

Zehnder Carboline Radiant Heating and Cooling Ceiling Panels



Submittal Data

English Language, IP Units

Heating

Cooling

Fresh Air

Clean Air

Submittal data

Project
Job number
Architect
Engineer
Contractor

Performance data: heating

Average water temperature	°F
Design room temperature	°F
Heating capacity	BTU/hr/sq. ft.

Performance data: cooling

Average water temperature	°F
Design room temperature	°F
Cooling capacity	BTU/hr/sq. ft.

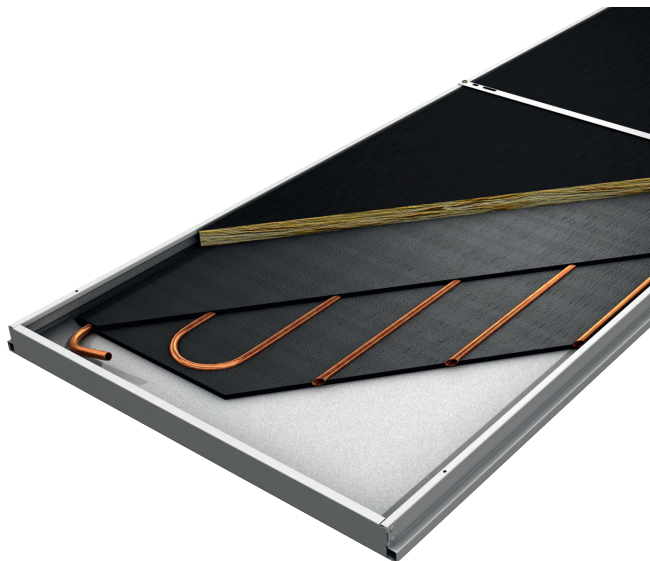


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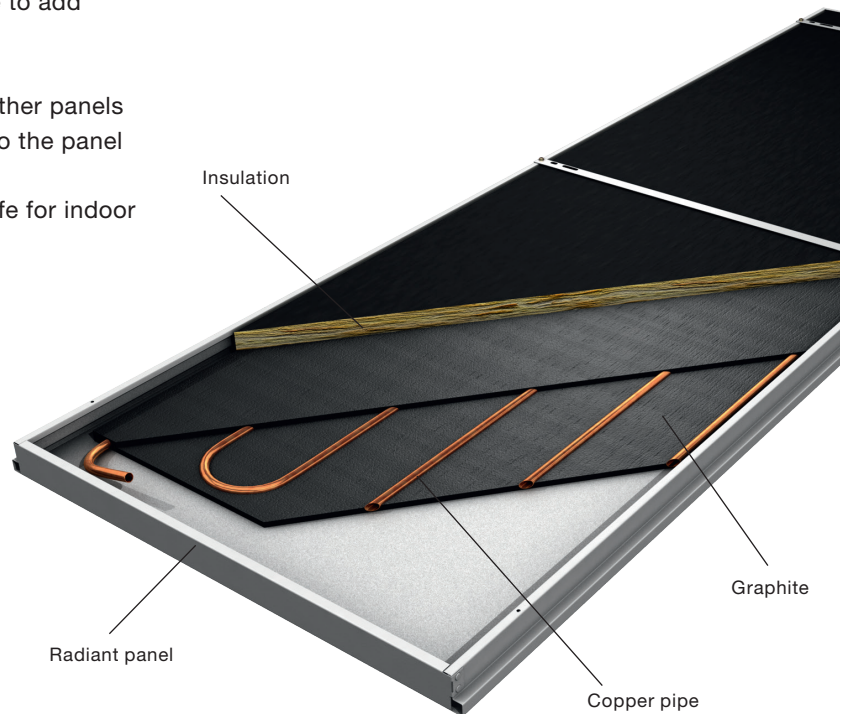
Standard unit features

Zehnder Carboline comprises of a copper pipe (Ø10 mm) which is embedded in an expanded graphite sandwich. This high-performance thermal element is bonded to a sheet steel cassette. The radiant panel has an angled profile on the side and top to create a self-supporting panel.

- Brackets are added to the steel cassette to add hanging stability to the structure
- Steel panel has a powder coat finish
- Panel is connected to supply/return or other panels with flexible hoses. The hoses connect to the panel with a push-to-connect fitting.
- All panels are non-flammable and are safe for indoor use
- RAL 9010 matte

Operating Parameters

- Max. working temperature: 185 °F
- Max. working pressure: 10 bar

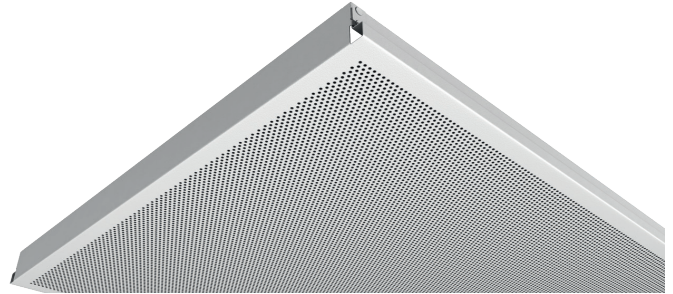


T-bar style shown

Optional features

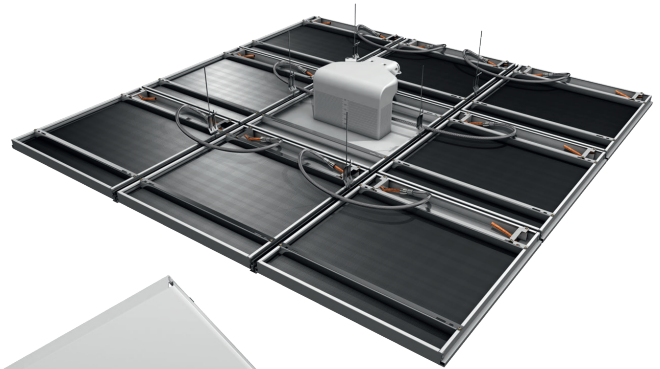
Perforated surface

- Zehnder Carboline is available with the option of either a smooth or perforated surface. Both types of surfaces are coated with a high-quality, powder-baked enamel finish. A perforated surface has the additional benefit of sound absorption. The reverberation within a room can be decreased on average of 44%. (Results based on perforated panel with insulation in a free hanging configuration, tested to DIN EN ISO 354. Results will vary based on room configuration.)



Ceiling cut-outs

- Ceiling cut-outs are integrated into the panel elements of Zehnder Carboline as required. Cut-outs typically accommodate air outlets, projector brackets, loudspeakers, fire alarms, lighting and similar items. Cut-outs cannot interfere with the copper tubing. Precise locations are confirmed by the factory.



Insulation

- 1" Fiberglass
- 1/2" Rockfon
- 1" Rockfon

Color

- 6 additional colors to choose from



Note: The number of panels, size of panels, optional cut-outs and perforated surface can be indicated on panel selection.

Heating and cooling output

The following tables show the Zehnder Carboline heating and cooling output depending on the $\Delta T_{\text{Surface to room}}$. The values of the heating output are based on DIN EN 14037, those of the cooling output on DIN EN 14240.

Note: The removal of the insulation has a positive effect on the cooling output. However, this additional output can only be added to the room with an open ceiling.

Removing the insulation increases the convection output, but only leads to a build-up of heat under the ceiling.

Heating:

$$\Delta T_{\text{Surface to room}} = \frac{(EWT + LWT)}{2} - T_p$$

Cooling:

$$\Delta T_{\text{Surface to room}} = T_p - \frac{(EWT + LWT)}{2}$$

Where:

EWT = Entering water temperature

LWT = Leaving water temperature

T_p = Perceived room temperature

Rating factors

Use the rating factors below to calculate performance levels for different mounting applications

	Heating	Cooling
Free hanging with insulation	1.00	1.00
Free hanging without insulation	1.25	1.17
Closed ceiling with insulation	0.80	0.87
Closed ceiling without insulation	0.83	0.87

Heating output - DIN EN 14037 (free hanging with insulation)

$\Delta T_{\text{Surface to room}}$ (°F)	BTU/panel				
	24" x 24"	24" x 48"	24" x 72"	24" x 96"	24" x 120"
130	1068	2137	3205	4274	5342
125	1023	2047	3070	4094	5117
120	979	1957	2936	3914	4893
115	934	1868	2802	3736	4670
110	890	1779	2669	3558	4448
105	845	1690	2536	3381	4226
100	801	1602	2404	3205	4006
95	757	1515	2272	3029	3787
90	714	1427	2141	2855	3569
85	670	1341	2011	2681	3352
80	627	1254	1882	2509	3136
75	584	1169	1753	2337	2922
70	542	1084	1625	2167	2709
65	499	999	1498	1998	2497
60	457	915	1372	1830	2287
55	416	832	1247	1663	2079
50	375	749	1124	1498	1873
45	334	667	1001	1335	1668
40	293	586	880	1173	1466
35	253	507	760	1013	1266
30	214	428	642	855	1069
25	175	350	525	700	875
20	137	274	411	548	685
15	100	200	300	400	500
10	64	128	192	256	320

Cooling output - DIN EN 14240 (free hanging with insulation)

$\Delta T_{\text{Surface to room}}$ (°F)	BTU/panel				
	24" x 24"	24" x 48"	24" x 72"	24" x 96"	24" x 120"
24	216	431	647	862	1078
23	206	412	619	825	1031
22	197	394	590	787	984
21	187	375	562	750	937
20	178	356	534	712	891
19	169	338	506	675	844
18	160	319	479	638	798
17	150	300	451	601	751
16	141	282	423	564	705
15	132	264	395	527	659
14	123	245	368	490	613
13	113	227	340	454	567
12	104	209	313	417	522
11	95	190	286	381	476
10	86	172	259	345	431
9	77	154	232	309	386
8	68	136	205	273	341
7	59	119	178	237	297
6	50	101	151	202	252
5	42	83	125	167	209
4	33	66	99	132	165
3	24	49	73	98	122
2	16	32	48	64	80
1.5	12	24	35	47	59
1	8	15	23	31	39

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Heating and cooling output

Common US comparison

Radiant panels have been applied in unconventional locations such as wall mount applications. It is common US/N. American practice to measure panel output using this vertical configuration. The output tables to the right are the heating and cooling outputs of the panel when used in this unconventional manner. Zehnder Rittling recommends following the EN standards (previous tables) for accurate design values for ceiling applications.

