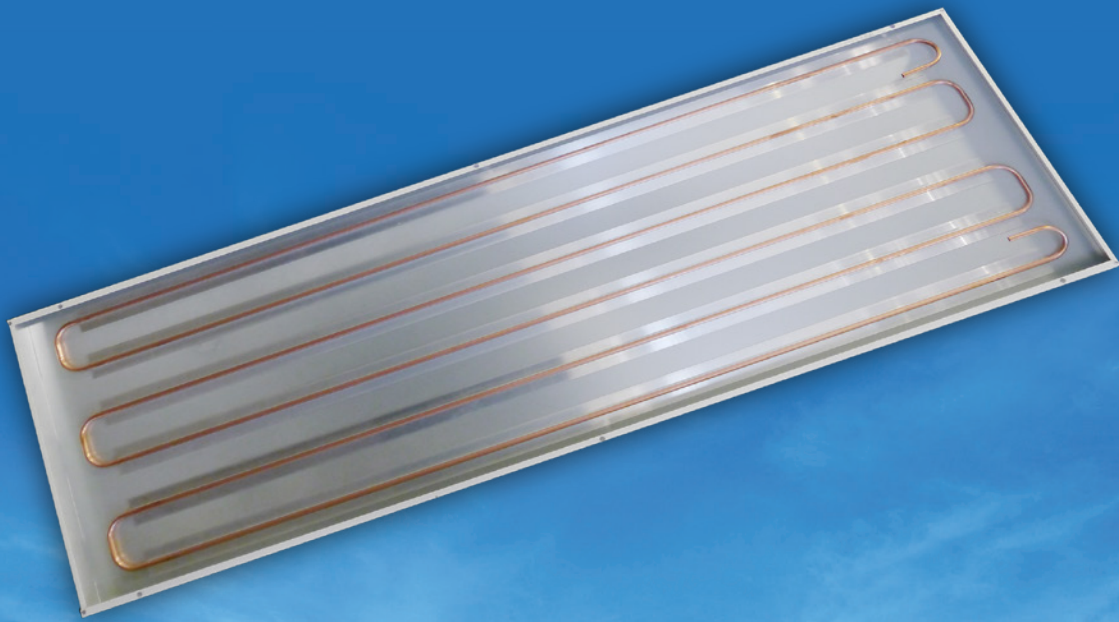




CEILFIT

Heating and Cooling Panels



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WHAT IS RADIANT HEATING?	3
Comfort	3
RADIANT HEATING?	4
Why radiant heating?	4
Zone or localised heating	4
System benefits	4
Graph (Temperature gradient)	4
MARK CEILFIT	5
The advantages of the Mark Ceilfit panel	6
Application areas	6
OPTIONAL: ACOUSTIC PANELS	7
TECHNICAL SPECIFICATIONS	8
Dimensions	8
Weight	8
Heating output	9
Cooling output	10
Relationship between the minimum mass flow and return temperature	11
The calculation of pressure losses of the Mark radiation panels	11
Pressure drop	12
CONNECTION TYPES	12
PROJECT PLANNING, ASSEMBLY AND SUSPENSION	13
Mounting	13
ACCESSORIES	14



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What is radiant heating?

Radiant heating is based on the principle of the heat transfer of a warm body to a body with a lower temperature by means of electromagnetic wave energy. This electromagnetic wave is not hindered by air, radiates walls, floor and other bodies in the specific room. These items absorb the radiation energy and then pass the heat on to the heat air stream.

This produces a convective flow of slowly rising warm air and colder air falling again that blend (induction).

The heating of the air in the space takes place substantially by this convective air flow from the heated floor and walls.

Heating a room by means of radiant panels always causes the floor temperature to be a few degrees higher than the room air temperature which in turn is experienced as very comfortable. Even directly under the radiation panel, the vertical temperature gradient is very low.

As the roof is often the largest surface that is directly in contact with the outside air, with air heating more energy will be lost by heating this cold surface (see graph "Temperature per meter height" on page 4).

Although this can be overcome by an increased air circulation, however, this requires extra energy and leads to a higher air displacement.

