
UP
MAGAZINE
EDUCATION 03
Special Edition: Ball-Proof Safety
FURAL
METALIT
DIPLING
BRÜNSCH

Sport hall | Bus Depot and School Wetzikon (CH)

» Ball-Proof at the Highest Level – our certified systems withstand 36 shots at 60 km/h without any damage. We are setting new standards for safe, installation-friendly ceiling solutions in sport halls. «

Christian Demmelhuber
CEO Fural Group

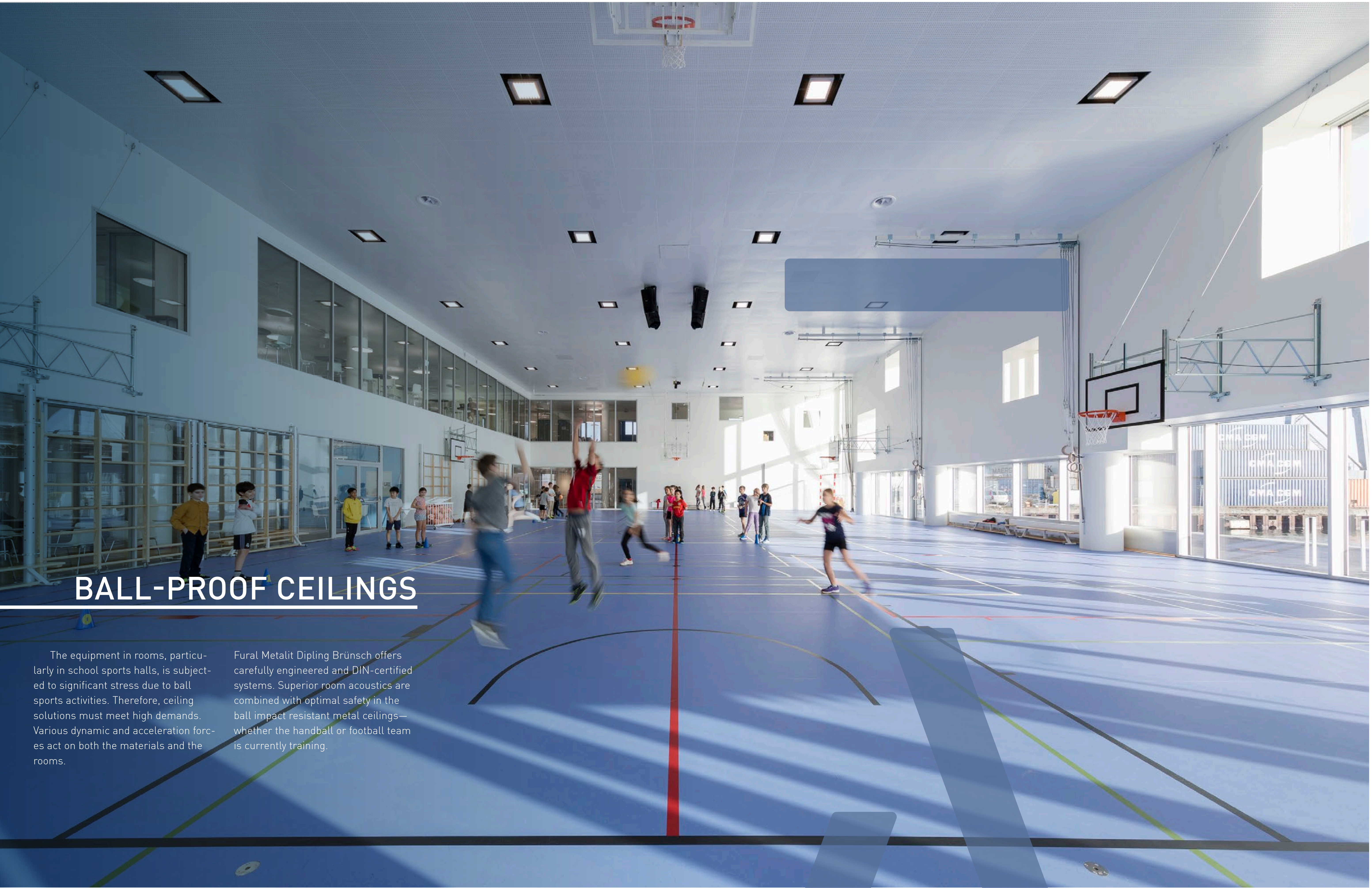
WHY METAL CEILINGS?

- The components come with a finished surface directly from delivery.
- Delivery and installation are dust-free.
- Both the ceilings and substructures are characterized by their durability (50+ years).
- Metal ceilings are particularly hygienic due to their closed lacquer surface.
- The lacquer surfaces are excellent for both dry and wet cleaning.
- For classrooms and sports halls, our ceilings can be manufactured to be ball impact resistant.
- Our metal ceiling systems are easily accessible for maintenance and inspections.
- Simple dismantling is possible.
- Our products are designed for reuse.
- All our components allow for pure-material recycling.
- We offer a wide variety of perforation options.
- Integration of technical elements is easy and precise.
- Our metal ceiling systems provide optimal compatibility with heating and cooling elements.
- We manufacture precise and aesthetically appealing products.
- Modular prefabrication enables short construction times.

Acoustics
Heating and Cooling
Fire Protection
Hygiene
Design
Sustainability
Parzifal®
Baffle
Ball Impact Safety

UP

We are committed to creating a healthy learning environment



BALL-PROOF CEILINGS

The equipment in rooms, particularly in school sports halls, is subjected to significant stress due to ball sports activities. Therefore, ceiling solutions must meet high demands. Various dynamic and acceleration forces act on both the materials and the rooms.

Fural Metalit Dipling Brünsch offers carefully engineered and DIN-certified systems. Superior room acoustics are combined with optimal safety in the ball impact resistant metal ceilings—whether the handball or football team is currently training.

SAFETY FOR SPORTS FACILITIES

Ball-Proof metal ceilings not only provide protection against strong mechanical forces – they also meet the highest standards for stability, durability, and certified safety in accordance with DIN 18032. Whether in gymnasiums, sports halls, or multi-purpose halls: these ceiling solutions remain dimensionally stable and resilient, even under intense and continuous use.

...the perfect acoustic solution.

Ball-proof safety test

Expanded Metal Ceiling | Sandgruben School, Basel (CH)

Learning in a Whisper Culture

Hearing enables communication, spatial orientation, and qualitative perception of our environment. Since we spend most of our time indoors, room acoustics play a significant role in our daily lives.

School thrives on verbal interaction. When room acoustics are poor and speech intelligibility in the classroom is compromised, it often results in both cognitive and health-related impacts on students and teachers.

Individual and group well-being can be negatively affected, and teaching, learning, and social interaction are disrupted.

In rooms with good acoustics, active listening is possible over longer periods, as acoustic disturbances are minimized.

With metal ceiling systems from Fural Metalit Dipling Brünsch, room acoustics can be significantly improved—not only in classrooms and offices but also in corridors and common areas. This transforms the school into an acoustically relaxed environment and an ideal place for learning.

↑ UP

Acoustic

»You are always active with a certain amount of noise.
But true impact happens in silence.«
(Peter Bamm, 1897–1975)

Speech Intelligibility

Speech intelligibility plays a particularly important role in educational settings: spoken instruction only works when children can concentrate on listening and the teacher's voice is not unnecessarily strained. This involves not only controlling reverberation but also minimizing background noise caused by activities such as moving chairs, whispering, or coughing.

While adults are often able to filter out such disturbances, younger students are far more easily distracted. Therefore, speech intelligibility is a fundamental factor in successful learning.

This is precisely where metal ceiling solutions from Fural Metalit Dipling Brünsch offer real benefits. For the specific demands of school construction, we offer a range of ceiling systems tailored to meet these acoustic challenges.

Indoor Air Quality

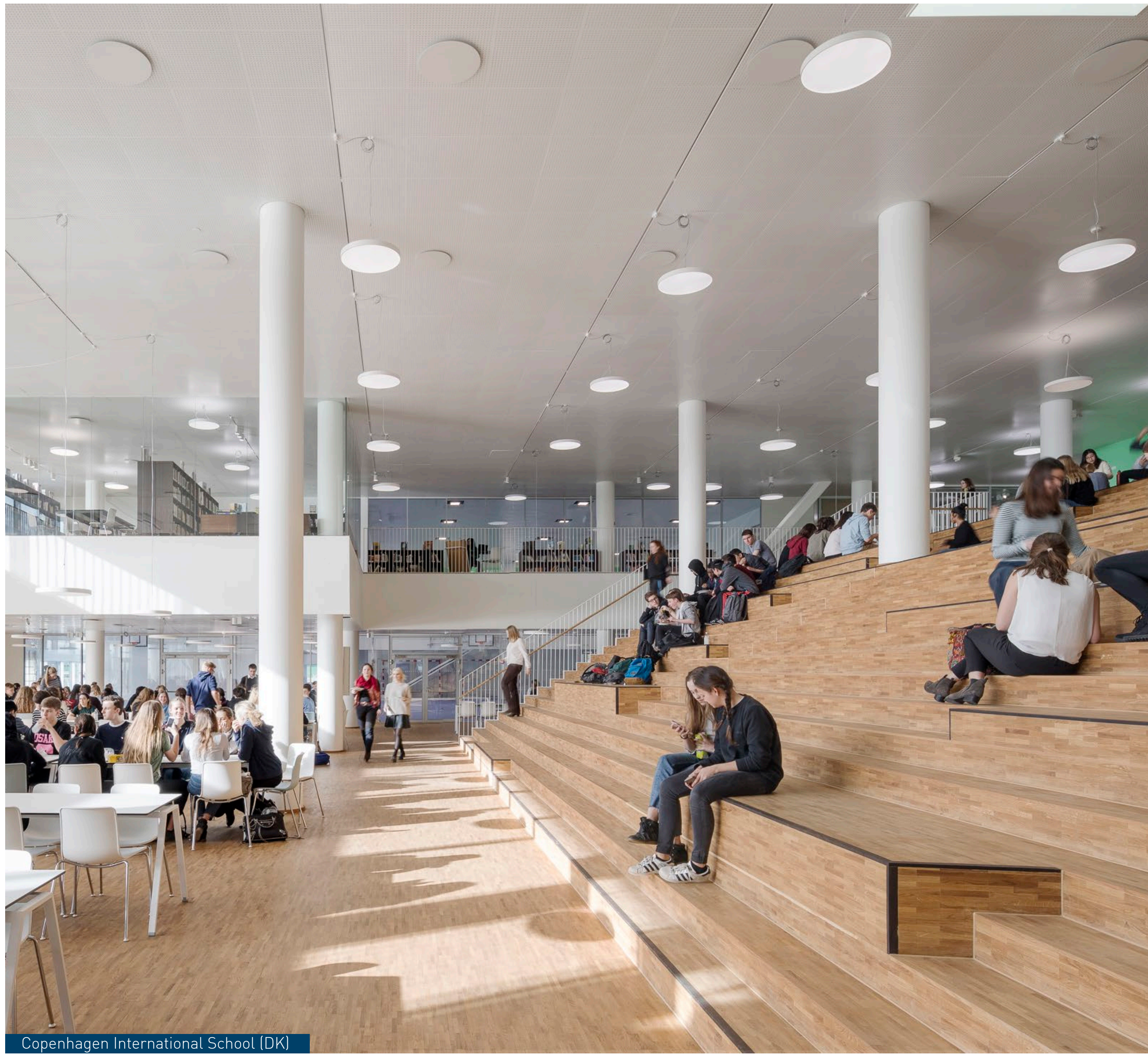
Indoor air quality is significantly influenced by the building materials used. Forward-looking construction projects are accompanied by ecological assessments during the planning and construction phases to select materials and chemicals based on environmental criteria and to avoid the introduction of harmful substances.

Special attention is given to solvents and allergenic building materials.

Potential sources of pollutants in building products include fibers, radon (from granite), and VOCs (volatile organic compounds) found in solvents in paints, adhesives, and coatings; biocides in wood preservatives and carpets; PAHs in parquet adhesives; as well as formaldehyde-containing adhesives in wood-based materials.

Compared to other ceiling materials, our metal ceilings and walls significantly contribute to improved indoor air quality and achieve excellent results in VOC testing. Additionally, our fire protection ceilings meet the required fire resistance ratings without the use of synthetic mineral fiber inserts.


Copenhagen International School (DK)


Copenhagen International School (DK)

ACOUSTICS TERMINOLOGY

Sound and sound level

The term "sound" refers to localised vibration and the propagating waves. These can occur in air (**airborne sound**) or in solid materials (**structure-borne sound**). If floors, ceilings and stairs are stimulated to vibrate by footfall, this is referred to as **impact sound**.

The sound intensity is designated with sound level L and specified in the decibel (dB) unit.

Acoustic quality

The term "acoustic quality" describes the interaction of the acoustic factors of a room for such sound events as music or speech with reference to the individual location of the person listening.

Rather than any physical properties of the room, the acoustic quality describes audio-physiological and audio-psychological effects on the listeners.

Acoustic quality is therefore not a clearly ascertainable quantity. It also depends on individual and subjective factors, for example on hearing capacity and listening experience.

However, the aim of a good acoustic plan should also be to include people with poorer hearing and therefore to achieve generally good average audibility.

Sound absorption area

The so-called **equivalent sound absorption area**, A, of a component is calculated by multiplying its area with the sound absorption coefficient, α.

All boundary surfaces, S_i, of a room have individual sound absorption coefficients, α_i, which allows the equivalent sound absorption area, A_i, to be determined for each partial area:

$$A_i = \alpha_i \times S_i (m^2)$$

The total equivalent sound absorption area, A, is calculated by adding up the individual amounts:

$$A_{total} = \alpha_1 \times S_1 (m^2) + \alpha_2 \times S_2 (m^2) + \dots$$

Reverberation time

The reverberation time, T_{60}, is a measure of the time required for the sound pressure to reduce to 1/1000 of its initial value after the sound source becomes silent.

