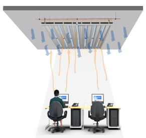
WK-D-WF

Cooling panel suspension



Principle of operation – WK-D-WF

Convective chilled ceiling elements

WK-D-WF

Convective chilled ceiling with performance-optimised wave-shaped blades for use in reception areas or other prestigious indoor spaces

Convective chilled ceiling elements for freely suspended installation (raft) or for integration (with gaps) into a continuous ceiling

- Comfortable cooling that provides thermal comfort for users
- Saving of energy costs as thermal loads are dissipated with water, and the air volume flow rate can hence be limited to the hygienically required minimum outdoor air flow rate
- High cooling capacity due to the open design
- Aesthetic design element thanks to the wave-shaped blades
- Design freedom is ensured thanks to variable use – either ceiling integration or free hanging (raft)
- Simple and fast installation of the cooling panels thanks to integral suspension brackets
- Optional addition of acoustic insulation material above the hanging brackets
- Ideally suited for the refurbishment of existing buildings
- Can be combined with concrete core activation
- Energy-efficient and cost-effective geothermal energy solutions can be used as the water flow temperature is usually not lower than 16 °C

General information

Application

- Suitable for exposed installation, either free hanging below the ceiling slab as a raft or integrated into continuous ceilings or above closed cell ceilings
- When used as a raft, dissipation of specific thermal loads up to 110 W/m² (to EN 14240)
- Ensures comfortable room temperatures, particularly in cooling mode
- Utilises the energy advantages of water for cooling/heating as it has a high specific thermal capacity
- Comparatively low water temperatures allow for further energy savings regarding the generation of energy
- Optional fitting of lights or other building services depending on the actual cooling panel

Special features

- Can be freely suspended (raft-type installation) or combined with an open cell ceiling to form a convective chilled ceiling
- Approx. 70% convection and 30% radiation
- Wave-shaped blade, 170 mm wide

Nominal sizes

- Nominal length: 1000, 1500, 2000, 2500, 3000, 3500, 4000 mm (intermediate lengths in 10 mm increments)
- Nominal widths: 400, 600, 800, 1000, 1200, 1400 mm (widths result from 170 mm blade width and 30 mm gaps)

Construction

- Exposed surface is pure white – RAL 9010 GU50
- Other RAL CLASSIC colours on request

Useful additions

- Flexible hoses Type FS
- Can be combined with LWS and X-AIRCONTROL control systems (e.g. for valves, valve actuators, dew point sensors, window contacts)

Materials and surfaces

- Profiled blades made of aluminium
- Copper pipe (serpentine)
- Cooling panel powder-coated RAL 9010, pure white GU50
- P1: Cooling panel powder-coated (RAL colour on request)

Construction features

- Wave-shaped blades with embedded copper pipe for the best possible heat transfer
- Brackets on the narrow sides to cover the copper pipe and for suspension (by others) from the ceiling slab
- Additional Z-bracket if L > 2500 mm

Standards and guidelines

- Cooling capacities to EN 14240
- Given heat capacities based on EN 14037, Part 5

