

# *Smart ceilings*



# Content

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<b>Company &amp; product</b>	<b>2</b>
Metawell GmbH	3
Metawell®	4
Metawell® Aluflex	5
 <b>Smart ceilings</b>	 <b>6</b>
Ceiling variants	7
Ceiling sails	9
<i>Ceiling islands</i>	17
Modular ceilings	20
<i>Sports hall ceilings</i>	26
Gapless ceilings	31
<i>Hospital ceilings</i>	35
Heating & cooling	39
Room acoustics	42
<i>Standard acoustic elements</i>	48
<i>Other acoustic solutions</i>	50
Design	51
Lighting technology	56
Supply air	62

# *Company & product*

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Metawell GmbH, Germany

# Metawell GmbH

*Made in Germany – operating worldwide*

At the company's location in Neuburg (Germany), the company Metawell GmbH produces and develops aluminium sandwich panels and lightweight components for over 35 years now with great success.

The very light but extremely rigid sandwich panels Metawell® and Metawell® Aluflex are used for numerous applications. In addition to lightweight panels, the company also provides pre-fabricated components, customized lightweight solutions and special products.

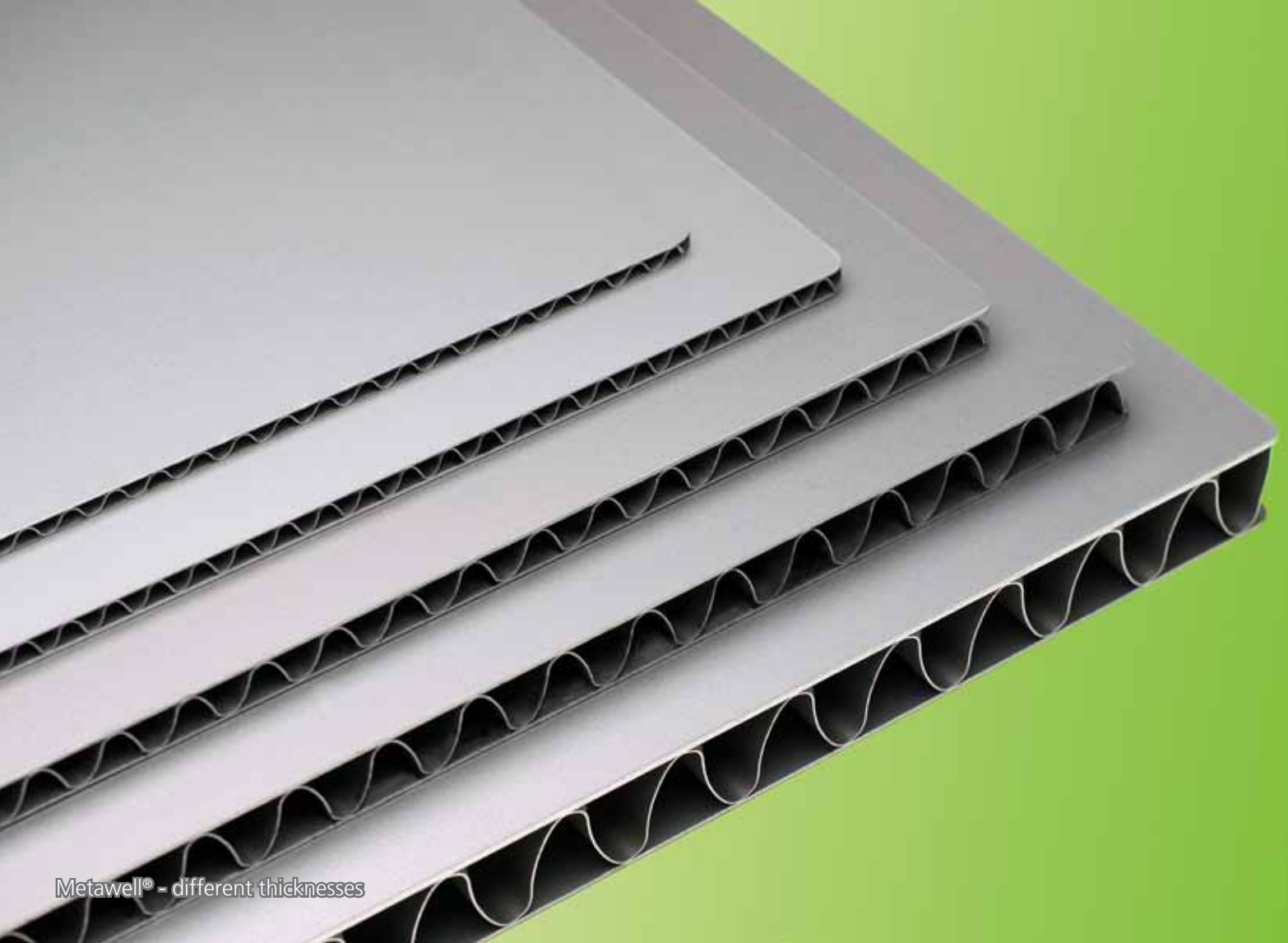
Engineering competence, modern manufacturing technologies and last but not least the passion for the products and their applications, make Metawell a competent and strong partner for lightweight solutions for customers from various industries around the world.

The company's goal is to use high-quality products to produce technically and economically convincing solutions for all areas where function and design combined with low weight are desired.

The company is certified according to ISO 9001: 2015 and ISO 14001: 2015. EPDs (Environmental Product Declarations) according to DIN EN ISO 14025 Type III and EN 15804 are available, too.







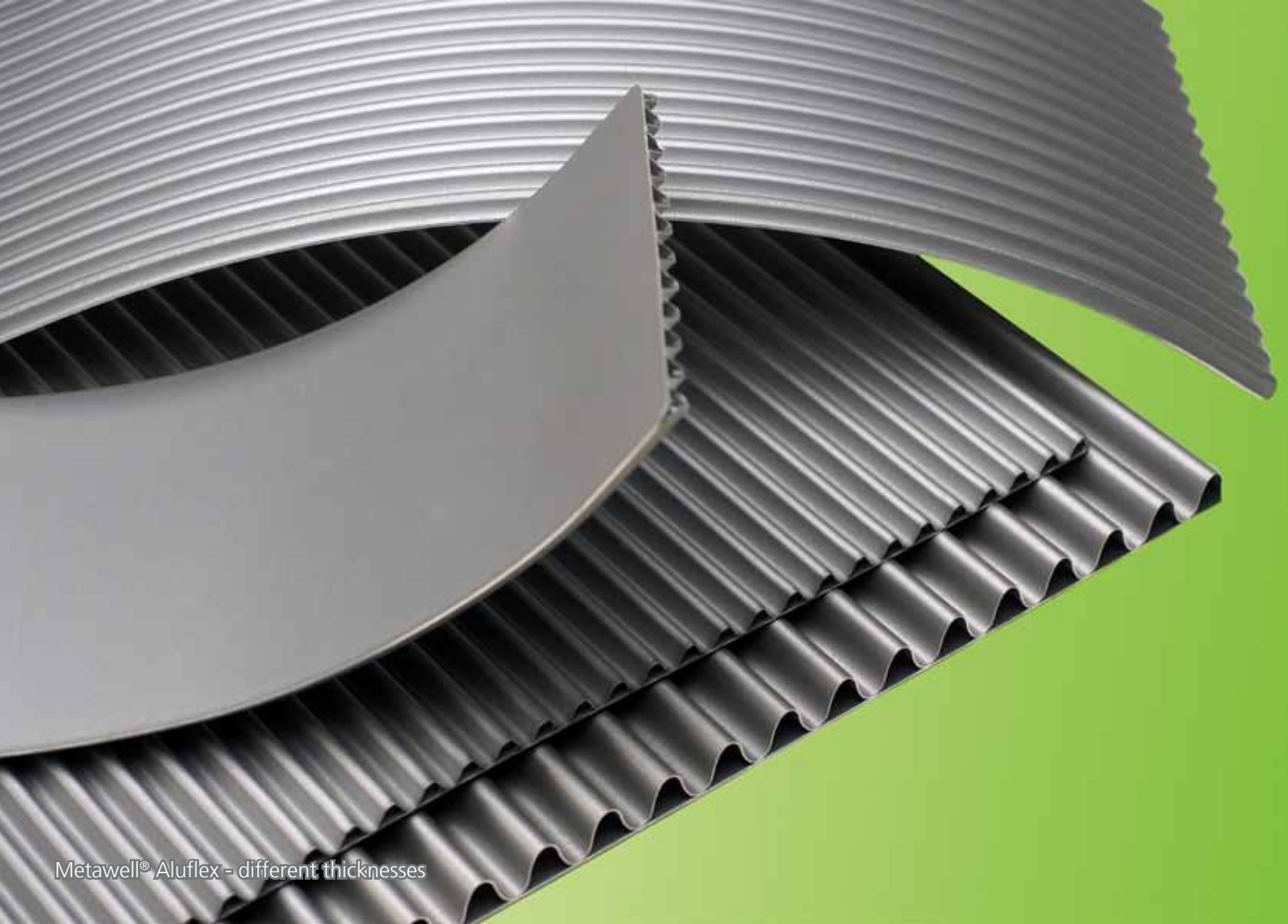
Metawell® - different thicknesses

## Metawell®

Metawell® is a patented aluminium sandwich panel that consists of two aluminium cover sheets and a corrugated aluminium core. The layers are glued together in a continuous manufacturing process. The aluminium is primed with a special coating, which guarantees a permanent adhesive connection and provides good corrosion protection. The light and rigid panels enable high weight savings, especially in large formats.

### *Advantages at a glance:*

- Low weight and high rigidity (same statical performance as solid aluminium but up to 80 % lighter).
- High corrosion protection because all aluminium sheets are pretreated with a primer.
- Good thermal conductivity and sound absorption.
- Excellent flatness even with larger elements.
- Powder-coatable panels available on request.
- High fire protection classifications for different areas.
- Production in a continuous manufacturing process.
- Simple processing of the material with standard tools.
- Full recyclability without prior material separation.
- High proportion of secondary aluminium used.



Metawell® Aluflex - different thicknesses

# Metawell® Aluflex

Metawell® Aluflex is a panel with rigidity levels that depend strongly on the direction of use. It consists of a single cover sheet which is glued to a corrugated sheet. This structure enables easy 2D-forming and provides a high rigidity to curved lightweight elements (e.g. curved ceilings)

## Advantages at a glance:

- Continuous manufacturing process.
- Material with highly anisotropic stiffness, which makes 2D-shaping easy.
- Simple processing of the material with standard tools.
- High corrosion protection since all used aluminium sheets are pretreated with a primer.
- Full recyclability without prior material separation.
- High proportion of secondary aluminium used.



Metawell® Aluflex - shaping parallel to the corrugation



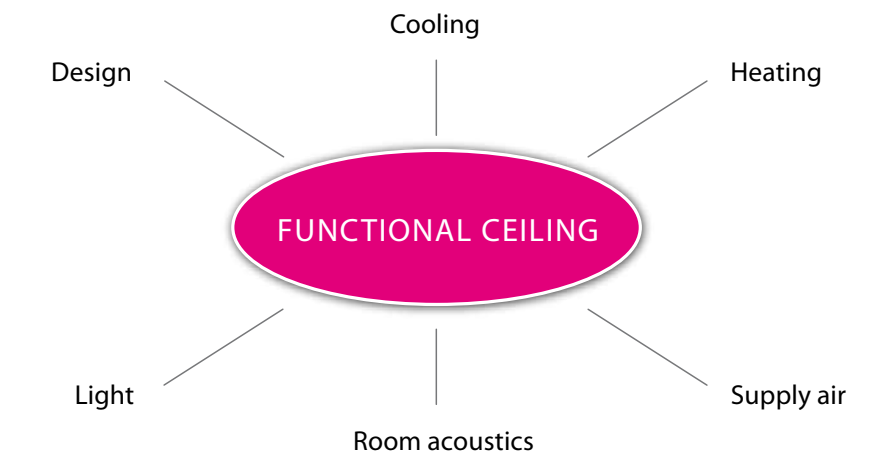
Metawell® Aluflex - shaping perpendicular to the corrugation

# *Smart ceilings*

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# Smart ceilings

Thanks to their properties, Metawell® panels are the perfect material for smart ceilings. The ceilings can be function carriers for air conditioning, fresh air supply, room acoustics and light control elements. Metawell's design takes the individual influencing parameters and their interaction with each other into account. (For example the perforated areas cannot provide light reflection).