This value is usually determined for a centre frequency (500 Hz or 1000 Hz) and specified accordingly.

The reverberation time increases in proportion to the volume of the room and in inverse proportion to the equivalent sound absorption area, A.

Sabine formula

In the field of technical acoustics, reverberation time T is calculated with the "Sabine formula":

$$T = V \div A \times 0.163$$

"V" describes the room volume and "A" the equivalent sound absorption area in m^2.

What do abbreviations α_s, α_p, α_w and NRC A stand for?

α_s (alpha$_s$) describes the so-called **one-third-octave** value. In a close spacing of thirds, 18 different sound absorption values are measured between 100 and 5000 Hz (100 Hz, 125 Hz, 160 Hz, 200 Hz, 250 Hz, 315 Hz, 400 Hz, 500 Hz, 630 Hz, 800 Hz, 1000 Hz, 1250 Hz, 1600 Hz, 2000 Hz, 2500 Hz, 3150 Hz, 4000 Hz and 5000 Hz). A value of 1.0 means complete absorption, while a value of 0.0 means complete reflection.

α_p (alpha$_p$) describes the so-called **practical sound absorption coefficient**. Three on-third-octave values α_s are used to calculate an **octave value** α_p. In addition 6 frequencies are represented (125 Hz, 250 Hz, 500 Hz, 1000 Hz, 2000 Hz and 4000 Hz).

α_w (alpha$_w$) describes the so-called **weighted sound absorption coefficient**. This is frequency-dependent and specified as a single-number value rounded to the nearest 0.05. The α_w value can be supplemented with so-called "shape indicators". These state that the measured values in the low (L), mid (M) or high (H) frequency range are better than those identified by the α_w value (see index word "shape indicators").

NRC A specifies the average of the sound absorption at octave values 250 Hz, 500 Hz, 1000 Hz and 2000 Hz, rounded to the nearest 0.05. A noise reduction coefficient of 0.80 stands for an average sound absorption of 80%.

Shape indicators (L/M/H)

The weighted sound absorption coefficient, α_w, can be supplemented with so-called "shape indicators", expressed by the letters L, M and H (low, mid, high), in which frequency ranges the sound absorption level is particularly high.

- L Particularly good absorption up to 250 Hz
- M Particularly good absorption at 500 Hz to 1000 Hz
- H Particularly good absorption at 2000 Hz to 4000 Hz

Absorber classes

According to DIN EN 11654, acoustic elements are assigned to absorber class A, B, C, D or E based on their sound absorption coefficient.

- A Extremely absorbent α_w 0.90–1.00
- B Highly absorbent α_w 0.80-0.85
- C Very absorbent α_w 0.60-0.75
- D Absorbent α_w 0.30-0.55
- E Slightly absorbent α_w 0.15-0.25

Longitudinal sound insulation $D_{n,f,w}$

In buildings with a skeleton construction – typically nearly all new office buildings today – the individual rooms are separated by lightweight partition walls. The ceilings are suspended.

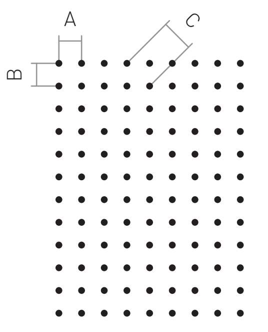
The cavity that this creates between raw ceiling and suspended ceiling acts as a sound transmission path which must be compensated for with longitudinal sound insulation.

The longitudinal sound insulation can be implemented with vertical or horizontal compartmentalisation.

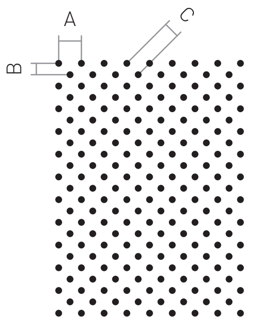
The longitudinal sound insulation is determined according to EN ISO 717-1 and specified as a weighted normalised flanking sound level difference **$D_{n,f,w}$** in **dB** units.

Here "$D_{n,f}$" describes the normalised flanking level difference for flanking components (e.g. suspended ceilings). "$_w$" means that the measured values have been weighted in accordance with normative specifications. The specified numerical value is the value read from the reference curve at 500 Hz.

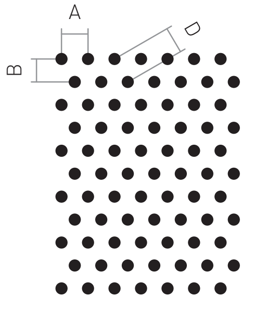
The reference curve is not shown in the test report diagrams.



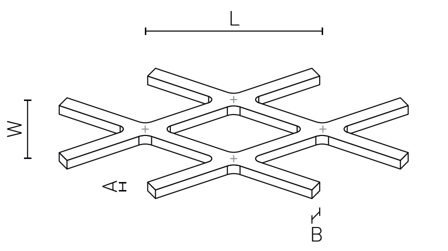
Rg



Rd



Rv



Mesh

Perforation sizing

- A Horizontal spacing
- B Vertical spacing
- C Diagonal spacing 45°
- D Offset spacing 60°

Expanded Metal Dimensions

- A Web Thickness
- B Web Width
- L Mesh Length
- W Mesh Width

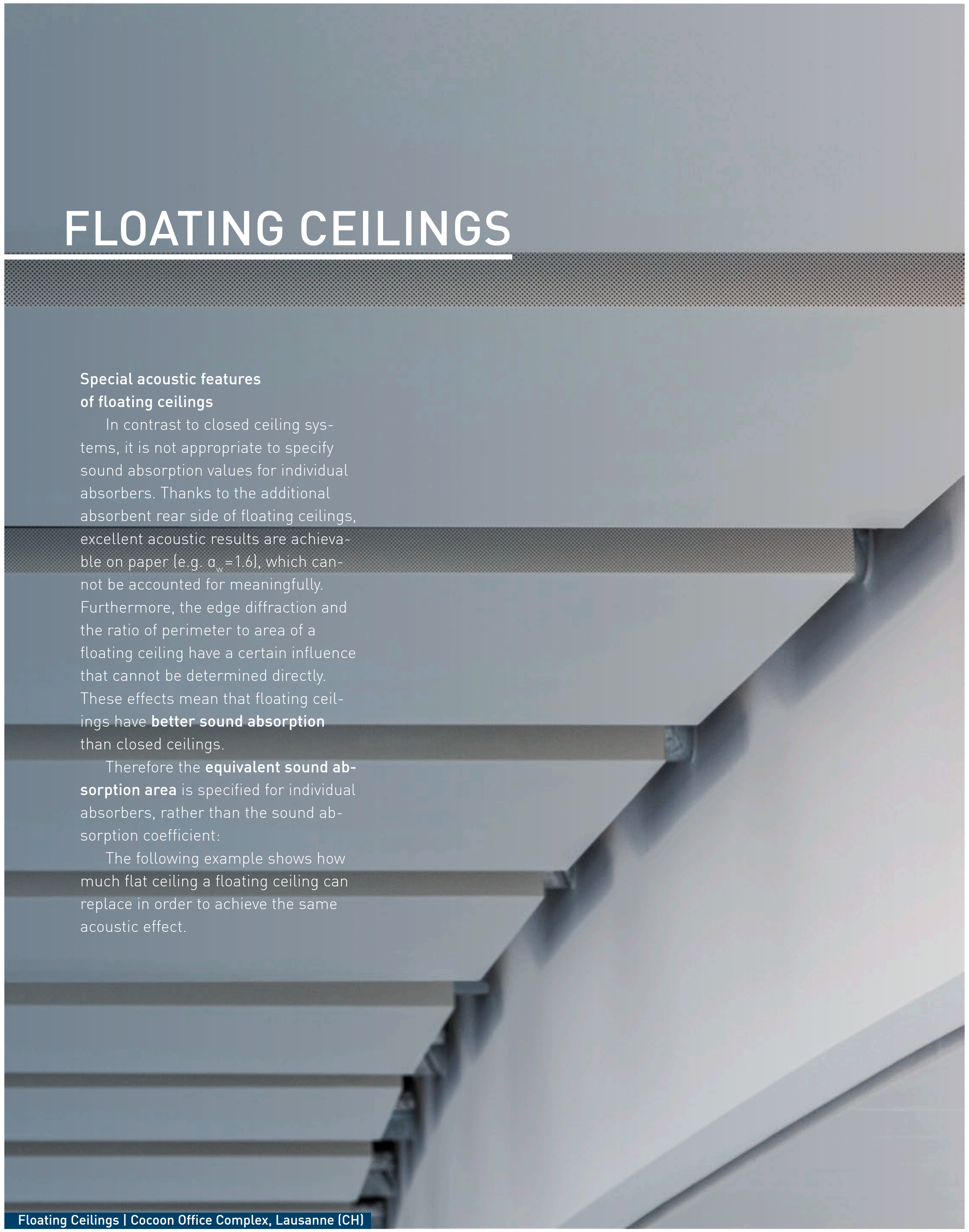
BALL-PROOF CEILINGS PLUS ACOUSTICS

Acoustics play a central role, especially in large hall spaces. Metal ceilings with integrated absorption systems significantly reduce reverberation and improve sound behavior. This lowers noise levels, enhances speech intelligibility, and makes sports more enjoyable for everyone.

Floating Ceilings absorb sound on both the front and back sides, significantly improving room acoustics!

Ceiling Sails | Secondary School, Munich Moosach (DE)

FLOATING CEILINGS



Special acoustic features of floating ceilings

In contrast to closed ceiling systems, it is not appropriate to specify sound absorption values for individual absorbers. Thanks to the additional absorbent rear side of floating ceilings, excellent acoustic results are achievable on paper (e.g. $\alpha_w = 1.6$), which cannot be accounted for meaningfully. Furthermore, the edge diffraction and the ratio of perimeter to area of a floating ceiling have a certain influence that cannot be determined directly. These effects mean that floating ceilings have **better sound absorption** than closed ceilings.

Therefore the **equivalent sound absorption area** is specified for individual absorbers, rather than the sound absorption coefficient.

The following example shows how much flat ceiling a floating ceiling can replace in order to achieve the same acoustic effect.

Floating Ceilings | Cocoon Office Complex, Lausanne (CH)

Example
- Room situation with dimensions l = 10 m, w = 10 m, h = 3 m
- Floor space: 100 m²
- Room volume V: 300 m³
- Carpet (100 m²): α = 0.06
- Plastered ceiling and wall (190 m²): α = 0.03
- Glass window front (30 m²)· α = 0.01
- Unfurnished

Formulas
- Equivalent sound absorption area A (α = degree of absorption, S = area): $A = \alpha \times S$
- Reverberation time T (V = volume): $T = 0.163 \times V/A$ (Sabine formula)

	Recommended reverberation time T ~ 0.6 s (DIN 18041)	Initial situation of a plastered, reverberant ceiling	All-over metal ceiling Fural Rg 2.5 – 16 % with 30 mm mineral wool 45 kg/m³ in PE film	Floating ceilings Fural Rg 2.5 – 16 % with 50 mm mineral wool 100 kg/m³ in PE film
T	Calculated reverberation time	3.0 s	0.6 s	0.6 s
S	Area of metal ceiling	–	75.0 m²	49.0 m² ~ 17x
A	Equivalent sound absorption area of the whole room	16.0 m²	81.8 m²	82.3 m²

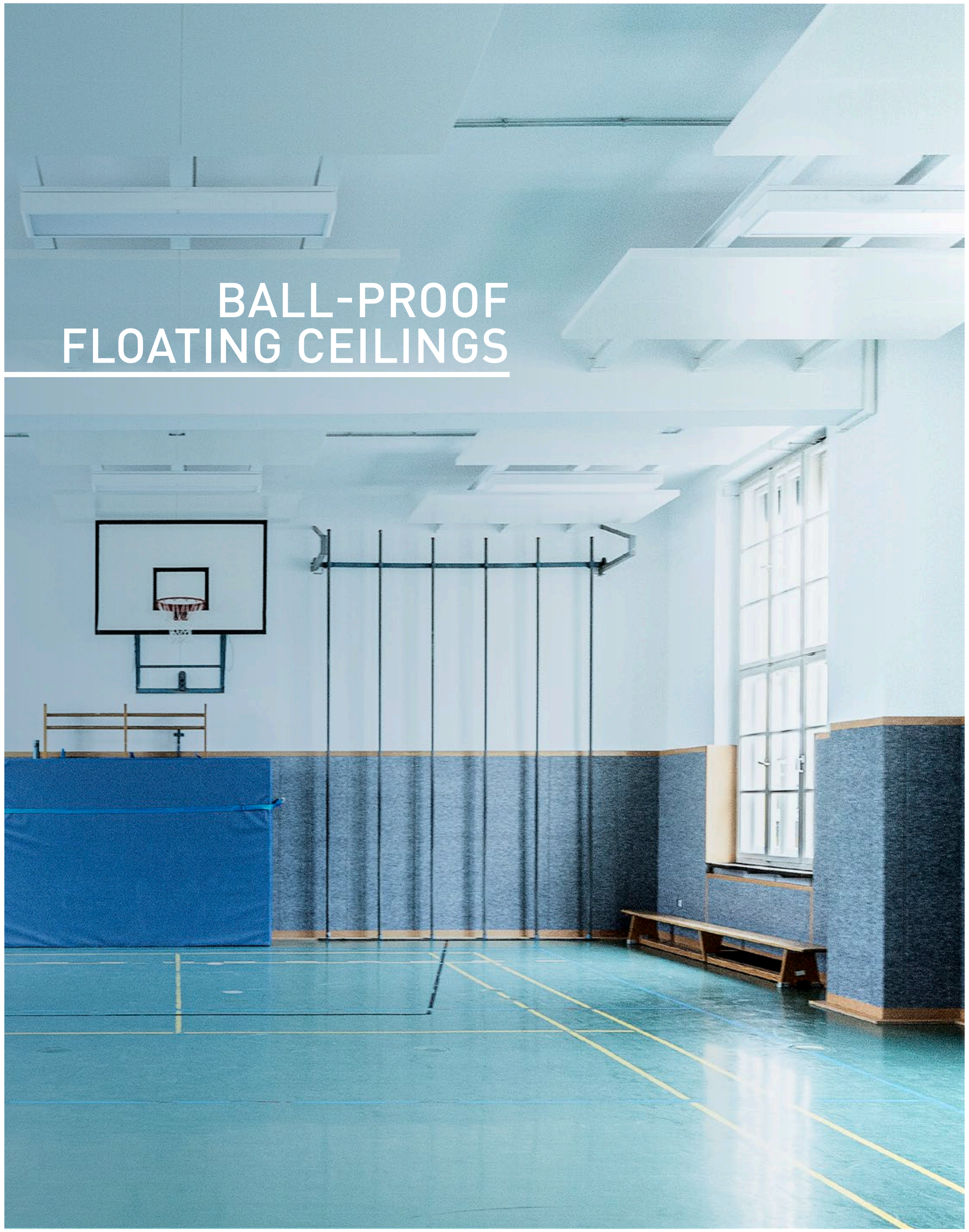
(The individual calculations can be found on the next page.)

