leveling element	0.1 m 1 mm	1.0 m 3 mm	4 m 9 mm	4 m 12 mm	15 m 15 mm

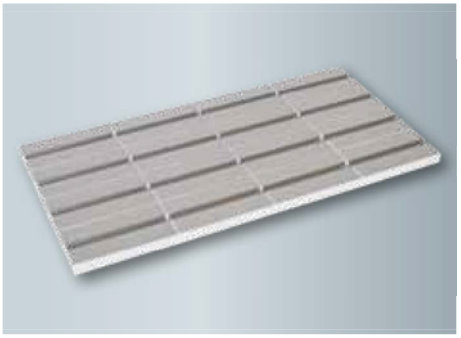
Properties

Rapid heating up and cooling down
Energy saving and maintenance free
Rapid installation through system components
Short construction time due to omitting of the screed drying phase

Fields of application

Highly suitable for wall heating systems
Floor heating and cooling
Ceiling heating and cooling

Aluminum dry construction element



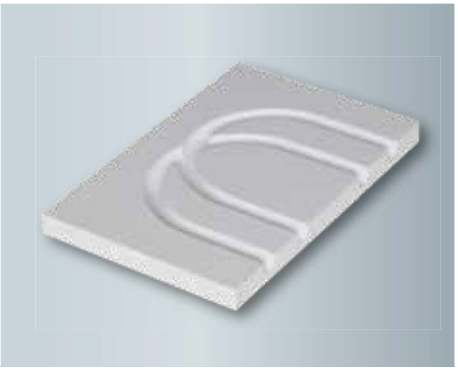
Designation/Dim.	Art. no.	Unit
Element Alu-VA 12.5	51.903.030	10 / carton
Element Alu-VA 25	51.903.031	10 / carton

The dry construction element made from EPS 035 DEO 240 kPa polystyrene foam is manufactured according to DIN EN 13163. Aluminum sheeting with a Ω-tube guidance are stuck on above the system element. These ensure the secure hold of the heating tube in the dimension of 16 mm in the panel. The element can be used on solid and wooden beam floors. The screed can be molded along with dry screed elements or wet screed according to DIN 18560.

The aluminum sheeting which is attached guarantees optimum heat distribution and walk-on stability.

Panel dimensions: 1,000 x 500 x 30 mm
Usable dimensions: 1,000 x 500 x 30 mm

Transition plate for aluminum dry construction element



Designation/Dim.	Art. no.	Unit
Transition plate	51.903.033	10 / carton

The dry construction element made from EPS 035 DEO dh polystyrene foam is manufactured according to DIN EN 13163. The tube guidance guarantees the exact and optimum bending radius of the heat tube in the 16 mm dimension. The element can be used on solid and wooden beam floors and the screed can be molded along with dry screed elements or wet screed according to DIN 18560. Installation clearance 25 mm.
Panel dimensions: 375 x 250 x 30 mm
Usable dimensions: 375 x 250 x 30 mm

Transition plate for aluminum dry construction element

Designation/Dim.	Art. no.	Unit
Transition plate 12.5	51.903.035	10 / carton
Transition plate 25	51.903.036	10 / carton

The transition plate made from EPS 035 DEO dh polystyrene foam is manufactured according to DIN EN 13163. The tube guidance guarantees the exact and optimum bending radius of the heat tube in the 16 mm dimension. The element can be used on solid and wooden beam floors. The screed can be molded along with dry screed elements or wet screed according to DIN 18560.
Panel dimensions: 500 x 250 x 30 mm
Usable dimensions: 500 x 250 x 30 mm

Filling and distribution element:

Designation/Dim.	Art. no.	Unit
Filling and distribution element:	51.903.037	16 / carton

EPS insulation panel (DEO dh) as fill element made from Styrofoam with WLG 035 W/mK, compressive stress at 10% compression > 200 kPa.
Panel dimensions: 1,000 x 500 x 30 mm

Thermal conduction panel

Designation/Dim.	Art. no.	Unit
Thermal conduction panel	51.903.040	10 units

Aluminum sheeting for equal load and heat distribution for the head and/or transition area in front of distributors.
Dimensions: 495 x 242 x 0.5 mm
Thermal conductivity 237 W(m*K) at 25 °C

Additional thermal insulation

For increasing the level of thermal insulation under the C3 PExRT dry construction system in rooms which are adjacent to either ground soil or unheated or only occasionally heated stories and which must fulfill the EnEV and DIN EN 1264.

Products:

Expanded polystyrene:	EPS 035 DEO 200 kPa 1,000 x 500 x 20 mm oder 30 mm
Thermal conductivity:	0.035 W/m²K
Extruded polystyrene:	XPS 035 DEO 300 kPa 1,250 x 600 x 30 mm
Thermal conductivity:	0.035 W/m²K
Compressive stress:	0.30 N/mm² at 10% compression
Construction material class:	B1 (flame retardant) according to DIN 4102
Extruded polystyrene:	XPS 035 DEO 500 kPa 1,250 x 600 x 40. 50. oder 60 mm
Thermal conductivity:	0.035 W/m²K
Compressive stress:	0.50 N/mm² at 10 % compression
Construction material class:	B1 (flame retardant) according to DIN 4102

Weight of the panel

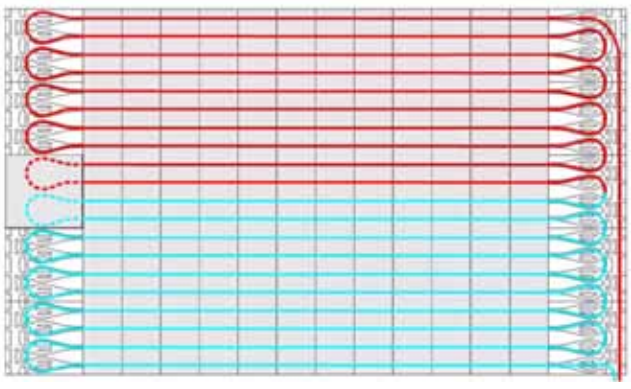
The dry construction is a light construction corresponding to its configuration. This is an urgent requirement in the refurbishment of old buildings. In this case, static data must be taken into particular consideration.

Layer construction type DIN 18560 construction type B

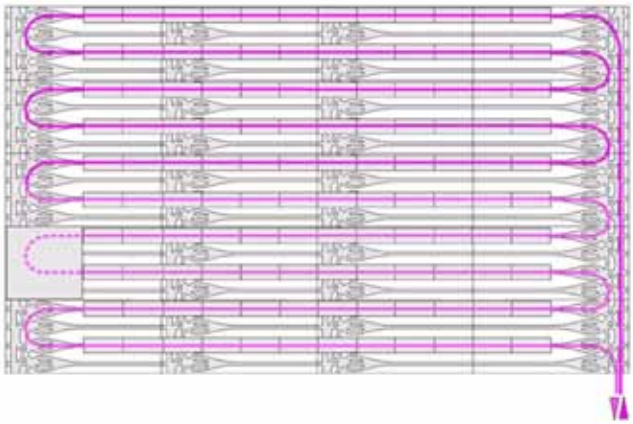
No connections to the screed occur through the separation of the system components of the composition. This means it is not necessary to take the expansion joint formation into account, as with wet systems.

Installation types

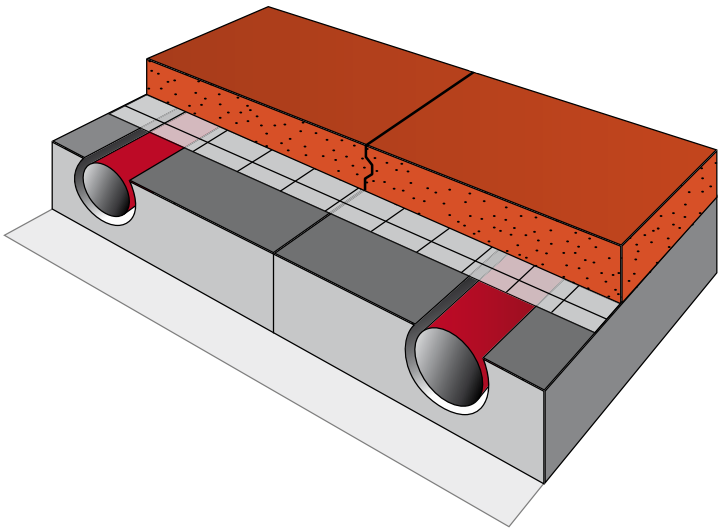
Installation VA 12.5



Installation VA 25

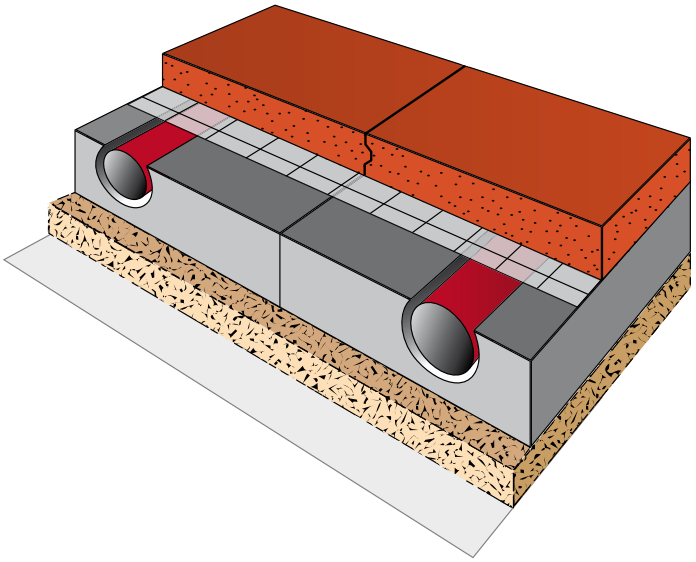


Construction of C3 PExRT dry construction with screed tile



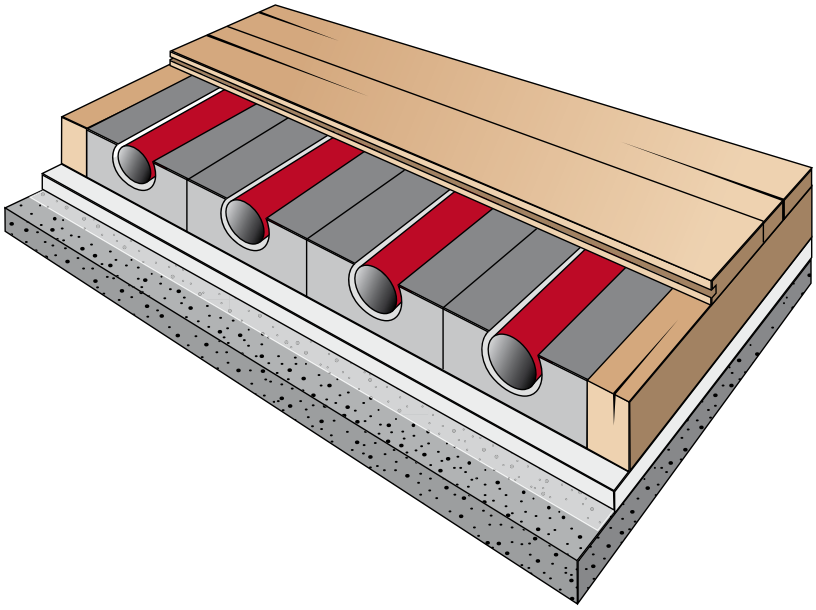
Technical data, floors against unheated rooms or soil		
Topsoil	Screed tile	20 mm
Construction height	With screed tile	50 mm
Weight	With screed tile	44 kg/m²
Dry construction element	EPS 035 DEO 200 kPa	30 mm
Thermal conductivity resistance R	According to the EnEV	0.86 kg/m²
Thermal transmission coefficient U		0.97 W/m²/K
Useful load		≤ 5 kN/m²
Individual load	Sum total point load ≤ distributed load	≤ 4 kN
Footfall sound improvement level		n/a
Constructions	According to EnEV, EN 1264, DIN 18202 and 18195, 1055	
Special features	The evenness tolerances according to DIN 182020 Tab 3, line 4 are to be carried out. Flat, clean and firm surface on which the dry installation floor heating elements are installed. Structural sealing against soil required according to DIN 18195, both under the floor panel and on the bare concrete floor if necessary. Screed tiles can be installed in areas of over 150 m² without a separating joint. Although these is no EN or DIN norm for the screed tiles this does not limit the product in any way. The manufacturer's instruction/ installation guidelines are to be complied with.	
Fields of application	Living and office space, doctors' practices, diners, school rooms, hotels, old people's homes, restaurants, dining rooms and reading rooms, rooms with fixed seating such as movie theaters or lecture halls. Entrance areas, rooms with large gatherings of people and public buildings. Corresponds with the requirements of DIN 1055-3, categories C1. C3, C5.	
Additional insulation	EPS 035 DEO 200 kPa from 20 mm, XPS 035 500 kPa from 40 mm	

Construction of C3 PExRT dry construction with screed tiles and sub-insulation



Load distributing layer	20 mm	Screed tile
Construction height mm	70 mm	
Weight	50 kg	
Thermal conductivity resistance	1.30 m² K/W	Minimum conductivity according to EnEV fulfilled
Heat transfer coefficient	0.77 W/m²K	
MFL dry construction element Insulation EPS 035 DEO 240 kPa	30 mm	
Footfall sound insulation Wood fiber element WLG 040	20 mm	
Distributed load	2 kN/m²	
Point load (≥ 20 cm²)	1.5 kN/m²	Total point loads ≤ distributed load
Fields of application	1 + 2*	Expansion joints in doorways/stairs: 1 mm of additional galvanized steel sheeting required
Footfall sound improvement level	27 (dB)	
Topsoil	Screed tile as finished floor covering	
Special features	Fulfills the minimum thermal conductivity resistance for unheated rooms. Screed tile can make an attractive flooring with rustic visuals (CREAPUR) and can be installed in glazed format and in different colors. Rapid response floor heating due to the limited height and the excellent thermal conductivity of the screed tile. The surface must be smooth (DIN 18202) and the MFL dry panels have to cover the entire surface.	
Fields of application	• Living areas, hallways and loft rooms in apartment buildings, hotel rooms and walk-in bathing areas/shower rooms • Hallways in office buildings, doctors' practices, hospitalization areas and lounges, office rooms and sales floors up to 50 m² and base areas in residential and office buildings	

