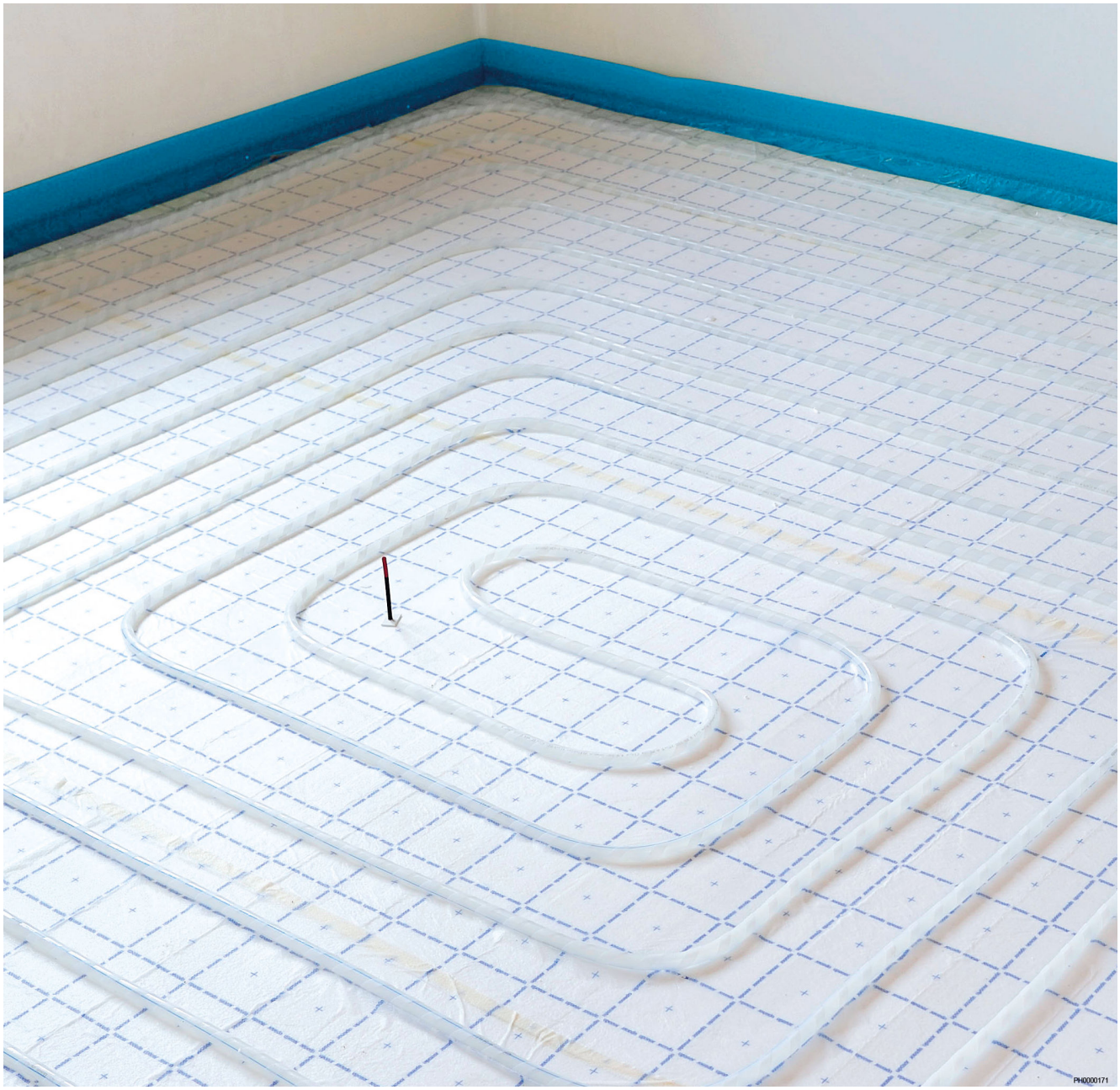
Uponor Klett underfloor heating/cooling system

EN Technical information



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1 System description


RP0000312

Uponor Klett is a system for fast and easy laying of underfloor heating and cooling pipes. Uponor Klett is used in combination with either Uponor Klett Comfort Pipe PLUS (PE-Xa pipes) or Uponor Klett MLCP RED (composite pipe).

The oxygen-tight pipes are supplied spiral wound with hook tape. A suitable loop foil is laminated onto the corresponding insulation panel. The printed installation grid provides orientation during installation. The Uponor Klett pipes are pushed down on the laminated insulation panel at calculated distances. The hook tape then engages with the loop foil of the insulation panel, hence holding the pipes in place. Hook tape as well as loop foil are ideally suited for each other, ensuring maximum retention force.

1.1 Benefits

- Ultra-fine hook and loop fixation for greater retention force
- Fast and easy installation by a single person, no special tools required
- Corrections are possible at any time during installation, without damaging the panels
- The laminated moisture barrier between the screed and the insulation layer is not damaged during pipe installation
- Easy installation even in rooms out of square
- Also available as Uponor Klett Twinboard for installation on existing insulations
- Uponor Klett Silent 30-3 for a sustainable heating and cooling system with favourable impact sound characteristics
- Uponor Klett pipes are easily combinable with other standard system components of the Uponor portfolio.

1.2 Components

Note

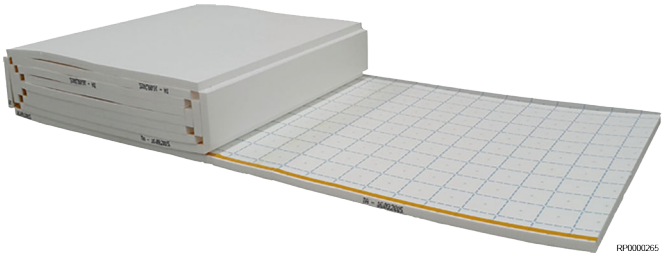
For more detailed information, product range and documentation, please visit the Uponor website: www.uponor.com.

Note

For detailed information about the product range, dimensions and availability, please refer to the Uponor price list.

Uponor Klett panel roll

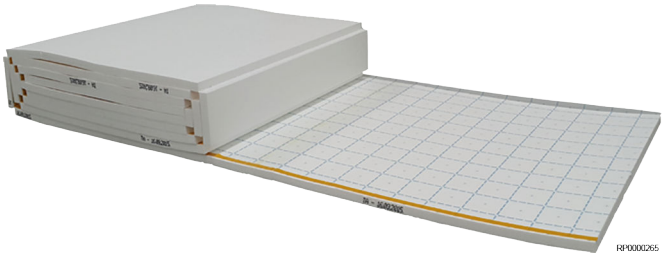
EPS DES WLS 032


RP0000265

The Uponor Klett panel roll is an EPS DES panel with added graphite and ideal for increased heat insulation and low-height floor constructions. It is available in versions 25-2 and 40-2 and integrated with thermal and impact sound insulation as per DIN EN 13163.

The installation area is 1 x 10 m (10 m^2).

EPS DES

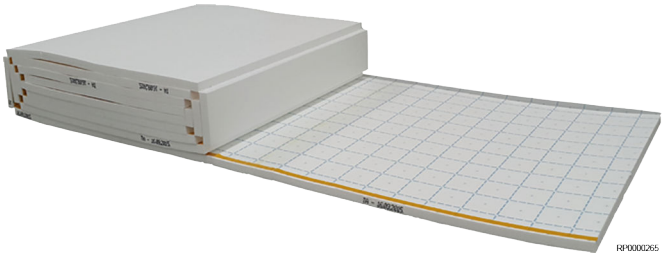


RP0000265

The Uponor Klett panel roll is an EPS DES panel with added graphite and ideal for increased heat insulation and low-height floorconstructions. It is available in versions 25-2, 30-2, 30-3, 35-3 and integrated with thermal and impact sound insulation as per DIN EN 13163.

The installation area is 1 x 10 m (10 m^2).

EPS DEO

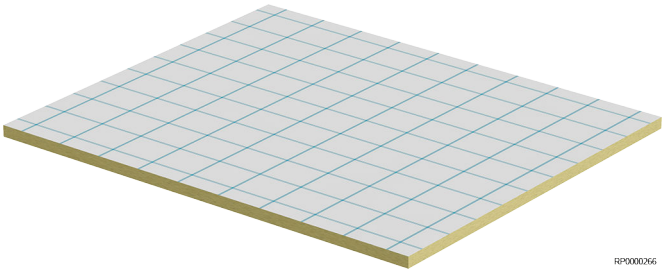


RP0000265

The Uponor Klett panel roll is an EPS DEO panel and ideal for increased heat insulation and low-height floor constructions. It is available in versions 20 mm, 23 mm, 27 mm, 38 mm, 44 mm, 47 mm and 53 mm.

The installation area is 1 x 10 m (10 m^2).

Uponor Klett Silent



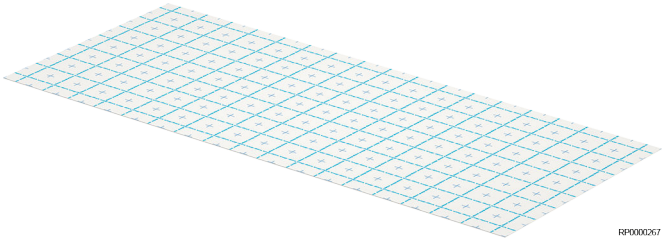
RP0000266

The Uponor Klett Silent is a mineral fibre insulation panel and is ideal for optimised impact sound insulation and low-height floor constructions. Reducing the pipe coverage to 30 mm is possible using Knauf liquid screed FE 80 ECO. With the test results, the system has proven to be low-emission.

Live load up to 5 kN/m^2 can use this panel.

The installation area is 1,2 x 1 m (1,2 m^2).

Uponor Klett Twinboard



RP0000267

The Uponor Klett Twinboard is a 3 mm PP double wall foldable board with a live load up to 5 kN/m^2. It can be installed separately on top of the existing insulation.

The installation area is 2,4 x 1 m (2,4 m^2).

Uponor Klett Comfort Pipe PLUS

RP0000124

Uponor Comfort Pipe PLUS is a highly flexible PE-Xa pipe spiral wound with hook tape with 5 layers in dimensions 14 x 2,0 mm and 16 x 2,0 mm.

The pipe fulfils the requirements for oxygen diffusion tightness as per DIN 4726.

Uponor Klett MLCP RED

RP0000268

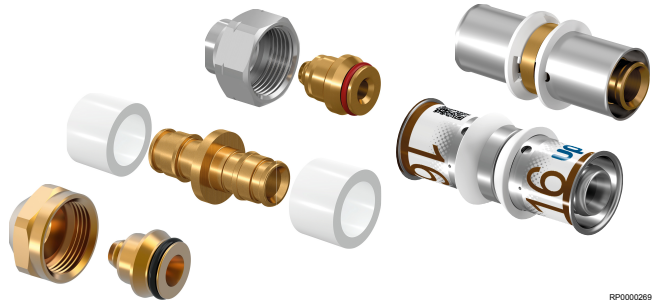
Uponor MLCP RED is a composite pipe spiral wound with hook tape which is stable and easy to install, available in the dimensions 16 x 2,0 mm.

The pipe fulfils the requirements for oxygen diffusion tightness as per DIN 4726.

Uponor jointing technology

Note

Only use fittings recommended by Uponor or its representatives.



RP0000269

Compression, Press, and Q&E joints are available to connect with respective pipes.

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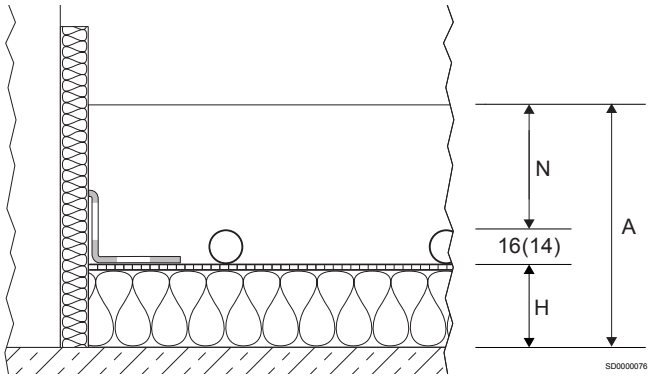
2 Planning/ design

2.1 Floor constructions



Item	Description
N	Minimum screed thickness
H	Insulation layer thickness (mm)
A	Structural height

As a result of combining insulations, the following constructions comply with the European minimum insulation requirements (refer to EN 1264-4 or EN 15377) for residential and non-residential buildings.

Additional planning information for special insulation requirements for non-residential buildings that deviate from this are described under “Thermal insulation requirements for radiant heating”.

The masses per unit area of the ceiling and the screed as well as the dynamic stiffness of the Uponor heat and impact sound insulation have to be considered in providing the proof of impact sound insulation. The rated impact sound improvement of the floorings is calculated from the weight per unit area of the screed and the dynamic stiffness of the insulation or indicated by an equivalent test report.