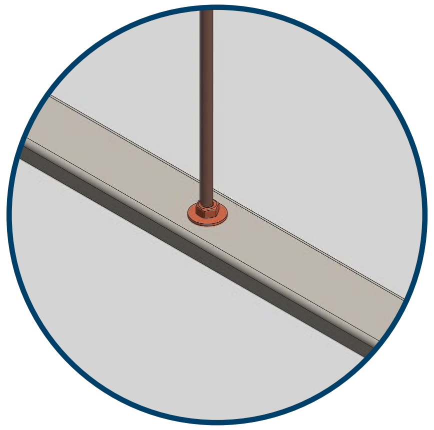
Conclusion

In order to achieve the same acoustic effect in a room, a much smaller area is required if floating ceilings are used. The additional physical dampening effects can yield a **material saving of up to 30%**.

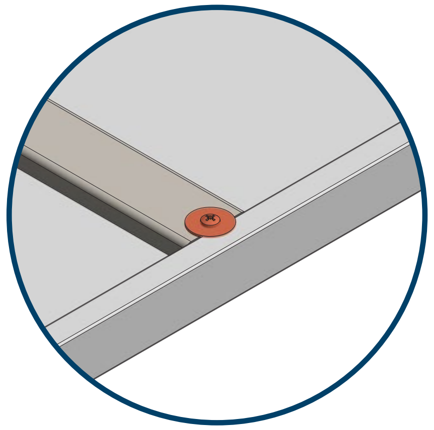
The benefits of floating ceilings
- Additionally absorbent rear side
- Saving of ~ 30% material area compared to a metal ceiling
- More flexible in terms of layout
- Existing lighting may continue to be used
- Straightforward retrofitting
- Can be used or retrofitted during building core activation
- Simple subsequent air conditioning

BALL-PROOF FLOATING CEILINGS





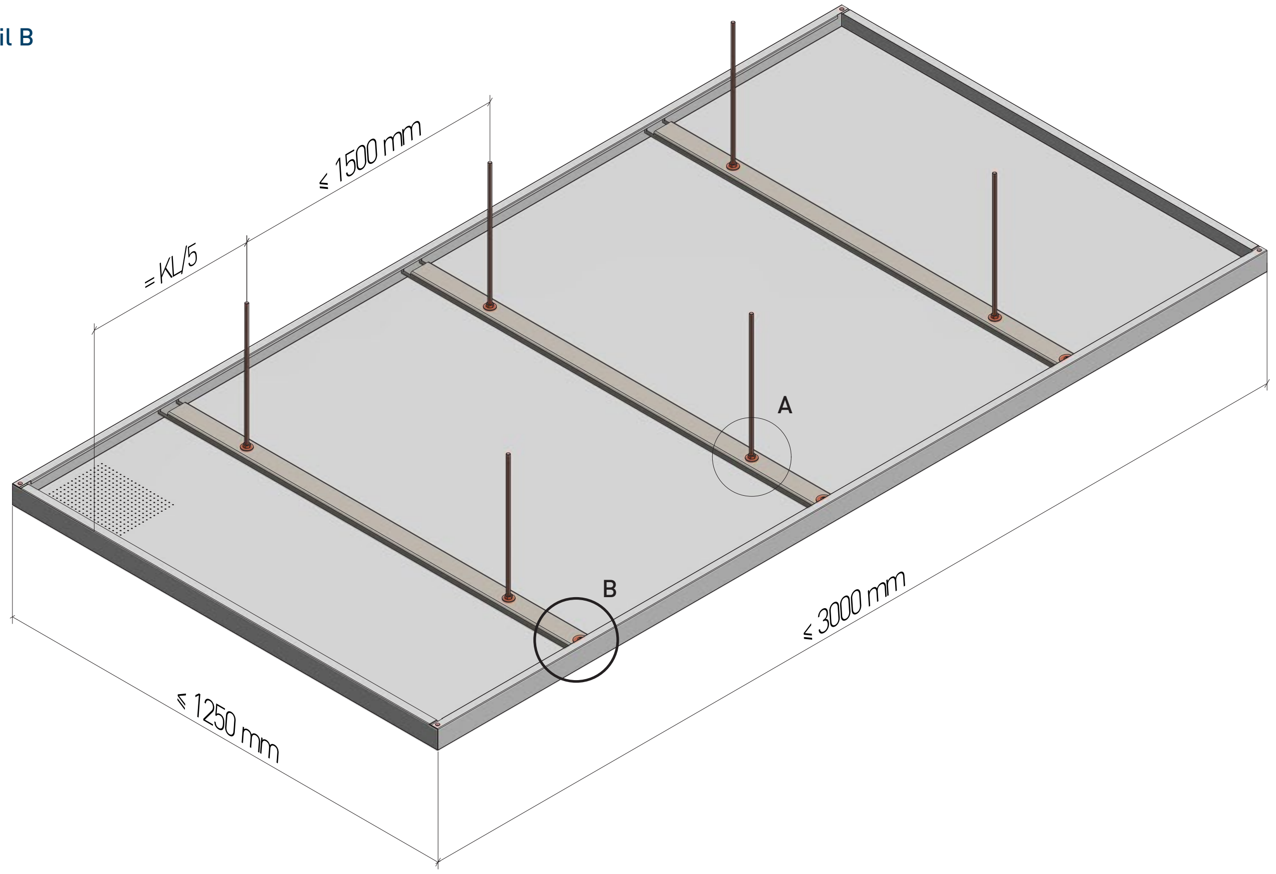
Detail A



Detail B

Floating Ceilings are an important element in contemporary architecture. When designed to be ball impact resistant, the individually suspended panels can also be installed in areas with higher demands.

The Floating Ceilings are made from durable, perforated steel sheets and are mounted using threaded rods. Their open construction allows for flexible arrangement within the space and effectively supports room acoustics exactly where needed. At the same time, the ceiling remains visually open and modern.



Drawing | Floating Ceiling with Threaded Rod

RENOVATION MADE EASY

Metal ceilings are the ideal solution for the renovation and refurbishment of sports and gymnasium halls. They can be flexibly adapted to existing building structures, allow for quick and clean installation, and easily integrate modern features such as acoustics, ventilation, or lighting.

Especially in older halls, metal ceilings create a new sense of design clarity, significantly improve room acoustics, and meet current requirements for hygiene, fire protection, and ball impact resistance according to DIN 18032.

With their robust construction, durable materials, and low-maintenance surfaces, they offer a future-proof solution—functional, economical, and aesthetically convincing. This transforms aging halls into modern spaces for sports, movement, and social interaction.

Perforated Metal Ceiling | Town Hall, Grafenwöhr (DE)

HYGIENE AND EASE OF MAINTENANCE

Cleanliness is especially important in sports and gym halls. Metal ceilings excel in this regard with smooth, easy-to-clean surfaces and optional antibacterial coatings. They are resistant to moisture, dirt, and disinfectants—making them ideal for long-term use in hygiene-sensitive areas.

...the perfect acoustic solution.

Wall cladding | Mittelschule Moosach, Munich (DE)

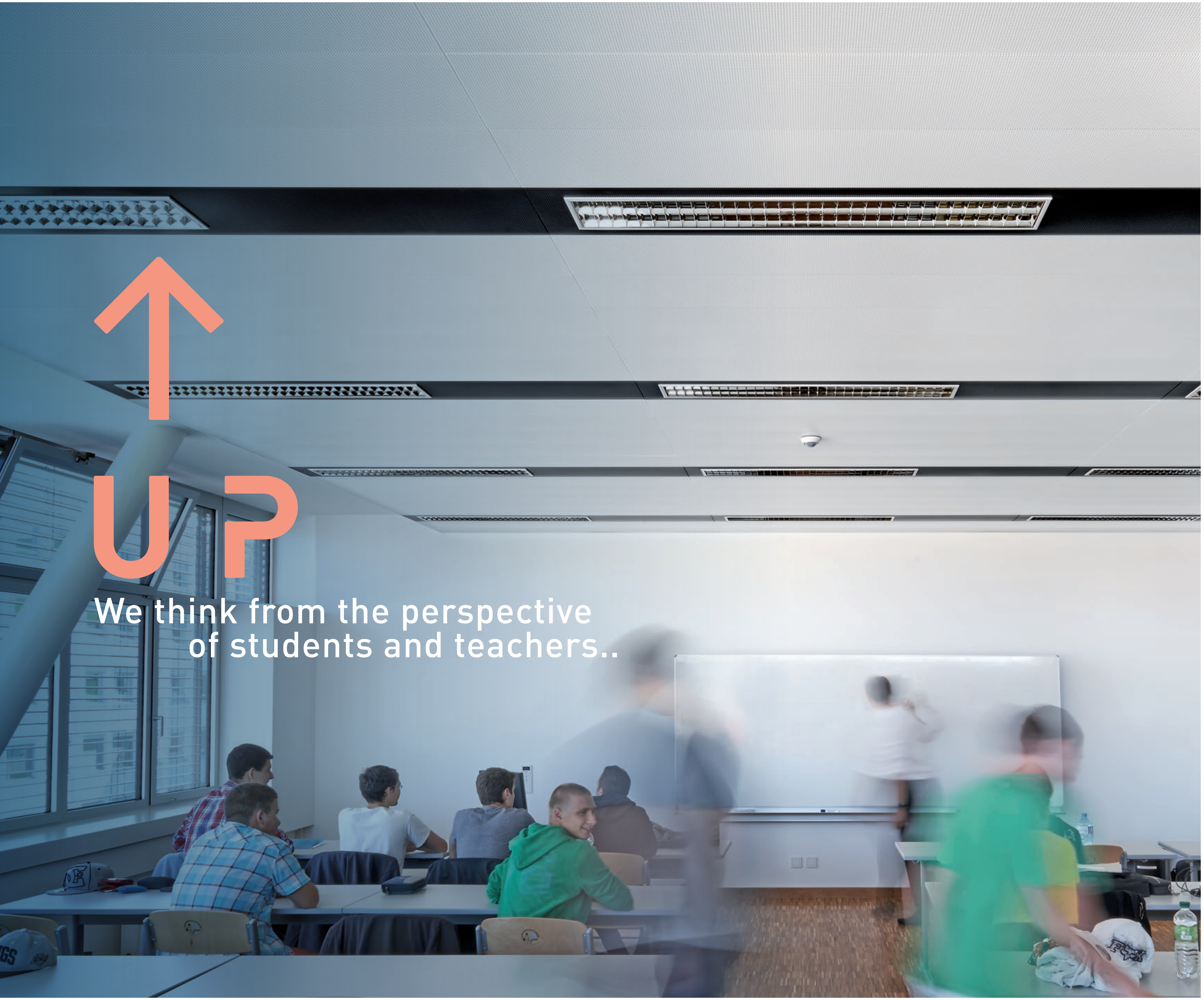
CLIMAT AND INDOOR AIR QUALITY

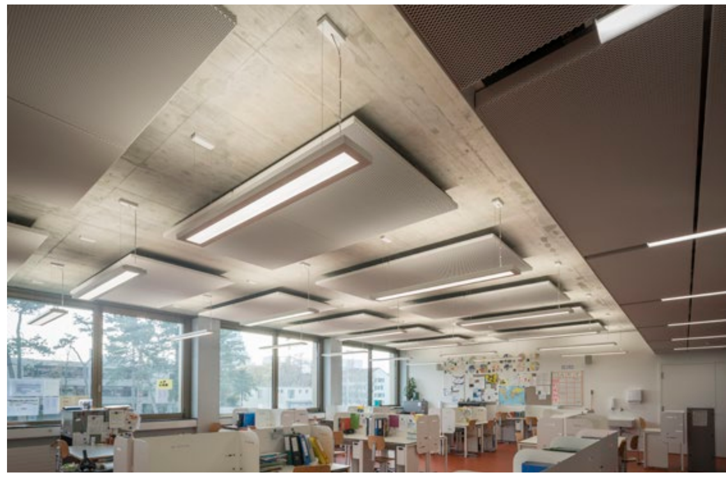
The well-being of pupils and teachers and their ability to concentrate and perform are influenced by various factors.