Smart ceilings are available in different ceiling variants:



# *Ceiling variants*

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# *Ceiling sails*

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Radiant and acoustic sail - IVG Munich (Germany)



Radiant and acoustic sail - MediaSaturn Ingolstadt (Germany)





Radiant and acoustic sail - HVB Munich (Germany) © Michael Heinrich





Radiant and acoustic sail - Tesis, Munich (Germany)



# Ceiling sails

Ceiling sails are suspended from the raw ceiling as single panels or combined to islands. They can have different contours, edge designs and surface coatings. Therewith the radiant ceiling as a functional component of the building technology becomes a creative design element with sound absorbing characteristics.

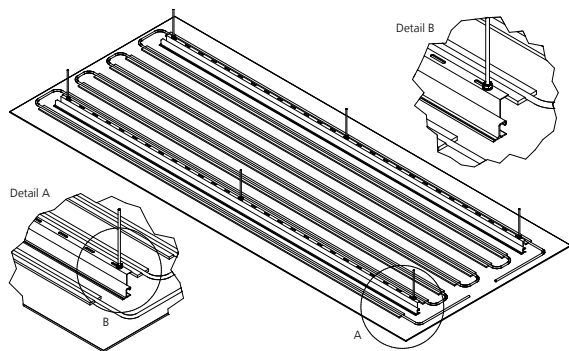
Thanks to their open design ceiling sails offer clear advantages vis-a-vis closed ceilings: greater specific performance, better accessibility, simpler assembly and lower investment costs.

Metawell® ceiling sails enable plenty of scope for creative design with regard to form, surface

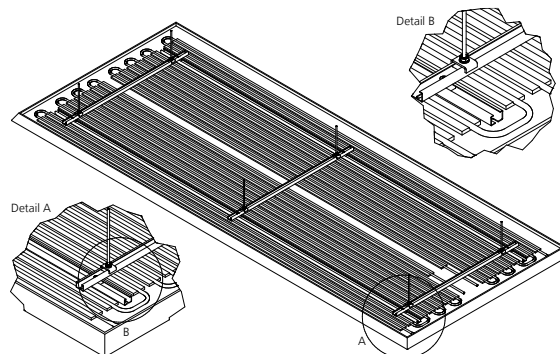
structure and color. Thanks to the good sound absorption and thermal conductivity, only part of the ceiling surface must be equipped with Metawell® ceiling sails.

Metawell® radiant ceiling sails improve room acoustics without reducing the cooling and heating efficiency of buildings with a core-tempered ceiling. Moreover, performance deficiencies can be compensated specifically. The ceiling sails are supplied ready to fit and are mounted at a certain distance from the ceiling. Thus, the reverse side of the ceiling sail can also absorb and neutralize sound waves.

- Ceiling sails warrant a better performance than closed ceilings because their open structure allows convection - particularly if the sails are flat such as Metawell® ceiling sails (no upstand needed for reinforcement).
- The high performance allows a reduced covering density compared to plaster-board and steel systems.
- Reduced assembly times and costs.
- Up to 150 W/m<sup>2</sup> cooling performance (at a temperature difference of 10 K).
- Up to 140 % sound absorption (relative to the projected floor space).
- Panel sizes up to 1480 x 6000 mm.
- Different contours, edges and surfaces.
- The back of the sail is easily accessible.
- Color coating is usually done in the factory.
- Retrofittings and wall (de-)installations are possible with little effort only.
- Compared to closed ceilings, sails have a significantly higher sound absorption, because the back makes an additional contribution.

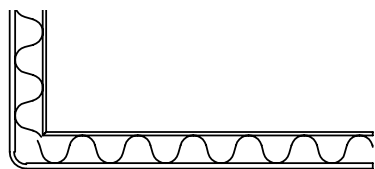


Ceiling sail type BK with pipe distance 120 mm and hook suspension

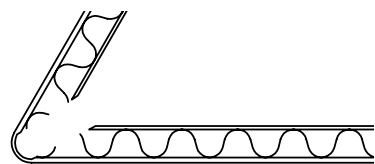


Ceiling sail type KR120 with pipe distance 60 mm and C-rail suspension

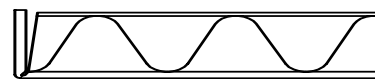
# Border finishes for ceiling sails



KR-90  
(90° folding)



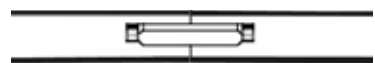
KR-120  
(120° folding)



