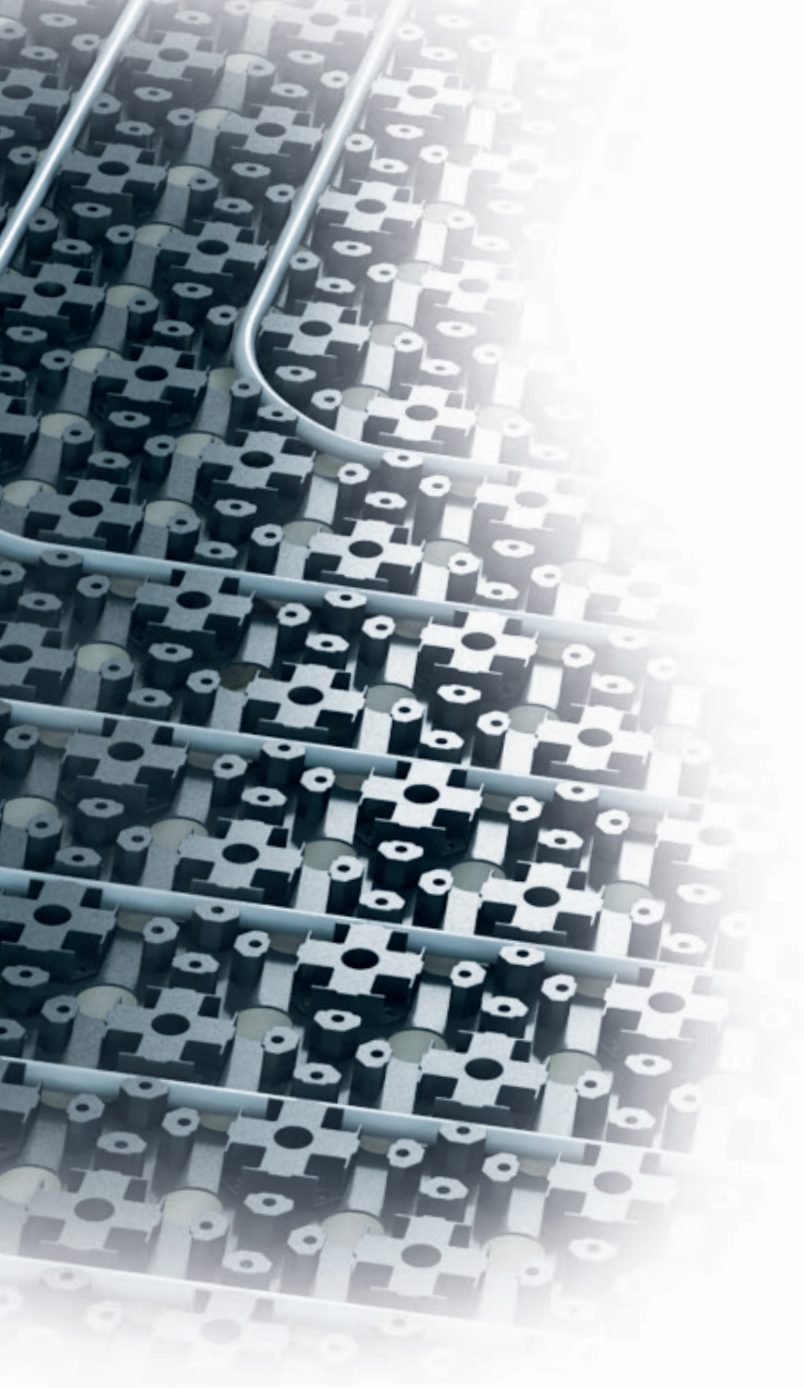


uponor

Uponor Minitec technical guide

UNDERFLOOR HEATING AND COOLING

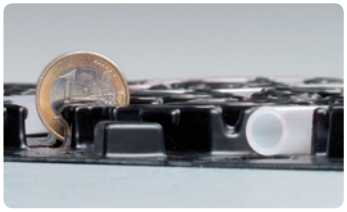
10 | 2014

The Uponor Minitec product line

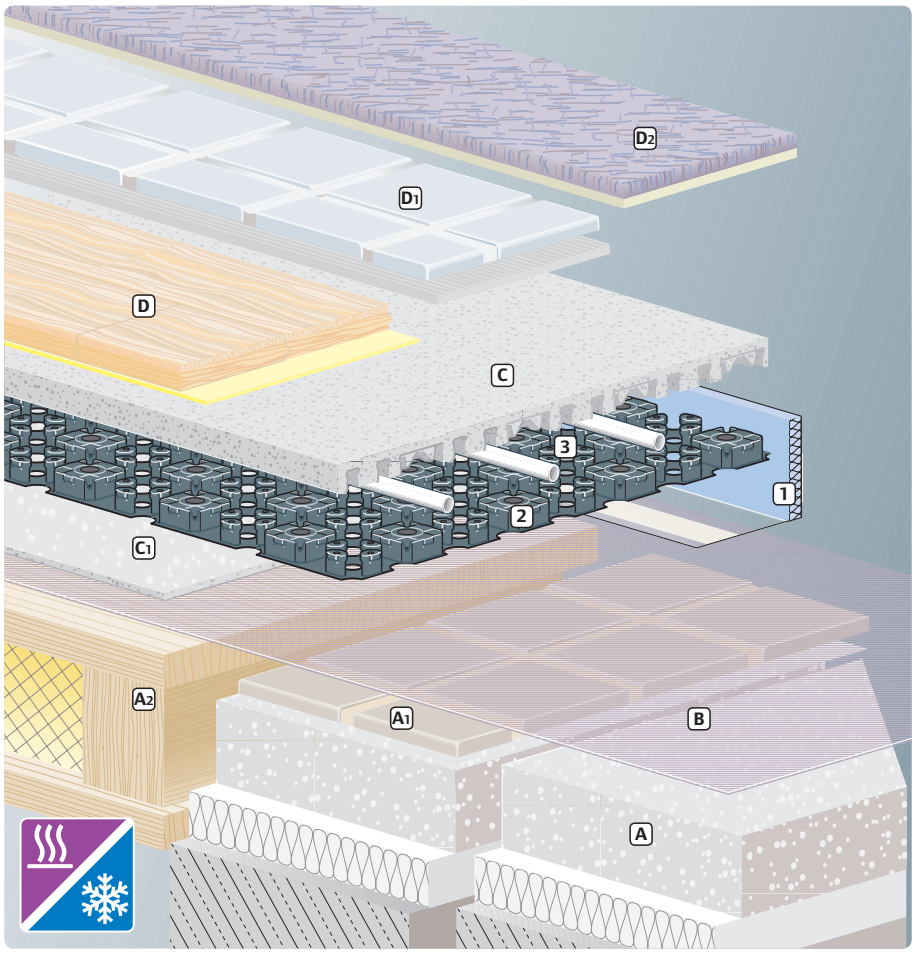
Fast installation, short heat-up time: Uponor Minitec offers you a range of advantages. The Uponor Minitec foil element for laying the Uponor PE-Xa pipes 9.9 x 1.1 mm can be installed on any existing screed, timber or tiled floor. Thanks to the low element height of around one centimetre, it is particularly suitable for integration into existing buildings.

The nub foil is equipped with punched holes in and between the nubs, which ensure, that the levelling compound can spread easily and bonds firmly with the substructure. The rear side of the elements is equipped with an adhesive surface, ensuring proper fixture to the floor during installation. The self-adhesive edging strip with self-adhesive foil available in L and I profile allows for a proper seal along the walls and the bottom surface.