Heating output (free hanging with insulation)

ΔT Surface to room (°F)	BTU/panel				
	24" x 24"	24" x 48"	24" x 72"	24" x 96"	24" x 120"
130	1236	2474	3710	4948	6184
125	1184	2368	3552	4736	5920
120	1126	2252	3378	4504	5630
115	1074	2148	3222	4296	5369
110	1019	2037	3057	4076	5094
105	961	1922	2883	3843	4805
100	911	1822	2734	3644	4555
95	856	1712	2569	3424	4280
90	796	1592	2388	3184	3980
85	746	1493	2239	2986	3731
80	689	1377	2065	2753	3442
75	634	1268	1902	2537	3170
70	581	1160	1741	2322	2902
65	521	1044	1565	2087	2609
60	469	936	1405	1872	2341
55	409	820	1229	1639	2048
50	359	717	1075	1433	1792
45	299	597	896	1194	1493
40	251	501	752	1003	1254
35	214	429	643	857	1072
30	179	358	537	715	894
25	144	289	433	578	722
20	111	222	333	444	556
15	79	159	238	317	396
10	49	98	148	197	246

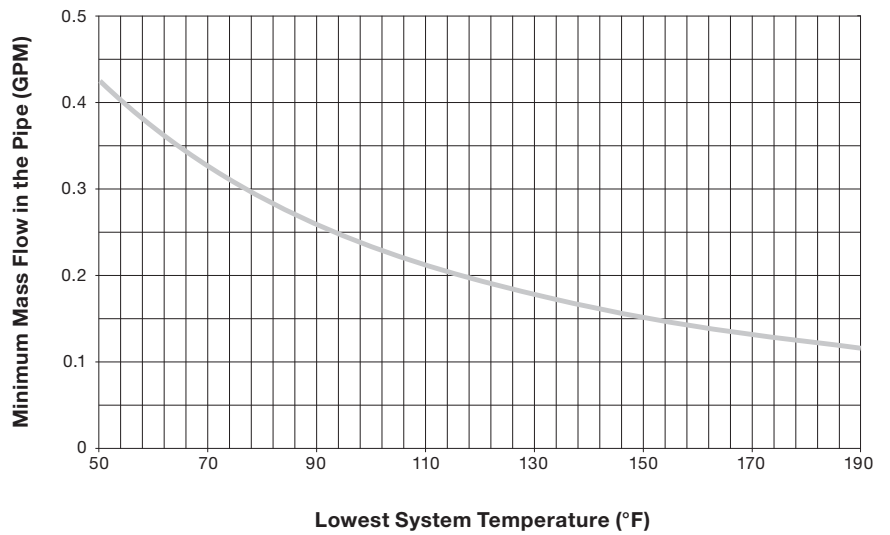
Cooling output (free hanging with insulation)

ΔT Surface to room (°F)	BTU/Panel				
	24" x 24"	24" x 48"	24" x 72"	24" x 96"	24" x 120"
24	185	369	553	738	922
23	176	352	528	704	879
22	172	343	516	687	859
21	163	325	487	649	812
20	154	308	462	615	769
19	145	290	437	582	727
18	136	272	408	543	680
17	132	264	396	528	660
16	123	245	369	491	614
15	114	229	343	458	572
14	106	210	316	420	526
13	97	194	290	387	484
12	92	184	276	368	461
11	84	168	252	336	420
10	75	150	224	299	374
9	67	134	200	267	334
8	59	118	177	235	295
7	52	105	156	209	261
6	44	90	134	179	223
5	37	74	111	149	186
4	29	57	86	114	143
3	22	43	63	85	106
2	14	28	42	56	70
1.5	10	20	31	41	51
1	6	13	19	26	32

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Minimal mass flow

To maintain the capacities stated, a turbulent flow must be ensured within the pipes in the panels. This minimum mass flow depends on the lowest system temperature. When heating, this corresponds to the return water temperature. When cooling or in a combined cooling/heating mode, this corresponds to the cold water supply temperature.



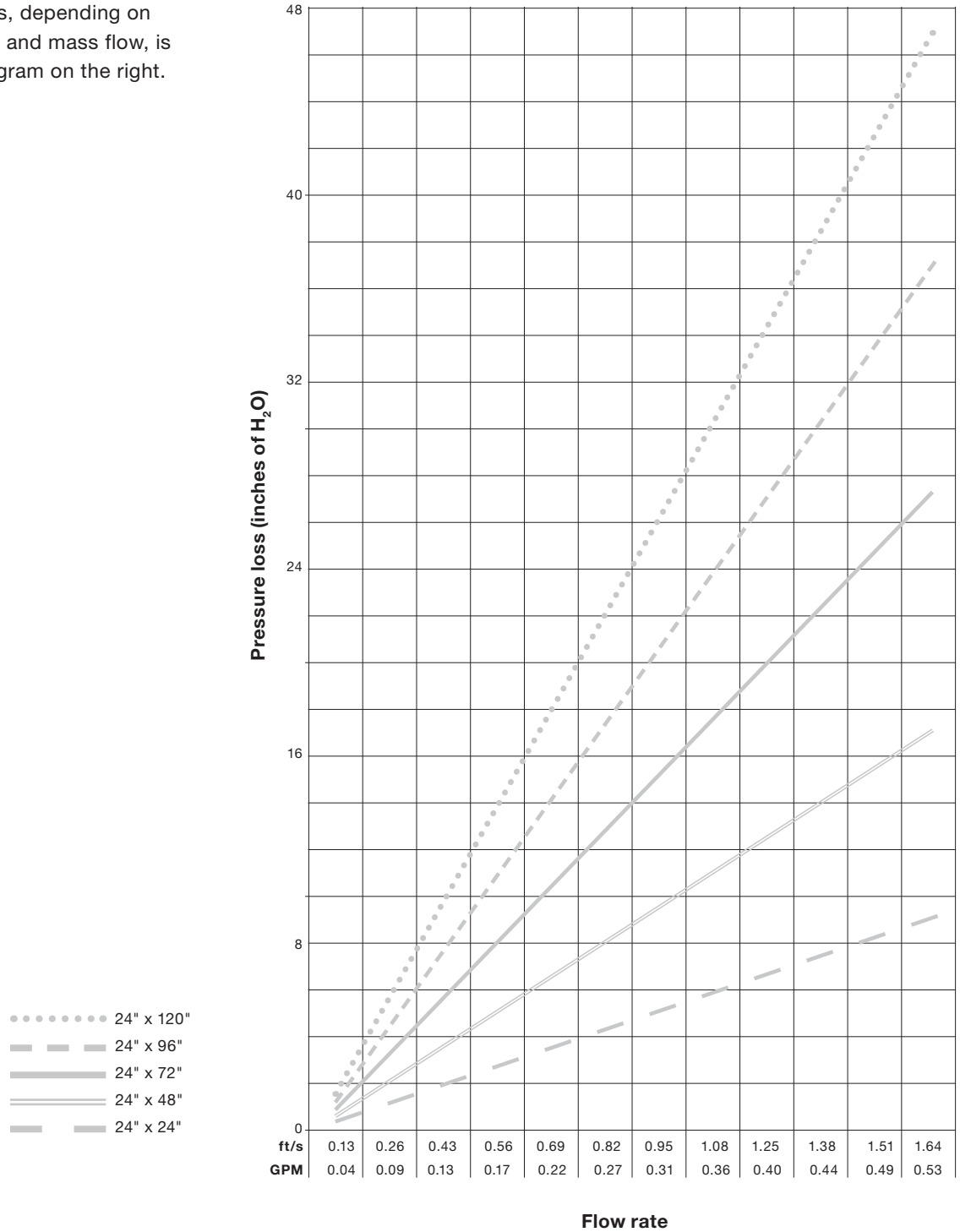
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Pressure loss calculation

Pressure loss calculation

The pressure loss, depending on the module sizes and mass flow, is shown in the diagram on the right.

Pressure loss per module

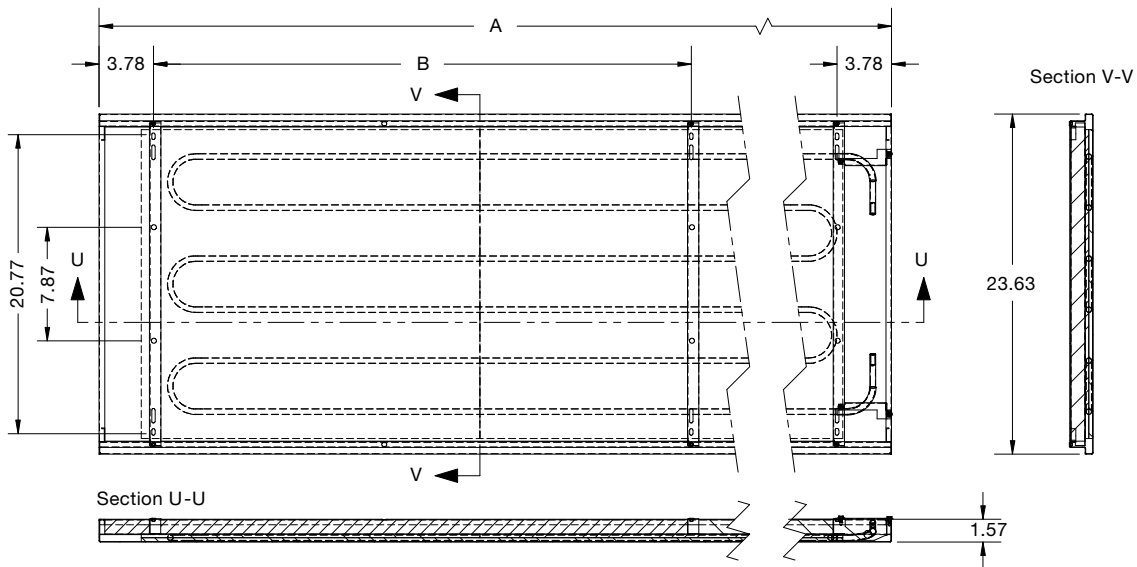
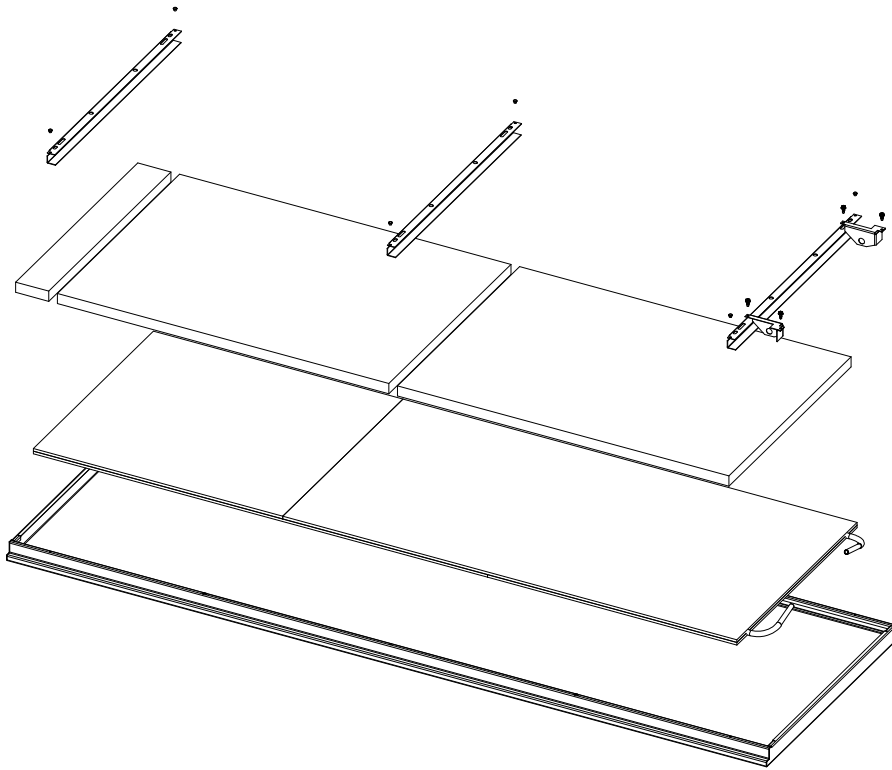