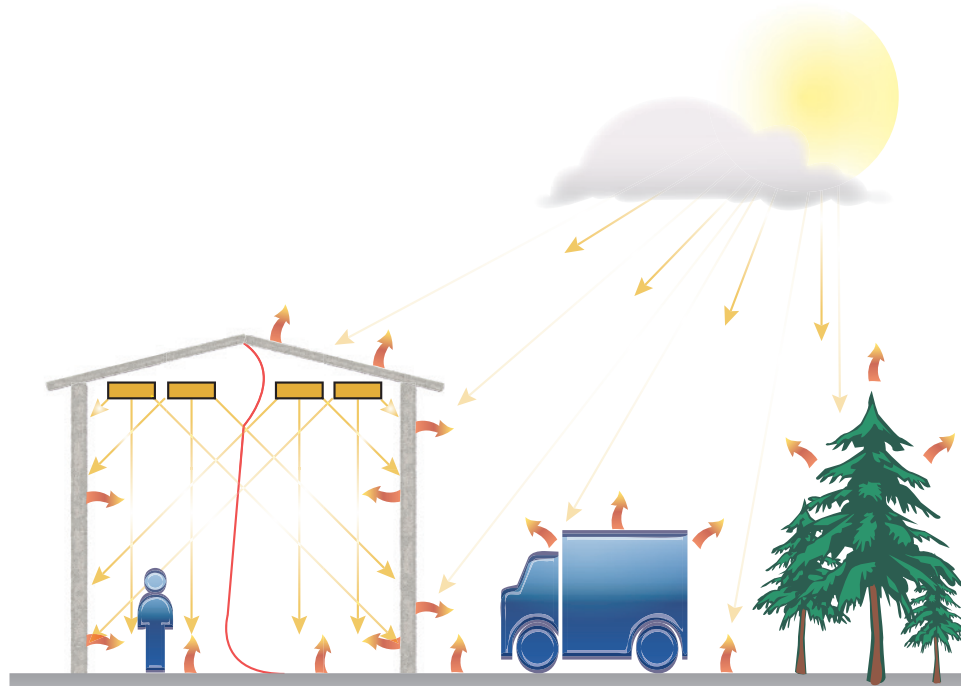
Consequence: drafts and dust displacement. Floor and walls remain cold!

COMFORT

When our body gives more heat to its environment than it produces, we experience this as uncomfortable.

The ideal method to heat cold surfaces is by means of radiant panels mounted on the ceiling which transfer their heat mainly through radiation.

Persons who are radiated in a room experience less heat loss and therefore greater comfort. As a result, the room air temperature may be set a few degrees lower. This way, in addition to more comfort energy saving can be realized.



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Radiant heating

WHY RADIANT HEATING?

Radiant heating has been used for decades in areas ranging from 2.5 to 25 meters suspension height. Radiant heating is installed at places where it costs nothing, namely on the ceiling. Radiant heating is relatively quickly assembled, has no maintenance, produces no noise and has a very long life.

ZONE OR LOCALISED HEATING

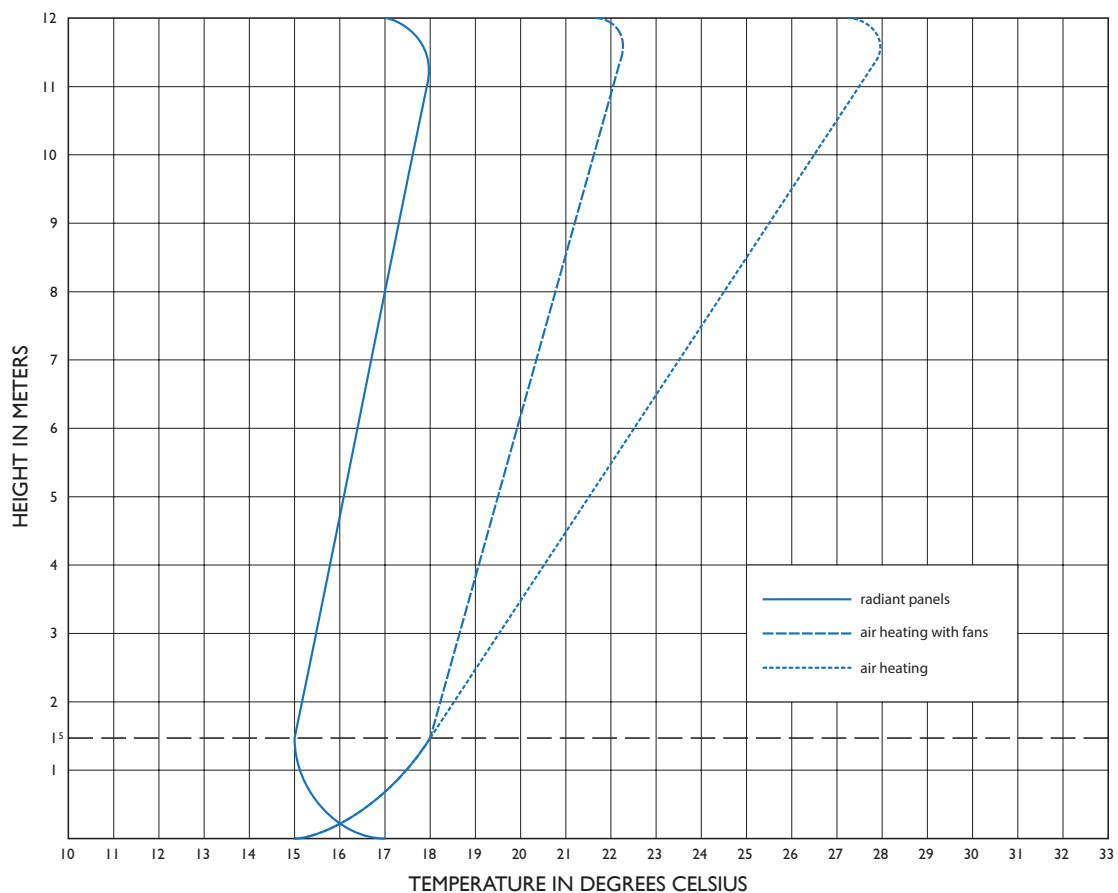
Radiant heating is also ideal for zone or local heating. Only the area to be heated is radiated. As a result, the energy costs are limited to a minimum.