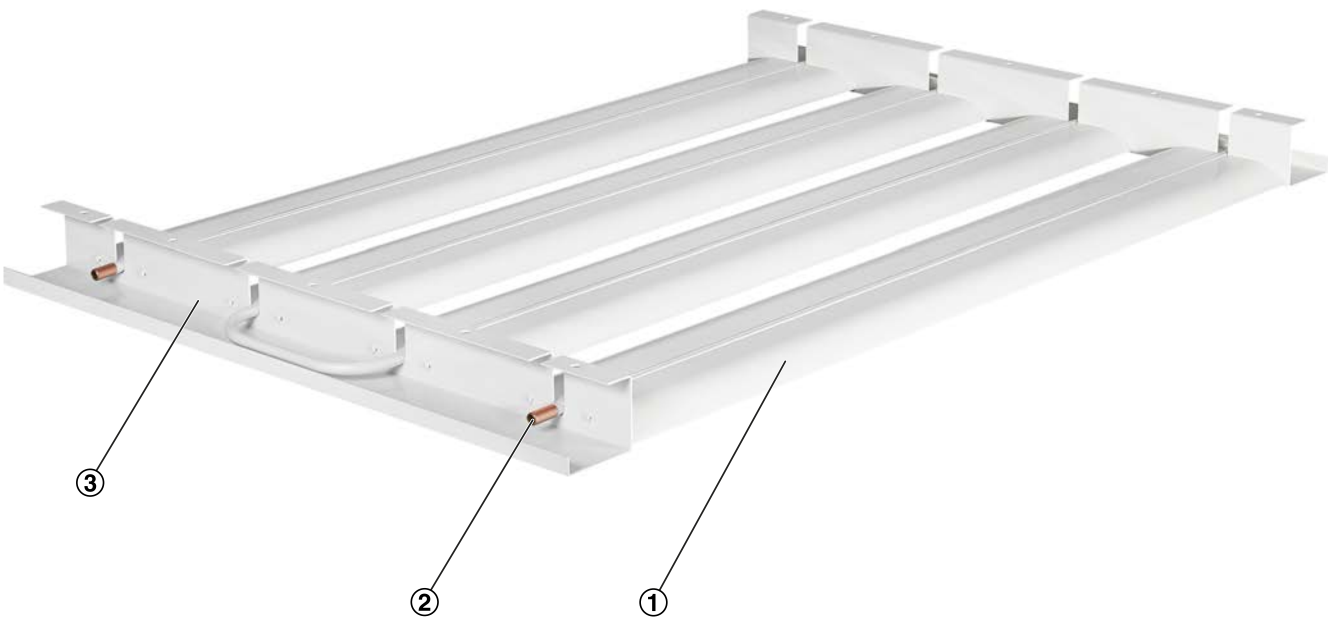
Maintenance

- No moving parts, hence low maintenance

Function

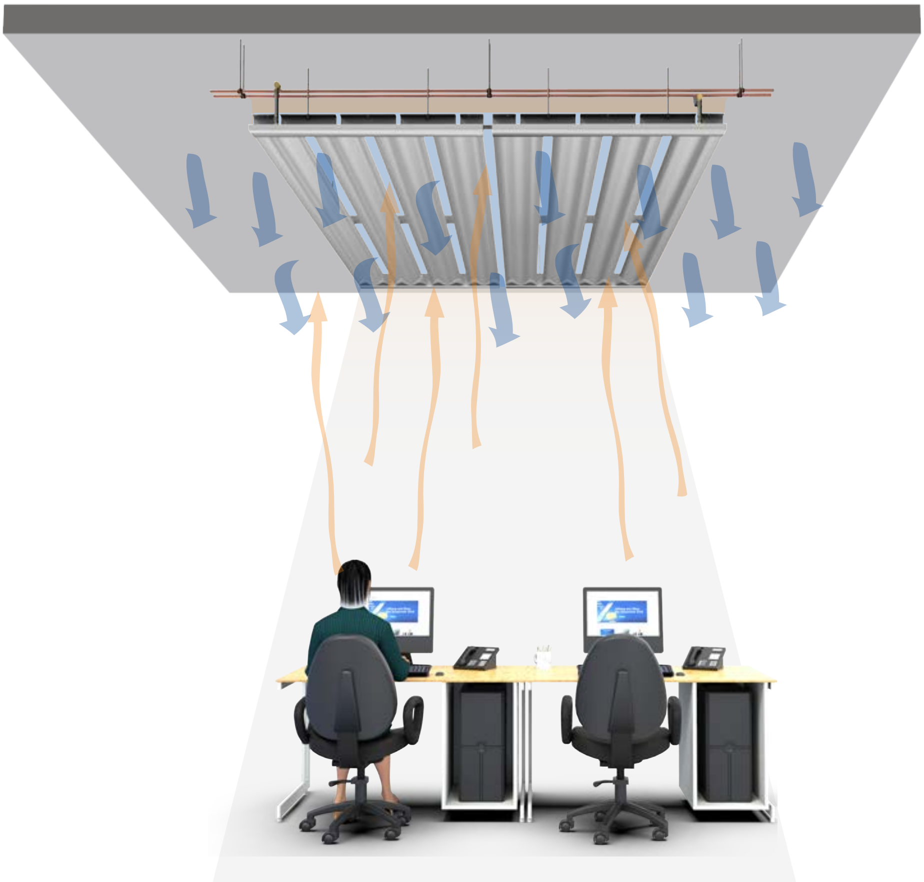
Continuous chilled ceilings and (convective) cooling panels used as rafts absorb heat energy from the room air and transfer it to the chilled water. Convective chilled ceilings are made up of cooling panels in an open design with regular gaps. Convective chilled ceilings (and also continuous chilled ceilings) operate according to radiation and convection principles. The heat radiated from the room is absorbed on the lower surface of the panels. The warm room air near the ceiling comes into contact with the wave-shaped blades that are carrying chilled water. The air is cooled as a consequence and then, due to the difference in density when compared to the warmer air, descends slowly back to the occupied zone. This ensures a high comfort level for room occupants as there are no draughts. As the cooling panels for convective chilled ceilings are installed in an open arrangement (with gaps) below the ceiling slab, the room air comes into contact also with the upper surface of the wave-shaped blades. This construction and installation type results in increased convection when compared to continuous radiant chilled ceilings and in a higher cooling capacity. The special shape of the panels allows for the best possible cooling capacity. The largest proportion of the cooling capacity is provided by convection (approx. 70 %). The remaining proportion of the cooling capacity is provided by radiation.

Schematic illustration of WK-D-WF



① Profiled blade
② Pipe (serpentine)
③ Hanging bracket

Principle of operation – WK-D-WF



Technical data

Length	1000, 1500, 2000, 2500, 3000, 3500, 4000
Height	70
Width	400, 600, 800, 1000, 1200, 1400
Standard cooling capacity EN 14240 (Δt 8 K)	Up to 110 W/m²
Cooling capacity (Δt 10 K)	Up to 142 W/m²
Heating capacity (Δt 15 K)	100 W/m²
Heating capacity (Δt 30 K)	215 W/m²
Max. operating pressure, water side	6 bar
Max. operating temperature, water side	50 °C

Cooling/heating capacities depending on Δt
When heating, surface temperatures > 35 °C should be avoided as otherwise comfort will suffer.
Maximum operating pressure and maximum operating temperature apply when flexible hoses are used.
When using chilled ceilings for heating, only the proportion of radiation is relevant.
When sizing chilled ceiling systems, it is NOT recommended to use the standard cooling capacities (φw,c,a) to EN 14240 as the results cannot really be compared. It is, however, recommended, to use the specific cooling capacity based on the usable panel area (φw,c,p) as it pertains to the active area of a chilled ceiling system.
Only then is it possible to determine the achievable cooling capacity and to compare it to the cooling capacity per m² of floor space that is required for the design.

