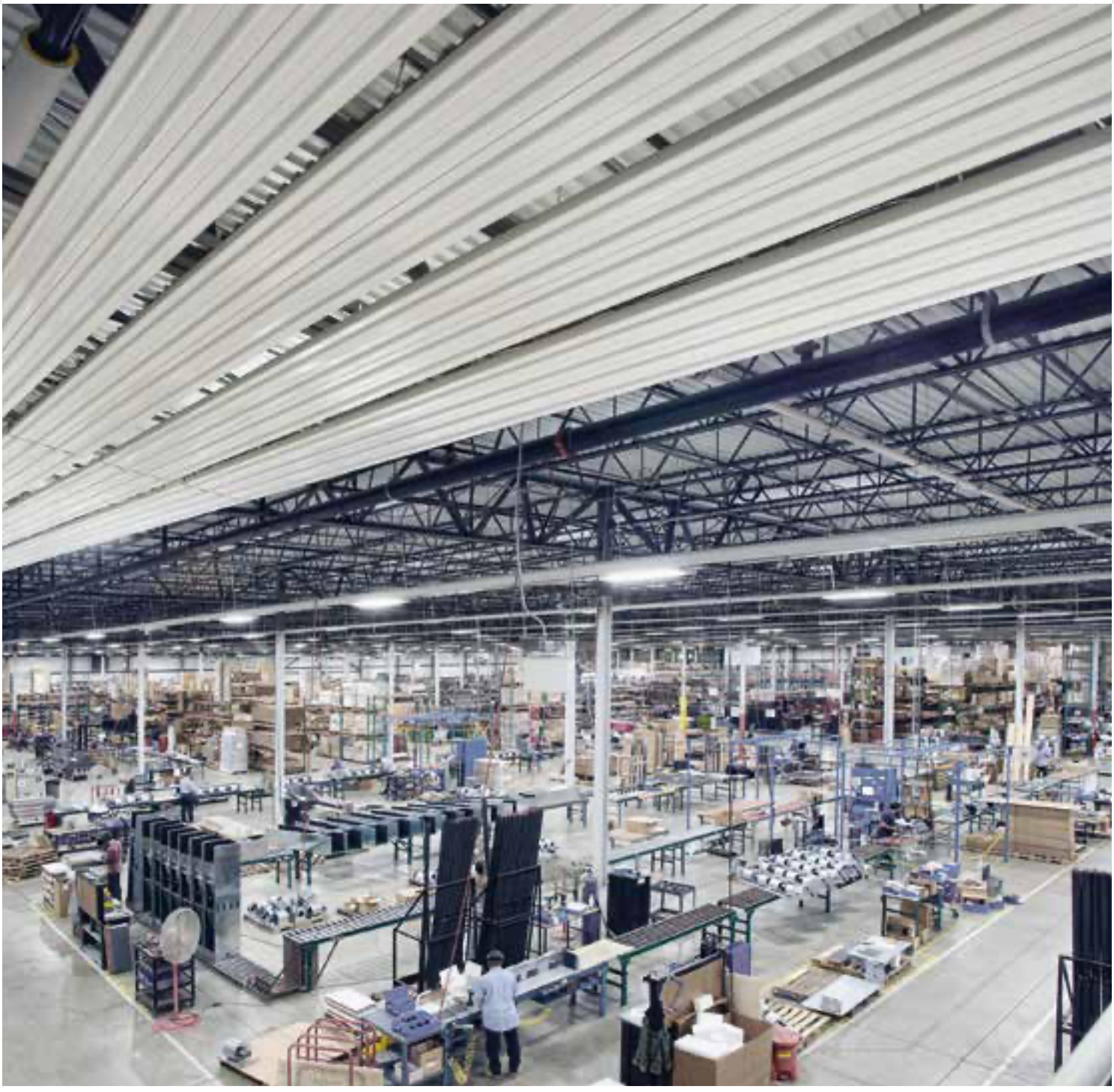
zehnder
always the best climate

LUFITAT

Zehnder ZIP

Technical brochure for radiant ceiling panels for heating and cooling

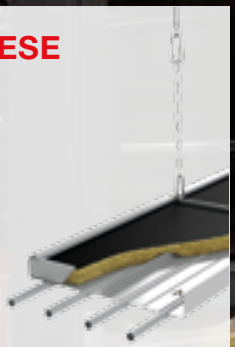


Modelled on the sun

Heating by the sun – a natural principle adopted by Zehnder ZIP radiant ceiling panels for indoor spaces – comfortable, healthy and energy-efficient. They do not use any electrical driving energy and are totally maintenance-free. Since they do not disperse any dust, they can help prevent allergic reactions, among other things. What's more, because the perceived temperature is around 3 K higher than the air temperature, you benefit from a really cosy feeling with minimum energy consumption. Zehnder ZIP radiant ceiling panels are ideally suited for use in production halls and warehouses, workshops, sports halls, garages, showrooms, shipyards, maintenance halls, wet rooms, etc. As one of Europe's leading suppliers of radiant ceiling panels, Zehnder has decades of valuable experience to draw from.

ZEHNDER ZIP OFFERS THESE SPECIAL FEATURES

Thanks to high levels of energy efficiency and a modular design, Zehnder ZIP enables functional solutions for heating and cooling.



PAGE **4-5**

MOUNTING AND INSTALLATION

The installation stage is made easier due to flexible systems and professional support from Zehnder.

PAGE **6-25**

Mercedes dealership, Strasbourg (France)

TECHNICAL SPECIFICATIONS

- Calculation of pressure loss and minimum mass flow
- Heating and cooling performance
- Technical specification

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Product benefits

Like all Zehnder products and systems, Zehnder ZIP radiant ceiling panels offer many advantages which contribute to creating a comfortable, healthy and energy-efficient indoor climate.

You can find more information on planning documents and installation instructions at:
www.international.zehnder-systems.com

ECONOMIC EFFICIENCY

- Up to 40% energy savings possible
- Air temperature may be 3 K lower (heating) or 3 K higher (cooling) than the perceived temperature
- Free choice of energy source; alternative energy sources, heat pumps, condensing appliance technology or waste process heat can also be used
- No additional electricity costs for driving energy
- No maintenance or servicing costs
- High heating and cooling output (according to EN 14037-2 (heating) or based on DIN 4715-1 (cooling))
- Extremely quick response to temperature changes

COMFORTABLE INDOOR CLIMATE

- Natural principle of radiant heat
- Heating and cooling effect immediately noticeable
- Even temperature distribution throughout the room or space
- No dust dispersal – advantage for allergy sufferers
- Quiet in operation

Factory at Ohnhäuser, Wallerstein (Germany)

SIMPLE AND SAFE INSTALLATION

- Lightweight construction makes installation easy
- Thermal insulation installed ex works – no cutting required on site
- Corrosion protection according to DIN 50017
- Simple module connection using press/screw fittings
- Special versions for wet rooms
- No welding required – quick connection of individual modules thanks to press/screw fittings

FLEXIBILITY

- Modular design, can be combined freely in terms of both length and width, length 2, 3, 4, 5 and 6 m, width 320 mm
- Flexible fixing system simplifies installation
- Unrestricted use of floor and wall space – radiators do not reduce the space available

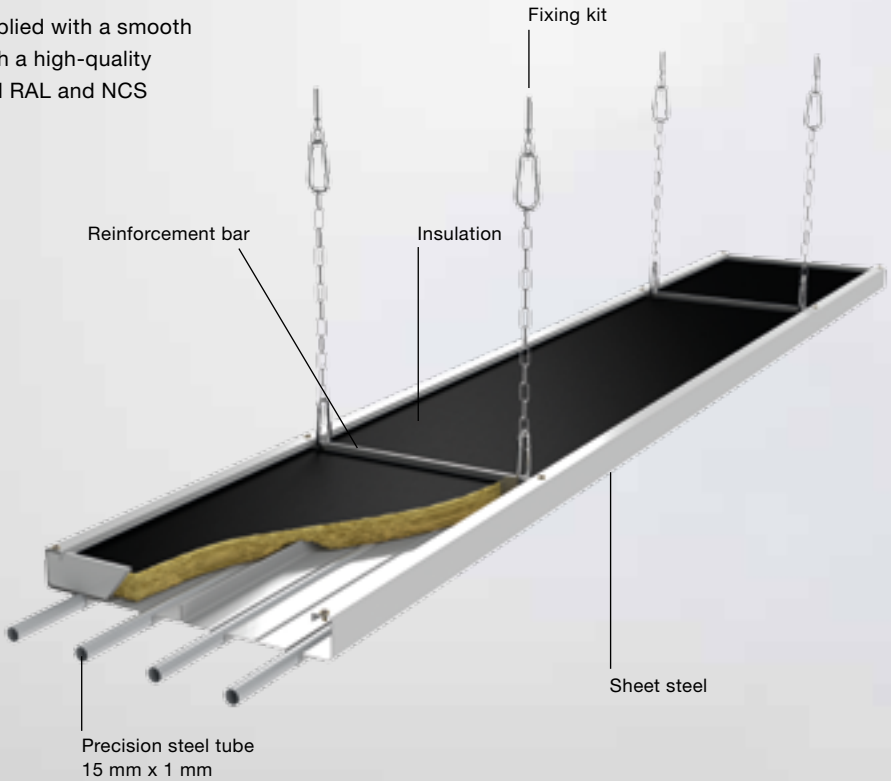
Structure and designs

Zehnder stands for quality, functionality and design. The company is certified to ISO 9001, ISO 14001 and ISO 50001 and manufactures its products in accordance with the strictest quality guidelines. Zehnder ZIP radiant ceiling panels are produced and tested according to EN 14037 and are therefore CE-compliant.

Structure of the module

A galvanised steel sheet with Zehnder special clip profiling forms the basis of the Zehnder ZIP radiant ceiling panel. Four exterior galvanised precision steel tubes and the top heat insulation are then embedded into it. The radiant ceiling panel is statically reinforced using chamfers, special duplications and edgings.

The Zehnder ZIP radiant ceiling panels are supplied with a smooth surface. This is galvanised and also coated with a high-quality polyester paint (similar to RAL 9016). Additional RAL and NCS colours available upon request.



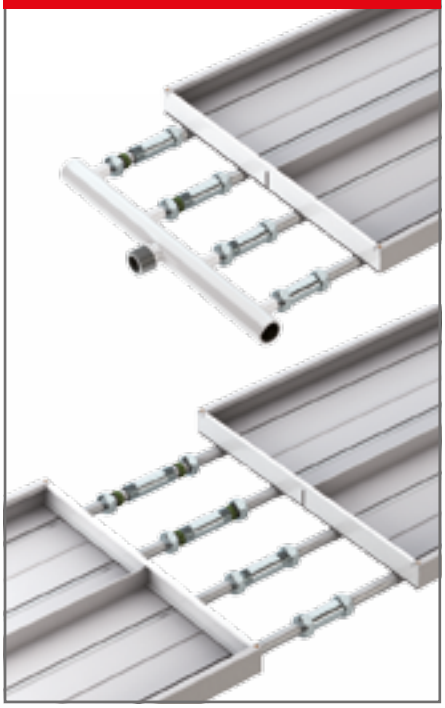
Connector technology

The Zehnder ZIP modules are assembled into the desired configuration by means of press-fit or threaded connections and the connection points are then hidden under a cover plate. The headers are painted as standard (similar to RAL 9016). So all you see is great design!

Maximum pressure and temperature levels:
- Standard version: 5 bar / 95 °C
- High pressure version: 10 bar / 120 °C

Press-fit connection

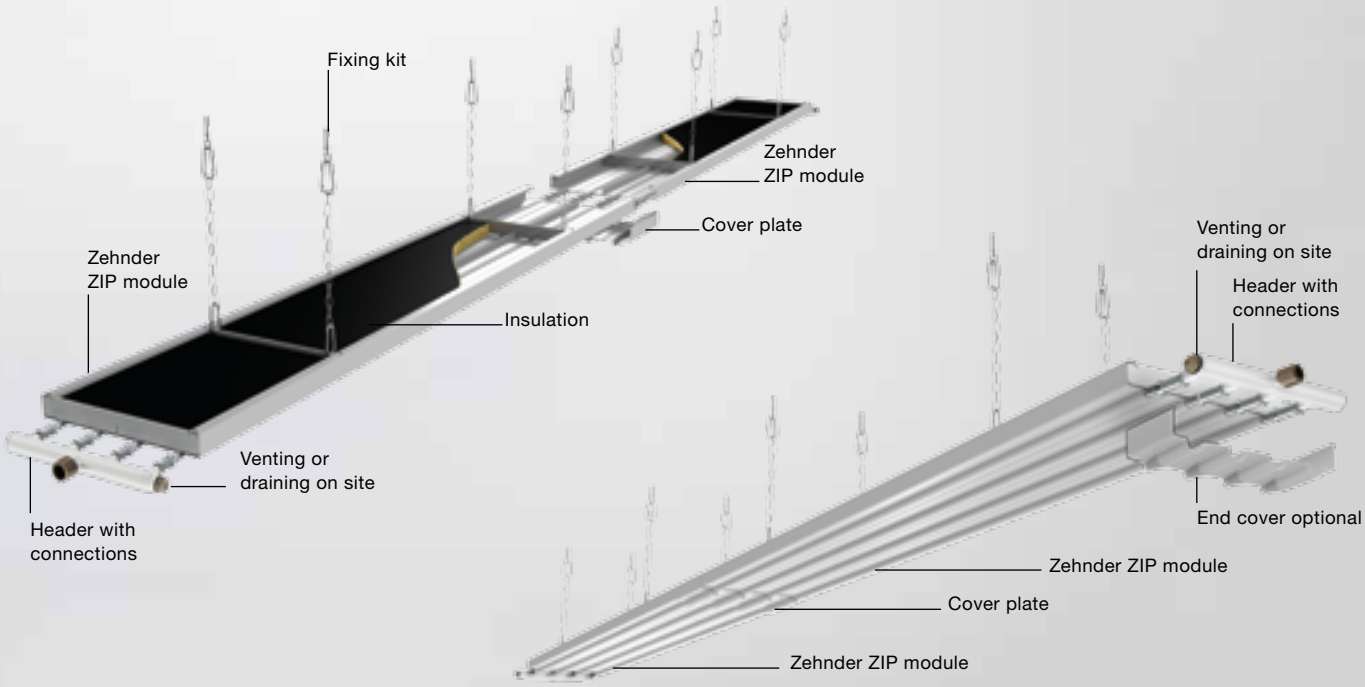
Threaded connection



Designs

Zehnder ZIP modules are 320 mm wide.