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Zehnder Carboline Ceiling Panels Submittal Data

English, IP Units

Dimensions: T-bar style, 2-pipe



Unit	24" x 24"	24" x 48"	24" x 72"	24" x 96"	24" x 120"
A	23.63"	47.63"	71.63"	95.63"	119.63"
B	16.06"	40.04"	2x 32.03"	2x 44.02"	3x 37.36"
No. of solid panels					
No. of perforated panels					
No. of panels with cut-outs*					

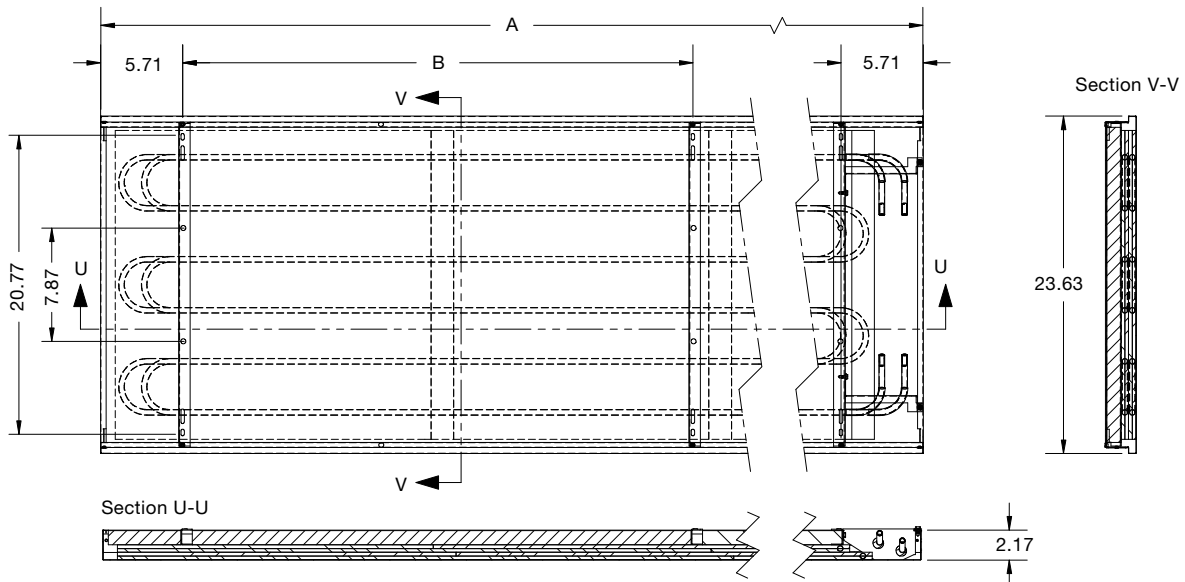
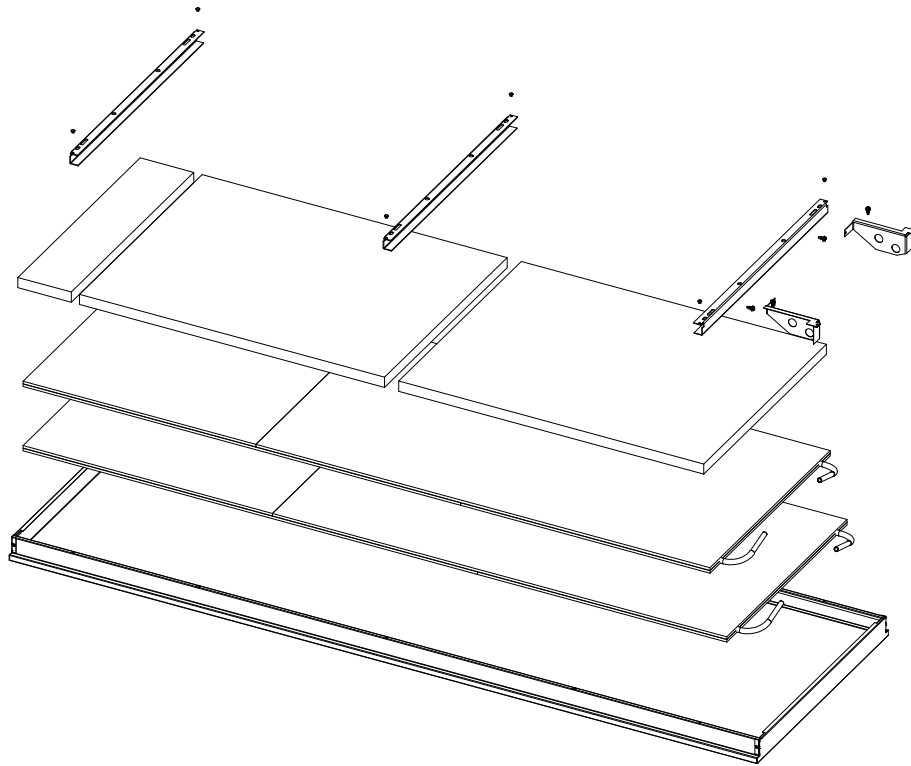
*Cut-out size and location to be confirmed with the factory.

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Zehnder Carboline Ceiling Panels Submittal Data

English, IP Units

 Dimensions: T-bar style, 4-pipe



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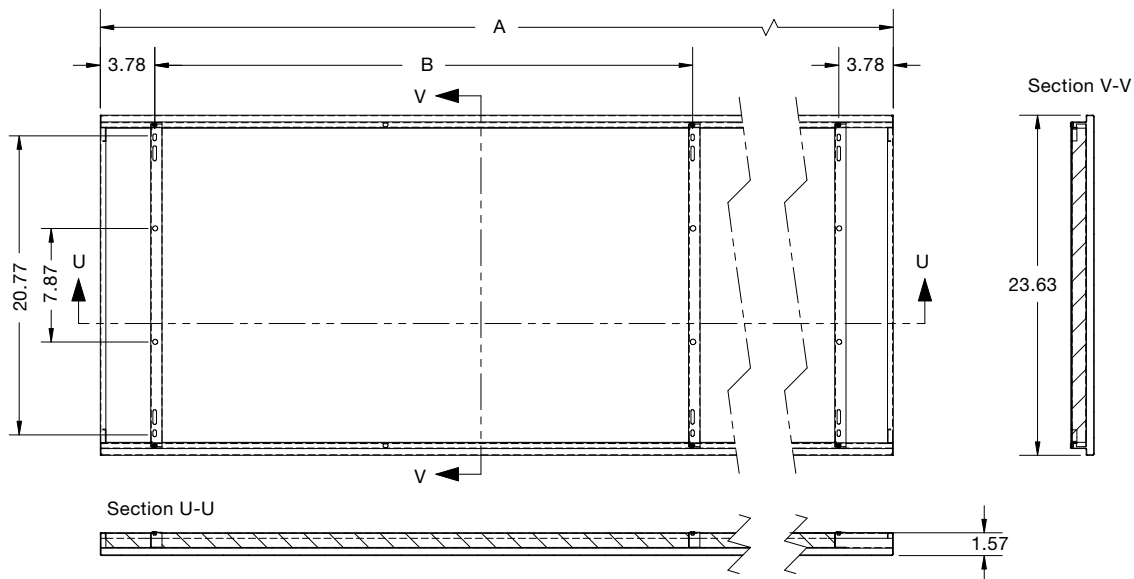
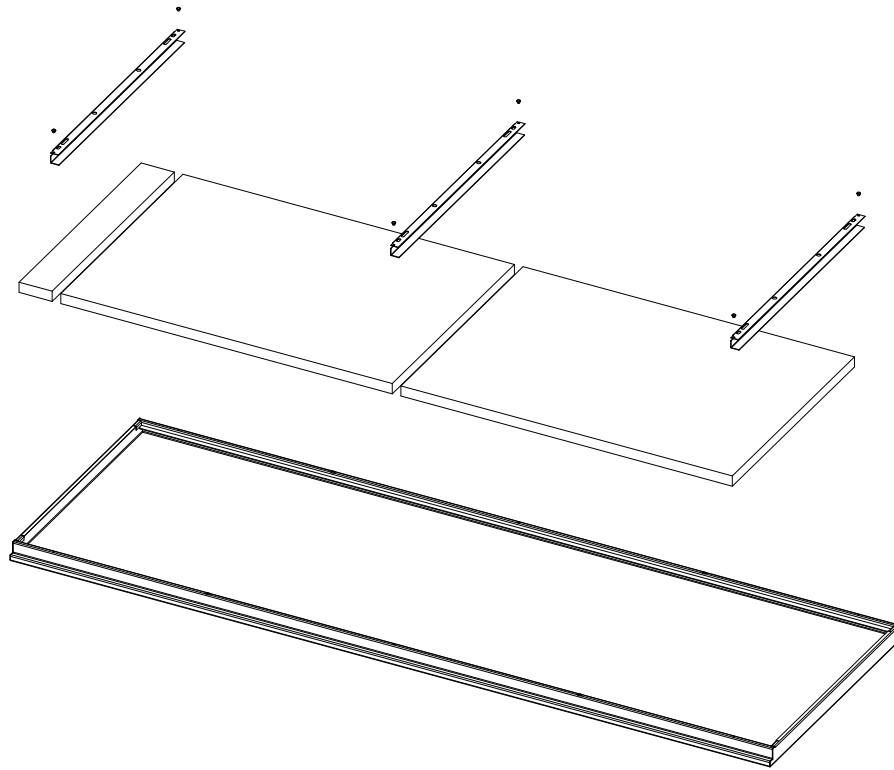
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Zehnder Carboline Ceiling Panels Submittal Data