Quick sizing

Examples of cooling capacities for different Δt, based on various panel sizes

			Δt = 8 K	Δt = 9 K	Δt = 10 K
L	B	A [m²]	Φw,c [W]	Φw,c [W]	Φw,c [W]
1000	400	0.4	44	50	57
1000	600	0.6	66	75	85
2000	800	1.6	175	200	225
2000	1000	2.0	219	250	282
2500	1000	2.5	274	312	352
2500	1200	3.0	328	375	422
3000	1200	3.6	394	450	506
3000	800	2.4	263	300	338
4000	1000	4.0	437	499	563
4000	1400	5.6	612	699	787

Δt = temperature difference between room temperature and mean water temperature
Φw,c = cooling capacity of a panel
Given capacities are independent of the selected ventilation variant.

Reference values for cooling

Water flow temperature t_{WV}	16 °C
Water return temperature t_{WR}	18 °C
Medium water temperature Δt_{Wm}	17 °C
Room temperature for Δt = 8 K (DIN EN 14240) $t_R = t_{ON}$	25 °C
	Variable, °C

Room temperature for different cooling capacities $t_R = t_{ON}$	
Temperature difference room to water Δt_{Wm-R}	See above, K

Examples of heating capacities for different Δt, based on various panel sizes

			Δt = 15 K	Δt = 30 K
L	B	A [m²]	Φw,c [W]	Φw,c [W]
1000	400	0.4	40	88
1000	600	0.6	60	132
2000	800	1.6	160	350
2000	1000	2.0	200	438
2500	1000	2.5	250	547
2500	1200	3.0	300	656
3000	800	2.4	240	525
3000	1200	3.6	360	787
4000	1000	4.0	400	875
4000	1400	5.6	560	1224

Δt = temperature difference between room temperature and mean water temperature
Φw,c = heating capacity of a panel
Given capacities are independent of the selected ventilation variant.

Reference values for heating

Water flow temperature t_{WV}	42 °C
Water return temperature t_{WR}	32 °C
Medium water temperature Δt_{Wm}	37 °C
Room temperature for Δt = 8 K (DIN EN 14240) $t_R = t_{ON}$	22 °C
Temperature difference room to water Δt_{Wm-R}	15 K

Specification text

This specification text describes the general properties of the product.

Specification text

Chilled ceilings and rafts are used for the cooling of internal spaces. They absorb heat energy from the room air and transfer it to the chilled water, thereby dissipating thermal loads. As the room air becomes cooler upon contact with the cooling panel, it gradually descends back to the occupied space as a result of the differences in density between warm and cool air. This is why chilled ceilings and rafts are considered a particularly good solution for creating comfortable room temperatures, especially for cooling. The Type WK-D-WF convective chilled ceiling has a larger specific cooling capacity than classic radiant chilled ceilings due to its large surface area and gaps. The cooling panels consist of performance-optimised, horizontally arranged wave-shaped blades and come in widths of 200 mm or multiples thereof. The attractive design of the blades and the flat structure of the cooling panel that is only 70 mm high allows for appealing raft solutions. Approx. 30% of the cooling capacity is provided by radiation. The large surface required for this is provided by wave-shaped blades that support load dissipation by heat radiation. Approx. 70% of the cooling capacity is provided by convection. The cooling panel has gaps so that the room air can flow around the blades with the embedded water carrying coil, which means that a relatively large volume of air is cooled on both the lower and the upper surfaces of the cooling panel. Thanks to their construction the cooling panels can be used as individual rafts or combined to a chilled ceiling whereby the panels are connected in a hydraulic circuit. Heating is also possible with WK-D-WF, but only the radiation proportion can be used for heating.

Special features

- Can be freely suspended (raft-type installation) or combined with an open cell ceiling to form a convective chilled ceiling
- Approx. 70% convection and 30% radiation
- Wave-shaped blade, 170 mm wide

Materials and surfaces

- Profiled blades made of aluminium
- Copper pipe (serpentine)
- Cooling panel powder-coated RAL 9010, pure white GU50
- P1: Cooling panel powder-coated (RAL colour on request)

Construction

- Exposed surface is pure white – RAL 9010 GU50
- Other RAL CLASSIC colours on request

Technical data

- Length: 1000, 1500, 2000, 2500, 3000, 3500, 4000 mm
- Height: 70 mm
- Width: 400, 600, 800, 1000, 1200, 1400 mm
- Cooling capacity EN 14240 (Δt 8 K): up to 110 W/m^2
- Cooling capacity (Δt 10 K): up to 142 W/m^2
- Heating capacity (Δt 15 K): 100 W/m^2
- Heating capacity (Δt 30 K): 215 W/m^2
- Maximum operating pressure – water side: 20 bar (with flexible hoses approx. 6 bar)
- Maximum operating temperature – water side: 75 °C (with flexible hoses approx. 50 °C)

Order code

```
WK-D-WF  /  3000  x  1000  /  P1-RAL…
   |          |        |          |
   1          2        3          4
```

1 Type
WK-D-WF Convective chilled ceiling element (cooling panel)

2 Nominal lengths [mm]
L
1000, 1500, 2000, 2500, 3000, 3500, 4000
Lengths > 2500 mm with additional Z-bracket in the middle

3 Nominal widths [mm]
B
400, 600, 800, 1000, 1200, 1400

4 Surface
No entry required: Powder-coated RAL 9010, pure white
P1 Powder-coated, specify RAL CLASSIC colour

Gloss level
RAL 9010 GU50
RAL 9006 GU30
All other RAL colours GU70

Order example WK-D-WF/4000×1000

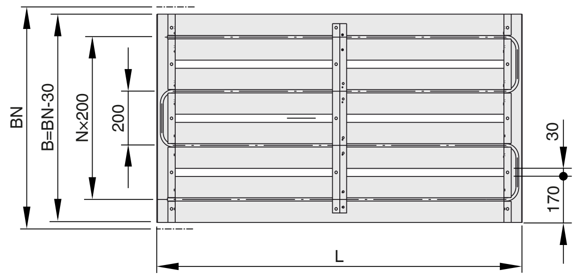
Nominal length	4000
Nominal width	1000
Surface	RAL 9010, pure white, GU50