In terms of length, Zehnder ZIP modules are available in metre increments from 2 m to 6 m. The individual modules can be connected together using press fittings or screw fittings to form one radiant ceiling panel strip. The connection points are hidden with cover plates.

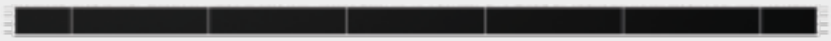


Dimensions and combinations

Standard lengths

Zehnder ZIP modules are available in standard lengths of 2, 3, 4, 5 and 6 m. Longer strips can be created by connecting multiple modules in a row.

Special lengths and colours are available on request.



Length 6 m

Length 5 m

Length 4 m

Length 3 m

Length 2 m

Combination options

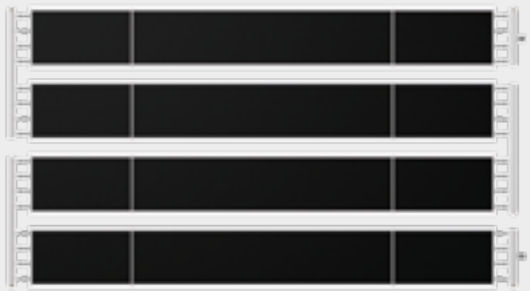
The Zehnder ZIP radiant ceiling panels can be installed individually or up to four strips next to each other.

Depending on the application, the water channelling can be adapted individually by selecting the available headers and collectors. In doing so, it should be noted that turbulent flows must be achieved in the tubes at the given temperatures and with the resultant output.

Individual
Zehnder ZIP strip

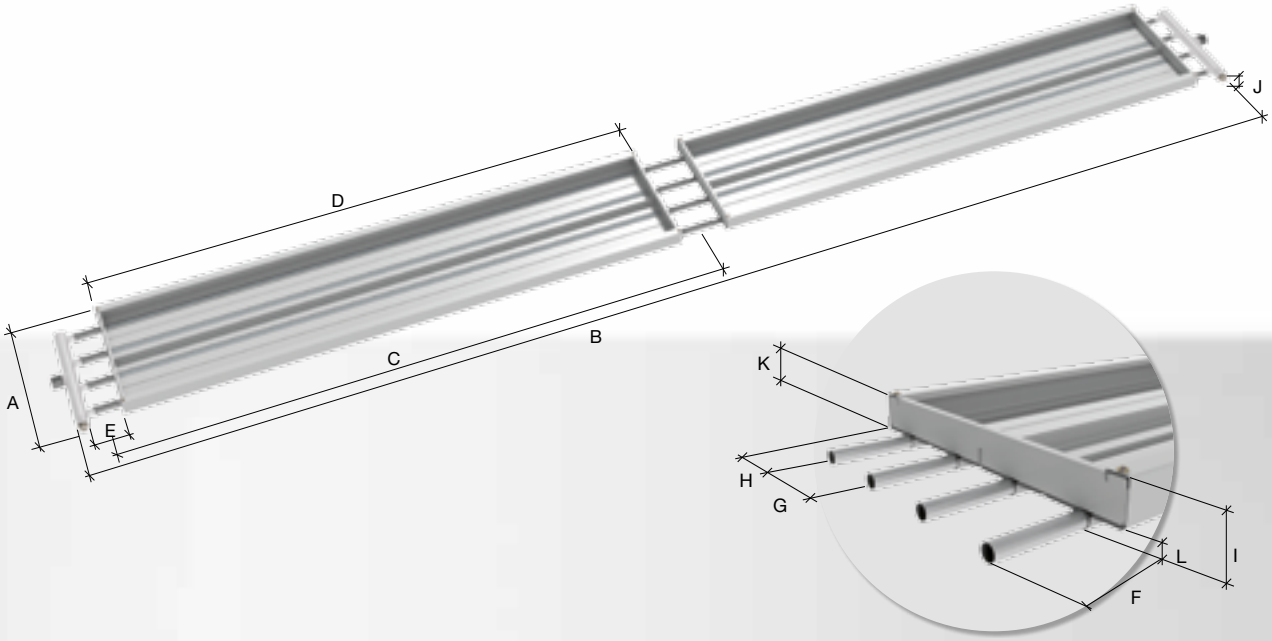
2 Zehnder ZIP strips
next to each other

3 Zehnder ZIP strips
next to each other



4 Zehnder ZIP strips
next to each other

Module dimensions



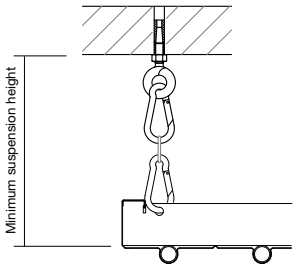
Module dimensions

Item	Description	Dimension in mm	Min. dimension in mm	Max. dimension in mm	Note
A	Overall width	320	-	-	
B	Overall length (without connections)	Variable	2,140	-[1)]	Grid: 1,000 mm
C	Length of individual element / Length of pipe	Variable	2,000	6,000	Grid: 1,000 mm
D	Radiant plate length of individual section	Variable	1,830	5,830	Grid: 1,000 mm
E	Distance of pipe projection from header	125	-	-	
F	Distance of pipe projection from connection piece	85	-	-	
G	Distance between two pipes	80	-	-	
H	Distance from pipe to side lip	40	-	-	
I	Overall height (without suspension)	55	-	-	
J	Diameter of header	32	-	-	
K	Height of side lip	42	-	-	
L	Height of pipe beading	13	-	-	

[1)] The overall length of the Zehnder ZIP strip depends on the operating conditions and the permitted pressure loss.

Standard fixing kits

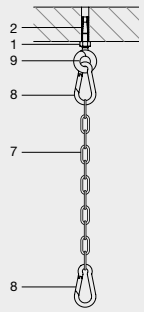
There are ten standard fixing kits for installing the radiant ceiling panels to the ceiling. In addition, Zehnder offers a number of customised solutions on request.



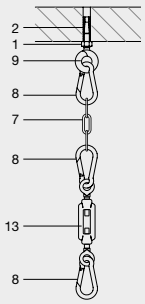
Key	Article number:
1 Hexagon nut M8	506080
2 Steel dowel M8	961120
3 Girder clamp M8	506030
4 Retaining cord	506100
5 Flat leaf screw M8	506050
6 Trapezoidal hanger M8	506020
7 Link chain 4 mm	509960
8 Carabiner hook 5 x 50	506010
9 Eyelet screw M8	506040
10 Washer M8	959020
11 Hexagon screw M8 x 40	506070
12 Hexagon screw M8 x 110	501500
13 Turnbuckle M6 x 110	506120

CONCRETE CEILING

KN 53
Minimum suspension height without link chain: 141 mm
Article number: 505160

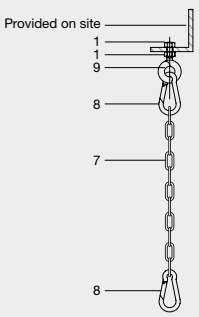


KN 83
Minimum suspension height without link chain: 379 mm
Article number: 505260

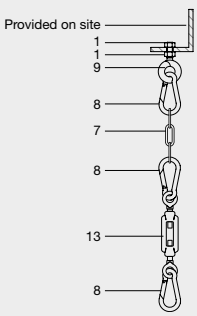


STEEL PROFILE

KN 54
Minimum suspension height without link chain: 141 mm
Article number: 505170

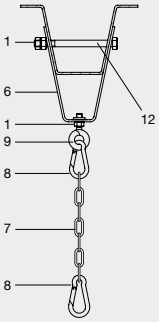


KN 84
Minimum suspension height without link chain: 379 mm
Article number: 505270

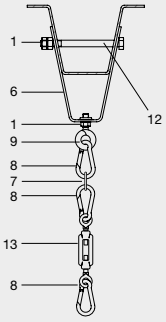


TRAPEZOIDAL SHEET METAL

KN 56
Minimum suspension height without link chain: 183 mm
Article number: 505210

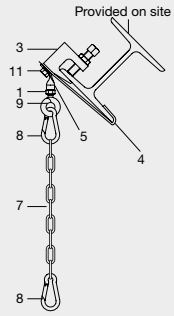


KN 86
Minimum suspension height without link chain: 421 mm
Article number: 505280

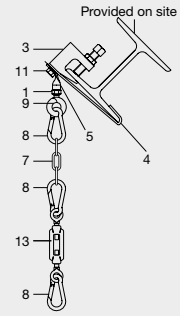


INCLINED STEEL GIRDER

KN 57
Minimum suspension height without link chain: 172 mm
Article number: 505220

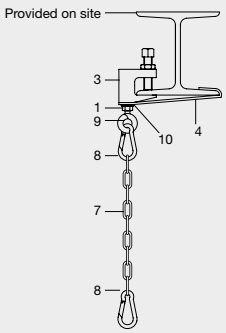


KN 87
Minimum suspension height without link chain: 410 mm
Article number: 505290

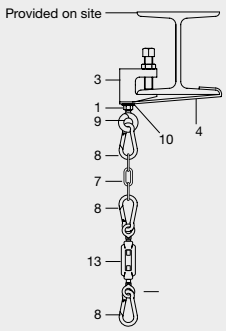


HORIZONTAL STEEL GIRDER

KN 58
Minimum suspension height without link chain: 151 mm
Article number: 505230



KN 88
Minimum suspension height without link chain: 389 mm
Article number: 505340



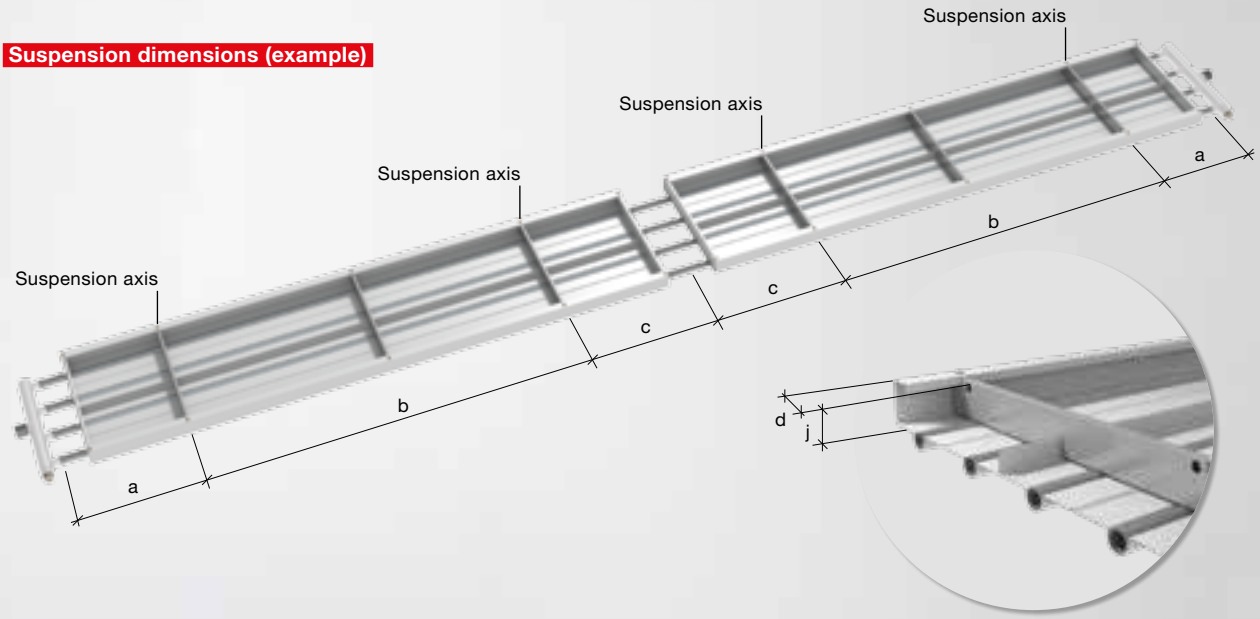
Suspension technology with reinforcement axes

Recommended number of suspension axes per module	
Module length	**Quantity**
2,000 mm	2
3,000 mm	2
4,000 mm	2
5,000 mm	3
6,000 mm	3

Suspension point for fixing kits per reinforcement axis		
Type	**Quantity fixing kits**	**Distance Suspension points**
Individual Zehnder ZIP strip	2	256 mm

Zehnder ZIP modules are delivered as standard with fixed reinforcement axes. These can be used as suspension axis for ceiling installation. The reinforcement axes enable an angled fitting of 45° across the length and 30° across the width.

