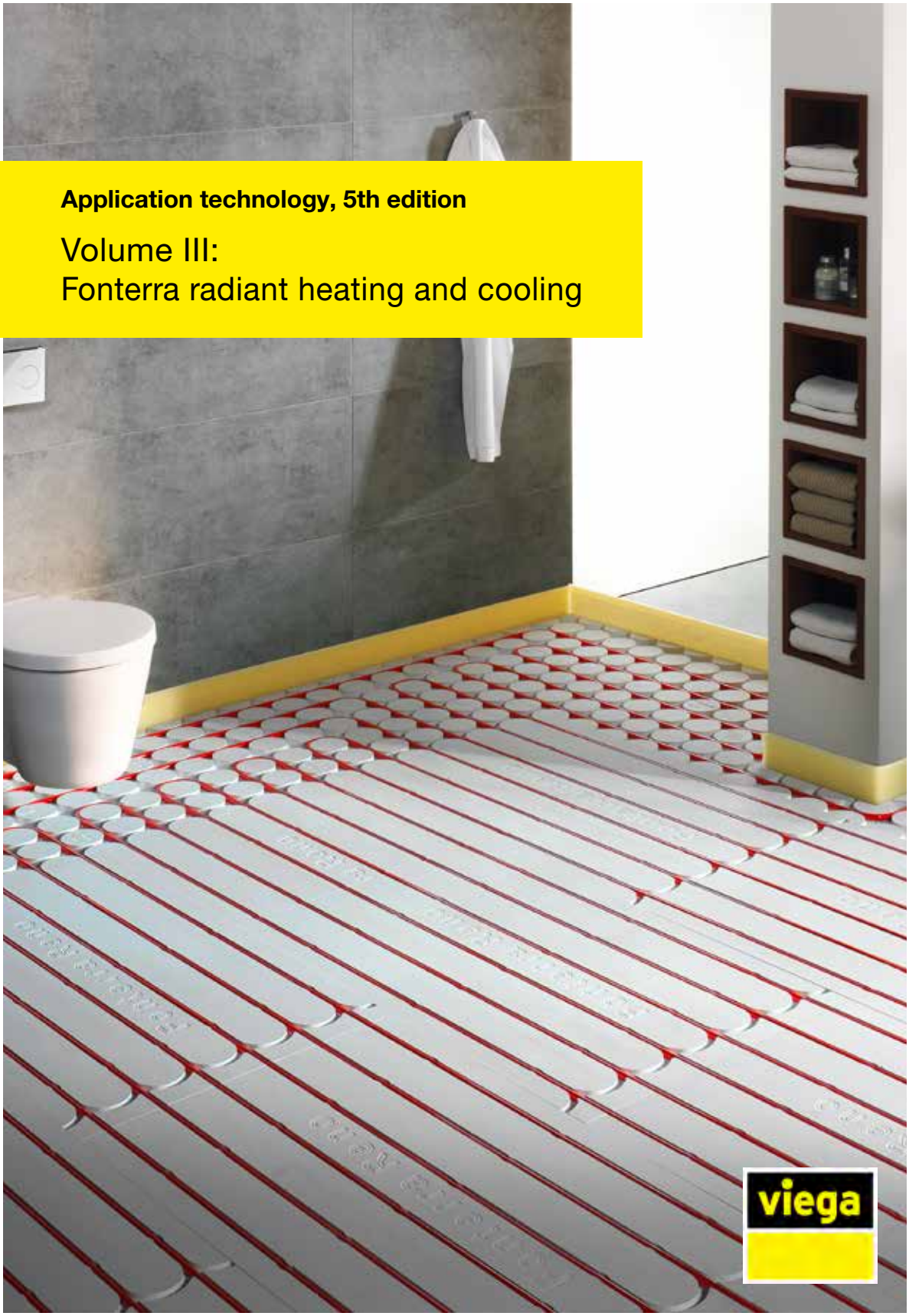
Application technology, 5th edition

Volume III:
Fonterra radiant heating and cooling



Fonterra Base

Planning

System description
Fonterra Base is the universal system for generation of an economic heating system in wet construction for surface heating systems in new building and fundamental reconstruction of old buildings. Thanks to the two different snap plate systems and the different pipe dimensions, it is easy to quickly and reliably fulfil the various requirements in the room geometry regarding full-surface covering.
Thanks to their structural design, Fonterra Base system panels provide for absolutely accurate fixing of the heating pipes, in terms of height as well as installation clearance, rectangular or diagonal.
Two system variants for different pipe dimensions cover all standard requirements in radiant heating and cooling systems.
If Fonterra Base systems are also used for cooling, a dewpoint sensor is required according to DIN EN 1264-4. The dewpoint sensor interrupts the cooling water flow before condensation or drops can form.

Fonterra Base 12/15 for pipe dimensions 12 and 15 mm:
- The diagonal installation of the pipelines is ensured by the arrangement of the holding dimples of the system panels; no additional fixing is required.

Fonterra Base 15/17 for pipe dimensions 15 and 17 mm:
- Diagonal laying of the pipelines is done by means of specifically developed wall brackets which ensure safe fixing of the pipelines according to DIN EN 1264-4.

System features

- Tested system safety
- Suitable as a wet system for cement and calcium sulphate screeds
- Easy and fast installation
- With reinforced snap plate fit for walking on
- System areas in the versions **30-2** (incl. insulation) or **ND11** (slightly insulated) and **Smart** (without insulation)

Fonterra Base 12/15

- Heating circuit length PB 12 x 1.3mm: max. 80 m
- Heating circuit length PB 15 x 1.5mm: max. 100 m

Fonterra Base 15/17

- Heating circuit length PB 15 x 1.5mm: max. 100 m
- Heating circuit length PB 16 x 2.0mm: max. 100 m
- Heating circuit length PE-Xc, PB 17 x 2.0mm: max. 120 m

Fonterra Base Example application

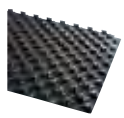
Fig. 49: Fonterra Base Example application

System components

Fonterra Base 12 / 15

Panels/pipe		
 Fonterra Base snap plate 12/15	 Fonterra Base manifold/door set 12/15	 PB pipe 12x1.3mm / 15x1.5mm
Accessories		
 Edge insulation strip	 Joint protection 12	 Expansion joint profile 10/80

Fonterra Base 15 / 17

Panels/pipe		
 Fonterra Base snap plate 15/17	 Fonterra Base manifold/door set 15/17	 PB pipe 15x1.5mm / 17x2.0mm
 PE-Xc pipe 17x2.0 mm	 Multilayer pipe 16x2.0mm	 PE-RT pipe 17x2.0 mm
Accessories		
 Edge insulation strip	 Fonterra Base wall bracket 15/17	 Protective pipe for joints 17x25
 Expansion joint profile 10/80		

System components

Name	Article number	
	Base 12/15	Base 15/17
PB pipe 12 x 1.3 mm, 120 mm	707712	—
PB pipe 12 x 1.3 mm, 240 mm	615680	—
PB pipe 12 x 1.3 mm, 650 mm	616502	—
PB pipe 15 x 1.5 mm, 240 mm	616519	
PB pipe 15 x 1.5 mm, 650 mm	616526	
PB pipe 17 x 2.0 mm, 240 mm	—	697600
PB pipe 17 x 2.0 mm, 400 mm		750022
PB pipe 17 x 2.0 mm, 650 mm	—	697617
Multi-layer pipe 16 x 2.0 mm, 240 m	—	692391
PE-Xc pipe 17 x 2.0 mm, 240 mm	—	609627
PE-Xc pipe 17 x 2.0 mm, 650 m	—	609641
PE-RT pipe 17 x 2.0 mm, 240 m	—	638313
PE-RT pipe 17 x 2.0 mm, 650 m	—	638320
Fonterra Base snap plate 30-2	664442	664473
Fonterra Base snap plates ND 11	664459	664480
Fonterra Base snap plate smart	664466	664497
Fonterra Base manifold/door set 30-2	664503	664534
Fonterra Base manifold/door set ND 11	664510	664541
Fonterra Base manifold/door set smart	664527	664558
Fonterra Base wall bracket 15/17mm	—	664565
Edge insulation strip 150/8 mm	609474	
Edge insulation strip 150/10 mm	609481	
Round profile 15 mm	609535	
Expansion joint profile	609542	
Joint protection 12	609511	—
Protective pipe for joints 12 x 18	668945	—
Protective pipe for joints 17 x 25	—	610708
Measuring point indication	569082	
Plastic dowel 75 mm	609719	
Plastic dowel 135 mm	609726	
Fixing hook	759322	
Screed additive mod. 1453	562717	
Screed additive mod. 1454	562724	
Screed additive mod. 1455	609207	

Tab. 17: System components

Tools for installation

Name	Article number	
	Base 12/15	Base 15/17
Pipe reel	562359 or 754761	
Pipe cutter for plastic pipes	652005	
Press jaw 12	616915	—
Press jaw 14/15	485559 or 439064	
Press jaw 16/17	—	351540 or 485566
Hand press tool 12	401436	—
Press machine, e.g. Pressgun Picco	735470	

Tab. 18: Tools for installation

Technical data

Technical data system panels

System panels		Fonterra Base 12/15			Fonterra Base 15/17		
		30 - 2 EPS 040 DES sg	ND 11 EPS 035 DEO 150 kPa	smart	30 - 2 EPS 040 DES sg	ND 11 EPS 035 DEO 150 kPa	smart
Dimensions (usable size)	[mm]	1320 x 880					
Panel height (incl. dimples)	[mm]	48	30	20	51	32	20
Footfall sound reduction	[dB]	28	—	—	28	—	—
Max. payload	[kN/m²]	5	45	—	5	45	—
Thermal resistivity	[K/W]	0,75	0,32	—	0,75	0,32	—
Fire protection class		B 2					
Material free of CFCs (foam and foil)		PS					
Installation raster diagonal	[cm]	7,5					
rectangular	[cm]	5,5					
Dynamic flexural stiffness	[MN/m³]	20	—	—	20	—	—