Floorboard construction



Construction height	Incl. Topsoil	45-50 mm
Weight		16 kg/m²
Thermal conductivity resistance R		0.86 m²K/W
Thermal transmission coefficient U		0.97 W/m²/K
dry construction element	Insulation EPS 035 DEO 240 kPa	30 mm
Distributed load		2.0 kN/m²
Point load		2.0 kN/m²
Topsoil	Wooden floorboards or parquet	
Footfall sound improvement level		-- dB
Special features	The surface must be smooth. The dry construction elements must have full contact with the wooden floorboards. The requirements of DIN 18202 also apply in this case.	
Fields of application	• Living areas, hallways and loft rooms in apartment buildings, hotel rooms and walk-in bathing areas/shower rooms • Hallways in office buildings, doctors' practices, hospitalization rooms and lounges, office rooms, sales floors up to 50 m², base areas in residential and office buildings, small workshops and factories with light operations	

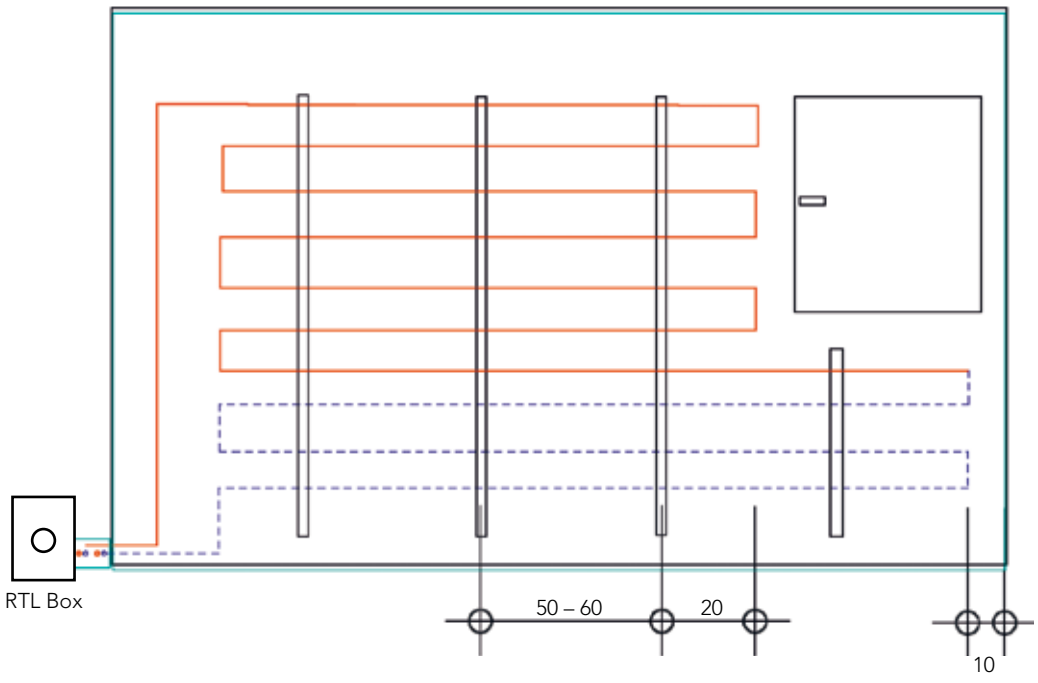
2.5 The wall heating system

The C3 PExRT wall heating system as wet or dry design is used when there is no option for underfloor heating due to too low installation heights or as additional source of heat when the thermal output of the installed UFH is insufficient (e.g. bathroom).

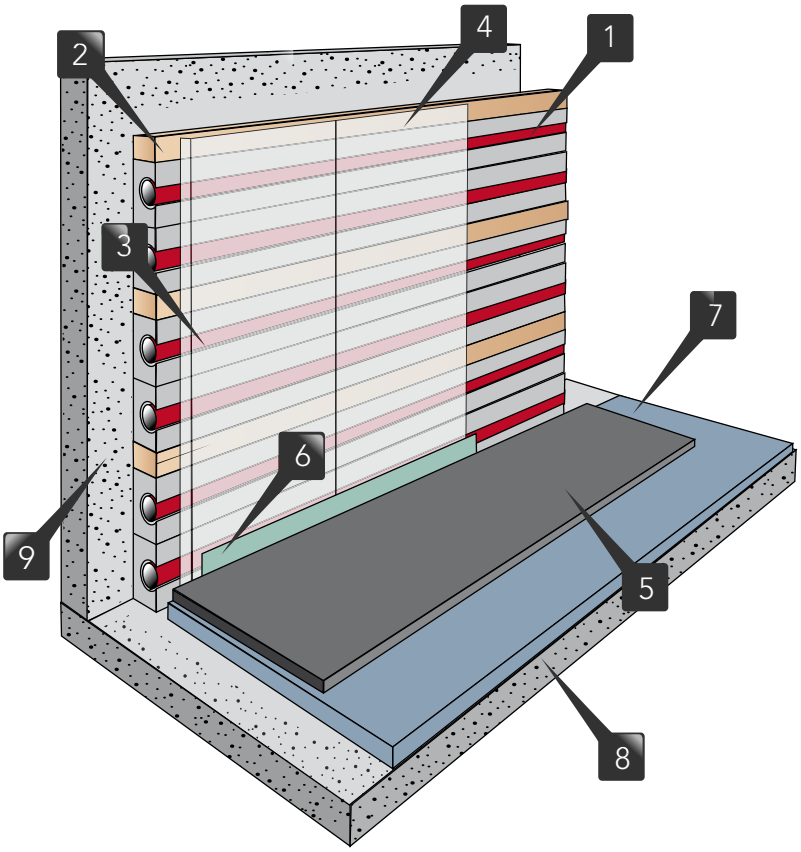
As regards regenerative energy sources with low supply temperatures, the C3 PExRT wall heating system has good advantages over traditional heating systems.
The sensible radiant heat is emitted directly to the body.
This means that you can operate the heating system with lower supply temperatures, which in turn results in cost savings.

- Create the surface according to the instructions of the plastering and stucco company.
- Fix C3 PExRT marginal insulating strips to the adjacent walls.
- Vertical attachment of the C3 PExRT universal walling to the wall at a distance of approx. 0.7 m with a drill hole distance of 0.25 m.
- In this context observe an installation distance from the universal walling to the tube crest in the area of the tube bend of 0.25 m.
- Install the C3 PExRT aluminum MPFX composite tube 16 x 2 with the help of the MP installation reel according to the calculated installation distance.
- In this context, ensure a distance of approx. 0.10 m from the windows and doors and the max. admissible bending radius of the aluminum composite tube.
- Completion of the plaster layers by a plastering and/or stucco company.

Installation diagram



Cross-section view in dry construction



1 Pipe
2 Profiled wood
3 Dry construction element
4 Rigips/Fermacell
5 Insulation
6 Marginal insulating strips
7 Screed
8 Raw concrete
9 Wall

Presentation of wall heating with dry construction system

2.6 The C3 PExRT renovation system

The advantages at a glance

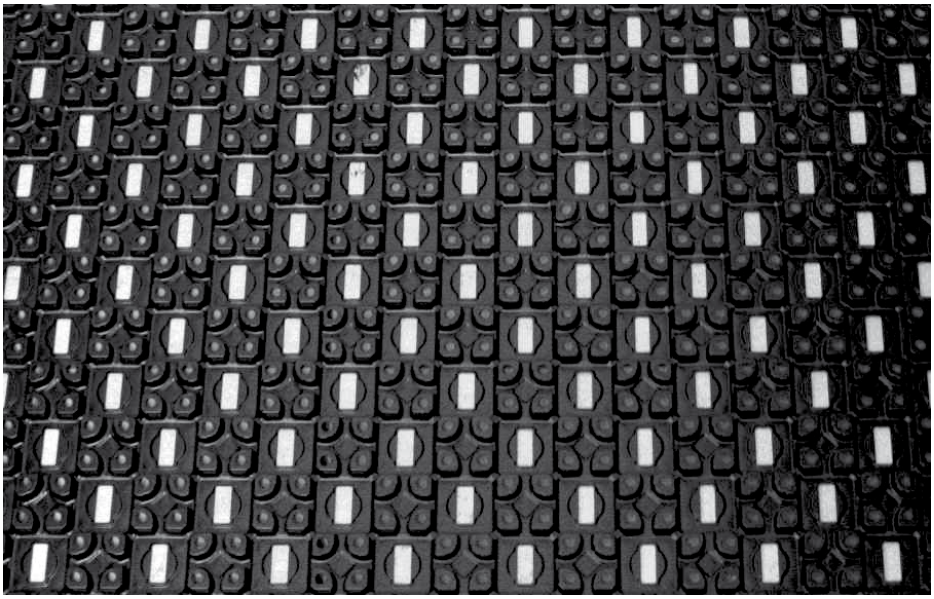
- Direct installation on existing surfaces; screed, tiles, wooden flooring
- Just 20 mm construction height in case of composite installation with special screed
- Just 32 mm construction height in case of installation on 20 mm insulating or separating layer with special screed
- Stable composite panel through two sided snap fastener connection
- Walk-on after approx. 5 hours (depending on thickness and temperature)
- Load-bearing after 2 days
- Ready for covering after screed curing and residual moisture ≤ 0.3 CM – % (check with CM device)
- Field of application: residential and office buildings, doctors' practices etc. up to a load capacity of 3 kN/m³, individual load 2 kN

Pipe material

The base material is a PE-Xc with a high molecular mass and a special stabilization. This material, which exists in granulate form, is extruded to create a C3 PExRT tube. In a second step the cross-linking takes place, which means the construction of the spatial lattice structure, through the high energy rays of an electron accelerator. In this case the accelerated ß-particles provide the energy for the reaction of the molecule chains.

Advantages

- Particularly flexible and easy to install
- Oxygen-tight according to DIN 4726



Installation steps

Before installing the thin layer system the surface must be checked by the company installing the leveling compound to ensure it is sufficiently load bearing.

Surface preparation

The surface must be free of cracks and have a solid and clean surface (free of oil, free of cleaning agents). Seal cracks with resin where necessary. Smooth out uneven areas on the surface (raised points, pipes, cables). The type of priming depends on the material of the previous surface. Wooden surfaces require special checking, grooves must be sealed, add priming coat using special wash primer , apply a 2 mm coating of filling putty and two priming coats of screed primer.
The manufacturer's instructions must be complied with under all circumstances.

1. Configuration of the marginal insulating strips

Remove protective film and press the strip onto the surface with the self-adhesive base.

2. Installation of the tube supporting film element

Turn approx. 10 cm of the protective film, fit the tube supporting film element incl. protective film with the semicircular punch holes in the left hand corner of the room. Step-by-step removal of the protective film and bonding to the surface. Position the next tube supporting film element with the side of the semicircular punch holes over the external row of the closed side, connect the panels and remove the protective film as with the first panel. If it is not possible to achieve sufficient bonding to the surface then alternatively a mechanical attachment can also achieve the same purpose.

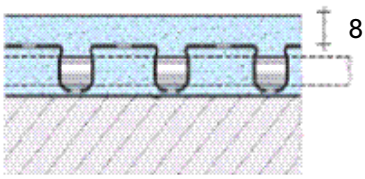
3. Tube installation

Rapid one-man tube installation of the PE-RT 10 x 2 mm heating tubes. Routing of the tubes in the studs with the a 50 mm grid, and at 45° installation with 70 mm grid. Fill and pressure-test the heating circuits.

4. Apply the grouting compound.

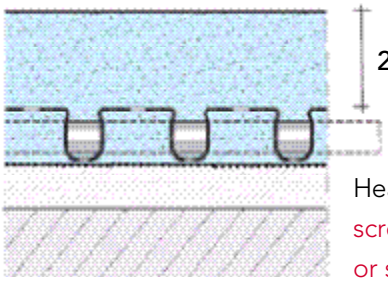
Layer thicknesses of special screed

Name	Bag size	Consumption	Construction height
Web.Plan 813-10	25 kg	1.5 kg/m² per 1 mm layer thickness	Up to 10 mm
Web.Plan 813-25	25 kg	1.4 kg/m² per 1 mm layer thickness	Up to 25 mm
Web.Plan 813-40	25 kg	1.4 kg/m² per 1 mm layer thickness	Up to 40 mm
PCI – Periplan	25 kg	1.6 kg/m² per 1 mm layer thickness	2 mm -30 mm
Knauf 425	40 kg	1.6 kg/m² per 1 mm layer thickness	