Suspension dimensions (example)



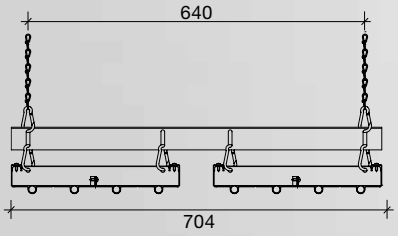
Dimensions

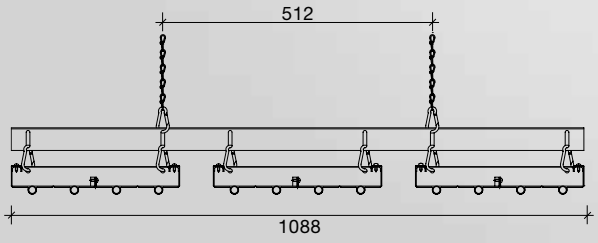
Item	Description	Dimension in mm	Min. dimension in mm	Max. dimension in mm
a	Header – suspension axis	500	-	-
b	Suspension axis – suspension axis [1) 2)]	Variable	1,000	3,000
c	Suspension axis – connection point	Variable	500	2,500
d	Outer edge of module – centre of 1st suspension point	32	-	-
j	Bottom edge of radiant panel – upper edge of suspension point	37	-	-

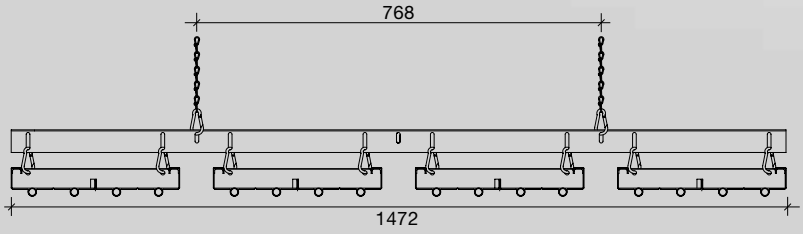
[1)] Grid of reinforcement bars 1,000 mm (special dimensions available upon request)
[2)] On request: additional suspension axes, delivered separately - Article no. 506250

Suspension technology with multiple suspension bars

Spacing of suspension points per bar







Recommended number of multiple suspension bars per module

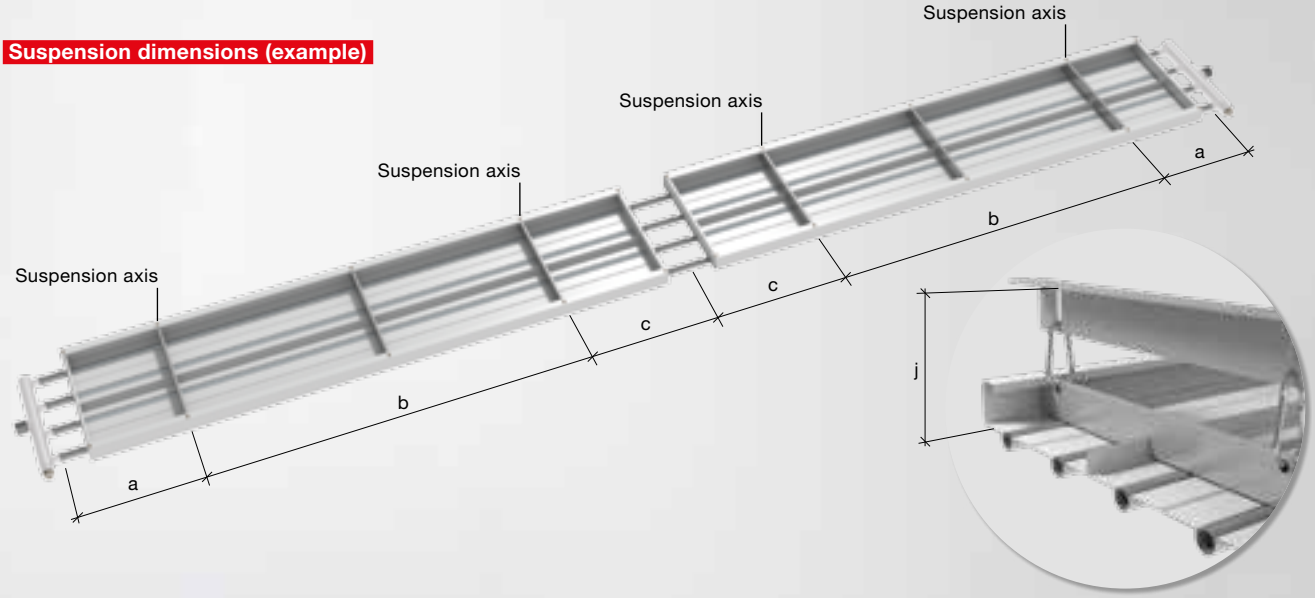
Module length	Quantity
2,000 mm	2
3,000 mm	2
4,000 mm	2
5,000 mm	3
6,000 mm	3

Fixing kits per multiple suspension bar

Type	Quantity fixing kits	Distance Suspension points
2 Zehnder ZIP strips next to each other	2	640 mm
3 Zehnder ZIP strips next to each other	2	512 mm
4 Zehnder ZIP strips next to each other	2	768 mm

By using multiple suspension bars, up to four Zehnder ZIP strips can be installed next to each other. Arranging several Zehnder ZIP modules next to one another reduces the number of fixing kits required. Carabiner hooks, which are required to connect a Zehnder ZIP module to the multiple suspension bar, are contained in the scope of delivery. Angle for fitting up to 45° across the length and up to 30° across the width is possible.

Suspension dimensions (example)



Dimensions

Item	Description	Dimension in mm	Min. dimension in mm	Max. dimension in mm
a	Header – suspension axis	500	-	-
b	Suspension axis – suspension axis [1) 2)]	Variable	1,000	3,000
c	Suspension axis – connection point	Variable	500	2,500
j	Bottom edge of radiant panel – upper edge of suspension point	111	-	-

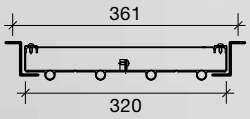
[1)] Grid of reinforcement bars 1,000 mm (special dimensions available upon request)
[2)] On request: Additional suspension axes, delivered separately - Article no. 506250

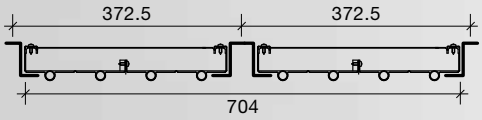
Article numbers

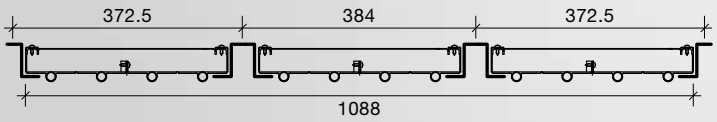
Multiple suspension bar 2, including carabiner	506220
Multiple suspension bar 3, including carabiner	506230
Multiple suspension bar 4, including carabiner	506240

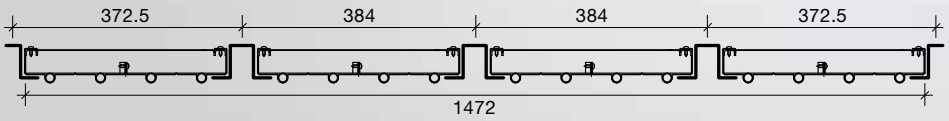
Suspension technology with Z profiles

Z-profile cross section









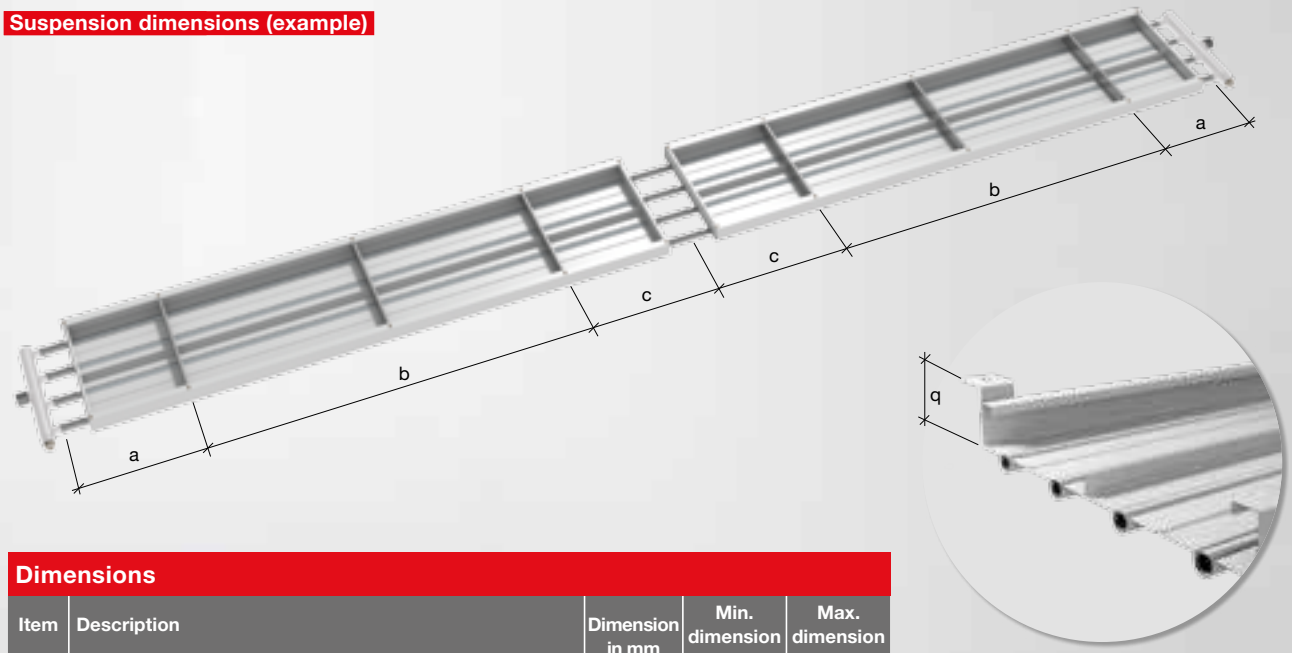
Recommended number of Z profiles or ZZ profiles per module

Module length	Number of ZIP strips next to each other							
	1		2		3		4	
	Z	ZZ	Z	ZZ	Z	ZZ	Z	ZZ
2,000 mm	4	-	4	2	4	4	4	6
3,000 mm	4	-	4	2	4	4	4	6
4,000 mm	4	-	4	2	4	4	4	6
5,000 mm	6	-	6	3	6	6	6	9
6,000 mm	6	-	6	3	6	6	6	9

Zehnder ZIP modules can be fixed close to the ceiling using Z-profiles. They also enable an angled fitting across the width of up to 45°. An angled fitting is not possible across the length.

ZZ profiles make it possible to install parallel Zehnder ZIP strips next to each other.

Suspension dimensions (example)



Dimensions

Item	Description	Dimension in mm	Min. dimension in mm	Max. dimension in mm
a	Header – Z-profile	500	–	–
b	Z-profile – Z-profile	Variable	1,000	3,000
c	Z-profile – connection point	Variable	500	2,500
q	Bottom edge of radiant panel – bottom edge of concrete ceiling	55	–	-

Article numbers

Z-profile	506710
ZZ-profile	506720

Suspension technology with support tracks

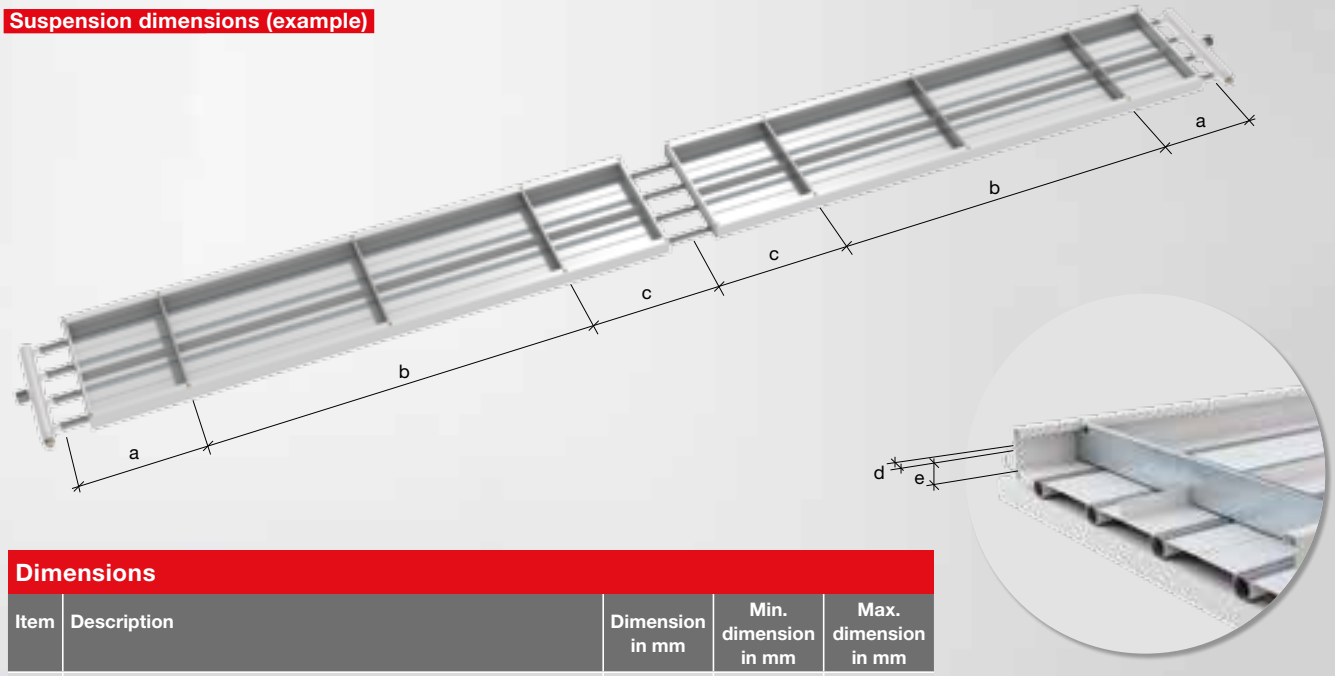
Recommended number of support tracks per module	
Module length	**Quantity**
2,000 mm	2
3,000 mm	2
4,000 mm	2
5,000 mm	3
6,000 mm	3

Fixing kits per support track		
Type	**Quantity fixing kits**	**Distance Suspension points**
Individual Zehnder ZIP strip	2	362 mm
2 Zehnder ZIP strips next to each other	2	746 mm
3 Zehnder ZIP strips next to each other	2	1,130 mm
4 Zehnder ZIP strips next to each other	-	-

One fixing option is support tracks, on which the Zehnder ZIP modules are positioned. The distance between the tracks can be up to 3 m. The suspension height of the support tracks is variable – a very low suspension height is possible.