English, IP Units

 Dimensions: T-bar style, inactive



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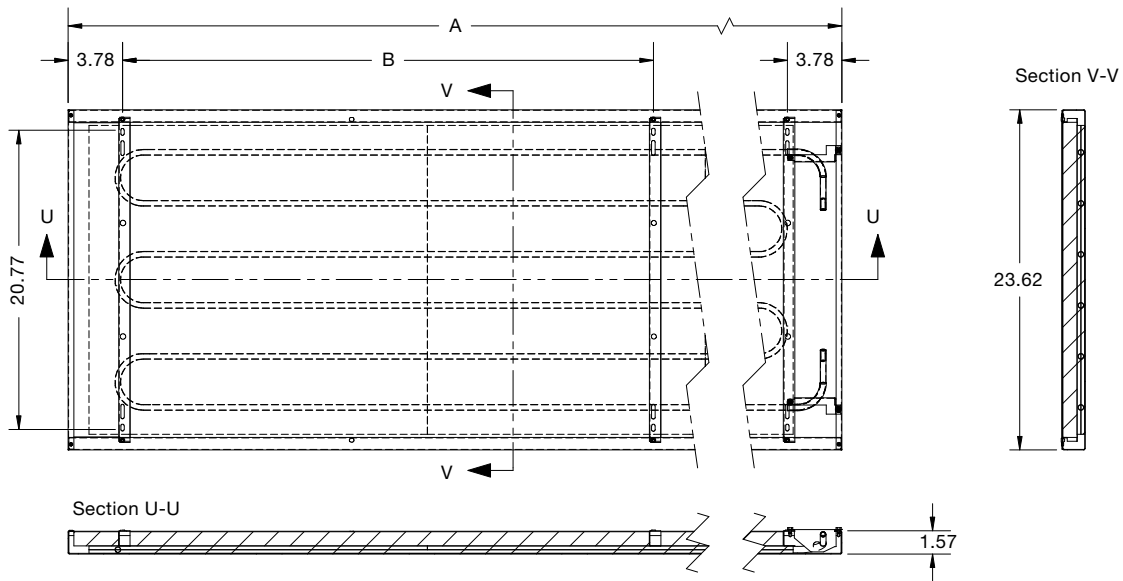
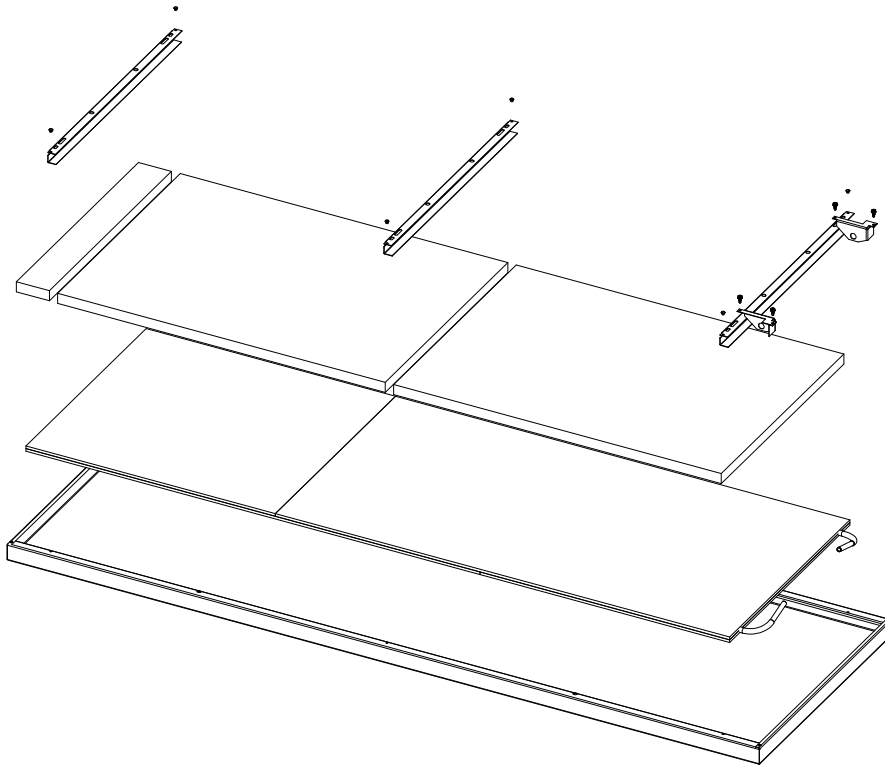
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Zehnder Carboline Ceiling Panels Submittal Data

English, IP Units

Dimensions: Free hanging style, 2-pipe



Unit	24" x 24"	24" x 48"	24" x 72"	24" x 96"	24" x 120"
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B	16.06"	39.69"	2x 31.65"	2x 43.46"	3x 37.00"
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No. of perforated panels					
No. of panels with cut-outs*					

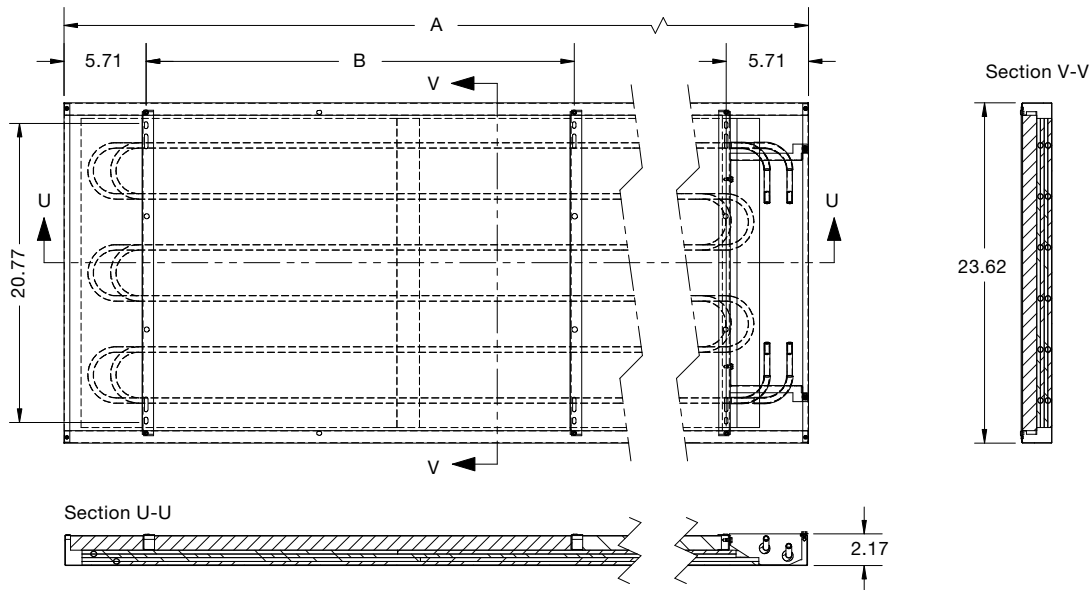
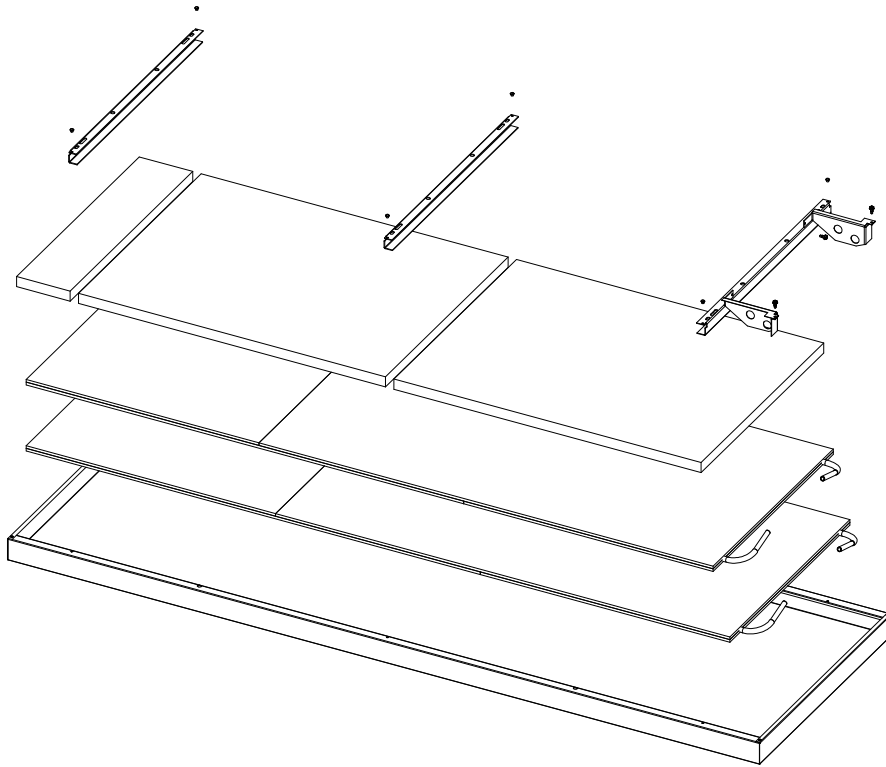
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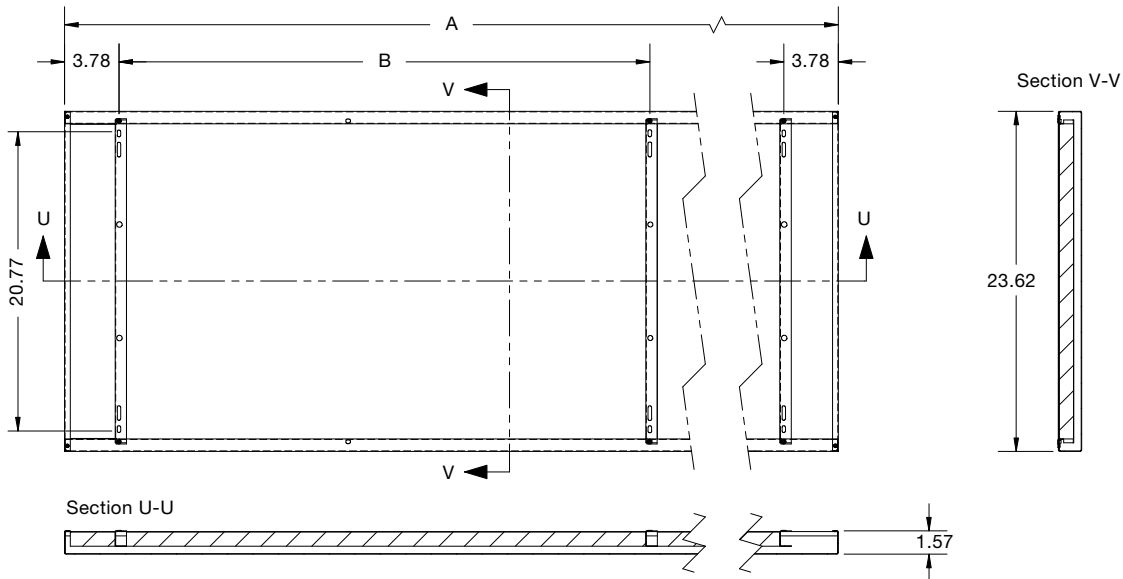
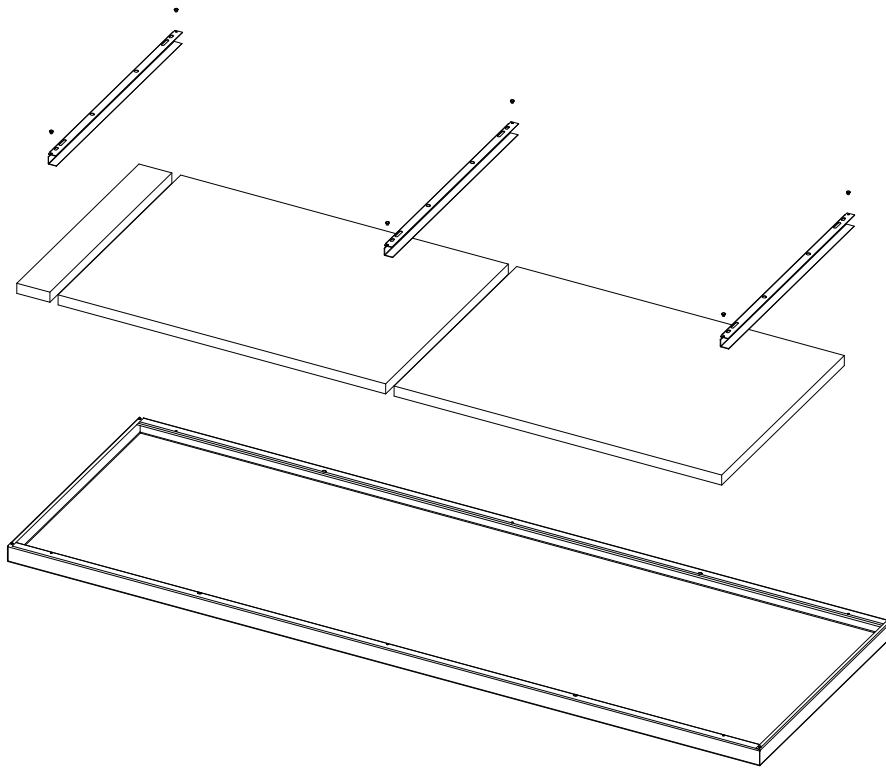
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Panel specifications