8 mm

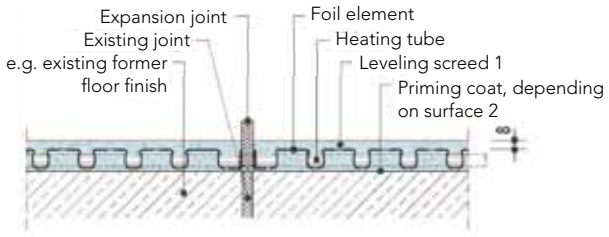
Heated screed as composite screed



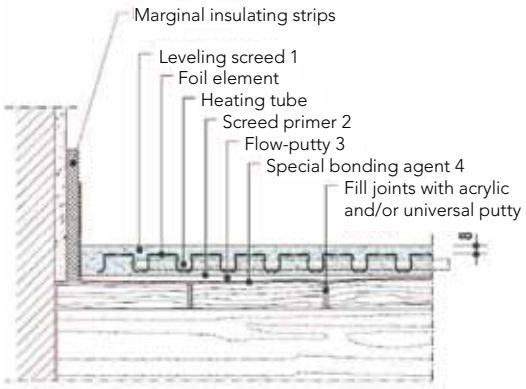
20 mm

Heated screed as screed on insulating or separating layer

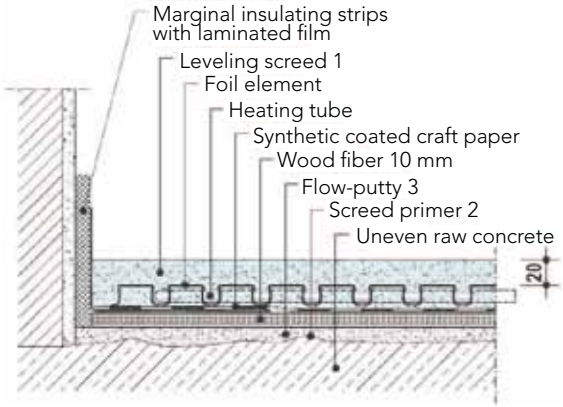
As composite on old screed or tiles



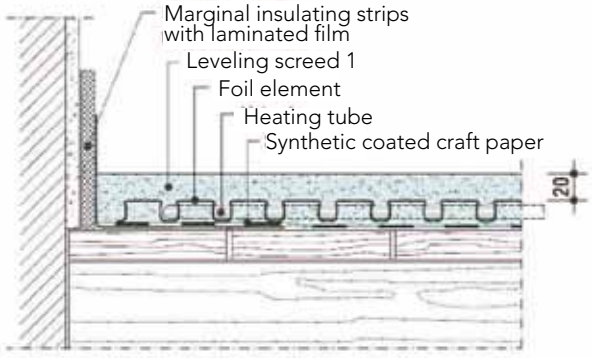
As composite – wooden beam ceiling



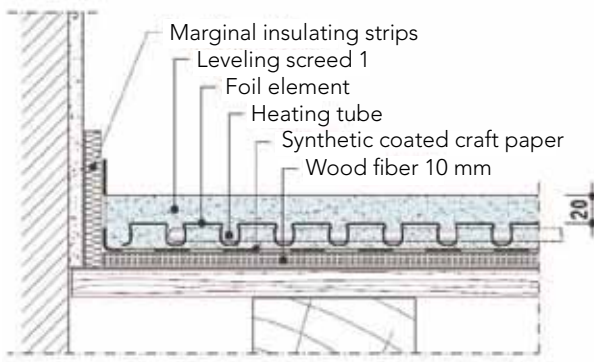
On insulating layer – solid ceiling



On separating layer – wooden beam ceiling



On insulating layer – wooden beam ceiling – F60



Certified film element with Knauf, PCI, St. Gobain-Maxit

Example:

Screed recommendation, Knauf:

1. Knauf leveling screed 425
2. Knauf screed primer
3. Knauf Faserflex 15 filling putty
4. Knauf special wash primer

The processing instructions of the different suppliers must be complied with, such as the type of priming, for example. The surface must be load bearing and even. If you have any questions please contact C3 PExRT

Presentation of connection system with sliding sleeve system

Connection system

The tube is connected with the fitting on the basis of the proven sliding sleeve technique. With the help of the expanding tool (expander tongs and expander head), a socket is molded to the end of the pipe requiring connection. This socket is then attached to the supporting core of the fitting and a sliding sleeve that has to be installed on the tube before the expansion is fitted to the connection fitting tube with the help of the sliding tool.

2.7 C3 PExRT underfloor heating tube

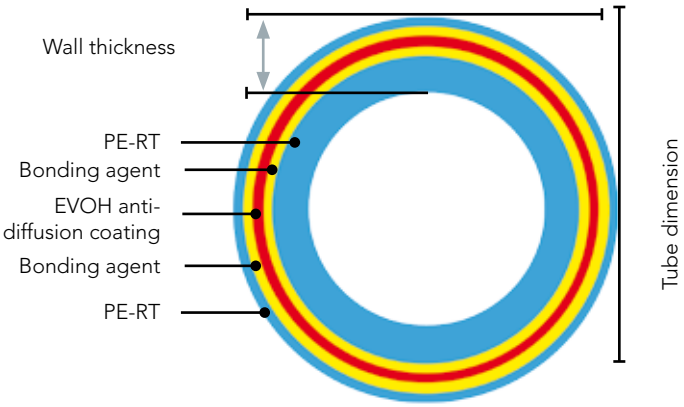
The UFH tube is available in different tube designs, such as diameter, material composition.
All MP-UFH tubes are oxygen impermeable in accordance with DIN 4726. Due to the following properties, the limit specified by this standard is fallen below significantly.

Tube types:

MPFR heating tube PE-RT

Material properties:

- PE-RT plastic tube
- 5 layer technology / 5 layer technology
- High acid resistance and temperature stability
- Co-extruded EVOH layer according to DIN 4724
- Pressure-resistant
- Corrosion-resistant
- Ethylene octene co-polymer / medium density
- High durability and fatigue strength
- Unique molecular structure with linear ethylene main chain and the octene side chains
- Particularly flexible and easy to install (oxygen impermeable according to DIN 4726)
- Extreme acid resistance and resistance to chemicals
- Very low flow resistance in the inner tube
- Extremely good thermal conductivity



Technical data:

Material	PE-RT Polyethylene-rised temperature
VPE/ring length	300 m and 600 m
Dimension	14 x 2 / 16 x 2 / 17 x 2 / 20 x 2
Surface roughness	40 nm

Properties	Values	Standard
Polyethylene	PE-RT	DIN 16833
Thermal conductivity	0.4 W/(mK)	DIN 16833
Coefficient of thermal expansion	1.95 x 10^{-4}/K	DIN 52612-1
Young's modulus	~ 500N/mm^2	DIN 53457 (4 point bending test)
Density	0.933 g/cm^3	ASTM D-1525
Tearing strength	34 MPa	ISO 527-2
Elongation at rupture	> 800%	ISO 527-2
Vicat softening temperature	122° C	ASTM D-1525
Continuous operating temperature	20...80° C	ISO 10508 class 4 / 5
Material class	B2 normal flammable	DIN 4102-4
Hardness, Shore D	53	ISO 868
Bending radius, bent freely	5xd mm (d=out. diam.)	DIN 4726
Oxygen diffusion barrier	40° C < 0.1 g/(m^3d)	DIN 4726
Certification	A 522	SKZ HR 3.16

Technical properties:

NW [mm]	Weight/m [g]	Liter/m [l]	Operating temperature [C°]	max. operating pressure [bar]	ISO 10508 [class]	Winding length [m]
17 x 2.0	103	0.133	60	9.8	1	1000
17 x 2.0	103	0.133	70	9.4	2	1000
17 x 2.0	103	0.133	60	9.4	4	1000
17 x 2.0	103	0.133	80	8.1	5	1000

Fields of application:

in the field of heating system installations according to

- DIN EN 12831 e.g. Radiator connection
- In the field of panel heating according to DIN EN 18560 and 1264 e.g. UFH
- Industrial underfloor heating and concrete core activation
- Open space heating
- Special applications

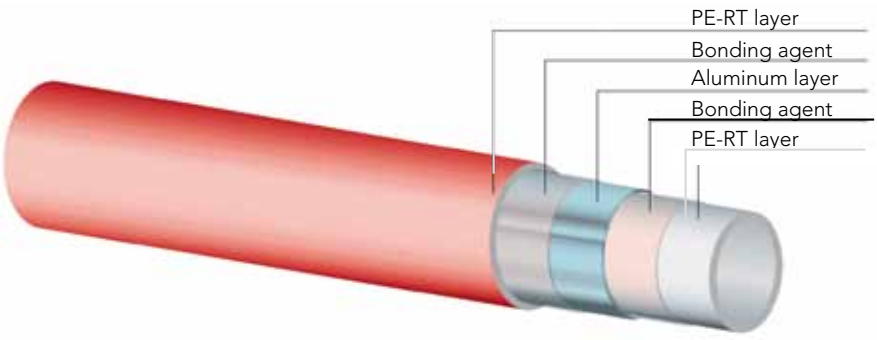
Tests:

- Complies with all current standards and regulations e.g. DIN 16833, DIN 4726
- Suitable for underfloor heating systems ISO 10508 class 4 / 5
- Monitored regularly by independent testing institutions, e.g. SKZ , DIN Certco

Creep rupture strength :

- To determine the pressure resistance of plastic tubes depending on the medium temperature and operational duration

C3 PExRT composite tube PE-RT/Aluminum/PE-RT



Material properties:

- 5-layer technology
- No spring-back effect
- Oxygen diffusion layer due to aluminum inliner
- High temperature stability
- Pressure-resistant
- Corrosion-resistant
- High durability and fatigue strength
- Particularly flexible and easy to install
- Can be installed in cold state
- Extreme acid resistance and resistance to chemicals
- Very good flow resistance in the inner tube

Fields of application:

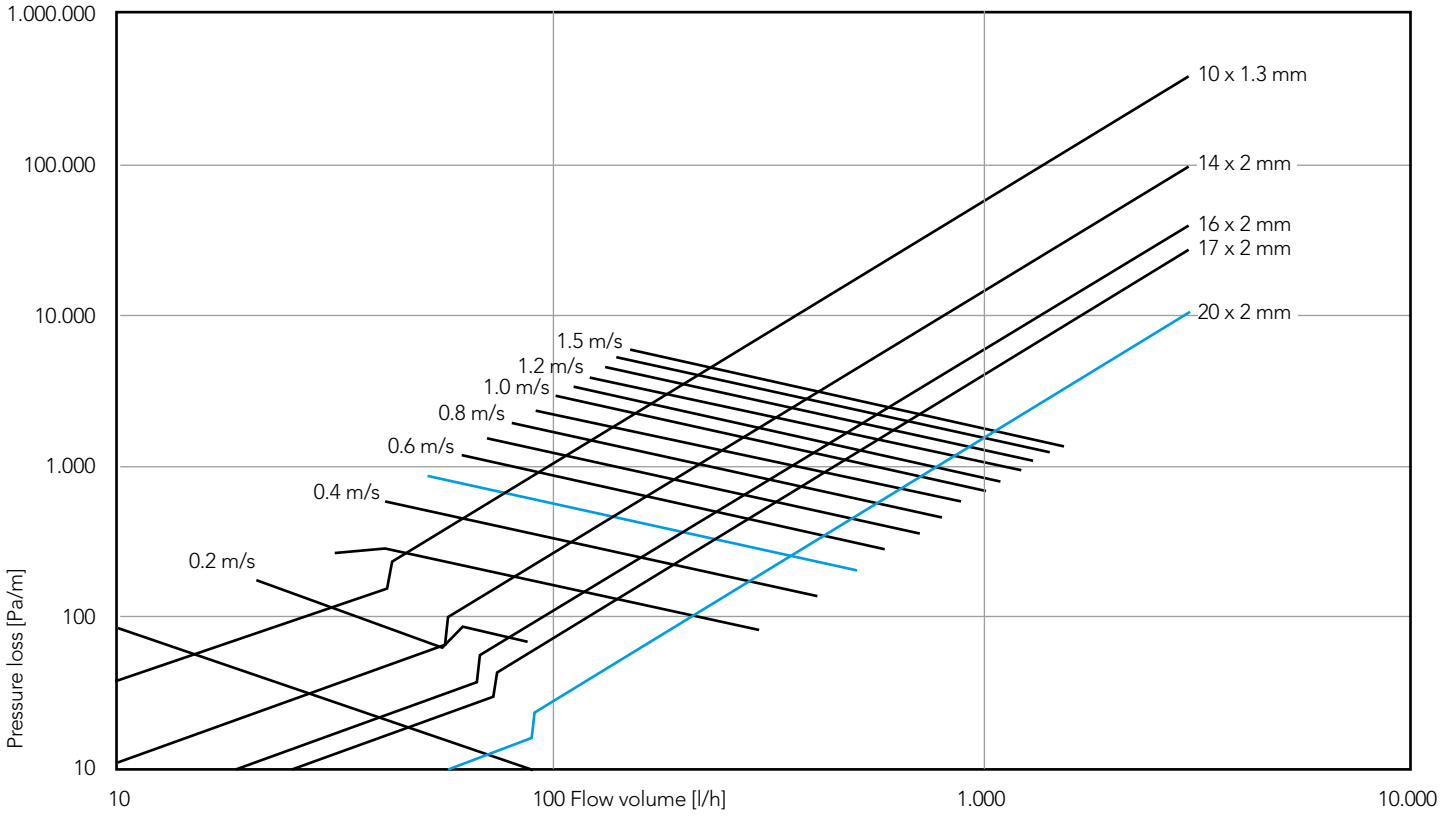
- In the field of heating installations according to DIN EN 12831 Radiator connection
- In the field of panel heating according to DIN EN 18560 and 1264 e.g. UFH
- Wall heating
- Heating and cooling blankets

Tests:

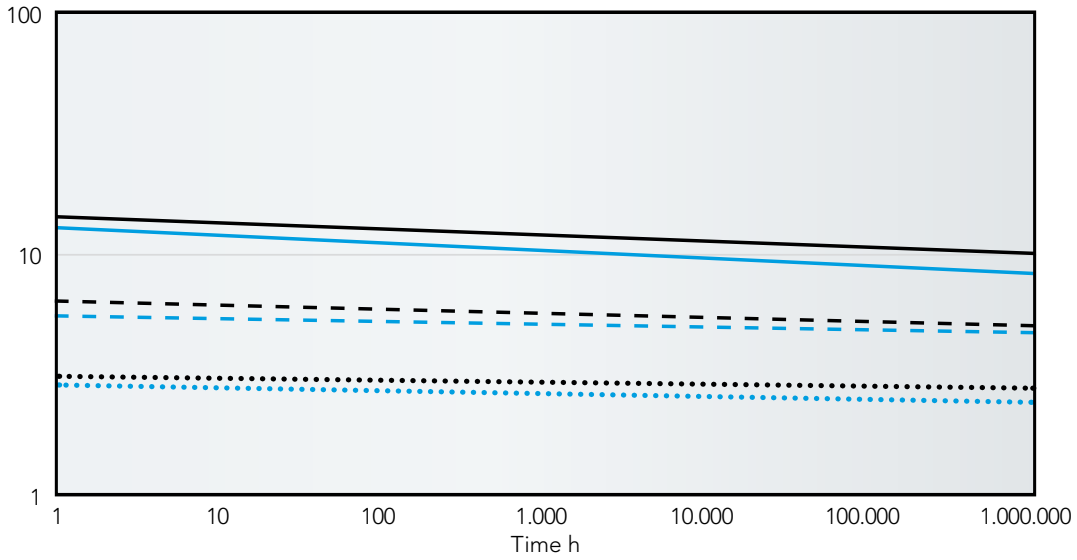
- Complies with all current standards and regulations e.g. DIN 16833, DIN 4726
- Suitable for underfloor heating systems ISO 10508 class 4
- Suitable for heater connection according to ISO 10508 class 5
- Monitored regularly by independent testing institutions, e.g. SKZ