Floor construction tables

These abbreviations are used in the following construction tables:

Abbreviations	Description
CT	Cement screed
CAF	Anhydride liquid screed
ΔLw [dB]	Impact sound improvement factor of flooring
ΔLw,P [dB]	Impact sound improvement factor of tested flooring

Uponor Klett 35-3

Thermal insulation requirements	Insulation layer thickness	Thermal resistance of insulation	Impact sound improvement factor of flooring ΔLw [dB]		Structural height A (2,0 kN/m²)[2]	
	H [mm]	$R_{\lambda, ins}$ [m² K/W]	CT N ≥ 45 [mm]	CAF[3] N ≥ 35 [mm]	CT N ≥ 45 [mm]	CAF[3] N ≥ 35 [mm]
Apartment ceiling separating heated rooms						
EN 1264-4	Klett EPS 35-3 = 35	0,75	31	30	≥ 96 (94)	≥ 86 (84)
Floor slabs[1]), ceilings against unheated rooms in residential and non-residential buildings						
EN 1264-4	Klett EPS 35-3 = 35 EPS-DEO 20 = 20 Total H = 55	1,32	31	30	≥ 116 (114)	≥ 106 (104)
Floor ceilings against outside air in residential and non-residential buildings (ϑi ≥ 19 °C)						
EN 1264-4	Klett EPS 35-3 = 35 EPS-DEO 45 = 45 Total H = 80	2,04	31	30	≥ 141 (139)	≥ 131 (129)

Thermal insulation requirements	Insulation layer thickness	Thermal resistance of insulation	Impact sound improvement factor of flooring ΔLw [dB]		Structural height A (4,0 kN/m²)[2]	
	H [mm]	$R_{\lambda, ins}$ [m² K/W]	CT N ≥ 70 [mm]	CAF[3] N ≥ 60 [mm]	CT N ≥ 70 [mm]	CAF[3] N ≥ 60 [mm]
Apartment ceiling separating heated rooms						
EN 1264-4	Klett EPS 35-3 = 35	0,75	33	32	≥ 121 (119)	≥ 111 (109)
Floor slabs[1], ceilings against unheated rooms in residential and non-residential buildings						
EN 1264-4	Klett EPS 35-3 = 35 EPS-DEO 20 = 20 Total H = 55	1,32	33	32	≥ 141 (139)	≥ 131 (129)
Floor ceilings against outside air in residential and non-residential buildings (ϑi ≥ 19 °C)						
EN 1264-4	Klett EPS 35-3 = 35 EPS-DEO 45 = 45 Total H = 80	2,04	33	32	≥ 166 (164)	≥ 156 (154)

[1] Observe additional construction height for structural waterproofing (refer to DIN 18533). Groundwater level ≥ 5 m.
[2] Observe dimensional tolerances at building site (refer to DIN 18202, Tab.2 and 3).
[3] Observe manufacturer's descriptions regarding the minimum screed thickness.

Uponor Klett Silent 30-3

Thermal insulation requirements	Insulation layer thickness	Thermal resistance of insulation	Impact sound improvement factor of tested flooring ΔLw,P [dB][4] ΔLw [dB][3]		Structural height A (2,0 kN/m²)[2]	
	H [mm]	$R_{\lambda, ins}$ [m² K/W]	CT[4] N ≥ 45 [mm]	CAF[3] N ≥ 35 [mm]	CT N ≥ 45 [mm]	CAF[3] N ≥ 35 [mm]
Apartment ceiling separating heated rooms						
EN 1264-4	Klett Silent 30-3 = 30	0,86	31	28	≥ 91 (89)	≥ 81 (79)
Floor slabs[1], ceilings against unheated rooms in residential and non-residential buildings						
EN 1264-4	Klett Silent 30-3 = 30 EPS-DEO 15 = 15 Total H = 45	1,29	31	28	≥ 106 (104)	≥ 96 (94)
Floor ceilings against outside air in residential and non-residential buildings (ϑi ≥ 19 °C)						
EN 1264-4	Klett Silent 30-3 = 30 EPS-DEO 40 = 40 Total H = 70	2,00	31	28	≥ 131 (129)	≥ 121 (119)

Thermal insulation requirements	Insulation layer thickness	Thermal resistance of insulation	Impact sound improvement factor of flooring ΔLw [dB]		Structural height A (5,0 kN/m²)[2]	
	H [mm]	R_{λ}, ins [m² K/W]	CT N ≥ 75 [mm]	CAF[3] N ≥ 65 [mm]	CT N ≥ 75 [mm]	CAF[3] N ≥ 65 [mm]
Apartment ceiling separating heated rooms						
EN 1264-4	Klett Silent 30-3 = 30	0,86	32	31	≥ 121 (119)	≥ 111 (109)
Floor slabs[1]), ceilings against unheated rooms in residential and non-residential buildings						
EN 1264-4	Klett Silent 30-3 = 30 EPS-DEO 15 = 15 Total H = 45	1,29	32	31	≥ 136 (134)	≥ 126 (124)
Floor ceilings against outside air in residential and non-residential buildings (ϑi ≥ 19 °C)						
EN 1264-4	Klett Silent 30-3 = 30 EPS-DEO 40 = 40 Total H = 70	2,00	32	31	≥ 161 (159)	≥ 151 (149)

[1] Observe dimensional tolerances at building site (refer to DIN 18202, Tab.2 and 3).
[2] Observe additional construction height for structural waterproofing (refer to DIN 18533). Groundwater level ≥ 5 m.
[3] Observe manufacturer's descriptions regarding the minimum screed thickness.
[4] With 48 mm CT covering, measurement and evaluation of Uponor Klett Silent for proof of sound insulation suitability has been conducted by accredited testing laboratories or a suitable certification body. The measured values enable evaluation as per the standard while considering the insulation materials and screeds actually used.

Uponor Klett 30-3

Thermal insulation requirements	Insulation layer thickness	Thermal resistance of insulation	Impact sound improvement factor of flooring ΔLw [dB]		Structural height A (2,0 kN/m²)[2]	
	H [mm]	$R_{\lambda, ins}$ [m² K/W]	CT N ≥ 45 [mm]	CAF[3] N ≥ 35 [mm]	CT N ≥ 45 [mm]	CAF[3] N ≥ 35 [mm]
Apartment ceiling separating heated rooms						
EN 1264-4	Klett EPS 30-3 = 30 EPS-DEO 10 = 10 Total H = 40	0,94	29	28	≥ 101 (99)	≥ 91 (89)
Floor slabs[1]), ceilings against unheated rooms in residential and non-residential buildings						
EN 1264-4	Klett EPS 30-3 = 30 EPS-DEO 25 = 25 Total H = 55	1,36	29	28	≥ 116 (114)	≥ 106 (104)
Floor ceilings against outside air in residential and non-residential buildings (ϑi ≥ 19 °C)						
EN 1264-4	Klett EPS 30-3 = 30 EPS-DEO 50 = 50 Total H = 80	2,08	29	28	≥ 141 (139)	≥ 131 (129)

Thermal insulation requirements	Insulation layer thickness	Thermal resistance of insulation	Impact sound improvement factor of flooring ΔLw [dB]		Structural height A (4,0 kN/m²)[2]	
	H [mm]	R_{λ}, ins [m² K/W]	CT N ≥ 70 [mm]	CAF[3] N ≥ 60 [mm]	CT N ≥ 70 [mm]	CAF[3] N ≥ 60 [mm]
Apartment ceiling separating heated rooms						
EN 1264-4	Klett EPS 30-3 = 30 EPS-DEO 10 = 10 Total H = 40	0,94	31	31	≥ 126 (124)	≥ 116 (114)
Floor slabs[1], ceilings against unheated rooms in residential and non-residential buildings						
EN 1264-4	Klett EPS 30-3 = 30 EPS-DEO 25 = 25 Total H = 55	1,36	31	31	≥ 141 (139)	≥ 131 (129)
Floor ceilings against outside air in residential and non-residential buildings (ϑi ≥ 19 °C)						
EN 1264-4	Klett EPS 30-3 = 30 EPS-DEO 50 = 50 Total H = 80	2,08	31	31	≥ 166 (164)	≥ 156 (154)

[1] Observe additional construction height for structural waterproofing (refer to DIN 18533). Groundwater level ≥ 5 m.
[2] Observe dimensional tolerances at building site (refer to DIN 18202, Tab.2 and 3).
[3] Observe manufacturer's descriptions regarding the minimum screed thickness.

Uponor Klett 30-2

Thermal insulation requirements	Insulation layer thickness	Thermal resistance of insulation	Impact sound improvement factor of flooring ΔLw [dB]		Structural height A (2,0 kN/m²)[2]	
	H [mm]	$R_{\lambda, ins}$ [m² K/W]	CT N ≥ 45 [mm]	CAF[3] N ≥ 35 [mm]	CT N ≥ 45 [mm]	CAF[3] N ≥ 35 [mm]
Apartment ceiling separating heated rooms						
EN 1264-4	Klett EPS 30-2 = 30	0,75	29	28	≥ 91 (89)	≥ 81 (79)
Floor slabs[1], ceilings against unheated rooms in residential and non-residential buildings						
EN 1264-4	Klett EPS 30-2 = 30 EPS-DEO 20 = 20 Total H = 50	1,32	29	28	≥ 111 (109)	≥ 101 (99)
Floor ceilings against outside air in residential and non-residential buildings (ϑi ≥ 19 °C)						
EN 1264-4	Klett EPS 30-2 = 30 EPS-DEO 45 = 45 Total H = 75	2,04	29	28	≥ 136 (134)	≥ 126 (124)

Thermal insulation requirements	Insulation layer thickness	Thermal resistance of insulation	Impact sound improvement factor of flooring ΔLw [dB]		Structural height A (5,0 kN/m²)[2]	
	H [mm]	R_{λ}, ins [m² K/W]	CT N ≥ 75 [mm]	CAF[3] N ≥ 65 [mm]	CT N ≥ 75 [mm]	CAF[3] N ≥ 65 [mm]
Apartment ceiling separating heated rooms						
EN 1264-4	Klett EPS 30-2 = 30	0,75	32	31	≥ 121 (119)	≥ 111 (109)

Thermal insulation requirements	Insulation layer thickness	Thermal resistance of insulation	Impact sound improvement factor of flooring ΔLw [dB]		Structural height A (5,0 kN/m²)[2]	
	H [mm]	R_{λ}, ins [m² K/W]	CT N ≥ 75 [mm]	CAF[3] N ≥ 65 [mm]	CT N ≥ 75 [mm]	CAF[3] N ≥ 65 [mm]
Floor slabs[1]), ceilings against unheated rooms in residential and non-residential buildings						
EN 1264-4	Klett EPS 30-2 = 30 EPS-DEO 20 = 20 Total H = 50	1,32	32	31	≥ 141 (139)	≥ 131 (129)
Floor ceilings against outside air in residential and non-residential buildings (ϑi ≥ 19 °C)						
EN 1264-4	Klett EPS 30-2 = 30 EPS-DEO 45 = 45 Total H = 75	2,04	32	31	≥ 166 (164)	≥ 156 (154)

[1] Observe additional construction height for structural waterproofing (refer to DIN 18533). Groundwater level ≥ 5 m.
[2] Observe dimensional tolerances at building site (refer to DIN 18202, Tab.2 and 3).
[3] Observe manufacturer's descriptions regarding the minimum screed thickness.

Uponor Klett WLS 032 – 25-2

Thermal insulation requirements	Insulation layer thickness	Thermal resistance of insulation	Impact sound improvement factor of flooring ΔLw [dB]		Structural height A (2,0 kN/m²)[2]	
	H [mm]	$R_{\lambda, ins}$ [m² K/W]	CT N ≥ 45 [mm]	CAF[3] N ≥ 35 [mm]	CT N ≥ 45 [mm]	CAF[3] N ≥ 35 [mm]
Apartment ceiling separating heated rooms						
EN 1264-4	Klett EPS 25-2 = 25	0,75	27	26	≥ 86 (84)	≥ 76 (74)
Floor slabs[1]), ceilings against unheated rooms in residential and non-residential buildings						
EN 1264-4	Klett EPS 25-2 = 25 EPS-DEO 20 = 20 Total H = 45	1,32	27	26	≥ 106 (104)	≥ 96 (94)
Floor ceilings against outside air in residential and non-residential buildings (ϑi ≥ 19 °C)						
EN 1264-4	Klett EPS 25-2 = 25 EPS-DEO 45 = 45 Total H = 70	2,04	27	26	≥ 131 (129)	≥ 121 (119)

Thermal insulation requirements	Insulation layer thickness	Thermal resistance of insulation	Impact sound improvement factor of flooring ΔLw [dB]		Structural height A (5,0 kN/m²)[2]	
	H [mm]	R_{λ}, ins [m² K/W]	CT N ≥ 75 [mm]	CAF[3] N ≥ 65 [mm]	CT N ≥ 75 [mm]	CAF[3] N ≥ 65 [mm]
Apartment ceiling separating heated rooms						
EN 1264-4	Klett EPS 25-2 = 25	0,75	29	28	≥ 116 (114)	≥ 106 (104)
Floor slabs[1]), ceilings against unheated rooms in residential and non-residential buildings						
EN 1264-4	Klett EPS 25-2 = 25 EPS-DEO 20 = 20 Total H = 45	1,32	29	28	≥ 136 (134)	≥ 126 (124)

Thermal insulation requirements	Insulation layer thickness	Thermal resistance of insulation	Impact sound improvement factor of flooring ΔLw [dB]		Structural height A (5,0 kN/m²)[2]	
	H [mm]	R_{λ}, ins [m² K/W]	CT N ≥ 75 [mm]	CAF[3] N ≥ 65 [mm]	CT N ≥ 75 [mm]	CAF[3] N ≥ 65 [mm]
Floor ceilings against outside air in residential and non-residential buildings (ϑi ≥ 19 °C)						
EN 1264-4	Klett EPS 25-2 = 25 EPS-DEO 45 = 45 Total H = 70	2,04	29	28	≥ 161 (159)	≥ 151 (149)

[1] Observe additional construction height for structural waterproofing (refer to DIN 18533). Groundwater level ≥ 5 m.
[2] Observe dimensional tolerances at building site (refer to DIN 18202, Tab.2 and 3).
[3] Observe manufacturer's descriptions regarding the minimum screed thickness.

