zehnder *carboline*

Introduction

The Zehnder Carboline sets new standards in terms of performance, temperature distribution and controllability. Constructed from steel sheeting and a patented graphite and copper insert, the Zehnder Carboline is a smooth, flat and lightweight panel designed for both heating and cooling. This high-performance system can easily and practically be integrated into existing, new grid and suspended ceilings making the Zehnder Carboline perfectly suited to providing climate control in offices, schools, hospitals, meeting rooms and surgeries – in short, everywhere a comfortable and healthy indoor climate plays a decisive role.

Standard Features:

- Fully tested and compliant to EN 14037 and EN 14240
- Flat, smooth finish
- Patented lightweight and rigid steel, graphite and copper construction
- White anti-bacterial powder coat finish RAL 9016
- Insulation
- 600mm wide
- Individual lengths up to 3000mm
- Peel-off plastic film protection on front face

Options:

- Fixing options for T-bar, free-hanging and plasterboard installations
- Perforated finish for enhanced acoustic performance (ISO 354)
- Integrated cutouts for lights, grilles and ancillary fittings
- A range of flexible hoses for connecting to 15mm pipework
- Internal or external threaded connections

Operating Parameters:

- Max. working temperature: 85°C
- Max. working pressure: 10 bar

Product Specification ([/] denotes options):
Zehnder Carboline comprises of a copper pipe (Ø10 mm) which is embedded in a graphite sandwich. This high-performance thermal element is placed inside a sheet steel cassette. The materials and their arrangement guarantee ideal heat transmission and high performance values. The radiant panel has an angled profile on the side and top. This increases the strength to create a self-supporting panel. The angled profiles are also intended for the mounting of fitting clips on the top of the panel.

Ceiling panel to be [perforated for acoustic performance to DIN EN ISO 354 / unperforated].

Heating output to be in accordance with EN 14037.

Cooling output to be in accordance with EN 14240.

Insulation to be 18mm fire retardant board, in accordance with EN13501: thermal conductivity 0.040 W/mK; raw density min 3.0 kg/m².

Panel to have microstructure finish in [white anti-bacterial powder coat RAL 9016 (20% mat) / colour selected from Zehnder's colour chart].

5 year warranty

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Expanded Natural Graphite

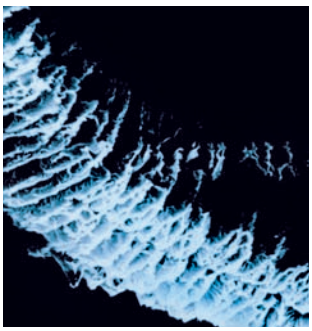
The material used for Zehnder Carboline is produced from scale-shaped natural graphite with a defined crystalline structure. This is a naturally occurring material and an inorganic modification of carbon; The carbon atoms of the graphite are arranged in a hexagonal crystal lattice in flat, superimposed layers. The production process enlarges the volume of these parallel scales by 200 to 400 times. This expanded natural graphite is then processed further into lightweight panels.

Properties of expanded natural graphite:

- Good thermal conductivity
- Low density
- Non-combustible
- Non-ageing
- Physically inert

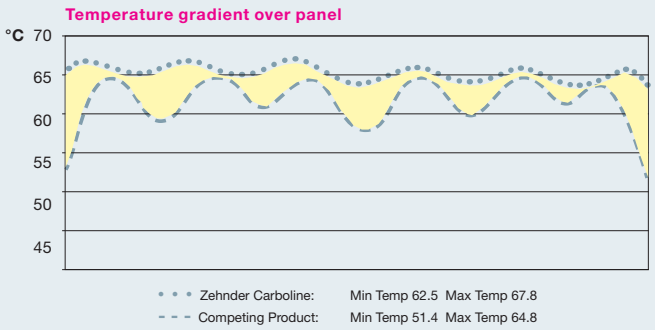
Klimatechnik mit ECOPHIT

SGL GROUP THE CARBON COMPANY

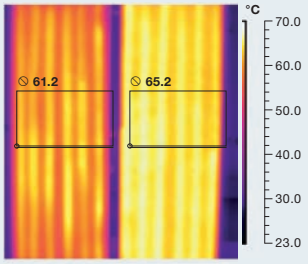


The expanded natural graphite guarantees an extremely even distribution of temperature. Due to the high and even surface temperature, the radiant component of Zehnder Carboline is significantly higher than in comparable ceiling-mounted heating and cooling systems. This additional radiant heat provides extra comfort in the various rooms, while simultaneously reducing energy costs.