Technical data			
Designation	Multi layer composite tube	Linear expansion	0.3 x 10^{-4} 1/K
Material	PE-RT / AL / PE-RT	Thermal conductivity W (m K) at 60 °C	0.40
VPE/ring length	500 m	Max. Bending radius	5 x d
Color	Red	Fire protection category	B 2
Dimension	14 x 2.0	Surface roughness	40 nm
Max. temperature load	90 °C	Water content L/running meter	0.0785
Ma.x operating pressure in bars (ISO 10508) at 70° C	10 bar	Art. no.	10.114.203

Pressure loss table



Behavior of PE-RT vs. PEX over a period of time



PE-RT 110° C

PE-RT 80° C

PE-RT 20° C

PEX 110° C

PEX 80° C

PEX 20° C

The behavior of PE-RT pipes in comparison with PE-X pipes over a period of time Source: PE-RT 2388 from Bodycote – measurement report, PEX from DIN 16892

2.8 Stainless steel heating circuit manifold UFH

The stainless steel heating manifold is specially designed for the precise control of underfloor and wall heating systems. The return flow distributor supports the control valve with external threads 30 x 1.5. You can use all of the standard actuators here. In the supply manifold, the flow indicators „DFA" 3/8" are mounted.

Distributor FBH stainless steel 1 1/4" type DFM

Floor distributor type 493 and 483-HZ/VA with integrated „DFA" flow indicator 3/8"

Manifold FBH stainless steel 1 1/4" type DFB

Underfloor manifold with integrated flow volume limiter type „DFB", adjustable via percentage scale.

Technical data:

Max. static pressure: PN6	6 bar
Max. Heating medium temperature	60° C
Illing and drain valve	R 3/8"
Ventilation valve	R 3/8"
Heating circuit – connection Eurocone	R 3/4"

Supply manifold (bottom):

Axial – internal thread	R 1"
Axial – wing nut (flat sealing)	R 1 1/4"
With flow limiter	DFB R 3/8"
Or control valve	R 3/8"
Or flow indicator „DFA" 0.5-3.5L/min R 3/8"	R 3/8"

Return manifold (top):

Axial – internal thread	R 1"
Axial – wing nut (flat sealing)	R 1 1/4"
Control valve external thread	M 30 x 1.5
Pressure pin sealing	double-0-ring
Closing dimension	11.8 mm
Valve stroke max.	3.5 mm
Valve opening force	~39 N
KVS value	3.0 m³/h

Adjustment values of the flow limiter „DFB" using the percentage scale 1-10 (10-100%):

Register lengths in %

Pipe Da x S	10	20	30	40	50	60	70	80	90	100 %
16 x 2	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10
17 x 2	1.3	2.2	3.3	4.4	5.2	6.3	7.2	8.2	9.2	10

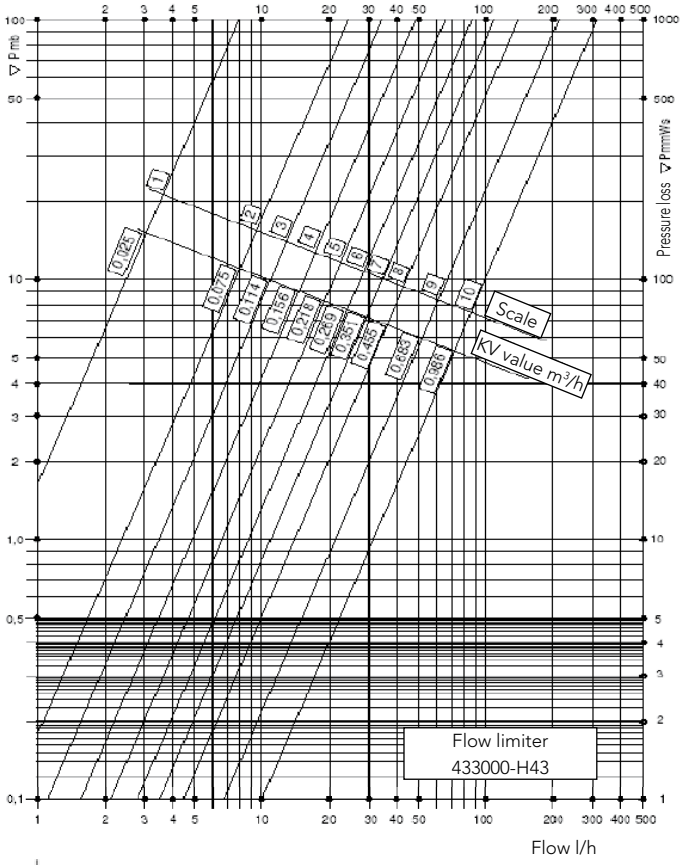
Installation:

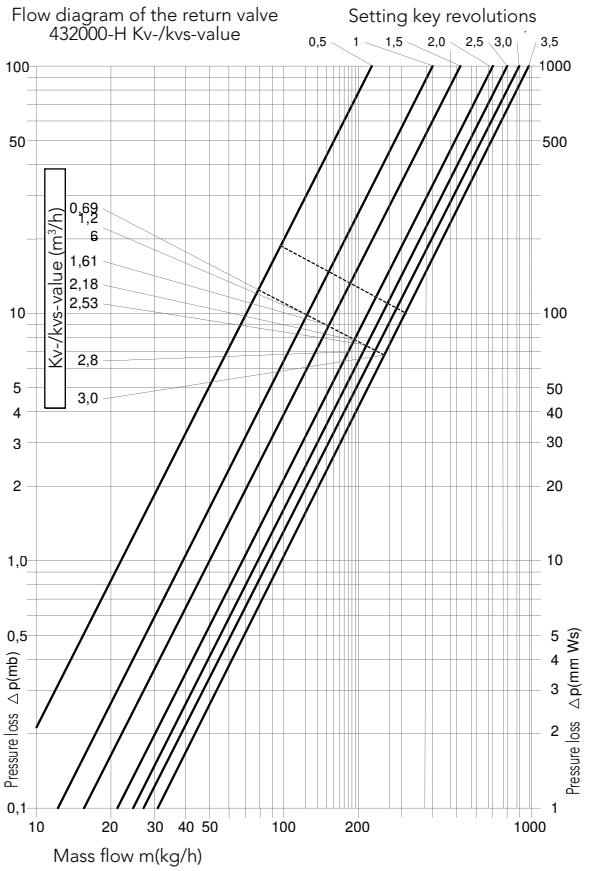
When selecting the manifold cabinet, please observe that both the dimensions of the ball cock and the heat meter installation set have to be considered, if required. Sufficient space for actuators and control bar have to be provided. It is to be ensured that on connecting the screws with a corresponding key, 3/4" is counter-held on the Eurocone connection 3/4"

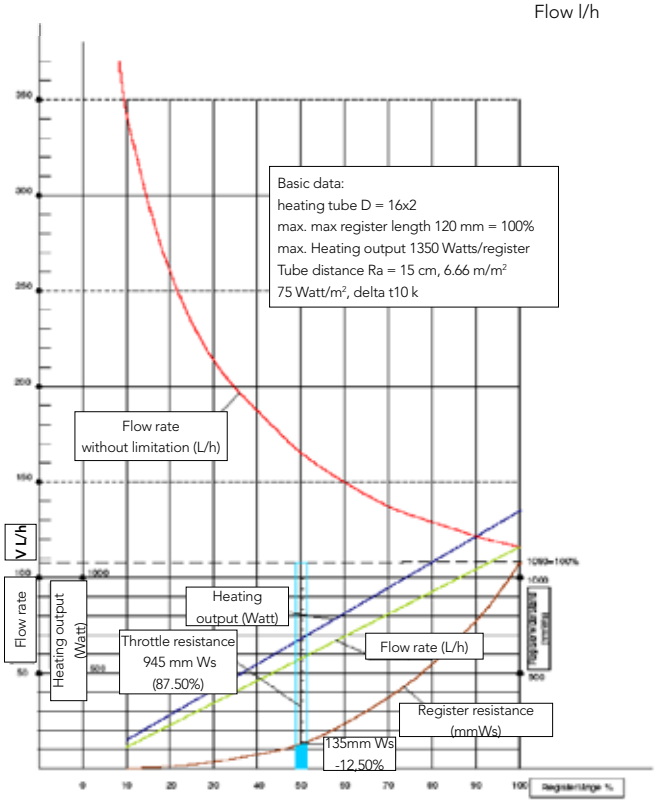
Important: if no heating registers are connected to the manifold, the port has to be closed with a cap of 3/4" due to safety reasons.

Heat circuit	Construction length (mm) (incl. end piece)	Construction length (mm) (incl. end piece and ball cock)
2	190	255
3	240	305
4	290	355
5	340	405
6	390	455
7	440	505
8	490	555
9	540	605
10	590	655
11	640	705
12	690	755

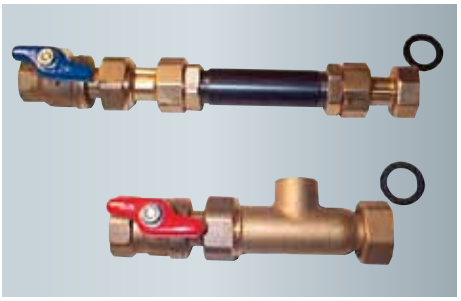
Flow chart of the flow limiter „DFB“







Port group WMZ, horizontal



- Meter 3/4" installation length 110 mm
- Meter 1" installation length 130 mm
- Ball cocks in supply and return
- Union nuts to the WMZ can be sealed
- With bore-hole for immersion sleeve 1/2"
- Packaged completely in cardboard box

Dimensions	Art. no.	Unit
WMZ horizontal	50.903.008	1 units

Port group WMZ, vertical

- Meter 3/4" installation length 110 mm
- Meter 1" installation length 130 mm
- Ball cocks in supply and return
- Angular piece with or without flow volume controller
- Union nuts to the WMZ can be sealed
- Angular piece with bore-hole 1/2" for immersion sleeve
- With bore-hole for immersion sleeve 1/2"
- Packaged completely in cardboard box

Dimensions	Art. no.	Unit
WMZ vertical	50.903.009	1 units

Fixed value control set FBH

Triple manifold installation dimensions:
130 mm pump group
Turn approx. 60 mm valve connection

Pre-mounted assembly for supply temperature control of underfloor heating systems with fixed value controller FL 50. circulation pump, max. flow volume 1.2 m³/h consisting of: fixed value controller FL 50. control valve, contact thermostat as temperature sensor, adjustable circulation pump, connection angle with bleed valve and thermometer, KFE cock 1/2", lockable screwed joint, 2 units reducers 3/4". When using a fixed value controller, the manifold cabinet size has to be extended by one dimension.

Fields of application:
Panel heating: underfloor, wall, and ceiling heating

Technical data:
½" control valve as connection for feed line Heating-side
Fixed value controller with capillary probe with M38 x 1.5 thread
Safety thermostat, contact thermostat AT 90
Incl. Drainage and ventilation ½"
Adjustable 3 level circulation pump (25 – 4) max. Flow volume 1.2 m³/h
½" feed-through screwed joint (lockable) as port for heating-side return
Incl. reducer and seals

Art. no.	Unit
50.903.007	1 units

3. Installation instructions

The C3 PExRT compact fixed value control set consists of a pre-mounted set of components for controlling the initial temperature of floor heating systems and is suitable for installation on the manifold.
The distributor and fixed value control set are only suitable for underfloor heating applications.

Individual components:

- 2 units reductions 1“ x ½ “
- 1 unit radiator locking screw connection
- 1 unit control valve
- 1 unit fixed setpoint controller
- 2 units seals 1“

1 pre-assembled set of components consisting of:

- 1 unit pump 1“
- 2 unit connection bracket 1“ x 1 ½“ incl. stoppers, thermometer, KE-tap
- 1 unit contact thermostat as temperature limiter

Installation

To install the C3 PExRT compact setpoint control set attach the control valve to the return bar of the distributor.

This is where you connect the heating flow!

Attach the locking radiator screw connection to the flow block.

This is where you connect the heating return flow!

In this context use the enclosed reductions 1“ x ½ “

On the opposite side, subsequent to fitting the 1“ seals, using the 1“ hexagonal fitting, fit the pre-mounted component with pump so that the flow direction of the pump is in the direction of the flow block.

Maximum operating temperature	50 °C
Maximum operating pressure	3 bar
Maximum test pressure	8 bar

Important! Please also comply with the operating parameters of the accessories that have also been used!

For economic reasons please always use the setpoint value control set in combination with the terminal strip (Art. no. 50903014) and the pump logic module (Art. no. 50903017).