SYSTEM BENEFITS

- Fast controllability by a low water content.
- Uniform temperature distribution all over the horizontal area.
- Very low vertical temperature gradient.
- Zone or local heating is possible.
- Still air layer, no dust or drafts.
- Room temperature is 3°C lower than heating by radiators or air heating.
- 25-30% energy savings compared to conventional air heating.
- 15% less full load hours.
- Very long life.
- Completely maintenance free.
- Great comfort by direct radiation.
- Heated floor.
- Space saving.
- Silent.
- Can be applied everywhere due to unobtrusive design.

TEMPERATURE PER METER HEIGHT:

GRAPH (the difference in the vertical temperature gradient radiant heating and air heating)



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Mark Ceilfit

The Mark CEILFIT gives a comfortable work and living environment through heating and cooling by convection and radiation. It is easy to regulate zones or rooms individually to ensure a pleasant surrounding. Due to the exclusion of radiators, extra wall and floor space is made available.

Our panels are compatible with grid type ceilings and can replace the standard tile without any additional work to the grid. The standard panels are available in common standard grid dimension, or as custom dimensions on request.

The Mark CEILFIT is constructed of RAL 9010 powder coated 0,7 mm steel sheet fused to copper tube. The copper tubing allows a quick and efficient heat or cooling transfer. The copper tubing is a 10x0,4mm high quality precision tubing that can withstand pressure up to 6 bar.

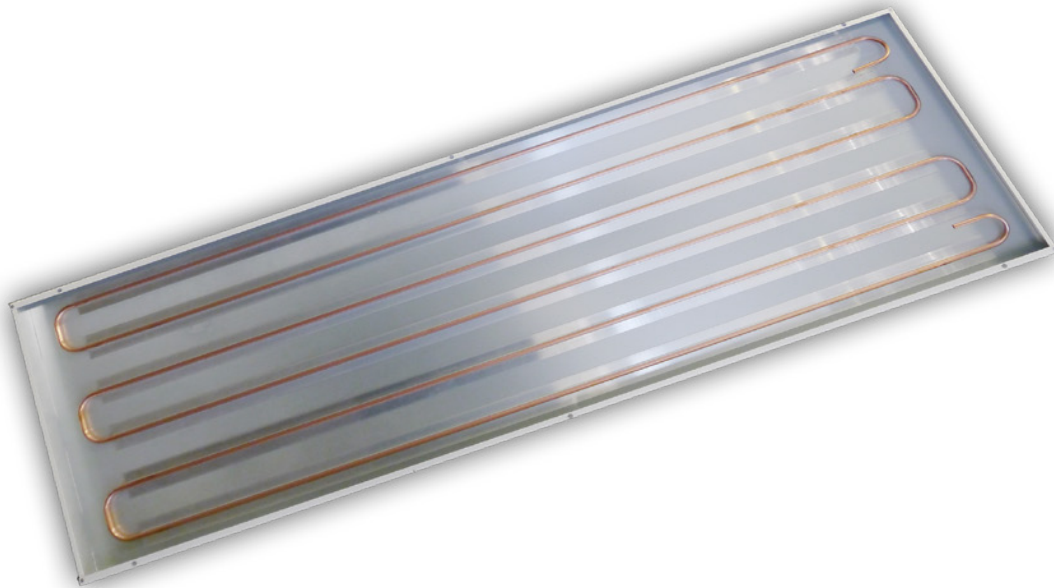
Panels can be optionally insulated with mineral wool with an aluminium foil layer. Dummy panels can be fitted to accommodate lightning, sensors, ventilation or other additions to the ceiling.

The panels are also available with perforation for a better sound absorption.

To support the weight of a fluid filled panel we strongly advise to add suspension wires from the panels to a structural part of the building or ceiling. The panels are accommodated with several holes to fix the suspension brackets or cables.

The Mark CEILFIT can be used in offices, schools, hospitals, public buildings and clinics.

All CEILFIT products are in accordance with the NEN-EN 13964 regulation.



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THE ADVANTAGES OF THE MARK CEILFIT PANEL



- Easy to clean
- Frees up floor and wall space
- Rapid warm up times, due to low water content
- Low air movement
- Low pressure drop (operating pressures)
- Low whole life costs - lack of moving parts
- Easily installed in standard T-Grid ceiling
- Cost efficient heating and cooling
- Attractive design