The levelling layer is installed just above the raised naps, resulting in a possible total installation height of only 15 mm. After a short drying time, the desired floor covering can be placed directly onto the surface. As the pipe is thus right below the top floor layer, heat-up times are short and Uponor Minitec can be operated at low heating water temperatures, responding quickly to temperature adjustments.



Element height approximately 1 centimetre



1 Uponor Edge insulation strip

2 Uponor foil element

3 Uponor PE-Xa 9.9 x 1.1 mm pipe

A Existing screed with underlying thermal and sound insulation

A1 Tiled floor

A2 Timber joist floor

B Priming of prepared substrate

C Self-levelling compound

C1 Additional levelling layer for timber joist floors

D Parquet/ laminat floor with additional seperating layer or adhesive

D1 Tiles with tile adhesive and grout

D2 Carpet with carpet adhesive

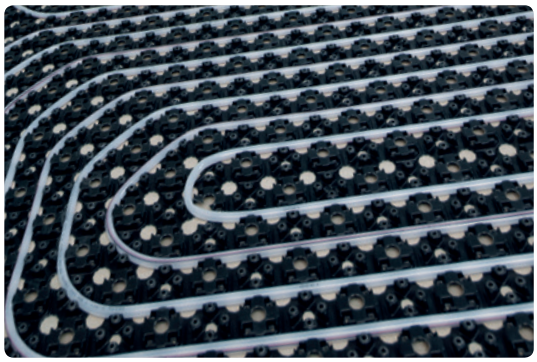
DIN Geprüft

7F 170 -F
PE-Xa 9.9x1.1

Minitec components

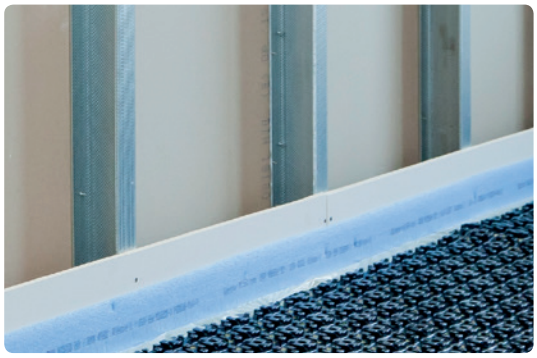
Uponor Minitec foil element

The sturdy Uponor nub foil elements can be walked on instantly and ensure fast and efficient installation of the Uponor PE-Xa pipes by a single technician. They are suitable for all room geometries and do not need to be installed right to the edge of the floor.