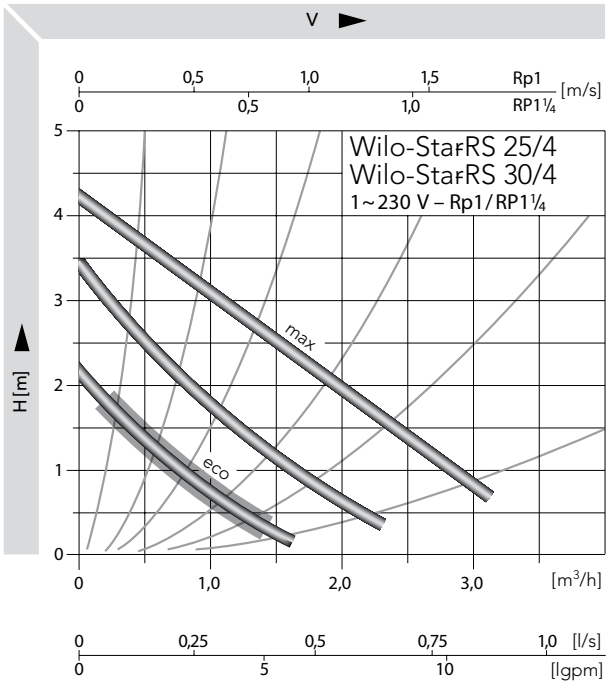
Electrical connection

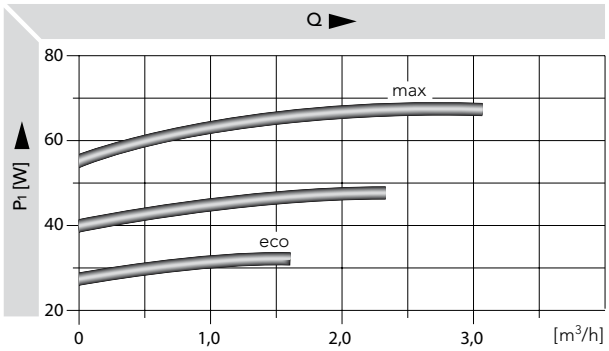
Connect to the available cable end

- green/yellow to earth
- blue to N
- brown to L

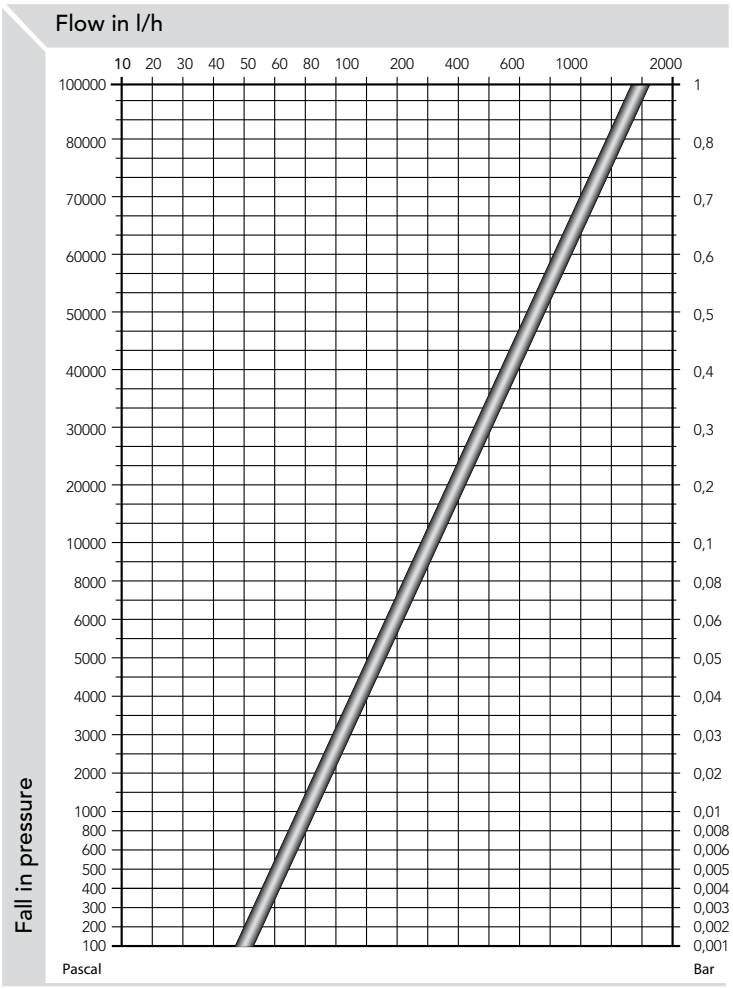
In accordance with the electrical wiring the setpoint value set controls the temperature of the under-floor heating independently to the set value.

Characteristic curve alternating current





Flow diagram control valve

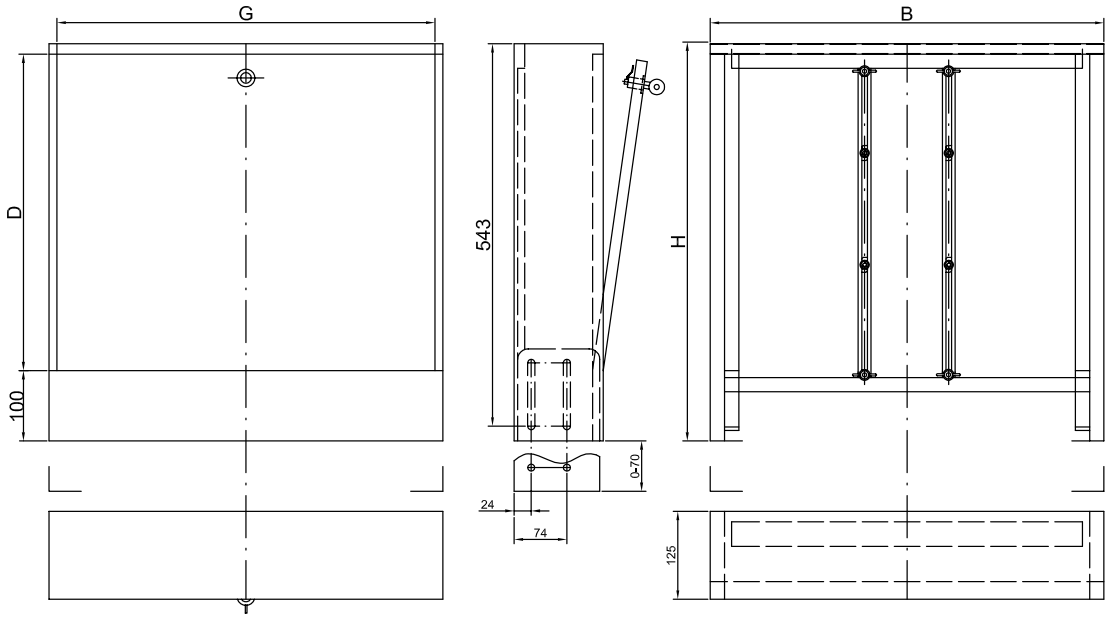


3. Products

Cable distribution cabinet, surface-mounted

Surface-mounted cable distribution cabinet made from galvanized sheet steel with removable door, also made from galvanized sheet steel. Fastening bar installed on the rear wall. Powder coated RAL 9010. Removable screed deflector plate. Height-adjustable cabinet feet, 0-70 mm. Polyamide cylinder lock with two keys.

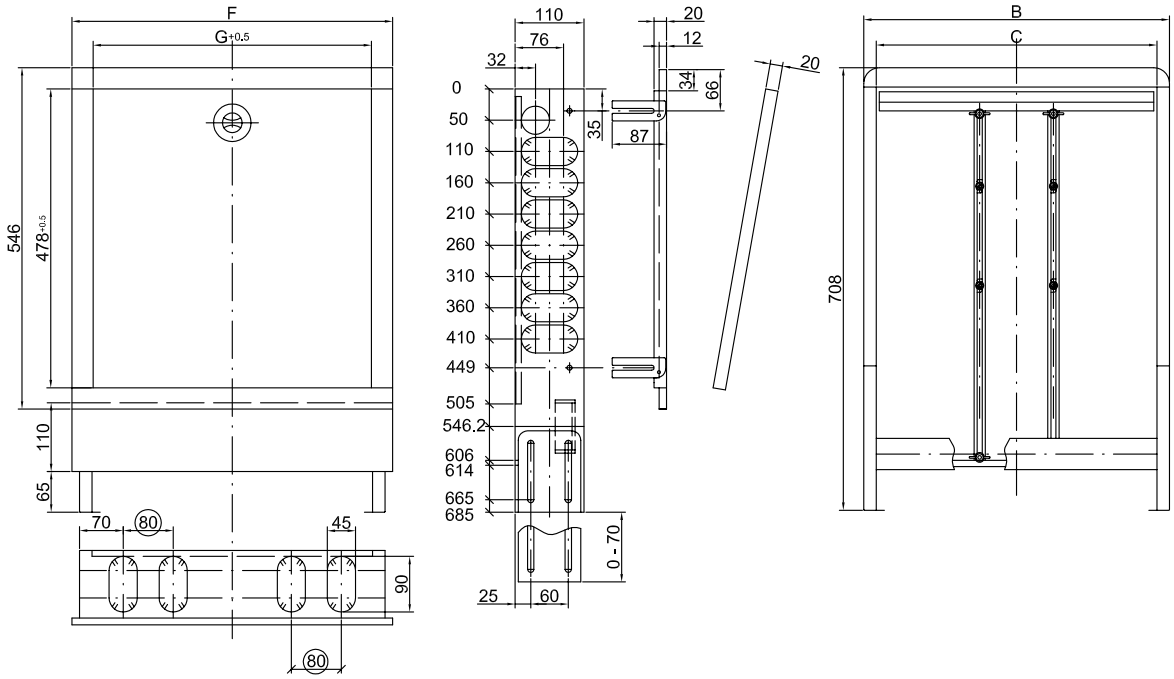
Cabinet type	AP 5 (3-5 circuits)	AP 8 (6-8 circuits)	AP 11 (9-11 circuits)	AP 12 (12 circuits and over)
Art. no.	50.922.002	50.922.003	50.922.004	50.922.005
B (mm)	552	802	952	1102
H (mm)	565-635	565-635	565-635	565-635
G (mm)	530	730	930	1080
D (mm)	450	450	450	450



Cable distribution cabinet, flush mounted

Flush mounted cable distribution cabinet made out of galvanized steel sheet with height-adjustable installation frame made from hot-dip galvanized steel sheet. With adjustable and removable frame with removable door and rotary lock. Powder coated RAL 9010. Depth adjustment 110-140 mm, height-adjustable cabinet feet, 0-70 mm. Special order: Polyamide cylinder lock with two keys.

Cabinet type	UP 5 (2-5 circuits)	UP 8 (6-8 circuits)	UP 11 (9-11 circuits)	UP 12 (12 circuits and over)
Art. no.	50.911.002	50.911.003	50.911.004	50.911.005
B (mm)	489	724	874	1024
C (mm)	449	684	834	984
F (mm)	513	748	898	1048
G (mm)	445	680	830	980



Hydraulic system components

Actuator

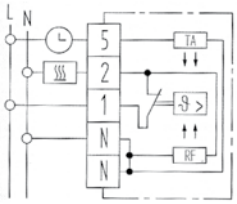
Small, compact design, manual adjustment mechanism, water protection according to protection type IP54. Also suitable for overhead mounting. Display of operating status and stroke position. Suitable without adapter, low diameter. 230 V, wing nut M 30 x 1.5 mm, free cable end with ferrules, length = 1 m. Current-free actuator connection 230 V AC 2.5 W, working stroke 4 mm.
Dimensions: 80.1 mm x 46 mm.

Dimensions	Art. no.	Unit
230 V	50.903.011	1 units

MP room controller surface-mounted, heating

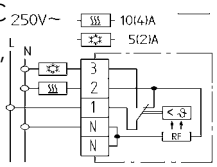
The room controllers are available in different versions for individual application options.
External heating such as, for example solar radiation into rooms can therefore be taken into account. All room controllers are equipped with night set-back resistor and are characterized by a very low hystheresis (0.5 K) due to the thermal return.

- Electro-mechanical room thermostat with high control accuracy
- Supply voltage: 230 V AC/50- 60 HZ
- Connection cable: 4 x 1.5
- Normally closed contact with heating function and thermal return
- With drop resistance (temperature resistance turn approx. 5 K) can be controlled via external time switch and/or extension module, can be controlled
- Color pure white (similar to RAL 9010)
- Wall installation (also possible on UP box)
- Adjustment range 5-30 °C
- Switching current:10 (4) A, max. max 10 actuators
- Protection class IP 30
- Dimensions: 75 x 75 x 28 mm
- Art. no 50,903,012



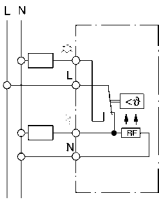
MP room controller surface-mounted, heating/cooling

- Electro-mechanical room thermostat with high control accuracy
- Supply voltage: 230 V AC/50-60 Hz
- Connection cable: 4 x 1.5
- Changeover contact with thermal return
- With drop resistance (temperature resistance turn approx. 5 K) can be controlled via external time switch and/or extension module, can be controlled
- Color pure white (similar to RAL 9010)
- Wall installation (also possible on UP box)
- Adjustment range 5-30 °C
- Switching current:10 (4) A, max. max 10 actuators
- Protection class IP 30
- With adapter frame ARA 1E direct on UP-box, with installation on UP Box with horizontal anchoring holes has to be ordered with adapter frame ARA 1 E
- Dimensions: 75 x 75 x 28 mm
- Art. no 50,903,016



MP room controller flush mounted 50 x 50

- Room controller suitable for the most current switch programs
- Electro-mechanical room thermostat with high control accuracy
- Supply voltage: 230 V AC/50-60HZ
- Connection cable: 4 x 1.5
- Changeover contact with thermal return with range limitation in the adjustment button
- Color pure white (similar to RAL 9010)
- Installation into a standard 55 UP socket (60 mm)
- Adjustment range *,,,, 6 (5-30 °C)
- Switching current: heating 10 (cooling 5) A
- Protection class IP 30
- Dimensions, cover: 75 x 75 mm
- Art. no 50,903,013

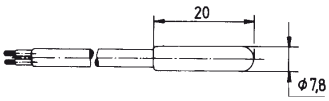


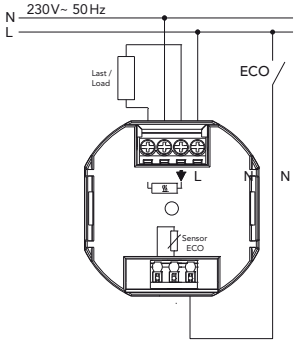
Energy-saving room controller

Designation/Dim.	Art. no.	Unit	€/unit	
3R	50.903.113	1 units	149.90	NEW!
3L with limiter function	50.903.114	1 units	174.50	NEW!