1. General

1.1 Related documents

- A. Drawings and general provisions of the contract, including general and supplementary conditions and division 1 specification sections, apply to this section.

1.2 Summary

- A. This section includes the following:
 - 1. Hydronic radiant heating and cooling ceiling panels.

1.3 Definitions

- A. Low voltage: as defined in NFPA 70 for circuits and equipment operating at less than 50V or for remote control, signaling and power limited circuits.

1.4 Submittals

- A. Product data: includes rated capacities, specialties and accessories for each product indicated.
- B. Shop drawings: Include plans, elevations, sections, details and attachments to other work. Indicate dimensions, weights, loads, required clearances, method of field assembly, components and location and size of each field connection.
 - 1. Include schedule showing model designation, size, room location and accessories furnished.
 - 2. IOM
- C. Coordination drawings: reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Suspended ceiling components
 - 2. Method of attaching hanging systems to building structure.
 - 3. Size and location of initial access modules for acoustical tile.
 - 4. Items penetrating finished ceiling, including the following:
 - a. Lighting fixtures
 - b. Air outlets and inlets
 - c. Speakers
 - d. Sprinklers
 - e. Access panels
 - 5. Perimeter moldings

- D. Samples for initial selection: for units with factory applied color finishes.

1.5 Quality

- A. Product Options: Drawings indicating size, profiles, and dimensional requirements of radiant ceiling panels.
- B. Radiant ceiling panels shall be shipped with an adhesive film protective coating on each individual element on the visual side.
- C. Radiant ceiling manufacturer to supply 5 year warranty from date of shipment.
- D. Panels to be manufactured in a certified ISO9001:2015 facility.
- E. Radiant ceiling panels and accessories shall be rated and tested for pressures as shown on drawings and manufacturers technical documentation.

1.6 Coordination

- A. Coordinate layout and installation of radiant panels and suspension components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire suppression system and partition assemblies.

2. Products

2.1 Manufacturers

- A. Manufacturers: subject to compliance with requirements, provide products by one of the following:
 - 1. Zehnder Rittling
 - 2. Alternates: approved equals or alternates are acceptable if and only if a mock-up and witness test is performed to demonstrate that the substitution meets the design criteria.

2.2 Hydronic Radiant heating and cooling ceiling panels

- A. Material:
 - a. Radiant ceiling panels to include graphite activation, copper meander, steel cassette and supported steel cross channels.
 - b. Panel Surface: All panels to have <solid> perforation pattern consisting of 2mm (0.08") diameter holes providing 25% open area as standard. Perforated panels to be supplied with an acoustical absorbing fleece for sound attenuation. The

Mechanical specifications

- microfiber fleece shall be non-flammable and meet the requirements of building material standards DIN 4102/B1 and BS 476/ASTM E84.
- c. Sound absorption data shall be available for all panel configurations and tested in accordance with DIN EN ISO 354.
 - d. Factory cut outs shall be supplied for radiant panels for integration with lights, projector brackets, speakers, fire sprinklers, and other air outlet devices.
 - e. Panel steel cassettes to be constructed of 24-gauge galvaneal sheet metal <stainless steel>. Cross channels to be constructed of 20-gauge galvanealed sheet metal to provide support for mounting system.
 - f. Non active radiant panels shall be supplied where indicated on the drawings. Non active panel steel cassettes to be constructed of 24-gauge galvaneal sheet metal <stainless steel>.
 - g. Radiant ceiling panel surface to be coated with highly emissive powder coat paint for optimal radiative properties. Color to be selected by architect.
 - h. Carbon graphite activation to be comprised of copper pipe embedded in a expanded graphite layer. The graphite layer shall be bonded to the steel cassette using low VOC adhesive.
 - i. Copper meander to be supplied with same end, opposite end or 2X meander connections based on drawings.
 - j. Max working temperature/pressure to be 185F / 145psi.
 - k. Radiant panels shall be 2-pipe <4-pipe>.
 - l. Radiant ceiling panels to be supplied with the following edges:
 - a. T-Bar
 - b. Free Hanging, Sail or Cloud
 - c. Tegular
 - m. Free hanging, cloud or sail panels shall be factory supplied with backclips to eliminate gaps.
 - n. Factory installed fire resistant 1" Rockfon insulation <1" fiberglass> shall be provided with glass lined fiber fleece to provide acoustical absorption and shall have ASTM E85 / ASTM E1264 classification.
 - o. Stainless steel flexible hoses to be supplied with panels for connections to surrounding panels and distribution system. Panel connection by means by brazing or press is not acceptable.
 - a. Corrugated flexible hoses shall have the following characteristics: standard length 30", maximum pressure 145 psi, maximum temperature 185° F, bend radius of 0.7 inches, water flow section comprised of stainless steel, and fire rating of UL-94 VO under card listing QMFZ2.E80017.
 - b. Braided flexible hoses shall have the following characteristics: standard length 30", maximum pressure 145 psi, maximum temperature 185 F, bend radius of 2.5 inches, water flow section comprised of ethylene thermoplastic rubber (EPTR), and fire rating of UL-94 VO under card listing QMFZ2.E80017.
 - p. Factory supplied mounting and hanging hardware for radiant panels.
 - a. Standard G Kit
 - i. Kit shall consist of toggle end 5 foot No. 2 wire cable and express gripple connector.
 - b. Y-Configured Wire Rope
 - i. Kit shall consist of (2) toggle ends (Y) on 5 foot No. 2 wire cable and express gripple connector.
 - c. Standard G Kit with Fine Adjustment
 - i. Kit shall consist of toggle end on 5 foot No. 2 wire cable, express gripple connector, duct pin, toggle plate, panel mounting clip, and self-tapping screw.
 - d. Chain Kit
 - i. Kit shall consist of fixing clips for panel connection and chain.

- e. Torsion Spring Hanging System
 - i. Specialized grid system with torsion spring hangers factory installed on radiant panels. Steel clips that locate and align the panels to the grid with torsion springs are to be factory machine riveted to the return edge of the panels using countersunk rivets and flush with the face of the panel. No fasteners of any kind shall be visible on exposed face surfaces of ceiling panels or support tees. No chains/cables are required for panel installation.
- q. Radiant panel performance and output as measured in BTU/hr;
 - 1. Nominal panel size as scheduled
 - 2. Heating Performance:
 - 1. Radiant panel capacity shall be tested and certified by manufacturer in accordance with DIN 14037 or ASHRAE 138-2013
 - 3. Cooling Performance:
 - 1. Radiant panel capacity shall be tested and certified by manufacturer in accordance with DIN 14240 or ASHRAE 138-2013.

- 1. Verify that controls and control enclosure are accessible.
- 2. Verify that control connections are complete to control valves as needed.
- 3. Verify that any identification tags are visible.
- 4. Verify that controls respond to inputs as specified.
- 5. Removal of protective film coating before system startup.
- 6. Release of stabilization profiles on panel edges.

3.3 Connections

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicated general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to radiant panels to allow for service and maintenance.
- C. In addition to Division 23 Section "Hydronic Piping", connect copper tubing to supply with shut-off valve, strainer, control valve, and union or flange, and to return with balancing valve and union or flange.

3.4 Field quality control

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Leak Test: After installation, fill water tubes and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, start units to conform to proper unit operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Remove and replace malfunctioning units and retest as specified above.

3.5 Cleaning and protection

- A. Remove protective film coating before startup of the system.
- B. Clean all visible surfaces of equipment; touch up as required.
- C. Protect all units before, during and after installation. Damaged materials due to improper protection shall be cause for rejection.