As well as better heat distribution, the reaction time of Zehnder Carboline under alternating cooling or heating loads is unrivalled. The system reacts much quicker than conventional ceiling-mounted heating and cooling systems. Critical to this is the combination of good conductivity and low mass found in expanded natural graphite. Due to the rapid response, energy efficiency is much higher than in conventional systems.

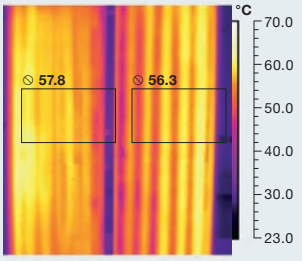


As the graph opposite illustrates, existing products in the market can have significantly varying temperature profiles across the panel surface. Zehnder Carboline achieves excellent temperature consistency over the panel surface which ensures the performance of the panel and optimises energy savings (represented by the shaded area on the graph).

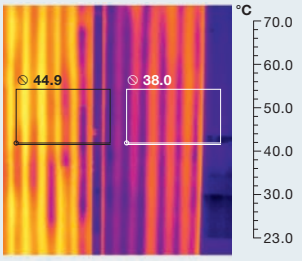


⦸ average surface temperature in °C

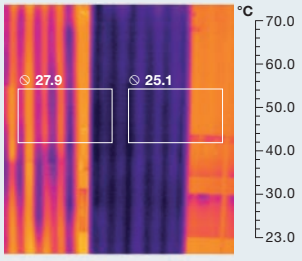
The thermographic images show the difference in performance of the Zehnder Carboline panel (shown as the right-hand image in each case) and an existing, comparable product, each under the same operating conditions (supply and return temperatures and mass flow rate). It can be seen that Zehnder Carboline responds much faster to changes in temperature in the transition from heating to cooling mode and achieves even temperature distribution in both states. Once again this provides a highly reactive system better able to achieve the desired room conditions with optimal efficiency.



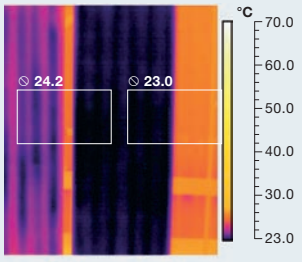
After 30 seconds



After 1 minute



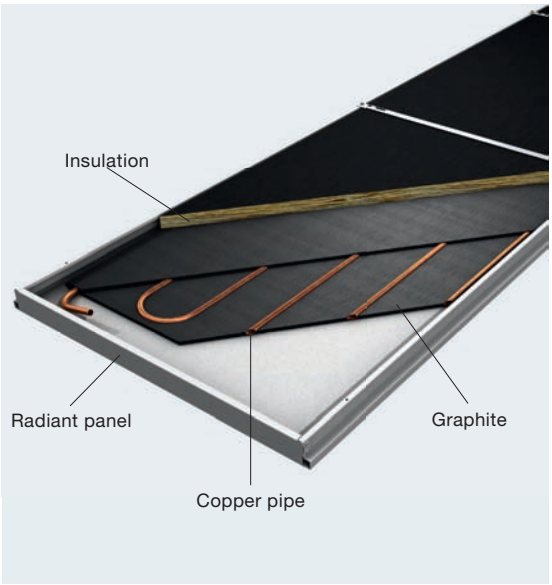
After 5 minutes

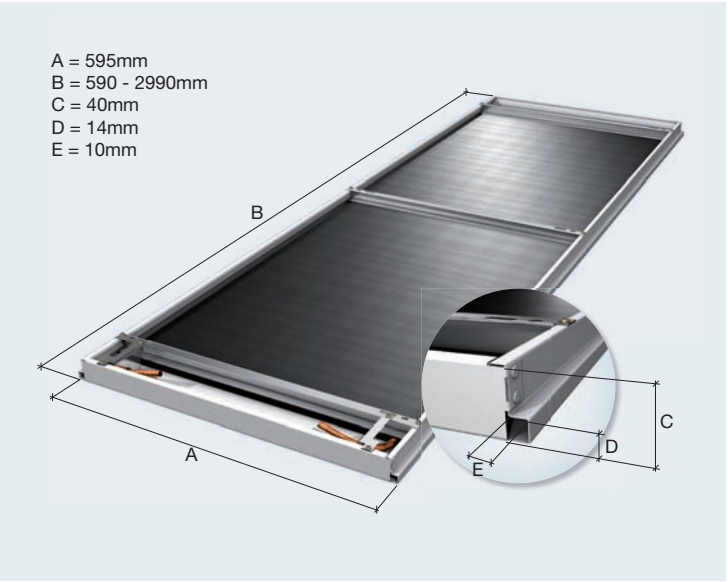


After 25 minutes

Profiles

Zehnder Carboline covers the entire range of grid ceilings for offices and meeting rooms, as well as schools, hospitals and doctors' surgeries. The elements come in a standard width and in five standard lengths.