Order example WK-D-WF/2500×1200/P1–RAL 9016

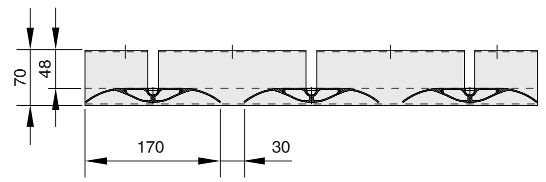
Nominal length	2500
Nominal width	1200
Surface	RAL 9016, white aluminium, GU30

Dimensions

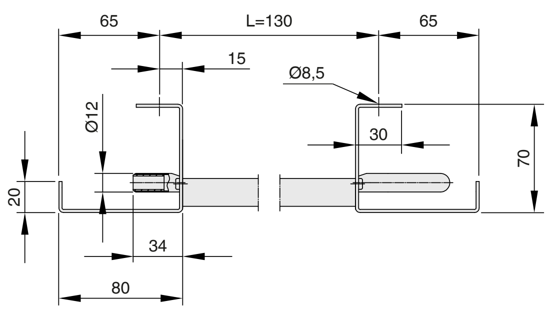
WK-D-WF with Z-bracket in the middle (L > 2500 mm)



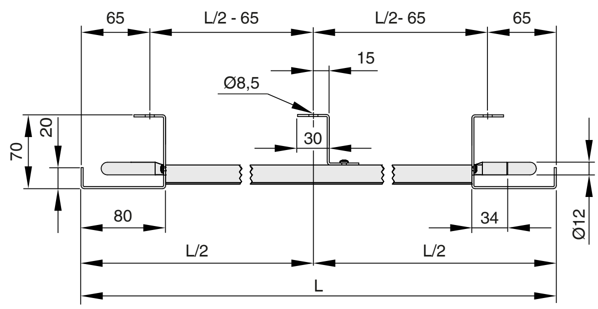
WK-D-WF cross section



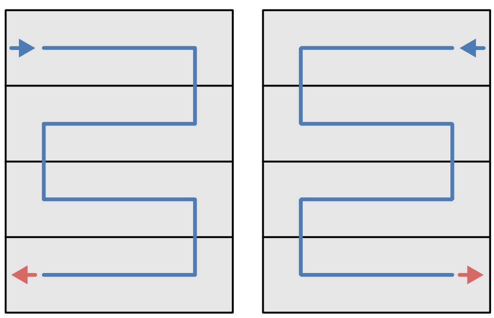
WK-D-WF with fixing brackets – length < 2500 mm



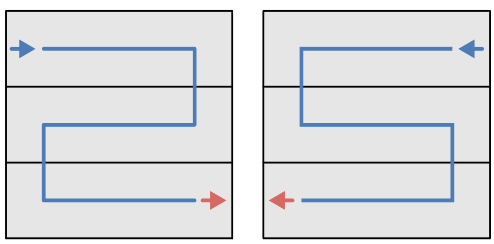
WK-D-WF with fixing brackets – length > = 2500 mm



Connections on the same side



Connections on opposite sides



Dimensions [mm]

Length	1000, 1500, 2000, 2500, 3000, 3500, 4000
Height	70
Width	400, 600, 800, 1000, 1200, 1400

Weight [kg]

①	2	3	4	5	6	7
②	400	600	800	1000	1200	1400
1000	7	10,5	14	17,5	21	24,5
1500	9,5	14	18,5	23	28	33
2000	11,5	17	23	28,5	34,5	40
2500	14,5	22	29	36,5	43,5	51
3000	17	25	33,5	42	50	58,5
3500	19	28,5	38	47,5	57	66,5
4000	21	32	42,5	53	63,5	74

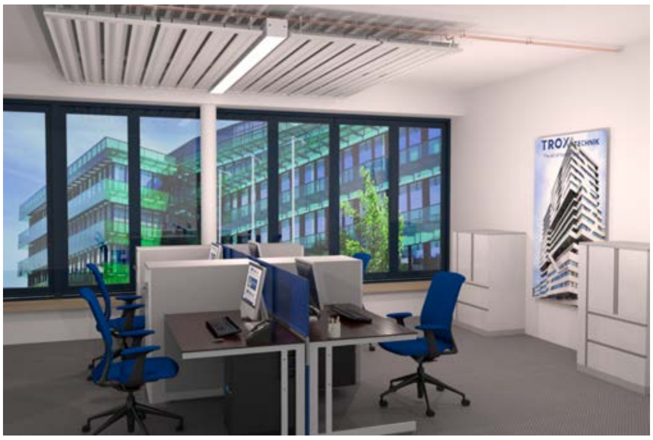
① No. of blades
② L/BN [mm]
Weight: approx. 14 to 18 kg/m²
Combinations of cooling panel dimensions depend on the water-side pressure drop of the panels.

