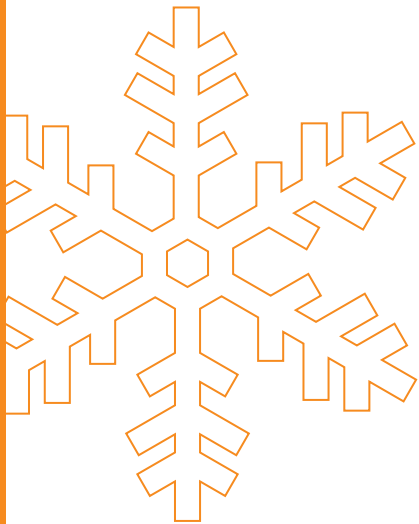


TC PLANNING

THERMAL PERFORMANCE. COOLING PERFORMANCE.



75 W/m² 73 W/m² 35 W/m²
316 W/m
53 W/m² 91 W/m²
55 W/m² 44 W/m²
59 W/m² 235 W/m
1020 W/Stk.
70 W/m² 52 W/m²
60 W/m² 82 W/m² 61 W/m²
56 W/m²
44 W/m² 55 W/m² 606 W/m²
141 W/m
82 W/m² 54 W/m²
330 W/Stk.
42 W/m² 54 W/m² 1434 W/m²

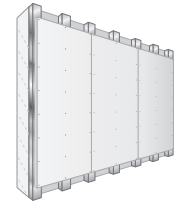
www.variotherm.com

VARIOTHERM

1 THERMAL PERFORMANCE

1.1 Modular wall heating

- Max. surface per heating circuit: 6.25 m² (e.g. 5 pcs. V020-100), pressure loss according to Variotherm dimensioning software
- Supply pipe with pre-insulated Variomodular pipe 16x2 Laser



t_f/t_r [°C]	t_{mH} [°C]	Heat output [W/m ²] at room temperature ...					T_o [°C] (at $T_r = 20$ °C)
		... 15 °C	... 18 °C	... 20 °C	... 22 °C	... 24 °C	
30/20	25.0	90	59	38	18	–	25
30/25	27.5	108	77	56	36	18	26
35/25	30.0	127	95	74	55	36	28
35/28	31.5	137	105	84	65	46	28
35/30	32.5	144	113	92	73	54	29
37.5/32.5	35.0	162	131	111	91	73	31
40/30	35.0	162	131	111	91	73	31
40/35	37.5	179	149	129	108	91	32
45/35	40.0	197	167	147	126	109	34
45/40	42.5	214	184	164	143	126	35
50/40	45.0	232	201	181	161	143	37
50/45	47.5	239	214	201	181	162	38

1.2 Modular ceiling heating

- Max. surface per heating circuit: 6.25 m² (e.g. 5 pcs. V020-100), pressure loss according to Variotherm dimensioning software
- Supply pipe with pre-insulated Variomodular pipe 16x2 Laser

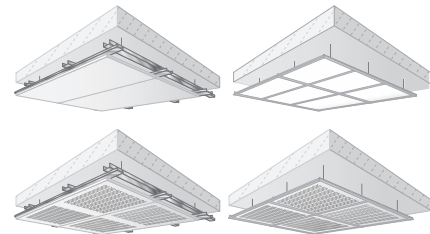


Chart valid with ceiling height 2.5–3.5 m.

t_f/t_r [°C]	t_{mH} [°C]	Heat output [W/m ²] at room temperature ...					T_o [°C] (at $T_r = 20$ °C)
		... 15 °C	... 18 °C	... 20 °C	... 22 °C	... 24 °C	
30/20	25.0	55	39	27	15	–	27
30/25	27.5	68	54	41	28	15	28
35/25	30.0	82	67	55	42	28	29
35/28	31.5	90	75	62	49	36	30
35/30	32.5	96	81	68	55	42	31
37.5/32.5	35.0	110	95	82	69	55	32
40/30	35.0	110	95	82	69	55	32

Do not exceed $t_{mH} = 35$ °C because of reasons of comfort!

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

T_r = Room temperature [°C]

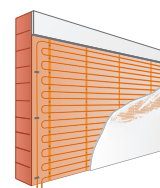
T_o = mean surface temperature [°C]

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

7.2 System wall heating

- Only valid with usage of Eco heating plaster (dry bulk density $28d = 1500 \text{ kg/m}^3$)
- Pipe distance 100 mm
- Finishing plaster thickness of 10 to 15 mm above pipe apex
- Max. length of VarioProFile pipe 16x2 Laser per heating circuit incl. supply pipe:
120 m ($1 \text{ m}^2 = 10 \text{ m}$), (e.g. 10 m^2 heating circuit and 20 m supply pipe), pressure loss according to Variotherm dimensioning software

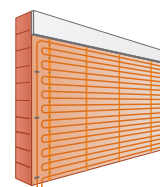
SWHK2



t_i/t_r [°C]	t_{mH} [°C]	Heat output [W/m²] at room temperature ...					T_0 [°C] (at $T_r = 20^\circ\text{C}$)
		... 15 °C	... 18 °C	... 20 °C	... 22 °C	... 24 °C	
30/20	25.0	100	65	42	20	–	25
30/25	27.5	121	85	62	41	20	27
35/25	30.0	142	106	83	62	40	29
35/28	31.5	154	118	95	74	52	30
35/30	32.5	162	127	104	82	61	30
37.5/32.5	35.0	183	148	125	103	82	32
40/30	35.0	183	148	125	103	82	32
40/35	37.5	204	169	146	123	103	34
45/35	40.0	225	190	167	144	124	36
45/40	42.5	246	210	187	164	144	38
50/40	45.0	267	231	208	185	164	40
50/45	47.5	288	251	229	206	186	42
55/45	50.0	310	272	250	228	208	44

- Only valid with usage of plaster provided by costumer (dry bulk density $28d \geq 1250 \text{ kg/m}^3$)
- Pipe distance 100 mm
- Pipe coverage approx. 10 mm above pipe apex
- Max. length of VarioProFile pipe 16x2 Laser per heating circuit incl. supply pipe:
120 m ($1 \text{ m}^2 = 10 \text{ m}$), (e.g. 10 m^2 heating circuit and 20 m supply pipe), pressure loss according to Variotherm dimensioning software

SWHK3



t_i/t_r [°C]	t_{mH} [°C]	Heat output [W/m²] at room temperature ...					T_0 [°C] (at $T_r = 20^\circ\text{C}$)
		... 15 °C	... 18 °C	... 20 °C	... 22 °C	... 24 °C	
30/20	25.0	90	58	37	18	–	23
30/25	27.5	108	76	56	36	18	25
35/25	30.0	127	95	74	55	36	27
35/28	31.5	138	107	85	66	46	28
35/30	32.5	146	114	93	74	54	29
37.5/32.5	35.0	164	133	112	92	73	30
40/30	35.0	164	133	112	92	73	30
40/35	37.5	183	152	131	110	92	32
45/35	40.0	202	171	150	129	111	34
45/40	42.5	221	189	168	148	129	36
50/40	45.0	240	207	187	166	147	38
50/45	47.5	259	225	206	185	167	40
55/45	50.0	279	244	225	205	187	41

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

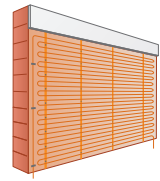
$$T_0 = \text{mean surface temperature [}^\circ\text{C]}$$

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

7.3 EasyFlex wall heating

- Only valid with usage of plaster provided by costumer (dry bulk density 28d $\geq$ 1250 kg/m³)
- **Pipe distance 77 mm**
- Pipe coverage approx. 10 mm above pipe apex
- Max. length of VarioProFile pipe 11.6x1.5 Laser per heating circuit incl. supply pipe: 80 m (1 m² = 13 m), (e.g. 5 m² heating circuit and 15 m supply pipe), pressure loss according to Variotherm dimensioning software

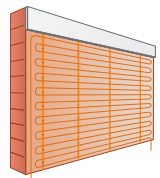
EWHK77



t_f/t_r [°C]	t_{mH} [°C]	Heat output [W/m ²] at room temperature ...					T_o [°C] (at $T_r = 20$ °C)
		... 15 °C	... 18 °C	... 20 °C	... 22 °C	... 24 °C	
30/20	25.0	91	58	37	17	–	24
30/25	27.5	110	77	56	37	17	26
35/25	30.0	130	97	76	57	35	28
35/28	31.5	142	109	87	67	47	28
35/30	32.5	150	117	95	75	55	29
37.5/32.5	35.0	170	137	115	94	76	31
40/30	35.0	170	137	115	94	76	31
40/35	37.5	189	157	136	115	95	33
45/35	40.0	209	177	156	134	115	35
45/40	42.5	230	197	175	153	134	36
50/40	45.0	251	217	195	173	153	38