Uponor PE-Xa pipe

The flexible Uponor PE-Xa pipes 9.9 x 1.1 mm are placed in the prepared grooves of the Uponor Minitec nub foil elements. They are held in place by the naps of the foil, ensuring that the installation meets the relevant standards. The foil is equipped with specially designed naps for the laying of the pipe in 90° and also in 45° bends.



Uponor edge insulation strip

The self-adhesive edging strip with self-adhesive foil available in L and I profile allows for a proper seal along the walls and the bottom.

In the first installation step, the edging strip foil should be glued to the bottom. Then, the nub foil on it should be glued along the edge.

Uponor movement joint profile

The Uponor Minitec product line contains all components for a proper mounting in doorways and for creating joint profiles for the design shape of individual covering layers.

Design basics

Temperatures

Floor surface temperature
Special attention must be paid to the floor surface temperature, taking into account medical and physiological considerations.

The difference between the mean surface temperature of the floor and the design indoor temperature, together with the basic characteristic, form the basis on which the capacity of the heating floor surface is calculated. The maximum surface temperatures are determined by the limit heat flow density defined in DIN EN 1264, which is taken into account as the theoretical design limit in the design tables and diagrams.

Max. surface temperatures according to DIN EN 1264:

- **29 °C in comfort zone**
- **35 °C in edge zone**
- **33 °C in comfort zone**

Room temperature, perceived temperature and mean radiation temperature
With radiant heating systems such as the Uponor underfloor heating systems, one can expect significant energy savings compared with less efficient heating systems.

This energy efficiency is mainly due to a better adjusted room temperature and the optimal vertical temperature profile in the room. To feel comfortable, the room air temperature ϑ_L as well as the mean radiation temperature ϑ_S of the surfaces enclosing the room are relevant factors. They result in a so called perceived temperature. That means, that people, living in rooms with underfloor heating, feel more comfortable even when the room air temperature is reduced.

Standard design room temperatures:

Living rooms	**20 °C**
Corridors	**15 °C**
Bedrooms	**20 °C**
Bathrooms	**25 °C**

Calculations

Design tables for approximate calculations

The design tables allow for quick approximate calculation of the pipe laying distances and maximum heating circuit size. **They do however not replace proper planning and calculation** of the project. Instructions for the use of the design tables:

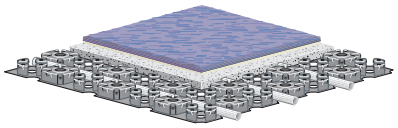
1. Select the design table for $\vartheta_i = 20°C$
2. Select the row of the predefined max. design heat flow density q_{des} of your project (not for bathrooms!)
3. In this row, select a design flow temperature $\upsilon_{V,des}$
4. Read the required installation distance Vz and the max. heating circuit size A_{Fmax} from the table
5. For bathrooms, use the design table for $\vartheta_i = 24°C$.

Sample reading (heating)

Design criteria:
Floor covering: carpet
Room size A_R ..... = 20 m²
Thermal output q_H ..... = 60 W/m²
Room temperature ϑ_i ..... = 20 °C
Thermal resistance of floor covering $R_{\lambda,B}$ = 0.15 m²K/W
Pipe spacing V_Z ..... = 10 cm
Chosen flow temperature $\vartheta_{V,des}$ ..... = 48 °C

Result:
max. surface area per heating circuit $A_{max.}$ ..... = 11,25 m²
Number of heating circuits n ..... = $A_R/A_{max.}$
n = 1.7
Resulting mean surface temperature $\vartheta_{F,m}$ ..... = 25.7 °C (OK)

Uponor Minitec design tables for 15 mm levelling layer ($\Delta p_{max.}$ = 250 mbar)



Design table, $\vartheta_i = 20$ °C , $R_{\lambda,B} = 0.15$ m²K/W (carpet)

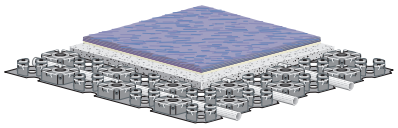
		$\vartheta_{V,des}$ = 53 °C[1]		$\vartheta_{V,des}$ = 48 °C		$\vartheta_{V,des}$ = 43 °C	
$\vartheta_{F,m}$ [°C]	q_H [W/m²]	Vz [cm]	$A_{Fmax.}$ [m²]	Vz [cm]	$A_{Fmax.}$ [m²]	Vz [cm]	$A_{Fmax.}$ [m²]
28.7	95.9	5	5.20				
28.2	90.0	5	6.25				
27.3	80.0	10	8.75	5	5.60		
26.9	75.0	10	10.05	5	6.60		
26.5	70.0	10	11.70	5	7.60		
26.1	65.0	10	12.80	10	9.75		
25.7	60.0	10	14.20	10	11.25	5	6.95
25.2	55.0	15	16.90	15	13.25	10	9.10
24.8	50.0	15	18.90	15	15.35	10	10.85
24.4	45.0	15	21.00	15	17.55	15	13.20
23.9	40.0	15	23.35	15	19.90	15	15.70