APPLICATION AREAS

- Schools
- Offices
- Hospitals
- Nursing homes
- Shops



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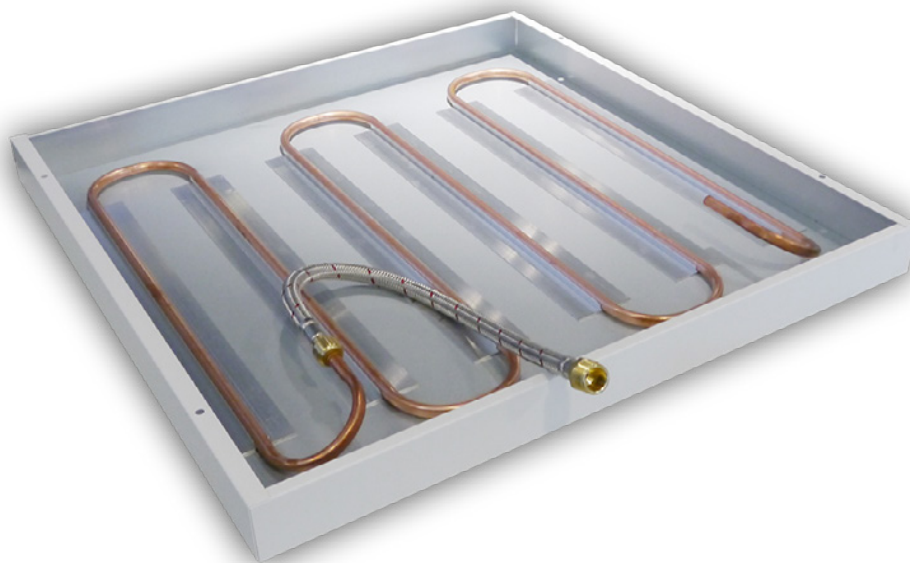
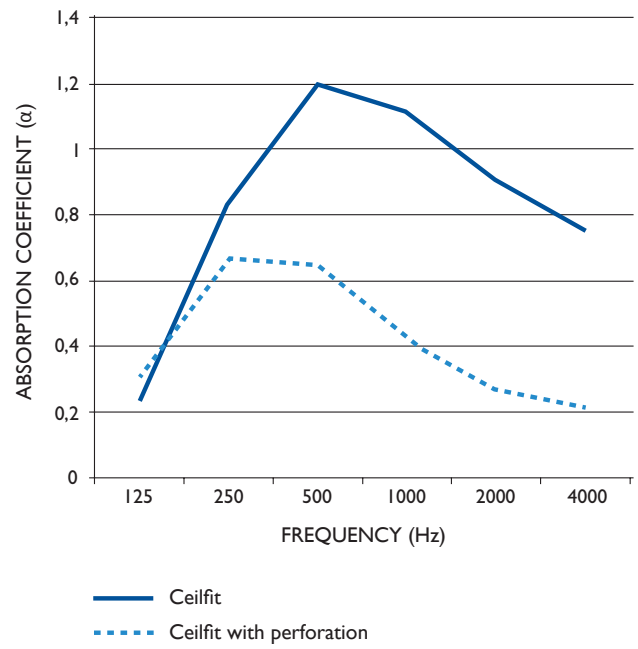
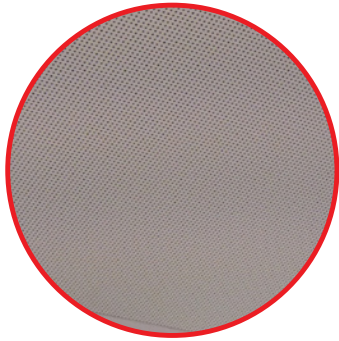
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Optional: acoustic panels

The Mark Ceilfit radiant panels can optionally be supplied in a perforated version for optimum room damping.