- Only valid with usage of plaster provided by costumer (dry bulk density 28d $\geq$ 1250 kg/m³)
- **Pipe distance 115 mm**
- Pipe coverage approx. 10 mm above pipe apex
- Max. length of VarioProFile pipe 11.6x1.5 Laser per heating circuit incl. supply pipe: 80 m (1 m² = 8.7 m), (e.g. 7.5 m² heating circuit and 15 m supply pipe), pressure loss according to Variotherm dimensioning software

EWHK115



t_f/t_r [°C]	t_{mH} [°C]	Heat output [W/m ²] at room temperature ...					T_o [°C] (at $T_r = 20$ °C)
		... 15 °C	... 18 °C	... 20 °C	... 22 °C	... 24 °C	
30/20	25.0	71	45	29	13	–	24
30/25	27.5	86	60	44	29	13	25
35/25	30.0	102	76	60	45	27	27
35/28	31.5	111	85	69	53	36	27
35/30	32.5	118	92	75	59	43	28
37.5/32.5	35.0	134	108	90	74	60	29
40/30	35.0	134	108	90	74	60	29
40/35	37.5	149	124	107	90	75	30
45/35	40.0	165	139	123	105	90	33
45/40	42.5	181	155	138	120	105	34
50/40	45.0	198	171	154	136	120	35

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

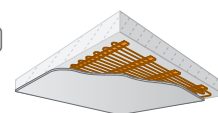
T_r = Room temperature [°C]

T_o = mean surface temperature [°C]

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

7.4 EasyFlex ceiling heating

- Only valid with usage of plaster provided by costumer (dry bulk density $28d \geq 1250 \text{ kg/m}^3$)
- **Pipe distance 77 mm**
- Pipe coverage approx. 10 mm above pipe apex
- Max. length of VarioProFile pipe 11.6x1.5 Laser per heating circuit incl. supply pipe: 80 m ($1 \text{ m}^2 = 13 \text{ m}$), (e.g. 5 m^2 heating circuit and 15 m supply pipe), pressure loss according to Variotherm dimensioning software



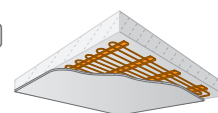
EDKH77

Chart valid with ceiling height 2.5–3.5 m.

t_f/t_r [°C]	t_{mH} [°C]	Heat output [W/m²] at room temperature ...					T_0 [°C] (at $T_r = 20^\circ\text{C}$)
		... 15 °C	... 18 °C	... 20 °C	... 22 °C	... 24 °C	
30/20	25.0	57	39	28	17	–	24
30/25	27.5	72	54	43	31	20	26
35/25	30.0	86	68	57	45	34	28
35/28	31.5	94	77	66	54	43	28
35/30	32.5	100	85	72	60	48	29
37.5/32.5	35.0	114	97	86	74	62	31
40/30	35.0	114	97	86	74	62	31

Do not exceed $t_{mH} = 35^\circ\text{C}$ because of reasons of comfort!

- Only valid with usage of plaster provided by costumer (dry bulk density $28d \geq 1250 \text{ kg/m}^3$)
- **Pipe distance 115 mm**
- Pipe coverage approx. 10 mm above pipe apex
- Max. length of VarioProFile pipe 11.6x1.5 Laser per heating circuit incl. supply pipe: 80 m ($1 \text{ m}^2 = 8.7 \text{ m}$), (e.g. 7.5 m^2 heating circuit and 15 m supply pipe), pressure loss according to Variotherm dimensioning software



EDKH115

Chart valid with ceiling height 2.5–3.5 m.

t_f/t_r [°C]	t_{mH} [°C]	Heat output [W/m²] at room temperature ...					T_0 [°C] (at $T_r = 20^\circ\text{C}$)
		... 15 °C	... 18 °C	... 20 °C	... 22 °C	... 24 °C	
30/20	25.0	44	31	22	13	–	24
30/25	27.5	56	42	33	25	16	25
35/25	30.0	67	53	44	36	27	27
35/28	31.5	73	60	52	43	33	27
35/30	32.5	77	65	56	47	37	28
37.5/32.5	35.0	90	76	67	58	49	29
40/30	35.0	90	76	67	58	49	29

Do not exceed $t_{mH} = 35^\circ\text{C}$ because of reasons of comfort!

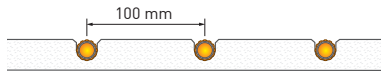
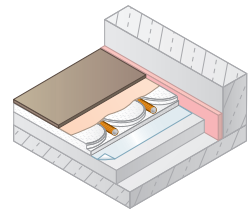
$$t_{mH} = \text{mean heating circuit water temperature} = \frac{t_f + t_r}{2} \text{ [}^\circ\text{C]} \\ T_r = \text{Room temperature [}^\circ\text{C]}$$

$$T_0 = \text{mean surface temperature [}^\circ\text{C]}$$

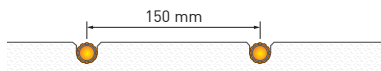
$$t_f/t_r = \text{flow/return temperature [}^\circ\text{C]}$$

7.5 Modular floor heating

- **Floor covering: tiles, ceramic and natural stone coverings, thermal resistance $d/\lambda = 0.01 \text{ m}^2\text{K/W}$**
- Max. flow temperature = 50 °C
- Max. length of VarioProFile pipe 11.6x1.5 Laser per heating circuit incl. supply pipe: 80 m (e.g. 6.5 m² heating circuit and 15 m supply pipe with 100 mm pipe spacing), pressure loss according to Variotherm dimensioning software
- Pipe requirement $[\text{m/m}^2] = 1/\text{pipe spacing} [\text{m}]$



t_v/t_r [°C]	t_{mH} [°C]	Heat output [W/m ²] at room temperature ...					T_o [°C] (at $T_r = 20$ °C)
		... 15 °C	... 18 °C	... 20 °C	... 22 °C	... 24 °C	
30/20	25.0	55	39	27	16	-	23
30/25	27.5	69	53	41	30	19	24
35/25	30.0	83	67	55	44	33	25
35/28	31.5	92	75	64	53	41	26
35/30	32.5	97	81	69	58	47	26
37.5/32.5	35.0	111	94	83	72	61	28
40/30	35.0	111	94	83	72	61	28
40/35	37.5	125	108	97	86	75	29
45/35	40.0	139	122	111	100	89	30
45/40	42.5	153	136	125	114	103	32
50/40	45.0	167	150	139	128	117	33
50/45	47.5	181	164	153	142	131	34



Not recommended for living and barefoot areas!

t_f/t_r [°C]	t_{mH} [°C]	Heat output [W/m ²] at room temperature ...					T_o [°C] (at $T_r = 20$ °C)
		... 15 °C	... 18 °C	... 20 °C	... 22 °C	... 24 °C	
30/20	25.0	46	32	23	14	-	22
30/25	27.5	58	44	35	25	16	23
35/25	30.0	70	56	46	37	28	24
35/28	31.5	77	63	53	44	35	25
35/30	32.5	82	67	58	49	39	25
37.5/32.5	35.0	93	79	70	60	51	26
40/30	35.0	93	79	70	60	51	26
40/35	37.5	105	91	82	72	63	28
45/35	40.0	117	103	93	84	75	29
45/40	42.5	128	114	105	96	86	30
50/40	45.0	140	126	117	107	98	31
50/45	47.5	152	138	128	119	110	32

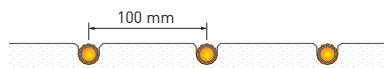
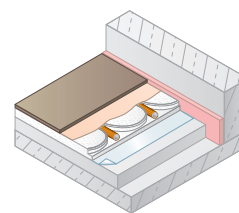
$$t_{mH} = \text{mean heating circuit water temperature} = \frac{t_f + t_r}{2} \text{ [°C]}$$

T_r = Room temperature [°C]

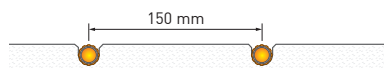
T_o = mean surface temperature [°C]