Tab. 19Technical data system panels

Technical data system pipes

System pipes		PB 12x1.3	PB 15x1.5	Multila-yer 16x2.0	PB 17x2.0	PE-Xc 17x2.0	PE-RT 17x2.0
Dimensions	[mm]	12x1.3	15x1.5	16x2.0		17x2.0	
Minimum bending radius		5 x d_a				6 x d_a	
Operating condition acc. to ISO 10508	Class/[MPa]	4/1	4-5/0.8		4/0.6		
	Class/[MPa]	5/0.8					
Operating condition acc. to ISO 21003-1	Class/[MPa]			5/1			
Operating condition acc. to ISO 15875-1	Class/[MPa]					4/1	
	Class/[MPa]					5/0.8	
Operating condition acc. to ISO 22391-1	Class/[MPa]						4/0.6
Max. operating temperature	[°C]	95		90	70	90	70
Mounting temperature	[°C]	≥ -5		≥ -15	≥ -5	> +5	
Water volume	[l/m]	0,069	0,113		0,13		
Heat conductivity λ	[W/(m·K)]	0,22		0,43	0,22	0,35	0,40
Linear coefficient of length expansion	[K^{-1}]	1.3×10^{-4}		2.3×10^{-5}	1.3×10^{-4}	2.0×10^{-4}	1.8×10^{-4}
Weight	[g/m]	50	67	105	99	102	106

Tab. 20: Technical data system pipes

Notes on dimensioning

Pipe requirement, mounting times and heating circuit lengths

Surface heating pipe	Installation clearance [cm]					
	5,5	11	16,5	22	27,5	33
Pipes required [m/m²]	17,6	8,8	5,9	4,4	3,5	2,9
Mounting time in group minutes/m² for PB pipe	5,0	5	4	3,5	2,5	2,5
Mounting time in group minutes/m² for multilayer pipe, PE-RT and PE-Xc pipe	6,0	5,5	5	4	3,5	3,5
Heating circuit length* 12 x 1.3 mm	up to 80 m**					
Heating circuit length* 16x2.0mm and 15x1.5mm	up to 100 m**					
Heating circuit length* 17x2.0mm	up to 120 m**					

Tab. 21: Pipe requirement, mounting times and heating circuit lengths Fonterra Base

* Connection lengths to the manifold must be considered.

** with 80 W/m² and Δλ = 10 K

Surface temperatures

DIN EN 1264-2 defines the maximum permissible surface temperatures with heated floor surfaces:

- 29 °C in living areas
- 35 °C in border zones
- 33 °C in bathrooms

System requirement

Material requirement Fonterra Base 12/15

System components	Available quantities/packing units	Pro-rata requirement
PB pipe 12 x 1.3 mm	120/240/650 m	depending on installation clearance
PB pipe 15 x 1.5 mm	240/650 m	depending on installation clearance
Fonterra Base snap plate 12/15 30-2	8 pieces	0.86 pc./m²
Fonterra Base snap plate 12/15 ND 11	8 pieces	0.86 pc./m²
Fonterra Base snap plate 12/15 snap plate smart without insulation	8 pieces	0.86 pc./m²
Edge insulation strip 150/8 mm for cement screed	200 m	if required 1.00 m/m²
Edge insulation strip 150/10 mm for flow and cement screeds	200 m	if required 1.00 m/m²
Measuring point indication	50 pieces	3 pc./200 m² or per apartment
Round profile 15 mm	25 m	if required
Expansion joint profile 10/80 mm	8 pieces	if required
Screed additive for heating cement screeds Model 1453.1	20 kg	0.14 kg/m²
Screed additive for heating cement-thin layer screeds d ≥ 30 mm model 1454	10 kg	1.3 kg/m²
Screed additive Temporex for quick binding Model 1455	10 kg	0.3 kg/m²

Tab. 22: Material requirement Fonterra Base 12/15

Approximate values per m² with screed acc.to DIN 18560, 45 mm pipe coverage and payload ≤ 2 kN/m²

Material requirement Fonterra Base 15/17

System components	Available quantities/ packing units	Pro-rata requirement
PB pipe 15 x 1.5 mm	240/650 m	depending on installation clearance
Multilayer pipe 16 x 2.0 mm	240 m	depending on installation clearance
PB pipe 17 x 2.0 mm	240/400/650 m	depending on installation clearance
PE-Xc pipe 17 x 2.0 mm	240/650 m	depending on installation clearance
PE-RT pipe 17 x 2.0 mm	240/650 m	depending on installation clearance
Fonterra Base snap plate 15 30-2	8 pieces	0.86 pc./m²
Fonterra Base snap plate 15 ND 11	8 pieces	0.86 pc./m²
Fonterra Base snap plate 15 smart without insulation	8 pieces	0.86 pc./m²
Fonterra Base wall bracket 15-17mm	25 pieces	depending on installation clearance
Edge insulation strip 150/8 mm for cement screed	200 m	if required 1.00 m/m²
Edge insulation strip 150/10 mm for flow and cement screeds	200 m	if required 1.00 m/m²
Measuring point indication	50 pieces	3 pc./200 m² or per apartment
Round profile 15 mm	25 m	if required
Expansion joint profile 10/80 mm	8 pieces	if required
Screed additive for heating cement screeds Model 1453.1	20 kg	0.14 kg/m²
Screed additive for heating-cement thin layer screeds d ≥ 30 mm model 1454	10 kg	1.3 kg/m²
Screed additive Temporex for quick binding Model 1455	10 kg	0.3 kg/m²

Tab. 23: Material requirement Fonterra Base 15/17
Approximate values per m² with screed acc.to DIN 18560, 45 mm pipe coverage and payload ≤ 2 kN/m²

Floor structures

Installation situations according to DIN EN 1264-4

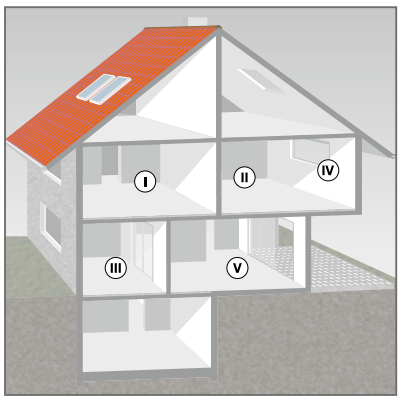


Fig. 50: Installation situations according to DIN EN 1264-4

Minimum thermal resistivities of the insulation layer

	Position	Thermal resistivity $R_{\lambda Insulation}$ [m² K / W]
I	over a heated room	0,75
II	over an unevenly heated room	1,25
III	over an unheated room	1,25
IV	against outside air *	2,0
V	against the soil **	1,25

Tab. 24: Minimum thermal resistivities of the insulation layer under the pipes of the underfloor heating or cooling system according to DIN EN 1264-4 ***

* - 5 °C > T_a ≥ -15 °C
** In case of a groundwater table ≤ 5 m, this value should be increased.
*** These requirements are valid for heating and cooling systems. For systems exclusively used for cooling, however, these are recommended values only.

The thermal resistivity of the ceiling is considered when determining the downward losses.

Structural design of the underfloor heating

To minimise heat losses to adjacent areas or to avoid noise annoyance, floor structures must be designed according to the requirements of DIN EN 1264.

The standard screed is made up of the total height "upper edge" heating pipe plus 45 mm screed thickness.
With pipe dimension 12 x 1.3 = 60 mm
With pipe dimension 15 x 1.5 = 63 mm
With pipe dimension 16 x 2.0 = 64 mm
With pipe dimension 17 x 2.0 = 65 mm

Heating screeds must be executed according to DIN 18560-2.
The nominal thicknesses of the screed must be determined according to Tables 1 to 4 of DIN 18560-2; with type A, they must additionally be increased by the external diameter of heating pipe d.
With a bending tensile strength class CT F4, the pipe coverage must be at least 45 mm, and at least 40 mm with flow screeds of the same bending tensile strength CAF-F4.

Fonterra Base

The structures shown are minimum requirements according to DIN EN 1264-4; they are represented with Fonterra Base with 45 mm pipe coverage and use of Viega screed additive for heating cement screed model 1453 plus floor covering.
A reduction of up to 15 mm is possible with cement screeds CT-F4, payload 2 kN/m² under utilisation of Viega screed additives for thin layer screed additives (model 1454).
With higher traffic loads, other tensile strength or hardness classes are required according to Tables 2 to 4 of DIN 18560, part 2. Furthermore, the quantity of the screed additive must be adjusted as specified in the instructions for use.
Alternative structures are possible if stricter requirements in the OHTC value are applicable for the structural heat insulation.