The support tracks enable long strips close to the ceiling with Zehnder ZIP modules. Angle for fitting is not possible.

Suspension dimensions (example)



Dimensions

Item	Description	Dimension in mm	Min. dimension in mm	Max. dimension in mm
a	Header – support track	500	-	-
b	Support track – support track	Variable	1,000	3,000
c	Support track – connection point	Variable	500	2,500
d	Outer edge of module – centre of 1st suspension point	21	-	-
e	Bottom edge of radiant panel – upper edge of suspension point	14	-	-

Article numbers

Support track 1	506610	403 x 30 x 20 mm
Support track 2	506620	787 x 30 x 20 mm
Support track 3	506630	1,171 x 30 x 20 mm

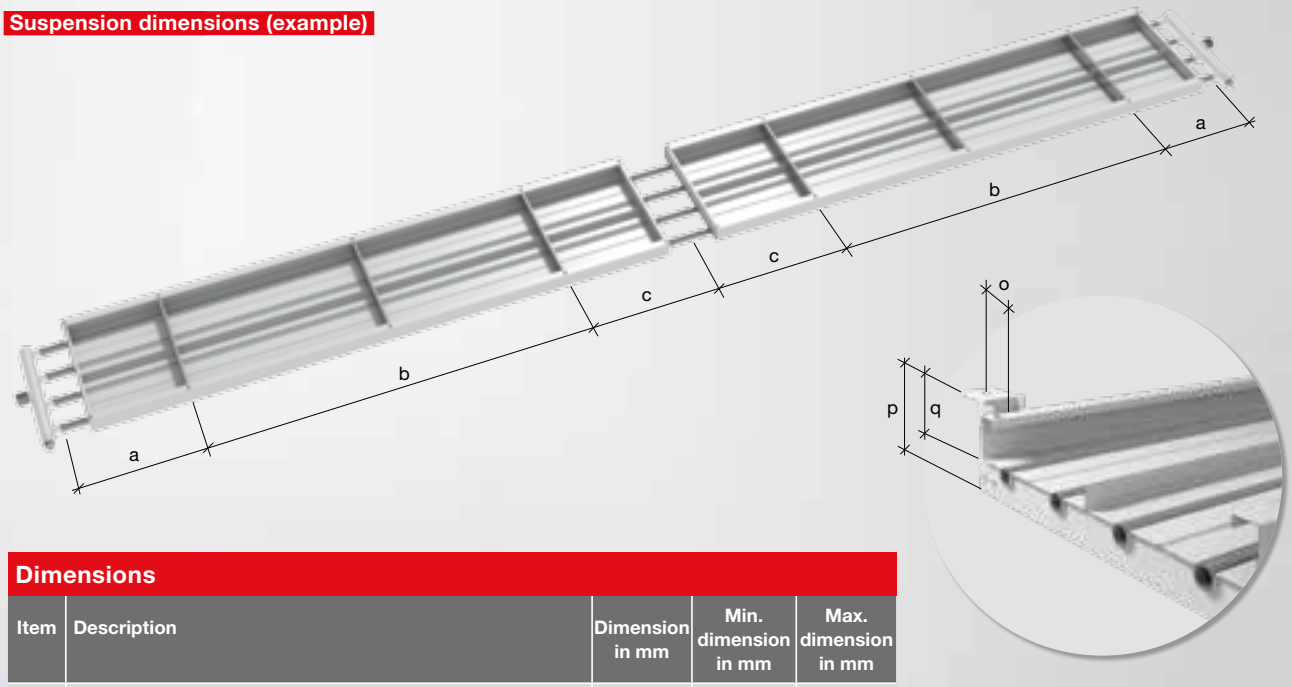
Suspension technology with fixed ceiling support braces

Recommended number of fixed ceiling support braces per module	
Module length	**Quantity**
2,000 mm	2
3,000 mm	2
4,000 mm	2
5,000 mm	3
6,000 mm	3

Fixing kits per fixed ceiling support brace		
Type	**Quantity fixing kits**	**Distance Suspension points**
Individual Zehnder ZIP strip	2	388 mm
2 Zehnder ZIP strips next to each other	2	772 mm
3 Zehnder ZIP strips next to each other	2	1,156 mm
4 Zehnder ZIP strips next to each other	3	2 x 770 mm

The fixed ceiling support braces are screwed into the ceiling and allow the Zehnder ZIP radiant ceiling panels to be installed close to the ceiling. An angled fitting is also possible across the width.
The maximum angle for fitting is 30° across the width.

Suspension dimensions (example)



Dimensions

Item	Description	Dimension in mm	Min. dimension in mm	Max. dimension in mm
a	Header – fixed brace	500	-	-
b	Fixed brace – fixed brace	Variable	1,000	3,000
c	Fixed brace – connection point	Variable	500	2,500
o	Outer edge of module – centre of 1st suspension point	34	-	-
p	Bottom edge of fixed brace – bottom edge of concrete ceiling	91	-	-
q	Bottom edge of radiant panel – bottom edge of concrete ceiling	56	-	-

Article numbers

Fixed brace 1	506650 / 502060
Fixed brace 2	506660 / 502070
Fixed brace 3	506670 / 502080
Fixed brace 4	506680 / 502090

Suspension technology with flexible ceiling support braces

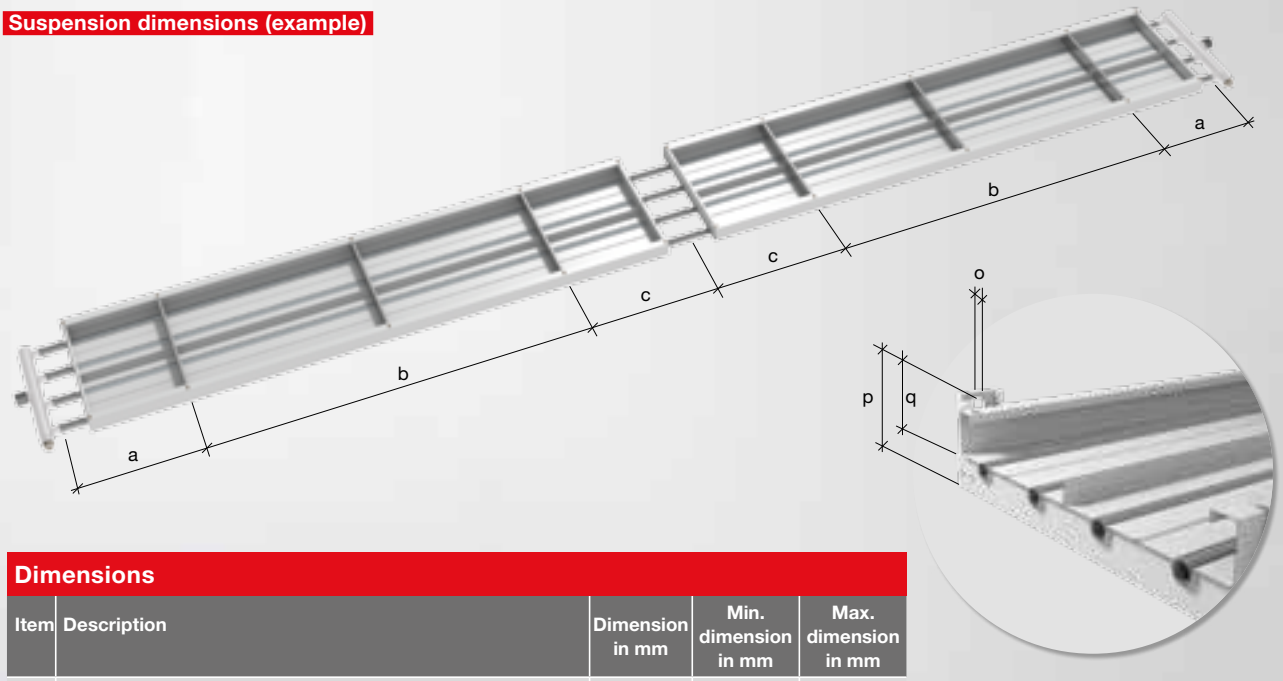
Recommended number of flexible ceiling support braces per module	
Module length	**Quantity**
2,000 mm	2
3,000 mm	2
4,000 mm	2
5,000 mm	3
6,000 mm	3

Fixing kits per flexible ceiling support brace		
Type	**Quantity fixing kits**	**Distance Suspension points**
Individual Zehnder ZIP strip	2	348 mm
2 Zehnder ZIP strips next to each other	2	732 mm
3 Zehnder ZIP strips next to each other	2	1,116 mm
4 Zehnder ZIP strips next to each other	3	2 x 750 mm

The flexible ceiling support braces enable a fitting with an angle of up to 30° across the width of the radiant ceiling panels. The modules interlock with the pipe beading in the flexible ceiling support braces to prevent them from slipping sideways.

The suspension height of the flexible ceiling support braces can vary.

Suspension dimensions (example)



Dimensions

Item	Description	Dimension in mm	Min. dimension in mm	Max. dimension in mm
a	Header – flexible brace	500	-	-
b	Flexible brace – flexible brace	Variable	1,000	3,000
c	Flexible brace – connection point	Variable	500	2,500
o	Outer edge of module – centre of 1st suspension point	14	-	-
p	Bottom edge of flexible brace – bottom edge of suspension point	81	-	-
q	Bottom edge of radiant panel – bottom edge of suspension point	50	-	-

Article numbers

Flexible brace 1	506920
Flexible brace 2	506930
Flexible brace 3	506940
Flexible brace 4	506950

Special solutions

Zehnder ZIP radiant ceiling panels are extremely flexible: in addition to the wide standard range, there are also a number of special solutions available. Therefore, whatever the room and whatever the project, we have exactly what you need. All RAL and NCS colours available upon request.

BALL GUARDS/BALL IMPACT RESISTANCE

Practical in sports halls: Due to the arched, galvanised grid, no “stray” shots get caught in the radiant ceiling panels. Ball guards can be used for a width of up to three Zehnder ZIP strips next to each other.

Furthermore, Zehnder ZIP radiant ceiling panels have successfully passed testing for ball impact resistance to DIN 18032 by the Stuttgart Materials Testing Institute.

DUST PROTECTOR PANEL

Zehnder ZIP radiant ceiling panels, if required, can be sealed with a dust protector panel. An easy-care and equally hygienic solution that is ideal for rooms with high dust levels.

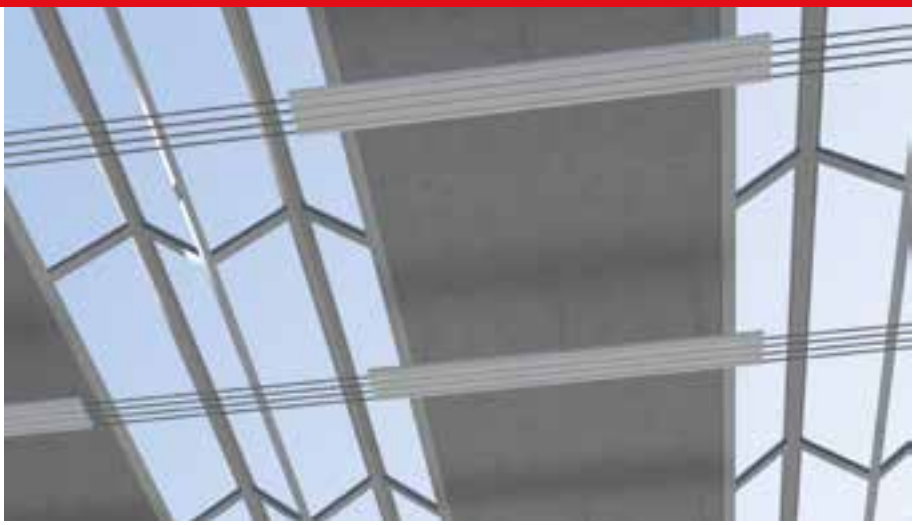
RAISED HEADERS

The headers finish above the radiant panel sheet and therefore cannot be seen from below.

NON-CONTINUOUS RADIANT PANEL PLATE

This version allows light to pass through unobstructed, for example, from skylights.

The length of the radiant panel interruption must not be more than 3 m.



WET ROOM DESIGN

This design of the radiant panels is suitable for use in wet rooms (steam).

As water could accumulate in the cover plates, these are not installed in the wet room design. The headers are galvanised, then painted.