Uponor Klett 25-2

Thermal insulation requirements	Insulation layer thickness	Thermal resistance of insulation	Impact sound improvement factor of flooring ΔLw [dB]		Structural height A (2,0 kN/m²)[2]	
	H [mm]	$R_{\lambda, ins}$ [m² K/W]	CT N ≥ 45 [mm]	CAF[3] N ≥ 35 [mm]	CT N ≥ 45 [mm]	CAF[3] N ≥ 35 [mm]
Apartment ceiling separating heated rooms						
EN 1264-4	Klett EPS 25-2 = 25 EPS-DEO 10 = 10 Total H = 35	0,89	27	26	≥ 96 (94)	≥ 86 (84)
Floor slabs[1]), ceilings against unheated rooms in residential and non-residential buildings						
EN 1264-4	Klett EPS 25-2 = 25 EPS-DEO 25 = 25 Total H = 50	1,31	27	26	≥ 111 (109)	≥ 101 (99)
Floor ceilings against outside air in residential and non-residential buildings (ϑi ≥ 19 °C)						
EN 1264-4	Klett EPS 25-2 = 25 EPS-DEO 50 = 50 Total H = 75	2,03	27	26	≥ 136 (134)	≥ 126 (124)

Thermal insulation requirements	Insulation layer thickness	Thermal resistance of insulation	Impact sound improvement factor of flooring ΔLw [dB]		Structural height A (5,0 kN/m²)[2]	
	H [mm]	R_{λ}, ins [m² K/W]	CT N ≥ 75 [mm]	CAF[3] N ≥ 65[mm]	CT N ≥ 75 [mm]	CAF[3] N ≥ 65 [mm]
Apartment ceiling separating heated rooms						
EN 1264-4	Klett EPS 25-2 = 25 EPS-DEO 10 = 10 Total H = 35	0,89	29	28	≥ 126 (124)	≥ 116 (114)
Floor slabs[1]), ceilings against unheated rooms in residential and non-residential buildings						
EN 1264-4	Klett EPS 25-2 = 25 EPS-DEO 25 = 25 Total H = 50	1,31	29	28	≥ 141 (139)	≥ 131 (129)
Floor ceilings against outside air in residential and non-residential buildings (ϑi ≥ 19 °C)						
EN 1264-4	Klett EPS 25-2 = 25 EPS-DEO 50 = 50 Total H = 75	2,03	29	28	≥ 166 (164)	≥ 156 (154)

[1] Observe additional construction height for structural waterproofing (refer to DIN 18533). Groundwater level ≥ 5 m.
[2] Observe dimensional tolerances at building site (refer to DIN 18202, Tab.2 and 3).
[3] Observe manufacturer's descriptions regarding the minimum screed thickness.

2.2 Design tables for cement screed load distribution layer

The following design tables facilitate fast and generally applicable determination of the installation distance and the max. heating circuit size. They do not replace detailed planning and calculation.

When using wet screed, the following points must be particularly observed:

- The entire surface must be sealed without gaps (trough design).
- The continuous operating temperatures must not exceed 55 °C.

Nominal thickness 45 mm, thermal conductivity 1,2 W/mK (pipe dimension 14 mm)

ϑi = 20 °C, Rλ,B = 0,15 m²K/W

		$\vartheta_{V,des}$ = 55,5 °C[1]		$\vartheta_{V,des}$ = 50 °C		$\vartheta_{V,des}$ = 45 °C	
$\vartheta_{F,m}$ (C)	q_{des} (W/m²)	T (cm)	$A_{F,max}$ (m²)	T (cm)	$A_{F,max}$ (m²)	T (cm)	$A_{F,max}$ (m²)
29	100	10	5				
28,6	95	10	7,5				
28,2	90	10	10				
27,8	85	15	10	10	5		
27,3	80	15	13	10	7,5		
26,9	75	20	13,5	10	10,5		
26,5	70	25	14	15	11,5	10	5,5
26,1	65	25	19	20	12,5	10	9
25,7	60	30	20,5	25	13	15	10
25,2	55	30	26,5	25	18,5	15	14
24,8	50	30	32	30	22	20	17
24,4	45	30	38	30	28,5	25	19,5
≤ 23,9	≤ 40	30	42	30	35	30	24,5

ϑi = 24 °C, Rλ,B = 0,02 m²K/W (bathrooms)

		$\vartheta_{V,des}$ = 55,5 °C[1]		$\vartheta_{V,des}$ = 50 °C		$\vartheta_{V,des}$ = 45 °C	
$\vartheta_{F,m}$ (C)	q_{des} (W/m²)	T (cm)	$A_{F,max}$ (m²)	T (cm)	$A_{F,max}$ (m²)	T (cm)	$A_{F,max}$ (m²)
33	100	10	14	10	11,5	10	6
32,6	95	10	14	10	12,5	10	7,5
32,2	90	10	14	10	14	10	8,5
31,8	85	10	14	10	14	10	10
31,3	80	10	14	10	14	10	11,5
30,9	75	10	14	10	14	10	13
30,5	70	10	14	10	14	10	14
≤ 30,1	≤ 65	10	14	10	14	10	14

The information in these design tables are based on the following basic data:

$R_{\lambda,ins}$ = 0,75 m²K/W, ϑ_u = 20 °C, concrete ceiling 130 mm, spread = 3 - 30 K, max. heating circuit length = 150 m, max. pressure loss per heating circuit (incl. 2 x 5 m manifold connecting line)

Δp_{max}= 250 mbar. In case of other supply temperatures, thermal resistances or basic data, please use design charts.

[1] In case of $\vartheta_{V,des}$ > 55,5 °C, the max. limit of specific thermal output and the max. floor surface temperature of 29 °C or 33 °C (bathroom) is exceeded.

Nominal thickness 45 mm, thermal conductivity 1,2 W/mK (pipe dimension 16 mm)

ϑi = 20 °C, Rλ,B = 0,15 m²K/W

		$\vartheta_{V,des}$ = 54,9 °C[1)]		$\vartheta_{V,des}$ = 50 °C		$\vartheta_{V,des}$ = 45 °C	
$\vartheta_{F,m}$ (C)	q_{des} (W/m²)	T (cm)	$A_{F,max}$ (m²)	T (cm)	$A_{F,max}$ (m²)	T (cm)	$A_{F,max}$ (m²)
29	100	10	9				
28,6	95	10	13				
28,2	90	15	12,5				
27,8	85	15	17,5	10	10		
27,3	80	20	18	10	14		
26,9	75	20	21	15	15,5		
26,5	70	25	27	20	16	10	11
26,1	65	25	35	20	23,5	10	14
25,7	60	30	36	25	27,5	15	19
25,2	55	30	42	25	35	20	22
24,8	50	30	42	30	39,5	20	28
24,4	45	30	42	30	42	25	35
≤ 23,9	≤ 40	30	42	30	42	30	40,5

ϑi = 24 °C, Rλ,B = 0,02 m²K/W (bathrooms)

		$\vartheta_{V,des}$ = 54,9 °C[1)]		$\vartheta_{V,des}$ = 50 °C		$\vartheta_{V,des}$ = 45 °C	
$\vartheta_{F,m}$ (C)	q_{des} (W/m²)	T (cm)	$A_{F,max}$ (m²)	T (cm)	$A_{F,max}$ (m²)	T (cm)	$A_{F,max}$ (m²)
33	100	10	14	10	14	10	12
32,6	95	10	14	10	14	10	14
32,2	90	10	14	10	14	10	14
31,8	85	10	14	10	14	10	14
31,3	80	10	14	10	14	10	14
30,9	75	10	14	10	14	10	14
30,5	70	10	14	10	14	10	14
≤ 30,1	≤ 65	10	14	10	14	10	14

The information in these design tables are based on the following basic data:

$R_{\lambda,ins}$ = 0,75 m²K/W, ϑ_u = 20 °C, concrete ceiling 130 mm, spread = 3 – 30 K, max. heating circuit length = 150 m, max. pressure loss per heating circuit (incl. 2 x 5 m manifold connecting line) Δp_{max}= 250 mbar. In case of other supply temperatures, thermal resistances or basic data, please use design charts.

[1)] In case of $\vartheta_{V,des}$ > 54,9 °C, the max. limit of specific thermal output and the max. floor surface temperature of 29 °C or 33 °C (bathroom) is exceeded.

2.3 Dimensioning diagrams

Bathrooms, showers, toilets and the like are excluded when determining the design flow temperature.

The limit curves must not be exceeded.

$\triangle\vartheta_{H,G}$ is found through the limit curve for the occupied zone with the smallest pipe spacing.

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

In cooling mode the supply water temperature depends on the dew point temperature, therefore a humidity sensor has to be installed.

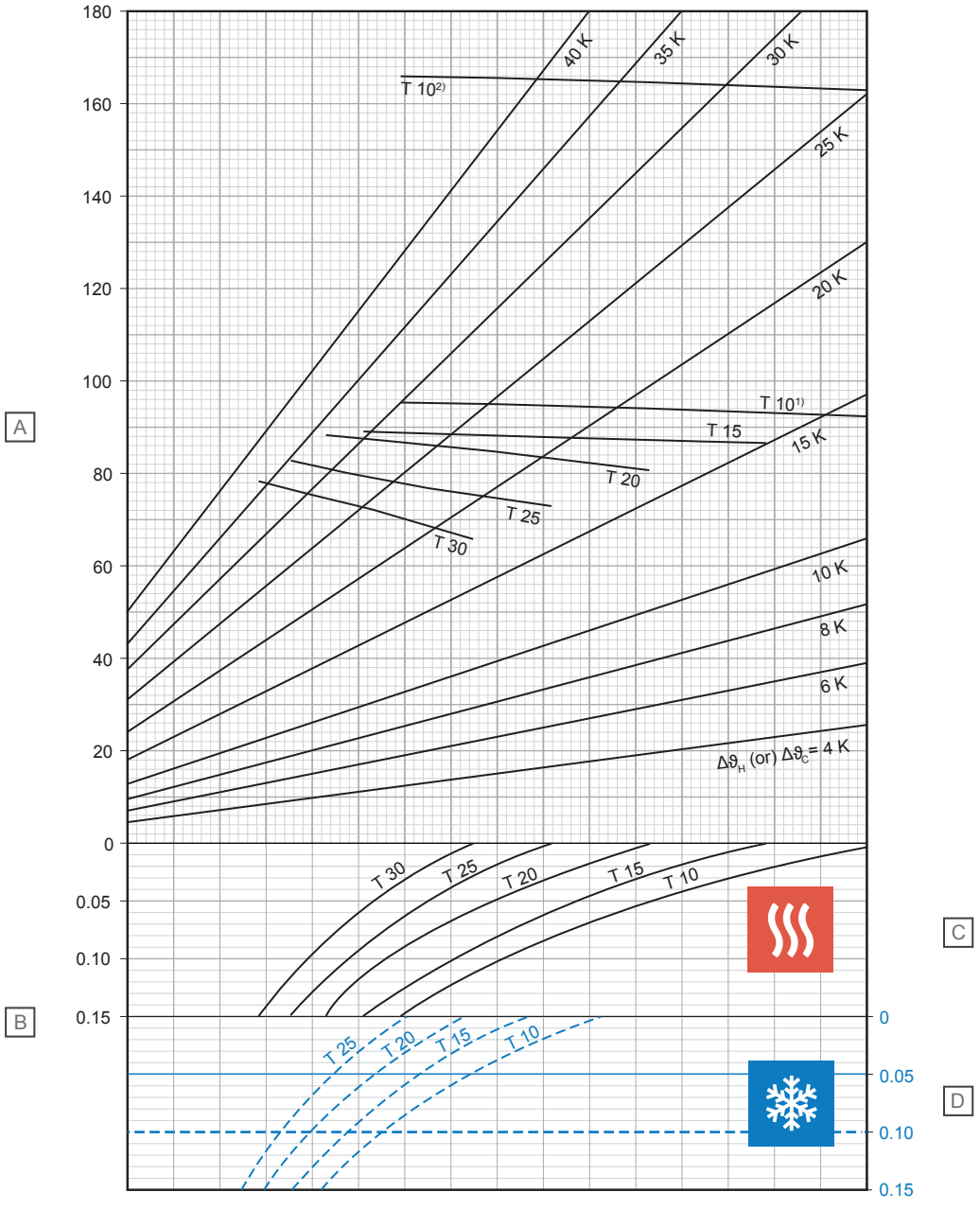
The following diagrams results are accurate and in accordance with EN 1264.