Room controller with energy consumption display Very big display with backlight; flush mounted installation. Temperature controller 5 – 30 °C in 0.5 °C steps, 3 A switching current 3L room controller including probe. Temperature display in 0.1 °C steps.

Max. switching current 10 (4) A
Output signal › pulse width modulation (PWM),
Cycle time can be set › 2 points (on/off),
Hysteresis and minimum on/off switching time can be set
ECO input for change of temperature via external time switch (ECO-temperature can be freely set)
Environmental temperature, operations 0 °C to 40 °C
Protection type IP 30 / protection class II





MP terminal strip 230 V

For the professional connection of actuators with room temperature controllers

- 230 V supply voltage, straight forward wiring without screwdriver
- 6 room thermostats can be connected separately
- Ready-to-connect with top hat rail for wall mounting
- LED for operating mode display
- Switching capacity max 13 actuators each with 3W
- 6 channel time switch and pump logic module can be connected optionally

Fields of application:

To be used with all MP room controllers. When being used with timer module, controllers with temperature set-back have to be used.

Connection of actuators and room controllers:

- The room temperature controllers and actuator for room 1 clamps, image 1, 2, 4
- The temperature controller and actuators for rooms R .. R6 are connected in accordance with the same scheme.
- It is possible to connect a wide range of actuators at the different zones.

Zones R1. R2	4 actuators each
Zones R3, R4	2 actuators each
Zones R5, R6	1 actuators each

- By connecting the clamps > from the different channels (e.g. > R1 and > R3) it is possible to increase the number of actuators per channel, image 3, 5.

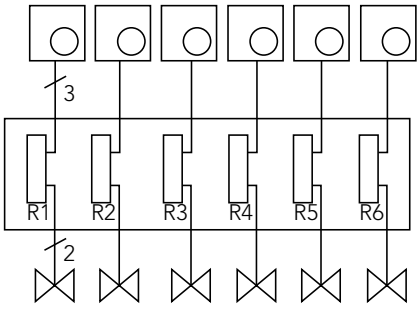
Please note: no controller can be connected to the extended channels.

Technical data:	
Order code	EV 230
Operating voltage	230 V 50 Hz
Energy consumption	10VA
Fuse	4A slow-blow
Dimensions	310 x 90 x 65 mm
Weight	~700 g
Environmental temperature (without condensation)	0.. + 50 °C
Storage temperature	-20 … + 60 °C
Light for operating voltage	1
Number of actuators 3W	max. 14*
Protection class	IP 43/with protective isolation
Protection class	II
Rated surge voltage	2.5 KV
Temperature for the ball pressure test	75
Voltage and current for the purposes of the EMC interference emission tests	230 V 4A
Art. no.	50.903.14

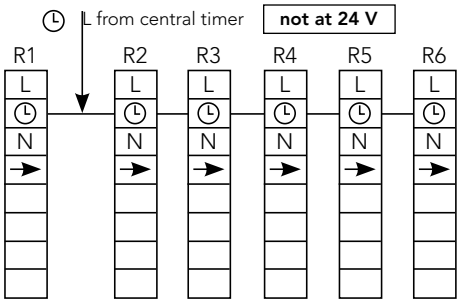
* Sum of all currents < 2 A
It is possible to connect a max. 14 actuators on one device (fusing)

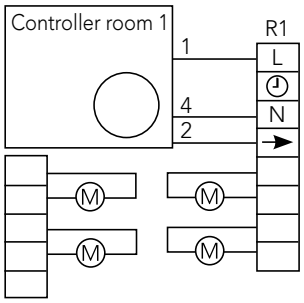
Connection diagram with C3 PExRT Room controller

Extension of the terminals for actuators at 230 , e.g. with terminal 3

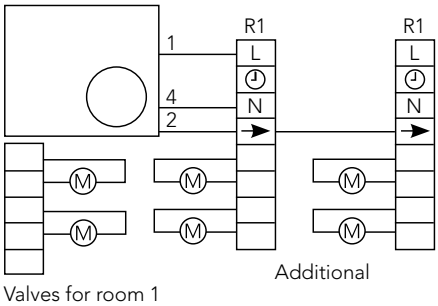


Number of wires each without ground conductor





Valves for room 1



Valves for room 1

Additional Valves for room 1

MP terminal strip heating + cooling

6 channel 230 V AC terminal strip for the professional connection of actuators with room temperature controllers, automatic switching between heating/cooling, straightforward wiring without screwdriver, time switch for controlling the room controller with TA-input, e.g. MP AP H/K, 6 separate-connection room thermostats, ready to plug, with top-hat rail for wall installation, max. switching performance 14 actuators à 3 W, white.

This terminal strip serves for wiring electrothermal actuators with room temperature controllers in case of individual room control, e.g. hot water underfloor heating/cooling.

One room thermostat can be connected to several actuators for each channel. Using an external signal (mains L), e.g. from a thermal heat pump, all channels can be switched between heating and cooling.

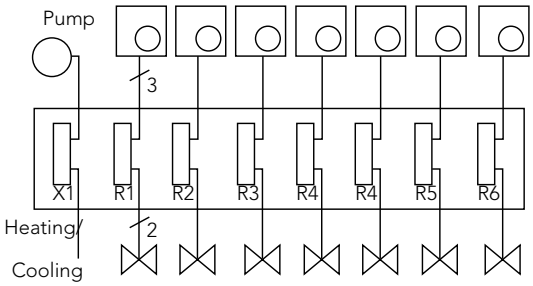
Using the terminal block with timer (EVU..H/C), the rooms can be assigned with time profiles to reduce and increase the temperature. All 6 rooms/zones can be set with separate time profiles.

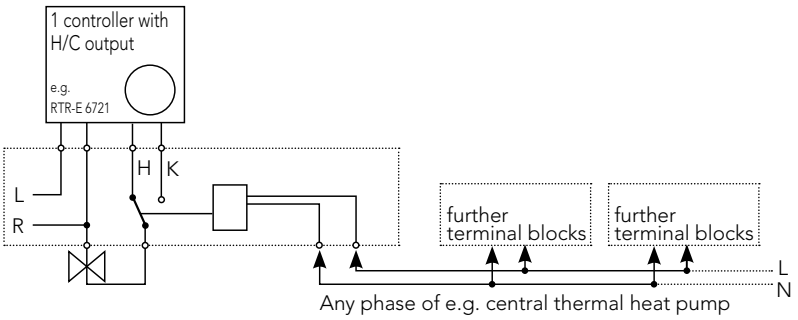
In cooling operation, the time profiles are not used, cooling occurs permanently.

Pump

Technical data:
Supply voltage 230 V
Switching between hot and cold operation via external signal (mains-L)
Up to 6 rooms / zones can be independently controlled
Individual rooms can be excluded from cooling, e.g. bathroom
Pump logic module-compatible
Time controller module can be connected (not included in the scope of delivery)
Switching capacity per channel max. 5 actuators à 3 W
LED display during operation
IP 43 protection class: II
Dimensions: W x H x D 305 x 90 x 60 mm

Wiring diagram



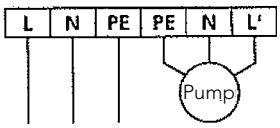


MP cover with pump logic and protection

Extension module with integrated pump logic (pump is shut down when all valves are closed), pump protection (pump runs once a day, e.g. during summer), during the set-back time the room temperature is reduced by 5 K.

Dimensions	Art. no.	Unit
230 V	50.903.017	1 units

Connection via L, N, PE



RTL Box

Designation/Dim.	Art. no.	Unit	€/unit
RTL Box	50.903.107	1 units	119.50

The control box is used to control the return flow temperature of panel heating systems. The control box consists of a flush-mounted box with pre-mounted valve block with room thermostat, protective cover, ventilation valve, thermostat head and wall cover. The valve block has 3/4" AG (Eurocone) for tubeside connection with compression fitting.

MP cover additionally with 6 channel time switch

Extension module with integrated 6-channel-time switch for max. 21 switching pairs and pump logic (pump is shut down when all valves are closed), pump protection (pump runs once a day, e.g. during summer), during the set-back time the room temperature is reduced by 5 K.

Dimensions	Art. no.	Unit
230 V	50.903.018	1 units

MP radio controller/sender AP

Microprocessor-controlled room temperature controller, sends to receiver 50.903.031/032, radio signal transmission, fuzzy controller switchable to two point operation with pulse width modulation,
Radio transmitter with analog temperature settings, battery-operated, 5 to 30 °C, 1 indicator light for training mode and battery replacement.

Dimensions	Art. no.	Unit
75 x 75 x 25.5 mm	50.903.030	1 units

Radio controlled clock thermostat

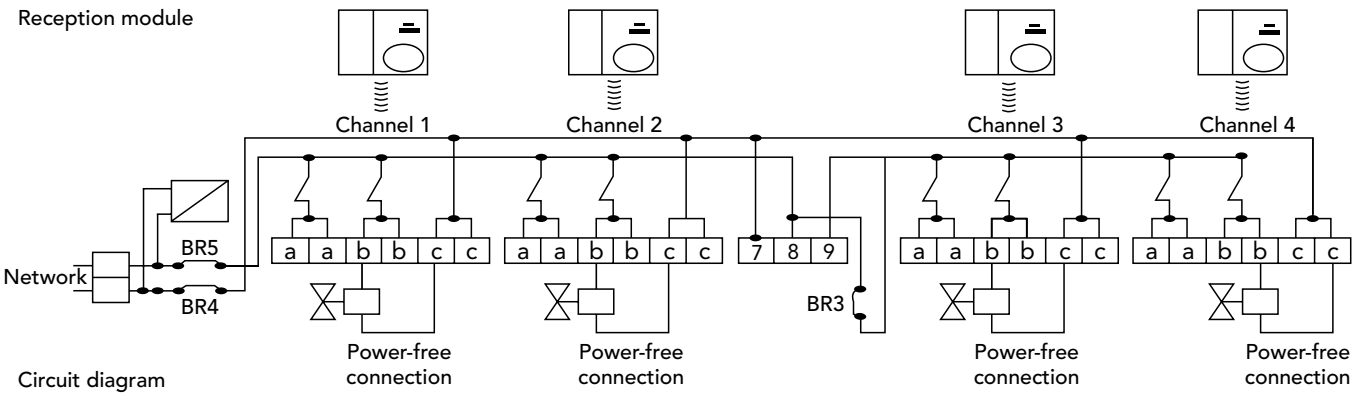
Designation/Dim.	Art. no.	Unit	€/unit	
137 x 96.5 x 31.3 mm	50.903.033	1 units	169.90	NEW!

Radio-controlled clock thermostat, very easy to program. Digital display of time of day and temperature, battery operated (2x 1.5 V AA) with adjustable week and day programs, with up to 6 switch times per day. The controller, which is microprocessor controlled, independently ‚learns' how long the run up time has to be in order to reach the required temperature. During the transitional time in particular, this intelligent feature means considerable levels of heating energy are saved and the environment is also relieved through reduced CO2 emissions. Combined vacation and party function (time limited temperature reduction or increase for hours or days), optimum start (the room temperature is reached at the set time, 3 preset programs, automatic summer / winter switching. Can by used for heating or cooling only.

MP radio control (4/6 channel receivers)

Radio receiver, monitoring of the transmitter: with transmitter failure (e.g. battery empty) heating occurs with 30% of the output, with integrated pump logic (shut down of a circulation pump if one of the actuators is closed, then one channel less for actuators). Connection max. 10 actuators per channel. 4/6 channel receivers when using the pump logic 3/5 channels, supply voltage 230 VAC (ready-to-connect), actuators 24V can be controlled via separate transformer, signal light for each output. 4 channels.