Dimensions, operating parameters and output

Feature		Unit of measurement	Individual ZIP strip	2 ZIP strips next to each other	3 ZIP strips next to each other	4 ZIP strips next to each other
Number of pipes		piece(s)	4	8	12	16
Pipe material		–	Exterior galvanised, welded precision steel tube according to EN 10305-3 / Seamlessly drawn, exterior galvanised pipe according to EN 10305-1			
Radiant plate		–	Galvanised strip-coated sheet steel			
Dimensions						
Widths		mm	320	704	1,088	1,472
Tube spacing		mm	80			
Distance between strips		mm	–	64	64	64
Minimum module length		mm	2,000			
Maximum module length		mm	6,000			
Operating parameters						
Max. operating temperature		°C	95 / 120			
Max. operating pressure		bar	5 / 10			
Weights						
Empty weight without water content, with insulation	Radiant panel	kg/m	3.8	7.6	11.4	15.2
	Per manifold	kg	0.9	1.7	2.6	3.4
Weight of insulation		kg/m	0.32	0.64	0.96	1.28
Water content		l/m	0.53	1.06	1.60	2.13
Operating weight with water content, with insulation	Radiant panel	kg/m	4.3	8.7	13.0	17.3
	Per manifold	kg	1.5	2.8	4.4	5.5
Weight of ball guards		kg/m	0.3	0.65	1	Not provided
Heat output						
Thermal output according to EN 14037-2 at Δt = 55 K with insulation		W/m	208	417	625	834
Thermal output constant (K)		–	2.0871	4.1742	6.2613	8.3484
Thermal output exponent (n)		–	1.1489			
Cooling output with insulation						
Cooling capacity based on DIN 4715-1 at Δt = 10 K		W/m	36	71	107	142
Cooling capacity constant (K)		–	3.283	6.566	9.849	13.132
Cooling capacity exponent (n)		–	1.034			
Cooling output without insulation						
Cooling capacity based on DIN 4715-1 at Δt = 10 K		W/m	42	84	126	168
Cooling capacity constant (K)		–	3.960	7.920	11.880	15.840
Cooling capacity exponent (n)		–	1.0265			

Weight of the components

Zehnder ZIP	Unit of measurement	Gross weight	Operating weight	Weight of water content
Raw module	kg/m	2.15	2.15	-
1 pipe	kg/m	0.33	0.46	0.13
1 end cover	kg	0.12	0.12	-
1 reinforcement axis	kg	0.11	0.11	-
1 press fitting	kg	0.04	0.04	-
Standard insulation	kg/m	0.22	0.22	-
XPS wet room insulation	kg/m	0.26	0.26	-
Ball guards ZIP 1	kg/m	0.30	0.30	-
Ball guards ZIP 2	kg/m	0.648	0.648	-
Ball guards ZIP 3	kg/m	1.006	1.006	-
Wet room cover	kg/m	1.60	1.60	-
XPS wet room insulation including cover	kg/m	1.86	1.86	-
2-pipe header	kg	0.32	0.41	0.09
4-pipe header	kg	0.54	0.73	0.19
6-pipe header	kg	0.83	1.16	0.33
8-pipe header	kg	1.03	1.44	0.41
12-pipe header	kg	1.53	2.21	0.67
4-pipe collector	kg	0.45	0.64	0.19
4-pipe collector, special	kg	0.52	0.75	0.22
8-pipe collector	kg	0.92	1.35	0.43
12-pipe collector	kg	1.42	2.10	0.67

Weight according to length

Zehnder ZIP	Unit of measurement	1 m	2 m	3 m	4 m	5 m	6 m
Empty weight of Zehnder ZIP module	kg	3.79	6.99	10.55	14.11	17.67	21.32
Water content of Zehnder ZIP module without header	kg	0.53	1.06	1.59	2.12	2.65	3.19
Standard insulation	kg	0,22	0,44	0,66	0,88	1,1	1,32
XPS wet room insulation including cover	kg	1,86	3,72	5,58	7,44	9,3	11,16
Ball guards	kg	0,3	0,6	0,9	1,2	1,5	1,8

Heating and cooling performance

The following tables show the heating and cooling performance of the Zehnder ZIP radiant ceiling panels depending on the excess and under temperatures. The heat output values have been measured according to EN 14037-2, while the measurement results for the cooling output are based on DIN 4715-1.
Note: The removal of the insulation has a positive effect on the cooling capacity (see table). Removing the insulation increases the thermal output, but can lead to heat accumulation under the ceiling.
When the Zehnder ZIP radiant ceiling panels are used for cooling, galvanised headers are delivered.

Output $\dot{Q} = K \cdot \Delta t^n$

The excess and under temperature can be calculated arithmetically:

$$t_i = t_p = \frac{(t_{sur} + t_{air})}{2}$$

$$\Delta t_{exc} = \frac{(t_{hf} + t_{hr})}{2} - t_i$$

$$\Delta t_{low} = t_i - \frac{(t_{cf} + t_{cr})}{2}$$

Cooling output without insulation

	Individual ZIP strip	2 ZIP strips next to each other	3 ZIP strips next to each other	4 ZIP strips next to each other
K	3.960	7.920	11.880	15.840
n	1.0265	1.0265	1.0265	1.0265
Δt_{low} (K)	**W/m**	**W/m**	**W/m**	**W/m**
15	64	128	191	255
14	59	119	178	238
13	55	110	165	220
12	51	102	152	203
11	46	93	139	186
10	**42**	**84**	**126**	**168**
9	38	76	113	151
8	33	67	100	134
7	29	58	88	117
6	25	50	75	100
5	21	41	62	83

Cooling output with insulation

	Individual ZIP strip	2 ZIP strips next to each other	3 ZIP strips next to each other	4 ZIP strips next to each other
K	3.283	6.566	9.849	13.132
n	1.034	1.034	1.034	1.034
Δt_{low} (K)	**W/m**	**W/m**	**W/m**	**W/m**
15	54	108	162	216
14	50	101	151	201
13	47	93	140	186
12	43	86	129	171
11	39	78	118	157
10	**36**	**71**	**107**	**142**
9	32	64	96	127
8	28	56	85	113
7	25	49	74	98
6	21	42	63	84
5	17	35	52	69

Legend

t_{air}	Air temperature (°C)
t_{sur}	Surrounding surface temperature (°C) = average radiant temperature = average surface temperature of all surfaces in the surrounding area (°C)
$t_i = t_p$	Indoor temperature (°C) = perceived temperature (°C)
t_{hf}	Heating flow temperature (°C)
t_{hr}	Heating return temperature (°C)
t_{cf}	Cooling flow temperature (°C)
t_{cr}	Cooling return temperature (°C)
Δt_{exc}	Excess temperature (K)
Δt_{low}	Under temperature (K)
K	Constant
n	Exponent
$\dot{Q}$	Output
$\dot{Q}_t$	Total thermal output
s	Inclination correction factor

Physical units

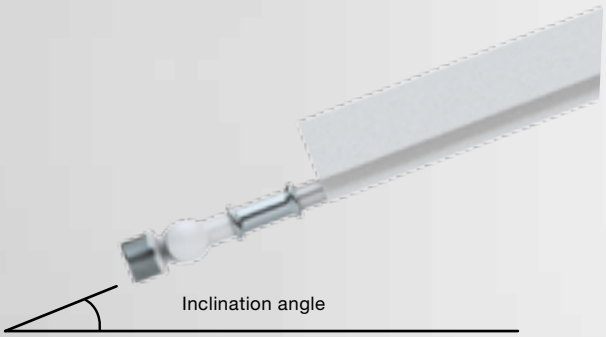
Degree centigrade (°C)
Kelvin (K)
Cubic metre (m^3)
Metre (m)
Millimetre (mm)
Pascal (Pa)
Kilogram (kg)

Thermal output with insulation

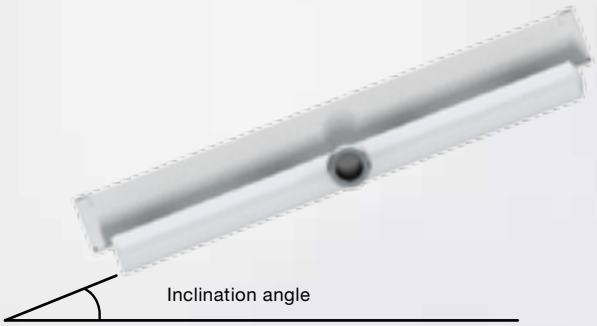
	Individual ZIP strip		2 ZIP strips next to each other		3 ZIP strips next to each other		4 ZIP strips next to each other	
K	2.0871	0.2456	4.1742	0.4912	6.2613	0.7368	8.3484	0.9824
n	1.1489	1.3524	1.1489	1.3524	1.1489	1.3524	1.1489	1.3524
Δt_{exc}	**W/m**	**W/manifold pair**	**W/m**	**W/manifold pair**	**W/m**	**W/manifold pair**	**W/m**	**W/manifold pair**
80	321	92.0	641	184	962	276	1,283	368
78	311	88.9	623	178	934	267	1,246	356
76	302	85.9	605	172	907	258	1,209	343
74	293	82.8	586	166	879	248	1,173	331
72	284	79.8	568	160	852	239	1,136	319
70	275	76.8	550	154	825	230	1,100	307
68	266	73.9	532	148	798	222	1,064	296
66	257	71.0	514	142	771	213	1,028	284
64	248	68.1	496	136	744	204	992	272
62	239	65.2	478	130	718	196	957	261
60	230	62.4	461	125	691	187	922	249
58	222	59.6	443	119	665	179	886	238
56	213	56.8	426	114	638	170	851	227
55	**208**	**55.4**	**417**	**111**	**625**	**166**	**834**	**222**
54	204	54.1	408	108	612	162	816	216
52	195	51.4	391	103	586	154	782	206
50	187	48.7	374	97.5	561	146	747	195
48	178	46.1	357	92.3	535	138	713	185
46	170	43.5	340	87.1	509	131	679	174
44	161	41.0	323	82.0	484	123	645	164
42	153	38.5	306	77.0	459	116	612	154
40	145	36.0	289	72.1	434	108	578	144
38	136	33.6	273	67.3	409	101	545	135
36	128	31.3	256	62.5	384	93.8	512	125
34	120	28.9	240	57.9	360	86.8	480	116
32	112	26.7	224	53.3	336	80.0	448	107
30	104	24.4	208	48.9	312	73.3	416	97.7
28	96.0	22.3	192	44.5	288	66.8	384	89.0
26	88.1	20.1	176	40.3	264	60.4	353	80.5
24	80.4	18.1	161	36.1	241	54.2	322	72.3
22	72.8	16.1	146	32.1	218	48.2	291	64.2
20	65.2	14.1	130	28.2	196	42.4	261	56.5
19	61.5	13.2	123	26.3	184	39.5	246	52.7
18	57.8	12.2	116	24.5	173	36.7	231	49.0
17	54.1	11.3	108	22.7	162	34.0	216	45.3
16	50.5	10.4	101	20.9	151	31.3	202	41.8
15	46.9	9.6	93.7	19.1	141	28.7	187	38.3
14	43.3	8.7	86.6	17.4	130	26.1	173	34.9
13	39.8	7.9	79.5	15.8	119	23.7	159	31.5
12	36.3	7.1	72.5	14.1	109	21.2	145	28.3
11	32.8	6.3	65.6	12.6	98.4	18.9	131	25.2
10	29.4	5.5	58.8	11.1	88.2	16.6	118	22.1
9	26.1	4.8	52.1	9.6	78.2	14.4	104	19.2
8	22.8	4.1	45.5	8.2	68.3	12.3	91.0	16.4
7	19.5	3.4	39.0	6.8	58.6	10.2	78.1	13.7
6	16.4	2.8	32.7	5.5	49.1	8.3	65.4	11.1
5	13.3	2.2	26.5	4.3	39.8	6.5	53.0	8.7

Inclination

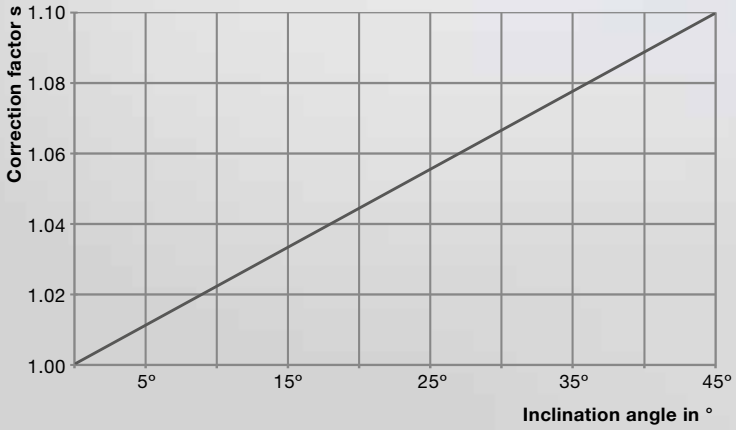
Depending on the design of the ceiling, radiant ceiling panels can be inclined in the lateral or longitudinal direction.
Inclining the radiant ceiling panel increases the output according to the formula $\dot{Q}_t = \dot{Q} \cdot s$.
This increase in output must be taken into account accordingly when calculating the mass flow. The maximum permitted angle of inclination depends on the suspension technology.



Radiant ceiling panel inclined in the longitudinal direction



Radiant ceiling panel inclined in the lateral direction



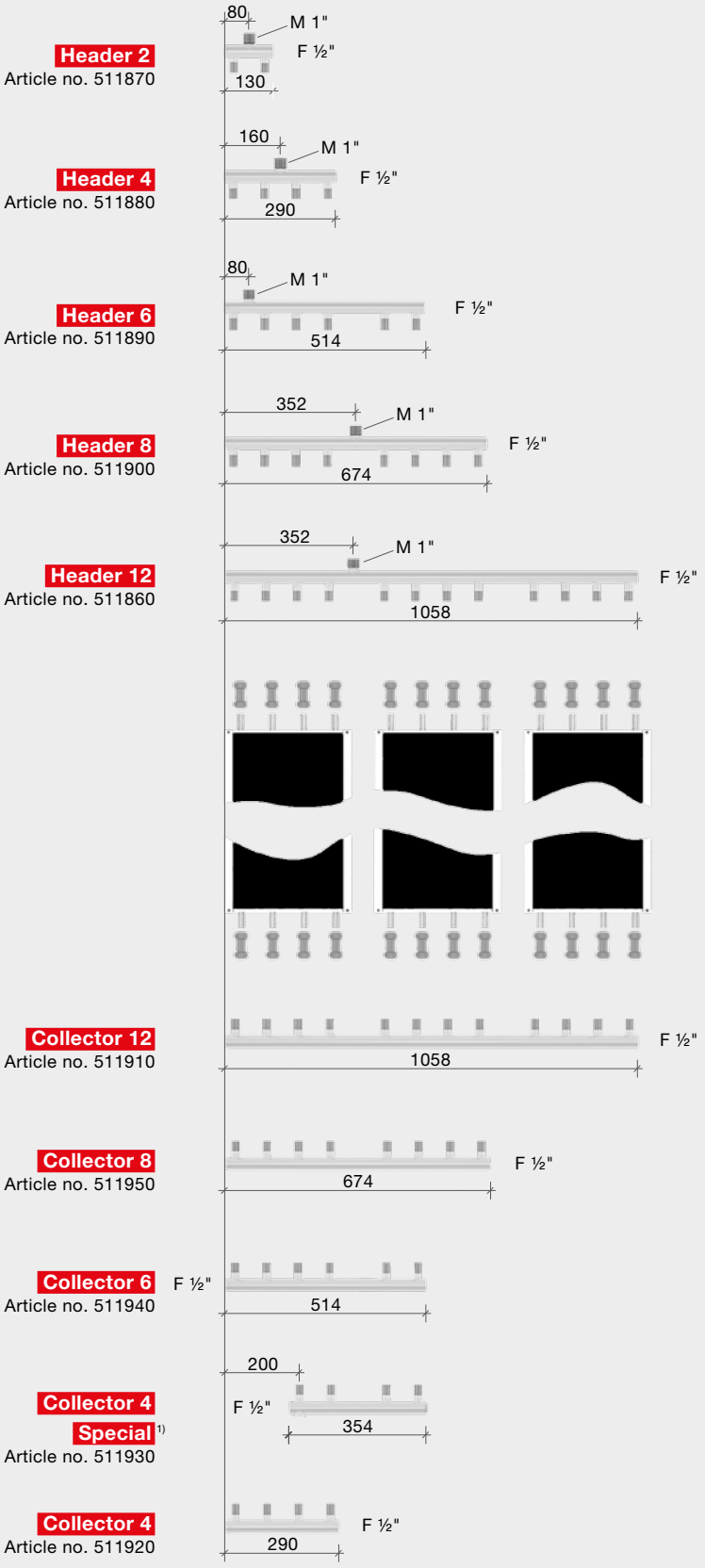
Increase in total thermal output $\dot{Q}_t$ with inclined radiant ceiling panels

Headers and collectors

The painted headers and collectors are pressed or bolted together with the externally galvanised pipes (as per DIN EN 10305) of the Zehnder ZIP modules.