Construction heights Base

Installation situation acc. to DIN EN 1264-4	Thick system pan. $d_{Ta\ Base}$	System panel	Thickness addtl. thickn. d_{ZD} with WLG 035	Thickness addtl. thickn. d_{ZD} with WLG 040	Building waterproofing d_{BA} acc. to DIN1895
I $R_{\lambda D}$ = 0.75 m²K/W	30 mm	30-2	—	—	—
	11 mm	ND 11	20 mm	20 mm	—
	1 mm	smart	30 mm	30 mm	—
II + III + V $R_{\lambda D}$ = 1.25 m²K/W	30 mm	30-2	20 mm	20 mm	if req. *
	11 mm	ND 11	40 mm	40 mm	if req. *
	1 mm	smart	50 mm	50 mm	if req. *
IV $R_{\lambda D}$ = 2.00 m²K/W	30 mm	30-2	50 mm	50 mm	—
	11 mm	ND 11	60 mm	70 mm	—
	1 mm	smart	70 mm	80 mm	—

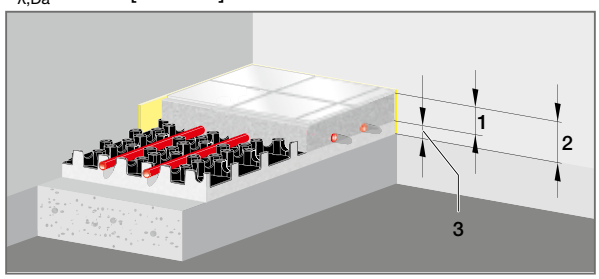
Tab. 25: Construction heights Base

* as required

Installation situation I according to DIN EN 1264-4

over a heated room

$R_{\lambda,Dä}$ = 0.75 [m²K/W]



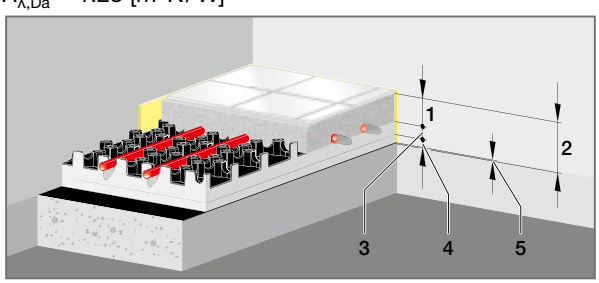
Installation situation I according to DIN EN 1264-4

Fig. 51: Installation situation I according to DIN EN 1264-4

Installation situation II + III + V according to DIN EN 1264-4

over an unevenly heated room,
over an unheated room, and against soil

$R_{\lambda,Dä}$ = 1.25 [m²K/W]



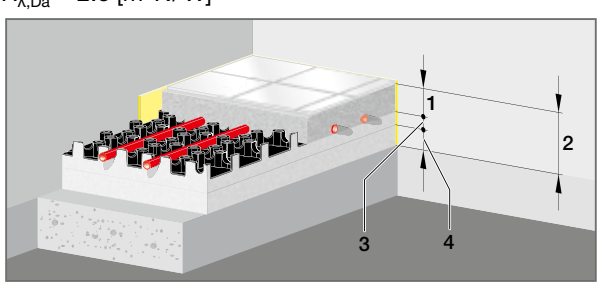
Installation situation II + III + V according to DIN EN 1264-4

Fig. 52: Installation situation II + III + V according to DIN EN 1264-4

Installation situation IV according to DIN EN 1264-4

against outside air

$R_{\lambda,Dä}$ = 2.0 [m²K/W]



Installation situation IV according to DIN EN 1264-4

Fig. 53: Installation situation IV according to DIN EN 1264-4

Key (Fig. 51 – Fig. 53)

① 45 mm + 3 mm + external diameter pipe
② Total height
③ System panel
④ Additional insulation
⑤ Building waterproofing

Output data Fonterra Base 12

Supply temperature	Room temperature δ_i [°C]	Floor covering $R_{\lambda,B}$ = 5)		Heat flow density [W/m²]	35	40	45	50	55	60	65	70	75	80	85	90	95	100
				Mean floor surface temperature RT 20 °C [1] [°C]		24		25		26		27		28			29	
				Mean floor surface temperature RT 24 °C [2]		28		29		30		31		32			33	
35 °C	20	0.02	IC [3]		27.5	22		16.5		11			5.5					
			max. IA [4]		18.5	15.7	12.9	11.9	9.1	8.9	7.3	5.8	4.6	4.4	3.4			
		0.05	IC [3]		22		16.5		11		5.5							
			max. IA [4]		16.8	12.8	11.4	9.1	7.9	5.4	4.6	3.8						
		0.10	IC [3]		16.5		11		5.5									
			max. IA [4]		13.6	9.1	8.0	4.6	4.1									
		0.15	IC [3]		11		5.5											
			max. IA [4]		9.1	6.5	4.5											
	24	0.02	IC [3]		16.5		11		5.5									
			max. IA [4]		13.3	9.1	8.5	6.2	4.6	4.1								
40 °C	20	0.02	IC [3]				33		27.5	22		16.5			11			5.5
			max. IA [4]				17.8	12.6	13.3	13.3	10.5	10.9	9.1	6.9	7.9	6.5	5.1	4.6
		0.05	IC [3]			33		27.5		22		16.5		11			5.5	
			max. IA [4]			18.9	17.1	12.6	12.3	11.8	9.3	9.1	7.4	5.6	4.6	4.6	3.5	
		0.10	IC [3]		33	27.5	22		16.5		11		5.5					
			max. IA [4]		19.9	16.5	14.2	12.4	8.9	8.2	5.5	4.6	3.6					
		0.15	IC [3]		22	16.5		11		5.5								
			max. IA [4]		17.4	13.6	9.1	9.0	4.6	4.6								
	24	0.02	IC [3]		33	27.5	22		16.5			11			55			
			max. IA [4]		18.5	16.3	14.9	13.5	11.1	8.7	6.1	7.1	5.3	4.6	4.6	3.4		
45 °C	20	0.02	IC [3]							33		27.5		22			16.5	
			max. IA [4]							14.9	10.4	12.5	9.1	11.1	8.6	6.6	8.6	6.9
		0.05	IC [3]					33		27.5		22		16.5			11	
			max. IA [4]					18.5	14.4	14.5	10.6	12.5	8.6	9.9	7.7	5.3	7.1	5.7
		0.10	IC [3]				33	27.5	22		16.5		11		5.5			
			max. IA [4]				18.2	16.7	14.4	11.4	10.9	8.3	8.3	6.2	4.6	4.6	3.2	
		0.15	IC [3]			33	27.5	22	16.5	11		5.5						
			max. IA [4]			19.2	16.1	13.5	11.5	9.1	7.8	4.6	4.6					
	24	0.02	IC [3]					33	27.5		22		16.5			11		
			max. IA [4]					15.0	14.2	11.4	12.2	9.4	10.3	8.4	6.4	7.7	6.4	5.0
50 °C	20	0.02	IC [3]										33		27.5			22
			max. IA [4]										13.0	8.8	12.0	9.2	5.9	9.7
		0.05	IC [3]								33		27.5			22		16.5
			max. IA [4]								15.1	10.9	12.9	9.3	5.2	8.8	6.0	8.6
		0.10	IC [3]							33	27.5	22		16.5			11	
			max. IA [4]							12.6	12.9	12.2	9.6	10.2	7.8	4.9	6.7	4.6
		0.15	IC [3]					33	27.5	22		16.5		11		5.5		
			max. IA [4]					17.1	15.1	13.1	9.8	9.9	6.4	6.9	3.3	4.6	3.0	
	24	0.02	IC [3]								33		27.5			22		16.5
			max. IA [4]								12.8	8.1	11.3	7.8	10.5	7.9	5.3	8.2

Tab. 26: Output data Fonterra Base 12

105	110	115	120	125	130	135	140	145	150	155	160	165
	30		31		32			33		34		35
5.5												
4.6	4.0	3.2										
16.5	11				5.5							
4.9	7.0	6.0	4.8	3.5	4.6	4.4	3.7	3.0				
	5.5											
3.9	4.6	4.3	3.3									
5.5												
4.6	4.6	4.1	3.3									
22		16.5				11					5.5	
7.5	5.1	8.4	7.0	5.4	3.6	6.6	5.7	4.7	3.5	3.3	4.6	4.1
16.5		11				5.5						
6.7	4.6	6.9	5.6	4.2	2.6	4.6	4.0	3.1	2.2			
5.5												
4.6	4.3	3.0										
16.5		11				5.5						
6.6	4.7	7.1	6.0	4.8	3.5	4.6	4.5	3.8	2.9			

Key for the output data Base

[1] RT 20 °C	Room temperature = 20 °C (living rooms)
[2] RT 24 °C	Room temperature = 24 °C (bathrooms)
[3] IC	Installation clearance [cm]
[4] max. IA [m²]	max. installation area [m²]
[5] Floor covering	Thermal resistivity of floor covering $R_{\lambda,B}$ = 0.02 m² K/W: with tiles 5 mm $R_{\lambda,B}$ = 0.05 m² K/W: with parquet 10 mm $R_{\lambda,B}$ = 0.10 m² K/W: with carpet 7 mm $R_{\lambda,B}$ = 0.15 m² K/W: with thick carpet

Tab. 27: Key for the output data Base with PB pipe 12 x 1.3mm

Reading example Base

Supply temperature	40 °C
Room temperature	20 °C
Floor covering	$R_{\lambda,B}$ = 0.1 m² K/W
Floor heating area	16 m²
Heat flow density	60 W/m²
mean floor surface temperature	26 °C
recommended installation clearance	IC 11
Max. heating circuit area	8.2 m²
16.0 m² must be covered; therefore	**2 heating circuits**

Tab. 28: Reading example Fonterra Base with PB pipe 12 x 1.3 mm

Pressure loss diagram PB pipe 12 x 1.3 mm

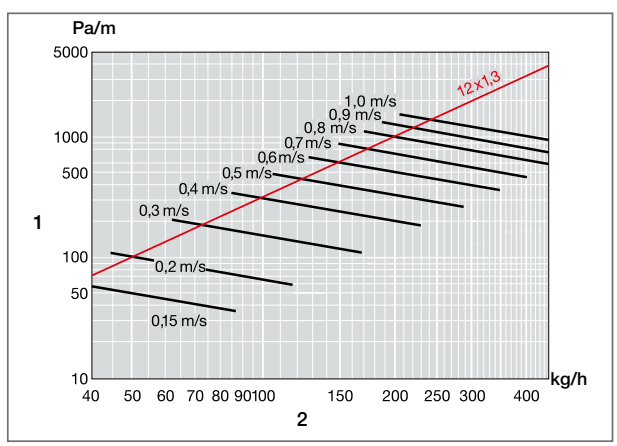


Fig. 54: Pressure loss diagram PB pipe 12 x 1.3 mm

Key
① Pressure gradient R [Pa/m]
② Mass flow m [kg/h] (fluid: water)