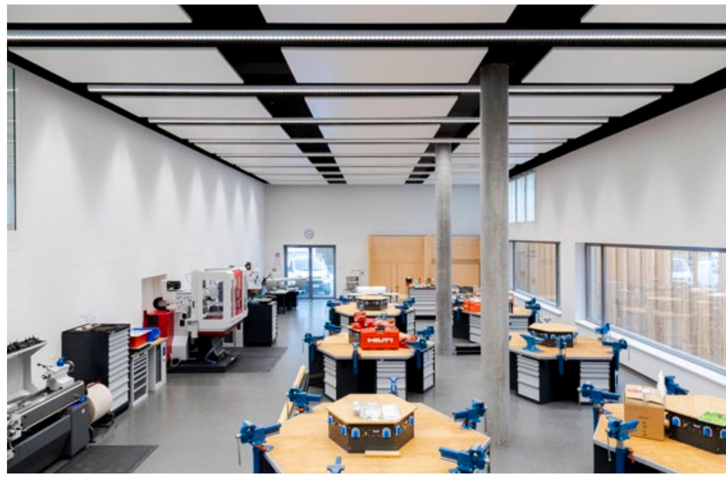
In addition to social factors, these include the comfort factors of indoor climate, indoor air quality, visual and room acoustic comfort, accessibility and the area of electromagnetic fields.

When planning teaching and learning spaces, the needs of the pupils should be considered first and foremost and only then should the technical and structural requirements and any problem areas of school operations be taken into account.

Floating Ceiling | E-Campus, Graz (AT)


UP
We think from the perspective
of students and teachers..





HEATING AND COOLING

Many children in one room also means a high amount of generated heat. To ensure a comfortable indoor temperature, metal ceilings can provide a practical and efficient solution. Thanks to its natural thermal conductivity metal is particularly well-suited for temperature control.

When designed as cooling ceilings, metal ceilings are especially energy-efficient due to their low supply temperature. Temperature regulation occurs via the principle of radiation—cooling is evenly distributed throughout the room without stirring up dust or creating drafts.

Cooling and heating ceilings using copper-aluminum or plastic systems can be implemented either as a continuous ceiling or as floating ceilings.

In the competition among schools for students, the surrounding environment can be a deciding factor. Parents also consider comfort and the visual appeal of the school when making their choice.

WLB | Heat Conducting Sheet

Innovation: Acoustic Guide Profile ALP with 100 W/m² Output Instead of 84 W/m² and 20% Higher Sound Absorption

- Less acoustically treated and activated surface required; possible elimination of additional absorption material
- Sustainability: 20% less material for the same performance,
  30% less copper due to reduced thickness (0.35 mm instead of 0.50 mm)
- Awarded the BVF Award 2023, BVF – 400 member companies in the field of surface heating and cooling

ALP | Acoustic Guide Profile

INTEGRATION

Ball-Proof metal ceilings are an integral part of a well-designed overall system: they can be installed quickly and safely, provide space for lighting, ventilation, and technical equipment — all while maintaining a uniform and functional appearance. Whether for new construction or renovation, their certified quality ensures maximum safety and design freedom.

Fittings | Karlstraße, Munich (DE)

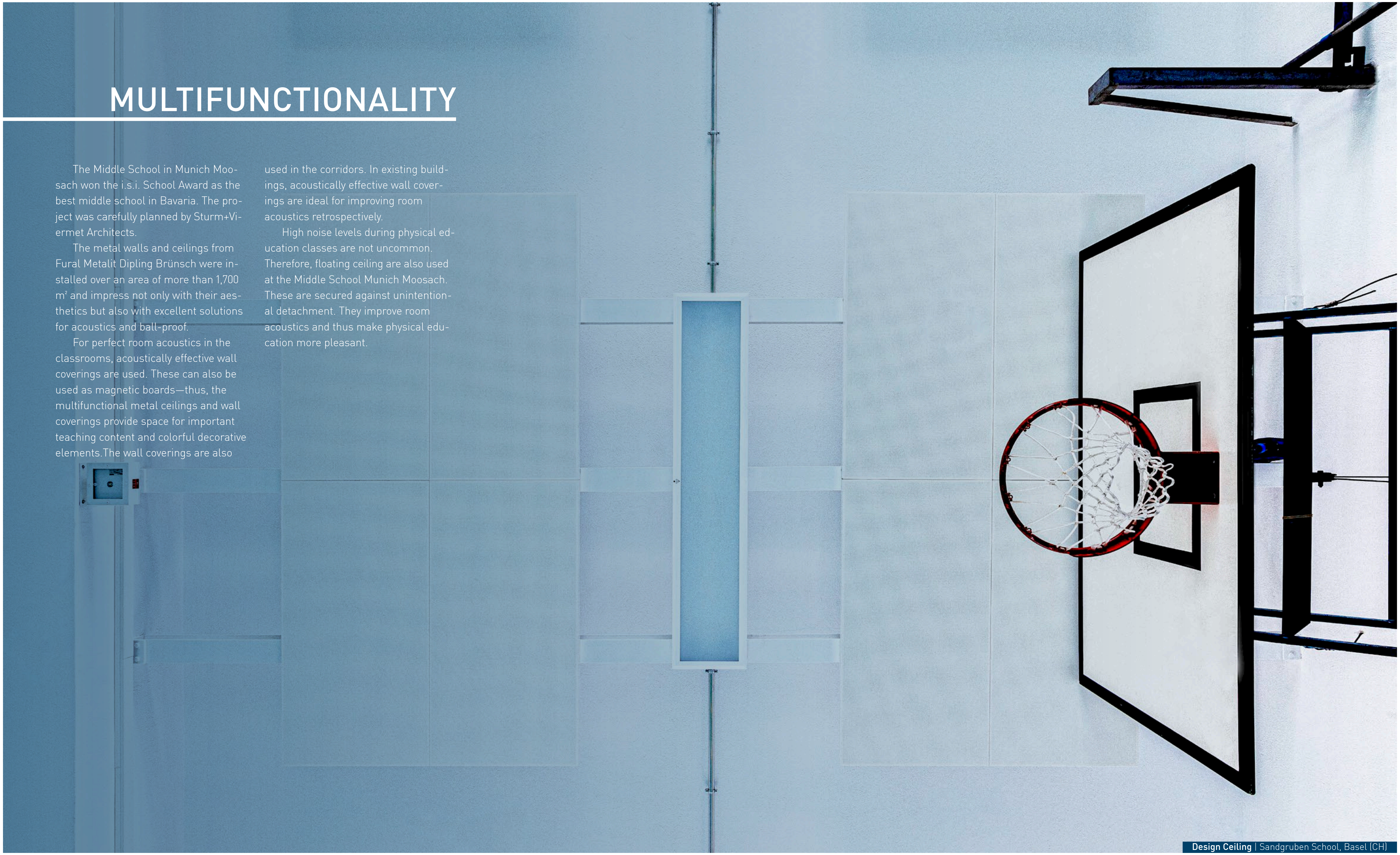
AESTHETICS

Sports halls are more than just functional spaces – they are places of gathering, competition, and inspiration. With high-quality metal design ceilings, they set architectural highlights that shape both space and atmosphere.

Our metal ceilings offer a wide range of design possibilities: from clean lines to delicate structures and individual color and surface finishes. They combine aesthetic design with practical
benefits such as ball-proof, sound insulation, and durability.

This creates spaces that not only impress technically but also captivate with their clear, modern appearance – perfect for top athletic performance and sustainable construction projects.

Design ceiling | Sandgruben School, Basel (CH)



MULTIFUNCTIONALITY

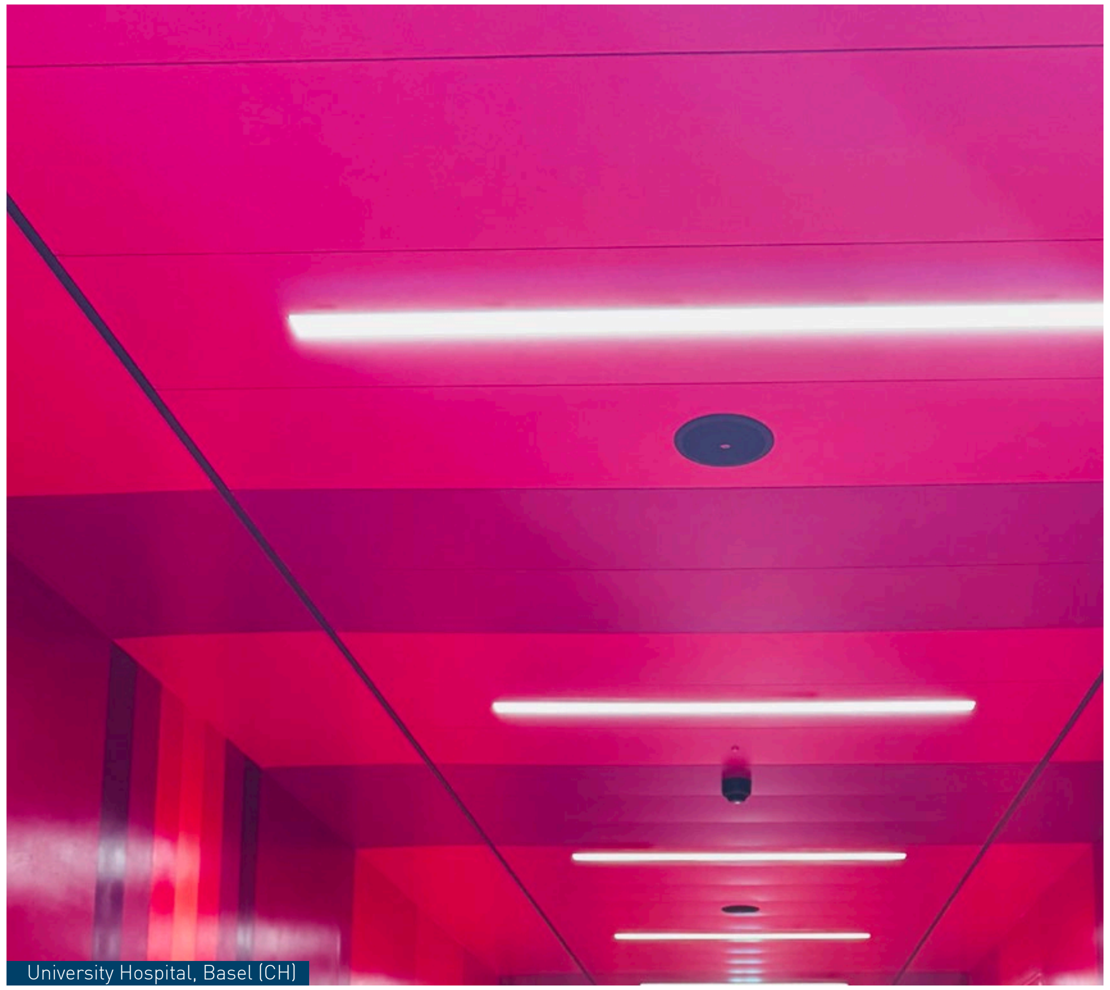
The Middle School in Munich Moosach won the i.s.i. School Award as the best middle school in Bavaria. The project was carefully planned by Sturm+Viermet Architects.

The metal walls and ceilings from Fural Metalit Dipling Brünsch were installed over an area of more than 1,700 m^2 and impress not only with their aesthetics but also with excellent solutions for acoustics and ball-proof.

For perfect room acoustics in the classrooms, acoustically effective wall coverings are used. These can also be used as magnetic boards—thus, the multifunctional metal ceilings and wall coverings provide space for important teaching content and colorful decorative elements.The wall coverings are also used in the corridors. In existing buildings, acoustically effective wall coverings are ideal for improving room acoustics retrospectively.

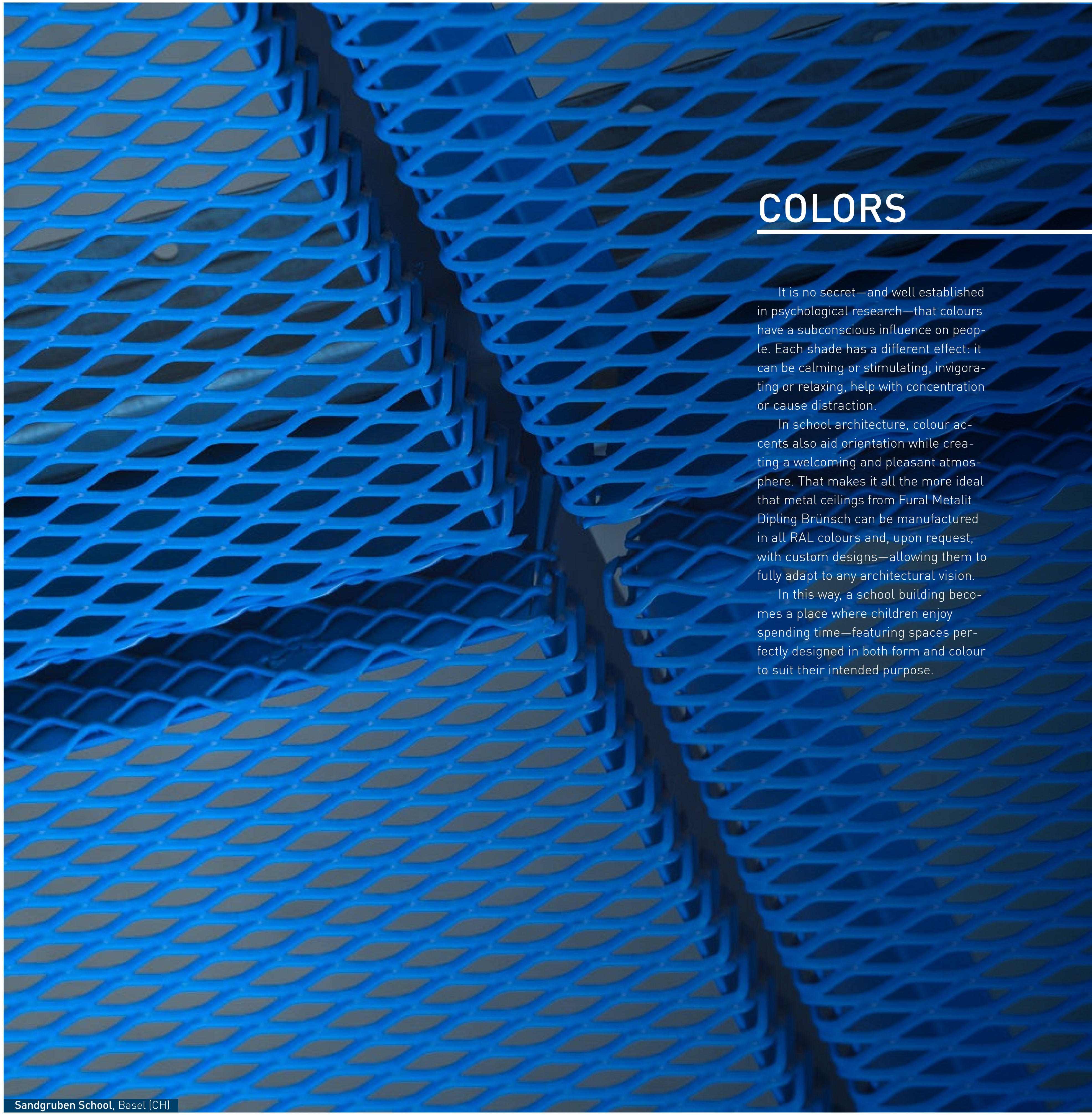
High noise levels during physical education classes are not uncommon. Therefore, floating ceiling are also used at the Middle School Munich Moosach. These are secured against unintentional detachment. They improve room acoustics and thus make physical education more pleasant.