Product details

Installation example: Fritzmeier, Germany

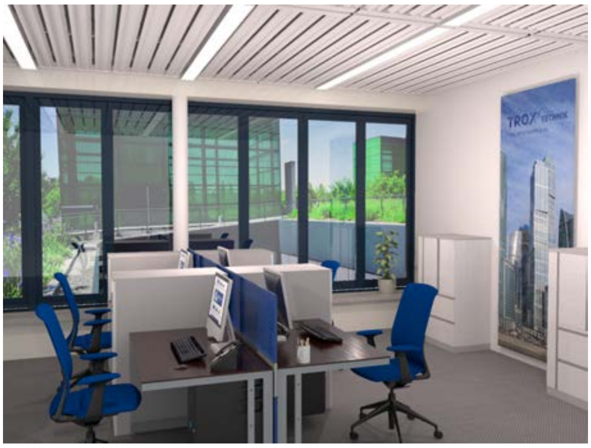
Installation example: Helvea office building, Zurich

Installation example: raft



Installation example: Chur post office, Chur, Switzerland

Installation example: raft with luminaires



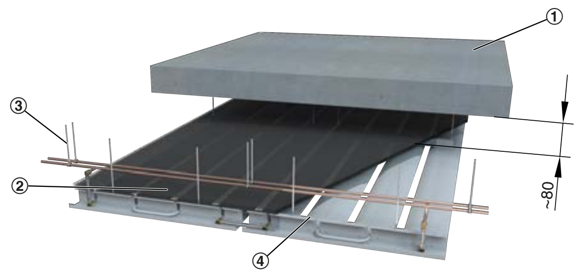
Installation and commissioning

- Any work associated with the installation of cooling panels, hydraulic connections and commissioning must be carried out by specialist personnel
- For details please refer to the installation instructions

Freely suspended cooling panel (raft)

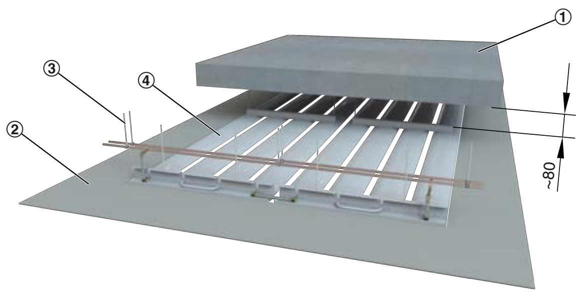
① Ceiling slab or suspended ceiling
② Cooling panel
Freely suspended installation is possible with all ceiling systems. A continuous airflow also on the upper surface must be ensured. With open cell ceilings, the cooling panels have to be installed above the grid. The free area should be as large as possible.

Freely suspended cooling panel (raft) with acoustic insulation



① Ceiling slab or suspended ceiling
② Acoustic pad
③ Threaded rods or other suitable and approved fixing material
④ Cooling panel
If freely suspended as a raft, the cooling panel can be fitted with some type of acoustic insulation material (to be fitted to the upper side). Acoustic pads have to be fitted above the fixing brackets to ensure that as much cooling capacity as possible is maintained.
Note that the capacity will be reduced to some extent.

Cooling panel integrated into continuous ceilings



① Ceiling slab
② Continuous plasterboard or metal ceilings
③ Threaded rods or other suitable and approved fixing material
④ Cooling panel
Flush ceiling installation in continuous ceilings is possible with or without adjacent gaps. The cooling capacity that can be achieved depends on the structure of the ceiling. Installation with gaps allows for higher effective cooling capacities.

Nomenclature

L_N [mm]
Nominal length (length of a cooling panel, variable, in mm increments)

B_N [mm]
Nominal width (multiples of 200 mm)

B [mm]
Width (B = BN - 30 mm)

H [mm]
Cooling panel height

$q_{v, w, c}$ [l/h]
Water flow rate – cooling

$q_{v, w, h}$ [l/h]
Water flow rate – heating

$\Phi_{w, c}$ [W]
Total cooling capacity in relation to the active area

$t_{w, s, c}$ [°C]
Water flow temperature

$t_{w, r, c}$ [°C]
Water return temperature

$t_{w, m, c}$ [°C]
Mean water temperature (tw, m, c = tw, s, c + tw, r, c/2)

$t_{r, c}$ [°C]
Room temperature – cooling

$t_{r, h}$ [°C]
Room temperature – heating

$t_{r, c}/t_{r, h}$ [°C]
Intake temperature in the ceiling area

$\Delta t = t_{r, c} - t_{w, m ,c}$ [K]
Temperature difference between room temperature and mean water temperature

$\Delta p_{, w, c}$ [Pa]
Pressure loss in a cooling circuit (water); several panels can be combined

$\Delta p_{, w, h}$ [Pa]
Pressure loss in a heating circuit (water); several panels can be combined

$\varphi_{w, c, a}$ [W/m²]
Specific cooling capacity in relation to the active area

$\varphi_{w, c, p}$ [W/m²]
Specific cooling capacity in relation to the panel area

$\varphi_{w, c, i}$ [W/m²]
Specific cooling capacity in relation to the installation area

$\varphi_{w, c, t}$ [W/m²]
Specific cooling capacity in relation to the room area

A_t [m²]
Test room area

A_i [m²]
Installation area

A_p [m²]
Panel area

A_a [m²]
Active area

Basic information and nomenclature

Chilled ceilings

- Radiant chilled ceiling
- Convective chilled ceiling
- Cooling panels (rafts)
- Ventilation
- Cooling capacity calculation
- Acoustics
- Control examples

Basic information and nomenclature

Types of chilled ceiling

Chilled ceilings and cooling panels used as rafts absorb heat energy from the room air and transfer it to the chilled water. Chilled ceilings are generally continuous suspended ceilings that operate according to the radiation principle. Chilled rafts are actually cooling panels in an open design with spaces between them. The upper surface of the cooling panels is in contact with the room air, hence they remove a considerable part of the total heat load by means of convection.