Headers and collectors are delivered with Zehnder press-fit connections (48 mm) or Zehnder threaded connections.

Zehnder accepts no liability for the use of other connections.

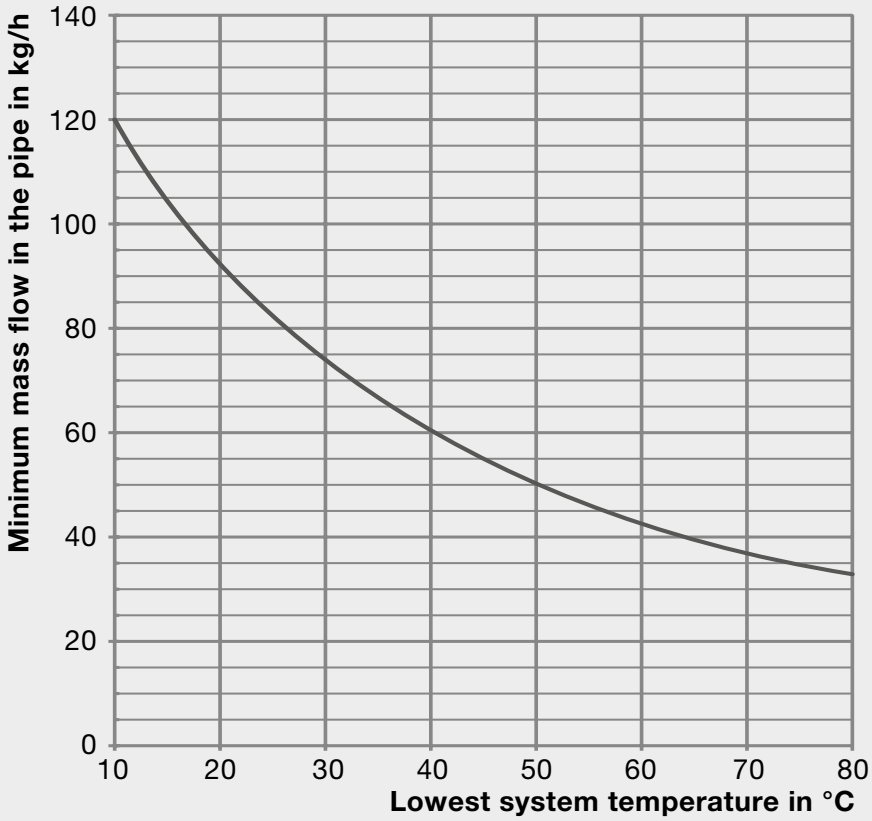


1) from one module to another

Minimum mass flow

To maintain the output shown in the tables, a turbulent flow must be ensured within the pipes in the radiant panel system. This minimum mass flow depends on the lowest system temperature. When heating, this corresponds to the return temperature. When cooling or in a combined cooling/heating mode, this corresponds to the cold water flow temperature. If the minimum mass flow per pipe is not achieved, this can result in a drop in performance of up to 15%.

Minimum mass flow

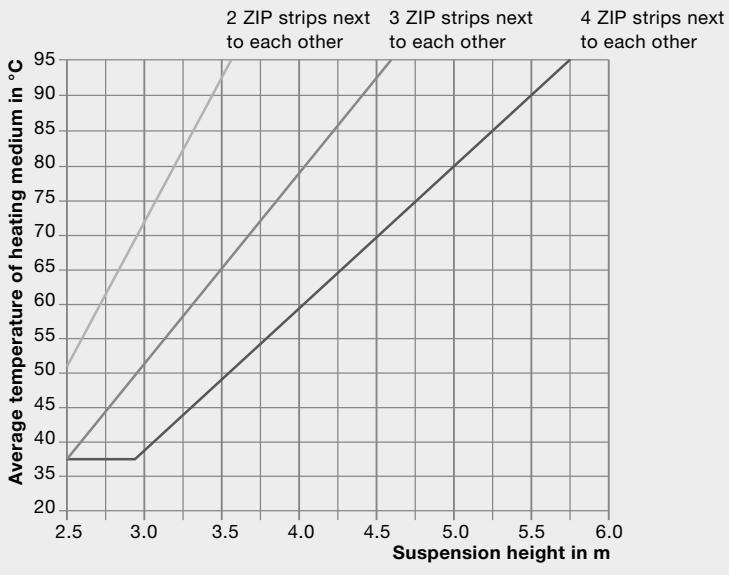


Temperature limits

The right design temperature must be selected in order to ensure the radiant ceiling system delivers a comfortable climate throughout the room. You can use the adjacent table and graph to check this design temperature, which must be lower than the two temperature limits (average temperature of heating medium). Higher temperature limits can be used for rooms and corridors where people do not spend a great deal of time. These values are only intended as a guide. A detailed calculation can be performed according to ISO 7730.

Temperature limits						
Suspension height	**Proportion of the ceiling surface covered by Zehnder ZIP radiant ceiling panels**					
m	**10%**	**15%**	**20%**	**25%**	**30%**	**35%**
	Average temperature of heating medium in °C					
≤ 3	73	71	68	64	58	56
4			91	78	67	60
5				83	71	64
6				87	75	69
7				91	80	74
8					86	80
9					92	87
10						94

Step 1: Ceiling coverage. The design temperature must not exceed the defined thresholds.



Step 2: Width of the radiant panel. The design temperature must not exceed the defined thresholds.

Layout basics

The heat load of the room is calculated according to the applicable standard. If the air exchange rate of a room is above the usual level achieved with gap ventilation (max.1/h), particularly with extraction systems, the air fed into the room must be pre-heated. Radiant heating systems alone cannot prevent infiltration of cold air at doors or loading areas. Strip curtains or air curtains, for example, must be used to help rectify this situation.

Example of layout and arrangement
The following example shows how a hall is dimensioned.

Goal
To achieve an even indoor temperature (20 °C) throughout the entire room.

Specifications

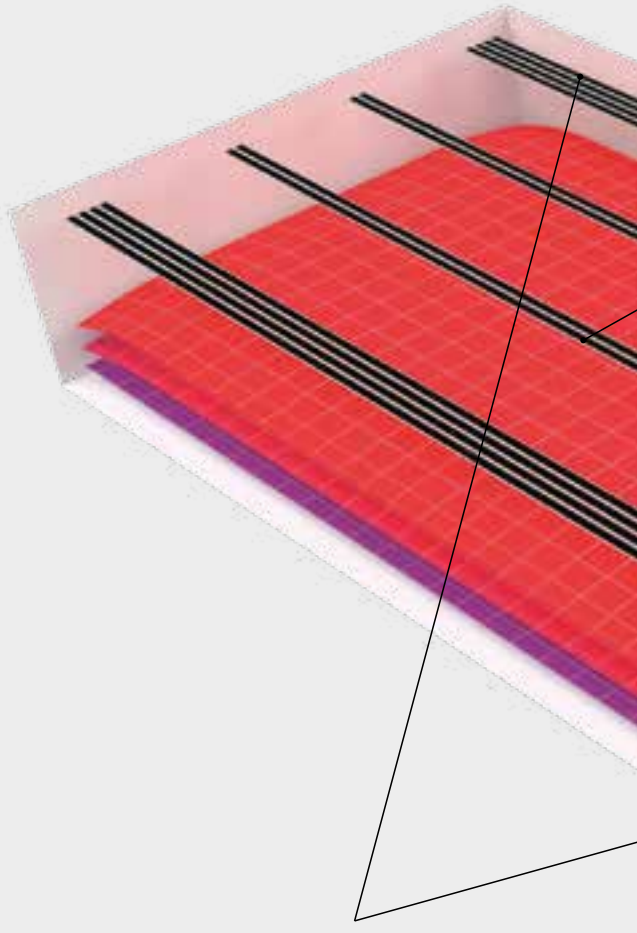
Free-standing hall:	Length 50 m
	Width 20 m
	Height 8 m
Air exchange:	0.3 1/h
Outdoor temperature:	–12 °C

Heat load

Standard transmission heat loss:	57,250 W
Design ventilation heat loss:	26,112 W
Design heat loss:	83,362 W

Layout of the radiant ceiling panels

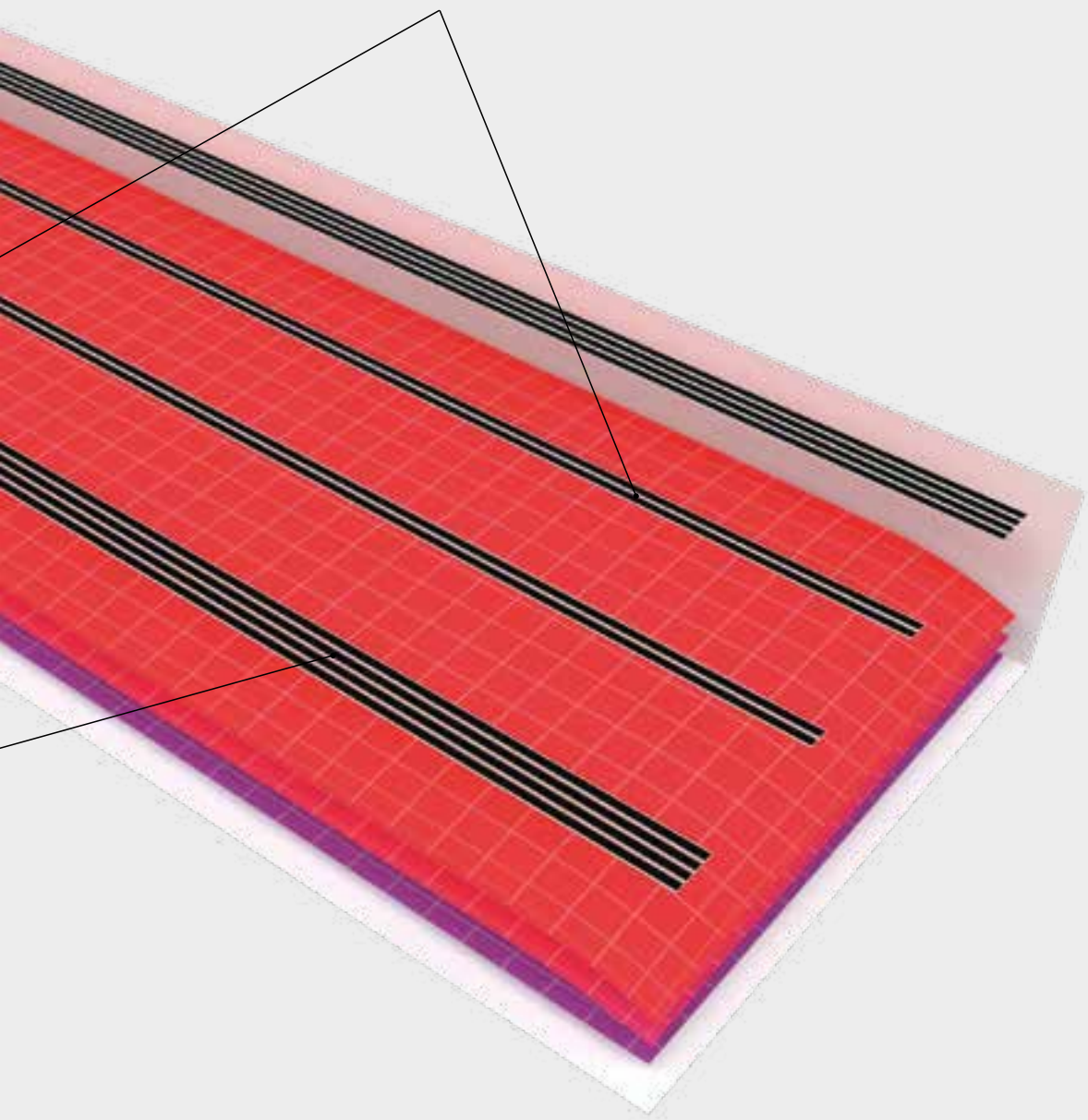
Flow temperature:	70 °C
Return temperature:	50 °C