The values in the design tables are based on the following key figures:
$R_{\lambda,ins}$ = 0.75 m²K/W, ϑ_u = 20 °C, 130 mm concrete floor, spread = 3-30 K, max. heating circuit length = 100 m
max. pressure drop per heating circuit including 2 x 5 m connecting lines Δp_{max} = 250 mbar
[1] At ϑ_V > 53 °C, the limit heat flow density and thus the max. floor surface temperature of 29 °C (33 °C for bathrooms) are exceeded.

Design data

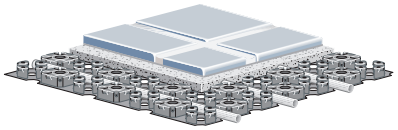
The design tables below allow for the fast approximate calculation of the pipe spacing and the maximum heating circuit size. They do however not replace proper planning and calculation of the project.

Uponor Minitec design tables for 15 mm levelling layer (Δp max. = 250 mbar)



Design table, ϑ_i = 20 °C , $R_{\lambda,B}$ = 0.15 m²K/W

		ϑ_V = 53 °C[1]		ϑ_V = 48 °C		ϑ_V = 43 °C	
$\vartheta_{F,m}$ [°C]	q_H [W/m²]	Vz [cm]	$A_{Fmax.}$ [m²]	Vz [cm]	$A_{Fmax.}$ [m²]	Vz [cm]	$A_{Fmax.}$ [m²]
28.7	95.9	5	5.20				
28.2	90.0	5	6.25				
27.3	80.0	10	8.75	5	5.60		
26.9	75.0	10	10.05	5	6.60		
26.5	70.0	10	11.70	5	7.60		
26.1	65.0	10	12.80	10	9.75		
25.7	60.0	10	14.20	10	11.25	5	6.95
25.2	55.0	15	16.90	15	13.25	10	9.10
24.8	50.0	15	18.90	15	15.35	10	10.85
24.4	45.0	15	21.00	15	17.55	15	13.20
23.9	40.0	15	23.35	15	19.90	15	15.70

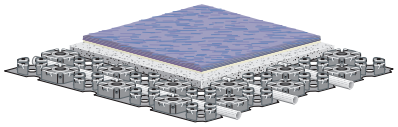


Design table, ϑ_i = 24 °C , $R_{\lambda,B}$ = 0.02 m²K/W

		ϑ_V = 53 °C[1]		ϑ_V = 48 °C		ϑ_V = 43 °C	
$\vartheta_{F,m}$ [°C]	q_H [W/m²]	Vz [cm]	$A_{Fmax.}$ [m²]	Vz [cm]	$A_{Fmax.}$ [m²]	Vz [cm]	$A_{Fmax.}$ [m²]
32.6	94.7	5	8.70	5	7.00		
32.2	90.0	5	9.15	5	7.45	5	5.20
31.3	80.0	5	10.15	5	8.45	5	6.30
30.9	70.0	5	11.25	5	9.55	5	7.50
29.7	60.0	5	12.55	5	10.80	5	8.75
29.2	55.0	5	13.25	5	11.50	5	9.45
28.8	50.0	5	14.05	5	12.25	5	10.15
27.9	40.0	5	14.50	5	14.05	5	11.85

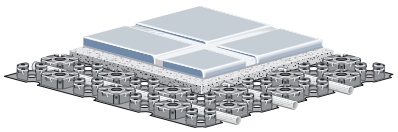
The values in the design tables are based on the following key figures:
$R_{\lambda,ins}$ = 0.75 m²K/W, ϑ_u = 20 °C, 130 mm concrete floor, spread = 3-30 K, max. heating circuit length = 100 m
max. pressure drop per heating circuit including 2 x 5 m connecting lines Δp_{max} = 250 mbar
For other flow temperatures, thermal resistance values, etc. please refer to the design diagram.
[1] At ϑ_V > 53 °C, the limit heat flow density and thus the max. floor surface temperature of 29 °C (33 °C for bathrooms) are exceeded.