Abbreviations

These abbreviations are used in the following diagrams:

Abbreviations	Unit	Description
$A_{F,max}$	m^2	Maximum surface area of the heating/ cooling area
q_c	W/m^2	Specific thermal output of embedded cooling systems
q_{des}	W/m^2	Design specific thermal output of floor heating systems
$q_{G,max}$	W/m^2	Maximum limit of specific thermal output of floor heating systems
q_H	W/m^2	Specific thermal output of embedded heating systems, excluding floor heating
q_N	W/m^2	Standard thermal output of floor heating systems
$R_{\lambda,B}$	m^2 K/W	Thermal resistance of floor covering effective thermal resistance of carped covering
$R_{\lambda,ins}$	m^2 K/W	Thermal resistance of thermal insulation
s_u	mm	Thickness of the layer above the pipe
T	cm	Pipe spacing
$\vartheta_{F,max}$	°C	Maximum floor surface temperature
ϑ_H	°C	Average temperature of the heating medium
ϑ_i	°C	Standard indoor room temperature
$\Delta\vartheta_c$	K	Temperature difference between room and cooling medium for cooling systems
$\Delta\vartheta_{C,N}$	K	Standard temperature difference between room and cooling medium for cooling systems
$\Delta\vartheta_H$	K	Temperature difference between heating medium and room
$\Delta\vartheta_{H,G}$	K	Limit temperature difference between heating medium and room for floor heating systems
$\Delta\vartheta_{H,N}$	K	Standard temperature difference between heating medium and room for heating systems, with the exception of floor heating
$\Delta\vartheta_{V,des}$	K	Design temperature difference between flow of heating medium and room of floor heating systems, determined by room with q_{max}
λ_u	W/mK	Thermal conductivity

Uponor Klett Comfort Pipe PLUS 14 x 2,0 mm with screed load distribution layer (su = 35 mm with λu = 1,2 W/mK)



Item	Unit	Description
A	W/m²	Specific thermal heating or cooling output [q_H or q_C]
B	m²K/W	Thermal resistance [$R_{\lambda,B}$]

C - Heating

T (cm)	q_H (W/m²)	$\Delta\vartheta_{H,N}$ (K)
10	92,3	13,7
15	86,4	15,0
20	80,5	16,3
25	72,9	17,2
30	65,5	17,9

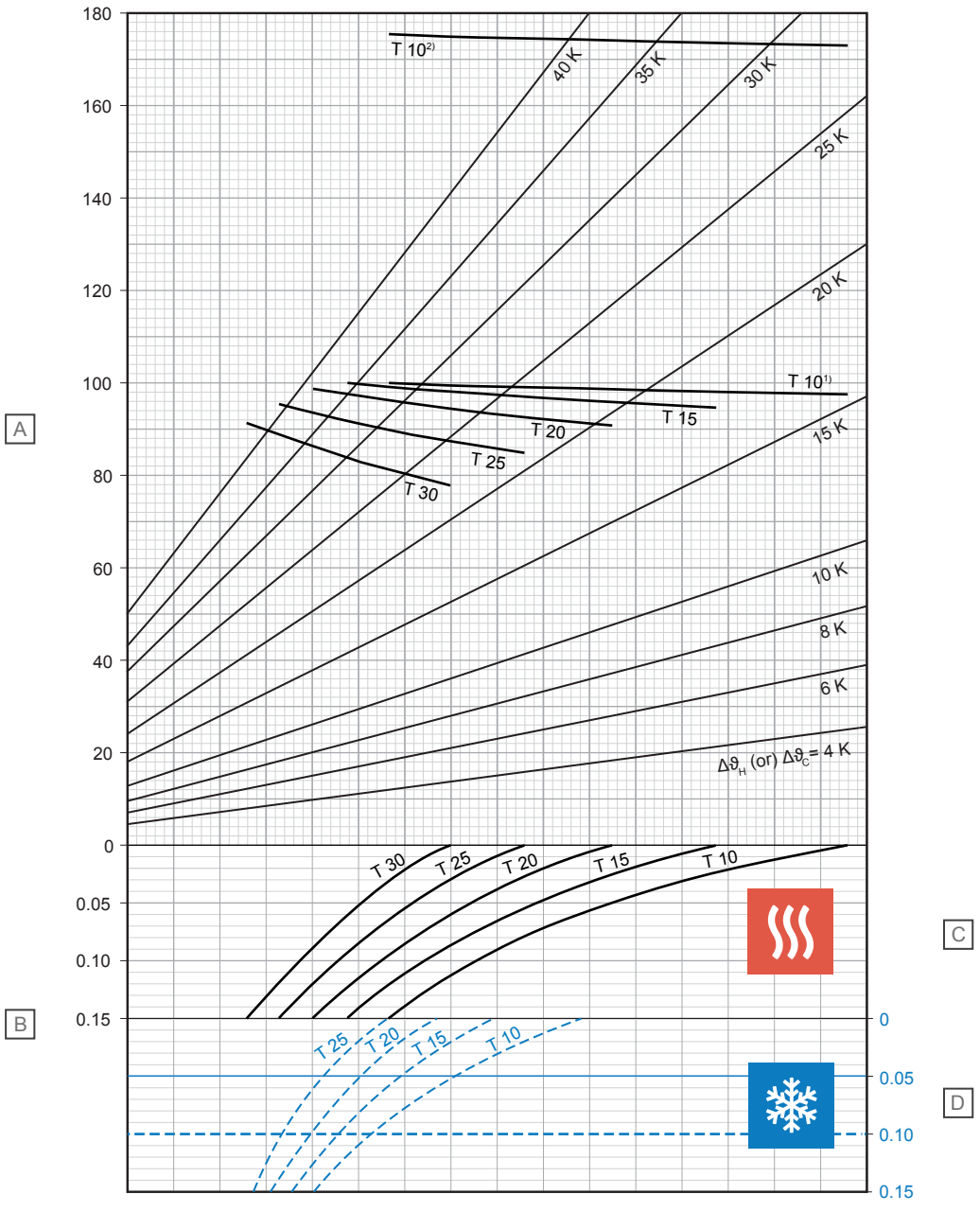
D - Cooling

T (cm)	q_C (W/m²)	$\Delta\vartheta_{C,N}$ (K)
10	37,0	8
15	32,7	8
20	29,0	8
25	25,8	8

[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

Uponor Klett Comfort Pipe PLUS 14 x 2,0 mm with screed load distribution layer (su = 45 mm with λu = 1,2 W/mK)



Item	Unit	Description
A	W/m²	Specific thermal heating or cooling output [q_H or q_C]
B	m²K/W	Thermal resistance [$R_{\lambda,B}$]

C - Heating

T (cm)	q_H (W/m²)	$\Delta\vartheta_{H,N}$ (K)
10	97,7	15,4
15	94,8	17,5
20	90,9	19,4
25	84,9	20,9
30	77,7	22,0

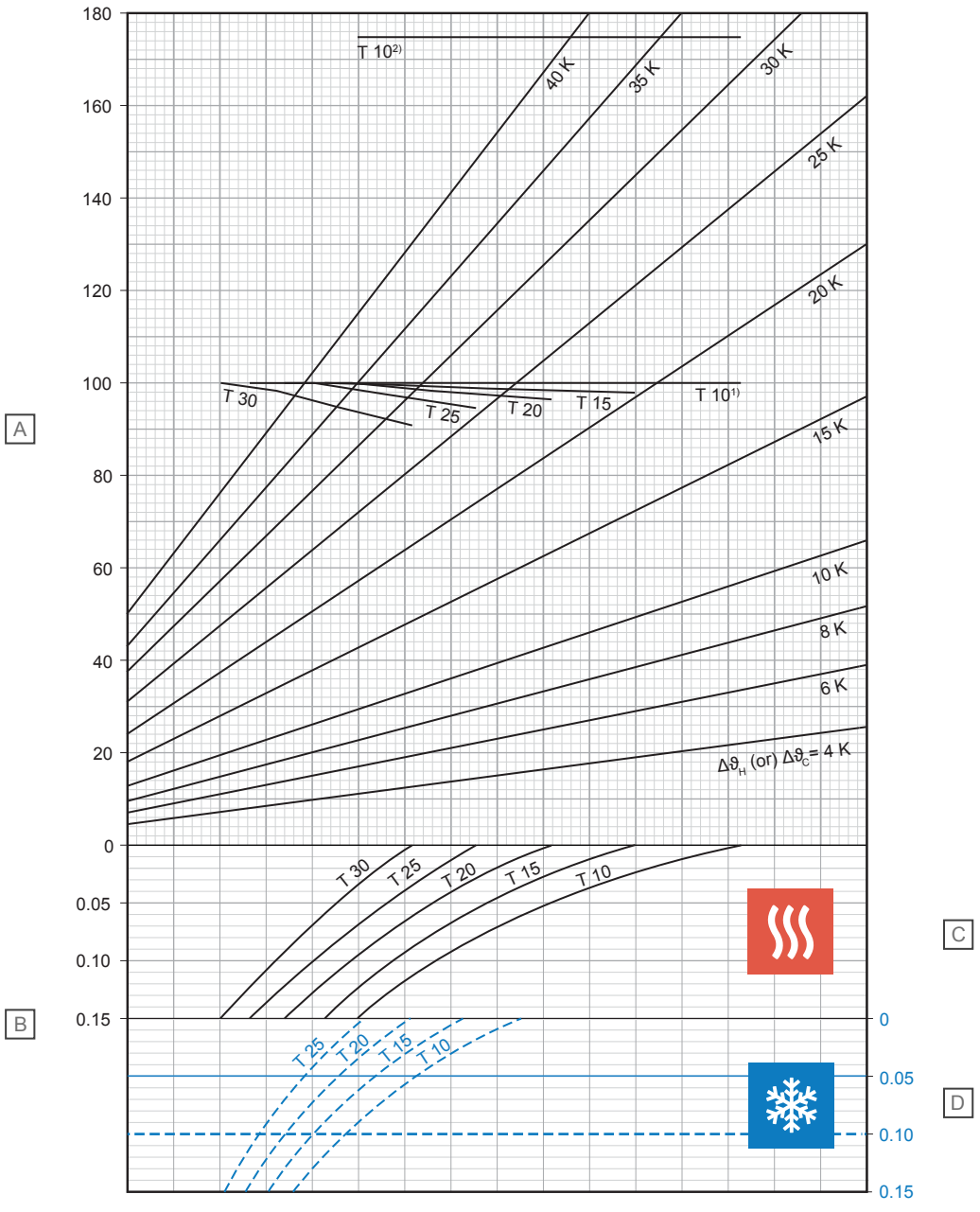
D - Cooling

T (cm)	q_C (W/m²)	$\Delta\vartheta_{C,N}$ (K)
10	35,4	8
15	31,4	8
20	28,0	8
25	24,9	8

[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

Uponor Klett Comfort Pipe PLUS 14 x 2,0 mm with screed load distribution layer (su = 65 mm with λu = 1,2 W/mK)



Item	Unit	Description
A	W/m²	Specific thermal heating or cooling output [q_H or q_C]
B	m²K/W	Thermal resistance [$R_{\lambda,B}$]

C - Heating

T (cm)	q_H (W/m²)	$\Delta\vartheta_{H,N}$ (K)
10	100,0	17,9
15	98,1	20,2
20	96,6	22,7
25	94,7	25,5
30	90,9	27,9

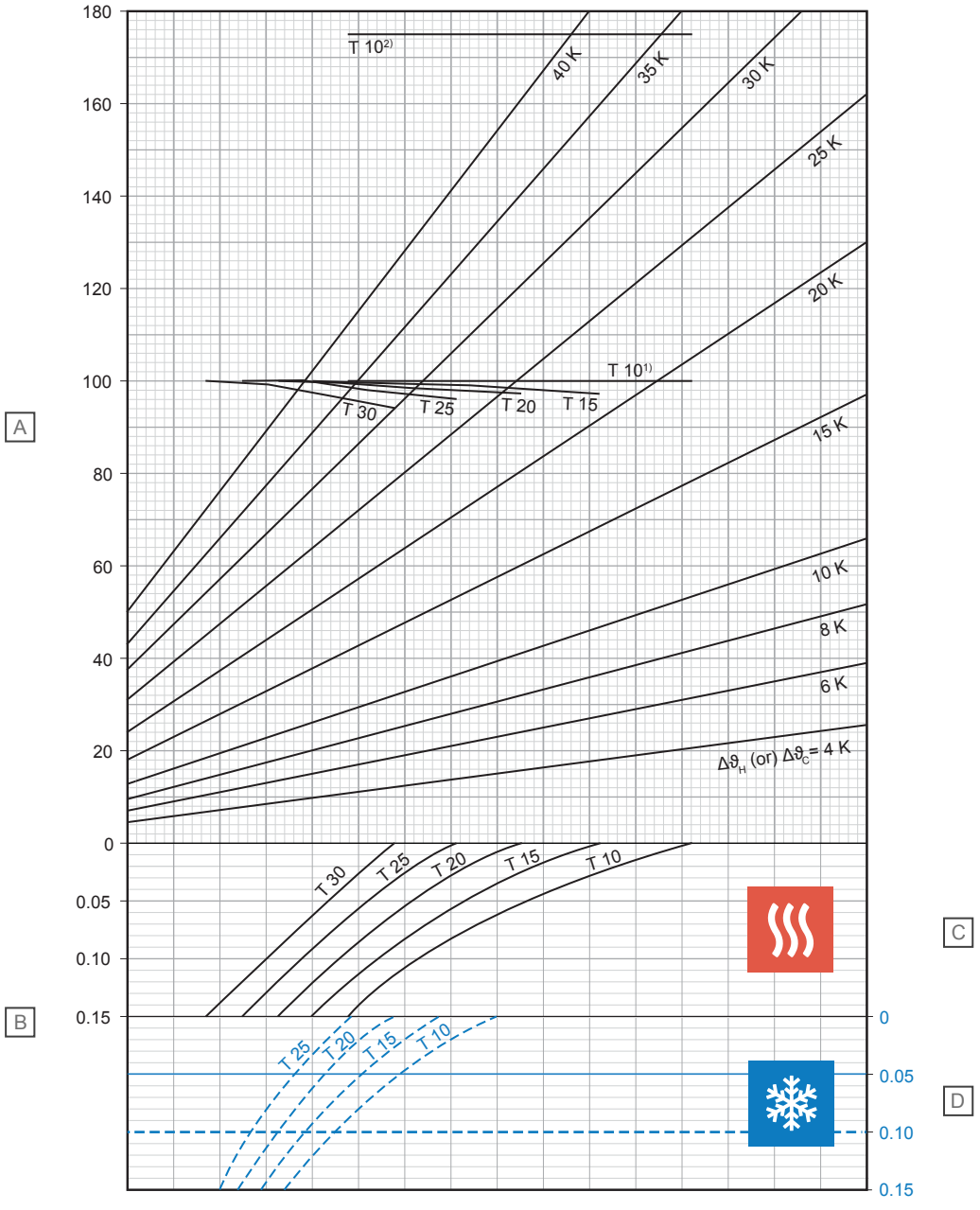
D - Cooling

T (cm)	q_C (W/m²)	$\Delta\vartheta_{C,N}$ (K)
10	32,3	8
15	28,9	8
20	26	8
25	23,3	8