4 Zehnder ZIP strips next to each other

Thermal output calculation

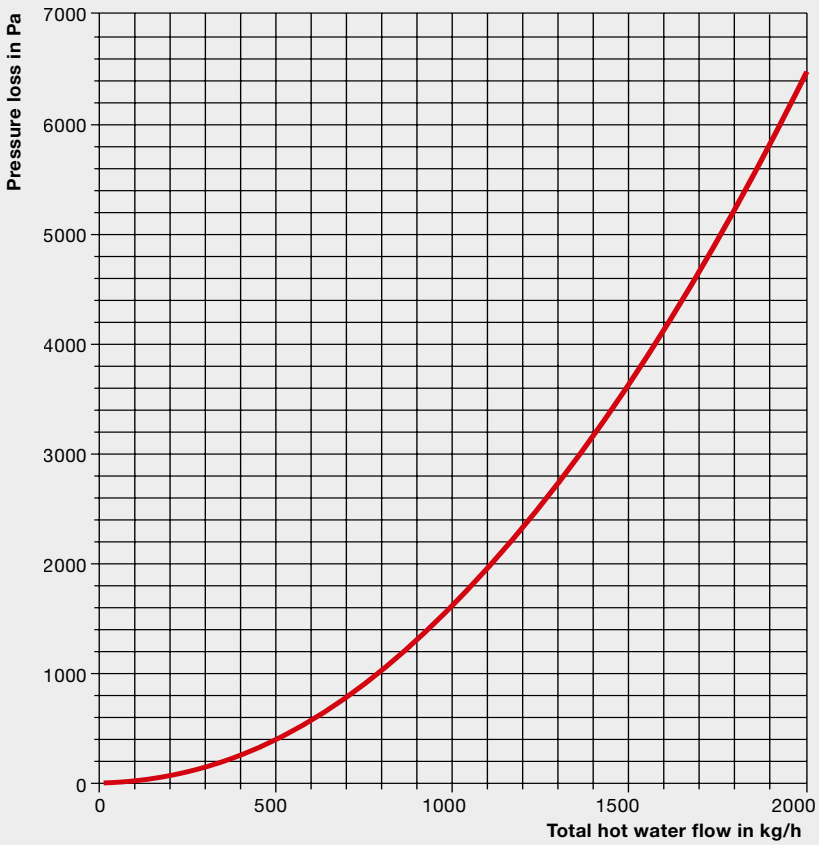
Type	Length in m	Excess temperature in K	Power in W/m	Power in W/ manifold pair	Quantity	Total thermal output in W	Mass flow per strip in kg/h
4 ZIP strips next to each other	48	40	578	144	2	55,776	1,199
2 ZIP strips next to each other	48	40	289	72	2	27,888	600
						83,664 W	



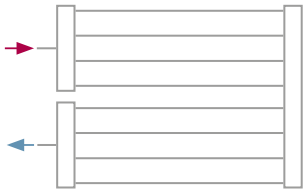
Pressure loss calculation

The pressure loss for Zehnder ZIP radiant ceiling panels is calculated as a total of the pressure loss in the pipe and the pressure loss in the headers. When using Zehnder volume flow controllers, the additional pressure loss for the volume flow controllers should be added to this.

Pressure loss of the pair of headers including connections



Determining the pressure loss:



e.g. 2 Zehnder ZIP strips next to each other; 48 m

1. Calculate total mass flow of the radiant ceiling panel in question.
   e.g. $\dot{m}$ = 601 kg/h (see page 34)

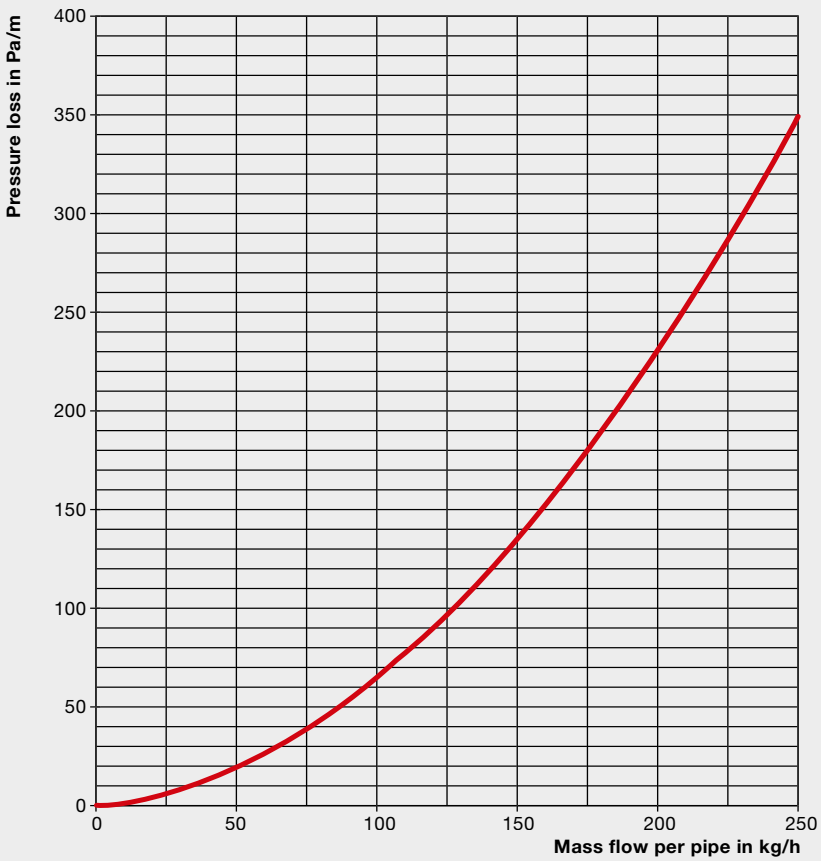
   Calculation formula:
   $\dot{m} = (\dot{Q} * 0.86) / \Delta t$
   $\dot{Q}$ = output (W)
   Δt = spread (K)
   $\dot{m}$ = mass flow (kg/h)

2. Refer to the graph for the pressure loss of the pair of headers.
   e.g. Δp = 600 Pa/pair of headers.
   Since the heating water flows into and out of a header twice, the value should be multiplied by two.

3. Refer to the graph for the pressure loss of the pipe. The mass flow is calculated by dividing the total mass flow by the number of pipes with parallel flow.
   e.g. 601 kg/h: 4 parallel pipes = 150 kg/h
   Δp = 135 Pa/m * 48 m * 2
   (for flow and return) = 12,960 Pa

4. The total pressure loss for the radiant ceiling panel is simply the sum of the individual pressure losses calculated previously.

Pressure loss per pipe



Hydraulic balancing of radiant ceiling panels

The correct water flow distribution for the heating water flow is important for operating any branched heating or cooling system efficiently. It must also be possible to fill, shut off and empty all radiant ceiling panels separately.

For systems where the radiant ceiling panels and the volume flows are identical, laying pipes according to the Tichelmann system (two-pipe system with reverse return, see **Fig. 1**) will provide a perfect hydraulic solution. However, the third pipe results in a considerable increase in costs where space heating systems are concerned and is not advisable in many instances if panels of different sizes are used.

Fig. 1: Pipes laid according to the Tichelmann system (two-pipe system with reverse return)

Systems where the individual panels have different outputs must be subjected to hydraulic balancing by means of piping calculations and adjustments. This process, however, demands a large investment in terms of time and money.

Hydraulic balancing is made easier with the Zehnder volume flow control combination (VSRK) (**Fig. 2**).

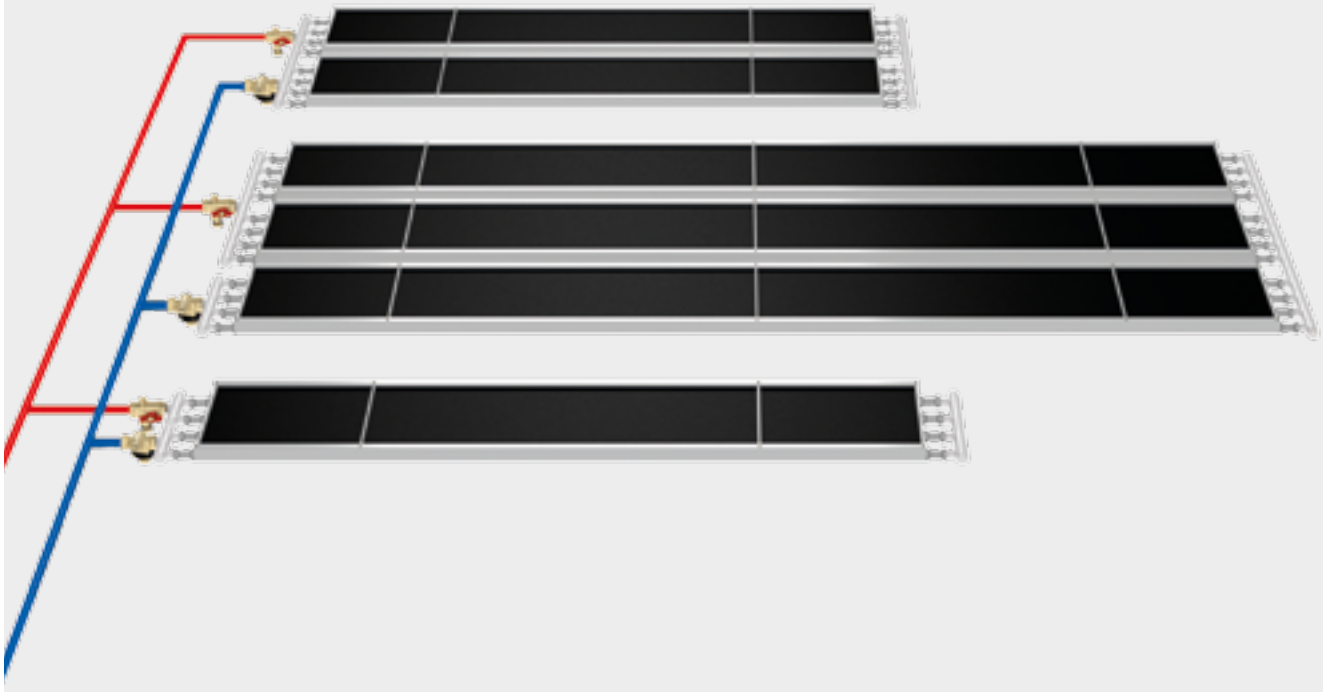


Fig. 2: Simpler pipe layout with Zehnder volume flow control combination (VSRK)

The Zehnder volume flow control combination VSRK

The VSRK is a complete set consisting of a volume flow controller and ball cocks.

The controller is set to the volume flow of the strip ex works. This removes the need for any time-consuming adjustment work on site.

Other advantages of the VSRK:
- Constant heating medium flow even when there is a high differential pressure
- Hydraulic balancing even for radiant panels of different sizes

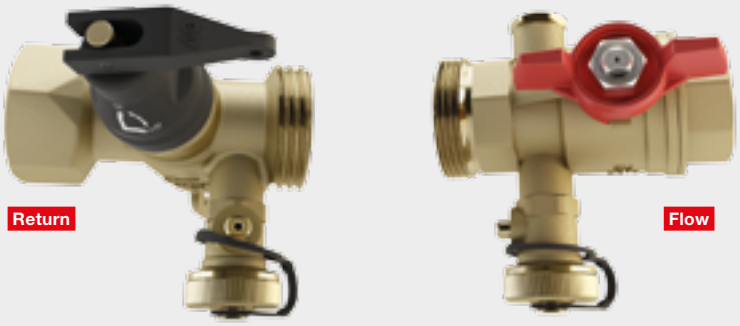
Longer-size panels need to have a flexible connection (armoured hose).

The Zehnder volume flow control combination is suitable for an operating temperature of -10 °C up to a maximum of 120 °C and a maximum operating pressure of 16 bar.
The working condition is permitted for the following medium: Water and ethylene/propylene glycol water mix (max. 50%), ph value 6.5–10.

Article numbers:

VSRK Combination DN15	509780
VSRK Combination DN25	509800
VSRK Combination DN32	509810
VSRK Special 15/15/15	505380
VSRK Special 25/15/15	505390
VSRK Special 25/25/25	502400
VSRK Special 32/25/25	505200
VSRK Special 32/32/32	505430
Flow, separate DN15	501000
Flow, separate DN25	505180
Flow, separate DN32	505190
Controller, separate DN15	502410
Controller, separate DN25	502420
Controller, separate DN32	502430
Armoured hose DN15	509260
Armoured hose DN25	509280
Armoured hose DN32	509310
Insert for VSRK DN 15	501030
Reducing sleeve 1" x ½"	501170
Connector 1"	501190
Reducing sleeve ⅝" x 1"	501180

Example of VSRK-25:



For more information, visit: **www.international.zehnder-systems.com**

Volume flow controller DN15	
Mass flow (kg/h)	Minimum differential pressure (kPa)
30	20.0
35	20.9
40	21.8
45	22.7
50	23.6
55	24.4
60	25.2
65	26.0
70	26.8
75	27.5
80	28.2
85	28.9
90	29.6
95	30.3
100	30.9
105	31.5
110	32.1
115	32.7
120	33.2
125	33.7
130	34.2
135	34.7
140	35.2
145	35.7
150	36.1
155	36.5
160	36.9
165	37.3
170	37.7
175	38.0
180	38.3
185	38.7
190	39.0
195	39.2
200	39.5
205	39.8
210	40.0