Design Ceiling | Sandgruben School, Basel (CH)



University Hospital, Basel (CH)

Federal School Centre,St. Pölten (AT)



Sandgruben School, Basel (CH)

COLORS

It is no secret—and well established in psychological research—that colours have a subconscious influence on people. Each shade has a different effect: it can be calming or stimulating, invigorating or relaxing, help with concentration or cause distraction.

In school architecture, colour accents also aid orientation while creating a welcoming and pleasant atmosphere. That makes it all the more ideal that metal ceilings from Fural Metalit Dipling Brünsch can be manufactured in all RAL colours and, upon request, with custom designs—allowing them to fully adapt to any architectural vision.

In this way, a school building becomes a place where children enjoy spending time—featuring spaces perfectly designed in both form and colour to suit their intended purpose.

Reduce, reuse, recycle 100% circular economy

Sustainable building with sustainable metal ceilings

Sustainability – a topic that is increasingly becoming the focus of social discussions – and justifiably so!

In the fight against climate change, the conscientious use of resources and measures to promote the ecosystem are urgently needed to protect the environment. The idea of sustainability should also find its way into the construction industry: Thus, at Fural Metalit Dipling we focus on this and process our steel and aluminum sheets directly in the factory and to measure, which avoids unnecessary work on the construction site. In addition, metal ceilings allow repairs and revisions at any time without much effort and can be reused. Last, but not least, our metal ceiling systems are long-lasting and easy to recycle, thus gentle on the environment.

Building materials

The use of building materials and constructions with substances that cause environmental damage has long been avoided or greatly reduced in sustainable construction.

In addition, we always keep an eye on the reusability of individual components in the event of modernization or reconstruction. Since around 79% of mineral waste in Germany comes from the building industry and a total of around 53% of the entire waste volume can be attributed to the building industry, possible deconstruction or conversion is increasingly being taken into account as early as the planning phase.

In addition, building components and products that require less energy to manufacture are now preferred - assessing the energy flows involved in manufacturing, transporting, and processing building materials involves calculating their primary share of non-renewable energy, their share of global warming, and their share of acidification.

Metal ceilings for more comfort in the room

Metal ceilings are ideal for cooling and heating rooms, because the temperature control is based on the radiation principle: The heat or cold radiates gently through the metal ceiling directly into the room. In addition, cooling ceilings work completely without air circulation and thus cause neither dust turbulence nor drafts.

»Nothing fits the building life cycle like a Fural metal ceiling«
(Dirk Freytag, CTO)

TECHNICAL ASPECTS

Certified Safety for Use in Sports and Multipurpose Halls

Our ball-proof ceiling systems are specifically designed for indoor areas used for sports activities. They combine the aesthetic flexibility of large-format linear and square panels with certified ball-proof in accordance with DIN 18032-3:2023-12 (Category D1) and DIN EN 13964:2014-08 (Class 1A). This ensures the highest standards in safety, stability, and acoustics—ideal for schools, sports facilities, and multipurpose spaces.

Flexible Formats with Intelligent System Design

Ceiling panels are available in lengths of up to three meters and widths of up to 625 millimetres. A variety of module sizes is available to meet specific requirements. The substructure system is based on a robust load-bearing framework with certified connection elements, ensuring easy installation and long-term stability. Additional safety components guarantee reliable performance even under high mechanical stress.

Maintenance-friendly thanks to foldable elements

Each individual panel can be easily folded down thanks to DOOR brackets, which is particularly advantageous for maintenance work or access for inspections. All components are perfectly coordinated, allowing for installation-friendly execution with minimal tools and time required.

Acoustically Effective and Architecturally Flexible

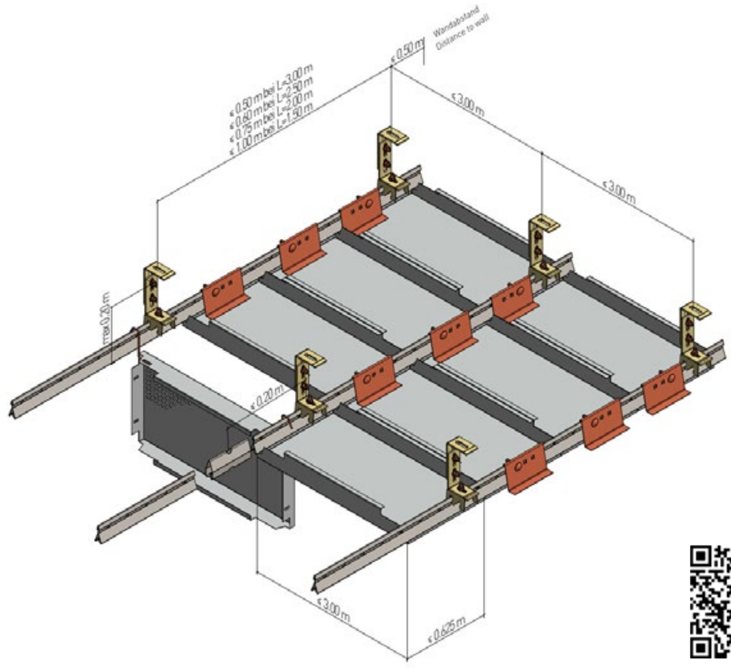
Thanks to integrated acoustic solutions, the ceiling also meets the highest acoustic performance standards. The deliberate combination of functionality, durability, and design flexibility makes the ball-proof systems from Fural Metalit Dipling Brünsch the ideal solution for high-traffic interior spaces with architectural ambition.

Clip-in System for long-span panels

The standard construction for long-span panels as a ball-proof ceiling with high sound absorption.

Available in module sizes up to 3000 × 625 mm.

DIN 18032-3:2023-12, Category D1
DIN EN 13964:2014-08, Annex D "Class 1A"



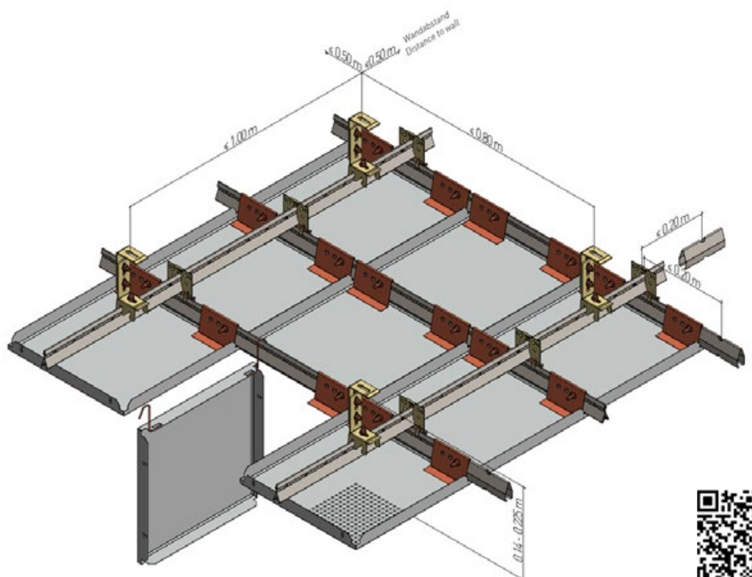
Data Sheet KLK 1.2.0.2 BWS

Clip-in System for square panels

The standard construction for clip-in square cassette panels as a ball-proof ceiling with high sound absorption.

Available in module sizes 625 mm and 600 mm.

Certified according to:
DIN 18032-3:2023-12, Category D1 and
DIN EN 13964:2014-08, Annex D "Class 1A"

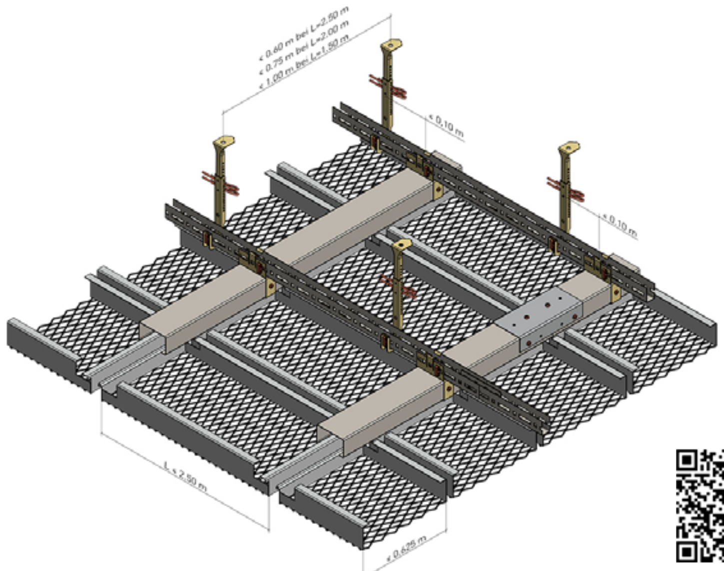


Data Sheet KQK 1.1.1.2 BWS

Hang-in System for Expanded Metal

The ball-proof long-span expanded metal ceiling with a hang-in system. The panels are hooked into a DZ profile, creating a distinctive joint pattern.

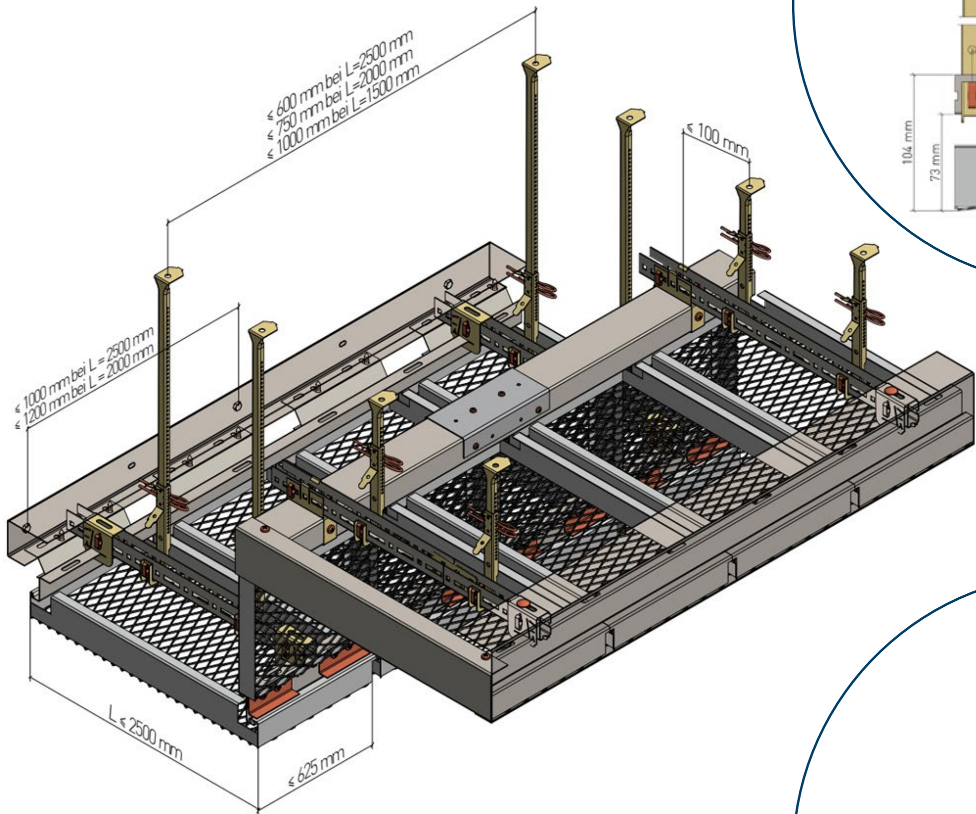
Available, depending on the panel type, in module sizes up to 2,500 × 625 mm.