BK (sheet covered edge)  
Radius: approx. 1 mm

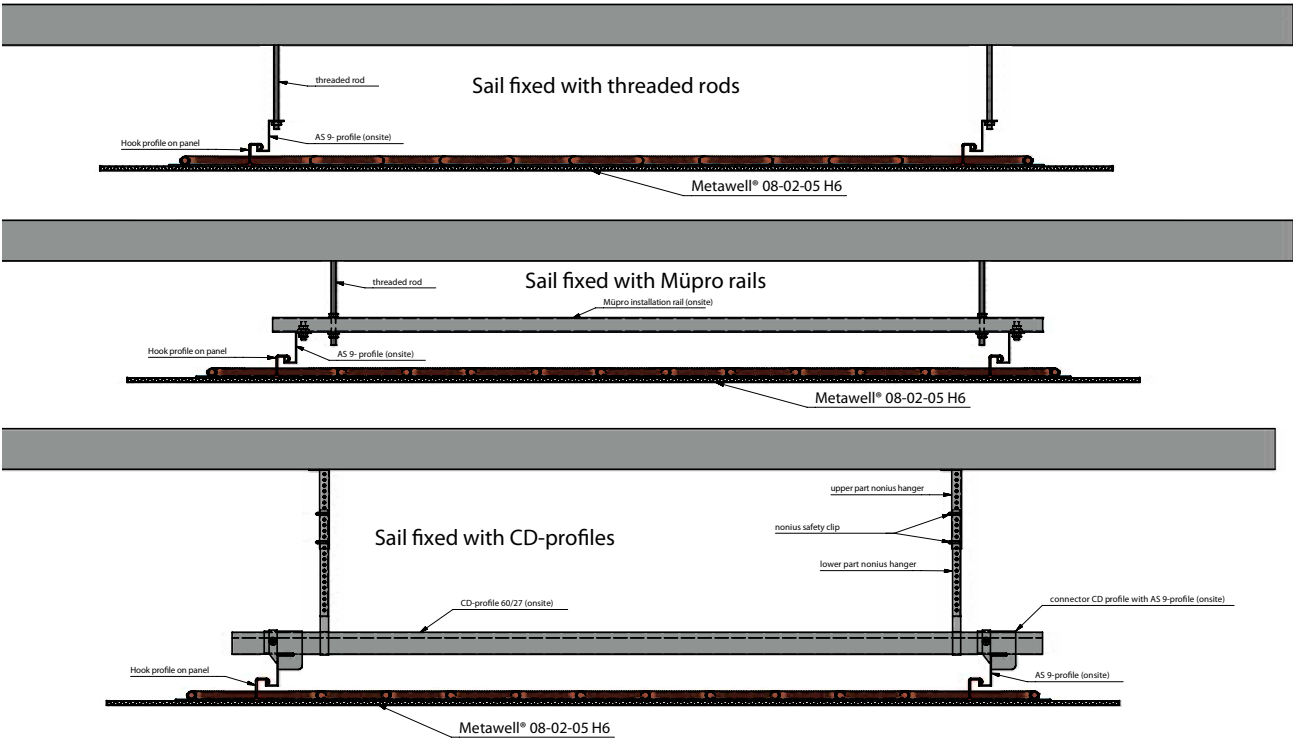


Plastic beading

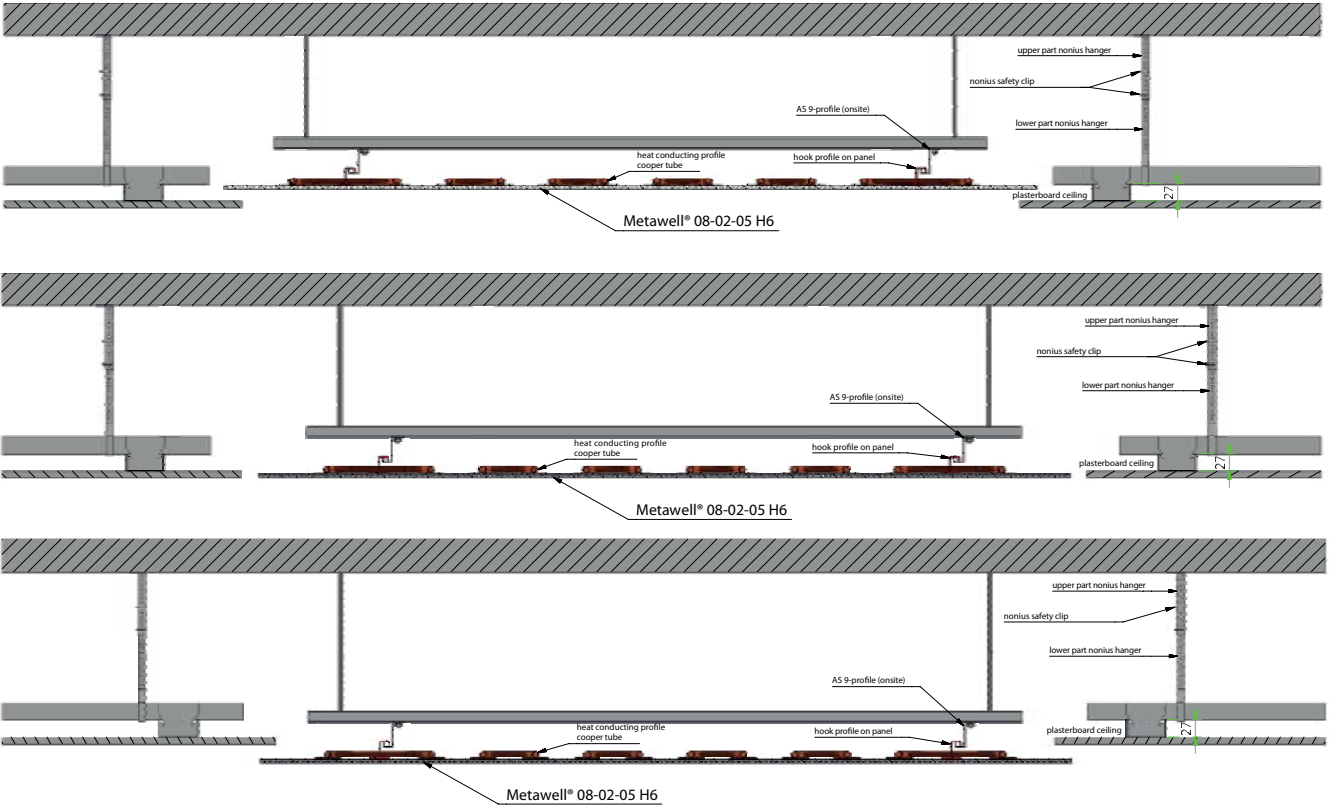


Tongue & groove system  
with chamfered tongue

# Substructure for sails

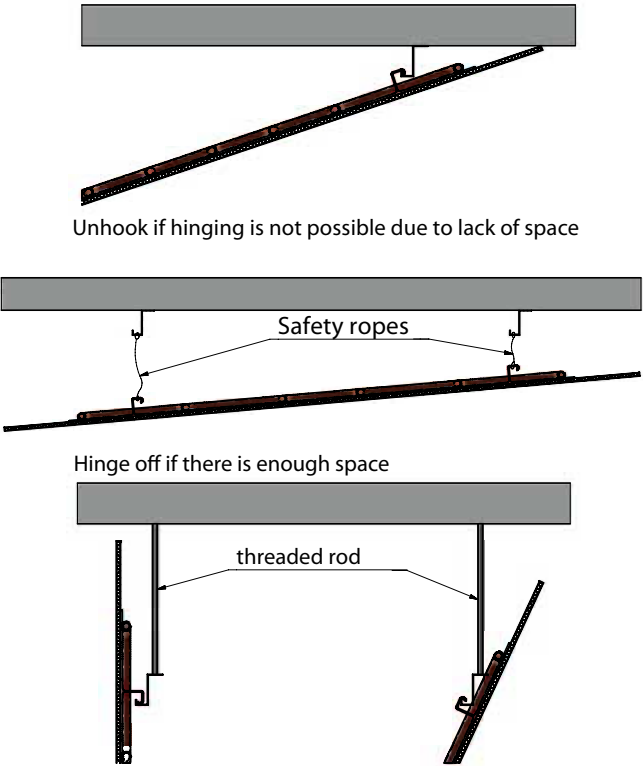


# Substructure for ceiling sails in combination with plasterboard



## Easy installation & revisionability

Mounting steps for ceiling sails



# *Ceiling islands*

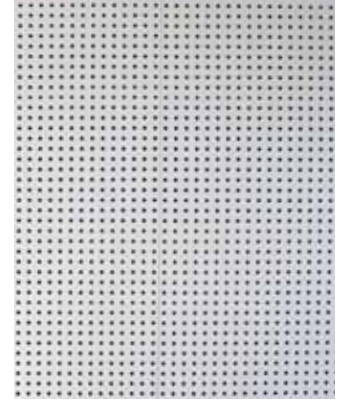
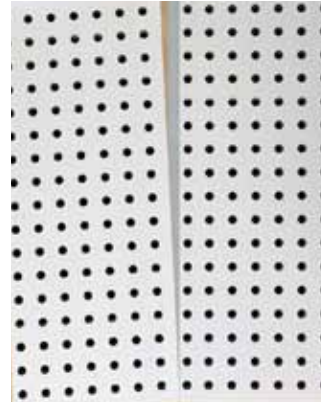
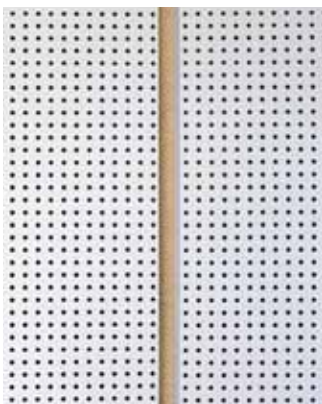
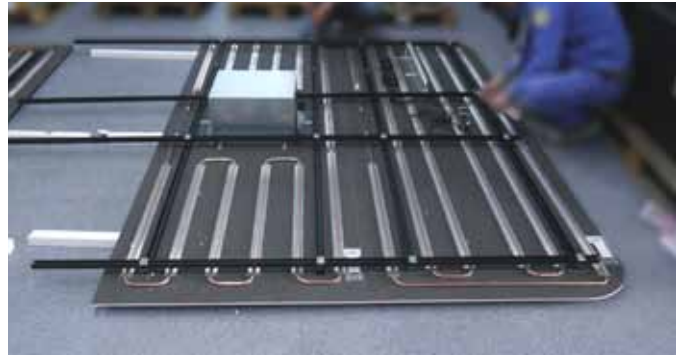
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# Tongue & groove connection

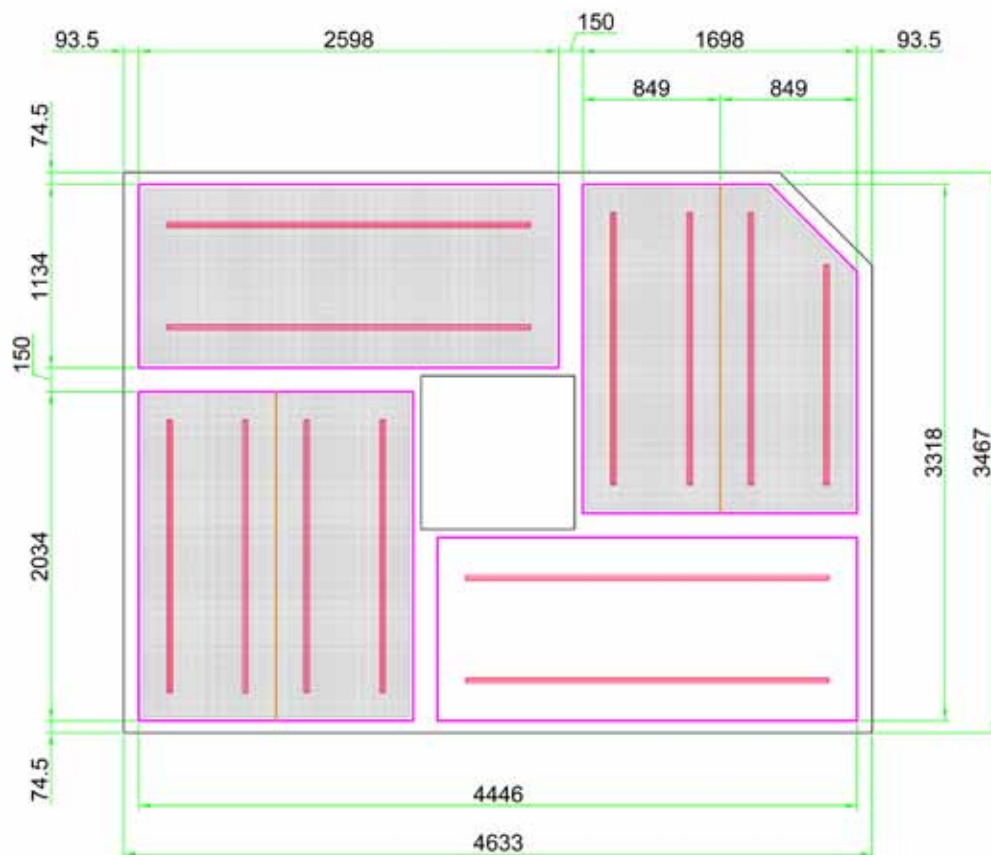
Metawell® panels can be installed in a simple, dimensionally stable and inexpensive way with a tongue and groove connection.

- Simple: A groove is milled into two Metawell® panels using a customary slitting cutter. The Metawell® panels are then stuck together using a fitting connecting profile.
- Dimensionally stable: Thanks to the 0.2 mm thick aluminium sheet used for the corrugation, which has high yield strength, the remaining corrugation parts stabilize the cover panels in the area of the groove and at the same time act like elastic spring elements.
- Cost-effective: The spring effect of the remaining corrugation ensures that the perfect fit of the connecting profile is retained in the groove even with slight movements. An additional filling of the panel edge is not necessary.

Metawell® panels with tongue & groove allow - in a simple manner - the installation of large radiant and acoustic ceilings. No drywall work is necessary for quick and clean installation. The hook profiles already attached on the back only need to be hooked in. The joints are hardly visible due to the flatness of the panels.







Ceiling pattern with tongue & groove connection

# *Modular ceilings*

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max. 1480 mm

max. 1480 mm











Radiant and acoustic ceiling - ILB Potsdam (Germany) © Frank Rothe



# Modular ceilings

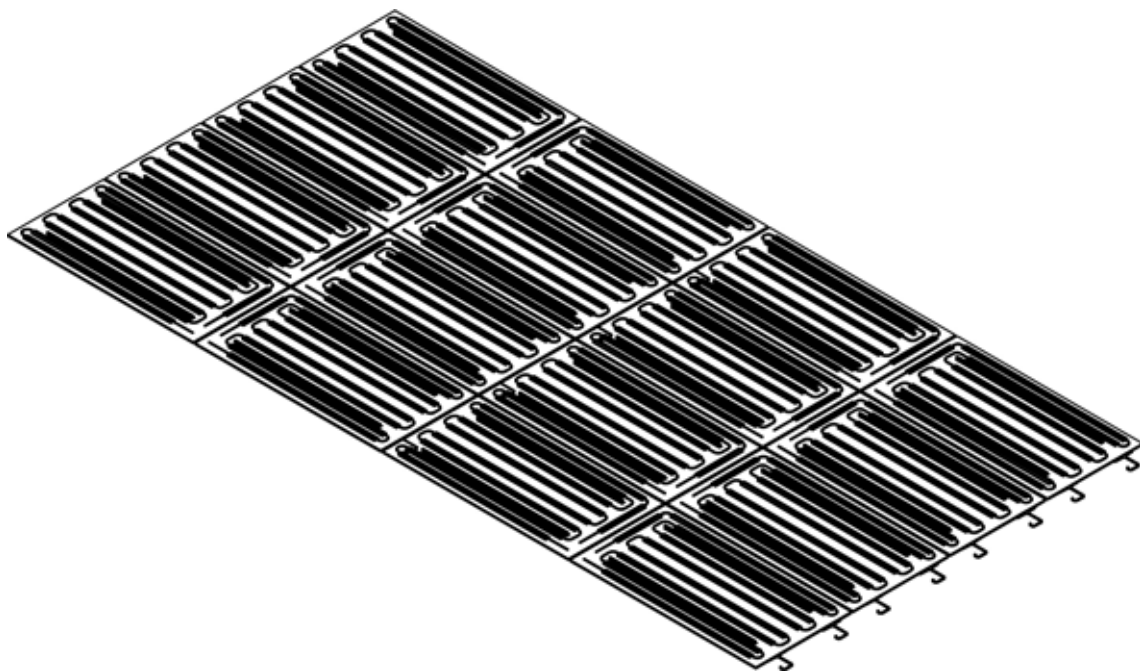
The modular ceilings dealt with hereafter usually consist out of square or rectangular panels that are installed by hanging them up with commercial substructures. Modular ceilings are found in rooms where a high performance is requested while the ceiling is almost closed.

In contrast to conventional grid ceilings, Metawell® ceilings do not require a band grid profile. What is more, the individual panels up to 6 m long and 1.5 m wide can be suspended directly from the raw ceiling as modular ceilings and be combined to form a ceiling with visible joints. As the panel geometry can be freely chosen, Metawell® panels can be provided with polygonal contours, too. Placeholders for possible partitions are put on the individual ceiling panels. These can easily be removed if necessary.

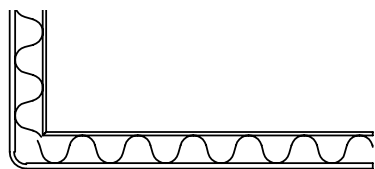
Modular ceilings can be realized in any dimension within the maximum element size of 1480 x 6000 mm. The largest square modular ceiling has a size of 1480 x 1480 mm. With the necessary 20 mm assembly joint, the grid is 1500 mm. Modular ceilings have a pipe distance of 80 mm and an installation joint of 20 mm.

The combination of a grid ceiling with other ceiling types such as gapless ceilings or sails allows a vivid ceiling design that combines harmoniously and optimally aesthetic aspects and functional attributes such as accessibility, sound absorption, light reflection, cooling and heating.

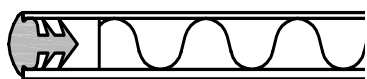
- Different panel sizes and formats.
- Mounting of large ceiling in-built units without additional substructure.
- Up to 120 W/m<sup>2</sup> cooling performance (at a temperature difference of 10 K).



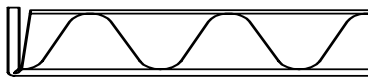
# Border finishes for modular ceiling



KR-90  
(90° folding)



Plastic beading

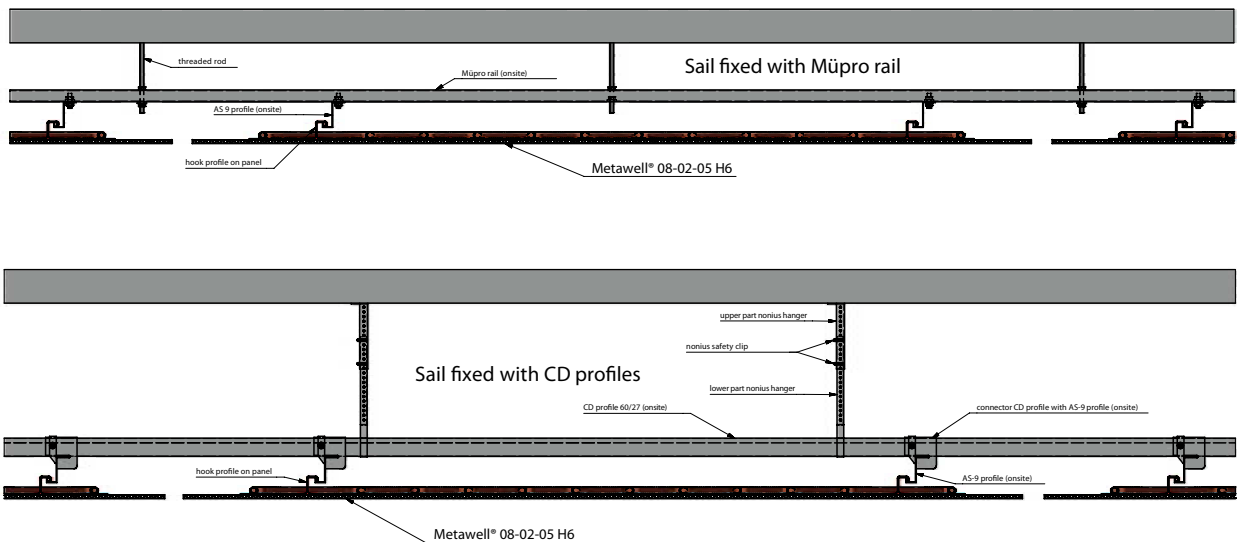


BK (sheet covered edge)  
Radius: approx. 1 mm



Tongue & groove system  
with chamfered tongue

# Substructure for modular ceiling



# *Sports hall ceilings*

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max. 6000 mm

max. 1480 mm

Sports hall - Campus Hoogvliet (The Netherlands) © Jan Bitter



Sports hall NBS Berkersheim - Frankfurt am Main (Germany) Foto: Constantin Meyer, Köln





Sports hall - Köln-Porz (Germany) © Stefan Schilling



Detail basketball hoop

# Sports hall ceilings

Ceiling constructions must not only meet the sound insulation requirements, but also be tested for ball impact resistance according to DIN 18032-3 and for shock resistance according to EN 13964-D. Thanks to the panels' extremely rigid structure, deformations by ball shots are almost impossible. The Metawell® ceiling may, as an option, also provide the heating of the hall. The copper pipe tubes mounted on the back side of the ceiling convert the acoustic ceiling into an acoustic and radiant ceiling. The sports hall ceilings are delivered with full perforation and rear-fixed acoustic fleece, optionally also with copper pipe meanders. The panels are mounted to standard CD rails with a narrow shadow gap. Because of the use of countersunk head screws with a 6 mm diameter the screw heads become invisible within the 6 mm perforation. Screwing on the visible side and setting a CD grid are particularly efficient.