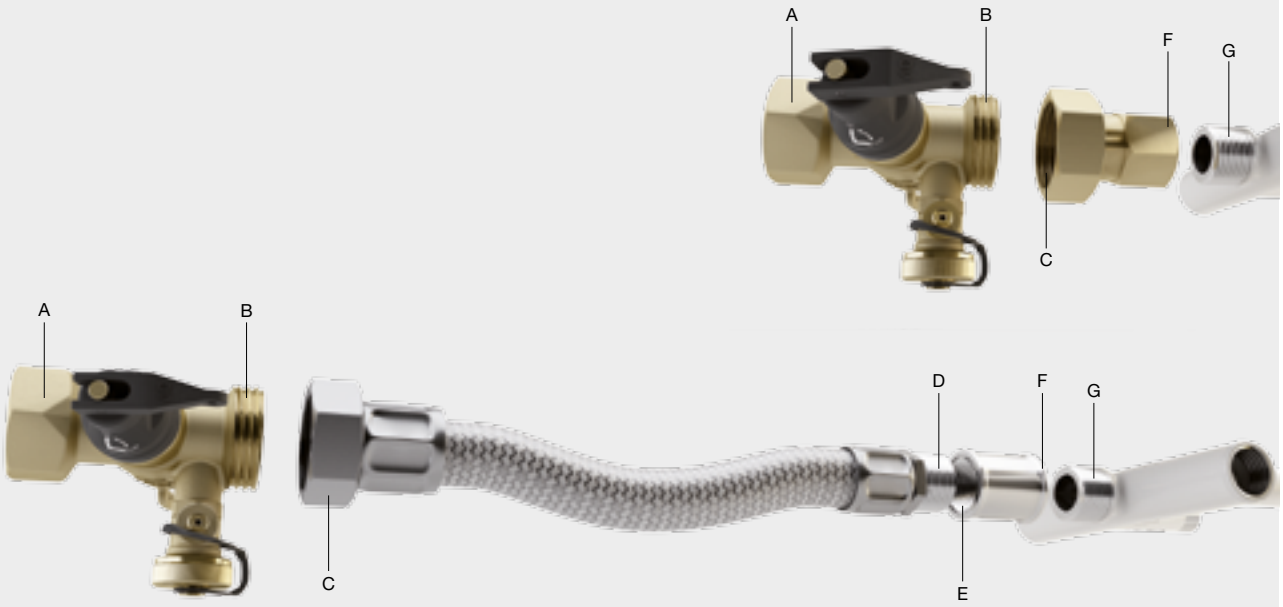
Volume flow controller DN25	
Mass flow (kg/h)	Minimum differential pressure (kPa)
150	20.0
175	20.9
200	21.8
225	22.7
250	23.6
275	24.4
300	25.2
325	26.0
350	26.8
375	27.5
400	28.2
425	28.9
450	29.6
475	30.3
500	30.9
525	31.5
550	32.1
575	32.7
600	33.2
625	33.7
650	34.2
675	34.7
700	35.2
725	35.7
750	36.1
775	36.5
800	36.9
825	37.3
850	37.7
875	38.0
900	38.3
925	38.7
950	39.0
975	39.2
1,000	39.5
1,025	39.8
1,050	40.0

Volume flow controller DN32	
Mass flow (kg/h)	Minimum differential pressure (kPa)
600	15.0
700	15.3
800	15.7
900	16.0
1,000	16.3
1,100	16.7
1,200	17.0
1,300	17.3
1,400	17.7
1,500	18.0
1,600	18.3
1,700	18.7
1,800	19.0
1,900	19.3
2,000	19.7
2,100	20.0
2,200	20.3
2,300	20.7
2,400	21.0
2,500	21.3
2,600	21.7
2,700	22.0
2,800	22.3
2,900	22.7
3,000	23.0
3,100	23.3
3,200	23.7
3,300	24.0
3,400	24.3
3,500	24.7
3,600	25.0

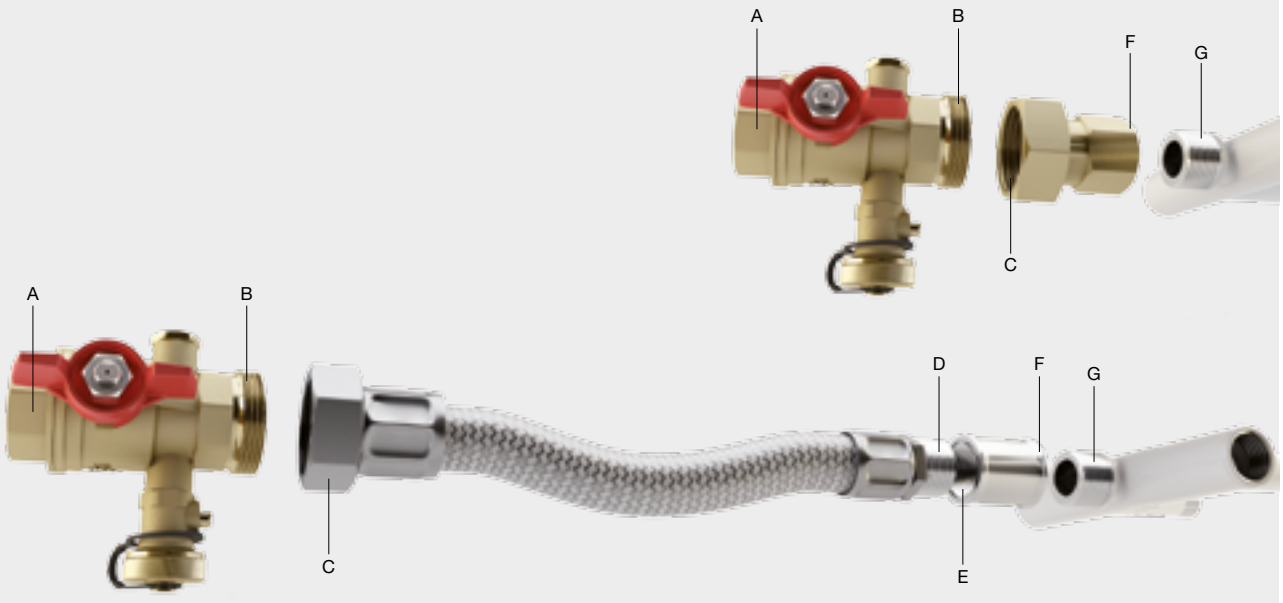
Connection size for Zehnder volume flow control combinations

VSRK dimensions	Controller or ball valve		Flat-sealing coupler screw connection	Male thread of hose	Female thread of connector	Female thread of connector	Conical male thread of header
	A	B	C	D	E	F	G
DN15	Rp ½"	G ¾"	Rp ¾"	R ½"	Rp ½"	R 1"	R 1"
DN25	Rp 1"	G 1 ¼"	Rp 1 ¼"	R 1"	Rp 1"	R 1"	R 1"
DN32	Rp 1 ¼"	G 1 ½"	Rp 1 ½"	R 1 ¼"	Rp 1 ¼"	R 1"	R 1"

Return



Flow



Description

Zehnder ZIP radiant ceiling panel made of 0.45 mm thick radiant sheet, galvanised on both sides, with Zehnder special clip profiling to hold four externally galvanised precision steel tubes with an external diameter of 15 mm according to EN 10305-3 (high pressure version EN 10305-1). Radiant sheet coated externally with polyester paint, similar to RAL 9016, and on the back with protective lacquer. Suitable for operating temperature up to a max. of 95 °C, maximum operating pressure 5 bar (high pressure version with max. operating temperature of 120 °C, maximum operating pressure 10 bar – in agreement with Zehnder).

The radiant panel sheets are statically self-supporting due to lateral and upper chamfers. The chamfers help to integrate as well as hold down the thermal insulation. Two end front plates are attached to the end of the radiant sheet. A radiant panel system can be fixed directly to the suspension axes which are attached to a fixed grid or to several parallel modules by using a joint multiple suspension bar with only two fixing points to the ceiling.

The headers consisting of a round tube (external diameter of 32 mm) or headers used as collectors are equipped with the required R1" male thread connectors (EN 10266), blind cover and ½" connector opposite for venting/draining. The headers are delivered loose and connected on site to the panel module or modules by pressing the accompanying press connectors or by tightening the accompanying screw connections.

Delivery is possible for 320 mm wide and any of 2, 3, 4, 5 or 6 m long modules which are ready to install. The individual modules are connected by pressing or screwing together tightly. The Zehnder ZIP radiant ceiling panels are protected against corrosion. Testing is carried out according to EN ISO 6270 in a condensate testing climate.

Zehnder ZIP radiant ceiling panels are tested for their ball impact resistance according to DIN 18032.

Brand:	Zehnder
Type:	ZIP radiant ceiling panels

Thermal insulation

Thermal insulation
Mineral wool free lined with black fleece according to EU directive 97/69 (note Q)
λ = 0.040 W/mK, thickness 40 mm

Insulation in LDPE foil
Mineral wool free lined with black fleece according to EU directive 97/69 (note Q) and shrink-wrapped in LDPE foil
λ = 0.040 W/mK, thickness 40 mm

XPS insulation
Extruded polystyrene rigid foam insulation
λ = 0.032 W/mK, thickness 20 mm

Operating parameters

Heating medium	..... / ..... °C
Room temperature	..... / ..... °C
Operating pressure	..... bar
Thermal output (overall)	..... W
Module length (overall)	..... m

Press-fit connection (Article no. 502280)

Galvanised press-fit connection 15 mm	..... piece(s)

Threaded connection (Article no. 633010)

Galvanised clamping ring screw connection 15 mm	..... piece(s)

Cover plates

Made of 0.45 mm thick sheet steel, galvanised on both sides, coated externally with polyester paint similar to RAL 9016, used to cover the press-fit or threaded connections at the connection points and to the headers
Cover plate (Article no. 506200)
End cover (Article no. 506210)

Upper covers

Dust protector panel
Galvanised upper plate cover (thickness 0.63 mm) incl. fixing clamps and screws – delivered loose

Ball guards
Galvanised metal grill cover incl. fixing clips and screws for use in sports facilities – delivered loose

Special solution for wet rooms
Special solution for wet rooms incl. XPS insulation and galvanised upper plate cover, sealed and installed at the factory

Fastening system

Fixing kit KN 53 (Article no.: 505160)
for fixing to concrete ceilings ..... piece(s)

Fixing kit KN 54 (Article no. 505170)
for fixing to steel profile ..... piece(s)

Fixing kit KN 56 (Article no. 505210)
for fixing to trapezoidal sheet metal ..... piece(s)

Fixing kit KN 57 (Article no. 505220)
for fixing to inclined steel girders ..... piece(s)

Fixing kit KN 58 (Article no. 505230)
for fixing to horizontal steel girders ..... piece(s)

Fixing kit KN 83 (Article no. 505260)
for fixing to concrete ceilings ..... piece(s)

Fixing kit KN 84 (Article no. 505270)
for fixing to steel profile ..... piece(s)

Fixing kit KN 86 (Article no. 505280)
for fixing to trapezoidal sheet metal ..... piece(s)

Fixing kit KN 87 (Article no. 505290)
for fixing to inclined steel girders ..... piece(s)

Fixing kit KN 88 (Article no. 505340)
for fixing to horizontal steel girders ..... piece(s)

Volume flow controller

Zehnder volume flow control combination consisting of a volume flow controller and a ball valve. The volume flow controller is a valve combination which consists of an automatic flow rate controller (with a nominal value that can be set at the factory) and an actuator head. The actuator head can be equipped with an actuator or a temperature controller (threaded connection M30 x 1.5 mm).

The volume flow control combination is usually applied to hydraulic balancing as well as to room temperature control. Due to the integrated barrier and draining, connected consumers can be shut off and cleaned or drained individually.

Technical data:

Dimensions:	DN25
Max. operating temperature ts:	120 °C
Min. operating temperature ts:	-10 °C
Max. operating pressure ps:	16 bar
Max. differential pressure:	4 bar
Connections:	Female thread Rp1" Male thread G 1¼"

Medium: Water or ethylene/propylene glycol water mix (max. 50%), ph value 6.5–10
Housing made of dezincification-resistant brass, seals made of EPDM or PTFE, valve spindle made of stainless steel.

Article numbers:

VSRK Combination DN15	509780
VSRK Combination DN25	509800
VSRK Combination DN32	509810
VSRK Special 15/15/15	505380
VSRK Special 25/15/15	505390
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Flow, separate DN15	501000
Flow, separate DN25	505180
Flow, separate DN32	505190
Controller, separate DN15	502410
Controller, separate DN25	502420
Controller, separate DN32	502430

Armoured hose

Zehnder armoured hose for heating systems, consisting of temperature-resistant and age-resistant EPDM with stainless-steel braided sleeve.

Hose DN25

Inner installation dimension:	500 mm
Hose length:	545 mm
Permissible operating pressure:	10 bar
Operating temperature range:	100 °C
Connections:	Male thread R1" Coupler Rp 1¼"

Article numbers:

Armoured hose DN15	509260
Armoured hose DN25	509280
Armoured hose DN32	509310
Insert for VSRK DN15	501030
Reducing sleeve 1" x ½"	501170
Connector 1"	501190
Reducing sleeve ⅝" x 1"	501180

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FOUR COMPLEMENTARY PRODUCT LINES

The broad and clearly structured portfolio from the Zehnder Group is split into four product lines. Consequently, we can provide the right product, the perfect system and the matching service for all types of projects – from new builds to renovations, single- or multiple-family homes, as well as commercial projects. This variety ensures that our wealth of experience is continuously expanding, providing tangible added value to our customers on a daily basis.

Decorative radiators
Our individual decorative radiators for living and bathrooms not only make a home warmer but also more attractive. Created by renowned designers, they impress with excellent functionality.

Comfortable indoor ventilation
Our comfortable indoor ventilation is energy-efficient and provides a healthy indoor climate. It promotes the well-being of the occupants and increases the value of the property.

Heating and cooling ceiling systems
Zehnder heating and cooling ceiling systems are convenient and energy-efficient for heating and cooling. They are perfectly attuned to the relevant environment.

Clean air solutions
Clean air solutions from Zehnder reduce the level of dust in the air, create a healthier working climate and reduce the amount of cleaning required.

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BRANDS THAT OFFER VARIETY

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The Zehnder brand offers excellent indoor climate solutions within the sectors of decorative radiators, clean air solutions, comfortable indoor ventilation and heating and cooling ceiling systems.

runtal

LUFITAT

The Runtal brand develops and manufactures exclusive radiators combining innovative technologies with unique designs.

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