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

- Floor covering: thin parquet floor, laminate and carpets,
thermal resistance $d/\lambda = 0.075 \text{ m}^2\text{K/W}$
- Max. flow temperature = 50 °C
- Max. length of VarioProFile pipe 11.6x1.5 Laser per heating circuit incl. supply pipe:
80 m (e.g. 6.5 m² heating circuit and 15 m supply pipe with 100 mm pipe spacing),
pressure loss according to Variotherm dimensioning software
- Pipe requirement $[\text{m/m}^2] = 1/\text{pipe spacing} [\text{m}]$



t_f/t_r [°C]	t_{mH} [°C]	Heat output [W/m ²] at room temperature ...					T_0 [°C] (at $T_r = 20$ °C)
		... 15 °C	... 18 °C	... 20 °C	... 22 °C	... 24 °C	
30/20	25.0	44	30	22	13	-	22
30/25	27.5	55	42	33	24	15	23
35/25	30.0	66	53	44	35	26	24
35/28	31.5	72	59	50	42	33	25
35/30	32.5	77	64	55	46	37	25
37.5/32.5	35.0	88	75	66	57	48	26
40/30	35.0	88	75	66	57	48	26
40/35	37.5	99	86	77	68	59	27
45/35	40.0	110	97	88	79	70	28
45/40	42.5	121	108	99	90	81	29
50/40	45.0	132	119	110	101	92	30
50/45	47.5	143	130	121	112	103	31



Not recommended for living and barefoot areas!

t_f/t_r [°C]	t_{mH} [°C]	Heat output [W/m ²] at room temperature ...					T_0 [°C] (at $T_r = 20$ °C)
		... 15 °C	... 18 °C	... 20 °C	... 22 °C	... 24 °C	
30/20	25.0	37	26	18	11	-	22
30/25	27.5	47	36	28	20	13	23
35/25	30.0	56	45	37	30	22	23
35/28	31.5	62	51	43	36	28	24
35/30	32.5	66	55	47	39	32	24
37.5/32.5	35.0	75	64	56	49	41	25
40/30	35.0	75	64	56	49	41	25
40/35	37.5	85	74	66	58	51	26
45/35	40.0	94	83	75	68	60	27
45/40	42.5	104	93	85	77	70	28
50/40	45.0	113	102	94	87	79	29
50/45	47.5	123	112	104	96	89	30

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

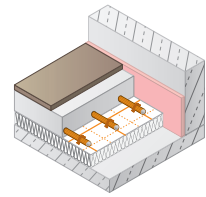
T_r = Room temperature [°C]

T_0 = mean surface temperature [°C]

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

7.6 Screed floor heating

- **Floor covering: tiles, ceramic and natural stone coverings,**
thermal resistance $d/\lambda = 0.01\text{--}0.02 \text{ m}^2\text{K/W}$
- Max. length of VarioProFile pipe 16x2 Laser per heating circuit incl. supply pipe:
120 m (e.g. 10 m² heating circuit and 20 m supply pipe with 100 mm pipe spacing),
pressure loss according to Variotherm dimensioning software
- Pipe requirement [m/m²] = 1/pipe spacing [m]



t_f/t_r [°C]	t_{mH} [°C]	Pipe spacing	Heat output [W/m ²] at room temperature ...					T_o [°C] (at $T_r = 20$ °C)
			... 15 °C	... 18 °C	... 20 °C	... 22 °C	... 24 °C	
30/20	25	100 mm	54	38	27	16	–	23
		150 mm	47	33	23	14	–	22
		200 mm	41	28	20	12	–	22
		250 mm	36	25	18	11	–	22
		300 mm	31	22	15	9	–	22
30/25	27.5	100 mm	67	51	40	29	18	24
		150 mm	58	44	34	26	16	23
		200 mm	51	38	30	22	14	23
		250 mm	45	34	26	19	12	23
		300 mm	38	29	23	17	11	22
35/25	30	100 mm	81	64	53	43	32	25
		150 mm	70	56	46	38	28	24
		200 mm	61	49	41	33	24	24
		250 mm	54	43	35	28	21	23
		300 mm	46	37	31	25	18	23
35/28	31.5	100 mm	88	72	61	50	40	25
		150 mm	77	62	53	44	32	24
		200 mm	67	55	47	39	30	24
		250 mm	59	48	41	33	27	23
		300 mm	51	41	35	29	22	23
35/30	32.5	100 mm	93	78	67	56	46	26
		150 mm	82	67	58	48	39	25
		200 mm	71	59	51	43	34	25
		250 mm	63	52	45	37	31	24
		300 mm	55	45	39	32	26	24
37.5/32.5	35	100 mm	107	91	81	69	59	27
		150 mm	93	79	69	61	51	26
		200 mm	82	69	61	53	45	26
		250 mm	71	61	53	46	39	25
		300 mm	62	53	46	41	34	24
40/30	35	100 mm	107	91	81	69	59	27
		150 mm	93	79	69	61	51	26
		200 mm	82	69	61	53	45	26
		250 mm	71	61	53	46	39	25
		300 mm	62	53	46	41	34	24
40/35	37.5	100 mm	121	105	95	83	72	29
		150 mm	105	91	82	72	62	27
		200 mm	92	80	71	63	55	27
		250 mm	81	70	63	56	48	26
		300 mm	70	61	54	48	42	25
45/35	40	100 mm	134	118	107	96	86	30
		150 mm	117	103	93	84	74	28
		200 mm	102	90	82	73	65	27
		250 mm	89	78	72	64	57	27
		300 mm	77	68	62	56	50	26
45/40	42.5	100 mm	148	132	122	110	99	31
		150 mm	129	115	106	96	87	29
		200 mm	113	101	92	84	76	28
		250 mm	99	88	81	73	66	27
		300 mm	86	77	70	64	57	26
50/40	45	100 mm	161	146	135	124	113	32
		150 mm	141	127	118	108	98	30
		200 mm	123	111	102	94	86	29
		250 mm	107	97	89	83	75	28
		300 mm	93	84	78	71	65	27
50/45	47.5	100 mm	175	158	148	137	127	33
		150 mm	153	138	129	119	110	31
		200 mm	133	121	113	105	96	30
		250 mm	117	106	98	91	84	29
		300 mm	101	92	86	79	73	28

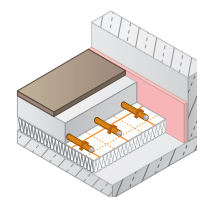
$$t_{mH} = \text{mean heating circuit water temperature} = \frac{t_f + t_r}{2} \text{ [°C]}$$

T_r = Room temperature [°C]

T_o = mean surface temperature [°C]

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

- Floor covering: thin parquet floor, laminate and carpets,
thermal resistance $d/\lambda = 0.075 \text{ m}^2\text{K/W}$
- Max. length of VarioProFile pipe 16x2 Laser per heating circuit incl. supply pipe: 120 m (e.g. 10 m² heating circuit and 20 m supply pipe with 100 mm pipe spacing), pressure loss according to Variotherm dimensioning software
- Pipe requirement $[\text{m/m}^2] = 1/\text{pipe spacing} [\text{m}]$



t_f/t_r [°C]	t_{mH} [°C]	Pipe spacing	Heat output $[\text{W/m}^2]$ at room temperature ...					T_0 [°C] (at $T_r = 20$ °C)
			... 15 °C	... 18 °C	... 20 °C	... 22 °C	... 24 °C	
30/20	25	100 mm	43	30	21	13	–	22
		150 mm	38	26	19	12	–	22
		200 mm	33	23	17	10	–	22
		250 mm	29	21	15	9	–	22
		300 mm	26	18	13	8	–	21
30/25	27.5	100 mm	53	40	32	24	15	23
		150 mm	48	36	29	21	14	22
		200 mm	42	32	26	19	13	22
		250 mm	38	29	23	16	10	22
		300 mm	33	25	20	14	9	21
35/25	30	100 mm	65	52	43	35	26	24
		150 mm	58	46	38	30	23	23
		200 mm	51	40	34	28	20	23
		250 mm	45	36	30	24	18	22
		300 mm	39	32	26	22	16	22
35/28	31.5	100 mm	71	58	49	41	32	24
		150 mm	64	51	44	36	29	23
		200 mm	55	45	38	32	25	23
		250 mm	49	40	34	28	22	22
		300 mm	43	35	30	25	20	22
35/30	32.5	100 mm	76	62	53	45	37	24
		150 mm	68	55	48	40	33	24
		200 mm	59	49	42	35	29	23
		250 mm	53	44	38	32	26	23
		300 mm	46	38	33	28	23	23
37.5/32.5	35	100 mm	86	73	65	56	48	26
		150 mm	76	65	58	49	43	25
		200 mm	68	58	51	44	38	24
		250 mm	60	52	45	39	33	23
		300 mm	52	45	39	34	29	23
40/30	35	100 mm	86	73	65	56	48	26
		150 mm	76	65	58	49	43	25
		200 mm	68	58	51	44	38	24
		250 mm	60	52	45	39	33	23
		300 mm	52	45	39	34	29	23
40/35	37.5	100 mm	96	84	76	66	58	26
		150 mm	86	74	68	59	52	26
		200 mm	76	66	59	52	46	25
		250 mm	68	58	53	46	40	24
		300 mm	59	51	46	40	35	24
45/35	40	100 mm	108	95	86	78	69	27
		150 mm	96	84	76	69	62	27
		200 mm	85	75	68	62	55	26
		250 mm	75	66	60	54	48	25
		300 mm	65	58	52	47	42	24
45/40	42.5	100 mm	118	105	96	88	79	28
		150 mm	105	93	86	78	71	27
		200 mm	93	83	76	69	63	27
		250 mm	83	73	68	62	55	26
		300 mm	72	64	59	54	49	25
50/40	45	100 mm	129	118	108	99	90	29
		150 mm	115	105	96	89	80	28
		200 mm	102	93	85	79	71	27
		250 mm	90	83	75	69	63	27
		300 mm	78	72	65	60	55	26
50/45	47.5	100 mm	139	126	118	109	100	30
		150 mm	128	113	105	98	90	29
		200 mm	110	100	93	86	80	28
		250 mm	98	88	83	76	70	27
		300 mm	84	78	72	67	62	26