[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

Uponor Klett Comfort Pipe PLUS 14 x 2,0 mm with screed load distribution layer (su = 75 mm with λu = 1,2 W/mK)



Item	Unit	Description
A	W/m²	Specific thermal heating or cooling output [q_H or q_C]
B	m²K/W	Thermal resistance [$R_{\lambda,B}$]

C - Heating

T (cm)	q_H (W/m²)	$\Delta\vartheta_{H,N}$ (K)
10	100,0	19,0
15	98,8	21,5
20	97,5	24,1
25	96,1	27,0
30	94,2	30,0

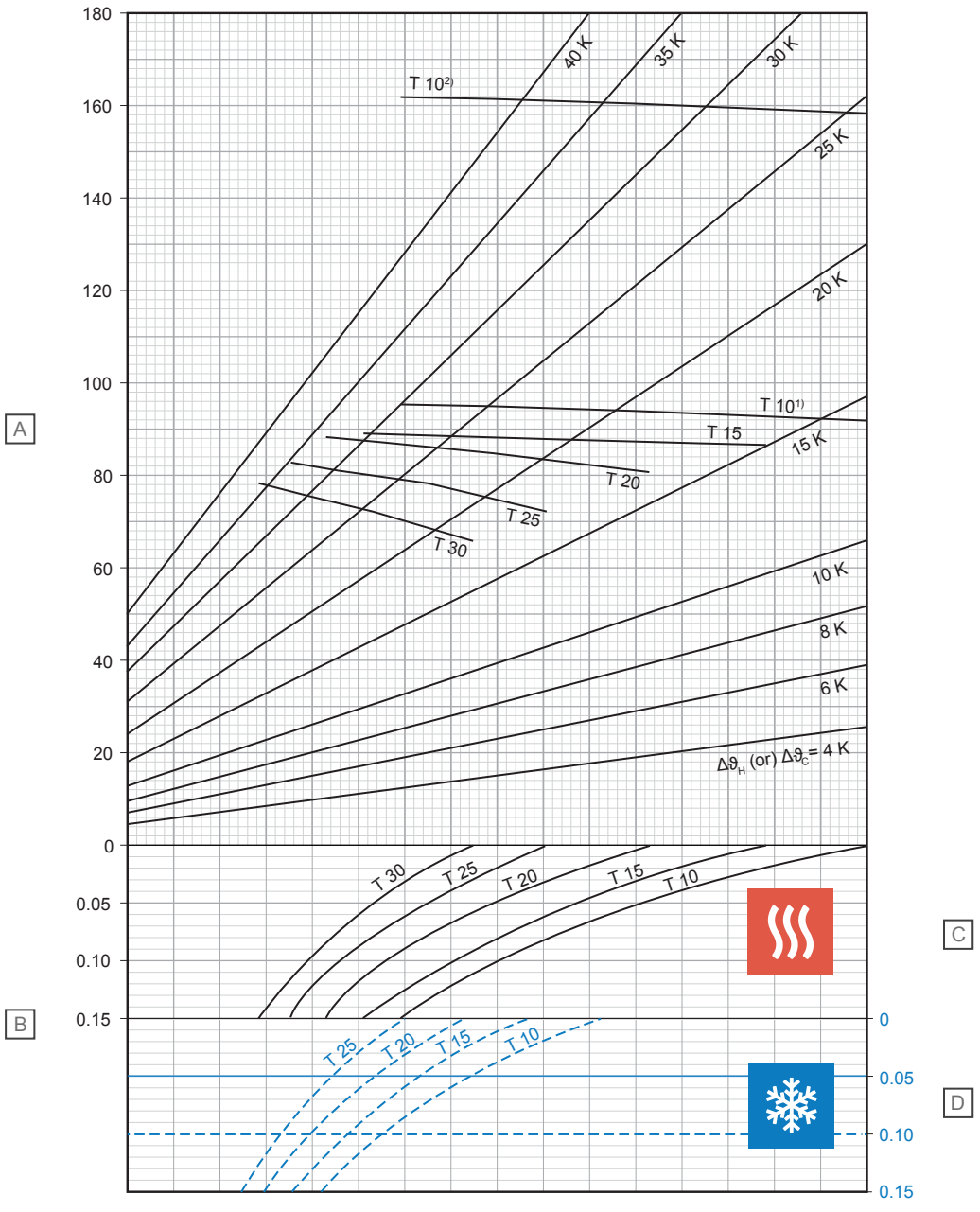
D - Cooling

T (cm)	q_C (W/m²)	$\Delta\vartheta_{C,N}$ (K)
10	30,9	8
15	27,8	8
20	25,0	8
25	22,6	8

[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

Uponor Klett Comfort Pipe PLUS 16 x 2,0 mm with screed load distribution layer (su = 35 mm with λu = 1,2 W/mK)



Item	Unit	Description
A	W/m²	Specific thermal heating or cooling output [q_H or q_C]
B	m²K/W	Thermal resistance [$R_{\lambda,B}$]

C - Heating

T (cm)	q_H (W/m²)	$\Delta\vartheta_{H,N}$ (K)
10	92,2	13,5
15	86,2	14,7
20	80,3	15,9
25	72,5	16,7
30	64,9	17,3

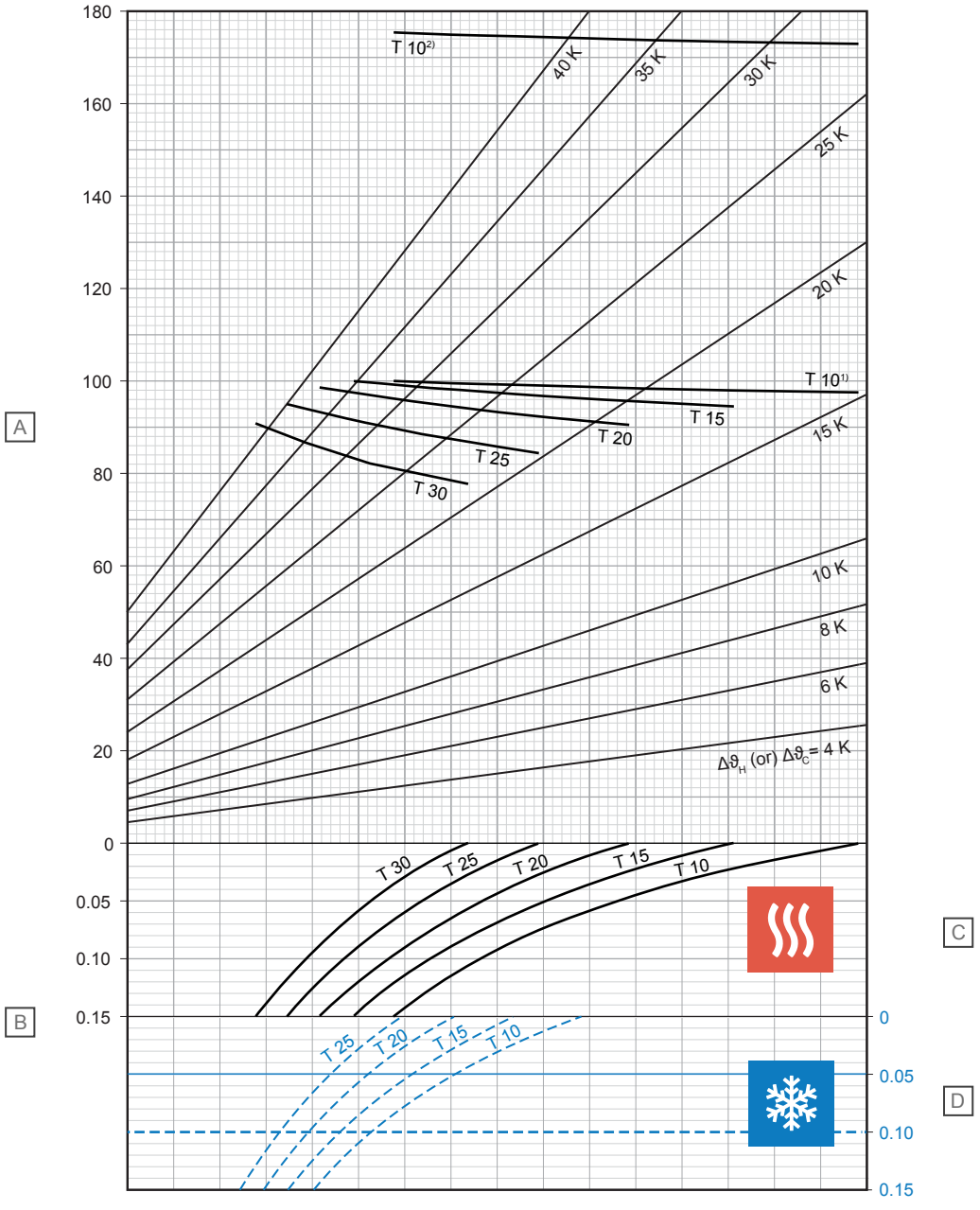
D - Cooling

T (cm)	q_C (W/m²)	$\Delta\vartheta_{C,N}$ (K)
10	37,4	8
15	33,2	8
20	29,6	8
25	26,3	8

[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

Uponor Klett Comfort Pipe PLUS 16 x 2,0 mm with screed load distribution layer (su = 45 mm with λu = 1,2 W/mK)



Item	Unit	Description
A	W/m²	Specific thermal heating or cooling output [q_H or q_C]
B	m²K/W	Thermal resistance [$R_{\lambda,B}$]

C - Heating

T (cm)	q_H (W/m²)	$\Delta\vartheta_{H,N}$ (K)
10	97,7	15,2
15	94,7	17,1
20	90,6	18,9
25	84,4	20,3
30	77,0	21,3

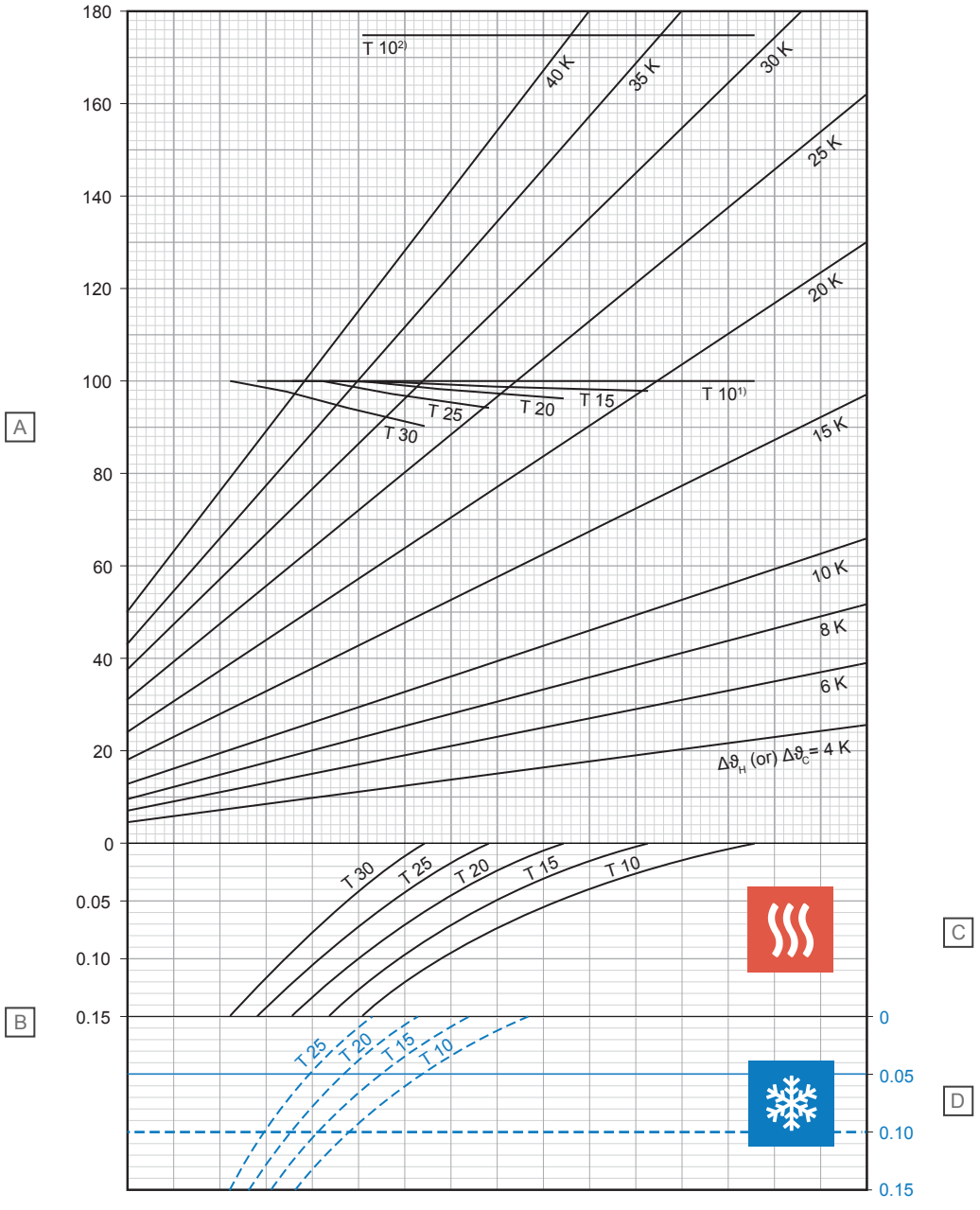
D - Cooling

T (cm)	q_C (W/m²)	$\Delta\vartheta_{C,N}$ (K)
10	35,8	8
15	31,9	8
20	28,5	8
25	25,4	8