Output diagrams Base with PB pipe 12 x 1.3 mm

Heating pipe PB 12, cement screed 45 mm pipe coverage

$R_{\lambda,B}$ = 0.02 m² K/W

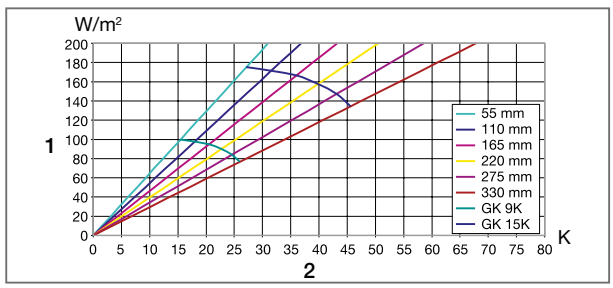


Fig. 55: $R_{\lambda,B}$ = 0.02 m² K/W

$R_{\lambda,B}$ = 0.05 m² K/W

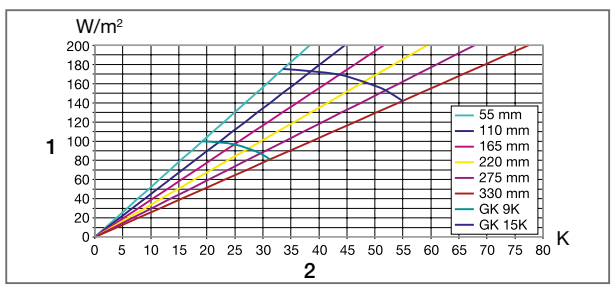


Fig. 56: Rλ,B = 0.05 m² K/W

$R_{\lambda,B}$ = 0.10 m² K/W

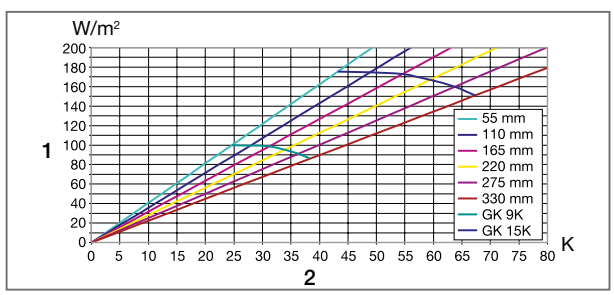


Fig. 57: $R_{\lambda,B}$ = 0.10 m² K/W

$R_{\lambda,B}$ = 0.15 m² K/W

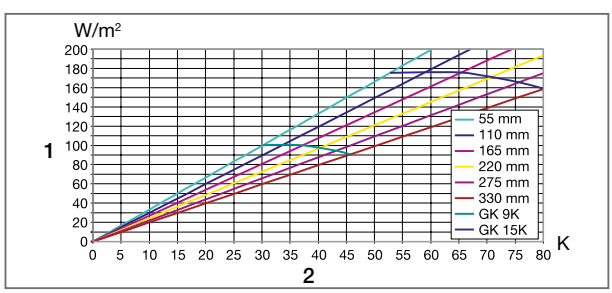


Fig. 58: $R_{\lambda,B}$ = 0.15 m² K/W

Key

① Heat flow density [W/m2]

② Overtemperature of fluid [K]

Output data Fonterra Base 15

Supply temperature	Room temperature δ_i [°C]	Floor covering $R_{\lambda,B}$ = 5)	Heat flow density [W/m²]	35	40	45	50	55	60	65	70	75	80	85	90	95	100
			Mean floor surface temperature RT 20 °C 1) [°C]	24			25		26		27		28			29	
			RT 24 °C 2) [°C]	28			29		30		31		32			33	
35 °C	20	0.02	IC 3)	27.5	22		16.5			11			5.5				
			max. IA 4)	28.6	22.7	20.2	17.0	14.6	11.0	11.4	8.6	5.7	5.7	5.2			
		0.05	IC 3)	22	16.5		11			5.5							
			max. IA 4)	22.7	17.0	17.0	11.4	11.4	8.7	5.7	5.7						
		0.10	IC 3)	16.5	11		5.5										
			max. IA 4)	17.0	11.4	11.4	5.7	5.7									
		0.15	IC 3)	11	5.5												
			max. IA 4)	11.4	5.7	5.7											
	24	0.02	IC 3)	16.5	11		5.5										
			max. IA 4)	17.0	17.0	11.4	5.7	5.7	5.7								
40 °C	20	0.02	IC 3)			33		27.5		22		16.5			11		
			max. IA 4)			27.7	20.7	21.0	15.2	16.8	12.5	14.2	11.2	7.9	10.3	8.3	6.0
		0.05	IC 3)		33	27.5		22		16.5		11		5.5			
			max. IA 4)		29.3	25.6	20.3	19.5	17.0	14.7	10.8	11.4	9.0	5.7	5.7	5.4	
		0.10	IC 3)	33	27.5	22	16.5		11		5.5						
			max. IA 4)	30.6	25.5	21.7	17.0	14.3	11.4	9.0	5.7	5.6					
		0.15	IC 3)	22	16.5	11		5.5									
			max. IA 4)	22.7	17.0	11.4	11.4	5.7	5.7								
	24	0.02	IC 3)	33	27.5	22		16.5		11		5.5					
			max. IA 4)	28.4	25.0	22.6	17.9	17.0	13.8	10.0	10.9	8.4	5.7	5.7	5.4		
45 °C	20	0.02	IC 3)							33		27.5		22		16.5	
			max. IA 4)						23.7	18.3	11.2	15.8	10.6	14.6	10.9	13.9	11.5
		0.05	IC 3)					33		27.5	22		16.5			11	
			max. IA 4)					23.7	16.1	17.8	18.7	14.6	15.6	12.8	9.5	11.3	9.2
		0.10	IC 3)			33		27.5	22		16.5		11		5.5		
			max. IA 4)			26.8	21.0	19.5	18.6	12.8	13.4	8.8	10.1	6.5	5.7	5.1	
		0.15	IC 3)		33	27.5	22		16.5	11		5.5					
			max. IA 4)		28.3	25.2	22.0	17.0	13.8	11.4	5.7	5.7					
	24	0.02	IC 3)				33		27.5		22		16.5			11	
			max. IA 4)				23.8	22.7	18.5	19.1	15.3	16.1	13.4	10.6	11.4	10.1	8.1
50 °C	20	0.02	IC 3)										33			27.5	
			max. IA 4)									20.9	16.0	9.8	16.0	11.7	6.5
		0.05	IC 3)								33		27.5			22	16.5
			max. IA 4)								19.0	19.2	16.3	10.7	14.8	10.8	13.6
		0.10	IC 3)						33		27.5	22		16.5		11	
			max. IA 4)						21.4	20.8	14.7	16.2	15.3	12.9	8.9	10.7	7.8
		0.15	IC 3)					33		27.5	22		16.5		11		5.5
			max. IA 4)					25.0	18.4	17.0	16.4	15.6	10.9	11.0	7.2	5.7	4.8
	24	0.02	IC 3)								33		27.5			22	16.5
			max. IA 4)								21.0	14.8	18.3	12.7	16.6	13.5	9.9	13.3

Tab. 29: Output data Fonterra Base 15

105	110	115	120	125	130	135	140	145	150	155	160	165
	30		31		32			33		34		35
5.5												
5.7	5.7	4.9										
16.5		11			5.5							
8.8	5.9	9.6	8.0	6.0	5.7	5.7	5.7	4.8	3.6			
11	5.5											
6.8	5.7	5.7	5.2									
5.5												
5.7	5.7	5.7	5.1									
22			16.5				11				5.5	
13.1	9.9	6.3	11.7	9.4	7.1	4.3	9.2	7.7	6.1	4.4	5.7	5.7
16.5			11				5.5					
11.3	8.2	11.0	9.3	7.2	5.0	5.7	5.7	5.0	3.5			
5.5												
5.7	5.7	4.8										
16.5			11				5.5					
10.9	8.3	5.5	9.5	7.8	6.0	4.1	5.7	5.7	4.9	3.6		

Key for the output data Base

[1] RT 20 °C	Room temperature = 20 °C (living rooms)
[2] RT 24 °C	Room temperature = 24 °C (bathrooms)
[3] IC	Installation clearance [cm]
[4] max. IA [m²]	max. installation area [m²]
[5] Floor covering	Thermal resistivity of floor covering $R_{\lambda,B}$ = 0.02 m² K/W: with tiles 5 mm $R_{\lambda,B}$ = 0.05 m² K/W: with parquet 10 mm $R_{\lambda,B}$ = 0.10 m² K/W: with carpet 7 mm $R_{\lambda,B}$ = 0.15 m² K/W: with thick carpet

Tab. 30: Key for the output data Base with PB pipe 15 x 1.5mm

Reading example Base

Supply temperature	40 °C
Room temperature	20 °C
Floor covering	$R_{\lambda,B}$ = 0.1 m² K/W
Floor heating area	16 m²
Heat flow density	50 W/m²
Mean floor surface temperature	25 °C
Recommended installation clearance	IC 16.5
Max. heating circuit area	17 m²
16.0 m² must be covered; therefore	**1 heating circuit**

Tab. 31: Reading example Base with PB pipe 15 x 1.5 mm

Pressure loss diagram PB pipe 15 x 1.5 mm

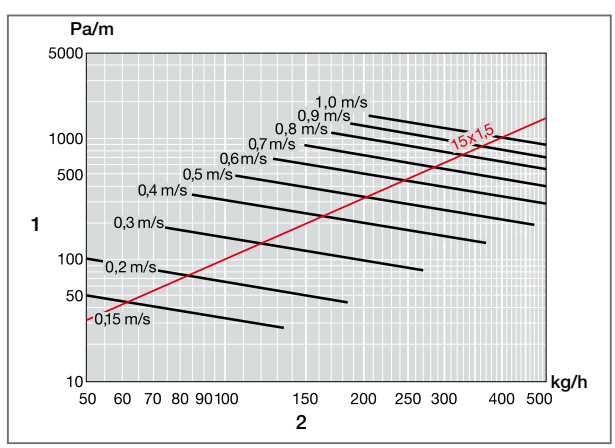


Fig. 59: Pressure loss diagram PB pipe 15 x 1.5 mm

Key
① Pressure gradient R [Pa/m] ② Mass flow m [kg/h] (fluid: water)