## Layout

On basis of the building physics data of the sports hall, the heating load of the hall is calculated by the planner, whereby the room height has a great influence on the temperature distribution.

In order to ensure the desired temperature in the area where the athletes are, a correction factor should be included in the calculation. Example: For a sports hall with a height of 7 m, a heat load of 25,000 watts is determined. The correction factor according to the table is 0.7. The heat load to be provided by the ceiling is therefore 35,700 watts.

## Acoustics

In order to ensure the speech intelligibility during training lessons and to keep the noise disturbance for athletes, trainers and audience low, room acoustic measures are taken. Subject to the kind of room use and the room volume the reverberation time in sports halls should be 1.4 to 2.5 sec., in multi-purpose halls even 1.1 to 4.4 sec.. DIN EN 18032 explicitly requests:

- speech intelligibility in single and in particular multiple sporting activities
- voice communication among the athletes
- speech intelligibility when using a sound system in sports halls with audience
- noise-free and therefore stress-free sporting activities

- Low supply temperature of the heating water.
- Minimum air supply requirement, which results in smaller air ducts and less air movement.
- Closed hall ceilings are hygienic.
- Balls cannot get stuck behind the ceiling.
- Dirt cannot settle down.
- The entire ceiling serves as an acoustic absorption surface.
- The ceiling system can also be used for heating, optionally for cooling.

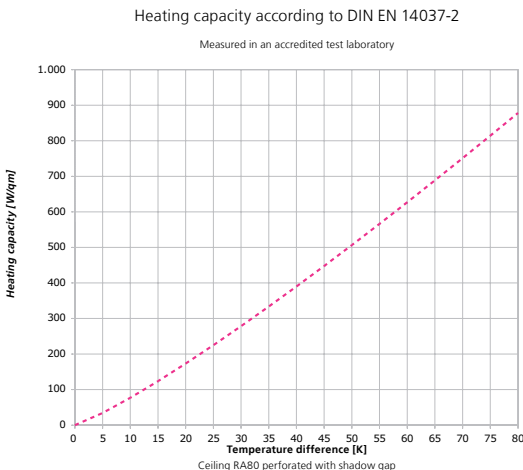


Diagram heating performance

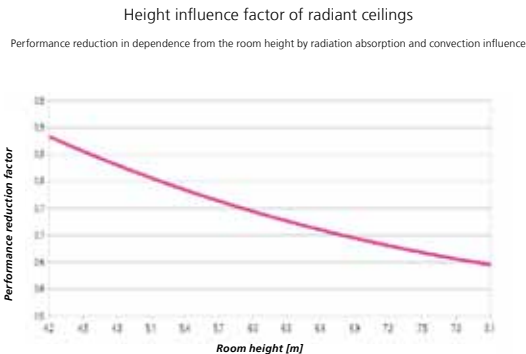


Diagram correction factor room height



# Sports hall ceilings

## Installation

The installation of the ceiling is quite simple and is carried out using standard CD rails and drywall screws - special and expensive substructures are not required.

A coarse and fine grid construction is mounted to the ceiling. The coarse grid has a spacing of 900 mm, the spacing of the fine grid depends on the width of the ceiling panels. If the width is 1480 mm, three fine grids must be provided per panel; in each case on the panel longitudinal edges and in the centre of the panel. The spacing is 700 mm. The perforated ceiling panels have a pre-drilled 2

mm hole instead of a 6 mm perforation hole at the points where the drywall screws have to be set - which clearly determines the positioning of the screws.

The screw head diameter of 5.9 mm is very similar to a perforation hole, so the attachment is hardly noticeable from the floor. In our example the gap between the panels is 10 mm.

All edge panels are supplied with over dimension. The excess material has to be cut off by the customer during assembly. This allows to level out tolerances of the building and to create a uniform shadow gap towards the walls.

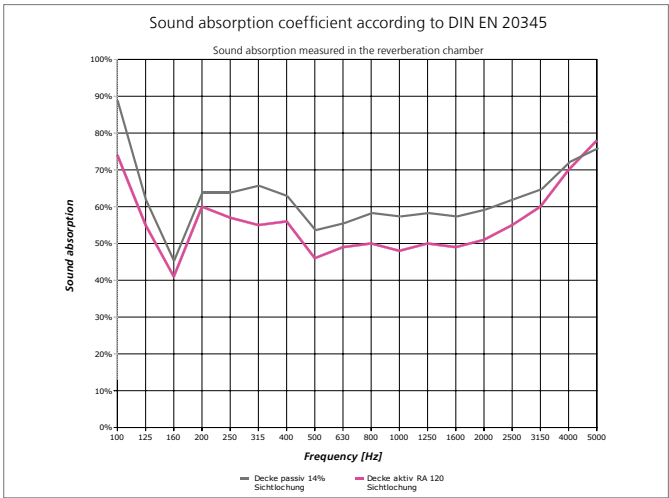
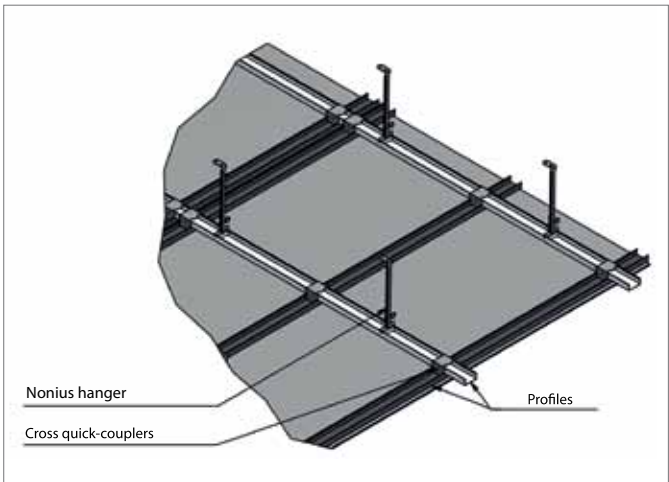


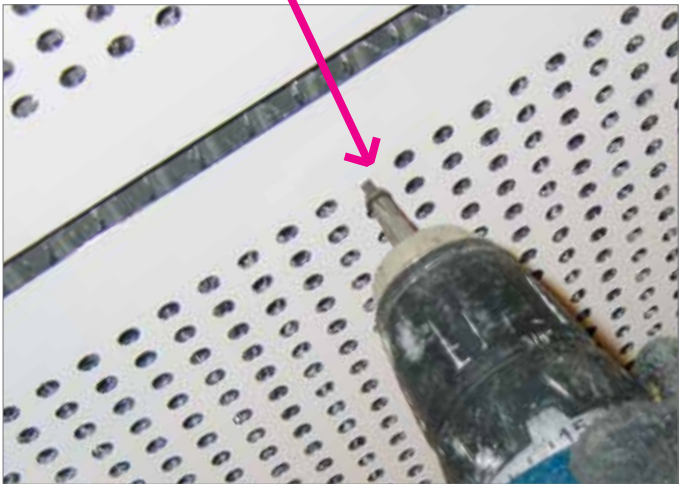
Diagram comparison of sound absorption of active and passive panels



Detail perforation and shadow gap



Substructure in 3D



Detail fixation

# *Gapless ceilings*

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Bucherer - Munich (Germany)



Brahms Kontor - Hamburg (Germany)





Uli Knecht - Munich (Germany)



Volksbank - Heidenheim (Germany)

# Gapless ceilings

Suspended closed ceilings are usually made of plasterboard. But Metawell® gapless ceilings are made with aluminium panels with copper pipes, both materials which warrant a better performance and a high reponse speed.

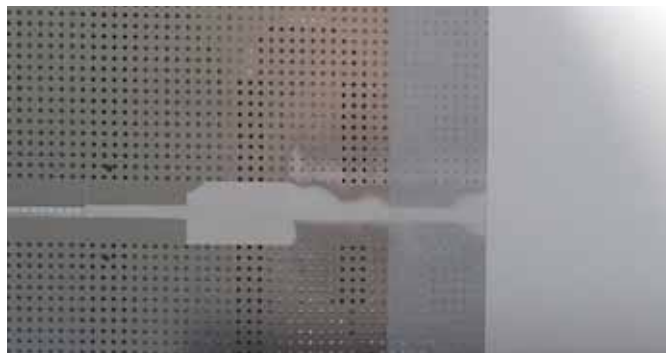
The exceptionally light aluminium sandwich panel is very bending-resistant. Therefore the grid dimensions of the substructure can be doubled compared to plasterboard.

## Installation of a gapless ceiling

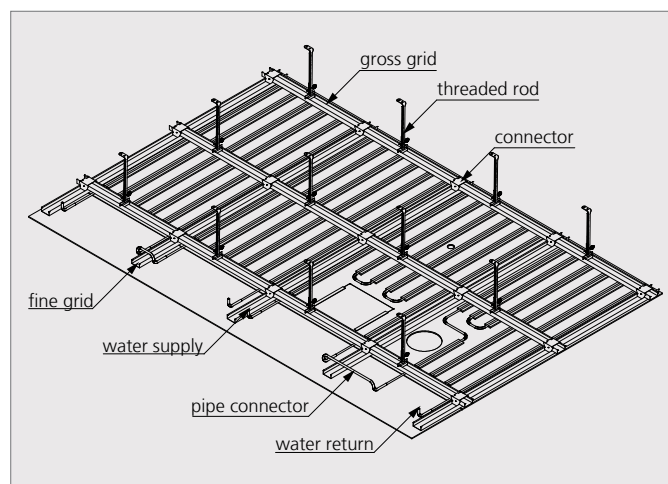
- The piping of the room is laid taking into account the later tube positions.
- The substructure of CD profiles is fixed in counter battens according to a defined ceiling layout on the bare ceiling via standard hangers.
- The Metawell® panels with the copper tubes are mounted with self-drilling countersunk screws leaving an all-round shadow gap.
- The copper tubes are connected to the room's piping system and a pressure test is run.
- The ceiling is closed with passive panels.
- Joints and screw heads are filled with standard materials and sanded.
- Then the surface is painted or - in the case of perforated panels - covered with a fleece and then coated with acoustic plaster.

Thanks to the extraordinary flatness of the panel, only the joint area has to be filled and not the entire panel.

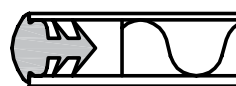
The coordination of built-in elements and copper tubes requires detailed planning, which is carried out according to the approved architect's drawing in coordination with the installation companies.



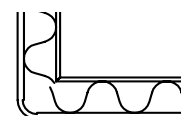
- Panel formats adjusted to the building.
- Optimised performance design taking into account the ceiling cut-outs and substructure.
- Up to 110 W/m<sup>2</sup> cooling performance (at a temperature difference of 10 K).



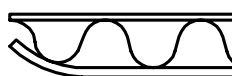
Substructure in 3D



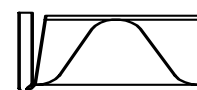
Plastic beading



KR-90



EP/D



BK

Border finishes for gapless ceilings

# *Hospital ceilings*

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Hospital Elisabethinen - Linz (Austria)



St. Joseph-Hospital - Bochum (Germany)

# Hospital ceilings

## *Pleasant, clean and healthy*

The ceiling construction in hospitals must not create a breeding ground for germs, it must be hygienically safe and easy to clean. The closed gapless Metawell® radiant ceiling consists out of an aluminium carrier plate with copper pipes and is thanks to its' characteristics ideal for the use in hospitals.

The installation of the Metawell® ceiling is just as easy as that of a plasterboard ceiling, but the cooling performance is approximately twice as high. However, unlike plasterboard, the aluminium sandwich panel does not absorb water, so that germ and mold cannot be formed.

Metawell® ceilings are delivered by the factory with a primed surface and are therefore easy to coat with all varnishes and colors common in hospitals.