Radiant chilled ceilings

Continuous radiant chilled ceilings take up the greatest portion (>50 %) of the heat load by means of radiation. The surfaces of the heat sources, such as people, office machines, and lights, radiate heat onto the surface of the chilled ceiling. For the most part, the heat is absorbed by the surface material of the chilled ceiling and then transferred to and dissipated by the chilled water. In addition to the radiation, the room air cools down on the lower surface of the chilled ceiling. As the cooling occurs evenly over the entire surface of the ceiling, low velocity convection currents are generated. This ensures a high thermal comfort level for users. Cooling panels and ceiling tiles form a functional unit. Optimum thermal transfer is achieved by close contact of the cooling panel and the ceiling tile.
Steel, aluminium or plasterboard are typically used materials for continuous ceilings.

Convective chilled ceilings

Convective chilled ceilings operate according to both radiation and convection principles. On the lower surfaces they absorb heat as any radiant chilled ceiling. Unlike radiant chilled ceilings, however, the cooling panels are used as rafts (freely suspended) with gaps between them, which means that the room air comes into contact with their upper surface as well as with their lower surface. This construction and installation type results in increased convection when compared to continuous radiant chilled ceilings. The result is a higher cooling capacity compared to radiant chilled ceilings. The construction and the shape of the panels have an impact on the achievable cooling capacity. The proportion of convection is usually between 60 and 70 %.

Cooling panels (rafts)

The function of cooling panels used as rafts is similar to that of continuous radiant chilled ceilings. Rafts are typically used for larger ceiling areas. Rafts cover only some ceiling sections (not the entire ceiling), which means it is an open arrangement with spaces between the panels. This type of application is also a visually attractive solution. An installation with spaces in the ceiling allows for a higher cooling capacity when compared to continuous radiant chilled ceilings. This is due to the greater convection percentage. The actual cooling capacity depends on the spaces between the panels as well as on the space between the panels and the ceiling slab. It is also possible to use the rafts for sound absorption. Any acoustic insulation, however, may impair the cooling capacity. Cooling panels can also be fitted with building services, e.g. with air terminal devices. There is a choice of exposed or concealed construction.
Another advantage of rafts is that they can be combined with concrete core activation.

Function

Radiation – continuous radiant chilled ceiling (e.g. WK-D-PP)

Convection – convective chilled ceilings with gaps (e.g. WK-D-WF)

Convection – cooling panel used as a raft (e.g. WK-D-KS)

Technical data

Additional ventilation

Chilled ceilings only influence the thermal loads in an internal space. In comfort zones, a mechanical ventilation and air conditioning system should additionally be used to maintain the air quality required by applicable standards. Chilled ceilings can be combined with mixed flow or displacement flow systems. The advantage of chilled ceilings in combination with mechanical ventilation is a controlled supply and extract air flow, the possibility of using heat recovery, and the satisfaction of the room occupants. The combination of both systems for ventilation and air conditioning is an energy-efficient solution that provides high comfort levels for room occupants.
When using a mixed flow system in the ceiling area, higher cooling capacities can be achieved due to the increased airflows near the chilled ceiling sections. The achievable capacity increase depends on the material of the panels as well as on the ceiling design. Air terminal devices can be integrated into the ceiling or chilled ceiling so that they are exposed or concealed.
If opening windows is the only type of ventilation, additional measures, e.g. window contacts and dew point sensors, are required. Depending on the building structure, wind pressure onto on the façade may have to be taken into account. The water flow temperature should not fall below 16 °C (below the dew point). Opening windows as the only ventilation method has also other disadvantages. In summer, for example, the warm outdoor air leads to additional thermal loads being introduced into the building, and a higher humidity of the outdoor air may result in the chilled ceiling being switched off. If humid outdoor air is introduced into the building, there is also an increased risk of mould growth.
In winter, the cold outdoor air may result in a higher cooling load that needs to be dissipated. And depending on the arrangement of desks or workstations for example, comfort may suffer due to the cold outside air, so this has to be taken into consideration.
Ventilation by opening windows is not energy-efficient and should be avoided.

Cooling capacity calculation

The standard cooling capacities are determined in a test room according to EN 14240. This standard specifies the boundary conditions, such as the temperature difference of Δt 8 K, and also the element area used to determine the active cooling capacity (coil length × pitch × number of profiles). Active area, installation area, floor area and proportion of the ceiling area used are considered. As a consequence, the data determined in the standard test room (DIN room) have to be adapted to the respective project-specific conditions. Depending on the selected parameters, the given standard cooling capacities can result significant differences in relation to the specific cooling capacity/m^2 of floor area. However, the result in W/m^2 is often used as the basis of the design capacity. In order to obtain useful realistic cooling capacity values for the different systems, VDI 6034 (Room cooling surfaces - planning, installation and operation) should be used for calculation. It should also be noted that chilled ceilings can only dissipate thermal loads. This is why the design should incluce a mechanical ventilation system that can provide the required minimum outdoor air rates. Such a ventilation system will affect the airflows in the room and hence the cooling capacity.