Output diagrams Base with PB pipe 15 x 1.5 mm

Heating pipe PB pipe 15, cement screed 45 mm pipe coverage

$R_{\lambda,B}$ = 0.02 m² K/W

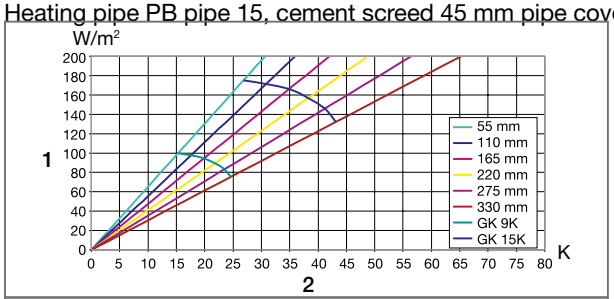


Fig. 60: $R_{\lambda,B}$ = 0.02 m² K/W

$R_{\lambda,B}$ = 0.05 m² K/W

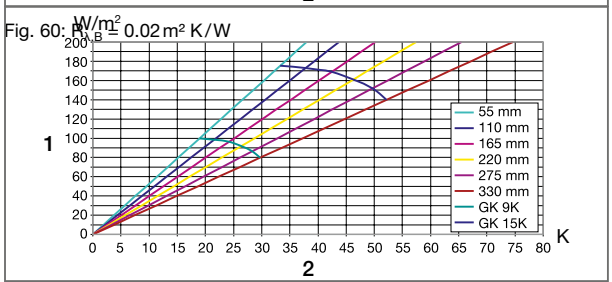


Fig. 61: $R_{\lambda,B}$ = 0.05 m² K/W

$R_{\lambda,B}$ = 0.10 m² K/W

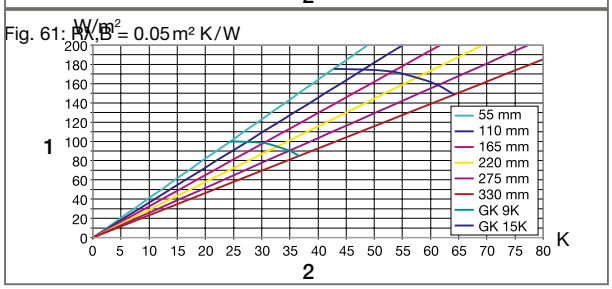


Fig. 62: $R_{\lambda,B}$ = 0.10 m² K/W

$R_{\lambda,B}$ = 0.15 m² K/W

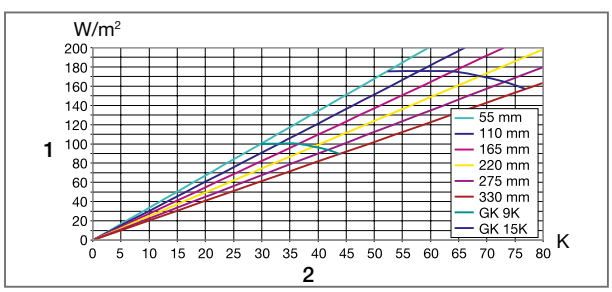


Fig. 63: $R_{\lambda,B}$ = 0.15 m² K/W

Key

① Heat flow density [W/m2]

② Overtemperature of fluid [K]

Output data Fonterra Base 17

Supply temperature	Room temperature δ_i [°C]	Floor covering $R_{\lambda,B} = 5$)	Heat flow density [W/m²]	35	40	45	50	55	60	65	70	75	80	85	90	95	100
	Mean floor surface temperature RT 20 °C 1) [°C]			24			25		26		27		28			29	
	RT 24 °C 2) [°C]			28			29		30		31		32			33	
35 °C	20	0.02	IC 3)	27.5		22		16.5		11		5.5					
			max. IA 4)	33.8	26.2	23.8	20.3	17.5	13.3	13.2	10.5	6.8	6.8	6.2			
		0.05	IC 3)	22		16.5		11		5.5							
			max. IA 4)	27.3	20.3	20.3	13.6	13.6	10.5	6.8	6.8						
		0.10	IC 3)	16.5		11		5.5									
			max. IA 4)	20.3	13.6	13.6	6.8	6.8									
		0.15	IC 3)		11		5.5										
			max. IA 4)	13.6	13.6	13.6	6.8										
	24	0.02	IC 3)	16.5		11		5.5									
			max. IA 4)	20.3	13.6	13.6	10.8	6.8	6.8								
40 °C	20	0.02	IC 3)				33		27.5		22		16.5			11	
			max. IA 4)			31.1	24.1	24.9	18.8	20.1	15.3	16.9	13.7	10.1	12.2	9.9	7.4
		0.05	IC 3)			33		27.5	22		16.5		11			5.5	
			max. IA 4)		32.9	25.7	24.4	23.1	20.3	17.6	13.3	13.6	10.7	7.5	6.8	6.4	
		0.10	IC 3)	33	27.5	22		16.5		11		5.5					
			max. IA 4)	35.0	30.3	26.0	20.3	16.9	10.7	10.7	6.8	6.7					
		0.15	IC 3)	27.5	22	16.5	11	5.5									
			max. IA 4)	31.4	25.2	20.3	13.6	6.8	6.8								
	24	0.02	IC 3)	33	27.5	22		16.5		11		5.5					
			max. IA 4)	33.3	29.7	26.5	21.4	20.1	16.0	12.3	12.8	10.1	6.8	6.8	6.4		
45 °C	20	0.02	IC 3)						33			27.5		22			16.5
			max. IA 4)						26.4	22.5	15.5	19.3	13.8	17.6	13.9	9.5	13.9
		0.05	IC 3)					33		27.5		22		16.5			11
			max. IA 4)					28.0	20.3	21.9	15.3	17.7	12.8	15.3	11.8	7.5	11.0
		0.10	IC 3)			33		27.5	22		16.5		11		5.5		
			max. IA 4)			30.1	25.1	23.5	22.2	15.9	16.2	11.1	11.9	8.1	6.8	6.2	
		0.15	IC 3)		33	27.5	22	16.5		11		5.5					
			max. IA 4)		31.8	28.3	24.8	20.3	16.3	13.6	6.8	6.8	5.1				
	24	0.02	IC 3)				33		27.5		22		16.5			11	
			max. IA 4)				28.5	21.1	22.4	16.3	18.5	14.0	15.9	12.8	9.5	11.9	9.8
50 °C	20	0.02	IC 3)										33		27.5		
			max. IA 4)										20.4	13.9	19.8	15.0	10.0
		0.05	IC 3)								33		27.5		22		
			max. IA 4)								23.5	15.8	20.0	14.4	18.1	13.9	9.3
		0.10	IC 3)						33		27.5	22		16.5		11	
			max. IA 4)						26.0	16.5	18.3	19.4	13.9	15.5	11.2	12.7	9.6
		0.15	IC 3)				33		27.5	22		16.5		11		5.5	
			max. IA 4)				28.1	22.9	21.0	20.0	18.7	13.3	13.2	8.8	6.8	5.8	
	24	0.02	IC 3)								33		27.5		22		
			max. IA 4)							25.3	19.0	11.3	17.2	11.8	16.4	12.6	8.3

Tab. 32: Output data Fonterra Base 17

105	110	115	120	125	130	135	140	145	150	155	160	165
	30		31		32			33		34		35
5.5												
6.8	6.8	5.8										
16.5		11				5.5						
11.1	7.9	11.5	9.6	7.5	5.3	6.8	6.8	5.6	4.2			
11	5.5											
8.3	6.8	6.8	6.2	4.3								
11	5.5											
7.4	6.8	6.8	6.0	4.5								
22			16.5				11				5.5	
16.1	12.7	8.9	14.1	11.7	9.0	6.2	11.0	9.4	7.6	5.7	6.8	6.8
16.5			11			5.5						
13.7	10.5	7.0	11.0	8.9	6.3	6.8	6.8	5.9	4.3			
5.5												
6.8	6.8	5.8										
16.5			11				5.5					
13.1	10.5	7.4	11.3	9.4	7.5	5.3	6.8	6.8	5.8	4.5		

Key for the output data Base

[1] RT 20 °C	Room temperature = 20 °C (living rooms)
[2] RT 24 °C	Room temperature = 24 °C (bathrooms)
[3] IC	Installation clearance [cm]
[4] max. IA [m²]	max. installation area [m²]
[5] Floor covering	Thermal resistivity of floor covering $R_{\lambda,B}$ = 0.02 m² K/W: with tiles 5 mm $R_{\lambda,B}$ = 0.05 m² K/W: with parquet 10 mm $R_{\lambda,B}$ = 0.10 m² K/W: with carpet 7 mm $R_{\lambda,B}$ = 0.15 m² K/W: with thick carpet

Tab. 33: Key for the output data Base with PB-PB pipe, PE-Xc and PE-RT pipe 17 x 2.0 mm

Reading example Base

Supply temperature	40 °C
Room temperature	20 °C
Floor covering	$R_{\lambda,B}$ = 0.05 m² K/W
Floor heating area	18 m²
Heat flow density	60 W/m²
Mean floor surface temperature	26 °C
Recommended installation clearance	IC 16.5
Max. heating circuit area	20.3 m²
18.0 m² must be covered; accordingly	**1 heating circuit**

Tab. 34: Reading example Base with PB-PB pipe, PE-Xc and PE-RT pipe 17 x 2.0 mm

Pressure loss diagram PB, PE-Xc and PE-RT pipe 17 x 2.0 mm

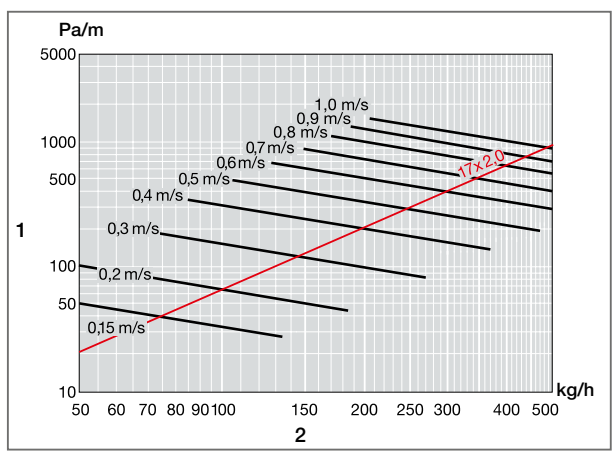


Fig. 64: Pressure loss diagram PB-PB pipe, PE-Xc and PE-RT 17 x 2.0 mm

Key
① Pressure gradient R [Pa/m] ② Mass flow m [kg/h] (fluid: water)