Design tables for 15 mm levelling layer (Δp max. = 100 mbar) with Uponor room control station



Design table, ϑ_i = 20 °C , $R_{\lambda,B}$ = 0.15 m²K/W

		ϑ_V = 53 °C[1]		ϑ_V = 48 °C		ϑ_V = 43 °C	
$\vartheta_{F,m}$ [°C]	q_H [W/m²]	Vz [cm]	$A_{Fmax.}$ [m²]	Vz [cm]	$A_{Fmax.}$ [m²]	Vz [cm]	$A_{Fmax.}$ [m²]
28.7	95.6	5	3.65				
28.2	90.0	5	4.35				
27.3	80.0	10	6.10	5	3.90		
26.9	75.0	10	7.05	5	4.65		
26.5	70.0	10	8.05	5	5.40		
26.1	65.0	10	9.05	10	6.85		
25.7	60.0	10	10.05	10	7.95		
25.2	55.0	15	12.00	15	9.35	5	5.80
24.8	50.0	15	13.40	15	10.85	5	6.65
24.4	45.0	15	14.90	15	12.40	10	9.00
23.9	40.0	15	16.60	15	14.10	10	10.40

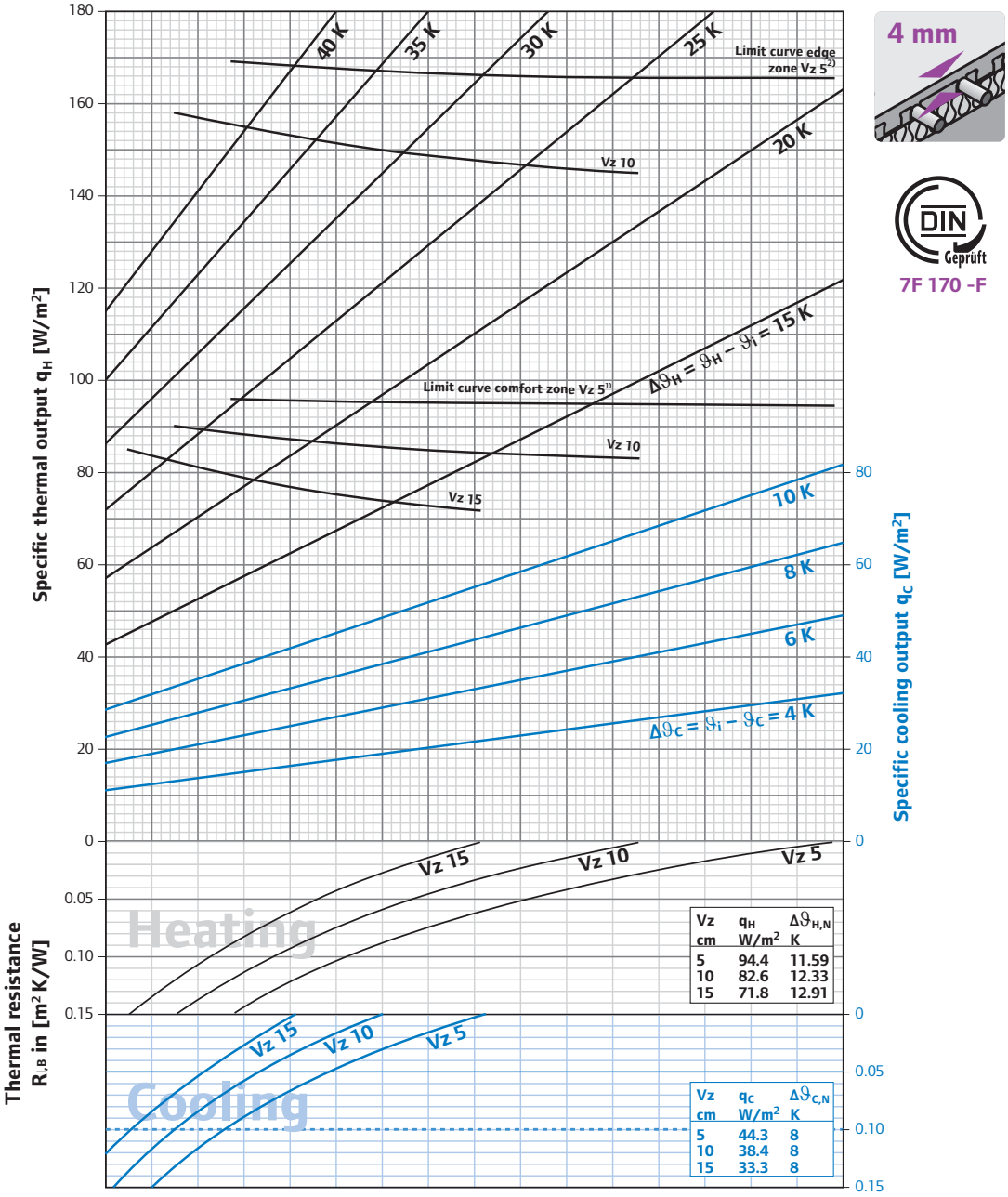


Design table, ϑ_i = 24 °C , $R_{\lambda,B}$ = 0.02 m²K/W

		ϑ_V = 53 °C[1]		ϑ_V = 48 °C		ϑ_V = 43 °C	
$\vartheta_{F,m}$ [°C]	q_H [W/m²]	Vz [cm]	$A_{Fmax.}$ [m²]	Vz [cm]	$A_{Fmax.}$ [m²]	Vz [cm]	$A_{Fmax.}$ [m²]
32.6	94.7	5	6.20				
32.2	90.0	5	6.50	5	5.30		
31.3	80.0	5	7.20	5	6.00	5	4.50
30.5	70.0	5	8.00	5	6.80	5	5.30
29.7	60.0	5	8.95	5	7.70	5	6.20
29.2	55.0	5	9.45	5	8.20	5	6.70
28.8	50.0	5	10.05	5	8.75	5	7.25
27.9	40.0	5	11.40	5	10.00	5	8.45

The values in the design tables are based on the following key figures:
$R_{\lambda,ins}$ = 0.75 m²K/W, ϑ_u = 20 °C, 130 mm concrete floor, spread = 3-30 K, max. heating circuit length = 80 m