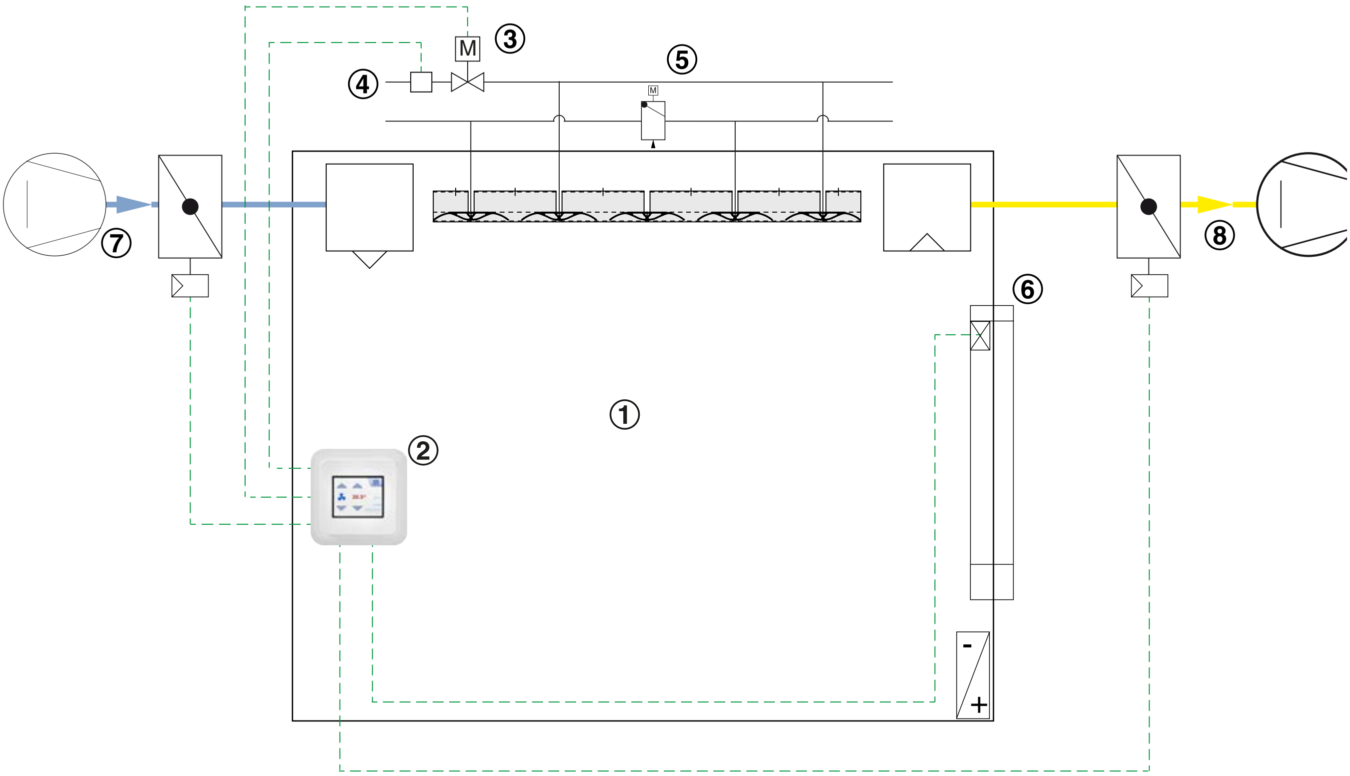
Acoustics

In the case of radiant chilled ceilings, the suspended ceiling is usually also used for sound absorption. There are various options, such as acoustic fleece or rock wool welded into PE film and fitted to the rear of perforated metal ceilings or plasterboard ceilings. Rafts offer various options. For large rafts that consist of metal or gypsum plasterboard panels, the measures described above can be taken. In the case of convective chilled ceilings/canopies which are designed with gaps, alternative options are used due to the influence of the acoustic measures. Acoustic measures can be installed here, e.g. directly on the bare ceiling or elevated above the cooling panels.

Explanations

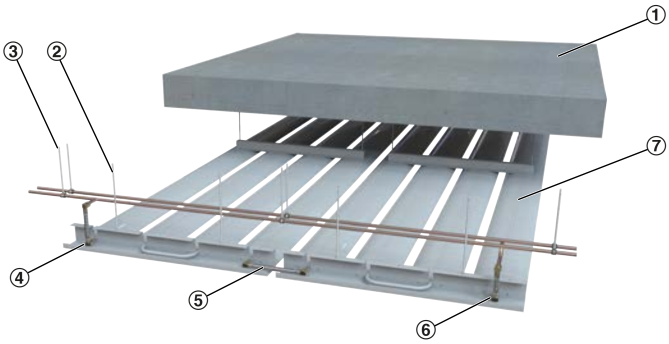
Explanations

Control – schematic illustration



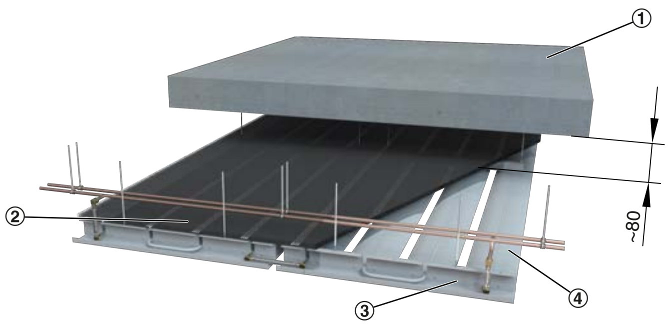
① Room
② Room control panel
③ Valve actuator and valve
④ Dew point sensor (chilled water flow)
⑤ Shut-off
⑥ Window contact (only required if windows can be opened)
⑦ Supply air
⑧ Extract air