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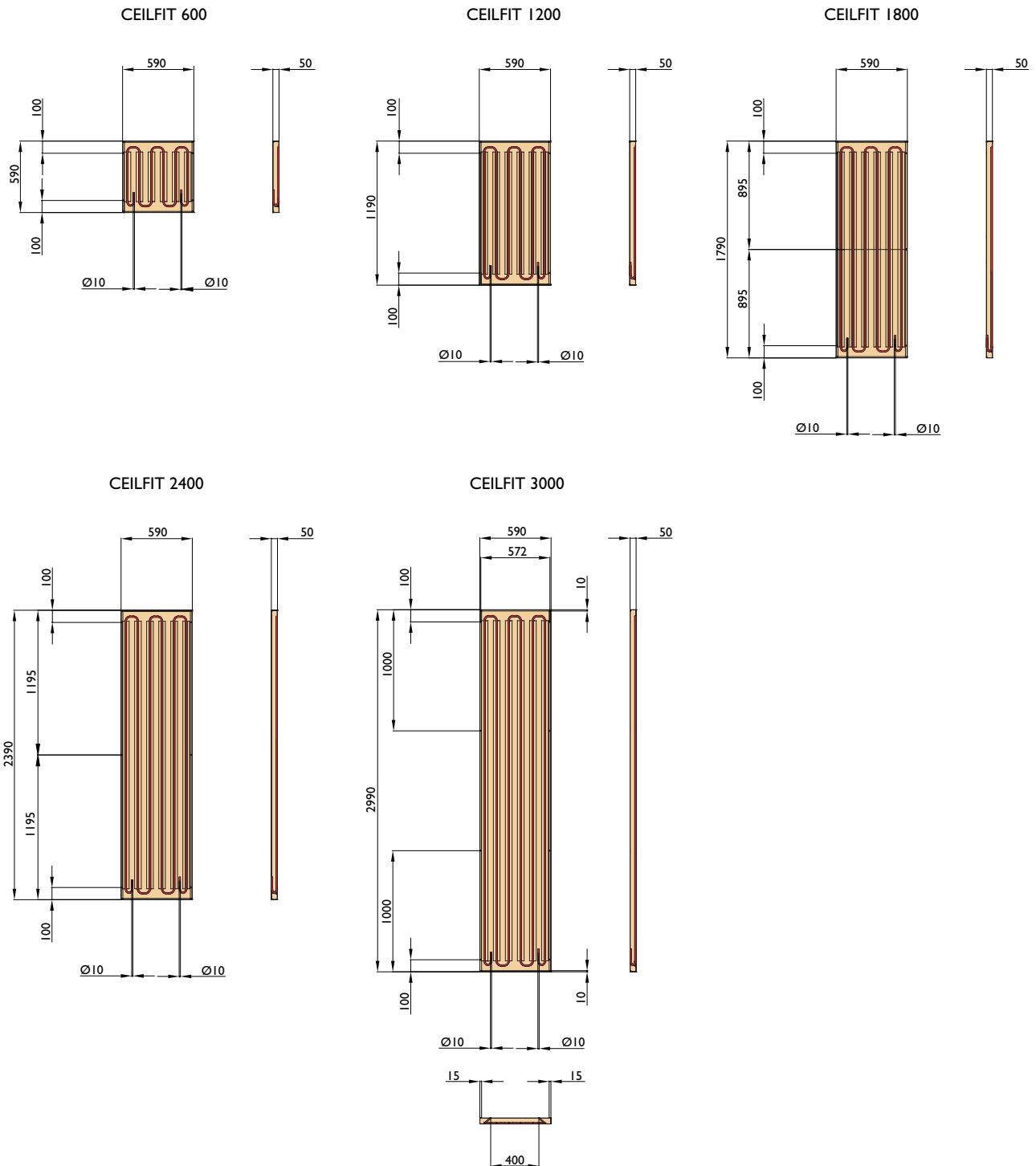
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Technical specifications

DIMENSIONS

Type	600	1200	1800	2400	3000
Width	mm 590	590	590	590	590
Length	mm 590	1190	1790	2390	2990



WEIGHT

Type		600	1200	1800	2400	3000
Panel weight without water content	kg	3,8	7,4	11,2	14,9	18,6
Panel weight with water content	kg	4,0	7,9	11,9	15,8	19,8