Output diagrams Base with PB, PE-Xc and PE-RT pipe 17 x 2.0 mm

Heating pipe PE-Xc 17, cement screed 45 mm pipe coverage

$R_{\lambda,B}$ = 0.02 m² K/W

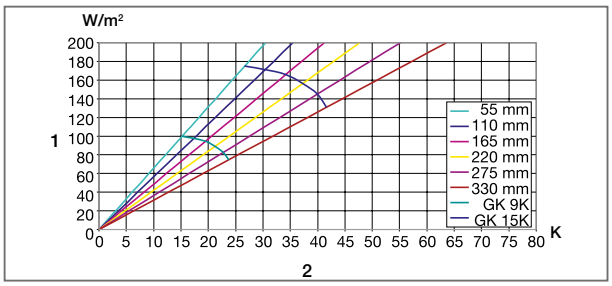


Fig. 65: $R_{\lambda,B}$ = 0.02 m² K/W

$R_{\lambda,B}$ = 0.05 m² K/W

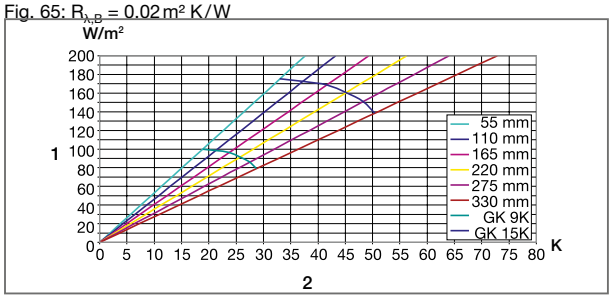


Fig. 66: $R_{\lambda,B}$ = 0.05 m² K/W

$R_{\lambda,B}$ = 0.10 m² K/W

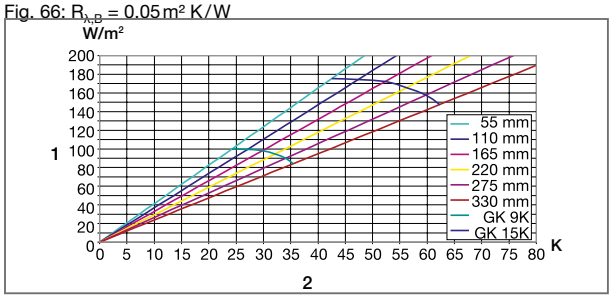


Fig. 67: $R_{\lambda,B}$ = 0.10 m² K/W

$R_{\lambda,B}$ = 0.15 m² K/W

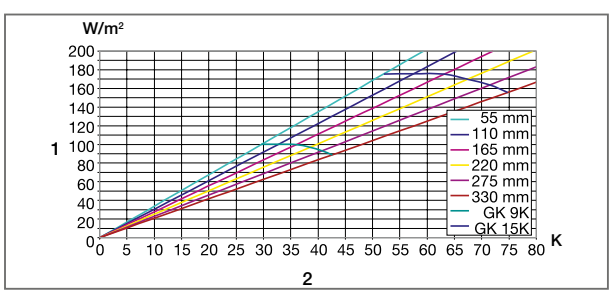


Fig. 68: Rλ,B = 0.15 m² K/W

Key

① Heat flow density [W/m2]

② Overtemperature of fluid [K]

Mounting

Structural requirements

Installation of a surface heating system

- Laws, directives, and statutory regulations are not only applicable for new buildings but also for structural changes of a certain magnitude to existing buildings. For all of Germany, they are defined in a Model Building Regulation, or in the building regulations of the respective Federal State.
- Any concerns must be raised immediately. Do not start any work before all defects have been remedied.
- Plastering work must be completed, and the wall plaster must be applied up to the raw concrete floor.
- When planning the heating circuits, coordinate the heating circuits and the screed fields. Diagonal crossing of movement joints in the substrate by heating pipes is not permitted.
- Windows and external doors must be installed.
- By means of the setting out point specified for constructional purposes, check for each storey that the required construction height is available everywhere.
- To receive the floating heating screed, the underground must be sufficiently dry and have a level surface. It must be free of raised points, pipelines etc. which may result in differences in the screed thickness. The tolerances of the elevation and the inclination of the load-bearing underground must be executed according to DIN 18202, Table 3 line 2a "Measuring tolerances in buildings". Compensation must be provided to level out the surface for reception of the insulation layer, but at least the footfall sound insulation as minimum requirement. The respective construction height must be considered in the plan. Filling materials may be used for the compensation layer if the manufacturer proves the suitability for this purpose. When applying a compensation layer, manufacturer's instructions regarding priming or bonding coat and the additional weight load must be taken into consideration.
- In accordance with DIN 18560 part 2, "Waterproofing against soil moisture" and "non-pressing water" must be specified by the building planner and provided before applying the screed (see DIN 18195-4 and DIN 18195-5).
- It is imperative that polystyrene heat and footfall sound insulation is protected with a PE foil against building waterproofing containing bitumen.
- The planner must specify whether a diffusion-resistant foil must additionally be installed below the surface heating as a precaution against any subsequent building defects from residual moisture.

Storage

Before installation, Fonterra system panels should be stored laying flat on a clean, dry, and frost proof underground.
Wait until immediately before mounting the panels before you remove the packaging.

Cleaning the underground

On take-over of the construction site before the start of the installation of the underfloor heating, the site must be swept clean. Check for cleanliness, setting out point, and levelness tolerances.
Afterwards, you can start to install the Fonterra underfloor heating system. As a first step, set up the edge insulation strip or, if applicable, install the additional insulation.

Installation of a surface heating system

- If applicable, install additional heat insulation (note the information on heat insulation and additional insulation layers).
- The entire surface is free of joints and hollow spaces.
- Mask any open spaces existing for object-specific reasons.
- Attach edge insulation strips continuously along all the enclosing walls and fittings such as door frames, pillars etc.
  Gaps cause noise bridges and may result in cracking of screed and floor covering.
- Thanks to the overlapping of the system panels, the installed layer is completely closed and suitable for cement screed application once the pipes for the underfloor heating have been laid.
- When using flow screeds, tightly seal the edge joint by gluing the edge insulation strip to the system panel.
- When using calcium sulphate flow screeds, prepare the edge joints with special care. Use the 10 mm edge insulation strip (model 1270.1) and tightly glue it to the system surface.
- Do not trim off any protruding edge insulation strips before you have filled the joints or completed the floor covering (special service acc. to VOB (Construction Tendering and Contract Regulations) part C, or DIN 18299).
- Observe the Viega mounting instructions.

When installing a surface heating system, pipe clearances to vertical building parts must be observed according to DIN 1264-4: 50 mm with vertical building parts, and 200 mm with chimneys and shafts.

Edge insulation strip

Before installing the Fonterra surface heating, determine whether cement or calcium sulphate flow screed will be used.
Besides accommodating the heat-induced length expansion, the edge insulation strip improves the footfall noise insulation properties of the floating screed and reduces losses due to heat/cold bridges to adjacent building parts.

When using cement screeds according to DIN 18560, the Fonterra edge insulation strip model 1270 or model 1270.1 can be used. When using calcium sulphate flow screed, the edge insulation strip (model 1270.1) must be used. Set up the edge insulation strip on the insulation, fix it, and place the foil tension-free on the system element.
Sticking the foil piece tension-free onto the system panel prevents the formation of hollow spaces and guarantees proper sealing of edge joints. Fonterra underfloor heating systems are designed to be suitable for both screed types. With heating screeds, the edge insulation strips must allow for at least 5 mm of movement. Corresponding edge strips (edge joints) must be installed at the walls and other upright building elements, such as door frames. Here, the adhesive film of the edge insulation strip must be at screed level; it must not be above the finished screed. Apply the screed first at the edges of the edge insulation strip, then proceed to the middle.

When fixing the edge insulation strip, take care not to produce any noise bridges.

Connection to the manifold

To provide for unobstructed routing of the pipes in the manifold area, manifolds should be installed in a very central position. According to DIN EN 1264-4, the heating and cooling circuit manifolds must be arranged in such a way that the supply pipes are as short as possible. Otherwise, the supply pipes may have a negative effect on the regulation of the room temperature. Because a number of collection and connection lines converge upstream of the manifolds and also dissipate heat, it may be necessary to wrap them in suitable insulation materials to prevent overheating of the top layer according to DIN EN 1264-2.

Additional insulation layers

The heat insulation to be installed is defined in the EnEV, DIN 4108 and DIN EN 1264.
These minimum requirements must be met. If additional insulation layers are required, they must be laid staggered and closely abutting under the Fonterra system areas. Additional insulation material must comply with the general considerations of DIN 13162 - 13171, must be tested and marked.
For heating screeds, the compressibility of the insulation layer must not exceed 5 mm depending on the payload.

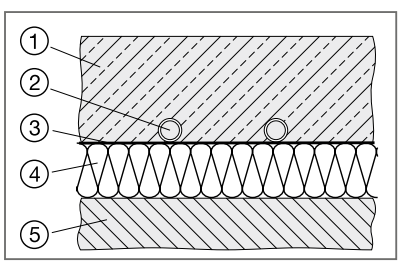
Comply with the following installation instructions:
When installing multi-layer insulation, attach the edge insulation strip only before you are ready to install the footfall sound insulation layer.
"If the surface of the floating screed is in an incline, a similar incline must already be provided in the load-bearing underground to ensure that you can apply the screed in the same thickness."