3. Execution

3.1 Pre-design services

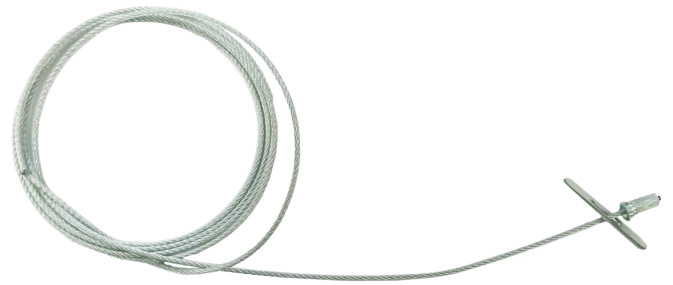
- A. Bid shall include the costs to complete final selections and coordination with the Engineer at the Engineers office. Allow for a minimum of three (3) days.

3.2 Installation - General

- A. Install radiant panel level and plumb. Maintain sufficient clearance for normal services, maintenance, or in accordance with construction drawings.
- B. To ensure proper installation and handling of the radiant panels, a complete IOM shall be supplied and reviewed before installation has begun.
- C. Complete installation and startup checks according to manufacturer's written instructions and perform the following:

Standard Gripple kit, 2'-8' panels

Components	Quantity per kit
Gripple express no. 2 connector	4
Toggle end	
Standard wire	
PDF Instruction Manual	1



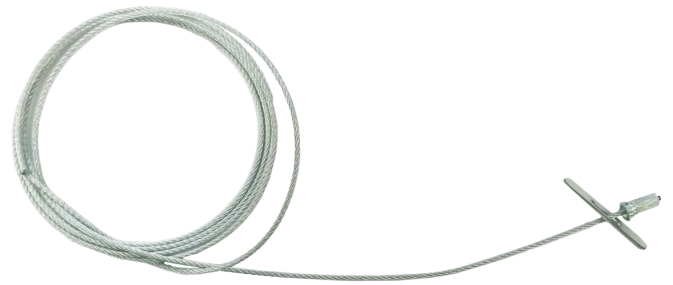
Toggle end on 5 foot No. 2 cable



Express gripple

Standard Gripple kit, 10' panels

Components	Quantity per kit
Gripple express no. 2 connector	6
Toggle end	
Standard wire	
PDF Instruction Manual	1



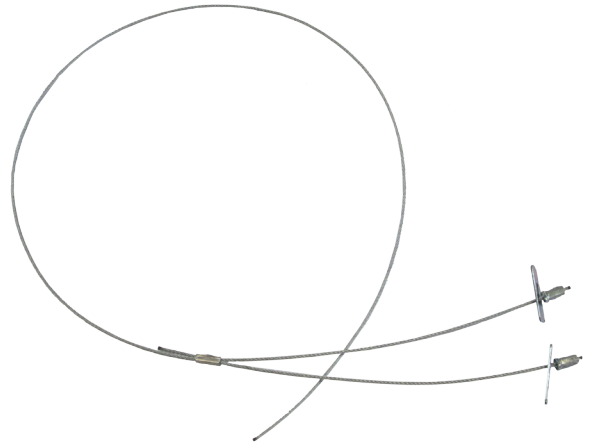
Toggle end on 5 foot No. 2 cable



Express gripple

Y-Gripple kit, 2'-8' panels

Components	Quantity per kit
Gripple express no. 2 connector	2
Toggle end	
Y-wire	
PDF Instruction Manual	1



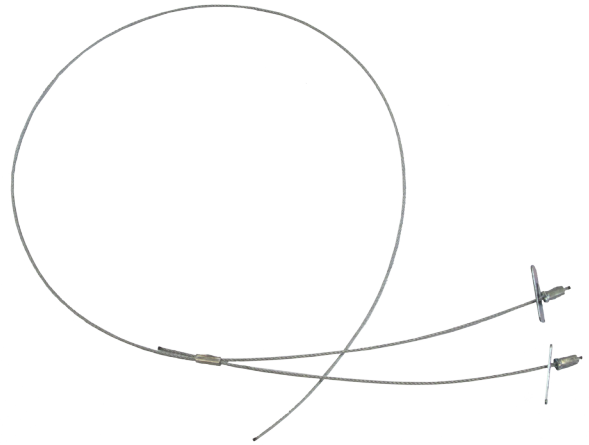
(2) Toggle ends (Y) on 5 foot No. 2 cable



Express gripple

Y-Gripple kit, 10' panels

Components	Quantity per kit
Gripple express no. 2 connector	3
Toggle end	
Y-wire	
PDF Instruction Manual	1



(2) Toggle ends (Y) on 5 foot No. 2 cable

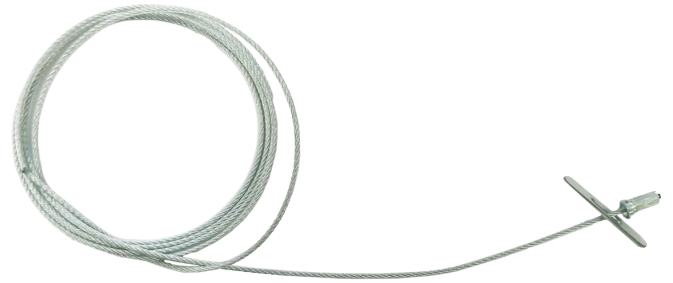


Express gripple

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Standard Gripple with fine adjustment hardware kit, 2'-8' panels

Components	Quantity per kit
Gripple express no. 2 connector	4
Toggle end	
Standard wire	
Duct pin - screw for fine adjustment	4
Toggle plate - plate for fine adjustment	4
Carboline clip LH	2
Carboline clip RH	2
Self tapping screw - #6-20 x 3/8" Phillips pan head	4
PDF Instruction Manual	1



Toggle end on 5 foot No. 2 cable



Express gripple



Duct Pin



Toggle plate



Carboline clip LH and RH

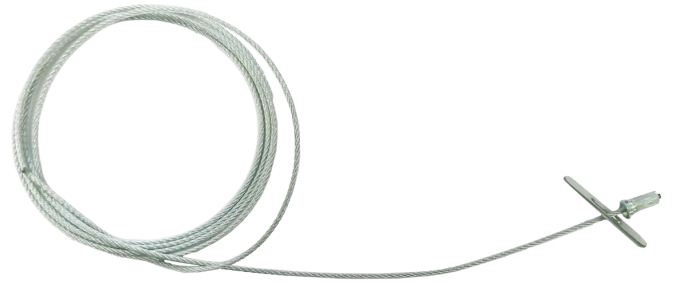


Self tapping screw

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Standard Gripple with fine adjustment hardware kit, 10' panels

Components	Quantity per kit
Gripple express no. 2 connector	6
Toggle end	
Standard wire	
Duct pin - screw for fine adjustment	6
Toggle plate - plate for fine adjustment	6
Carboline clip LH	3
Carboline clip RH	3
Self tapping screw - #6-20 x 3/8" Phillips pan head	6
PDF Instruction Manual	1



Toggle end on 5 foot No. 2 cable



Express gripple



Duct Pin



Toggle plate



Carboline clip LH and RH



Self tapping screw

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Suspension details

Suspension and attachment

Zehnder offers several suspension systems to integrate the ceiling panels with the ceiling design. Each suspension system has undergone rigorous safety testing to ensure a safe installation.

- For T-bar installations, additional wire ropes are used to secure the panels to the ceiling for safety reasons.
- Free-hanging applications can be attached directly to a concrete ceiling with chain or wire rope. Modules of different sizes can be created by arranging the Carboline panels in various combinations next to and behind one another.



T-bar with chain

Suspension points/module

24" x 24"	24" x 48"	24" x 72"	24" x 96"	24" x 120"
4	4	6	6	8



Free-hanging with wire rope

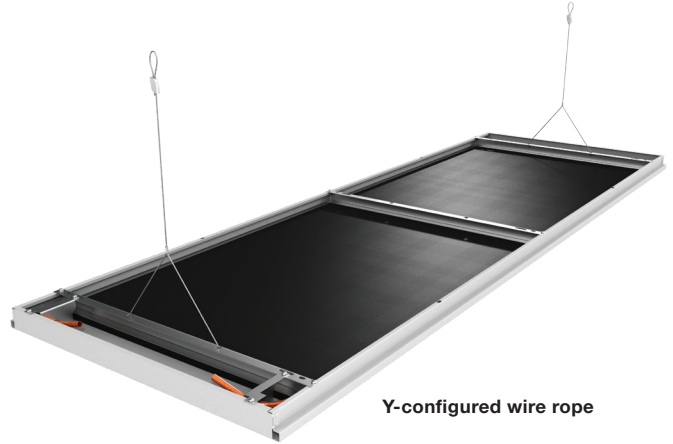
	Weight (lbs.)				
	24" x 24"	24" x 48"	24" x 72"	24" x 96"	24" x 120"
Empty weight without water, with insulation	10.52	18.89	27.95	36.31	45.37
Operating weight with water, with insulation	10.98	19.86	29.43	38.29	47.86
Weight of insulation	0.46	0.93	1.41	1.87	2.36
Weight of water content	0.46	0.97	1.48	1.98	2.49

Suspension details

Y-configured wire rope

Y-configured wire rope is used in conjunction with T-bar grid systems.

Number of panels	x	Number of suspension points	÷2	=	Number of ropes
	x		÷2	=	

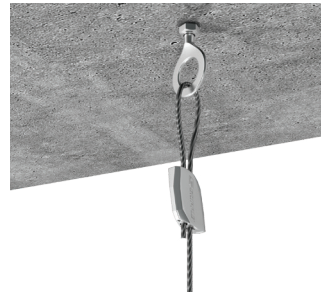


Y-configured wire rope

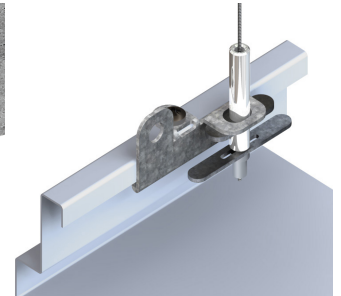
Wire rope

Wire rope is provided with gripper cable hangers for a faster, more flexible installation. The .05" thick wire ropes used to secure the Carboline free hanging version make for seamless integration in any room. Leveling the panel with the fine adjustment setting means that the wire rope can be set to the exact installation height.

Number of panels	x	Number of suspension points	=	Number of ropes
	x		=	



Wire rope ceiling connection



Wire rope panel connection

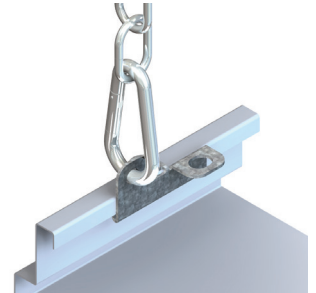
Chains

Chains and fixing clips are supplied to attach 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.