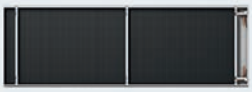
The copper pipes (Ø10 mm, pipe centres 100 mm) are sandwiched within a compressed graphite panel. This has allowed a proven high thermal conductivity with 95% efficiency to be achieved across the entire area of the element. This high-performance element is firmly bonded to a galvanised sheet steel cassette. The deburred pipe ends are screwed to the cassette using location brackets in order to provide reinforcement and pressure relief. The visible side is coated with high-grade polyester fine-structure paint. The sheet steel cassette is available smooth or perforated (for acoustically performance). Fixing clips are applied at various points across the sheet steel cassette.

All weights in KG

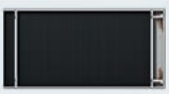
CBL600/3000 (595 x 2990 mm)

CBL600/2400 (595 x 2390 mm)

CBL600/1800 (595 x 1790mm)



CBL600/1200 (595 x 1190 mm)



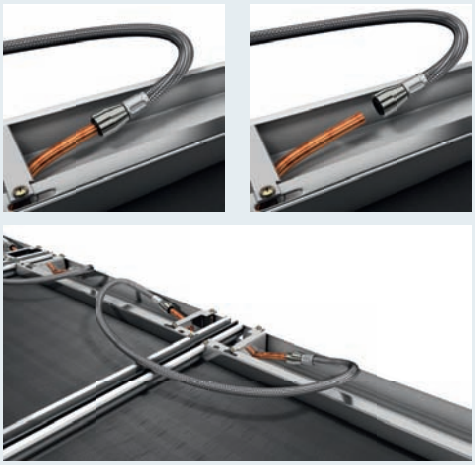
CBL600/0600 (595 x 590 mm)

Weight with insulation	Operating weight with insulation	Insulation weight	Water content weight	Number of suspension points	Number of pipe rows	Pipe separation	Heat Output (EN 14037) △T = 55K	Cooling Output (EN 14240) △T = 10K
20.58	21.71	1.07	1.13	6	6	100 mm	1065	183
16.47	17.37	0.85	0.90	4			852	146
12.68	13.35	0.64	0.67				639	110
8.57	9.01	0.42	0.44				426	73
4.77	4.98	0.21	0.21				213	37

Options

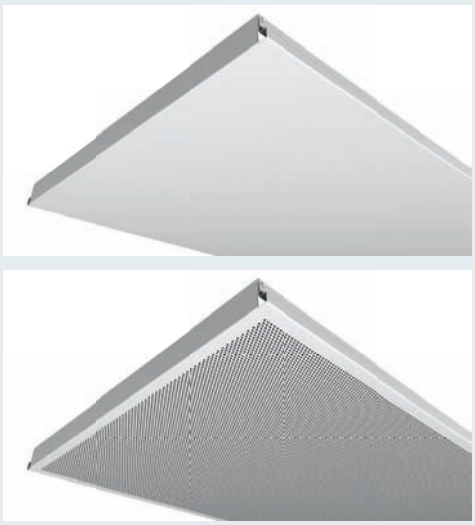
Connections

For Zehnder Carboline, both connection pipes are located on the same end. This enables easy installation and quick connection of the panels. Special connection hoses can be used to connect two panels to each other; they can be pushed directly onto the pipes with no need for an additional tool.