WK-D-WF – Water-side connections – schematic illustration



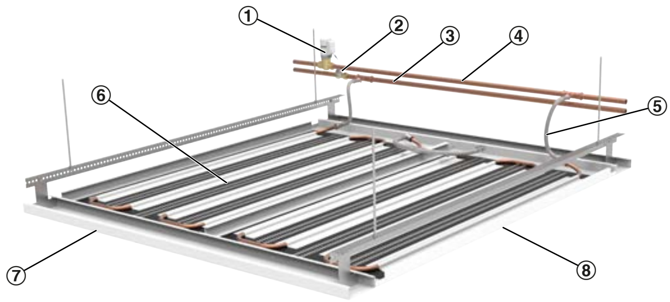
① Ceiling slab
② Hangers, threaded rods
③ Suspension of flow and return pipes
④ Water return connection
⑤ Flexible hose
⑥ Water flow connection
⑦ Cooling panel (raft)

WK-D-WF – Freely suspended cooling panel (raft) with acoustic insulation



① Ceiling slab or suspended ceiling
② Acoustic fleece
③ Hanging bracket
④ Cooling panel (raft)

WK-D-PP – Water-side control – schematic illustration



① Valve and valve actuator (return)
② Shut-off (flow)
③ Flow
④ Return
⑤ Flexible hose
⑥ Cooling panel
⑦ Ceiling grid section
⑧ Metal ceiling tile

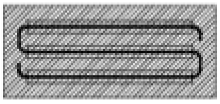
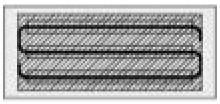
Control system

Control of the chilled water temperature is particularly important for the control of passive cooling systems. The mode of operation and control depends on the overall technical design. The main supply pipes have to be fitted with devices for venting, shut-off, filling and draining. Flexible hoses are the easiest way to connect cooling panels to other cooling panels and to the main pipe. For example, flexible hoses type FS can be used as they allow for various connection options. Dew point sensors should be used to prevent condensation. Window contacts can be used to automatically switch off the chilled ceiling when a window is opened. This reduces the risk of condensation. The chilled water temperature should be controlled so that it does not come too close to the theoretical dew point. Room temperature control usually includes a controller that controls valves and actuators so that the required water flow rate or water temperature is maintained. There is a choice between single room control or integration with a central BMS. Since chilled ceilings only influence the thermal loads in an internal space, air terminal devices are required to provide the space with outdoor air. A ventilation system is actually required for providing outdoor air, for removing hazardous substances and for limiting the relative humidity. Water and air can be controlled with LWS or X-AIRCONTROL control components, for example. Various bus systems are available depending on the selected control system.

VDI 6034

VDI Guideline 6034 describes the planning, installation and operation of cooling surfaces for rooms.
The testing of chilled ceilings has to comply with EN 14240 (which replaced DIN 4715 in 2004). Information on heating capacities can be based on EN 14037 Part 5.
VDI 6034 provides a sample calculation for cooling capacities with reference to EN 14240 in Chapter 7.1.6.
It illustrates the effects that different reference values have on the cooling capacity.

Example based on VDI 6034

DIN 4715	DIN EN 14240 from 2004
	
Ceiling tile length x ceiling tile width for Δt 10 K	Coil length x axial distance x number of profiles for Δt 8 K

Calculation: $\Delta t = t_{r,c} - t_{w,m,c}$ (standard cooling capacity with Δt = 8 K)

	Description	Calculation	Calculation value	Unit
Ex.: calculation of specific cooling capacity acc. to EN 14240 (2004)				
Cooling capacity ($\Delta t = t_{r,c} - t_{w,m,c}$ = 8 K)	$\Phi_{w,c}$	Cooling capacity according to general appraisal certificate	518	W
Test room floor area	A_t	3.8 m × 3.8 m	14.44	m²
Installation area	A_i	No. of tiles + support structure	11.31	m²
Panel area	A_p	No. of panels × L × B, e.g. 24 × 1.42 m × 0.3 m	10.22	m²
Active area	A_a	for example 1.3 m × 0.2 m	6.24	m²
Nominal cooling capacity in relation to the active area	$\varphi_{w,c,a}$	518 W/6.24 m^2	83	W/m^2
Options regarding cooling capacity specification				
Based on the active area (A_a)	$\varphi_{w,c,a}$	518 W/6.24 m^2	83	W/m^2
Based on the panel area (A_p)	$\varphi_{w,c,p}$	518 W/10.22 m^2	51	W/m2
Based on the installation area (A_i)	$\varphi_{w,c,i}$	518 W/11.31 m^2	46	W/m^2
Based on the room area (A_t)	$\varphi_{w,c,t}$	518 W/14.44 m^2	36	W/m^2

The different approaches above show that the same measured standard cooling capacity can result in different specific cooling capacities per m^2 depending on the reference area used.
If, for example, in the case of a metal ceiling the no. of panels used is known, the achievable total cooling capacity can be determined based on that panel area.
This calculation of the cooling capacity is the same in the now obsolete DIN 4715 and in the new EN 14240 when the panel area Ap and Δt of 10 K are used.
Note that the cooling capacity measurement to EN 14240 also includes the cooling capacity for the inactive sections of the ceiling (without any active cooling panels). This can result in a higher total cooling capacity if only small sections of the metal ceiling area are fitted with cooling panels.
An alternative and better way is to use the room area (At) as a reference. It usually gives the required (design) cooling capacity for the room under consideration.
It is never possible to use the entire ceiling area for activation because of the various ceiling constructions and because sections of the ceiling are always used for necessary building services such as lights, sprinklers or air terminal devices.
In addition to a chilled ceiling there should always also be a mechanical ventilation system that provides outdoor air. Such systems impact cooling capacities to varying degrees.