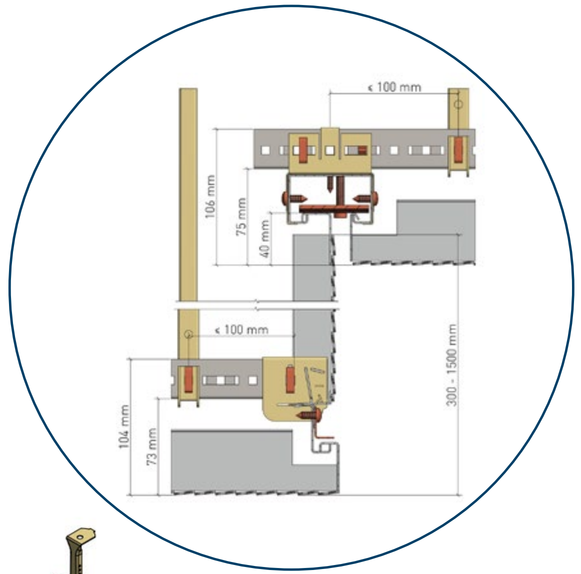


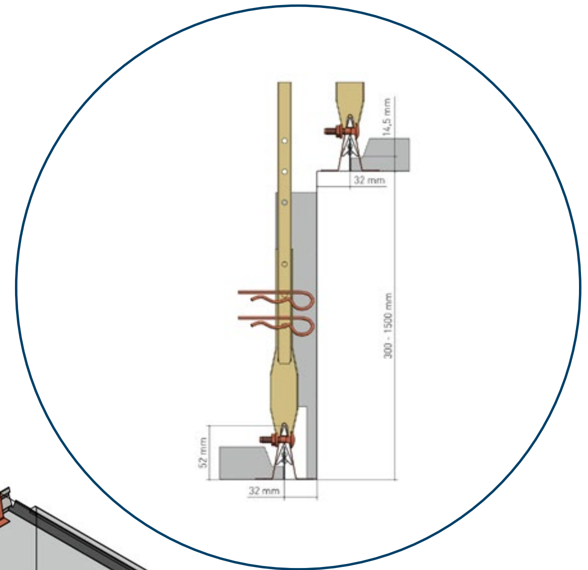
Data Sheet KLH-DZ STM 2.2.1.2 BWS

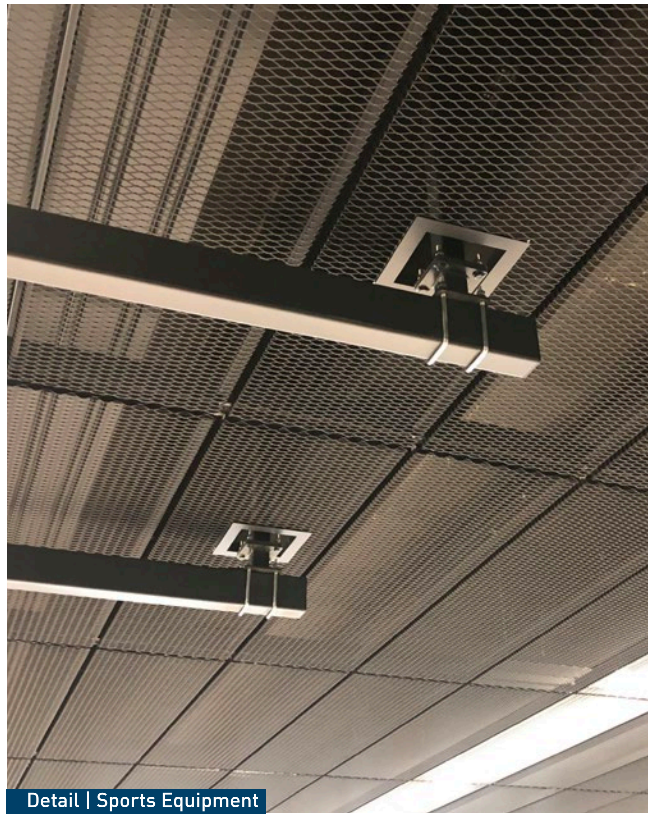
DETAIL SOLUTIONS

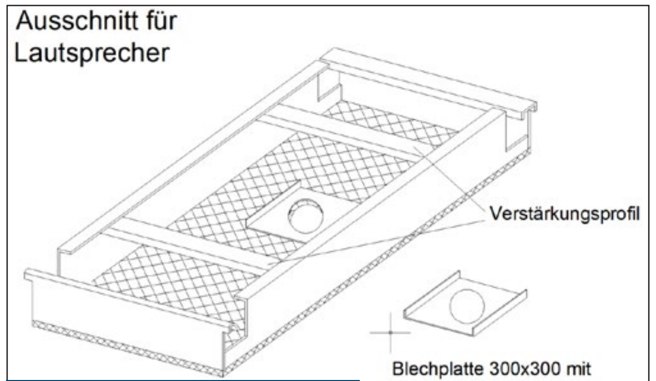
For special installation situations—such as steel structures for sports equipment, basketball hoops, or so-called ceiling offsets—appropriate detailed solutions are available. A two-part, robust frame enables secure and precise integration of on-site cutouts without compromising the ball-proof or the structural integrity of the ceiling system. The system components are designed to be flexible enough to adapt to varying conditions. However, there are limits in terms of testing capabilities. Not every situation can be tested one-to-one. In cases of deviations, Fural Metalit Dipling Brünsch provides engineering solutions. Upon request, a (fee-based) assessment by an accredited testing authority can be arranged.