Dimensions	Art. no.	Unit
57 x 372 x 42 mm	50.903.031	1
57 x 450 x 42 mm	50.903.032	1



Circuit diagram

5 . Heat output tables

Tiling

R B = 0.02 m² K/W (tiling)

Heating medium temperature H °C	Internal temperature i °C	Tube distance RA cm 7.5	10	12,5	15	17.5	20	22,5	25
		Tube proportion rm./sqm 13.4	10.0	8.0	6.7	5.7	5.0	4.4	4.0
35	15	133	124	115	106	98	91	85	79
		26.6	25.9	25.2	24.5	23.6	23.3	22,7	22,2
	18	113	105	98	90	84	77	72	67
		28.0	27.4	26.8	26.2	25.7	25.1	14.7	24.2
	20	100	93	86	79	74	68	64	59
		29.0	28.4	27.9	27.3	26.8	26.4	26.0	25.6
	22	86	80	75	69	64	59	55	51
		29.9	29.4	28.9	28.4	28.0	27.6	27.2	26.9
	24	73	68	63	58	54	50	47	43
		30.8	30.3	29.9	29.5	29.2	28.8	28.5	28.2
40	15	166	155	144	132	123	114	106	98
		29.3	28.4	27.5	26.6	25.9	25.1	24.5	23.9
	18	146	136	126	116	108	100	93	86
		30.7	29.9	29.1	28.3	27.7	27.0	26.4	25.9
	20	133	124	115	106	98	91	85	79
		31.6	30.9	30.2	29.5	28.9	28.3	27.7	27.2
	22	120	111	103	95	89	82	76	71
		32,6	31.9	31.3	30.6	30.1	29.5	29.0	28.6
	24	106	99	92	85	79	73	68	63
		33.5	32,9	32,3	31.7	31.2	30.7	30.3	29.9
45	15	199	186	172	159	148	137	127	118
		31.8	30.8	29.7	28.7	27.8	26.9	26.2	25.5
	18	179	167	155	143	133	123	114	106
		33.3	32,4	31.4	30.4	29.7	28.9	28.2	27.5
	20	166	155	144	132	123	114	106	98
		34.3	33.4	32,5	31.6	30.9	30.1	29.5	28.9
	22	153	142	132	122	113	105	98	90
		35.2	34.4	33.6	32,8	32,1	31.4	30.8	30.2
	24	139	130	121	111	103	96	89	83
		36.2	35.4	34.7	33.9	33.3	32,6	32,1	31.6

1. Horizontal row: heat stream density q W/sq m
2. Horizontal row: average surface temperature Fm° C

thick carpet, parquet

R B = 0.10 m² K/W (thick carpet, parquet)

Heating medium temperature H °C	Internal temperature i °C	Tube distance RA cm 7.5	10	12,5	15	17.5	20	22,5	25
		Tube proportion rm./sqm 13.4	10.0	8.0	6.7	5.7	5.0	4.4	4.0
35	15	64	61	58	55	53	50	48	46
		21.0	20.7	20.5	20.3	20.0	19.8	19.6	19.4
	18	54	52	49	47	45	43	41	39
		23.2	23.0	22,7	22,5	22,4	22,2	22,0	21.8
	20	48	46	44	42	40	38	36	35
		24.6	24.4	24.2	24.1	23.9	23.7	23.6	23.4
	22	41	40	38	36	34	33	31	30
		26.0	25.9	25.7	25.6	25.4	25.3	25.1	25.0
	24	35	34	32	30	29	28	27	25
		27.5	27.3	27.2	27.1	26.9	26.8	26.7	26.6
40	15	80	76	73	69	66	63	60	57
		22,3	22,0	21.7	21.4	21.2	20.9	20.7	20.4
	18	70	67	64	61	58	55	53	51
		24.5	24.3	24.0	23.7	23.5	23.3	23.1	22,8
	20	64	61	58	55	53	50	48	46
		26.0	25.7	25.5	25.3	25.0	24.8	24.6	24.4
	22	57	55	52	50	48	45	43	41
		27.4	27.2	27.0	26.8	26.6	26.4	26.2	26.0
	24	51	49	47	44	42	40	39	37
		28.9	28.7	28.5	28.3	28.1	27.9	27.8	27.6
45	15	96	92	87	83	79	76	72	69
		23.6	23.3	23.0	22,6	22,3	22,0	21.7	21.4
	18	86	82	79	75	71	68	65	62
		25.9	25.5	25.2	24.9	24.6	24.3	24.1	23.8
	20	80	76	73	69	66	63	60	57
		27.3	27.0	28.7	26.4	26.2	25.9	25.7	25.4
	22	73	70	67	64	61	58	55	53
		28.8	28.5	28.2	28.0	27.7	27.5	27.3	27.0
	24	67	64	61	58	56	53	51	48
		30.3	30.0	29.8	29.5	29.3	29.0	28.8	28.6

1. Horizontal row: heat stream density q W/sq m
2. Horizontal row: average surface temperature Fm° C

PVC, Linoleum

R B = 0.02 m² K/W (PVC, linoleum)

Heating medium temperature H °C	Internal temperature i °C	Tube distance RA cm 7.5	10	12,5	15	17.5	20	22,5	25
		Tube proportion rm./sqm 13.4	10.0	8.0	6.7	5.7	5.0	4.4	4.0
35	15	98	92	86	81	76	71	67	63
		23.8	23.3	22,9	22,4	22,0	21.6	21.2	20.9
	18	83	78	73	69	64	60	57	53
		25.6	25.2	24.8	24.4	24.0	23.7	23.4	23.1
	20	73	69	65	60	57	53	50	47
		26.8	26.4	26.1	25.7	25.4	25.1	24.8	24.5
	22	64	60	56	52	49	46	43	41
		28.0	27.6	27.3	27.0	26.7	26.5	26.2	26.0
	24	54	51	47	44	42	39	37	35
		29.1	28.8	28.6	28.3	28.1	27.8	27.6	27.4
40	15	122	115	108	101	95	89	84	79
		25.8	25.2	24.6	24.1	23.6	23.1	22,6	22,2
	18	107	101	95	89	83	78	74	69
		27.6	27.1	26.6	26.1	25.6	25.2	24.8	24.4
	20	98	92	86	81	76	71	67	63
		28.8	28.3	27.9	27.4	27.0	26.6	26.2	25.9
	22	88	83	78	73	68	64	60	57
		30.0	29.6	29.2	28.7	28.4	28.0	27.7	27.4
	24	78	74	69	64	61	57	54	50
		31.2	30.8	30.4	30.0	29.7	29.4	29.1	28.8
45	15	147	138	129	121	114	107	100	94
		27.2	27.1	26.4	25.7	25.1	24.5	24.0	23.5
	18	132	124	117	109	102	96	90	85
		29.6	29.0	28.3	27.7	27.2	26.7	26.2	25.7
	20	122	115	108	101	95	89	84	79
		30.8	30.2	29.6	29.1	28.6	28.1	27.6	27.2
	22	112	106	99	93	87	82	77	72
		32,0	31.5	30.9	30.4	29.9	29.5	29.1	28.7
	24	103	97	91	85	80	75	70	66
		33.2	32,7	32,2	31.7	31.3	30.9	30.5	30.2

1. Horizontal row: heat stream density q W/sq m
2. Horizontal row: average surface temperature Fm° C

medium carpet

R B = 0.09 m² K/W (medium carpet)

Heating medium temperature H °C	Internal temperature i °C	Tube distance RA cm 7.5	10	12,5	15	17.5	20	22,5	25
		Tube proportion rm./sqm 13.4	10.0	8.0	6.7	5.7	5.0	4.4	4.0
35	15	77	73	70	66	62	59	56	53
		22,1	21.8	21.5	21.1	20.9	20.6	20.3	20.1
	18	66	62	59	56	53	50	48	45
		24.1	23.9	23.6	23.3	23.0	22,8	22,6	22,4
	20	58	55	52	49	47	44	42	40
		25.5	25.2	25.0	24.7	24.5	24.3	24.1	23.9
	22	50	48	45	43	40	38	36	34
		26.8	26.6	26.4	26.1	26.0	25.8	25.6	25.4
	24	43	40	38	36	34	32	31	29
		28.1	27.9	27.8	27.6	27.4	27.2	27.1	26.9
40	15	97	92	87	82	78	74	70	66
		23.7	23.3	22,9	22,5	22,2	21.8	21.5	21.2
	18	85	81	76	72	69	65	62	58
		25.8	25.4	25.1	24.7	24.4	24.1	23.8	23.5
	20	77	73	70	66	62	59	56	53
		27.1	26.8	26.5	26.1	25.9	25.6	25.3	25.1
	22	70	66	63	59	56	53	50	48
		28.5	28.2	27.9	27.6	27.3	27.1	26.8	26.5
	24	62	59	56	52	50	47	45	42
		29.8	29.5	29.3	29.0	28.8	28.5	28.3	28.1
45	15	116	110	104	98	93	89	84	80
		25.3	24.8	24.3	23.9	23.5	23.1	22,7	22,3
	18	104	99	94	89	84	80	76	72
		27.4	26.9	26.5	26.1	25.7	25.3	25.0	24.6
	20	97	92	87	82	78	74	70	66
		28.7	28.3	27.9	27.5	27.2	26.8	26.5	26.2
	22	89	84	80	75	72	68	64	61
		30.1	29.7	29.3	29.0	28.6	28.3	28.0	27.7
	24	81	77	73	69	65	62	59	56
		31.4	31.1	30.8	30.4	30.1	29.8	29.6	29.3

1. Horizontal row: heat stream density q W/sq m
2. Horizontal row: average surface temperature Fm° C

CREAPUR screed tile or Fermacell GF 25 mm

Thermal conductivity value of the floor cover (R_{IB}m²K/W) 0.05 – spread (sK) 5 (e.g. parquet and same thermal conductivity value)

Surface temperature according to DIN EN 1264:

Public areas: 20 °C

Bathrooms: 32 °C

Peripheral zone: 35 °C

Average hot water tempe-rature	Room tem-perature	Screed tile 20 mm UFH	Surface tempe-rature	Screed tile 20 mm UFH	Surface tempe-rature	Fermacell) 25 mm UFH	Surface tempe-rature	Fermacell) 25 mm UFH	Surface tempe-rature
		VA 12.5		VA 25		VA 12.5		VA 25	
Q_m	Q_j		Q_F		Q_F		Q_F		Q_F
°C	°C	W/m²	°C	W/m²	°C	W/m²	°C	W/m²	°C
45	24	101.2	33.1	81.3	31.5	74.8	30.9	60.6	29.7
45	22	110.9	31.9	89.1	30.1	82,0	29.5	66.4	28.2
45	20	120.6	30.7	96.9	28.7	89.2	28.1	72,3	26.4
45	18	130.3	29.4	104.7	27.4	96.4	26.7	78.1	25.2
45	15	144.9	27.6	116.4	25.3	107.2	24.6	86.8	22,9
40	24	76.8	31.1	61.7	29.8	56.8	29.4	46.0	28.4
40	22	86.6	29.9	69.6	28.5	64.0	28.0	51.9	27.0
40	20	96.3	28.7	77.4	27.1	71.2	26.6	57.7	25.5
40	18	106.0	27.5	85.2	25.8	78.4	25.2	63.5	24.0
40	15	120.6	25.7	96.9	23.7	89.2	23.1	72,3	21.7
35	24	52,3	29.0	42,0	28.1	38.7	27.8	31.3	27.1
35	22	62,1	27.8	49.9	26.8	46.0	26.4	37.2	25.4
35	20	71.9	26.7	57.8	25.5	53.2	25.1	43.1	24.2
35	18	81.7	25.5	65.7	24.1	60.4	23.7	48.9	22,7
35	15	96.3	23.7	77.4	22,1	71.2	21.6	57.7	20.5
30	24	27.3	26.8	21.9	26.3	20.2	26.1	16.3	25.7
30	22	37.4	25.7	30.1	25.0	27.7	24.8	22,4	24.3
30	20	47.4	24.6	38.1	23.7	35.0	23.5	28.4	22,9
30	18	57.2	23.4	46.0	22,4	42,3	22,1	34.3	21.4
30	15	71.9	21.7	57.8	20.5	53.2	20.1	43.1	19.2

VA: Distance between two pipes in centimeter.

Thermal conductivity value of the floor cover (R_{IB}m²K/W) 0.10 – spread (sK) 5 (e.g. carpet)

Surface temperature according to DIN EN 1264:
Public areas: 20 °C
Bathrooms: 33 °C
Peripheral zone: 35 °C (1m)

Average hot water temperature	Room temperature	Screed tile 20 mm UFH	Surface temperature	Screed tile 20 mm UFH	Surface temperature	Fermacell) 25 mm UFH	Surface temperature	Fermacell) 25 mm UFH	Surface temperature
		VA 12.5		VA 25		VA 12.5		VA 25	
Q_m	Q_j		Q_F		Q_F		Q_F		Q_F
°C	°C	W/m²	°C	W/m²	°C	W/m²	°C	W/m²	°C
45	24	78.8	31.2	65.4	30.1	61.9	29.8	51.4	28.9
45	22	86.4	29.9	71.7	28.6	67.8	28.3	56.4	27.3
45	20	93.9	28.5	78.0	27.2	73.8	26.8	61.3	25.8
45	18	101.5	27.1	84.3	25.7	79.7	25.3	66.2	24.2
45	15	112,8	25.0	93.7	23.5	88.6	23.1	73.6	21.8
40	24	59.8	29.6	49.7	28.8	47.0	28.5	39.0	27.8
40	22	67.4	28.3	56.0	27.3	52,9	27.0	44.0	26.3
40	20	75.0	26.9	62,3	25.8	58.9	25.6	48.9	24.7
40	18	82,6	25.6	68.6	24.4	64.8	24.1	53.9	23.1
40	15	93.9	23.5	78.0	22,2	73.8	21.8	61.3	20.8
35	24	40.7	28.0	33.8	27.4	32,0	27.2	26.6	26.7
35	22	48.4	26.7	40.2	25.9	38.0	25.7	31.6	25.2
35	20	56.0	25.3	46.5	24.5	44.0	24.3	36.6	23.6
35	18	63.6	24.0	52,8	23.0	50.0	22,8	41.5	22,0
35	15	75.0	21.9	62,3	20.8	58.9	20.6	48.9	19.7
30	24	21.2	26.2	17.6	25.9	16.7	25.8	13.9	25.5
30	22	29.2	24.9	24.2	24.5	22,9	24.4	19.0	24.0
30	20	36.9	23.6	30.6	23.1	29.0	22,9	24.1	22,5
30	18	44.6	22,3	37.0	21.6	35.0	21.5	29.1	20.9
30	15	56.0	20.3	46.5	19.5	44.0	19.3	36.6	18.6

CREAPUR screed tile or Fermacell GF 25 mm

Thermal conductivity value of the floor cover (R_{IB}m²K/W) 0.15 – spread (sK) 5 (e.g. ready-made parquet/wooden floorboards/verlour)

Surface temperature according to DIN EN 1264:

Public areas: 20 °C

Bathrooms: 33 °C

Peripheral zone: 35 °C (1m)

Average hot water temperature	Room temperature	Screed tile 20 mm UFH	Surface temperature	Screed tile 20 mm UFH	Surface temperature	Fermacell) 25 mm UFH	Surface temperature	Fermacell) 25 mm UFH	Surface temperature
		VA 12.5		VA 25		VA 12.5		VA 25	
Q_m	Q_j		Q_F		Q_F		Q_F		Q_F
45	24	64.6	30.0	54.8	29.2	52,9	29.0	44.5	28.3
45	22	70.8	28.6	60.0	27.7	58.0	27.5	48.8	26.7
45	20	77.0	27.1	65.3	26.1	63.0	25.9	53.1	25.1
45	18	83.2	25.6	70.5	24.6	0.0	18.0	57.3	23.4
45	15	92,5	23.4	78.4	22,2	75.7	22,0	63.8	21.0
40	24	49.0	28.7	41.6	28.1	40.1	27.9	33.8	27.4
40	22	55.3	27.2	46.9	26.5	45.2	26.4	38.1	25.7
40	20	61.5	25.8	52,1	25.0	50.3	24.8	42,4	24.1
40	18	67.7	24.3	57.4	23.4	0.0	18.0	46.7	22,5
40	15	77.0	22,1	65.3	21.1	63.0	20.9	53.0	20.1
35	24	33.4	27.3	28.3	26.9	27.3	26.8	23.0	26.4
35	22	39.7	25.9	33.6	25.3	32,5	25.2	27.3	24.8
35	20	45.9	24.4	38.9	23.8	37.6	23.7	31.7	23.2
35	18	52,1	23.0	44.2	22,3	0.0	18.0	35.9	21.5
35	15	61.5	20.8	52,1	20.0	50.3	19.8	42,4	19.1
30	24	17.4	25.8	14.8	25.6	14.3	25.5	12,0	25.3
30	22	23.9	24.4	20.3	24.1	19.6	24.0	16.5	23.7
30	20	30.2	23.0	25.6	22,6	24.8	22,5	20.8	22,2
30	18	36.5	21.6	31.0	21.1	29.9	21.0	25.2	20.6
30	15	45.9	19.4	38.9	18.8	37.6	18.7	18.7	31.7

6 . Laws and regulations, DIN standards

The applicable standards and regulations for installing underfloor heating systems are shown in the following table. On the basis of the diversity of the also applicable DIN standards, laws, and regulations only the most important ones are listed.