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

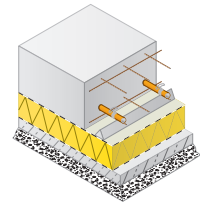
T_r = Room temperature [°C]

T_0 = mean surface temperature [°C]

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

7.7 Industrial floor heating

- **200 mm concrete slab**
- Max. length of Variomodular pipe 20x2 Laser per heating circuit incl. supply pipe: 150 m (e.g. 25 m² heating circuit and 25 m supply pipe with 200 mm pipe spacing), pressure loss according to Variotherm dimensioning software
- Pipe requirement [m/m²] = 1/pipe spacing [m]



t_i/t_r [°C]	t_{mH} [°C]	Pipe spacing [mm]	Pipe coverage 140 mm						Pipe coverage 165 mm					
			Heat output [W/m ²] bei T_r ...					T_0 [°C]	Heat output [W/m ²] bei T_r ...					T_0 [°C]
			15 °C	18 °C	20 °C	22 °C	24 °C	(at $T_r = 20$ °C)	15 °C	18 °C	20 °C	22 °C	24 °C	(at $T_r = 20$ °C)
30/20	25.0	200	35	25	18	11	–	22	34	24	18	11	–	22
		250	31	22	15	10	–	21	30	21	15	9	–	21
		300	27	19	13	9	–	21	26	18	13	8	–	21
30/25	27.5	200	43	32	26	19	13	22	41	31	25	18	13	22
		250	38	29	23	17	11	22	37	28	22	17	11	22
		300	32	25	19	15	10	22	31	24	18	15	9	22
35/25	30.0	200	52	46	35	28	21	23	51	44	34	27	20	23
		250	46	40	31	25	19	23	44	39	30	24	18	23
		300	39	34	30	21	16	23	38	33	29	20	16	23
35/28	31.5	200	58	48	39	33	26	24	56	47	38	32	25	23
		250	50	43	35	30	23	23	49	41	34	29	22	23
		300	43	36	31	25	19	23	41	35	30	24	18	23
35/30	32.5	200	63	50	43	38	29	24	61	49	41	37	29	24
		250	54	45	38	34	27	24	53	43	37	33	26	23
		300	47	38	32	29	22	23	45	37	31	28	21	23
37.5/32.5	35.0	200	69	59	52	45	38	25	67	57	51	43	37	25
		250	61	52	46	40	34	24	59	51	44	39	33	24
		300	52	45	39	34	29	24	51	43	38	33	28	23
40/30	35.0	200	69	59	52	45	38	25	67	57	51	43	37	25
		250	61	52	46	40	34	24	59	51	44	39	33	24
		300	52	45	39	34	29	24	51	43	38	33	28	23
40/35	37.5	200	78	67	63	53	47	26	76	65	61	52	45	26
		250	69	58	54	48	41	25	66	56	53	46	40	25
		300	59	50	47	41	35	24	57	49	45	40	34	24
45/35	40.0	200	86	76	69	62	56	26	83	74	67	60	54	26
		250	76	67	61	55	49	26	74	65	59	53	48	25
		300	66	57	52	48	42	25	64	55	51	46	41	25
45/40	42.5	200	95	85	78	71	65	27	92	82	76	69	63	27
		250	84	75	69	63	57	26	81	73	67	61	55	26
		300	71	64	59	54	48	25	69	62	57	53	47	25
50/40	45.0	200	104	94	86	79	72	28	100	91	83	76	70	28
		250	91	83	76	70	65	27	88	80	74	68	63	27
		300	78	70	66	61	55	26	76	68	64	59	53	26
50/45	47.5	200	112	102	95	87	81	29	109	99	92	85	78	29
		250	99	90	84	78	71	28	96	88	81	76	69	28
		300	83	78	71	67	61	27	80	76	69	65	59	26

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

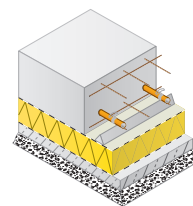
T_r = Room temperature [°C]

T_0 = mean surface temperature [°C]

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

• **250 mm concrete slab**

- Max. length of VarioProFile pipe 20x2 Laser per heating circuit incl. supply pipe:
150 m (e.g. 39 m² heating circuit and 20 m supply pipe with 300 mm pipe spacing),
pressure loss according to Variotherm dimensioning software
- Pipe requirement [m/m²] = 1/pipe spacing [m]



t_r/t_r [°C]	t_{mH} [°C]	Pipe spacing [mm]	Pipe coverage 190 mm						Pipe coverage 215 mm					
			Heat output [W/m ²] bei T_r ...					T_o [°C]	Heat output [W/m ²] bei T_r ...					T_o [°C]
			15 °C	18 °C	20 °C	22 °C	24 °C	(at $T_r = 20$ °C)	15 °C	18 °C	20 °C	22 °C	24 °C	(at $T_r = 20$ °C)
30/20	25	200	33	23	17	11	–	22	32	22	16	10	–	22
		250	29	21	14	9	–	21	29	20	14	9	–	21
		300	25	18	13	8	–	21	24	17	12	8	–	21
30/25	27.5	200	40	30	24	18	13	22	39	29	23	17	12	22
		250	36	27	21	16	11	22	35	26	21	16	10	22
		300	30	23	18	14	9	22	29	22	17	14	9	22
35/25	30	200	49	43	33	26	20	23	48	41	32	25	19	23
		250	43	38	29	23	18	23	41	36	29	22	17	23
		300	37	32	29	20	15	23	35	31	28	19	15	23
35/28	31.5	200	54	46	37	31	24	23	53	44	35	30	23	23
		250	47	40	33	29	21	23	46	39	32	28	21	23
		300	40	34	29	23	18	23	39	33	29	22	17	23
35/30	32.5	200	59	47	40	36	28	24	57	46	39	35	27	24
		250	51	42	36	32	25	23	49	41	35	31	24	23
		300	44	36	30	27	21	23	42	35	29	26	20	23
37.5/32.5	35	200	65	55	49	42	36	25	63	54	48	41	35	24
		250	57	49	43	38	32	24	55	48	41	36	31	24
		300	49	42	37	32	27	23	48	41	35	31	26	23
40/30	35	200	65	55	49	42	36	25	63	54	48	41	35	24
		250	57	49	43	38	32	24	55	48	41	36	31	24
		300	49	42	37	32	27	23	48	41	35	31	26	23
40/35	37.5	200	73	63	59	50	44	25	71	61	57	48	42	25
		250	64	54	51	45	38	25	62	53	49	43	37	25
		300	55	47	44	38	33	24	54	46	42	37	32	24
45/35	40	200	80	71	65	58	53	26	78	69	63	56	51	26
		250	71	63	57	52	46	25	69	61	55	50	45	25
		300	62	54	49	45	39	25	60	52	48	43	38	24
45/40	42.5	200	89	79	73	67	61	27	86	77	71	65	59	27
		250	79	71	65	59	54	26	76	68	63	57	52	26
		300	67	60	55	51	46	25	65	58	54	49	44	25
50/40	45	200	97	88	80	74	68	27	94	86	78	72	66	27
		250	86	78	71	66	61	27	83	75	69	64	59	26
		300	73	66	62	57	52	26	71	64	60	55	50	26
50/45	47.5	200	105	96	89	82	76	28	102	93	86	80	73	28
		250	93	85	79	73	67	27	90	82	76	71	65	27
		300	78	73	67	63	57	26	75	71	65	61	55	26