Metawell® radiant ceilings can be used both for heating and cooling of rooms. The heat given off by a radiant heating ceiling is sensed as very pleasant. Since the surrounding surfaces are heated as well the same room temperature can be

perceived with less energy expenditure (1-2 kelvin lower).

In comparison to a floor heating the radiant ceiling heating has the advantage that the floor temperature does not get too high. Thereby problems with athlete's foot, which spreads relatively fast on a constantly warm floor, can be prevented.

Disinfectants, which are regularly used for cleaning, do not dry out quickly and are therefore more effective. The warmth from above also scores with better hygiene, because convector ducts and heater niches present a dirt problem not to be underestimated.

## *Sustainable and energy efficient*

Metawell® hospital ceiling elements consist out of an aluminium carrier plate with copper pipes. Both materials are excellent heat conductors. Therefore Metawell® hospital ceilings respond extremely fast and achieve high performance values. At the end of the life cycle, they can be recycled without reprocessing.

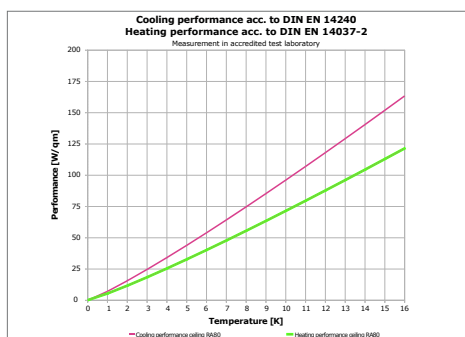


Diagram heating and cooling performance



Room layout „typical“ 2-bed hospital room

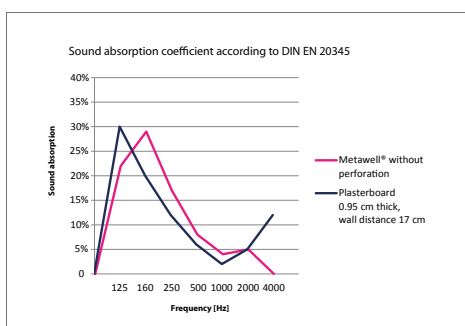
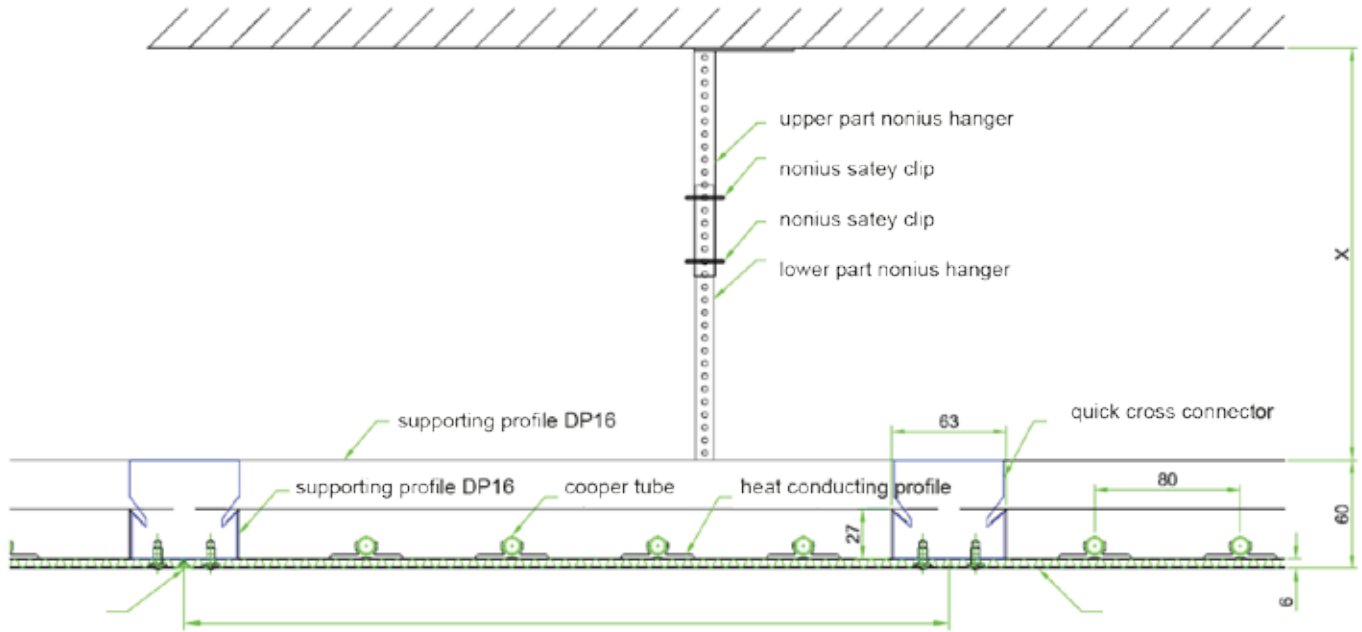


Diagram acoustical comparison Metawell® / plasterboard



Layout with Metawell® radiant ceiling

# Hospital ceilings



Nonius suspension counter battens

## Heating and cooling performance

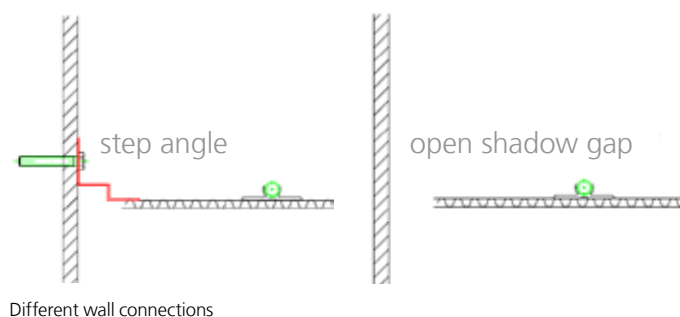
Aluminium and copper are, as already mentioned, excellent heat conductors. The less ceiling surface is taken by additional fittings (e.g. lamps, etc.) the more surface is available for the copper tubes and consequently an optimal cooling and heating performance can be achieved.

## Installation

Metawell® gapless ceilings are delivered with a smooth surface (without sound absorption) or perforated (with sound absorption) and as passive (without copper tubes) or active (with copper tubes) ceilings.

The copper tubes on active panels are pressed into aluminium heat conducting profiles. The profiles are invisibly and durably connected to the panel with an adhesive tape and blind rivets.

Gapless ceilings are normally permanently connected to the supply network, e.g. the copper tubes are pressed or brazed with the room-sided piping.





# *Heating & cooling*

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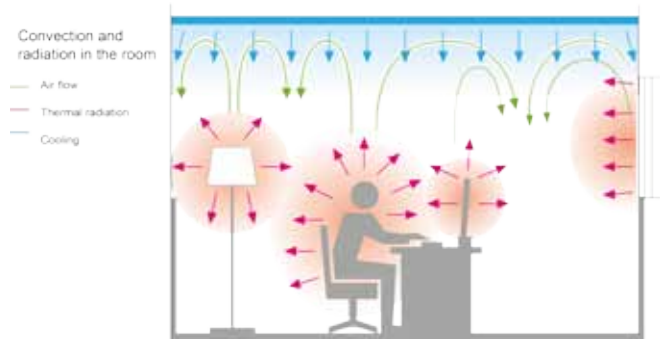
# Heating & cooling performance

The term radiant ceiling refers to a suspended – frequently also sound-absorbing – ceiling, which can heat and cool a room. Radiant ceilings work like the sun by means of radiation. When heating warm water flows through the copper pipes on the backside of the panel. In the cooling phase, the Metawell® ceiling element absorbs the heat radiation of the room, whereby the floor, walls and furnishings cool down and as a result the room temperature drops.

Aluminium and copper are excellent heat conductors. That is why Metawell® in combination with its low component mass not only achieves high performance values but also an extremely fast response behavior.

Tightness and compliance with the warranted performance values are guaranteed by the following precautions:

- Use of continuous tubes only.
- All pipe ends are calibrated and provided with a protection cap. Pipe ends that are connected via plugs are stiffened with support sleeves.
- Panel coating, glue, heat conducting profile and copper pipe are optimally adjusted to each other.
- The copper tubes are manufactured and assembled with machines developed especially for series production.



Heat conductivity	
Cooper	385 W/m K
Aluminium	220 W/m K
Thermo panel	2 W/m K
Plasterboard	1 W/m K
Polymer	< 1 W/m K

## Economic efficiency

- Heating and cooling with one system
- Lower energy consumption, since the perceived room temperature can be set 1-2 °C lower
- Less space requirements in the ceiling cavity and in the technical centre, since water is a better energy source than air
- Hardly any maintenance costs
- The high performance allows a lower occupancy density
- Fast and easy installation
- Quick reaction time because of the excellent

heat conductors aluminium and copper

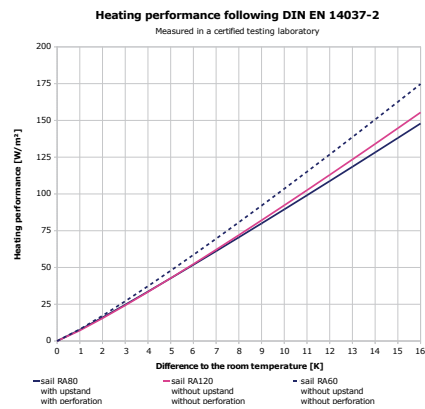
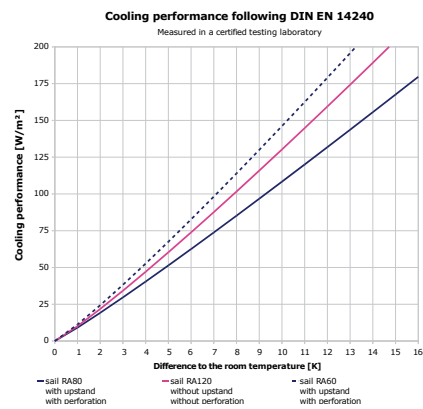
- Less sickness-related absenteeism
- Improved performance of employees

## Well-being

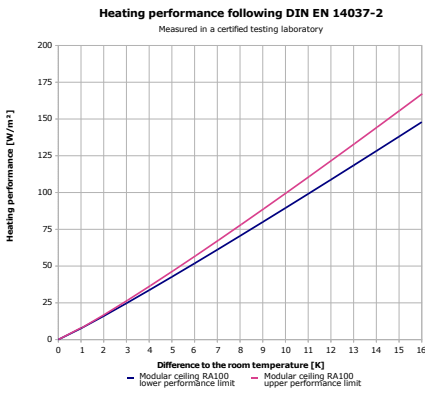
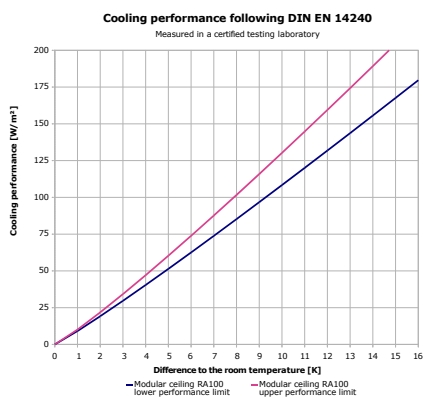
- Radiation heats like the sun
- No noise disturbance and no noticeable draft
- No whirling up of bacteria and dust
- Good room acoustics due to high sound absorption
- Equal temperature level in the room

# Heating & cooling performance

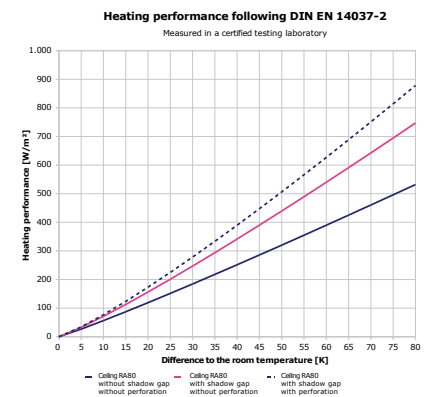
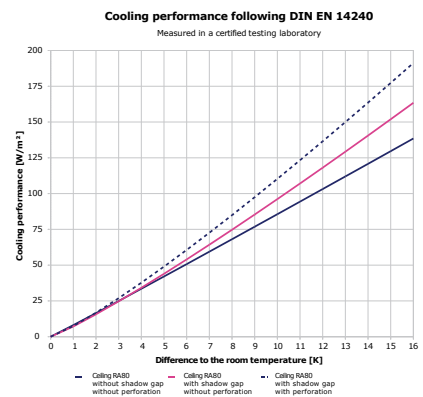
## Ceiling sails



## Modular ceilings



## Gapless ceilings





# *Room acoustics*

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# Room acoustics

*There is strength in tranquillity – improving room acoustics quite easily*

In our hectic and steadily louder world, the desire for silence is only too easily comprehensible. This applies to the private sphere, but in particular to the workplace. Whether it is in office buildings, kindergartens, schools, sports halls, public administration and public buildings or in certain areas in hospitals – excessive noise is perceived as disturbing and can, in the long run, lead to a reduced performance.