[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

Uponor Klett Comfort Pipe PLUS 16 x 2,0 mm with screed load distribution layer (su = 65 mm with λu = 1,2 W/mK)



Item	Unit	Description
A	W/m²	Specific thermal heating or cooling output [q_H or q_C]
B	m²K/W	Thermal resistance [$R_{\lambda,B}$]

C - Heating

T (cm)	q_H (W/m²)	$\Delta\vartheta_{H,N}$ (K)
10	100,0	17,6
15	98,0	19,8
20	96,4	22,2
25	94,3	24,8
30	90,3	27,0

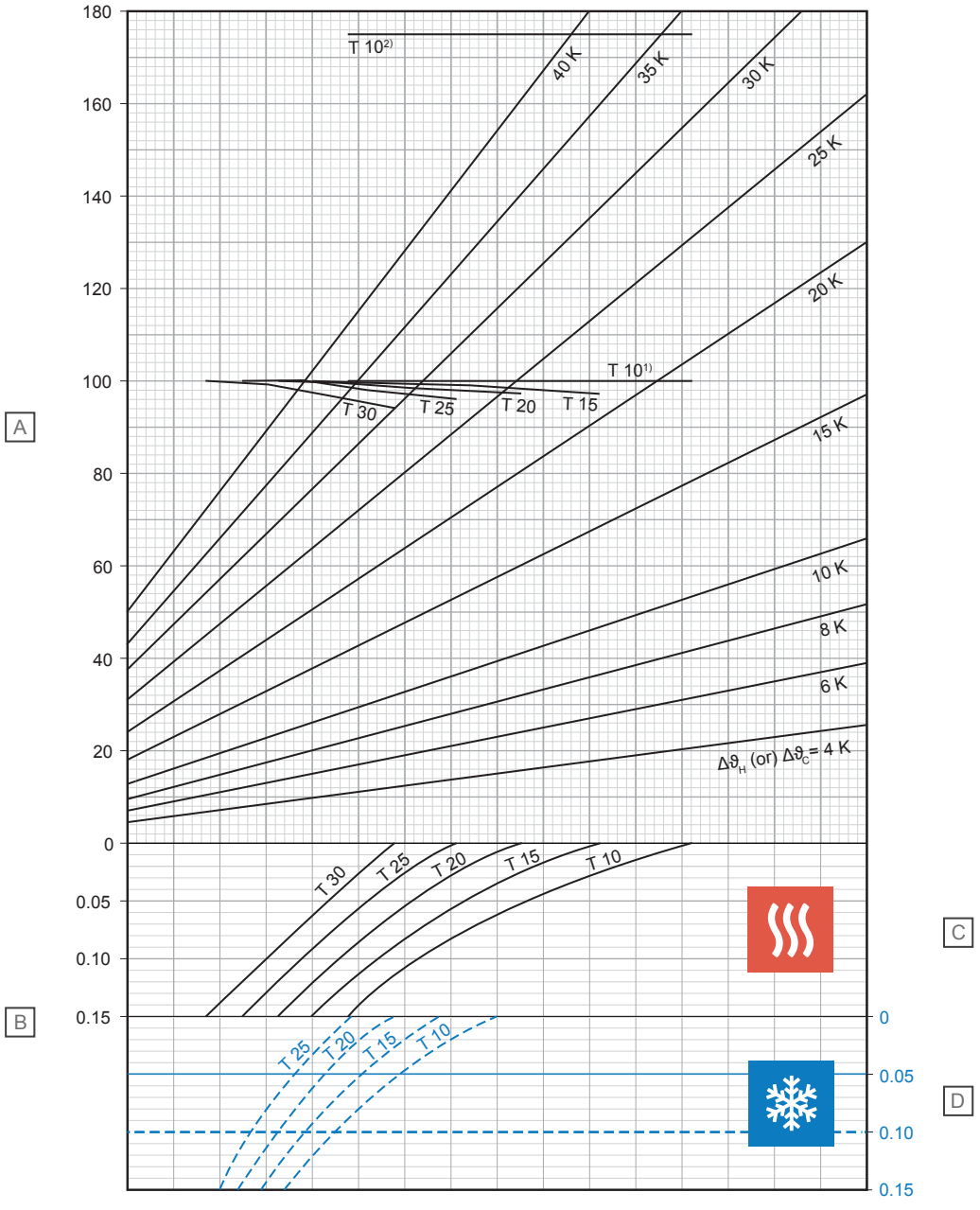
D - Cooling

T (cm)	q_C (W/m²)	$\Delta\vartheta_{C,N}$ (K)
10	32,7	8
15	29,4	8
20	26,4	8
25	23,8	8

[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

Uponor Klett Comfort Pipe PLUS 16 x 2,0 mm with screed load distribution layer (su = 75 mm with λu = 1,2 W/mK)



Item	Unit	Description
A	W/m²	Specific thermal heating or cooling output [q_H or q_C]
B	m²K/W	Thermal resistance [$R_{\lambda,B}$]

C - Heating

T (cm)	q_H (W/m²)	$\Delta\vartheta_{H,N}$ (K)
10	100,0	18,7
15	98,8	21,1
20	97,3	23,6
25	95,9	26,3
30	93,8	29,1

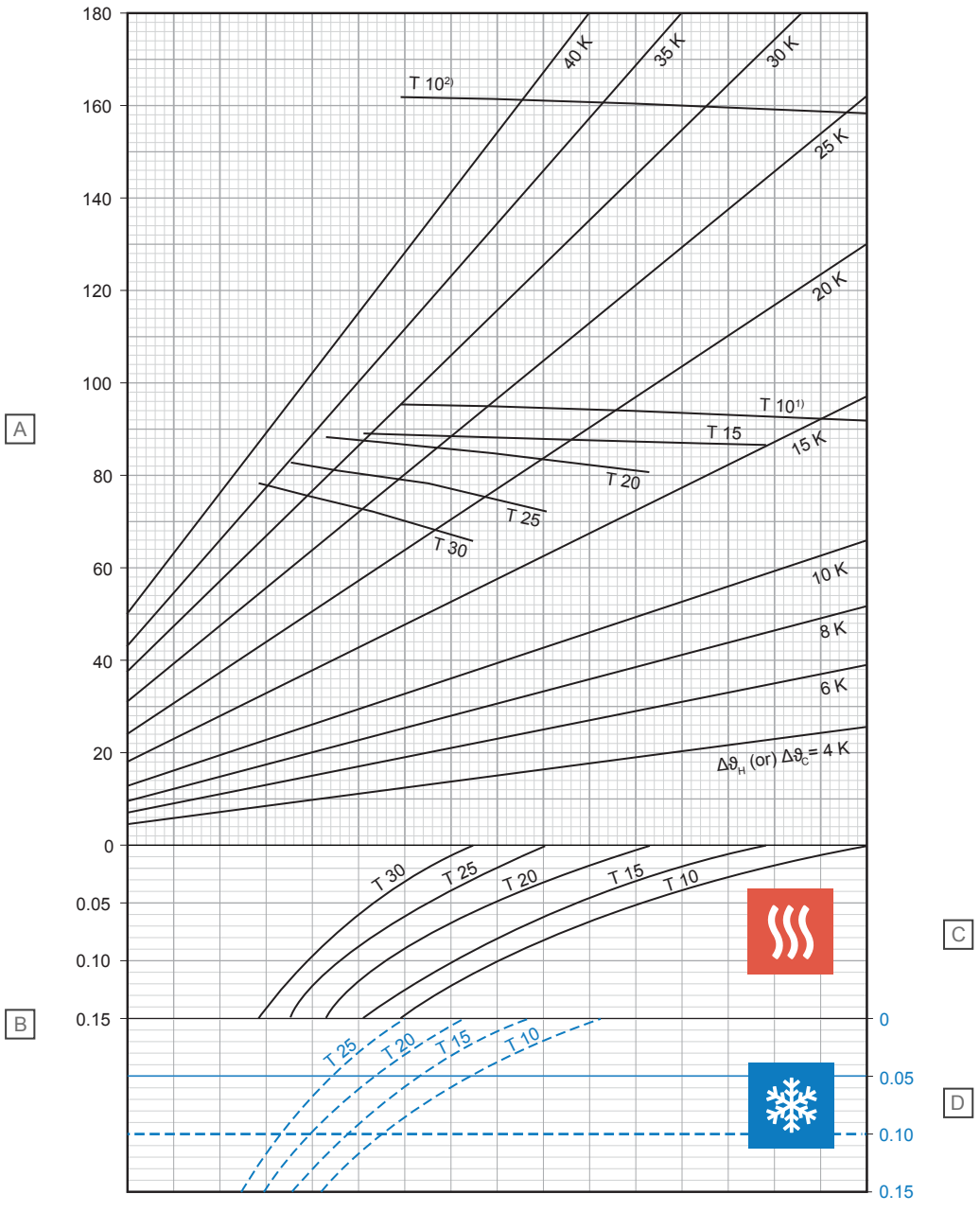
D - Cooling

T (cm)	q_C (W/m²)	$\Delta\vartheta_{C,N}$ (K)
10	31,3	8
15	28,2	8
20	25,5	8
25	23,0	8

[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

Uponor Klett MLCP RED 16 x 2,0 mm with screed load distribution layer (su = 35 mm with λu = 1,2 W/mK)



Item	Unit	Description
A	W/m²	Specific thermal heating or cooling output [q_H or q_C]
B	m²K/W	Thermal resistance [$R_{\lambda,B}$]

C - Heating

T (cm)	q_H (W/m²)	$\Delta\vartheta_{H,N}$ (K)
10	92,2	13,3
15	86,1	14,5
20	80,1	15,6
25	72,2	16,3
30	64,5	16,8