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

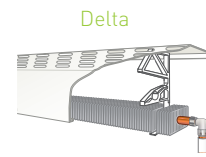
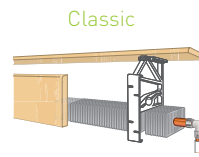
T_r = Room temperature [°C]

T_o = mean surface temperature [°C]

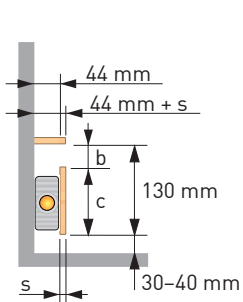
t_i/t_r = flow/return temperature [°C]

7.8 Skirting heating

- Max. length of skirting heating per heating circuit:
 - Type mini, Ia, IIa: 7.5 m (= 7.5 m heating element)
 - Type IIIa: 5.0 m (= 10 m heating element)

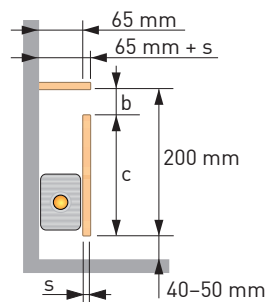


Classic skirting heating



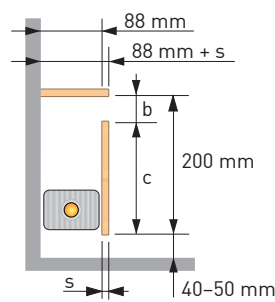
Mini Classic skirting heating

b ... 25 mm
c ... 105 mm
s ... min. 15 mm (e.g. wooden multi-layer board)



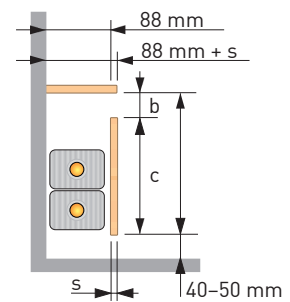
Ia Classic skirting heating

b ... 37 mm
c ... 163 mm
s ... min. 15 mm (e.g. wooden multi-layer board)



IIa Classic skirting heating

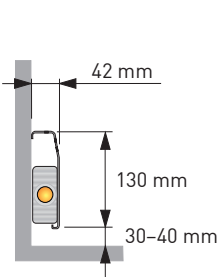
b ... 37 mm
c ... 163 mm
s ... min. 15 mm (e.g. wooden multi-layer board)



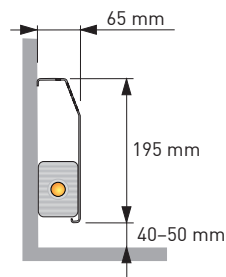
IIIa Classic skirting heating

b ... 37 mm
c ... 163 mm
s ... min. 15 mm (e.g. wooden multi-layer board)

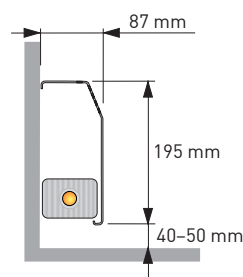
Delta skirting heating



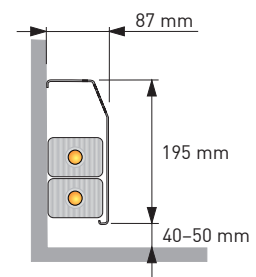
Mini Delta skirting heating



Ia Delta skirting heating



IIa Delta skirting heating



IIIa Delta skirting heating

Heat output in W/m, in relation to a room temperature of $T_r = 20\text{ °C}$:

Type	Flow temperature t_f [°C]											
	Δt (spread) = 5 °C				Δt (spread) = 10 °C				Δt (spread) = 15 °C			
	30 °C	35 °C	40 °C	45 °C	50 °C	55 °C	60 °C	65 °C	70 °C	75 °C	80 °C	85 °C
mini	39	45	60	85	112	141	171	204	241	276	312	355
Ia	65	76	100	141	186	235	285	340	401	460	520	567
IIa	92	108	140	197	255	316	385	456	532	611	688	749
IIIa	108	126	168	238	311	390	473	561	657	754	856	938
recommended range												

Correction factors for other room temperatures [T_r]:

T_r [°C]	15	16	17	18	19	20	21	22	23	24
Factor	1.11	1.09	1.07	1.04	1.02	1.00	0.98	0.95	0.92	0.90

Example: Type IIa, $t_f = 55\text{ °C}$, $T_r = 24\text{ °C} \rightarrow 316\text{ W/m} \times 0.90 = 284\text{ W/m}$

Heat output in W/m, in relation to excess temperatures:

Type	Skirting heating excess temperature = $\frac{(t_f + t_r)}{2} - T_r$										
	10 °C	15 °C	20 °C	25 °C	30 °C	35 °C	40 °C	45 °C	50 °C	55 °C	60 °C
mini	42	52	79	112	141	171	204	248	288	333	369
Ia	70	88	131	186	235	285	340	413	480	543	603
IIa	100	124	183	255	316	385	456	548	636	718	795
IIIa	118	148	221	311	390	473	561	677	788	897	997

Classic skirting heating with larger shaft heights, heat output in W/m:

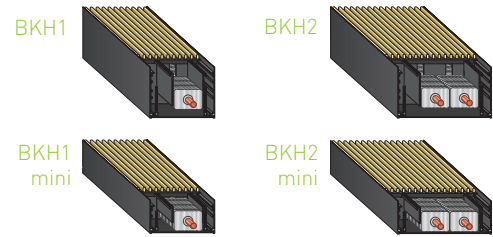
Required minimum flow temperature	mini		Ia		IIa		IIIa	
	Shaft height [mm]	Excess performance [%]	Shaft height [mm]	Excess performance [%]	Shaft height [mm]	Excess performance [%]	Shaft height [mm]	Excess performance [%]
35 °C	100	0	160	0	160	0	160	0
40 °C	200	13	260	14	260	18	260	17
45 °C	300	24	360	27	360	33	360	32
50 °C	400	33	460	37	460	46	460	46
55 °C	500	41	560	46	560	56	560	57
60 °C	700	52	760	58	760	70	760	73
65 °C	900	58	960	64	960	76	960	82

T_r = Room temperature [°C]

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

7.9 Trench heating

- Max. length of heating circuit in trench heating (heating element):
 - BKH1/BKH1 mini: 7.5 m (= 7.5 m heating element)
 - BKH2/BKH2 mini: 5.0 m (= 10 m heating element)