Designing rooms acoustically pleasant is a great challenge, especially when considering building physics and design trends, such as concrete core tempering.

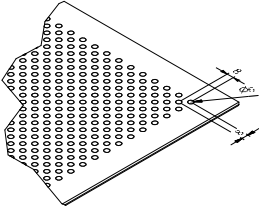
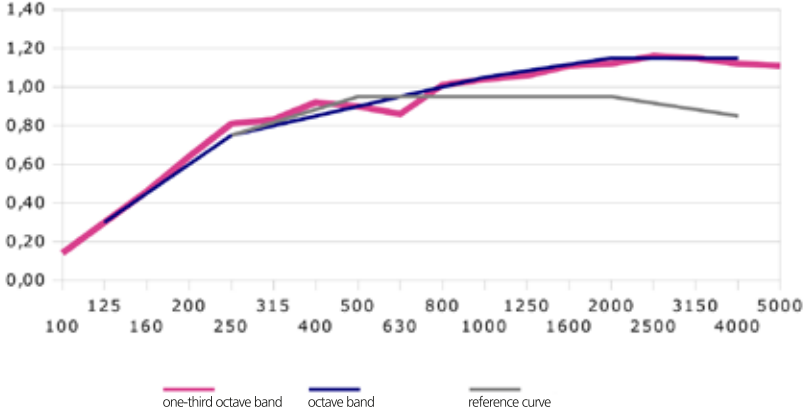
The optimization of the audibility in the room, increased speech intelligibility and a low reverberation time are of great importance here.

*How can Metawell® acoustic panels provide better room acoustics?*

By the installation of sound-absorbing Metawell® acoustic sails, modern work and recreation rooms with pleasant room acoustics can be created, even retrospectively.

- Adaptation of the reverberation time to the room use.
- Improved speech intelligibility.
- Well-directed sound control or sound diffusion.
- Uniform sound absorption over the entire frequency range.
- More than 100 % sound absorption for ceiling elements possible by additional sound absorption by the backside of the panel.
- Low weight of the panels.
- Good static stability of the panels. Attachments and fittings can be easily implemented.
- Freedom of design, as any geometries and many surfaces are possible.
- Good heat conduction and therefore no measurable influence on the cooling and heating performance of concrete core tempering with enough space between ceiling and panel.
- Good accessibility, as the gap between the ceiling elements and the walls allows easy revision.
- Lower installation costs, since the surface to be installed is smaller and the elements can be more easily aligned.

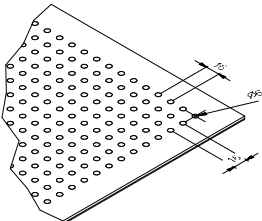
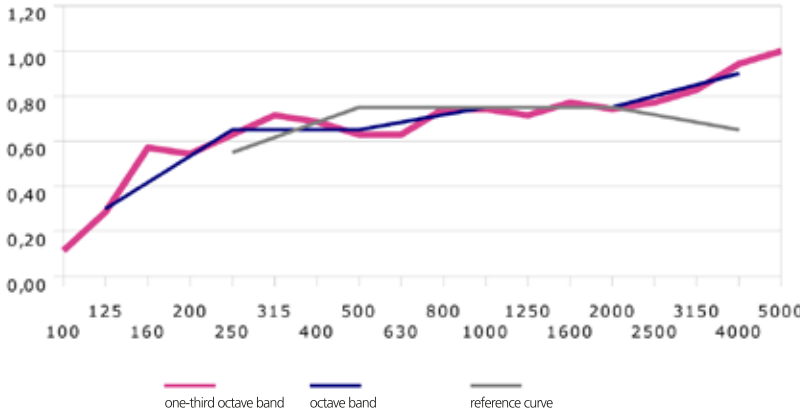
# Perforation X6x8

Data sheet	Acoustic sail with perforation
Ceiling type	Acoustic ceiling
Perforation	X6x8 (hole quota 22,1%)
Tubing	without
Surface	Coil coating
Back side	Acoustic fleece with 20 mm melamine foam
Hollow space	294 mm
Sound absorption coefficient	95% (acc. to DIN EN ISO 354) Absorption class A (most absorbent)
Diagram	 





# Perforation Q6x16

Data sheet	Thermically active acoustic ceiling with visible perforation																																																																												
Ceiling type	Acoustic sail																																																																												
Perforation	Q6x16 (hole quota 11,0%)																																																																												
Tubing	R120																																																																												
Surface	Coil coating																																																																												
Back side	Acoustic fleece																																																																												
Hollow space	294 mm																																																																												
Sound absorption coefficient	75% (acc. to DIN EN ISO 354) Absorption class C (highly absorbent)																																																																												
Diagram	  <table><caption>Sound Absorption Coefficient (alpha) vs Frequency (Hz)</caption><tr><th>Frequency (Hz)</th><th>one-third octave band (red)</th><th>octave band (blue)</th><th>reference curve (grey)</th></tr><tr><td>100</td><td>0,15</td><td>0,15</td><td>0,15</td></tr><tr><td>125</td><td>0,30</td><td>0,30</td><td>0,30</td></tr><tr><td>160</td><td>0,60</td><td>0,40</td><td>0,40</td></tr><tr><td>200</td><td>0,55</td><td>0,50</td><td>0,50</td></tr><tr><td>250</td><td>0,65</td><td>0,60</td><td>0,60</td></tr><tr><td>315</td><td>0,75</td><td>0,65</td><td>0,65</td></tr><tr><td>400</td><td>0,70</td><td>0,70</td><td>0,70</td></tr><tr><td>500</td><td>0,65</td><td>0,75</td><td>0,75</td></tr><tr><td>630</td><td>0,65</td><td>0,70</td><td>0,70</td></tr><tr><td>800</td><td>0,75</td><td>0,75</td><td>0,75</td></tr><tr><td>1000</td><td>0,75</td><td>0,75</td><td>0,75</td></tr><tr><td>1250</td><td>0,70</td><td>0,75</td><td>0,75</td></tr><tr><td>1600</td><td>0,80</td><td>0,75</td><td>0,75</td></tr><tr><td>2000</td><td>0,75</td><td>0,75</td><td>0,75</td></tr><tr><td>2500</td><td>0,85</td><td>0,85</td><td>0,75</td></tr><tr><td>3150</td><td>0,90</td><td>0,90</td><td>0,75</td></tr><tr><td>4000</td><td>0,95</td><td>0,95</td><td>0,75</td></tr><tr><td>5000</td><td>1,00</td><td>1,00</td><td>0,75</td></tr></table>	Frequency (Hz)	one-third octave band (red)	octave band (blue)	reference curve (grey)	100	0,15	0,15	0,15	125	0,30	0,30	0,30	160	0,60	0,40	0,40	200	0,55	0,50	0,50	250	0,65	0,60	0,60	315	0,75	0,65	0,65	400	0,70	0,70	0,70	500	0,65	0,75	0,75	630	0,65	0,70	0,70	800	0,75	0,75	0,75	1000	0,75	0,75	0,75	1250	0,70	0,75	0,75	1600	0,80	0,75	0,75	2000	0,75	0,75	0,75	2500	0,85	0,85	0,75	3150	0,90	0,90	0,75	4000	0,95	0,95	0,75	5000	1,00	1,00	0,75
Frequency (Hz)	one-third octave band (red)	octave band (blue)	reference curve (grey)																																																																										
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# Perforation Q5x10

Data sheet	Thermally active acoustic ceiling with primer
Ceiling type	Acoustic ceiling
Perforation	Q5x10 (hole quota 17,3%)
Tubing	R120
Surface	Primer
Back side	Acoustic fleece
Hollow space	294 mm
Sound absorption coefficient	65% (acc. to DIN EN ISO 354) Absorption class C (highly absorbent)
Diagram	<p>one-third octave band    octave band    reference curve</p>

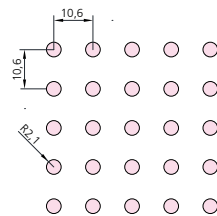


# More perforation variants

## PERFORATION PATTERNS

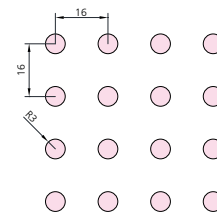
### Pattern Q4x10

Diameter: 4.2 mm  
Distance: 10,6667 mm  
Layout: square  
Hole quota: 11.0 %  
Panel type: Alu 08-02-05 H6  
Weight: 4.1 kg/m<sup>2</sup>



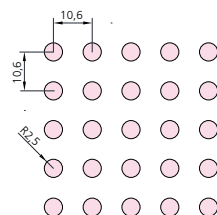
### Pattern Q6x16

Diameter: 6 mm  
Distance: 10.6667 mm  
Layout: square  
Hole quota: 11.0 %  
Panel type: Alu 08-02-05 H6  
Weight: 4.1 kg/m<sup>2</sup>



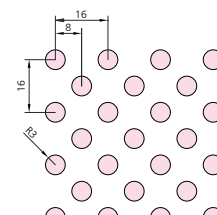
### Pattern Q5x10

Diameter: 5 mm  
Distance: 10,6667 mm  
Layout: square  
Hole quota: 17.3 %  
Panel type: Alu 08-02-05 H6  
Weight: 3.8 kg/m<sup>2</sup>



### Pattern X6x8

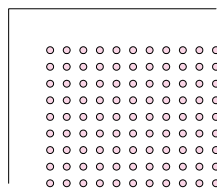
Diameter: 6 mm  
Distance: 8 mm  
Layout: shifted  
Hole quota: 22.1 %  
Panel type: Alu 08-02-05 H6  
Weight: 3.6 kg/m<sup>2</sup>



## PERFORATION FIELDS

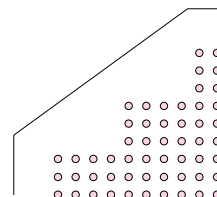
### All-over perforation

This perforation type consists of hole rows in any number arranged in a square or off-set pattern. These make for the free opening quota stated in the relevant perforation pattern type.



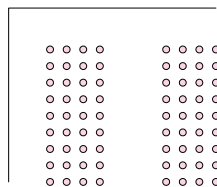
### Stepped perforation

A stepped perforation follows a diagonal or curved panel contour at a determined distance from the edge. As standard, there is one step every four holes unless the contour angle is so small that larger steps can be chosen.



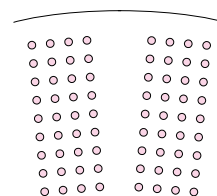
### Strip perforation

The strip perforation consists of at least four rows of holes, with the perforation being arranged in a square hole pattern and the individual hole fields between the copper tubes. As a result, optimum cooling or heating power and sound absorption are achieved on air-conditioned ceilings with copper pipe meanders on the rear.



### Radial strip perforation

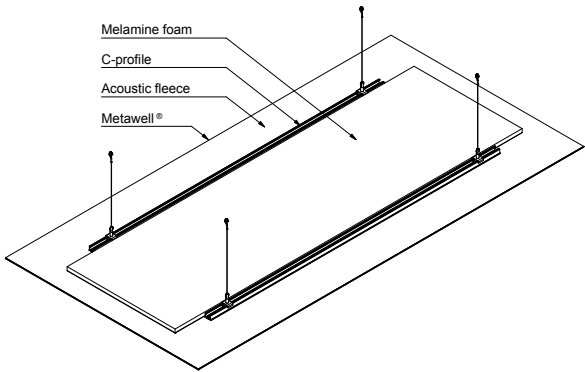
Ceiling islands in round or elliptic buildings are mostly radially arranged and therefore have a non-rectangular shape adjusted to the building structure. This shape can be adopted in the perforation by arranging the perforation radially rather than parallel.