max. pressure drop per heating circuit including 2 x 5 m connecting lines Δp_{max} = 100 mbar
For other flow temperatures, thermal resistance values, etc. please refer to the design diagram.
[1] At $\vartheta_{V,des}$ > 53 °C, the limit heat flow density and thus the max. floor surface temperature of 29 °C (33 °C for bathrooms) are exceeded.

Design diagram heating/cooling Uponor Minitec with 15 mm levelling layer ($s_{ü}$ = 4 mm with $l_{ü}$ = 1.0 W/mK)



DIN Geprüft

7F 170 -F

[1] Limit curve valid for ϑ_i 20 °C and $\vartheta_{F,max}$ 29 °C or ϑ_i 24 °C and $\vartheta_{F,max}$ 33 °C

[2] Limit curve valid for ϑ_i 20 °C and $\vartheta_{F,max}$ 35 °C

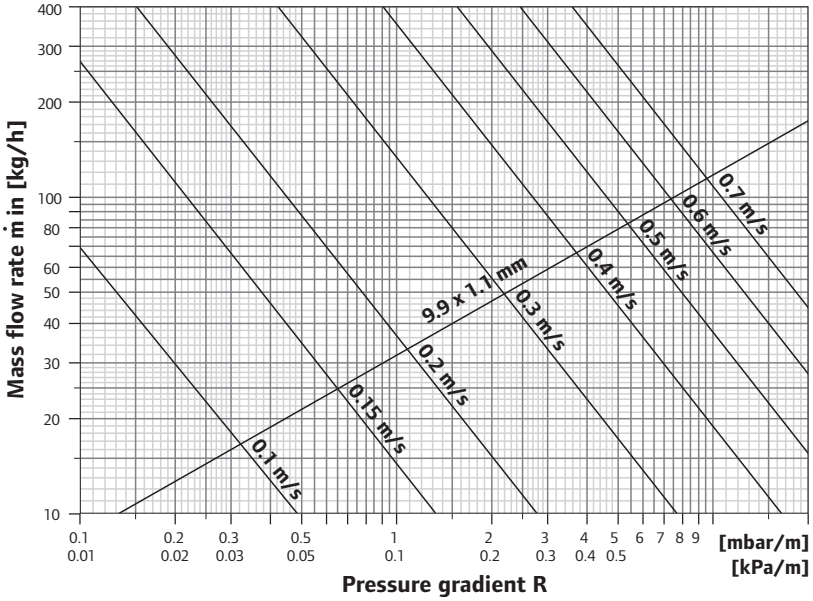
Note: According to DIN EN 1264 are baths, showers and toilets not included. The limit curves must not be exceeded.

The design supply water temperature must maximum be: $\vartheta_{V,des} = \Delta\vartheta_{H,g} + \vartheta_i + 2.5$ K

$\Delta\vartheta_{H,g}$ is found by the limit curve for the occupied zone with the smallest pipe spacing.
At cooling the supply temperature to be controled by dew point temperature, humidity sensor to be included.

Pressure drop diagram

The pressure losses in the Uponor PE-Xa pipes can be determined with the aid of the diagram