Length [mm]	Type	Heat output [W/pce.] at flow temperature t_f ... [recommended range: 45–60 °C]									
		... 40 °C	... 45 °C	... 50 °C	... 55 °C	... 60 °C	... 65 °C	... 70 °C	... 75 °C	... 80 °C	... 85 °C
1000	BKH1 mini	48	55	65	78	94	114	136	162	190	222
	BKH1	50	62	76	94	115	140	168	199	233	271
	BKH2 mini	49	74	99	124	149	174	199	224	249	274
	BKH2	56	86	116	145	175	205	234	264	294	323
1250	BKH1 mini	62	71	84	101	122	147	176	209	246	287
	BKH1	65	80	99	122	149	181	217	257	302	350
	BKH2 mini	65	98	131	164	197	229	262	295	328	361
	BKH2	74	113	152	191	230	270	309	348	387	426
1500	BKH1 mini	76	87	103	124	150	181	217	257	302	353
	BKH1	80	98	121	150	183	222	266	316	370	430
	BKH2 mini	81	122	163	203	244	285	325	366	407	448
	BKH2	92	140	189	237	286	334	383	431	480	528
1750	BKH1 mini	90	104	123	148	178	215	257	305	359	418
	BKH1	95	116	144	178	217	264	316	374	439	510
	BKH2 mini	97	146	194	243	291	340	389	437	486	534
	BKH2	110	168	226	284	341	399	457	515	573	631
2000	BKH1 mini	105	120	142	171	206	248	297	352	415	483
	BKH1	110	135	166	205	252	305	365	433	508	590
	BKH2 mini	113	169	226	282	339	395	452	508	565	621
	BKH2	128	195	262	330	397	464	532	599	666	733
2250	BKH1 mini	119	136	161	194	234	282	337	400	471	549
	BKH1	125	153	189	233	286	346	415	491	576	669
	BKH2 mini	129	193	257	322	386	450	515	579	644	708
	BKH2	146	222	299	376	452	529	606	683	759	836
2500	BKH1 mini	133	152	180	217	262	315	377	448	527	614
	BKH1	140	171	212	261	320	387	464	550	645	749
	BKH2 mini	144	217	289	361	433	506	578	650	723	795
	BKH2	164	250	336	422	508	594	680	766	852	938
2750	BKH1 mini	147	169	200	240	290	349	418	495	583	680
	BKH1	155	189	234	289	354	429	514	609	714	829
	BKH2 mini	160	240	320	401	481	561	641	721	802	882
	BKH2	182	277	373	468	563	659	754	850	945	1041
3000	BKH1 mini	161	185	219	263	318	383	458	543	639	745
	BKH1	170	208	257	317	388	470	563	667	782	909
	BKH2 mini	176	264	352	440	528	616	704	792	880	969
	BKH2	199	304	409	514	619	724	829	934	1038	1143
3250	BKH1 mini	176	201	238	286	346	416	498	591	695	810
	BKH1	185	226	279	344	422	511	612	726	851	988
	BKH2 mini	192	288	384	480	576	672	767	863	959	1055
	BKH2	217	332	446	560	674	789	903	1017	1132	1246
3500	BKH1 mini	190	218	257	309	374	450	538	639	751	876
	BKH1	199	244	302	372	456	552	662	784	920	1068
	BKH2 mini	208	311	415	519	623	727	831	934	1038	1142
	BKH2	235	359	483	606	730	854	977	1101	1225	1348
3750	BKH1 mini	204	234	277	333	401	483	578	686	807	941
	BKH1	214	262	324	400	490	594	711	843	988	1148
	BKH2 mini	223	335	447	559	670	782	894	1006	1117	1229
	BKH2	253	386	519	652	785	919	1052	1185	1318	1451
4000	BKH1 mini	218	250	296	356	429	517	618	734	863	1007
	BKH1	229	281	347	428	524	635	761	901	1057	1227
	BKH2 mini	239	359	478	598	718	837	957	1077	1196	1316
	BKH2	271	414	556	699	841	983	1126	1268	1411	1553
4250	BKH1 mini	232	266	315	379	457	551	659	782	919	1072
	BKH1	244	299	369	456	558	676	810	960	1126	1307
	BKH2 mini	255	383	510	638	765	893	1020	1148	1275	1403
	BKH2	289	441	593	745	896	1048	1200	1352	1504	1656
4500	BKH1 mini	247	283	334	402	485	584	699	829	975	1137
	BKH1	259	317	392	484	592	717	859	1018	1194	1387
	BKH2 mini	271	406	542	677	812	948	1083	1219	1354	1489
	BKH2	307	468	629	791	952	1113	1275	1436	1597	1758
4750	BKH1 mini	261	299	354	425	513	618	739	877	1032	1203
	BKH1	274	335	414	511	626	759	909	1077	1263	1467
	BKH2 mini	287	430	573	717	860	1003	1146	1290	1433	1576
	BKH2	325	496	666	837	1008	1178	1349	1520	1690	1861
5000	BKH1 mini	275	315	373	448	541	651	779	925	1088	1268
	BKH1	289	354	437	539	660	800	958	1136	1332	1546
	BKH2 mini	302	454	605	756	907	1058	1210	1361	1512	1663
	BKH2	343	523	703	883	1063	1243	1423	1603	1783	1963

Values refer to a room temperature of $T_r = 20$ °C at a volume flow = 90 l/h. Measurements according to DIN 4704-4.

Correction factor for a room temperature T_r [°C] at a flow temperature $t_f = 60$ °C:

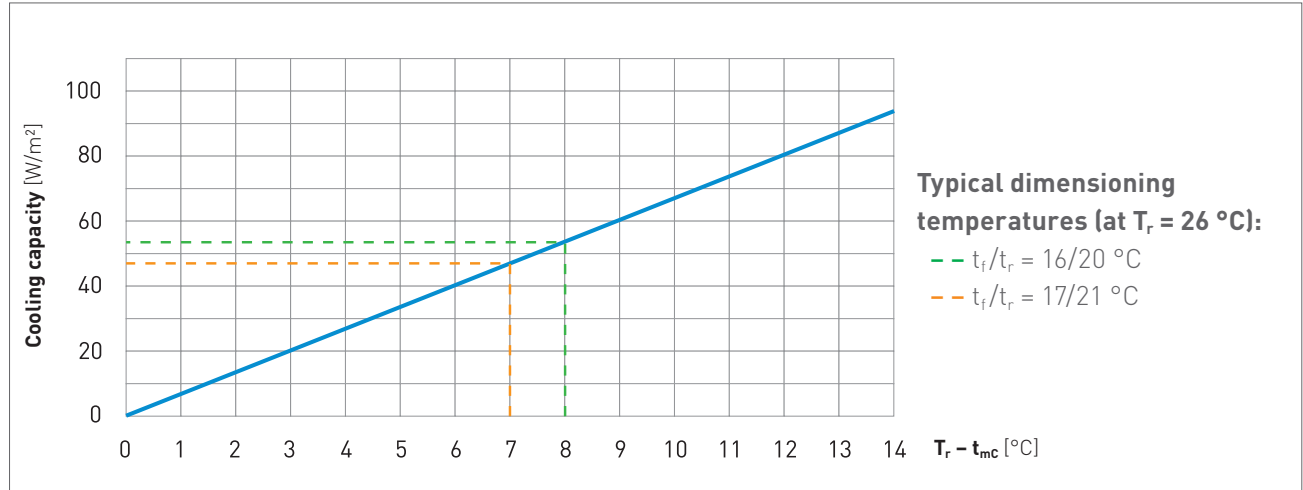
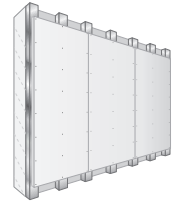
T_r [°C]	15	16	17	18	19	20	21	22	23	24
Factor	1.18	1.14	1.11	1.07	1.04	1.00	0.96	0.93	0.90	0.86

Example: BKH2, 4500 mm, $t_f = 60$ °C, $T_r = 23$ °C → 952 W x 0.90 = 856 W

8 COOLING PERFORMANCE ❄️

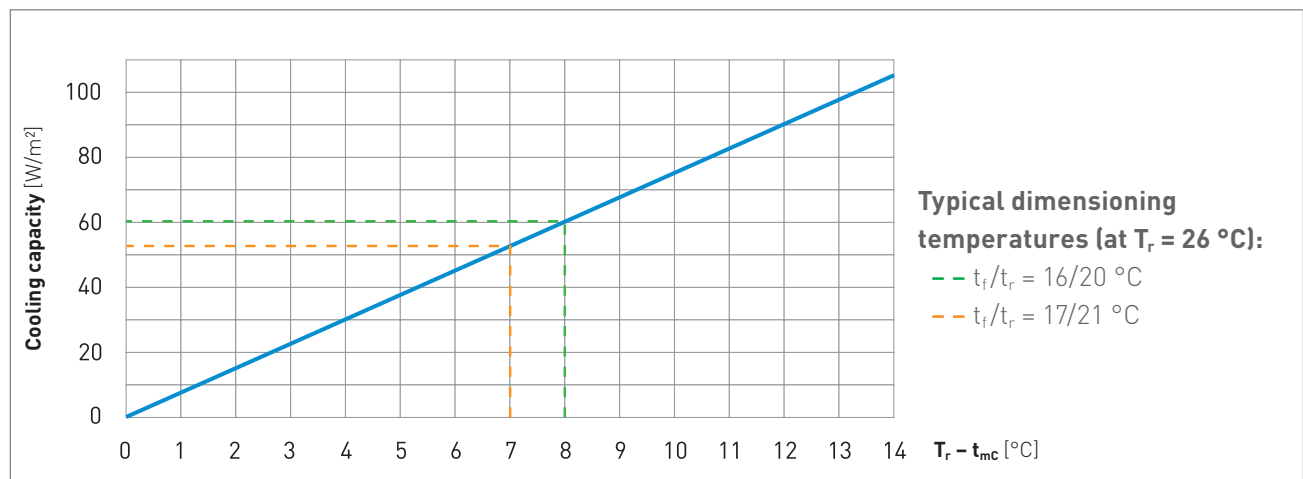
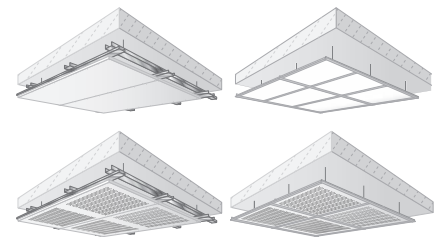
8.1 Modular wall cooling