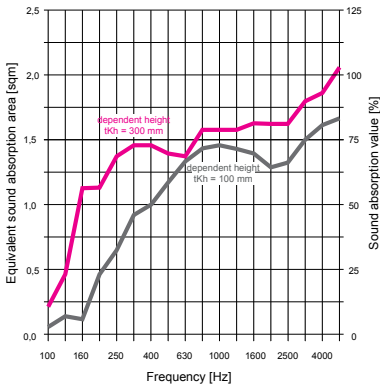
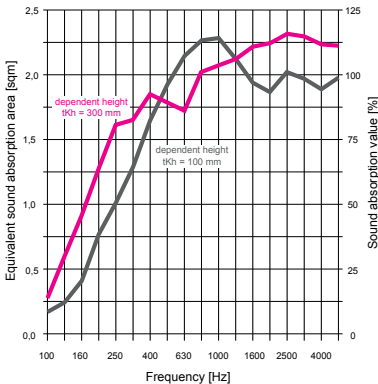




# Standard acoustic elements

- Metawell® acoustic elements are suitable for all rooms where the reverberation time impairs speech intelligibility.
  - The aluminium sandwich structure warrants high rigidity with an elegant and filigree appearance. With only 6 mm of visible edge, the element is very thin, but at the same time so rigid that the suspension ropes can be arranged far in the centre of the panel and are therefore barely visible.
  - With the included suspension ropes, the sail can be mounted in no time. A minimum suspension height of 160 mm must be observed. If the suspension height is lower, a different suspension system is available on request.
- The sail is delivered with a high-quality coil-coated surface in the color RAL 9010 (pure white). If renovation is required after years, the element can be easily repainted. The acoustic values are still preserved - even with multiple painting.



	Basic 2000-W	Basic 2000-W with LED	Perfect 2000-W	Perfect 2000-W with LED
Dimension	980x2000 mm			
Absorber class (suspension height 300 mm)	B		A	
Equivalent sound absorption area and sound absorption value for suspension heights 100 mm and 300 mm (acc. DIN EN ISO 11654, Müller BBM)	<p>Equivalent sound absorption area resp. sound absorption value</p> 		<p>Equivalent sound absorption area resp. sound absorption value</p> 	
Color	RAL 9010 (pure white)			
Perforation	Q6x16		X6x8	
Panel thickness	6 mm			
Absorber	acoustic fleece		acoustic fleece with melamine foam	
With LED-work place lighting	no	yes	no	yes
Weight	9.7 kg	10.8 kg	8.9 kg	10.0 kg



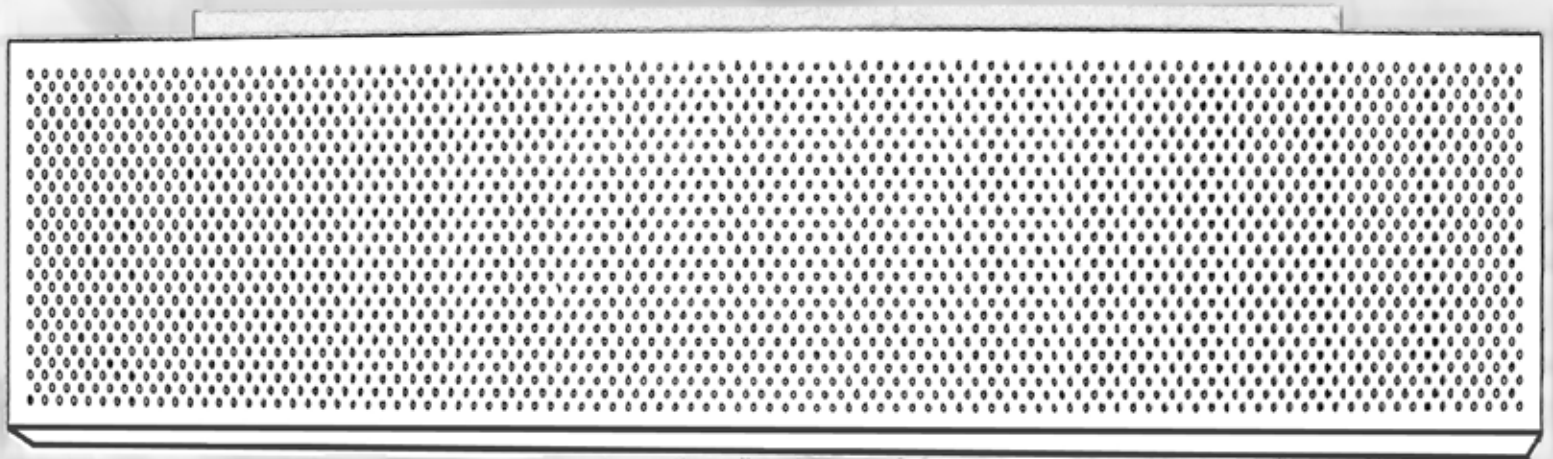
Acoustic ceiling element with LED-workplace lighting



Acoustic ceiling element - Wago, Minden (Germany) © Lutz Weil



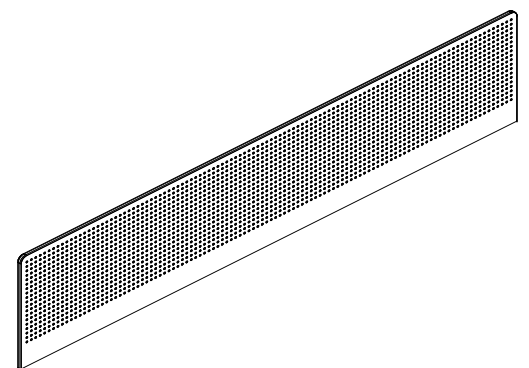
# *Other acoustic solutions*



Acoustic baffle



Desk absorber © Alexander Schölzel, Fa. Easy Lights GmbH





# *Design*





Ceiling element with LED



Radiant ceiling with digital print

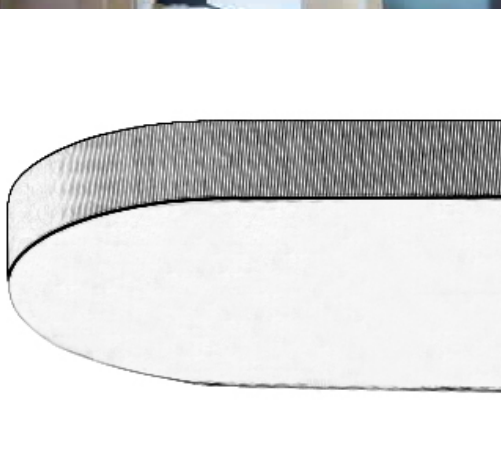


Rounded ceiling elements - Raiffeisenbank, Neustadt-Vohenstrauß (Germany)



Oval ceiling elements - MELO, Munich (Germany)

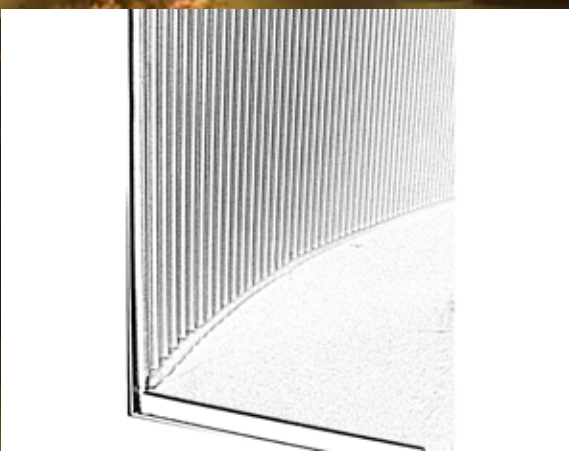




Reggefiber, Rijssen (The Netherlands) - Combination Metawell® & Metawell® Aluflex



Mirror-like ceiling elements - IjHal, Amsterdam (The Netherlands)  
Combination Metawell® & Metawell® Aluflex



Kunsthalle, Mannheim (Germany) © Cem Yücel

# *Lighting technology*

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# Lighting technology

The high rigidity of Metawell® allows the statics to be weakened by large cutouts for recessed luminaires and high lamp weights, e.g. with pendant lights. As a rule, it is not necessary to hang the lights separately from the raw ceiling. This leaves the lighting technician a great scope for design and saves installation costs. By varying the size of the perforated fields, the surface color and the degree of gloss, light reflection can be customized to the needs of the user, especially with floor lamps and floodlights.

For radiant ceiling sails using LED lights is possible

## LED-workplace lighting

Together with a renowned LED manufacturer, a light calculation was carried out for a typical workplace. Usually the ceiling sails are axially arranged in an office room. Often the room dimensions are as follows: room depth about 5 m, room height about 3 m and an axle width of ~ 1.4 m. Sufficient illumination is provided with 2 LED lights per sail.

The cover of the LED light is flush with the Metawell® acoustic element and the sides of the light cover are opaque to prevent light scattering.

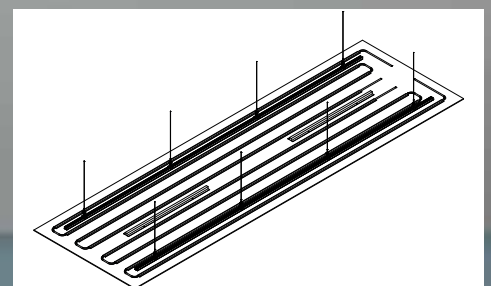
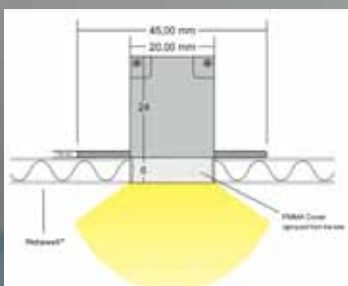
as well. The small lighting can be positioned between the copper tubes, so the heating and cooling capacity is not reduced.

The pendants can also be attached subsequently through the existing perforation. For example, pendants with a weight of up to 7.5 kg can be attached to the panels without additional reinforcement. The power cable can be led through the perforation to the backside of the panel.

The dimmable LED light is provided including power supply (230 V AC / 24 V DC, 30 W) with connector cable with 2 m open strands for an easy connection to the existing power supply.

LED-workplace lighting at a glance:

- Luminaire length 985 mm
- Voltage LED light: 24 VDC
- Power: 30 W
- Color temperature: 3500 K
- Luminous flux: 4000 lm
- Efficiency: 136 lm / W
- Color rendering value: CRI: 84





Radiant and acoustic sail with LED lighting, Visus Health, Bochum (Germany)



Easy fixing of pendants © Michael Heinrich





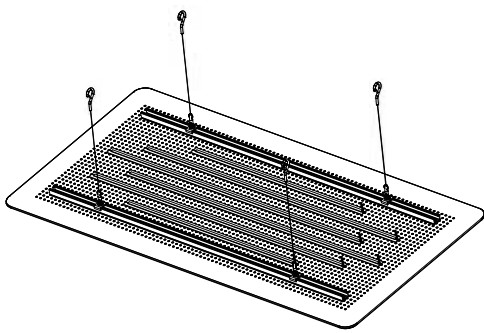
Dental laboratory, Munich (Germany)