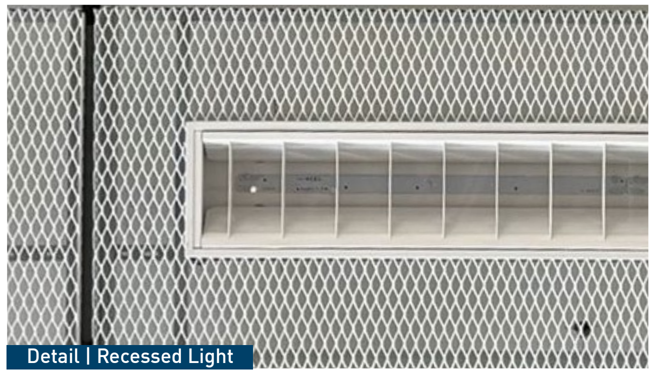


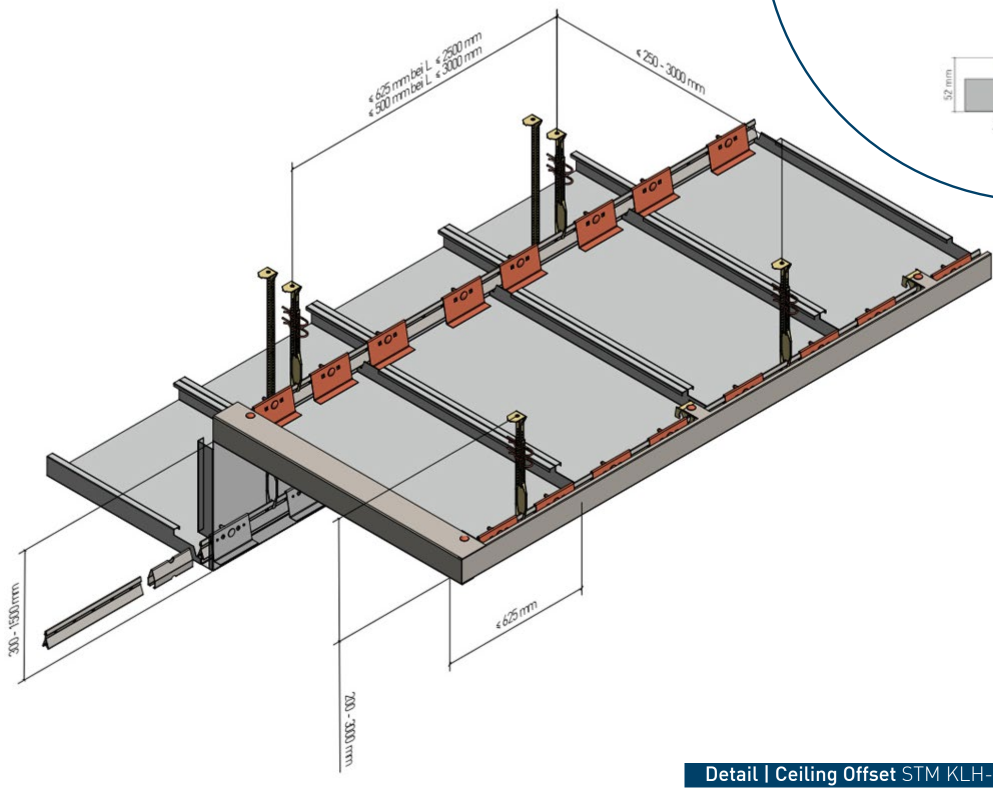



Detail | Sports Equipment

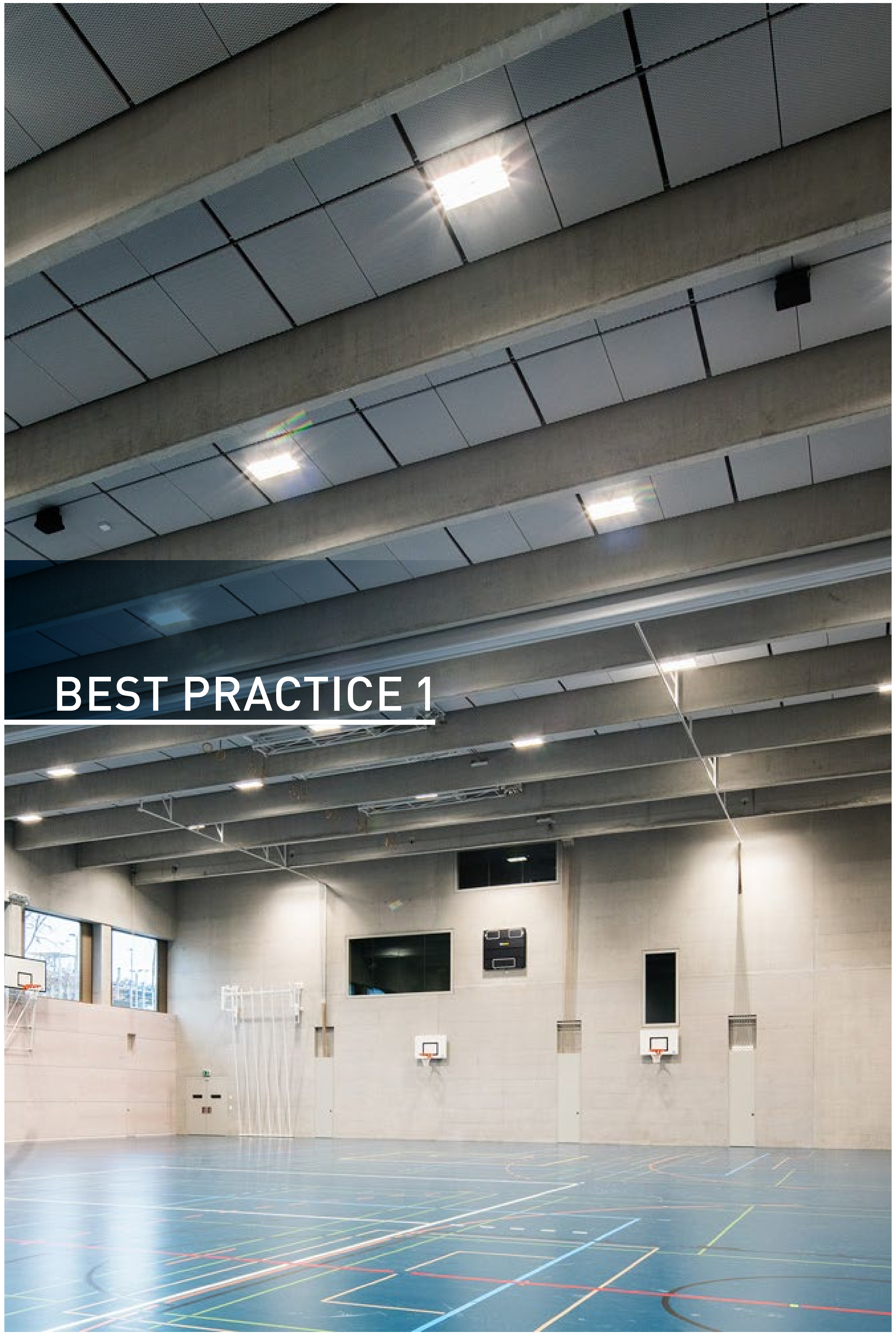


Detail | Cutout for Speaker


Detail | Recessed Light



Detail | Ceiling Offset STM KLH-DZ 2.2.1.2 BWS und KLK 1.2.0.2 BWS

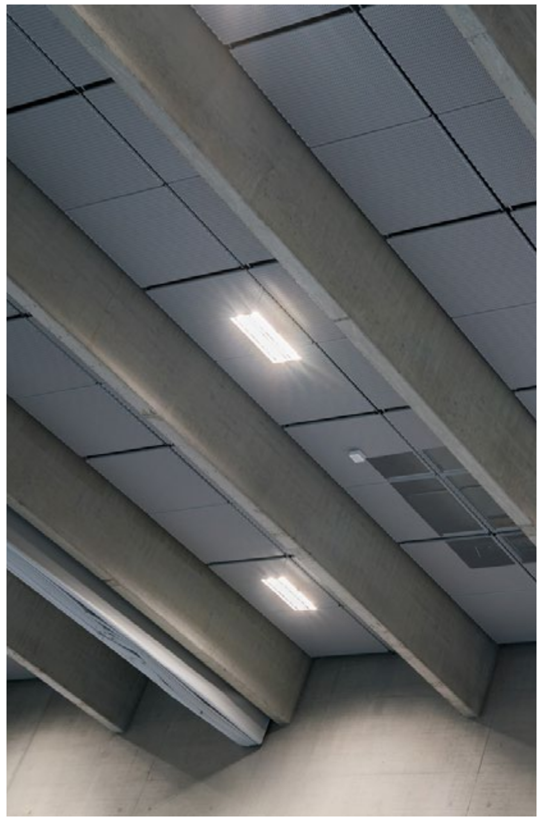


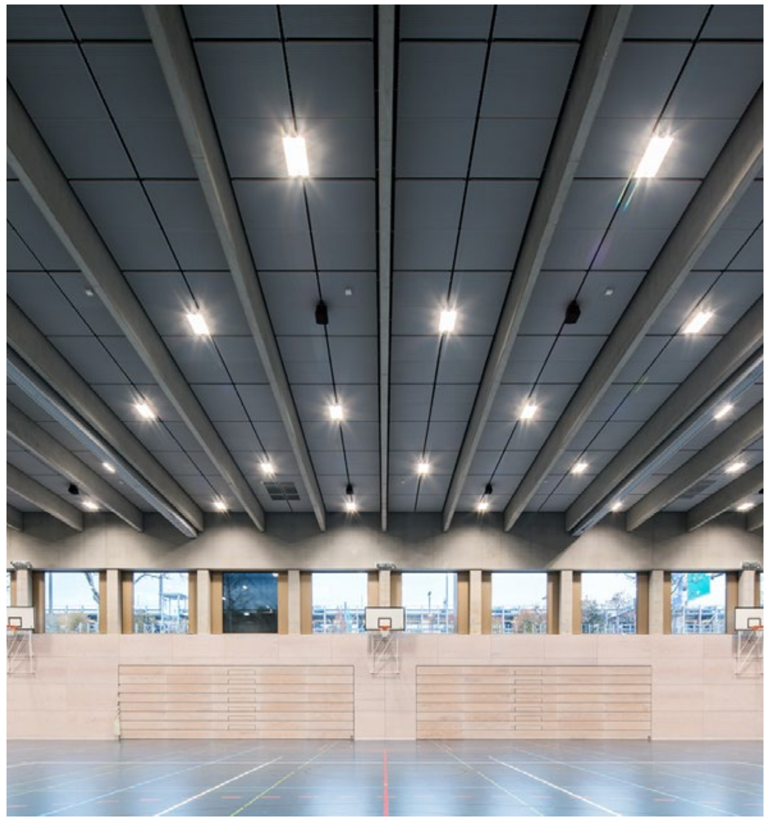
BEST PRACTICE 1

Secondary School Campus, Basel

When expanded metal is used in metal ceilings or ceiling baffles, it creates a surprisingly soft, almost textile-like appearance. In this school building, Stücheli Architekten fully explored the design potential of expanded metal, using the material not only as a functional building component but also as part of the architectural narrative. At the same time, the ceiling baffles impress with their excellent acoustic properties—a major advantage in noise-sensitive educational environments. In this way, aesthetics and function come together in a compelling and effective manner.

Architecture	Stücheli Architekten AG
Ceiling System	Ceiling Baffles
Metal Ceiling Area	5,500 m²
Material	Galvanised Steel Sheet
Surface	Bold NCS Colour Tones (or: Bold NCS Colors – US spelling)
Mesh	Fural
	20,0 × 10,0 × 2,0 × 1,5
Free Cross-Section	60 %
L (Diagonal 1)	20,00 mm →
W (Diagonal 2)	10,00 mm ↓
B (Web Width)	2,0 mm
A (Web Thickness)	1,0 mm



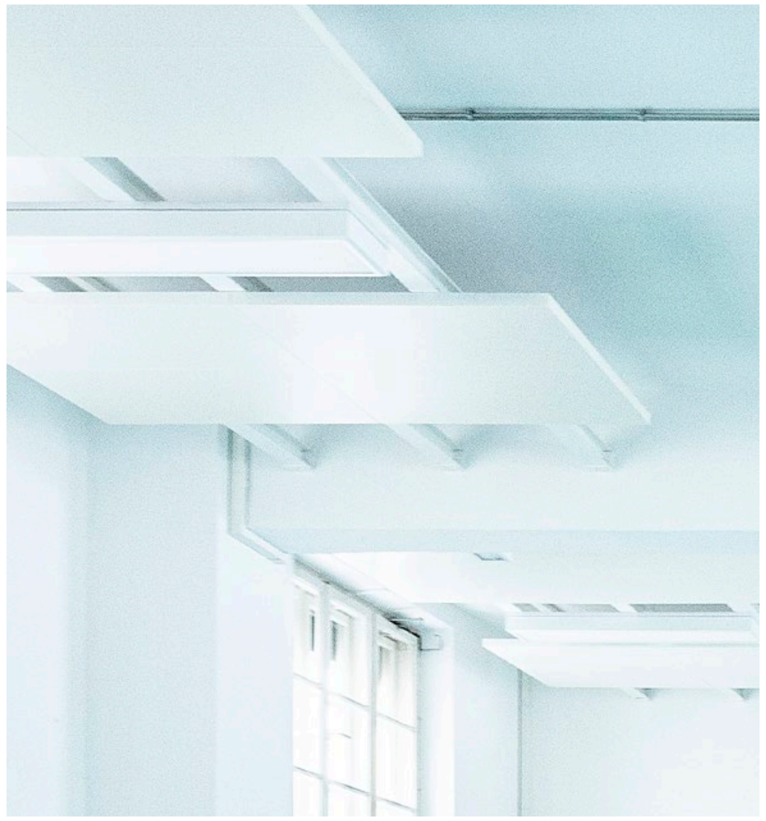


BEST PRACTICE 2

Secondary School, Munich Moosach

The Munich Moosach Secondary School was awarded the i.s.i. School Prize as the best secondary school in Bavaria. For optimal room acoustics, acoustically effective wall claddings by Fural were installed—finished in RAL 9010 and designed for practical use as magnetic boards. In the sports hall, Fural Metalit Dipling Brünsch ceiling baffles also contribute to improved room acoustics. They are secured against accidental detachment and create a pleasant sound environment during physical education classes—enhancing both concentration and enjoyment of movement.

Architecture	Sturm + Viermetz Architekten
Ceiling System	Floating ceiling, Acoustic wall
Metal Ceiling Area	1.734 m²
Material	Galvanised steel sheet
Surface	RAL 9010
Perforation	Fural
	Rg 0,7 - 4 %
Perforation Ø	0,7 mm
Hole content	4 %
Max. perforation width	1.197 mm
Des. acc. to DIN 24041	Rg 0,70 - 3,00
Horizontal spacing	3,00 mm →
Vertical spacing	3,00 mm ↓
Diagonal spacing	4,24 mm ↘
Perforation direction	→

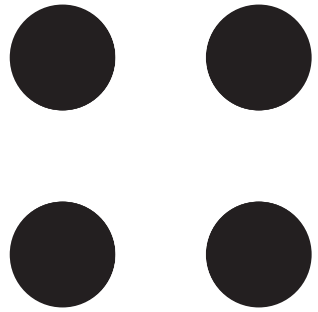


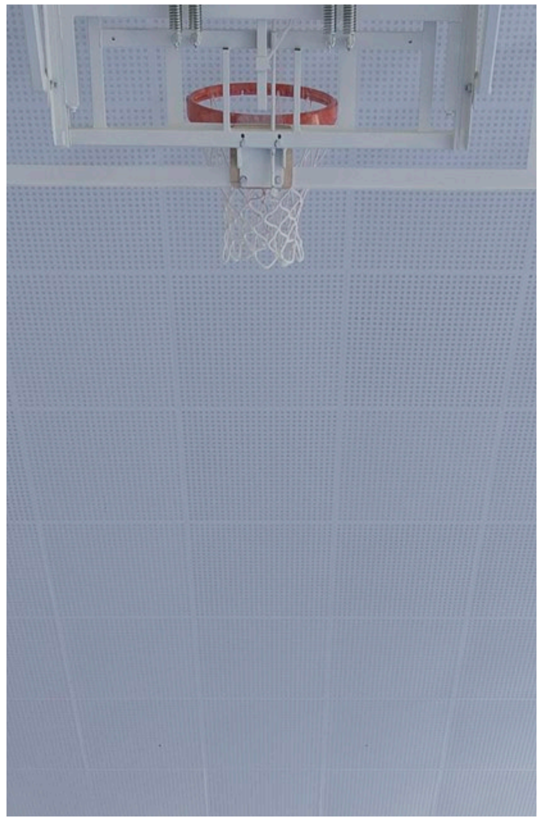
BEST PRACTICE 3

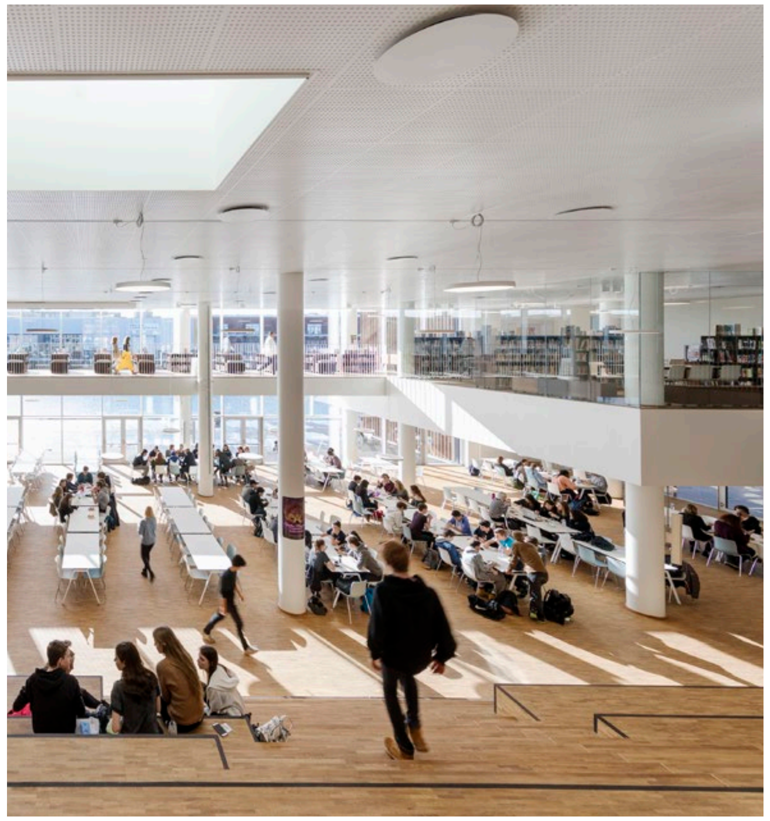
International School, Kopenhagen

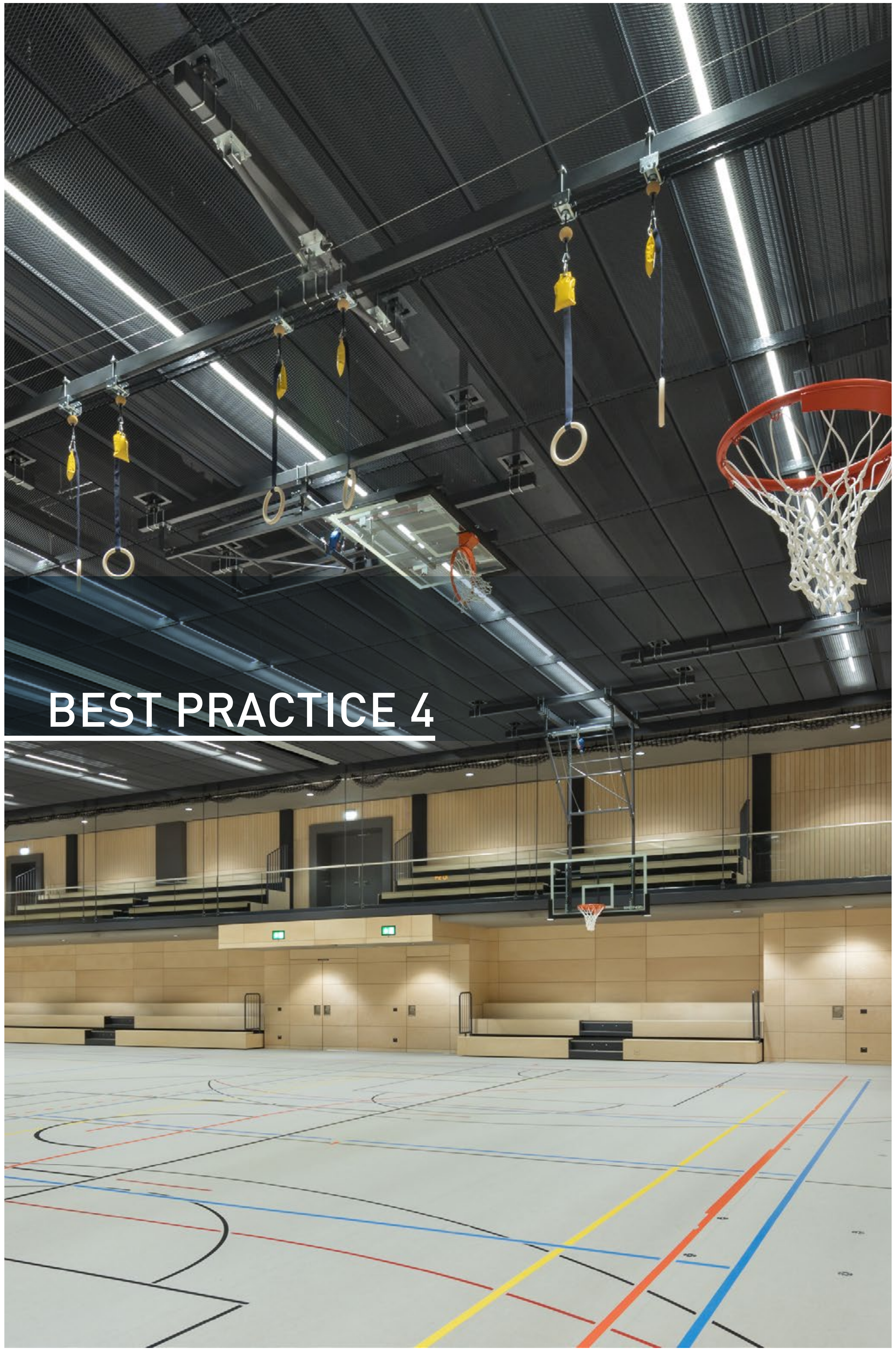
At Copenhagen International School (CIS) in Copenhagen, versatile metal ceilings are used throughout the building. In collaboration with JS Ventilation, a special cooling ceiling system was developed to provide comfortable temperatures and draft-free ventilation. The system is based on the proven clip-in system, which was flexibly adapted to the different room types—with varying perforations and colors. While the majority of the ceilings are finished in RAL 9016 (Traffic White), the smaller performance rooms are designed in RAL 9017 (Traffic Black). The project impressively demonstrates how metal ceilings can combine design diversity with functional requirements.