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HEATING OUTPUT

Heat delivery per panel in Watt

with insulation						without insulation					
K	600	1200	1800	2400	3000	K	600	1200	1800	2400	3000
90	293	653	1012	1371	1729	90	353	789	1222	1656	2089
89	289	644	998	1352	1706	89	349	778	1206	1633	2061
88	285	635	984	1333	1682	88	344	768	1189	1611	2032
87	281	628	972	1317	1662	87	340	758	1175	1591	2008
86	277	619	959	1299	1638	86	335	748	1158	1569	1979
85	274	611	947	1282	1618	85	331	738	1144	1549	1954
84	270	602	933	1264	1594	84	326	727	1127	1527	1926
83	266	594	921	1247	1574	83	322	718	1112	1507	1901
82	262	586	907	1229	1550	82	317	707	1096	1484	1873
81	259	578	895	1213	1530	81	313	698	1081	1465	1848
80	255	570	883	1196	1509	80	309	689	1067	1445	1823
79	251	561	870	1178	1486	79	304	678	1050	1423	1795
78	248	554	858	1161	1466	78	300	669	1036	1403	1770
77	244	545	844	1143	1442	77	295	658	1019	1381	1742
76	241	537	832	1127	1422	76	291	649	1005	1361	1717
75	237	529	820	1110	1401	75	286	639	990	1341	1692
74	233	520	806	1092	1378	74	282	629	974	1319	1664
73	230	513	794	1076	1357	73	277	619	959	1299	1639
72	226	505	782	1059	1337	72	273	610	945	1280	1615
71	222	496	768	1041	1313	71	268	599	928	1257	1586
70	219	488	756	1024	1293	70	264	590	914	1238	1561
69	215	480	744	1008	1272	69	260	580	899	1218	1537
68	212	473	732	992	1252	68	256	571	885	1198	1512
67	208	464	719	973	1228	67	251	560	868	1176	1484
66	204	456	707	957	1208	66	247	551	854	1156	1459
65	201	448	695	941	1187	65	243	542	839	1137	1434
64	197	441	683	925	1167	64	238	532	825	1117	1409
63	194	433	671	908	1146	63	234	523	810	1097	1384
62	190	424	657	890	1123	62	229	512	793	1075	1356
61	186	416	645	873	1102	61	225	503	779	1055	1331
60	183	408	633	857	1082	60	221	493	764	1035	1306
59	180	401	621	841	1061	59	217	484	750	1016	1282
58	176	393	609	825	1041	58	213	475	735	996	1257
57	173	385	597	808	1020	57	208	465	721	977	1232
56	169	377	585	792	999	56	204	456	706	957	1207
55	166	370	573	776	979	55	200	447	692	937	1183
54	162	362	561	760	958	54	196	437	677	918	1158
53	159	354	549	743	938	53	192	428	663	898	1133
52	155	346	537	727	917	52	188	419	648	878	1108
51	152	339	525	711	897	51	183	409	634	859	1083
50	148	331	513	695	876	50	179	400	619	839	1059
49	145	323	501	678	856	49	175	390	605	819	1034
48	141	315	489	662	835	48	171	381	590	800	1009
47	138	309	478	648	818	47	167	373	578	783	988
46	135	301	466	632	797	46	163	364	563	763	963
45	131	293	454	616	777	45	159	354	549	744	938
44	128	286	442	599	756	44	155	345	534	724	913
43	124	278	430	583	736	43	150	336	520	704	889
42	122	271	420	569	718	42	147	328	508	688	867
41	118	263	408	553	698	41	143	318	493	668	843
40	115	256	396	537	677	40	138	309	479	648	818
39	112	249	386	523	659	39	135	301	466	631	797
38	108	241	374	506	639	38	131	292	452	612	772
37	105	234	362	490	618	37	126	282	437	592	747
36	102	227	352	476	601	36	123	274	425	575	726
35	98	219	340	460	580	35	119	265	410	556	701
34	95	213	329	446	563	34	115	257	398	539	680
33	92	205	317	430	542	33	111	247	383	519	655
32	89	198	307	416	525	32	107	239	371	502	634
31	85	190	295	400	504	31	103	230	356	483	609
30	82	184	285	386	487	30	99	222	344	466	588
29	79	177	274	372	469	29	96	214	331	449	567
28	76	169	262	355	448	28	92	205	317	429	542
27	73	163	252	341	431	27	88	197	305	413	520
26	70	156	242	328	413	26	84	189	292	396	499
25	66	148	230	311	393	25	80	179	278	376	474
24	63	142	220	297	375	24	77	171	265	359	453
23	61	135	209	283	358	23	73	163	253	342	432
22	58	128	199	269	340	22	69	155	240	326	411
21	55	122	189	256	322	21	66	147	228	309	389
20	52	115	178	242	305	20	62	139	215	292	368

K = Average water temperature - room temperature. Values for a mass flow of 0.02 litres per second/pipe.

Maximum waterpressure: 6 Bar

Maximum water temperature: 80 °C

Heat delivery inline with EN 14037-5

When panels are installed below a height of 3 meter, the mean temperature of the panel should not be more than +45 °C in order to avoid radiation assymetry.

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COOLING OUTPUT

Cooling capacity per panel in Watt

with insulation					
K	600	1200	1800	2400	3000
15	52	117	181	246	310
14	49	108	168	228	288
13	45	100	155	210	265
12	41	92	142	193	243
11	37	83	129	175	221
10	34	75	116	157	199
9	30	67	104	141	178
8	26	59	91	124	156
7	23	51	79	107	135
6	19	43	67	91	114
5	16	35	55	74	93
4	12	28	43	58	73
3	9	20	31	42	54
2	6	13	20	27	34
1	3	6	10	13	16

without insulation					
K	600	1200	1800	2400	3000
15	61	136	204	285	360
14	57	126	189	265	334
13	52	116	174	244	308
12	48	106	160	223	282
11	43	97	145	203	257
10	39	87	131	183	231
9	35	78	117	163	206
8	31	68	102	143	181
7	26	59	88	124	156
6	22	50	75	105	132
5	18	41	61	86	109
4	14	32	48	67	85
3	11	23	35	49	62
2	7	15	23	32	40
1	3	7	10	14	18

K = Average water temperature - room temperature. Values for a mass flow of 0.02 litres per second/pipe.

Maximum waterpressure: 6 Bar

Cooling capacity inline with EN 14240

When panels are used for cooling, it is recommended to use non-insulated panels

Panel cooling is dry cooling. This type of cooling requires a dew point control system.