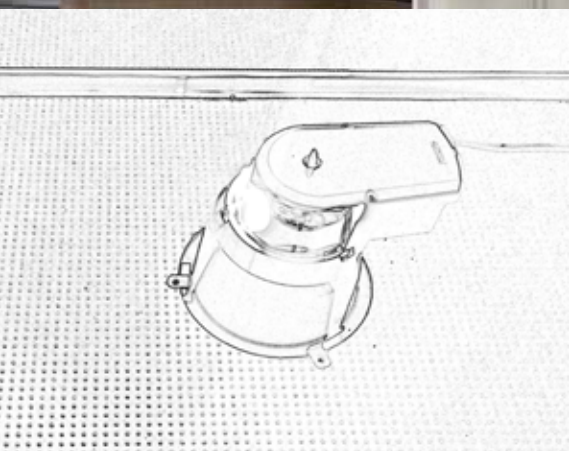




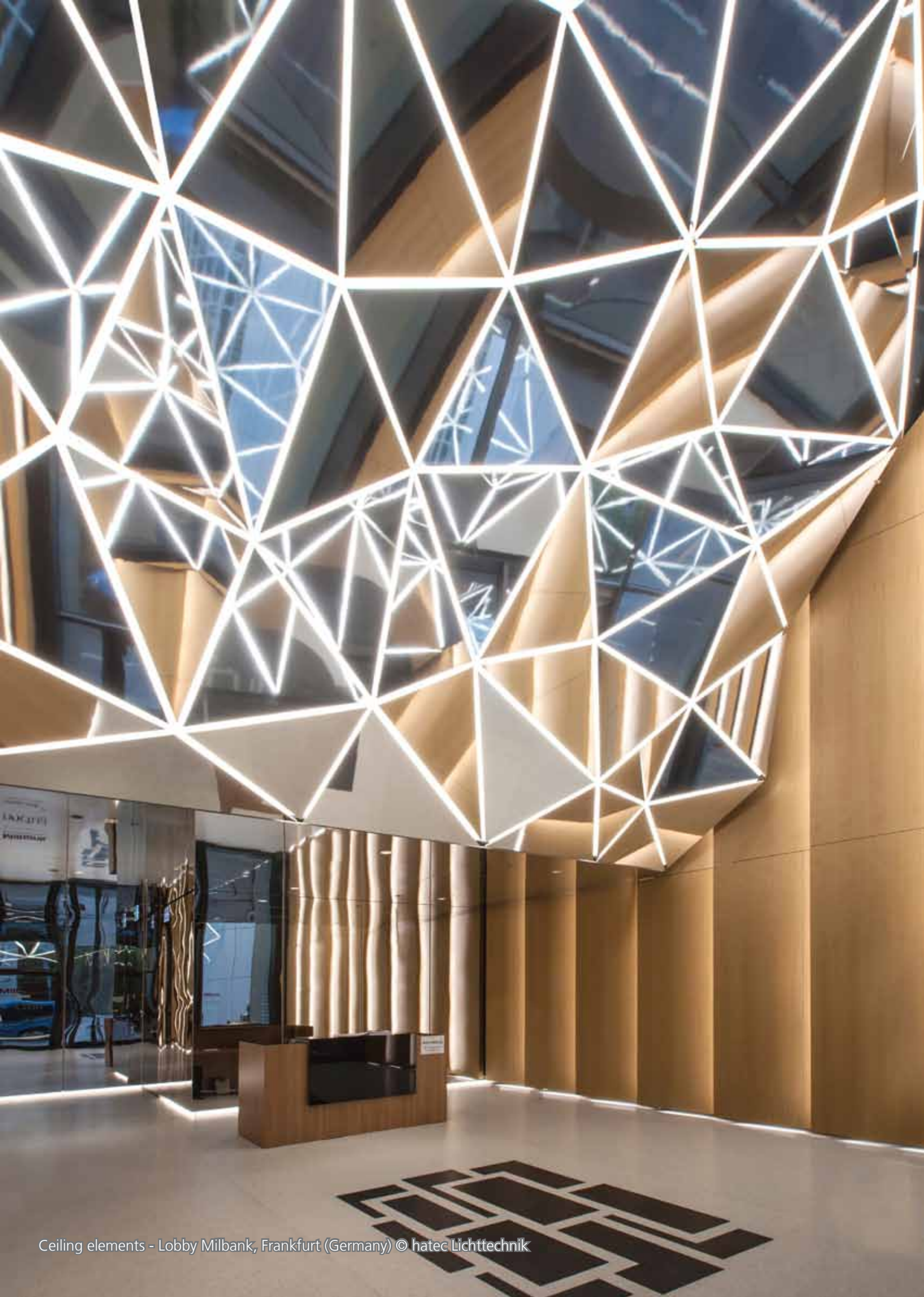
Acoustic element with LED, Easy Lights GmbH © Alexander Schölzel



Stadhuis, Lelystad (Niederlande)







Ceiling elements - Lobby Milbank, Frankfurt (Germany) © hatec Lichttechnik

# *Supply air*

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# Supply air

By using radiant ceilings, a large part of the cooling load of the rooms is carried away by the medium water.

The supply air required for the room can be brought into the room at low temperatures, also to discharge cooling loads.

The exact values are to be determined by TGA specialist planners. The supply air outlet is concealed on the back of Metawell® radiant ceilings and ensures a horizontal air flow with swirl effect. The outlet cannot be seen from below because it is hidden behind the perforation.

There are three different nominal widths (NW) to choose from: NW 160, NW 200 and NW 250 - each with an installation height of 177 mm. Due to the large percentage of open area the pattern X6x8 results in particularly favorable values for noise level and the airside pressure drop.

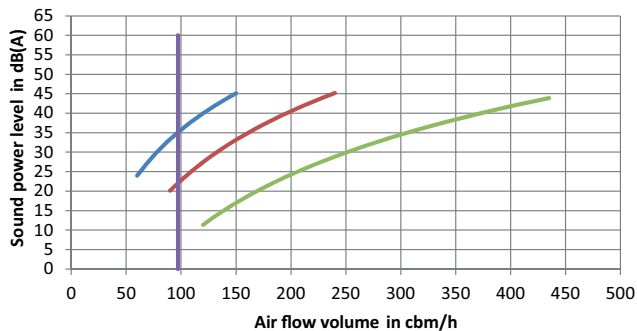
The exact design depends on the room dimensions, the number of sails and the supply air volume flow.

Calculation example:

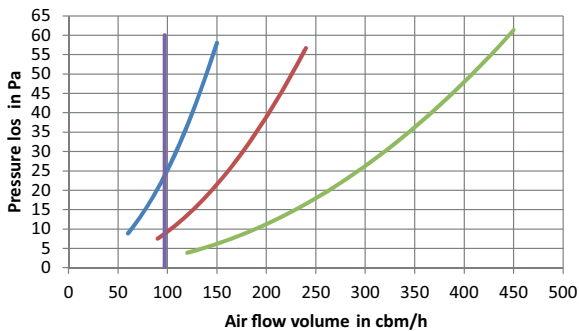
## Layout

<b>Room</b>		<b>Room category</b>		<b>Cooling</b>		<b>Heating</b>	
Width	4.1 m	<b>Emissions</b>	good low	Supply air	18.0	21.0	°C
Length	5.0 m			Room	26.0	21.0	°C
Height	3.2 m			Temperature difference	8.0	0.0	K
Surface	20.3 qm	<b>People</b>	2 Pers.	Performance	264.4	0.0	W
Volume	64.8 cbm	<b>Air boxes</b>	1 Pcs		13.0	0.0	W/qm
<b>Ventilation</b>		<b>Standard</b>		<b>Demand</b>		<b>Choice</b>	
Air changes		5.0	1.5	1.5	/h		
Air needed		324		97	cbm/h		
						4.8 cbm/(h qm)	
						48.6 cbm/(h pers.)	

## Diagram



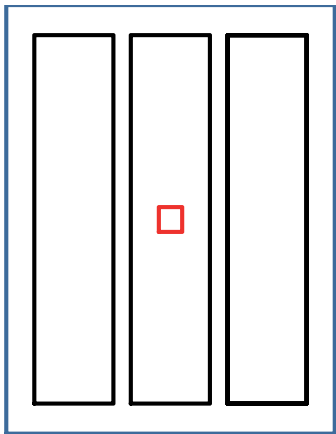
— X6x8 with TID160 — X6x8 with TID200  
— X6x8 with TID250 — Design point



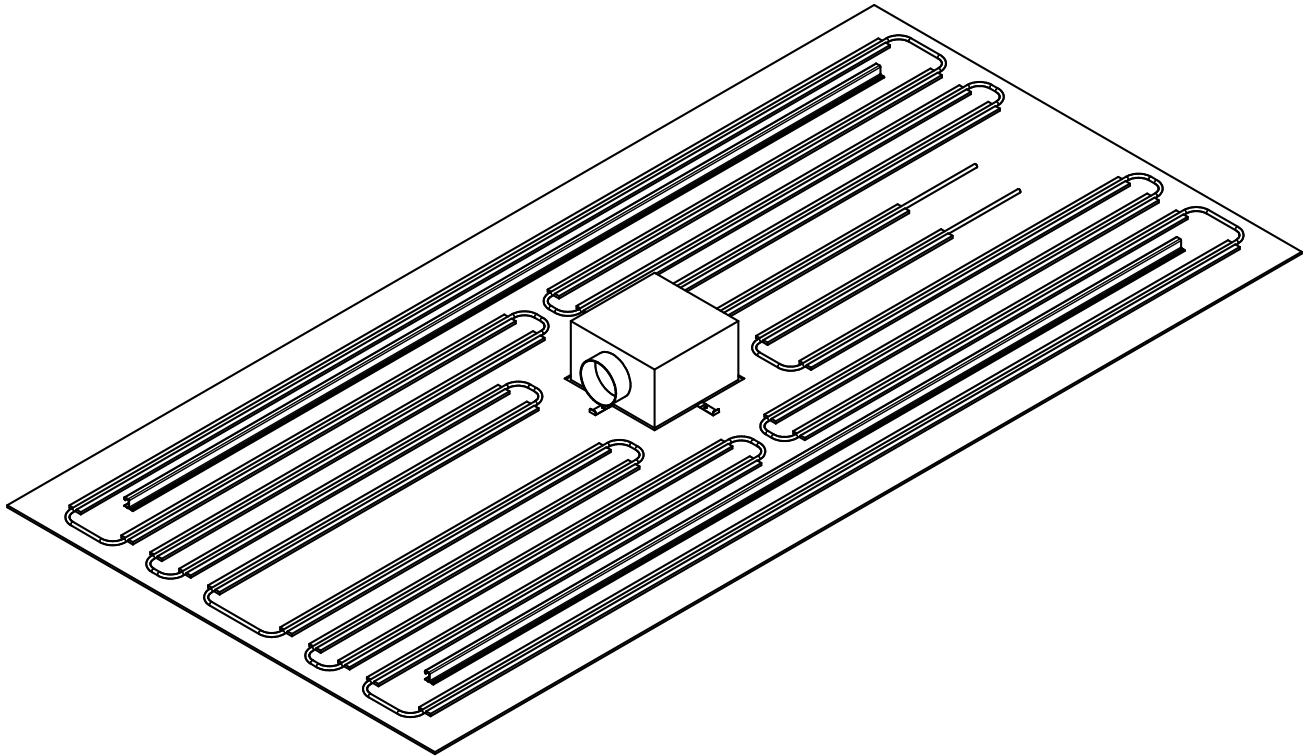
— X6x8 with TID160 — X6x8 with TID200  
— X6x8 with TID250 — Design point

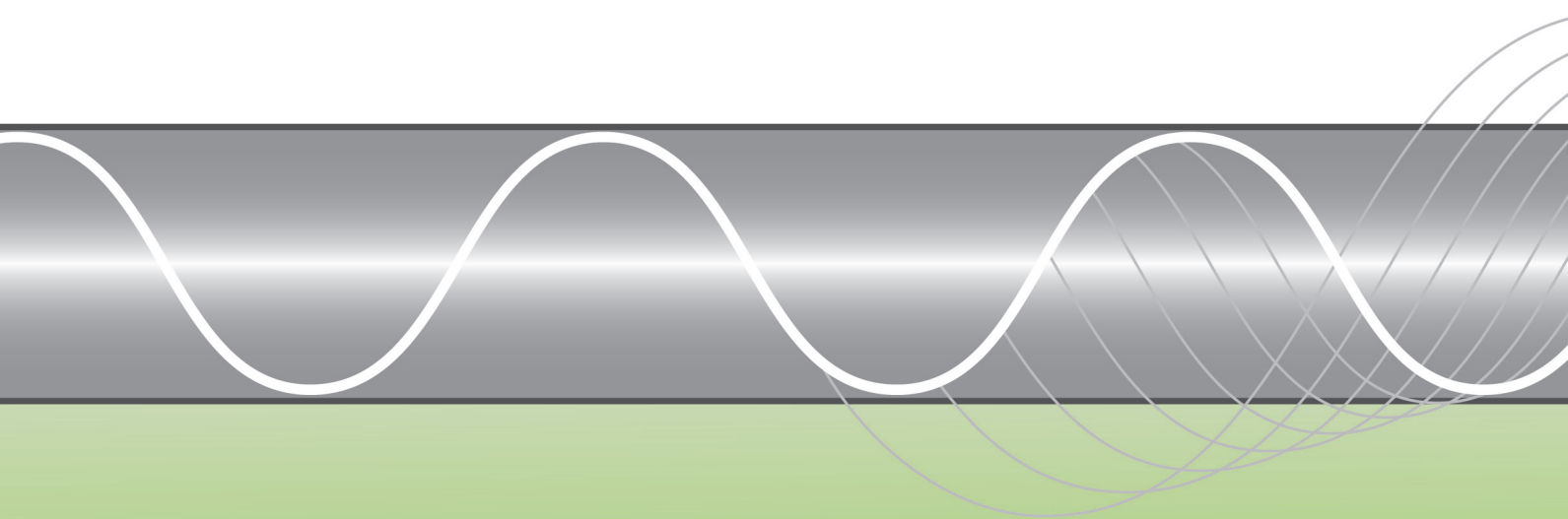
## Ceiling plan for X6x8 with TID160

<b>Ceiling plan</b>	
Axes	3 Pcs
Frieze	0.350 m
Distance	0.220 m
Width	0.987 m
Length	4.300 m
<b>Air box</b>	
Width	0.290 m
Length	0.290 m
Height	0.177 m
Recess	0.35 m
Connection	0.123 m
Supply air	97.2 cbm/h
Sound	35.1 dB(A)
Pressure	23.8 Pa
Throw distance	1.5 m



# *Supply air*





## **Metawell GmbH**

*metal sandwich technology*

*Schleifmuehlweg 31 · D-86633 Neuburg / Donau*

*Phone +49 8431 6715-0 · Fax +49 8431 6715-792*

*info@metawell.com · www.metawell.com*

*info@metawell.com · www.metawell.com*