Number of panels	x	Number of suspension points	=	Number of chains
	x		=	



Fixing clips ceiling connection

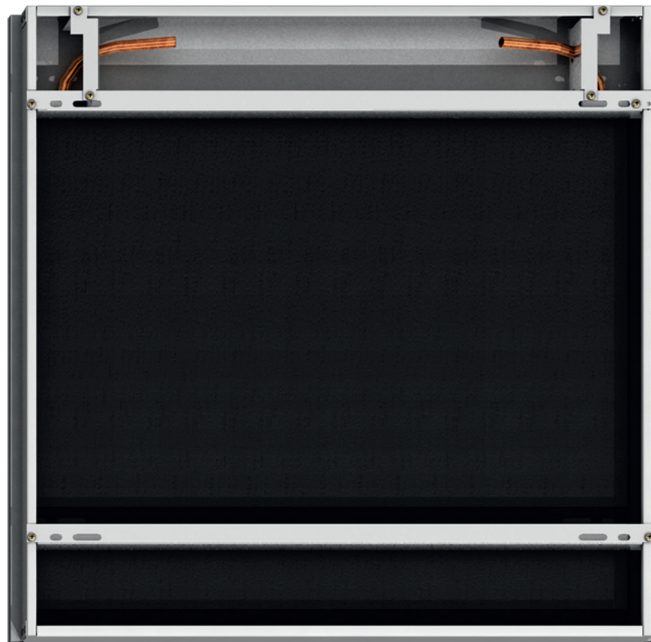
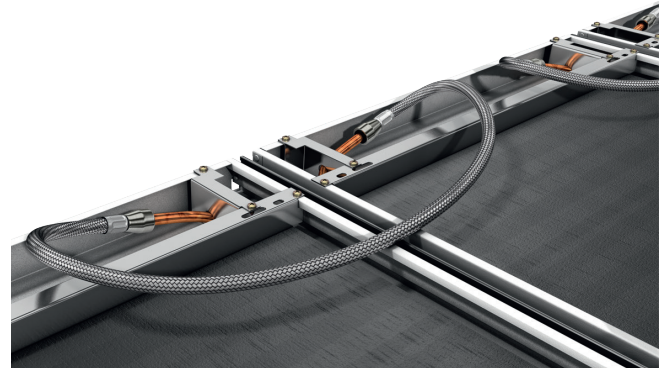


Fixing clips panel connection

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Connection technology

For Zehnder Carboline, both connection pipes are located on the same end. Connections to panels require a 10 mm push-to-connect fitting. Do not braze/solder tubes or use ProPress fittings.



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Programmable non-communicating wall thermostat

Features and benefits

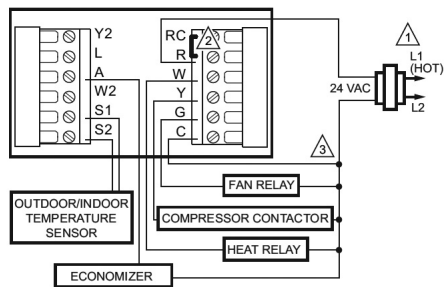
- Large, clear display with backlight shows the current and set temperature and time—even in the dark.
- Menu-driven programming make setup effortless.
- Touchscreen interaction.
- Real-time clock keeps time during power failures and automatically updates to daylight savings.
- “Saving Changes” notification lets you know when the schedule changes have been saved.
- Change reminders let you know when to replace the batteries.
- Holiday Override options allow you to override the program schedule, as desired.
- Speedy same-schedule programming.
- Armchair programming allows you to remove the thermostat from the wall for programming.

Thermostat description

Feature	Description
Changeover	Manual or auto changeover selectable
System setting	Heat-Off-Cool-Auto
Fan setting	Auto-On

Electrical ratings

Terminal	Voltage (50/60 Hz)	Running current
W (heating), Y (cooling), A (Economizer/TOD)	20-30 Vac	0.02 – 1.0 A
G (heating)	20-30 Vac	0.02 – 0.6 A

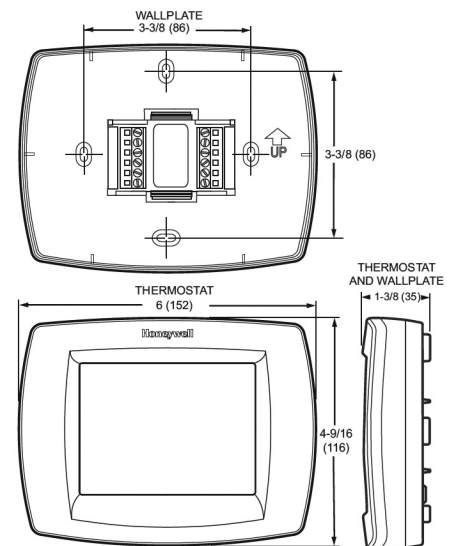


- ⚠️ POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.
- ⚠️ FACTORY INSTALLED JUMPER.
- ⚠️ WHEN USING BATTERIES, THE 24V COMMON CONNECTION IS OPTIONAL.



Specifications

- **Temperature**
 - **Ratings**
Operating ambient: 0 °F to 120 °F (-18 °C to 49 °C).
Shipping: -30 °F to 150 °F (-34.4 °C to 65.6 °C).
 - **Display accuracy:** ±1 °F (±0.5 °C).
 - **Setpoint range**
Heating: 40 °F to 90 °F (4 °C to 32 °C).
Cooling: 50 °F to 99 °F (10 °C to 37 °C).
- **Humidity ratings (RH, non-condensing):** 5% to 90%
- **Cycle rates (at 50% load)**
 - Heating: selectable 1-12 cycles per hour.
 - Cooling: selectable 1-6 cycles per hour.
- **Interstage differential**
 - Droopless control. Once the first stage is running at 90% load, the thermostat energizes the second stage.
- **Cool indication**
 - Displays “Cool On” when Cool is activated.
- **Heat indication**
 - Displays “Heat On” when Heat is activated.
- **Auxiliary heat indication**
 - Displays “Aux. Heat On” when Auxiliary Heat is activated.
- **Clock accuracy**
 - ±1 minute per month.
- **Finish**
 - Premier White® color.



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Dew-point monitor and transducer

Effective protection against humidity damage and excessive cooling. Control system for a regulating unit using a holding relay, which interrupts the flow of cold water or raises the temperature of the cooling water.

Features

- Measurement is effected by a spring-loaded dew-point sensor.
- Active measured value acquisition.
- Versions with external sensor.

Technical description

- Housing made of pure-white, flame-retardant thermo-plastic (RAL 9010).
- Holding relay with change-over contact.
- Screw terminals for wire of up to 1.5 mm².
- Strap retainer for 10 to 100 mm ø pipe and heat-conducting paste are included in supply.

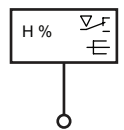
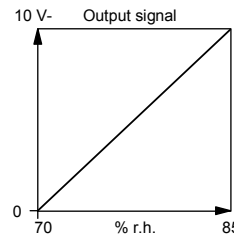
Operation

The resistance of the dew-point sensor rises in accordance with the relative humidity. The resistance value is evaluated with the aid of the electronics unit and then (via a holding relay) used to control the change-over contacts. When power is applied, contacts 4-6 close as soon as the switching point is reached or exceeded. At the same time, contacts 4-5 open. If the switching point is undercut by the amount of the switching difference, contacts 4-6 open and contacts 4-5 close. In addition, there is an analog output signal (Pin 3) available. If no power is applied, contacts 4-6 are closed and contacts 4-5 are open.

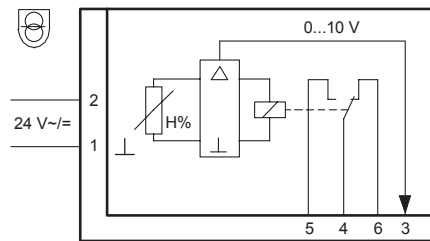
Switching point	Sensor	Measuring range %RH	Power supply	Weight (kg)
95 ± 4	On housing	70-85	24 V~/=	0.1

Specifications

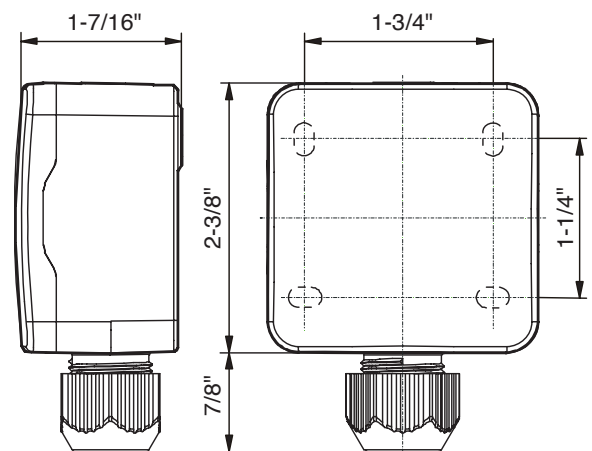
- Power supply 24 V~/=: ± 20%
- Switching difference: Fixed, approximately 5% RH
- Power consumption: Max. 1 VA
- Changeover contacts: 1A, 24 V~/=
- Output signal approximately 70-85% RH: 0-10 V, load > 10 kΩ
- Response time in still air:
 - ◆ 80-99 %RH: Maximum 3 minutes
 - ◆ 99-80 %RH: Maximum 3 minutes
- Exposure to dew: Maximum 30 minutes
- Ambient temperature: 5-60 °C
- Degree of protection: IP 40 (EN 60529)



Wiring diagram



Dimensions



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Insulation/sound absorption

Zehnder offers three types of optional insulation that can be added to any type of panel in any application.

Type	R value ($\text{ft}^2 \cdot \text{F} / \text{BTU} / \text{hr}$)
1" glass wool	3.6
1" Rockfon	3.6
1/2" Rockfon	1.8

Rockfon insulation is lined on one side with glass fibre fleece, giving the insulation its sound absorbing qualities. It can be used with both a solid steel cassette or a perforated cassette. Zehnder perforated panels are lined with a sound absorbing non-woven material between the steel cassette and the graphite sandwich to give additional sound absorbing qualities to the panel.