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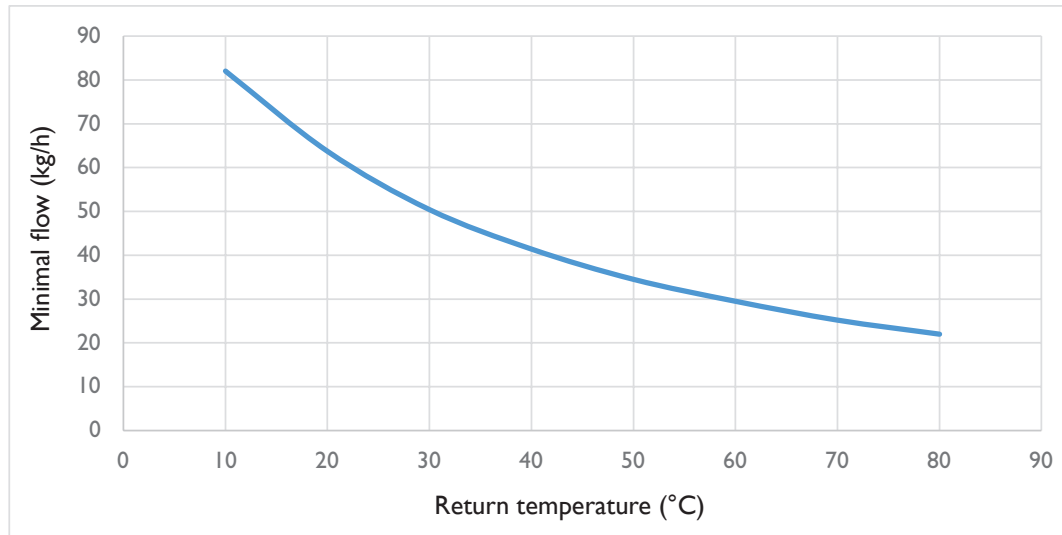
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RELATIONSHIP BETWEEN THE MINIMUM MASS FLOW AND RETURN TEMPERATURE

The graph below shows the relationship between the minimum mass flow and the return temperature. The minimum mass flow is required to obtain a turbulent flow in the pipes. Only then the heat output can be realized. In case this mass flow rate is too low (often caused by short panel lengths), a laminar flow is created which in turn results in a strong decline of the heat output.

A too low mass flow in the tubes can be prevented by:

- Decreasing the difference between the flow and return temperature.
- Applying separation plates in the collector.
- Connecting multiple panel lengths in series.



* Example calculation below

THE CALCULATION OF PRESSURE LOSSES OF THE MARK RADIATION PANELS

The resistance of the most optimally selected panel is as low as possible and yet mass flow rate is sufficient.

Depending on the type of panel, this is determined by:

- the mass flow of the medium per panel
- the method of connection of the hydraulic system

The mass flow per panel is calculated using the output and the difference between the flow and return temperature:

$$M = \frac{P}{C_p \times \Delta t} \text{ kg/s} \quad \text{or} \quad \frac{P \times 0,86}{\Delta t} \text{ kg/h}$$

P = total output of the panel in W.

Δt = temperature difference between flow and return

C_p = specific heat of water $\pm 4200 \text{ J}/(\text{kg}\cdot\text{K})$

The factor K is defined by:

$$K = \frac{T_a + T_r}{2} - T_u$$

T_a = flow temperature of the water

T_r = return temperature of the water

T_u = room temperature

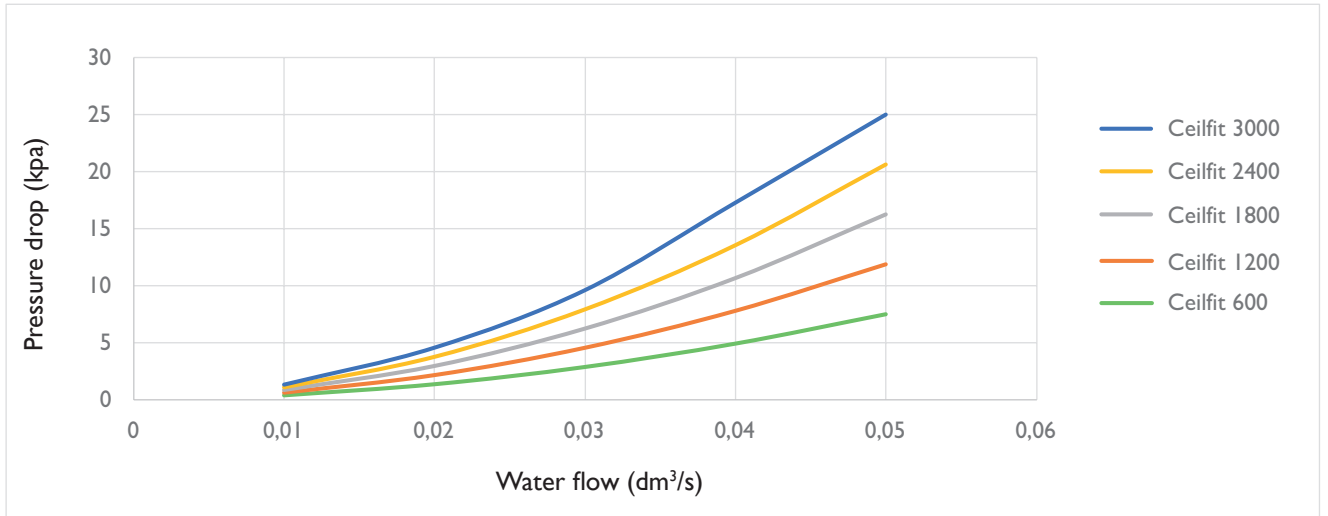
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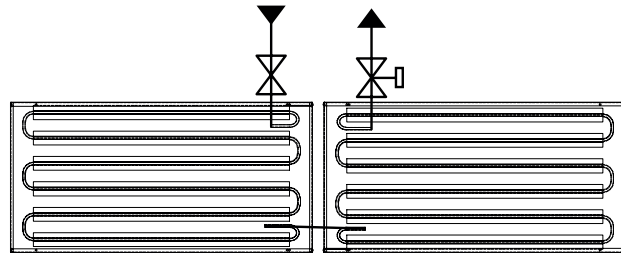
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PRESSURE DROP