The footfall sound insulation must not be weakened or reduced.
If pipelines are laid on the load-bearing underground, they must be fastened and be protected from changing temperatures according to DIN 1264-4 and in compliance with the national regulations. Compensation must be provided to level out the surface for reception of the insulation layer, but at least the footfall sound insulation as minimum requirement. The respective construction height must be considered in the plan.

Screeds and screed additives
Floating screeds must meet the general requirements defined in DIN EN 13813 and DIN 18560-1.

DIN 18560 differentiates between three building types.
Fonterra Base is building type A.

Building type A



Systems with pipes within the screed

Fig. 69: Systems with pipes within the screed

Key
① Screed
② Heating element
③ Cover
④ Insulation layer
⑤ Load-bearing underground

Special design with waterproofing against surface water
In wet rooms such as bathrooms and showers or in swimming pools, there is surface water or splashing water. The only protection is waterproofing above the load distribution layer which prevents penetration of moisture into the building structure by means of a coat of sealing paint or a waterproofing system.

With hot water underfloor heating system, the mean temperature in the calcium sulphate and cement screed in the area of the heating elements must not permanently exceed 55 °C.
According to DIN 18560, the building type and required payload define the thickness, stability and hardness of the required screed.
The bending tensile strength class of calcium sulphate and cement heating screed must be in accordance with tables 1 to 4, depending on the respective payloads. Select the nominal thickness of the screed according to tables 1 to 4; with building type A, additionally increase it by the external diameter of the heating pipe. With a bending tensile strength class CT F4, the pipe coverage must at least comply with the nominal thickness of 45 mm, and at least with the nominal thickness of 40 mm with flow screeds of the same bending tensile strength CAF-F4.

Overview nominal screed thickness acc. to DIN 18560-2

Payload	Single load	c	Nominal thickness	
			CAF-F4	CT-F4
≤ 2 kN/m²		≤ 5 mm	35 + d	45 + d
≤ 3 kN/m²	≤ 2 kN	≤ 5 mm	50 + d	65 + d
≤ 4 kN/m²	≤ 3 kN	≤ 3 mm	60 + d	70 + d
≤ 5 kN/m²	≤ 4 kN	≤ 3 mm	65 + d	75 + d

Tab. 35: Overview nominal screed thickness acc. to DIN 18560-2

CT-F4 Cement screed, bending tensile strength F4
CAF-F4 Calcium sulphate flow screed, bending tensile strength F4
c max. permissible compressibility of the insulation layers
d Pipe diameter/snap plate height

If the installation height is required to be as small as possible, use the Fonterra Base system in connection with thin layer cement screed with 30 mm pipe coverage.

Viega screed additive for cement screeds

To make cement screed suitable for use in connection with surface heating systems, additives must be added to the screed which improve the bending tensile strength and pressure resistance and reduce the formation of air pores. Adding the screed additive Viega Temporex (model 1455) to the cement screed significantly accelerates setting and curing. Functional heating can start after only 10 days.

Mixing of several additives is not permitted.

If a smaller total height is demanded, a reduction of the screed height may be the solution. In this case, the cement screed must be specifically modified. Adding Viega screed additive model 1454 for thin layer cement screed modifies the cement screed in such a way that a screed thickness of 30 mm only will fulfil the requirements in the screed panel.

Overview of the consumption of screed additives

	Regular cement screed	Thin layer cement screed	Cement screed, fast
Screed additive*	Model 1453.1	Model 1454	Model 1455
Packing unit	20 kg	10 kg	
Pipe coverage	45 mm	30 mm	45 mm
Ratio in relation to the cement weight	0.8 to 1.0 weight %	7 to 10 weight %	2 weight %
Application quantity	approx. 0.14 kg/m2	approx. 1.30 kg/m2	approx. 0.3 kg/m2
Consistency after 1 - 2 min.	plastic to stiff	plastic to soft	plastic to stiff
Hard enough to walk on after	3 days	3 days	2 days
Hardening phase	21 days	21 days	10 days
Functional heating	3 days at 25 °C 4 days at e.g. 45 °C	3 days at 25 °C 4 days at e.g. 45 °C	3 days at 25 °C 4 days at e.g. 45 °C

Tab. 36: Overview of the consumption of screed additives

* Do not add any other screed additives. Compliance with the instructions for use is mandatory.

Viega screed additives make functional heating as described in DIN EN 1264-4 possible.
"With cement screed, functional heating must not start earlier than 21 days after screed installation, or according to the manufacturer's instructions, and earlier than 7 days with calcium sulphate screeds.
Functional heating starts with a supply temperature between 20 °C and 25 °C which must be maintained for at least 3 days. Next, the maximum design supply temperature must be set and maintained for at least 4 days. Functional heating must be documented." For documentation, the sample in the appendix to this brochure (Heating log) can be used.
Any shrinkage cracks must be force-fit sealed, e.g. with synthetic resin. Before the floor covering is installed, another course of heating is recommended, the 'readiness-for-covering heating'.
The floor layer must ascertain the residual moisture of the screed in at least 3 measuring points per 200 m² heating area, or per apartment. He decides when the screed is ready for floor laying.

Coordination between the heating installers, screed installers and floor layers is necessary. For information, refer to the brochure "Schnittstellenkoordination bei beheizten Fußbodenkonstruktionen" (Interface coordination with floor constructions) of BVF Hagen or on the Internet at: www.flaechenheizung.de.

Screed reinforcement

Generally, reinforcement of screeds or heating screeds on the insulation layer is not required (DIN 18560, part 2, par. 5.3.2).
Quote: " Generally, reinforcement of screeds on the insulation layer is not required. A reinforcement cannot prevent cracking. In certain cases, reinforcement can be useful. There are two types of reinforcement: lattice-truss and fibre reinforcement."
In best case, reinforcement could be able to prevent widening of cracks or height offset.

Joints

A joint plan must be generated which shows the type and arrangement of the joints.
The joint plan must be generated by the building planner and submitted to the executing company as a part of the specification.
Movement joints must be provided in the screed above the building joints. Furthermore, joints (edge joints) must be provided to separate the screed from upright building parts. Any additional joints required must be arranged in such a way that compact fields are created. Movement joints within the screed area must be protected from height offset if necessary.
Depending on their function, the following joint types are differentiated according to DIN 18560 "Floor screeds in building construction":

- Movement joints
- Edge joints
- Concealed joints

Movement joints

Movement joints absorb movements of the screed in all directions. They completely separate the screed right up to the heat and footfall sound insulation. If connection lines cross a movement joint, protection must be provided in the form of a 300 mm long section of Fonterra protective pipe for joints installed at the crossover point.
These movement joints must be provided along the same lines in the floor covering.

Edge joints

Edge joints separate the screed from all enclosing surfaces, but also from building parts in the room such as columns, stairs, or room partition elements. Edge insulation strips provide for the 5 mm minimum movement clearance specified in the DIN standard.
Do not trim off the movement and edge joint insulation strips before completion of the floor covering work respectively joint filling for hard floors. Finally, they must be permanently sealed when the tile surface is laid.

Concealed joints

Concealed joints, also called trowel grooves, can additionally relieve the tension in screed fields already separated by movement joints.
They can for example be made in door passages where real movement joints

are not mandatory. A trowel groove must as a maximum cut the top third of the screed panel. Take care not to damage the pipes. After hardening, the groove is sealed e.g. with synthetic resin; it must not be superimposed as a joint in the tile surface or similar.

Screed fields of 40 m² and more as well as side lengths of more than 8 m must be separated by movement joints. Generally, a side ratio of a/b < 1/2 must not be exceeded. According to DIN EN 1264-4, any irregularly formed areas must be separated off with joints; the aim is to have only rectangular areas with the above-specified dimensions.

For T- or L-shaped rooms, Viega recommends to create rectangular or square screed fields.
Floating heating screed is subject to length expansion. For cement screed, the heat expansion coefficient is 0.012 mm/m K.
For flow screeds, field sizes and movement joints must be coordinated with the manufacturer.
If movement joints are guided through supply lines, the joints must be protected. This is done by means of a slit joint protection. Next, the round profile is pushed between the pipes or over the entire length of the expansion joint into the snap plate.
Finally, the expansion joint profile is placed over the round profile and glued to the system surface. The round profile separates the screed in the required form in the snap plate area, the expansion joint profile separates it in the coverage area.
The screed should first be applied to both sides of the expansion joint strip, and from there to the middle.

Design movement joint

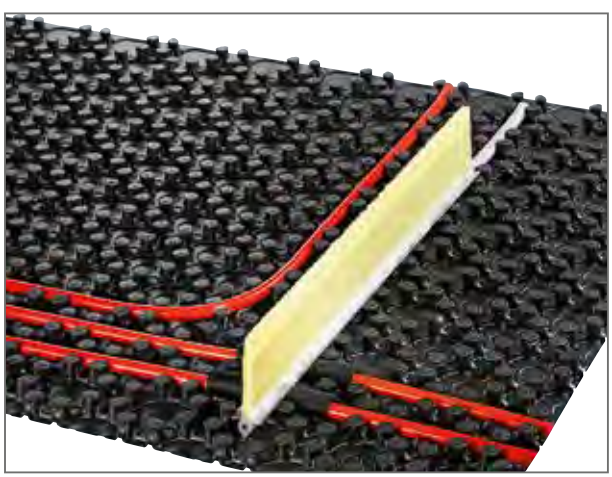


Fig. 70: Design movement joint

Assembly steps

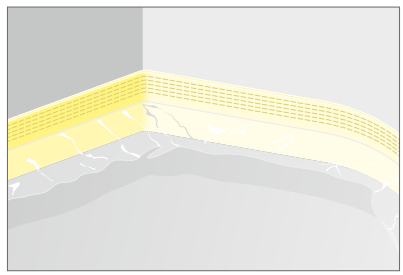


Fig. 71: Lay and fasten the edge insulation strips.