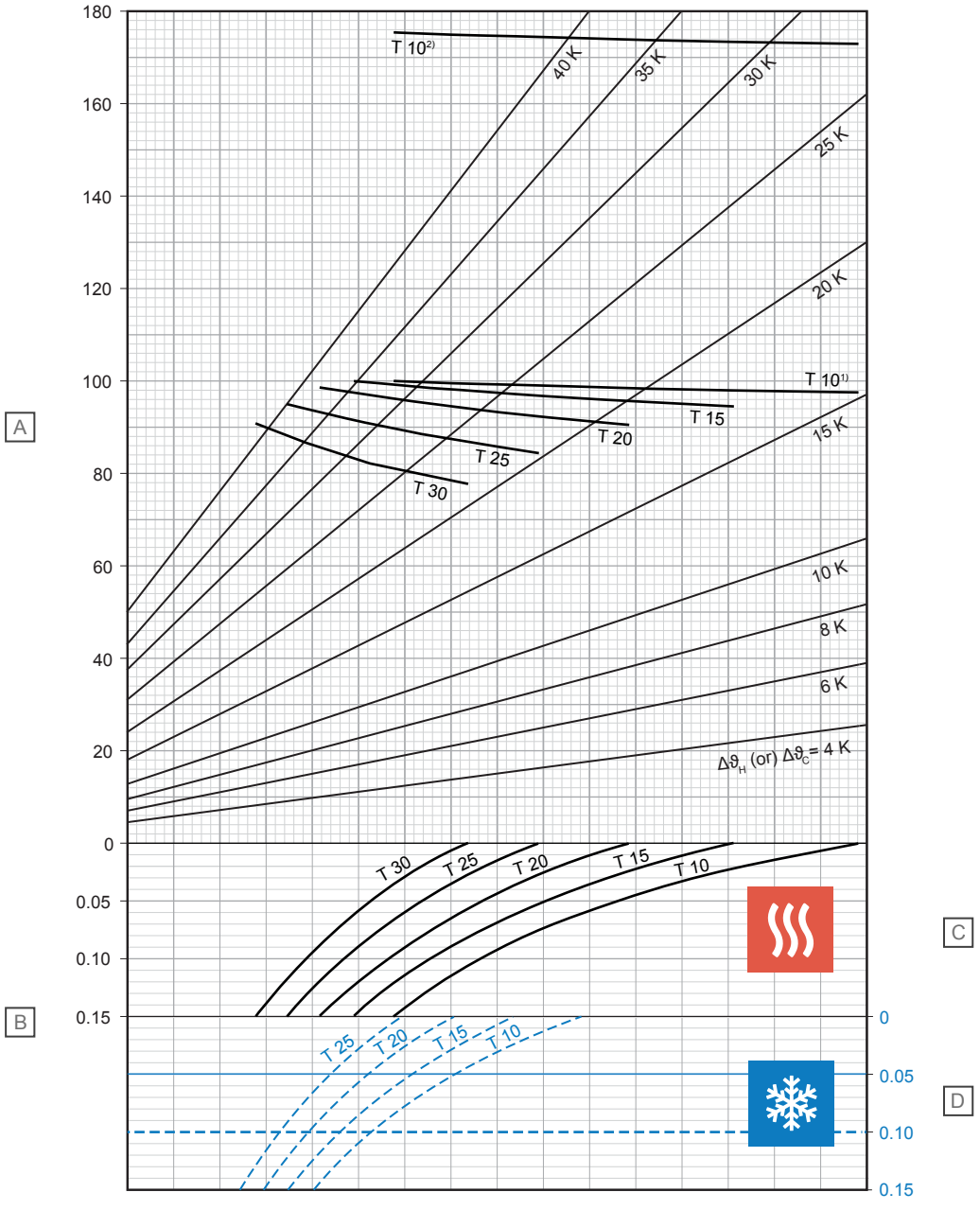
D - Cooling

T (cm)	q_C (W/m²)	$\Delta\vartheta_{C,N}$ (K)
10	37,7	8
15	33,6	8
20	30,0	8
25	26,7	8

[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

Uponor Klett MLCP RED 16 x 2,0 mm with screed load distribution layer (su = 45 mm with λu = 1,2 W/mK)



Item	Unit	Description
A	W/m²	Specific thermal heating or cooling output [q_H or q_C]
B	m²K/W	Thermal resistance [$R_{\lambda,B}$]

C - Heating

T (cm)	q_H (W/m²)	$\Delta\vartheta_{H,N}$ (K)
10	97,7	15,0
15	94,6	16,8
20	90,3	18,5
25	84,1	19,8
30	76,5	20,7

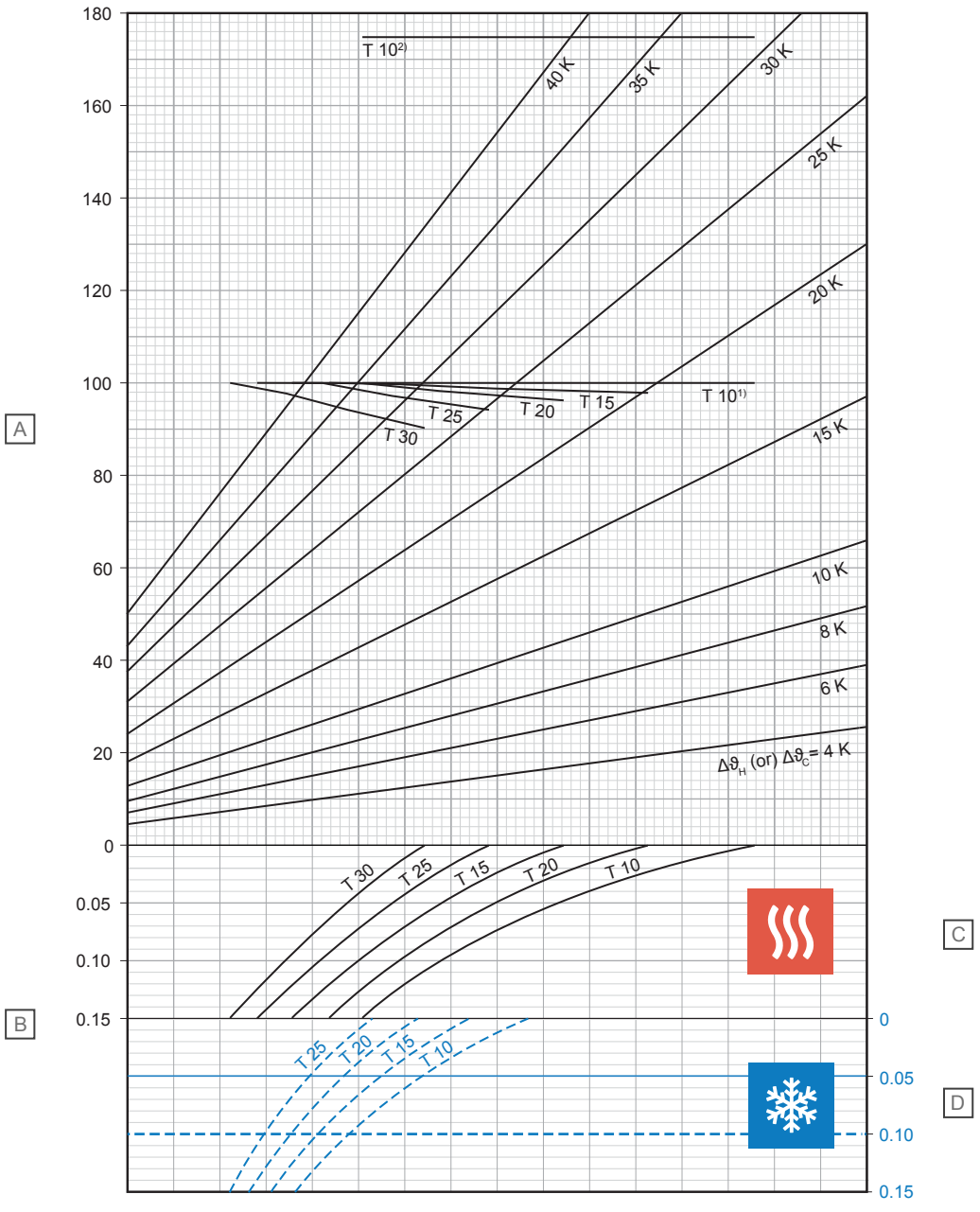
D - Cooling

T (cm)	q_C (W/m²)	$\Delta\vartheta_{C,N}$ (K)
10	36,0	8
15	32,2	8
20	28,8	8
25	25,8	8

[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

Uponor Klett MLCP RED 16 x 2,0 mm with screed load distribution layer (su = 65 mm with λu = 1,2 W/mK)



Item	Unit	Description
A	W/m²	Specific thermal heating or cooling output [q_H or q_C]
B	m²K/W	Thermal resistance [$R_{\lambda,B}$]

C - Heating

T (cm)	q_H (W/m²)	$\Delta\vartheta_{H,N}$ (K)
10	100,0	17,4
15	98,0	19,5
20	96,2	21,8
25	94,1	24,3
30	89,9	26,4

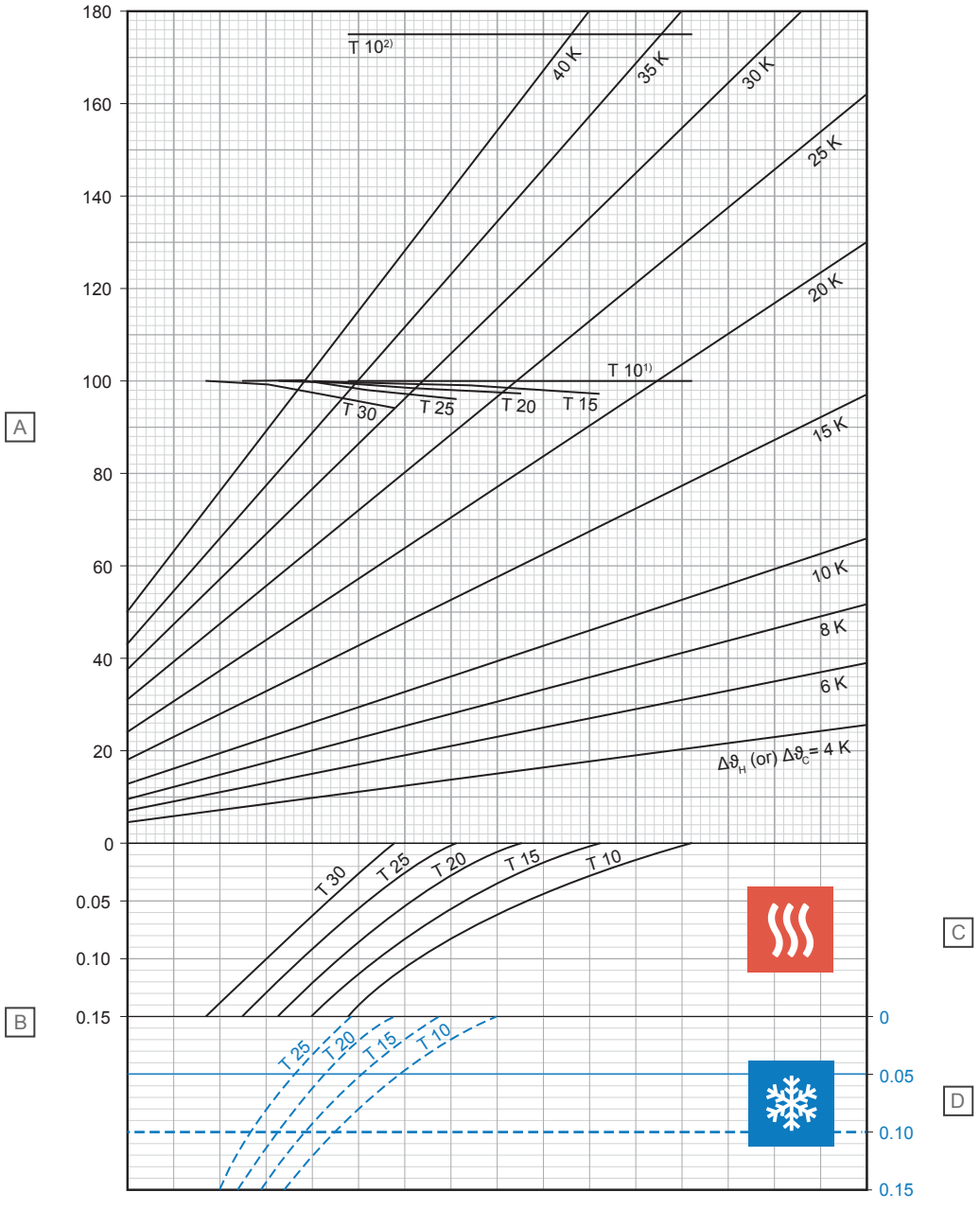
D - Cooling

T (cm)	q_C (W/m²)	$\Delta\vartheta_{C,N}$ (K)
10	32,9	8
15	29,7	8
20	26,8	8
25	24,1	8

[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

Uponor Klett MLCP RED 16 x 2,0 mm with screed load distribution layer (su = 75 mm with λu = 1,2 W/mK)



Item	Unit	Description
A	W/m²	Specific thermal heating or cooling output [q_H or q_C]
B	m²K/W	Thermal resistance [$R_{\lambda,B}$]

C - Heating

T (cm)	q_H (W/m²)	$\Delta\vartheta_{H,N}$ (K)
10	100,0	18,5
15	98,7	20,8
20	97,3	23,2
25	95,7	25,8
30	93,5	28,5

D - Cooling

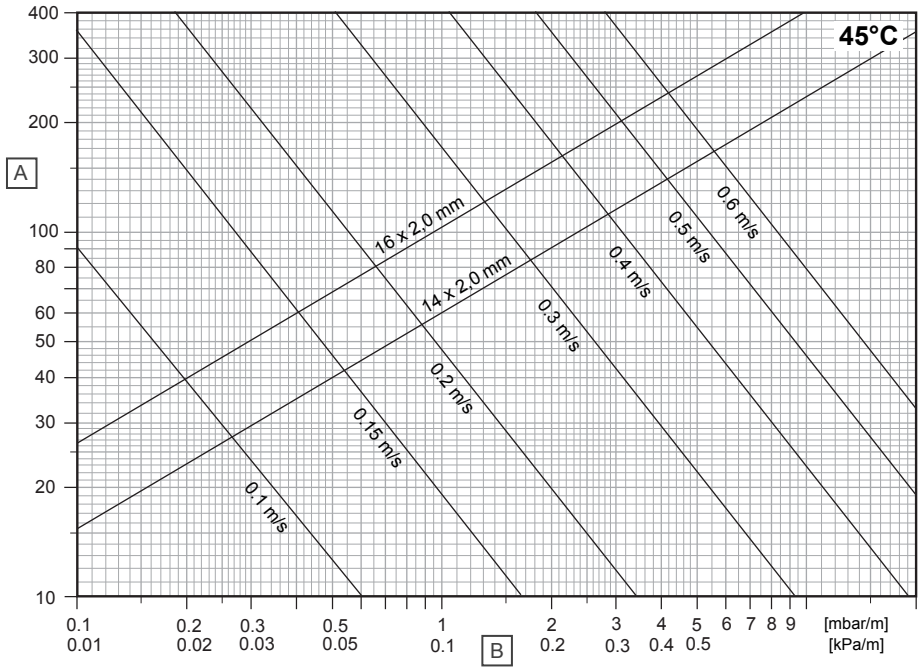
T (cm)	q_C (W/m²)	$\Delta\vartheta_{C,N}$ (K)
10	31,5	8
15	28,5	8
20	25,8	8
25	23,3	8