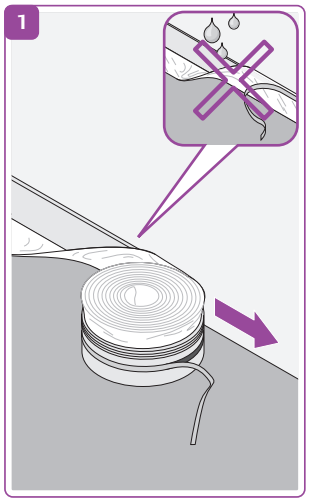


Installation

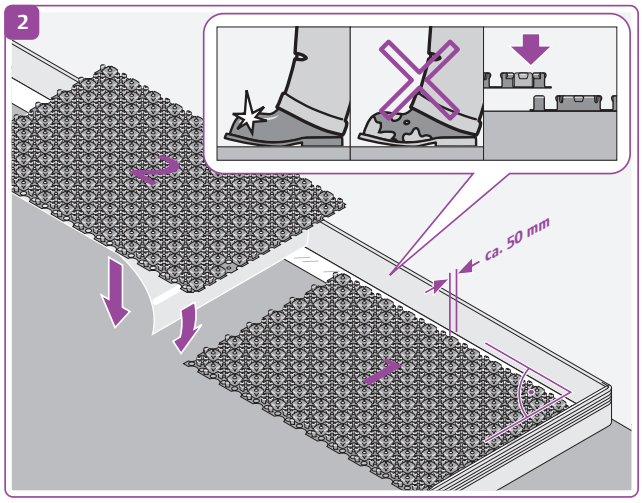
General

Uponor Minitec must be installed by expert installers only. Observe the following assembly instructions and additional instructions which are provided with the components and tools or which can be downloaded from www.uponor.com