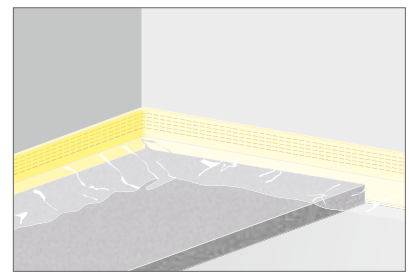


Fig. 72: Lay the footfall sound insulation.

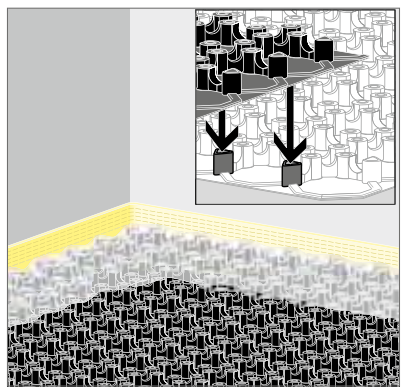


Fig. 73: Lay the snap plate.

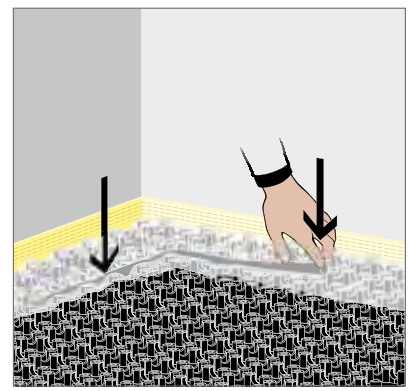


Fig. 74: By means of an edge profile, fix the foil of the edge insulation strip free of tension on the snap plate.

Fig. 75: Lay the heating pipes.

Fig. 76: Provide the expansion joints.

Floor coverings

General

Floor coverings installed in connection with underfloor heating must be approved for this use and have a thermal resistivity ≤ 0.15 m² K/W. The installation work must be carried out properly; it starts as soon as the readiness for covering has been ascertained. This is done by measuring the residual moisture of the screed in the places where Viega measuring point sets have been installed. The measurement is done by means of a CM instrument. Before the floor covering is installed, the floor layer must confirm the suitability of the covering for installation on the screed, as specified in DIN EN 1264-4.

For edge and expansion joints, only permanently elastic filling is permitted. Grout residues must be removed.
According to DIN EN 14259, adhesives must be suitable for creating a solid and permanent connection. They must have no negative effects on the floor covering or the underground and must not emit any disagreeable smell after application.
The floor temperature should be between 18 °C and 22 °C, the relative humidity between 40 and 65%.

Parquet, laminate

Parquet coverings must be laid in compliance with the manufacturers' installation instructions.
The moisture content for multi-layer parquet must be noted; it can be found in the respective standards.
Three-layer parquet can be laid without ("floating") or with adhesive (note manufacturer's information). Use adhesive which is shear-resistant and described by the manufacturer as "suitable for underfloor heating" and "heat ageing resistant".

Parquet, laminate

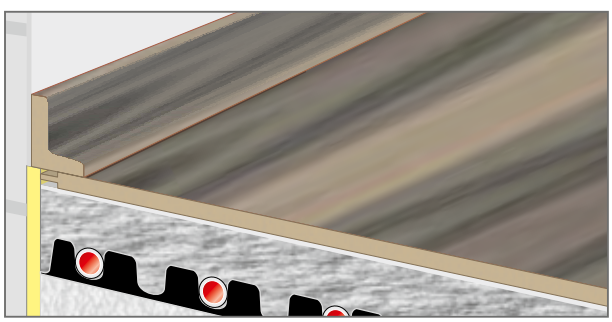


Fig. 77: Parquet, laminate

Natural or artificial stone coverings

Natural or artificial stone coverings are very popular; thanks to their small thermal resistivity of 0.012 m^2K/W for ceramic tiles and 0.010 m^2K/W for natural stone coverings, they are particularly well suited for surface heating systems.
This favourable combination of thermal conductivity of the floor and lower supply temperature of the system provide for a significant reduction of the operating costs.

Natural and artificial stone coverings

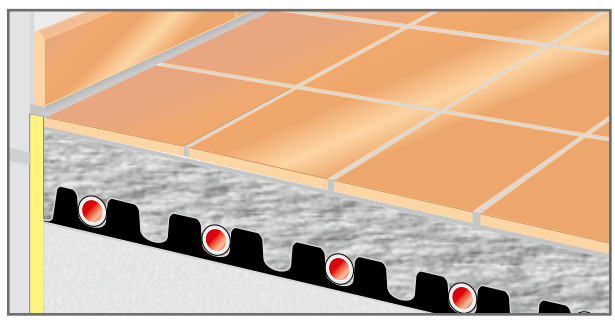


Fig. 78: Natural and artificial stone coverings

Textile / elastic floor coverings

Textile / elastic floor coverings are suitable for use with underfloor heating systems if marked accordingly.
Due to their higher thermal resistivity, they need a higher supply temperature than ceramic coverings, but they show better results than stone floor coverings in terms of compensation for the ripple of the floor temperature profile.
The installation work must be done according to the regulations of DIN 18365 and the manufacturers' instructions.

Textile/elastic floor coverings

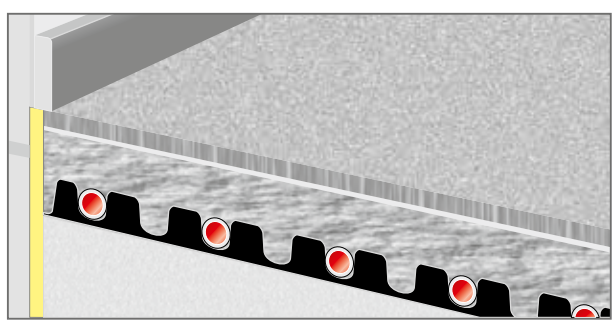


Fig. 79: Textile/elastic floor coverings

Timber floors on underfloor heating systems tend to show increased swelling and shrinking movements. Thus, widening of the joints must be expected during the heating season. This is not a quality defect. Keeping a constant climate of approx. 20 °C and 50% relative humidity helps to reduce this joint formation.
Also note the parquet manufacturer's recommendations.

Functional heating

We recommend to retain the document.

Building project		Date	
Building owner's address			
Installation company's address			

Functional heating of cement, calcium sulphate, and anhydrate screed is intended to check the heated floor installation and must be carried out according to DIN EN 1264-4.

Start of heating at the earliest

- 10 days after application of cement screed with screed additive mod. 1455
- 21 days after application of cement screed with screed additive mod. 1453.1 and 1454
- 7 days after application of calcium sulphate and anhydride screed

General notes

- The heating process must be slow and continuous.
- During functional heating, the screed must not be exposed to draughts.
- Heat for 3 days with a supply temperature of 20 to 25 °C, then 4 days with maximum design supply temperature (max. 55 °C).
- Note any manufacturer's instructions which deviate from DIN EN 1264-4.

Materials used		
	Pipes:	☐ 12x1.3 mm ☐ 15x1.5 mm ☐ 16x2.0 mm ☐ 17x2.0 mm
	Pipe material:	☐ PB ☐ Multilayer ☐ PE-Xc ☐ PE-RT
	Screed type:	
	Screed additives:	

Functional heating log

with supply temperature 20 - 25 °C	Start:			End:
with maximum dimensioning temperature in the supply	Start:			End:
Interruptions:	☐ yes	from:	to:	☐ no

The system was approved for further building work at an outside temperature of °C.

☐ At this point, the system was out of operation.
☐ At this point, the floor was heated at a supply temperature of °C.
☐ All windows and external doors were closed.

Notes on commissioning

The supply temperatures and the individual room temperature regulation must be set in such a way that the maximum screed temperature in the proximity of the heating pipes is not exceeded.

- 55 °C with cement, calcium sulphate, and anhydride screed
- or according to the screed manufacturer's specification

Comments

Building owner	**Site management**	**Qualified installation company**
Date/signature/stamp		

Pressure test

After completion of the installation work and execution of the pressure test, this document must be handed over to the planner/building owner. We recommend to retain the document.

Building project		Date	
Building owner's address			
Installation company's address			

Before applying the screed, do a leakage test of the heating circuits using water; as an alternative, compressed air can be used according to DIN EN 1264-4. The leakage test is carried out at the finished but not yet covered pipelines.

Notes on the test procedure

- Fill the system with filtered water and vent it completely.
- In case of major differences (~10 K) between the ambient temperature and the filling water temperature, wait for 30 minutes after filling the system for the temperatures to adjust.
- Carry out the leakage test at a pressure of 0.4 MPa (4 bar), max. 0.6 MPa (6 bar).
- System units not designed for these pressure levels (e.g. safety valves, expansion vessels etc.) must be exempted from the test.
- Visual inspection of the piping system/check per manometer*.
- The pressure must be kept constant during the application of the screed.
- Take suitable measures to exclude freezing, for example room heating or addition of anti-freeze to the heating water.
- If the anti-freeze is not required for normal operation, the system must be cleaned by emptying and flushing with at least three water exchanges.
- The water temperature must be kept constant during the test.

* Pressure gauges must be used which clearly indicate pressure changes of 0.01 MPa.

Materials used	Pipes:	☐ 12x1.3 mm	☐ 15x1.5 mm	☐ 16x2.0 mm	☐ 17x2.0 mm
	Pipe material:	☐ PB	☐ Multilayer	☐ PE-Xc	☐ PE-RT
	Pipe connectors:	☐ Pressing	☐ Clamping		

Log of the pressure test

Start of the pressure test:	Start pressure:	Water temperature [°C]:
End of the pressure test:	Final pressure:	Water temperature [°C]:

Visual inspection of pipe connectors carried out?	☐ yes	☐ no
Position of couplings marked in the installation plan?	☐ yes	☐ no
Leak tightness was established, no permanent form changes identified in any component?	☐ yes	☐ no
Has the operating pressure been set on system handover?	☐ yes	☐ no

Building owner	**Site management**	**Qualified installation company**
Date/signature/stamp		

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