[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

2.4 Pressure drop diagrams

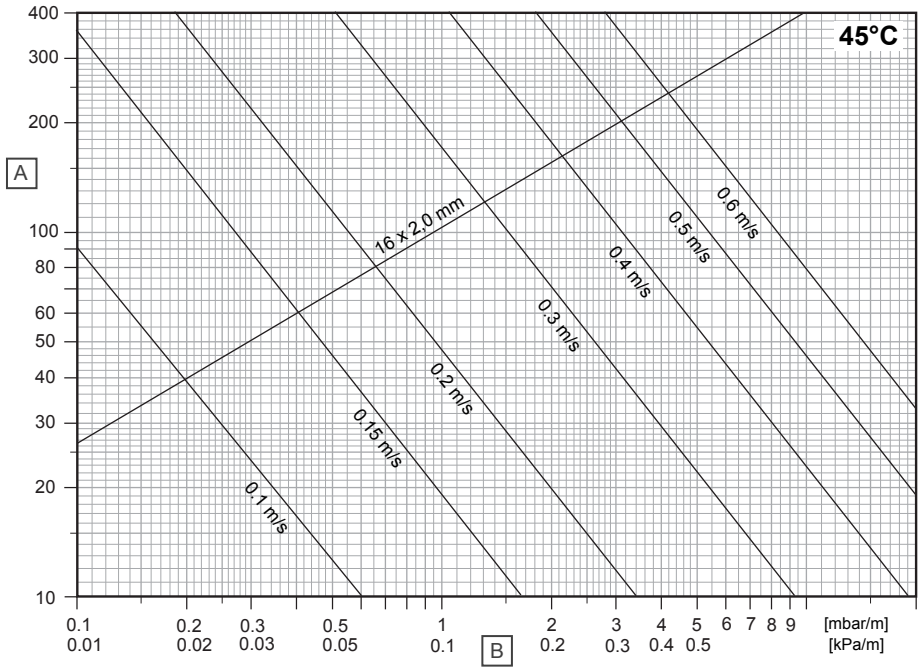
Uponor Klett Comfort Pipe PLUS



DI0000226

Item	Unit	Description
A	kg/h	Mass flow rate
B	R	Pressure gradient

Uponor MLCP RED



DI0000227

Item	Unit	Description
A	kg/h	Mass flow rate
B	R	Pressure gradient

3 Installation

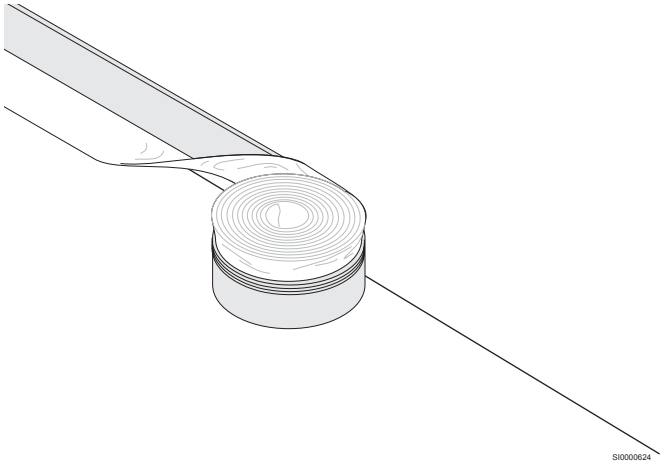
3.1 Installation process

Note

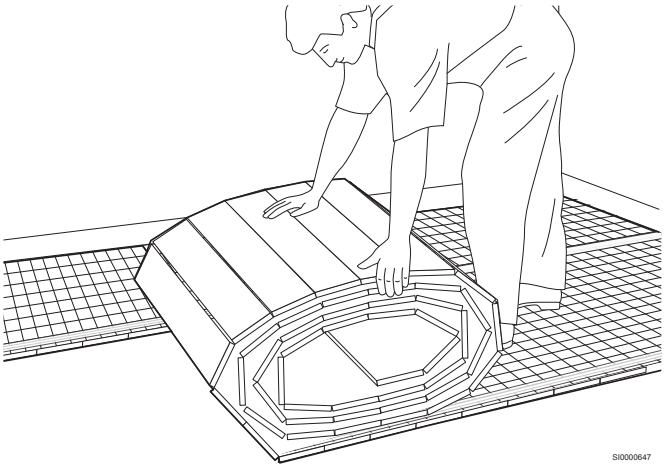
Installation must be performed by a qualified person in accordance with local standards and regulations.

As a guidance, always read and follow the instructions given in respective Uponor installation manual.

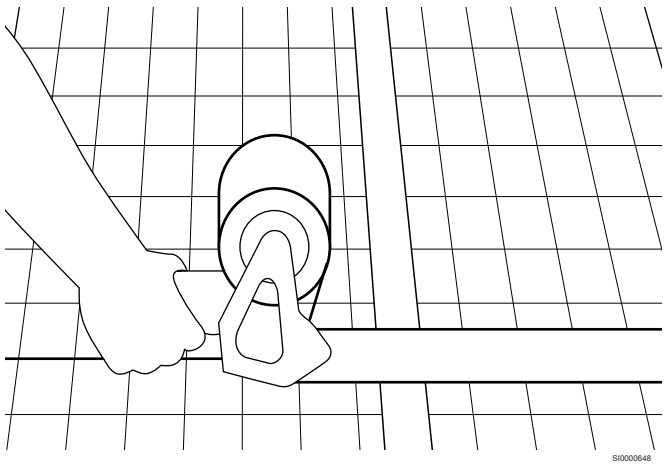
1. Edging strip installation



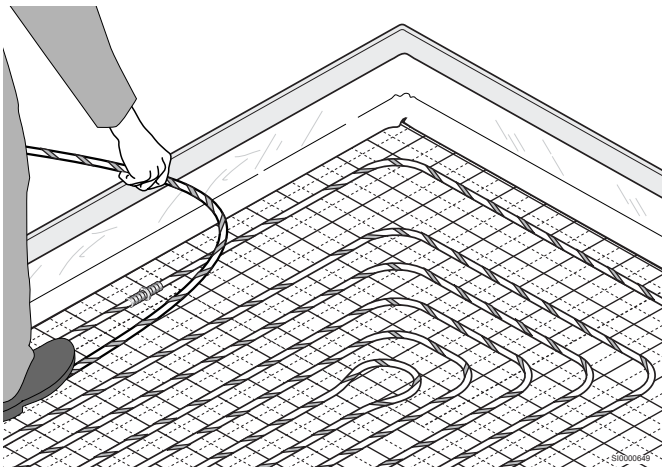
2. Panels installation



3. Join the gaps



4. Pipes installation



4 Technical data

4.1 Technical specifications

Uponor Klett Panel roll EPS DES WLS 032

Description	Value
Dimensions	10000 x 1000 x 25 mm
Material	EPS with added graphite
Max. traffic load [G]	5 kN/m²
Thermal resistance [$R_{\lambda,ins}$]	0,75 m²K/W
Dynamic stiffness [s´]	30 MN/m³
Reaction to fire (refer to EN 13501-1)	Class E
Foil grid	100 x 100 mm
Type of system	Wet system
Load distribution layer	Cement screed or anhydrite screed

Uponor Klett Panel roll EPS DES

	25 – 2	30 – 2	30 – 3	35 – 3
Dimensions	10000 x 1000 x 25 mm	10000 x 1000 x 30 mm	10000 x 1000 x 30 mm	10000 x 1000 x 35 mm
Material	EPS	EPS	EPS	EPS
Max. traffic load [G]	5 kN/m²	5 kN/m²	4 kN/m²	4 kN/m²
Thermal resistance [$R_{\lambda,ins}$]	0,6 m²K/W	0,75 m²K/W	0,65 m²K/W	0,75 m²K/W
Dynamic stiffness [s´]	30 MN/m³	20 MN/m³	20 MN/m³	15 MN/m³
Reaction to fire (refer to EN 13501-1)	Class E	Class E	Class E	Class E
Foil grid	100 x 100 mm			
Type of system	Wet system			
Load distribution layer	Cement screed or anhydrite screed			

Uponor Klett Panel Silent

Description	Value
Dimensions	1200 x 1000 x 30 mm
Short designation according to EN 13162	MW EN 13162 T6(T+)-SD20-CP3 (30-3)
Material, insulation	Mineral fibres
Max. traffic load [G]	5 kN/m²
Thermal resistance [$R_{\lambda,ins}$]	0,86 m²K/W
Compressibility	3 mm
Dynamic stiffness [s´]	20 MN/m³
Area of application according to EN 4108	DES-sm
Rated impact sound improvement [ΔL_w,P]	31 dB (with 48 mm CT covering)[1)]
Reaction to fire (refer to EN 13501-1)	Class E
Melting point of the rockwool	> 1000 °C
Foil grid	100 x 100 mm
Type of system	Wet system
Load distribution layer	Cement screed or anhydrite screed

[1] Measurement and evaluation of Uponor Klett Silent for proof of sound insulation suitability has been conducted by accredited testing laboratories or a suitable certification body. The measured values enable evaluation as per the standard while considering the insulation materials and screeds actually used.

Uponor Klett Twinboard foldable panel

Description	Value
Dimensions	2400 x 1000 x 3 mm
Material	Double wall foldable PP panel
Max. traffic load [G]	5 kN/m²
Certificates	Tested and evaluated by KIWA TBU
Reaction to fire (refer to EN 13501-1)	Class E
Foil grid	100 x 100 mm
Type of system	Wet system
Load distribution layer	Cement screed or anhydrite screed

Uponor Klett Comfort Pipe PLUS

	14 x 2,0 mm	16 x 2,0 mm
Pipe designation	Uponor Klett Comfort Pipe PLUS	Uponor Klett Comfort Pipe PLUS
Pipe dimension	14 x 2,0 mm	16 x 2,0 mm
Pipe length	240 m; 640 m	240 m; 640 m
Material	PE-Xa, five-layer pipe	PE-Xa, five-layer pipe
Colour	White with two blue longitudinal stripes	White with two blue longitudinal stripes
Manufacturing	Refer to EN ISO 15875	Refer to EN ISO 15875
Certificates	KOMO, DIN CERTCO	KOMO, DIN CERTCO
Area of application	Class 4 + 5 / 6 bar (EN ISO 15875)	Class 4 + 5 / 6 bar (EN ISO 15875)
Max. operating temperature[1)]	90 °C (EN ISO 15875)	90 °C (EN ISO 15875)
Pipe jointings	Uponor screw connection Uponor Smart press coupling	Uponor screw connection, Uponor Smart press coupling, Uponor Q&E technology
Weight	0,09 kg/m	0,1 kg/m
Water content	0,077 l/m	0,11 l/m
Oxygen tightness	Refer to ISO 17455; DIN 4726	Refer to ISO 17455; DIN 4726
Density	0,934 g/cm³	0,934 g/cm³
Material class	Class B2 and class E, DIN 4102 / EN 13501	Class B2 and class E, DIN 4102 / EN 13501
Min. bending radius	8 x D; free-hand bending (112 mm) 5 x D; supported bending (70 mm)	8 x D; free-hand bending (128 mm) 5 x D; supported bending (80 mm)
Pipe roughness	0,007 mm	0,007 mm
Ideal installation temperature	> 0 °C	> 0 °C
UV protection	Opaque cardboard (store remaining quantities in the cardboard box)	Opaque cardboard (store remaining quantities in the cardboard box)

1) When more than one design temperature appears for any class, the times should be aggregated (e.g. the design temperature profile for 50 years class 5 is: 20 °C for 14 years followed by 60 °C for 25 years, 80 °C for 10 years, 90 °C for 1 year and 100 °C for 100h).

Uponor Klett MLCP RED

Description	Value
Pipe designation	Uponor Klett MLCP RED
Pipe dimension	16 x 2,0 mm
Pipe length	240 m; 480 m
Material	Multi-layer composite pipe (PE-RT - aluminium - PE-RT), monitored by SKZ (Southern German Plastics Centre), oxygen-tight refer to DIN 4726.
Colour	Red
Manufacturing	Refer to EN ISO 21003
Certificates	KOMO, DIN CERTCO
Area of application	Class 4 / 5 (ISO 10508)
Max. operating temperature	60 °C
Max. operating pressure	4 bar
Pipe jointings	Uponor screw connection Uponor S-Press PLUS
Weight	0,076 kg/m
Water volume	0,091 l/m
Oxygen tightness	Refer to ISO 17455; DIN 4726
Building material class	B2 according to DIN 4102
Min. bending radius	4xd if free bending (64 mm) 3xd if supported bend (48 mm)
Pipe roughness	0,004 mm
Best mounting temperature	≥ 0 °C
UV protection	Brown cardboard (store remaining quantities in the cardboard box)

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Uponor reserves the right to make changes, without prior notification, to the specification of incorporated components in line with its policy of continuous improvement and development.

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