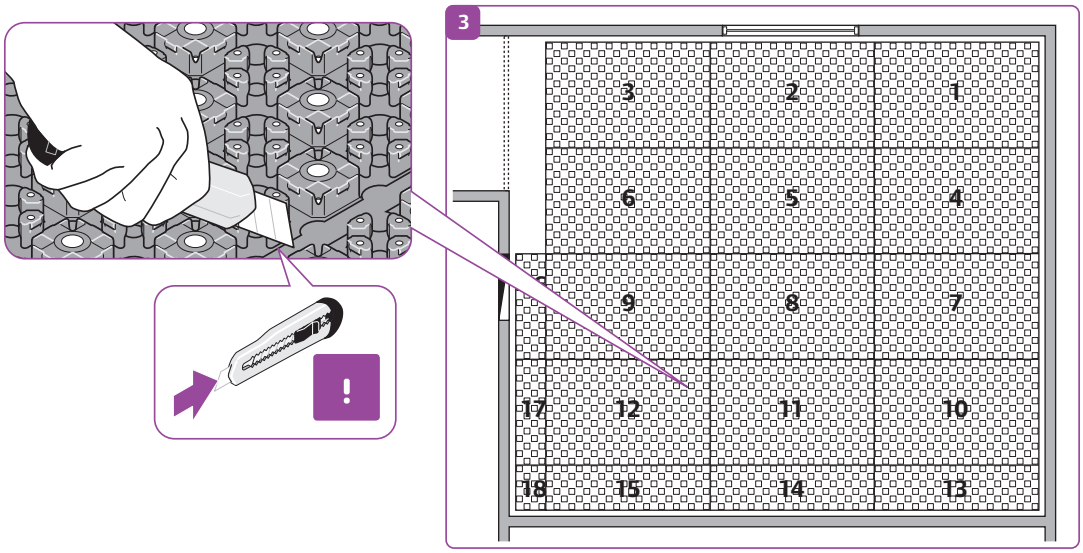
Overview of the installation steps



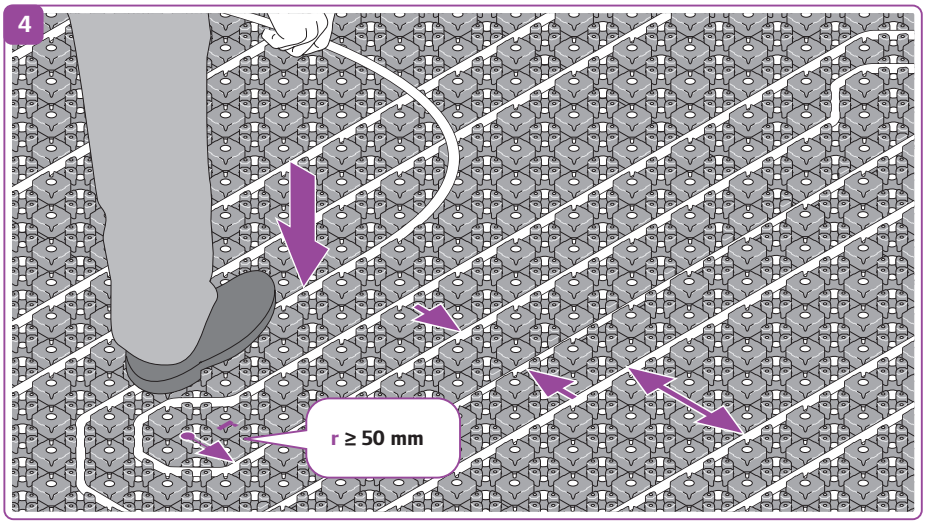
Mounting edge strips



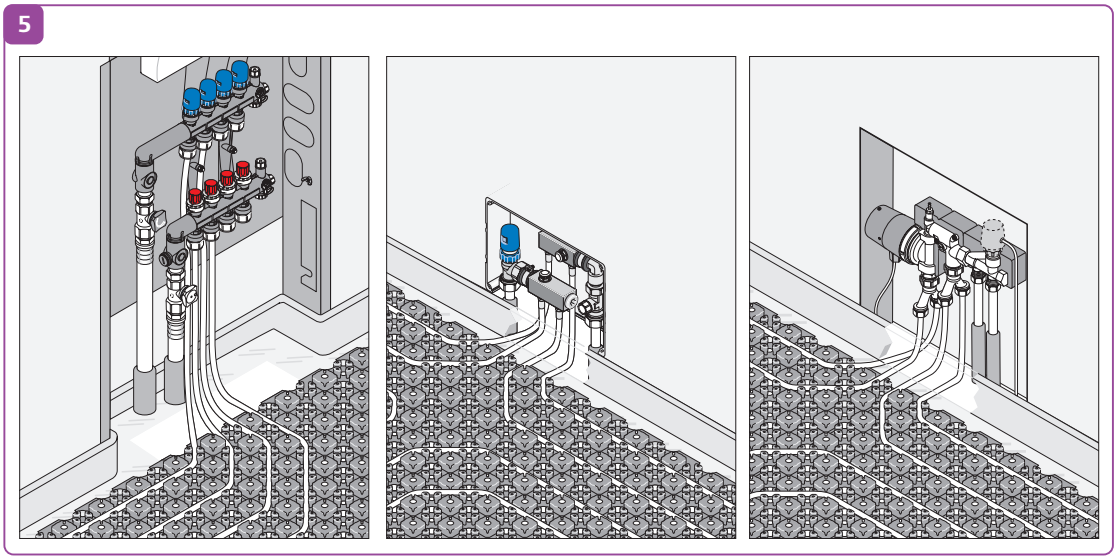
Installing foil element



Installation steps for foil elements



Installing pipes in foil elements

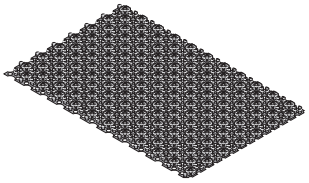


Connecting PE-Xa pipes

Get to know more about Uponor Minitec

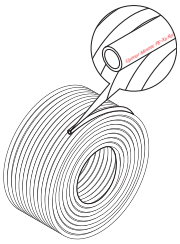
This QR code leads you to the film:

Technical data



Uponor Minitec foil element			
Material	Polystyrene		
Max. traffic load (including levelling compound)	5,0 kN/m²		
Pipe spacing	Vz 5, 10, 15		
Foil element dimensions (l x w)	1,120 mm x 720 mm		
Total element height	12 mm		
System type	Wet system*		
Volumetric share of levelling layer (at layer thickness 15 mm)	Vz 5 approx. 12.4 l/m²	Vz 10 approx. 13.2 l/m²	Vz 15 approx. 13.5 l/m²
DIN reg. no.	7F170-F		

* on existing load distribution layer



Uponor PE-Xa pipe	
Pipe dimensions	9.9 x 1.1 mm
SDR (Standard Dimension Ratio)	Value 9 (acc. EN ISO 15875)
S (Pipe Series)	Value 4 (acc. EN ISO 15875)
Material	PE-Xa (acc. EN 16892)
Colour	Nature
Manufactured	According to DIN EN 16892 / DIN EN ISO 15875-2
Oxygen tightness	According to DIN 4726, section 3.5
Density	0.94 g/cm³ (acc. EN 16892)
Thermal conductivity	0.35 W/mK
Mean thermal linear expansion coefficient at	70 °C: 0.15 mm/m K (acc. EN 16892)
Crystallite melting temperature	133 °C
Building material class	B2
Min. bending radius	50 mm
Pipe roughness	0.007 mm
Water content	0.0465 l/m
Pipe marking	[length] m PE-Xa 9.9 x1.1 oxygen-tight according to DIN 4726 EN ISO 15875 class 4/8 bar [DIN approval mark] 3V279 PE-X
Max. continuous operating pressure (water at 20 °C)	19.1 bar (safety factor SF = 1.25 (according to DIN EN ISO 15875 for 20 °C), for 50 operating years
Max. continuous operating pressure (water at 70 °C)	8.8 bar (safety factor SF = 1.5 (according to DIN EN ISO 16893), for 50 operating years
Application class according to DIN EN ISO 15875	4 (underfloor heating)
At permissible operating pressure	8 bar
DIN CERTCO reg. no.	3V 279 PE-Xa
Pipe couplings Uponor	9.9 x 1.1 type couplings
Optimum installation temperature	≥ 0 °C
UV protection	lightproof cardboard box (unused piping must be stored in cardboard box!)

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Uponor Corporation
www.uponor.com