Sound absorption

Frequency (Hz)	Reverberation times (sec)				Reduction in reverberation time		
	T1	T2	T3	T4	$\Delta T1-T2$	$\Delta T1-T3$	$\Delta T1-T4$
100	13.86	10.3	8.15	6.55	-26%	-41%	-53%
125	10.21	6.23	5.09	5.13	-39%	-50%	-50%
160	12.1	5.41	4.64	4.45	-55%	-62%	-63%
200	12.68	5.13	4.31	4.47	-60%	-66%	-65%
250	11.29	3.77	3.24	3.96	-67%	-71%	-65%
315	10.88	3.31	2.91	4.11	-70%	-73%	-62%
400	9.34	2.87	2.58	4.07	-69%	-72%	-56%
500	7.46	2.61	2.38	3.85	-65%	-68%	-48%
630	6.78	2.56	2.31	3.85	-62%	-66%	-43%
800	6.92	2.92	2.41	4.15	-58%	-65%	-40%
1000	6.66	3.3	2.41	4.07	-50%	-64%	-39%
1250	6.21	2.96	2.31	3.86	-52%	-63%	-38%
1600	5.67	2.69	2.14	3.66	-53%	-62%	-35%
2000	5.05	2.67	2.07	3.42	-47%	-59%	-32%
2500	4.41	2.34	1.91	3.08	-47%	-57%	-30%
3150	3.6	2.13	1.78	2.65	-41%	-51%	-26%
4000	2.97	1.87	1.63	2.24	-37%	-45%	-25%
5000	2.22	1.56	1.43	1.79	-30%	-36%	-19%
					-52%	-59%	-44%

- T1: Empty chamber
- T2: Perforated Free Hanging Panel with no insulation
- T3: Perforated Free Hanging Panel with 1/2" Rockfon insulation
- T4: Perforated Free Hanging Panel with 1" Rockfon insulation
- Testing in accordance with DIN EN ISO 354
- Sound absorbing performance will vary depending on building structure

Fiberglass insulation

Description

Flexible duct liner insulation is made from strong, glass fibers bonded with a thermosetting resin. The airstream surface is protected with a reinforced coating system, which combines a state-of-the-art acrylic coating with a flexible glass mat reinforcement to provide a smooth airstream surface.

Advantages

- Improves indoor environmental quality by helping to control both temperature and sound.
- The tough, acrylic polymer coating helps guard against the incursion of dust or dirt into the substrate, minimizing the potential for biological growth.
- Coating is formulated with an immobilized, EPA-registered, protective agent to protect the coating from potential growth of fungus and bacteria. Duct liner meets all requirements for fungi and bacterial resistance. Tests were conducted in accordance with ASTM C 1338 and ASTM G 21 (fungi testing) and ASTM G 22 (bacteria resistance testing). **Note:** As with any type of surface, microbial growth may occur in accumulated duct system dirt, given certain conditions. This risk is minimized with proper design, filtration, maintenance and operation of the HVAC system.
- The reinforced coating surface provides superior resistance to penetration of incidental water into the fiber glass wool core.
- GREENGUARD® certification is proof that the product meets the Environmental Institute's indoor air quality standards for VOCs.

Thermal performance

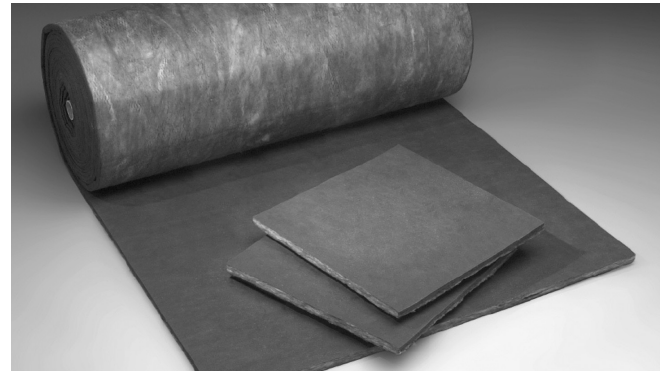
Thickness		R-value		Conductance	
in	mm	hr•ft ² •°F/Btu	m ² •°C/W	Btu/(hr•ft ² •°F)	W/m ² •°C
1/2	13	2.2	0.38	0.46	2.61
1	25	4.2	0.74	0.24	1.36

R-value and conductance are calculated from the material thermal conductivity tested in accordance with ASTM C 518 at 75 °F (24 °C) mean temperature

Sound absorption coefficients (type "A" mounting)

Thickness		Sound absorption coefficient at frequency (cycles per second) of						
in	mm	125	250	500	1000	2000	4000	NRC
1/2	13	0.07	0.20	0.44	0.66	0.84	0.93	0.55
1	25	0.08	0.31	0.04	0.84	0.97	1.03	0.70

Coefficients were tested in accordance with Test Method ASTM C 423-90 and ASTM E 795



General properties

- Operating temperature (max.): ASTM C 411 250 °F (121 °C)
- Air velocity (max.): ASTM C 1071 6,000 fpm (30.5 m/sec)
- Water repellency: INDA IST 80.6-92
- Fungi resistance: ASTM C 1338 Does not breed or promote
- Fungi resistance: ASTM G 21 No growth
- Bacteria resistance: ASTM G 22 No growth

Surface burning characteristics

- Meets the surface burning characteristics and limited combustibility of the following standards: standard/test method
 - ◆ ASTM E 84
 - ◆ UL 723
 - ◆ NFPA 255
 - ◆ NFPA 90A and 90B, FHC 25/50 and limited combustibility
 - ◆ NFPA 259
 - ◆ CAN/ULC S102-M88
- Flame spread: not over 25
- Smoke developed: not over 50

Specification compliance

- ASTM C 1071, Type I
- ASTM G 21 and G 22
- ICC Compliant
- California Title 24
- ASHRAE 62-2001
- SMACNA Application Standards for Duct Liners
- NAIMA Fibrous Glass Duct Liner Installation Standard
- Canada: CGSB 51-GP-11M and CAN/CGSB 51.11

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Rockfon insulation

Material

Stone wool (mineral wool) ceiling tiles.

Surface finish

Factory painted glass scrim.

Fire performance

■ 1" insulation

- ◆ Surface burning characteristics: UL723 (ASTM E84) Flame Spread Index 0-5, Smoke Developed Index 0-5 (UL labeled). CAN/ULC S102 Flame Spread Index 10-15, Smoke Developed Index 5.

■ 1/2" insulation

- ◆ Surface burning characteristics: UL723 (ASTM E84) Flame Spread Index 0, Smoke Developed Index 5 (UL labeled). CAN/ULC S102 Flame Spread Index 5, Smoke Developed Index 0.

ASTM E1264 classification

■ 1" insulation

- ◆ Type XX - stone wool base with membrane-faced overlay, Pattern E.

■ 1/2" insulation

- ◆ Type XX - stone wool base with membrane-faced overlay, Pattern G.

Sag resistance

Rockfon ceiling tiles are dimensionally stable even at high humidity levels of up to 100% relative humidity and can be installed at all temperatures ranging from 32 °F to 104 °F. No acclimatization is needed. Rockfon ceiling tiles can be installed during the very early stage of the build (when windows are not fully sealed) without any risk of deflection of the tiles. The low weight, stability and non-hygroscopic character of Rockfon tiles will limit the weight of the fully installed ceiling whilst retaining its declared properties even when applied in infrequently heated and unheated rooms without condensation.

VOC/formaldehyde emissions

The product fulfills requirements for low emitting acoustic ceiling tiles and meets the California Department of Health Services Standard Method V1.1 (February 2012) "Standard method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers (Section 01350)." Selected potential applications: LEED, CHPS and CALGreen.

Hygienic properties

Rockfon ceiling tiles are made of water repellent stone wool. Stone wool has no nutritional value and therefore it provides no sustenance to harmful microorganisms.

Sustainability

Rockfon stone wool ceiling tiles are primarily made from abundantly available basalt rock and contain up to 42% recycled materials. Rockfon products supplied in North America are produced in ISO9001/ISO14001 certified factories.

Modular size	lbs./sq. ft.	sq. ft./carton	NRC	CAC	AC	Fire class	Light reflectance	R value (BTU units)	RSI value (Watts units)
2' x 2' x 1/2"	0.33	144	0.60	-	-	A	0.85	1.8	0.31
2' x 2' x 1"	0.73	64	0.85	33	190	A	0.85	3.5	0.62

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Zehnder Carboline Ceiling Panels Submittal Data

English, IP Units

Stainless steel corrugated hoses

DN10 - 10 mm PTC x 10 mm PTC

Number of hoses _____

DN10 - 10 mm PTC x 1/2" NPT

Number of hoses _____

DN12 - 10 mm PTC x 10 mm PTC

Number of hoses _____

DN12 - 10 mm PTC x 1/2" NPT

Number of hoses _____

1/2" Thermoplastic with bonded stainless steel braid - 10 mm PTC x 10 mm PTC

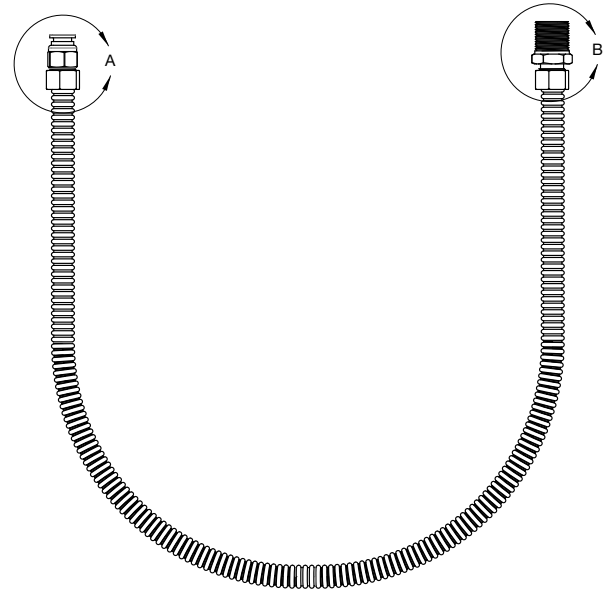
Number of hoses _____

1/2" Thermoplastic with bonded stainless steel braid - 10 mm PTC x 1/2" NPT

Number of hoses _____

Type	Dia.	Length	Bend radius static	Maximum operating pressure	Maximum operating temperature
Stainless steel	DN10	30"	0.7"	145 PSI	185 °F
	DN12	30"	0.8"	145 PSI	185 °F
Braided*	1/2"	30"	2.5"	145 PSI	185 °F

* UL94 VO fire rated

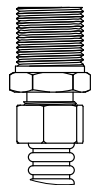


Detail A



10mm push fitting brass material connects to panel

Detail B



1/2" NPT fitting brass material connects to supply/return

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Warranty

Zehnder Rittling guarantees its products to be free from defects in material and workmanship for a period of five years from date of shipment from our factory.

Should there be any defects in the good(s), the purchaser should promptly notify Zehnder Rittling. Upon receipt of written consent from Zehnder Rittling, the purchaser shall return the defective good(s) to the factory for inspection with freight prepaid. If inspection shows the goods to be defective, Zehnder Rittling will at its discretion repair or replace the said item(s). Defects arising from damage due to shipment, improper installation, negligence or misuse by others are not covered by this warranty.

This warranty is extended only to the original purchaser from Zehnder Rittling.

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