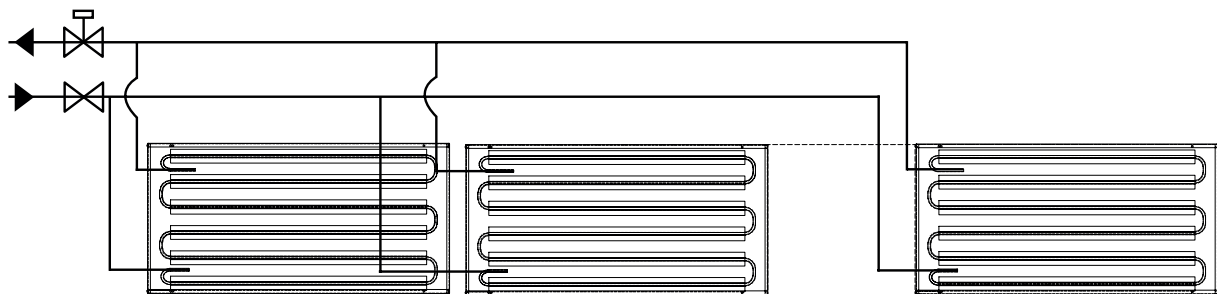


Control

CONNECTION IN SERIES



CONNECTION IN PARALLEL



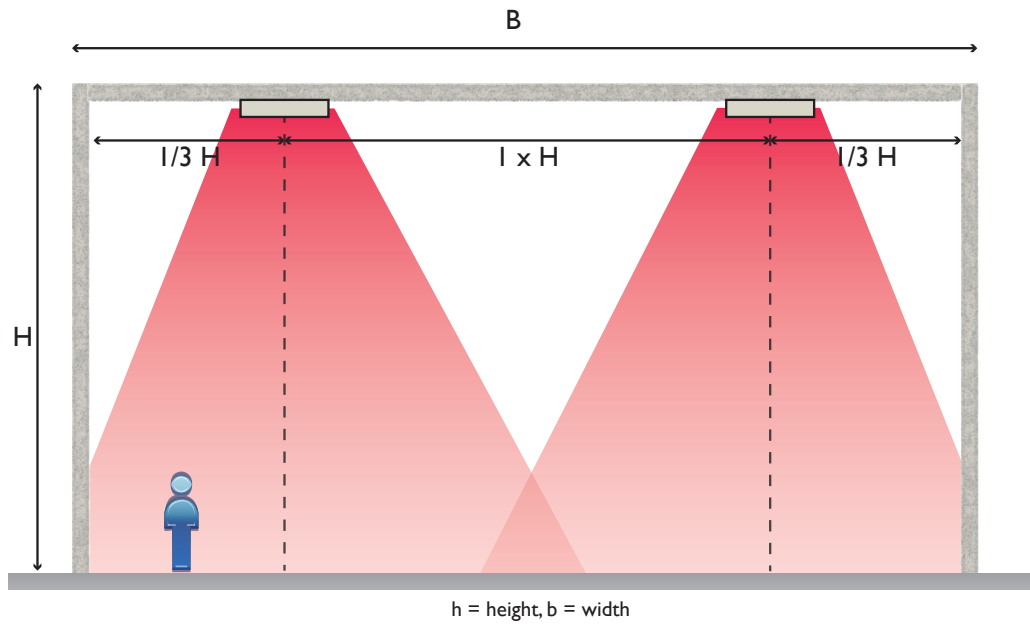
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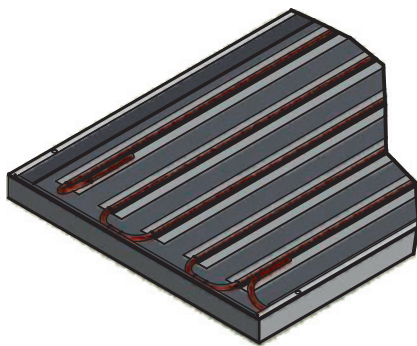
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Project planning, assembly and suspension



Panels should be evenly distributed in the room, emphasize more close to windows and outer walls.



MOUNTING



Type	No. of suspension points
600	4
1200	4
1800	6
2400	6
3000	8



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Accessories

Hose connection 10 x 10 mm

Maximum operating temperature: 80 °C

Maximum operating pressure: 6 bar

Hose connection 10 x 1/2" female thread as coupler

Maximum operating temperature: 80 °C

Maximum operating pressure: 6 bar

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 Unit 5A Commercial Courtyard, Duke Street, Settle,
 North Yorkshire, United Kingdom. BD24 9RH
 T: +44 (0) 1729 824 108
 W: www.puravent.co.uk
 E: info@puravent.co.uk



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