Standards and regulations	Meaning
a.R.d.T.	The accepted rules of technology
EnEV	Energy saving regulations, 2002
ETB	Introduced Technical Building Regulations
Heating costs V	Heating costs calculation regulations
VOB/B and C	General contract conditions for completion of building contracts, DIN 1961
DIN 1055	Design loads for buildings
DIN 18195	Structural waterproofing
DIN 18202	Tolerances in building construction
DIN 18336	Construction Contract Procedures VOB, part C General technical specifications in construction contracts (ATV); waterproofing
DIN 18352	Construction Contract Procedures VOB, part C General technical specifications in construction contracts (ATV); tiling and plate works
DIN 18353	Construction Contract Procedures VOB, part C General technical specifications in construction contracts (ATV); screed works
DIN 18356	Floor covering work
DIN 18560	Screeds in building construction
DIN 4102	Fire safety in building construction
DIN 4108	Thermal insulation in building construction
DIN 4109	Sound-proofing in building construction
DIN 4701	Rules for calculating the requirements of buildings
DIN EN 832	Thermal performance of buildings – calculation of heat energy requirements
DIN EN 1264	Underfloor heating, systems and components, parts 1 to 4
DIN EN 13162	Thermal insulation products for factory-made mineral wool (MW) products
DIN EN 13163	Thermal insulation products for factory-made expanded polystyrene (EPS) products
DIN EN 13164	Thermal insulation products for factory-made extruded polystyrene foam (XPS) products
DIN EN 13165	Thermal insulation products for factory-made polyurethane hard foam (PUR) products
DIN EN 13166	Thermal insulation products for factory-made phenol hard foam (PF) products
DIN EN 13167	Thermal insulation products for factory-made phenol glass foam (CG) products
DIN EN 13168	Thermal insulation products for factory-made phenol wood wool (WW) products
DIN EN 13169	Thermal insulation products for factory-made phenol expanded perlite (EPB) products
DIN EN 13170	Thermal insulation products for factory-made expanded cork (ICB) products
DIN EN 13171	Thermal insulation products for factory-made phenol wood fiber (WF) products
DIN V 4108-10	Thermal insulation for saving energy in buildings – Application-specific requirements of thermal insulation materials
DIN V 4108-6	Thermal insulation for saving energy in buildings – Calculation of the annual thermal heat and annual heat energy requirements
DIN V 4701-10	Energetic assessment of room heating and ventilation systems; heating of drinking water, ventilation

7 . Heating protocol for underfloor heating system

according to DIN EN 1264 part 4 (heating)

Construction project.....

Part / floor / room: .....

Customer: .....

HVAC company: .....

Type of screed: .....

Manufacturer: .....

Composition floor layer .....

Screed works completed on: .....

Start of heating with constant supply temperature of 25 °C on: .....

Start of heating with max. supply temperature

from.....°C (max. 60 °C permitted) on: ..... (at earliest: 3 days after start with 25 °C)

End of heating on: .....

(at earliest: 4 days after start with max. supply temperature)

Was the heating interrupted?

from.....to.....

Was the heated floor area free? yes/no

Were the rooms ventilated in a draft-free manner? yes/no

The system was approved at an external temperature

of .....°C for further construction measures on:

.....

In doing so, the system was out of operation yes/no

In doing so, the floor was heated at a temperature of..... °C:

.....

Builder-owner/Contractor	Construction site management	Installation worker
Stamp/Signature	Stamp/Signature	Stamp/Signature

Template for pressure test

Pressure test protocol according to DIN 18380 for heating lines

Construction project:

.....

.....

.....

.....

Construction stage:

.....

.....

.....

Testing person / company:

.....

.....

.....

System height .....m

Configuration parameters Initial temperature .....°C Return flow temperature..... °C

Stat:.....(date, time) Testing pressure:..... bar (min. 5 bar, max. 6 bar

End: .....(date, time) Fall in pressure: ..... bar (max. 0.2 bar

max admissible operating pressure (referring to the lowest point of the system) ..... bars

Nominal widths used.....

The system mentioned above was heated to the design temperature on .....
and no leakages were found. There were also no leakages found after the system had cooled down.

The connections were subjected to a visual inspection: yes/no

Frost protection agent was added to the water: yes/no

Procedure explained as specified above: yes/no

Certification:

..... (Place, date).....(Stamp, signature, contractor)

..... (Place, date).....(Stamp, signature, customer)

Basics sheet / fax template

8 . Minimum required information to implement an underfloor heating design

Customer address
Company .....
Name .....
Address .....
ZIP, location .....
Telephone.....
Responsible ADM: .....
Date: .....

BUILDING-SPECIFIC INFORMATION

◊ Construction plan as printed drawing or as file (dxf, dwg, tiff,..)
◊ Thermal insulation calculation, ENEV, heating load (if applicable)
◊ New building ◊ Old building ◊ Industrial building ◊ Other
◊ Information on influential factors such as exhaust air systems, additional heating system
◊ In the construction sketch: rooms indicated with FBH
Screed type:
◊ Cement screed / Anhydrite screed ◊ Flow screed
Room flooring:
◊ Tiles.....
◊ PVC .....
◊ Parquet: .....

SYSTEM-SPECIFIC INFORMATION

Underfloor heating

supply temperature .....°C (e.g. WP 35 °C)
Tube types:
..... PE-RT 17 x 2 mm
..... PE-RT 17 x 2 mm
..... PERT / AL / PERT 16 x 2 mm
Insulation type: .....
Control type: .....
Manifold cabinet
Floating ◊ B ◊ G ◊ L
Surface ◊ B ◊ G ◊ L

Wall heating

◊ Gypsum
◊ Gypsum plasterboard
◊ Cement mortar, stone, tiles

CALCULATION PROCEDURE

◊ detailed calculation procedure (U-values of the customer/according to DIN)
◊ simplified calculation method with assumed heat requirement

If data for the calculation are missing, standard values according to DIN are used.

The design is implemented in accordance with DIN EN 1264.

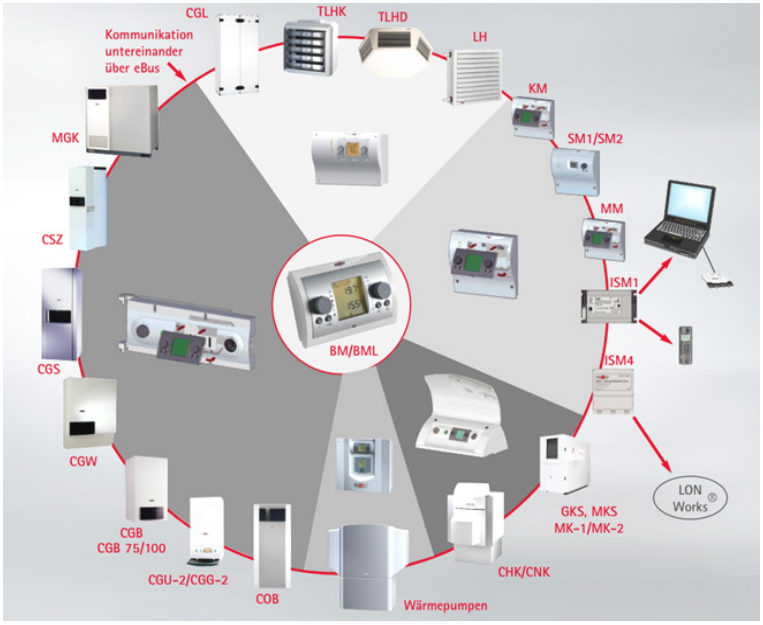
Please check as applicable and send to the following address together with the documents:

C3 PExRT GmbH & Co. KG, Silbersteinstraße 14, 97424 Schweinfurt, Tel. +49 9721/ 65 977-500, Fax: -661

9 . Design and project planning

Quick calculation to determine the weights FBH

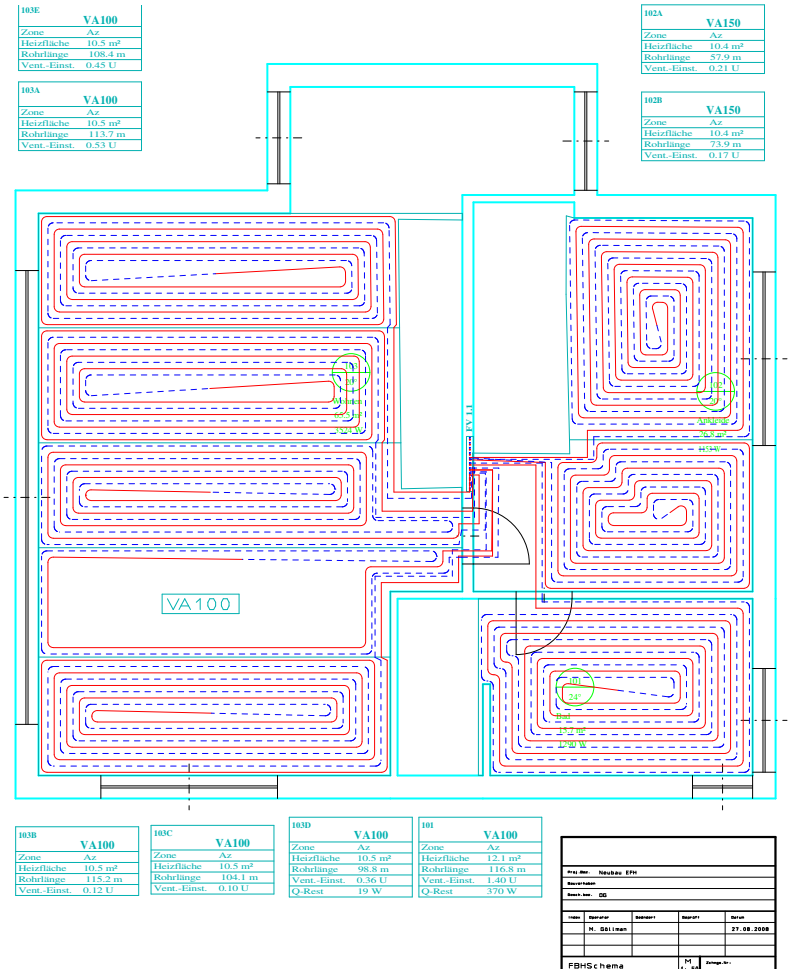
For determination of dimensions/quantities only, we offer an online calculation aid on our website.
This is activated with a password and can be used by our customers free of charge.



Project planning and design using the calculation service

Using the enclosed performance tables and diagrams you can deduct key bases with concern to the thermal calculation.

You are also invited to use our in-house calculation service.
We will design and plan the system individually for your building.
The FBH is designed according to DIN EN 1264 with indications of the dimensions, the installation clearances, the offer, as well as a graphic representation in the form of a CAD plan.
The calculation of the heating load of your building according to DIN EN 12831 forms the basis for the above.



Quality with guarantee

TÜV PRODUCT SERVICE

zertifiziert nach DIN ISO 9001

VDI 3803
VDI 6022
DIN 1946 T4
DIN / EN 1886

Gerät nach VDI 6022

CE 0085

EUROVENT CERTIFIED PERFORMANCE

▪KG TE

RLT Raumlufttechnische Geräte Herstellerverband e.V.

▪KG Top

Made in Germany WOLF Qualität Sicherheit Zukunft

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Register curt:
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VAT ID number: DE8 11132553

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Tax number: 132/116/90911

Chairman
of the supervisory board:
Alfred Gaffal

Management board:
Bernhard Steppe (Speaker)
Rudolf Meindl
Christian Amann
Gerdewan Jacobs

Commerzbank AG Ingolstadt
Deutsche Bank Ingolstadt
HypoVereinsbank Ingolstadt
Rabobank Staphorst-Rouveen

Kto. 1911825
Kto. 300041100
Kto. 4481860

BLZ 72140052
BLZ 72170007
BLZ 72120078

Swift-Code: COBADEFF721, IBAN-Nr. DE60721400520191182500
Swift-Code: DEUTDEMM721, IBAN-Nr. DE68721700703000411100
Swift-Code: HYVEDEMM426, IBAN-Nr. DE86721200780004481860
Swift-Code: RABONL2U, IBAN-Nr. NL29 RABO 0133 0579 25