- Max. surface per cooling circuit: 6.25 m² (e.g. 5 pcs. V020-100), pressure loss according to Variotherm dimensioning software
- Supply pipe with pre-insulated Variomodal pipe 16x2 Laser



8.2 Modular ceiling cooling

- Max. surface per cooling circuit: 6.25 m² (e.g. 5 pcs. V020-100), pressure loss according to Variotherm dimensioning software
- Supply pipe with pre-insulated Variomodal pipe 16x2 Laser



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

T_r = Room temperature [°C]

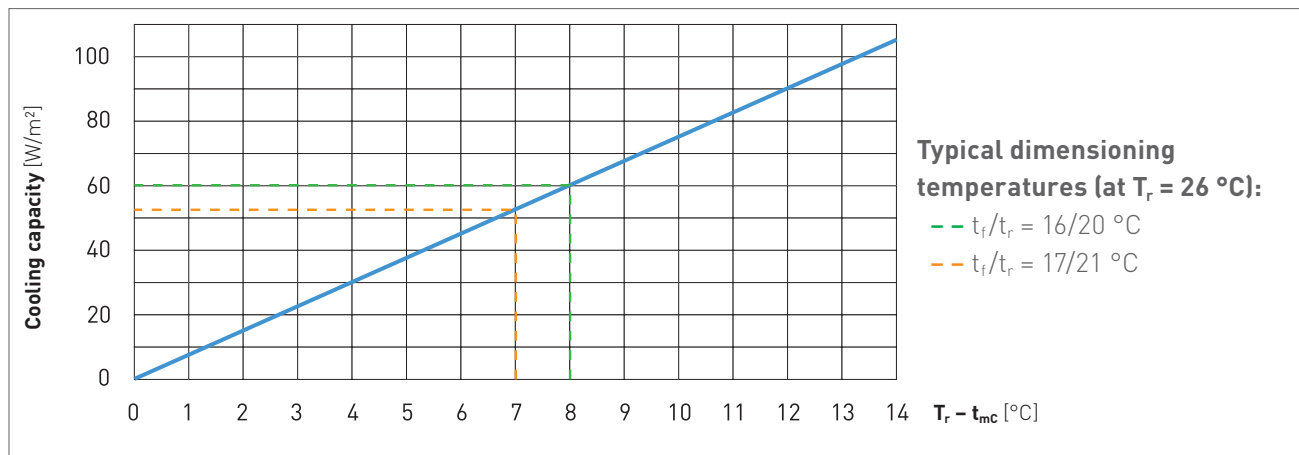
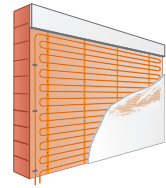
T_0 = mean surface temperature [°C]

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

8.3 System wall cooling

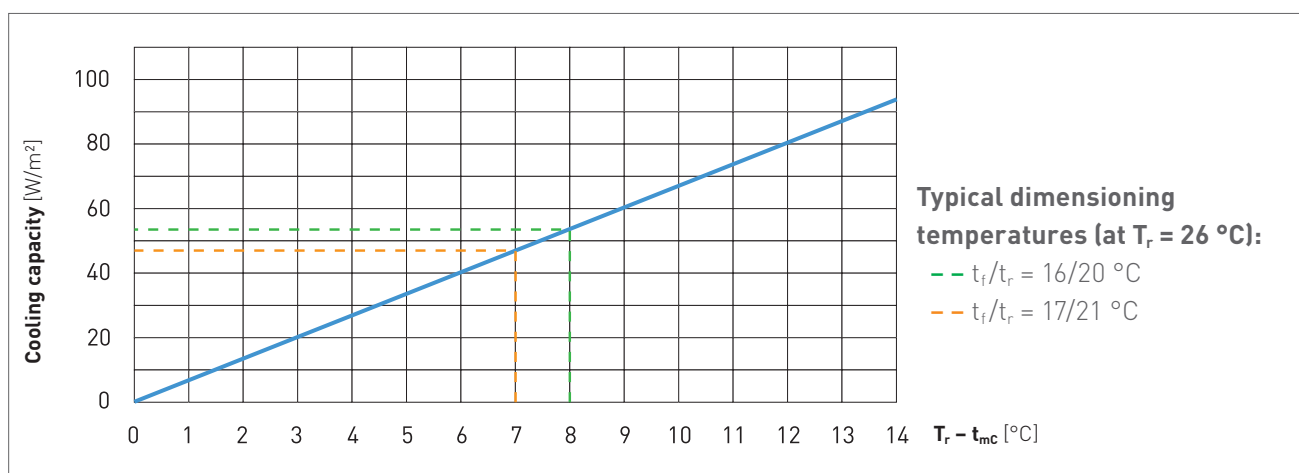
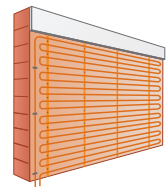
- Only valid with usage of Eco heating plaster (dry bulk density $28d = 1500 \text{ kg/m}^3$)
- Pipe distance 100 mm
- Finishing plaster thickness of 10 to 15 mm above pipe apex
- Max. length of VarioProFile pipe 16x2 Laser per cooling circuit incl. supply pipe: 120 m (1 $\text{m}^2 = 10 \text{ m}$), (e.g. 10 m^2 cooling circuit and 20 m supply pipe), pressure loss according to Variotherm dimensioning software

SWHK2



- Only valid with usage of plaster provided by costumer (dry bulk density $28d \geq 1250 \text{ kg/m}^3$)
- Pipe distance 100 mm
- Pipe coverage approx. 10 mm above pipe apex
- Max. length of VarioProFile pipe 16x2 Laser per cooling circuit incl. supply pipe: 120 m (1 $\text{m}^2 = 10 \text{ m}$), (e.g. 10 m^2 cooling circuit and 20 m supply pipe), pressure loss according to Variotherm dimensioning software

SWHK3



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

T_r = Room temperature [°C]

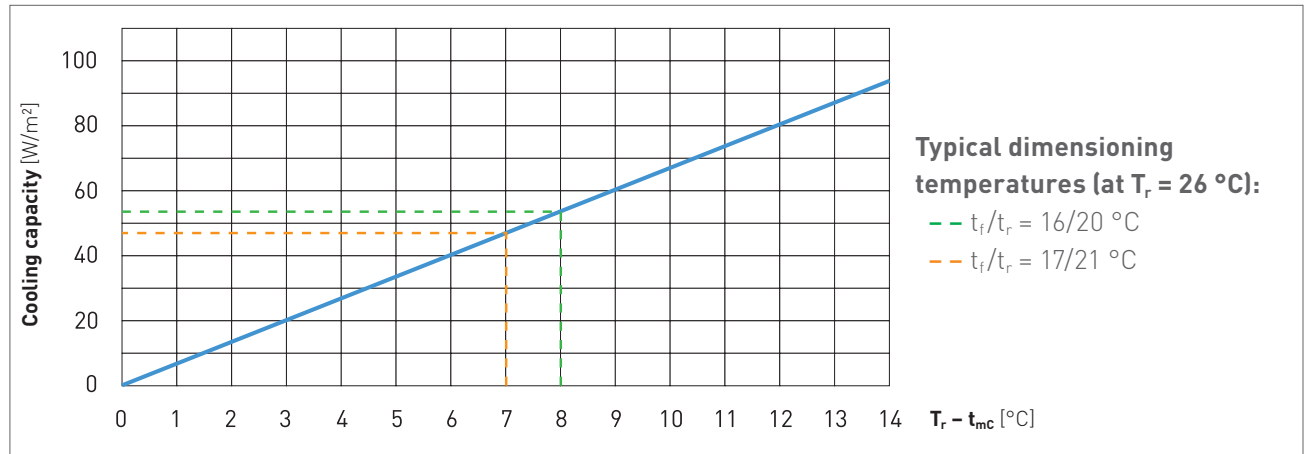
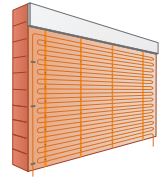
T_0 = mean surface temperature [°C]