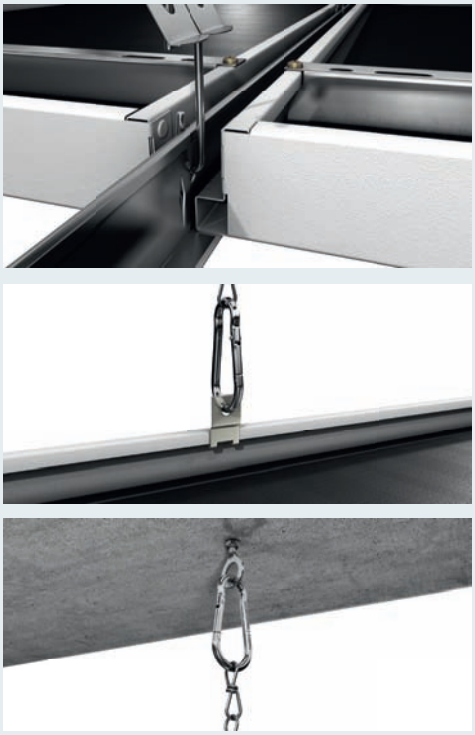
Acoustic Absorption

Each panel also has the option of either a smooth or perforated surface. As well as their cooling and heating effect, the radiant ceiling panels can also be used for acoustic absorption: The sound waves pass through the perforated surface of the radiant panel into the insulation within, where they are absorbed. This results in a significant reduction of the noise level or a reduction in the reverberation time (e.g. in open-plan offices, call centres and schools). Please contact us for detailed information on calculating the acoustic performance.



Fixing Options

Zehnder Carboline is installed as standard into a ceiling grid. It is also possible to attach the panels directly to the ceiling. Fixing hooks are supplied to fix the panel to the ceiling. These simply clip into the lip on the side of the panel. The individual clips can be moved along the panel and can, therefore, be flexibly adjusted to the conditions in the building. A standard installation set is available for installing the cooling and heating elements to the ceiling. This installation set allows the panel to be fixed directly to the concrete ceiling. Zehnder offers further tailor-made solutions on request.



Outputs

Heating Output

The Zehnder Carboline radiant heating output has been tested to and is fully compliant with EN 14037. Radiant output is proportional to the fourth power of the surface temperature in Kelvin. The Zehnder Carboline is extremely efficient in that the temperature of the radiating surface is very close to the system temperature. Heat losses for spaces heated by radiant panels should be calculated in the normal way, however, it should be remembered that with radiant heating, comfort conditions are achieved with an air temperature which is typically 3K lower than conventional heating.

Cooling Output

The Zehnder Carboline radiant heating output has been tested to and is fully compliant with EN 14202. Ceilings used for cooling operate on the same principles of radiation and convection as radiant heating. The warm air rises through convection and the heat is transferred to the cooled ceiling. The cooled air flows back into the room through convection. Approximately 40% of the heat absorption by the ceiling is based on convection, with 60% being heat radiated from the warm surfaces, but the relationship between radiation and convection generally depends on the type of ceiling panel and the ambient temperature of the surroundings.

Cooling output					
	600 x 600	600 x 1200	600 x 1800	600 x 2400	600 x 3000
K	3,183	6,367	9,550	12,734	15,917
n	1,070				
Δ t (K)	W	W	W	W	W
15	58	115	173	231	289
14	54	107	161	214	268
13	50	99	149	198	248
12	45	91	136	182	227
11	41	83	124	166	207
10	37	75	112	150	187
9	33	67	100	134	167
8	29	59	88	118	147
7	26	51	77	102	128
6	22	43	65	87	108
5	18	36	53	71	89
4	14	28	42	56	70
3	10	21	31	41	52
2	7	13	20	27	33
1	3	6	10	13	16

Heat output					
	600 x 600	600 x 1200	600 x 1800	600 x 2400	600 x 3000
K	1,928	3,856	5,783	7,711	9,639
n	1,174				
Δ t (K)	W	W	W	W	W
80	331	661	992	1322	1653
78	321	642	963	1284	1605
76	311	623	934	1245	1556
74	302	603	905	1207	1508
72	292	584	876	1169	1461
70	283	565	848	1130	1413
68	273	546	819	1093	1366
66	264	528	791	1055	1319
64	254	509	763	1018	1272
62	245	490	735	980	1225
60	236	472	708	943	1179
58	227	453	680	907	1133
56	217	435	652	870	1087
55	**213**	**426**	**639**	**852**	**1065**
54	208	417	625	834	1042
52	199	399	598	797	997
50	190	381	571	762	952
48	181	363	544	726	907
46	173	345	518	691	863
44	164	328	492	655	819
42	155	310	465	621	776
40	147	293	440	586	733
38	138	276	414	552	690
36	129	259	388	518	647
34	121	242	363	484	605
32	113	225	338	451	564
30	105	209	314	418	523
28	96	193	289	386	482
26	88	177	265	353	442
24	80	161	241	322	402
22	73	145	218	290	363
20	65	130	195	260	325
18	57	115	172	230	287
16	50	100	150	200	250
14	43	85	128	171	214
12	36	71	107	143	178
10	29	58	86	115	144
8	22	44	66	89	111
6	16	32	47	63	79

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