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

8.4 EasyFlex wall cooling

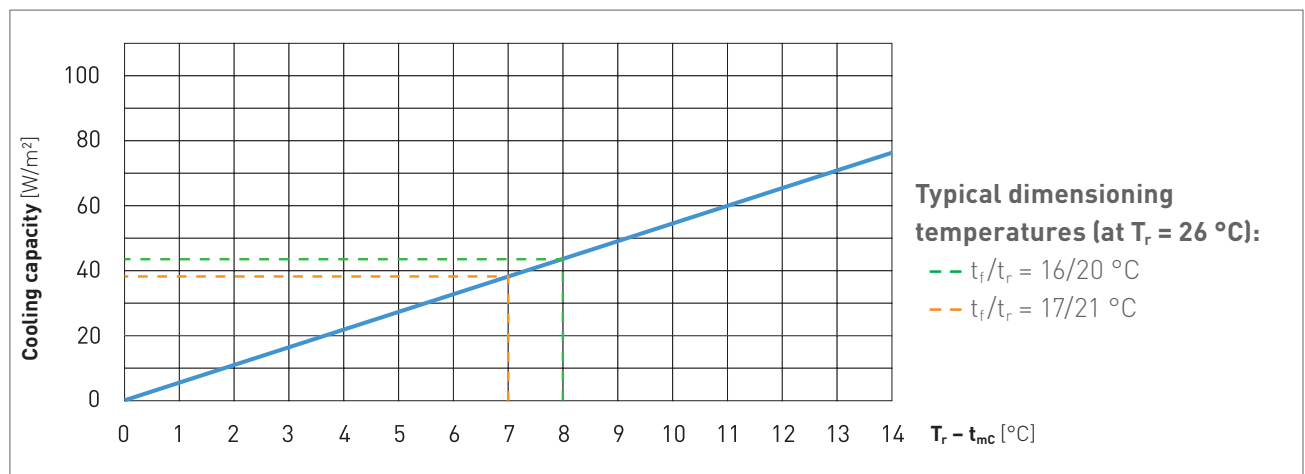
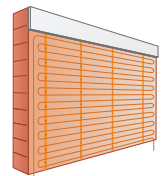
- Only valid with usage of plaster provided by costumer (dry bulk density $28d \geq 1250 \text{ kg/m}^3$)
- **Pipe distance 77 mm**
- Pipe coverage approx. 10 mm above pipe apex
- Max. length of VarioProFile pipe 11.6x1.5 Laser per cooling circuit incl. supply pipe: 80 m ($1 \text{ m}^2 = 13 \text{ m}$), (e.g. 5 m^2 cooling circuit and 15 m supply pipe), pressure loss according to Variotherm dimensioning software

EWHK77



- Only valid with usage of plaster provided by costumer (dry bulk density $28d \geq 1250 \text{ kg/m}^3$)
- **Pipe distance 115 mm**
- Pipe coverage approx. 10 mm above pipe apex
- Max. length of VarioProFile pipe 11.6x1.5 Laser per cooling circuit incl. supply pipe: 80 m ($1 \text{ m}^2 = 8.7 \text{ m}$), (e.g. 7.5 m^2 cooling circuit and 15 m supply pipe), pressure loss according to Variotherm dimensioning software

EWHK115



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

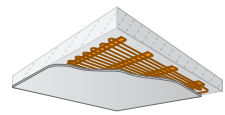
$$T_r = \text{Room temperature [°C]}$$

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

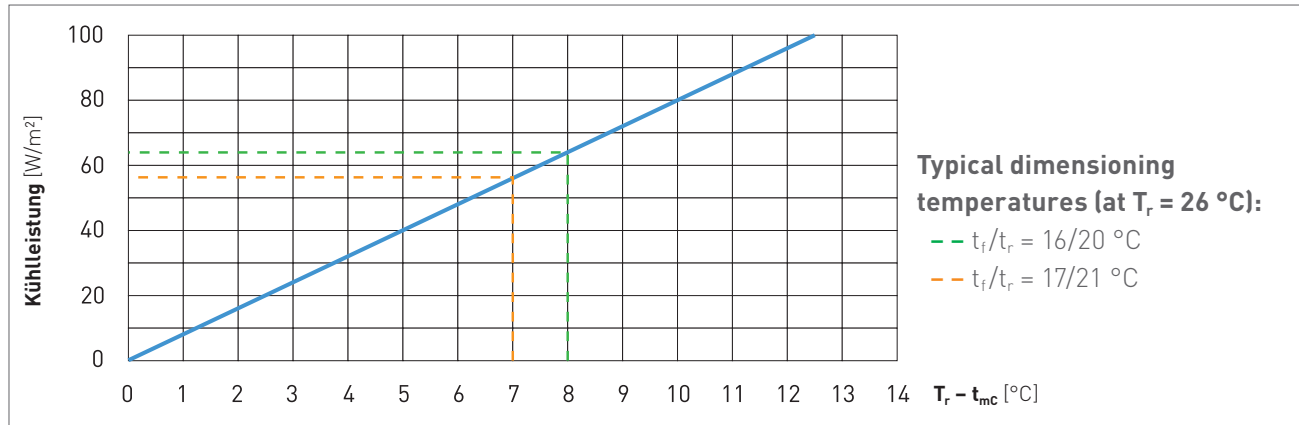
$$t_i/t_r = \text{flow/return temperature [°C]}$$

8.5 EasyFlex ceiling cooling

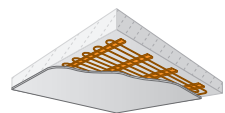
- Only valid with usage of plaster provided by costumer (dry bulk density $28d \geq 1250 \text{ kg/m}^3$)
- **Pipe distance 77 mm**
- Pipe coverage approx. 10 mm above pipe apex
- Max. length of VarioProFile pipe 11.6x1.5 Laser per cooling circuit incl. supply pipe: 80 m ($1 \text{ m}^2 = 13 \text{ m}$), (e.g. 5 m^2 cooling circuit and 15 m supply pipe), pressure loss according to Variotherm dimensioning software



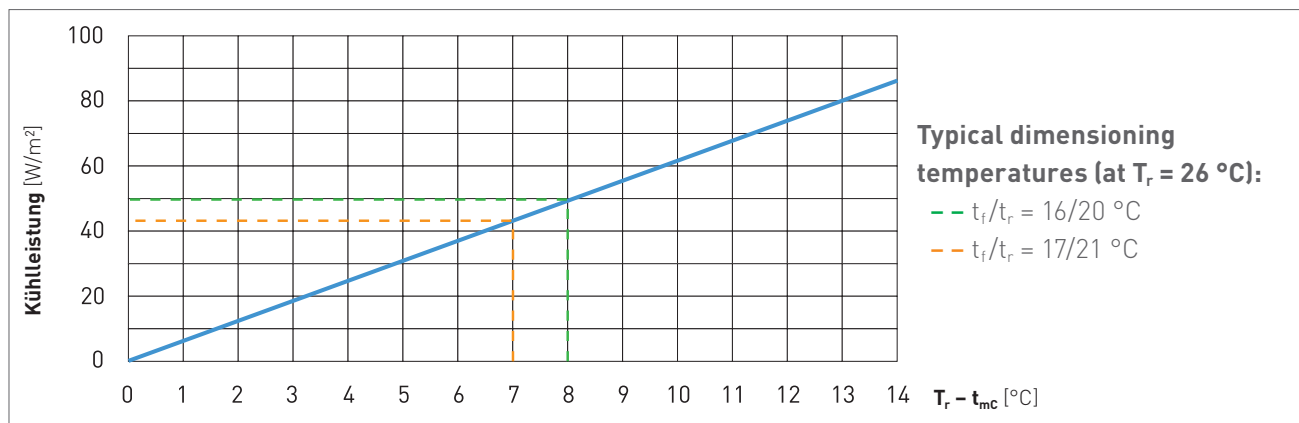
EDKH77



- Only valid with usage of plaster provided by costumer (dry bulk density $28d \geq 1250 \text{ kg/m}^3$)
- **Pipe distance 115 mm**
- Pipe coverage approx. 10 mm above pipe apex
- Max. length of VarioProFile pipe 11.6x1.5 Laser per cooling circuit incl. supply pipe: 80 m ($1 \text{ m}^2 = 8.7 \text{ m}$), (e.g. 7.5 m^2 cooling circuit and 15 m supply pipe), pressure loss according to Variotherm dimensioning software



EDKH115



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

T_r = Room temperature [°C]

T_0 = mean surface temperature [°C]

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

8.6 Surface condensation

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

Relative humidity [%rF]	Room temperature [T_r]				
	24 °C	25 °C	26 °C	27 °C	28 °C
70 %	18.0	19.0	20.0	21.0	22.0
60 %	15.5	16.5	17.5	18.5	19.2
50 %	13.0	14.0	15.0	15.8	16.8
40 %	9.8	10.5	11.5	12.5	13.2

9 COMPILATION

Object:

Date:

[illegible]

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