Architecture	C.F. Møller Architects
Ceiling System	Clip-in System
Metal Ceiling Area	22.100 m²
Material	Galvanised Steel Sheet
Surface Finish	RAL 9016
Perforation	Fural
	Rg 14,0 - 23 %
Perforation Ø	14,0 mm
Hole content	23 %
Max. perforation width	598 mm
Des. acc. to DIN 24041	Rg 14,00 - 26,00
Horizontal spacing	26,00 mm →
Vertical spacing	26,00 mm ↓
Diagonal spacing	36,76 mm ↘
Perforation direction	→





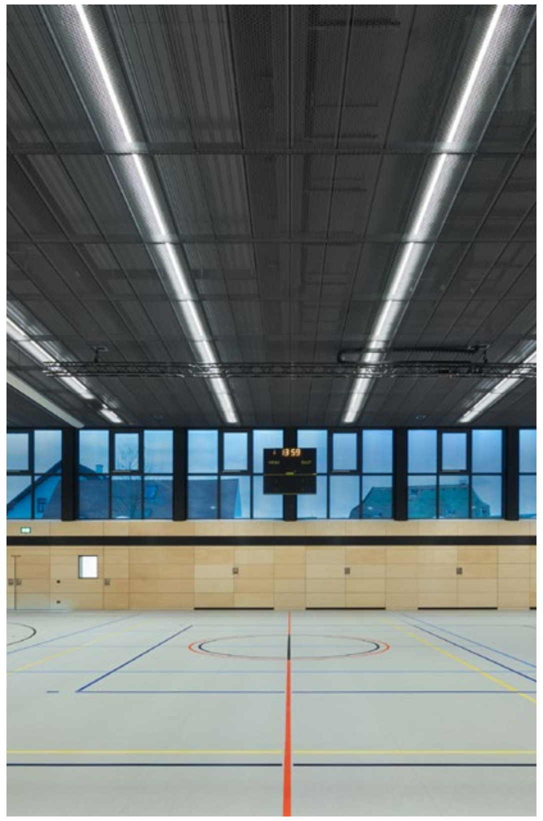


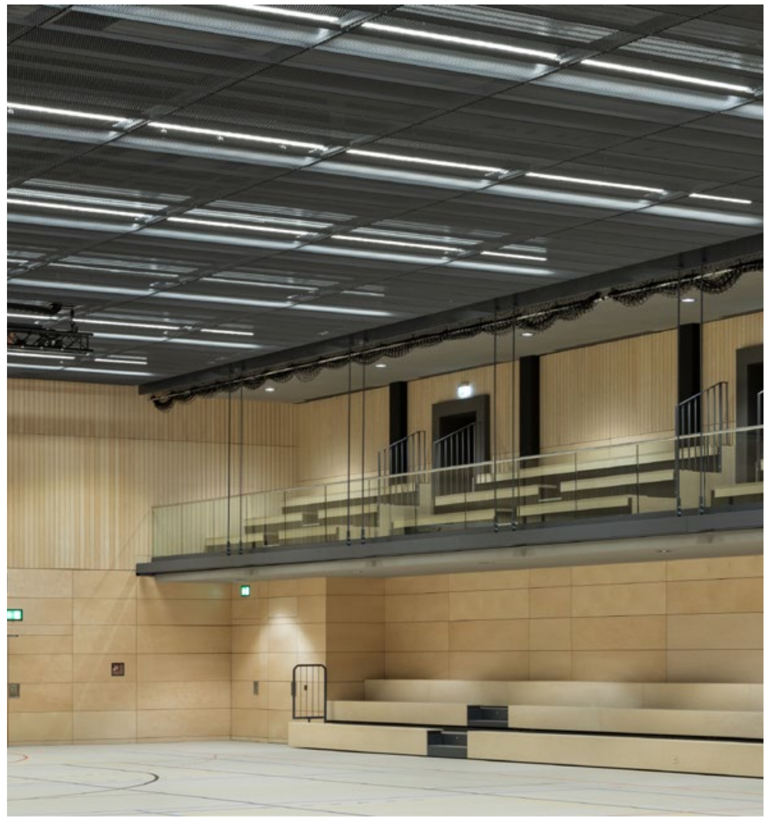


Stadthalle, Grafenwöhr

As part of the renovation of the Grafenwöhr City Hall, expanded metal ceilings with a hang-in system were installed. The open structure provides excellent acoustics and allows for the seamless integration of technical elements. A key feature of the project was the use of custom detailed solutions to accommodate sports-specific installations such as equipment suspension points and ball-proof systems. The result: a robust, functional, and visually appealing ceiling solution for modern sports facilities.

Architecture	m3plan, Grafenwöhr
Ceiling system	KLH-DZ Hang-in System
Metal ceiling area	900 m²
Material	Galvanised steel sheet
Surface	Parzifal® RAL 9005
Mesh	Fural 62,0 × 23,0 × 3,0 × 2,5
Free cross-section	73,9 %
L (Diagonal 1)	62,0 mm →
W (Diagonal 2)	23,0 mm ↓
B (Web Width)	3,0 mm
A (Web Thickness)	2,5 mm

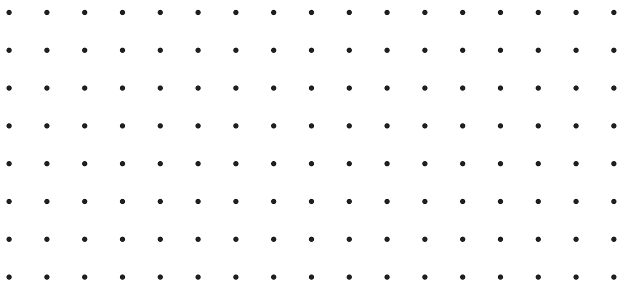




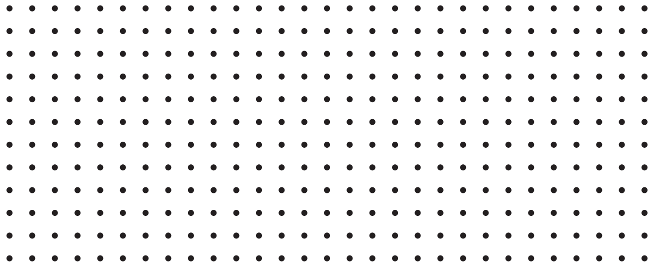

UP
We are metal ceilings —
lightness and transparency.
The perfect acoustic solution.

TESTED PERFORATIONS 1

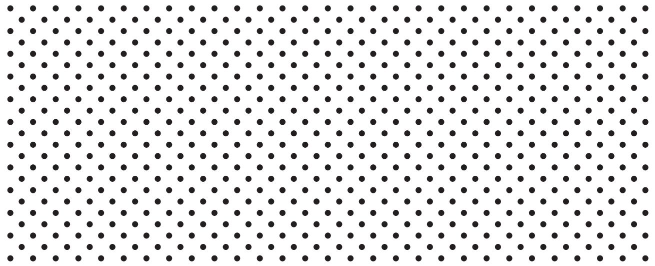
Fural	Rg 0.7 - 1 %
Perforation Ø	0.7 mm
Hole content	1 %
Max. perforation width	1,197 mm
Des. acc. to DIN 24041	Rg 0.70 - 6.00
Horizontal spacing	6.00 mm →
Vertical spacing	6.00 mm ↓
Diagonal spacing	8.48 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	31/08/2007 P-BA 231/2007
NRC	0.65
α_w	0.50 (LM)
Absorber class	D (DIN EN 11654)
Acoustic infill	w/o



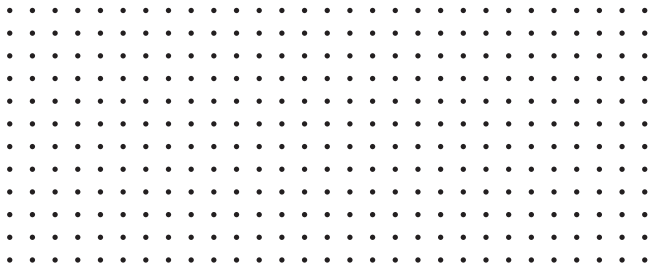
Fural	Rg 0.7 - 1.5 %
Perforation Ø	0.7 mm
Hole content	1.5 %
Max. perforation width	1,400 mm
Des. acc. to DIN 24041	Rg 0.70 - 5.00
Horizontal spacing	5.00 mm →
Vertical spacing	5.00 mm ↓
Diagonal spacing	7.07 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	04/12/2019 M 105629
NRC	0.60
α_w	0.50 (L)
Absorber class	D (DIN EN 11654)
Acoustic infill	w/o



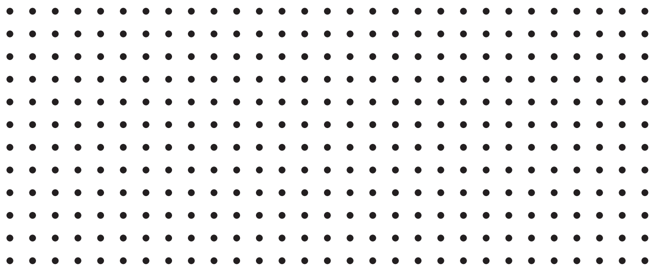
Fural	Rg 0.8 - 6 %
Perforation Ø	0.8 mm
Hole content	6 %
Max. perforation width	1,400 mm
Des. acc. to DIN 24041	Rg 0.80 - 3.00
Horizontal spacing	3.00 mm →
Vertical spacing	3.00 mm ↓
Diagonal spacing	4.24 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	09/06/2017 M 105629/17
NRC	0.75
α_w	0.75
Absorber class	C (DIN EN 11654)
Acoustic infill	w/o



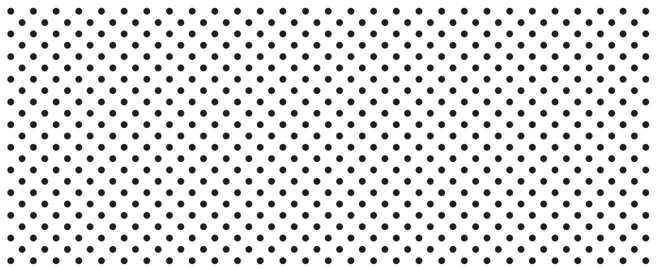
Fural	Rd 0.8 - 11 %
Perforation Ø	0.8 mm
Hole content	11 %
Max. perforation width	1,400 mm
Des. acc. to DIN 24041	Rd 0.80 - 2.12
Horizontal spacing	3.00 mm →
Vertical spacing	1.50 mm ↓
Diagonal spacing	2.12 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	09/06/2017 M 105629/18
NRC	0.75
α_w	0.70
Absorber class	C (DIN EN 11654)
Acoustic infill	w/o



Fural	Rg 0.7 - 4 %
Perforation Ø	0.7 mm
Hole content	4 %
Max. perforation width	1,197 mm
Des. acc. to DIN 24041	Rg 0.70 - 3.00
Horizontal spacing	3.00 mm →
Vertical spacing	3.00 mm ↓
Diagonal spacing	4.24 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	31/08/2007 P-BA 219/2007
NRC	0.80
α_w	0.75 (LM)
Absorber class	C (DIN EN 11654)
Acoustic infill	w/o

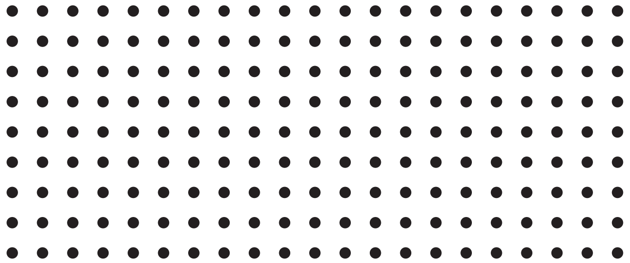


Fural	Rg 0.9 - 7 %
Perforation Ø	0.9 mm
Hole content	7 %
Max. perforation width	1,022 mm
Des. acc. to DIN 24041	Rg 0.90 - 3.00
Horizontal spacing	3.00 mm →
Vertical spacing	3.00 mm ↓
Diagonal spacing	4.24 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	30/09/2019 M 105629/44
NRC	0.75
α_w	0.70
Absorber class	C (DIN EN 11654)
Acoustic infill	w/o

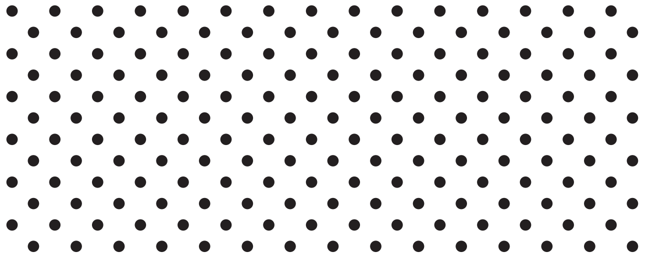


Fural	Rd 0.9 - 14 %
Perforation Ø	0.9 mm
Hole content	14 %
Max. perforation width	1,022 mm
Des. acc. to DIN 24041	Rd 0.90 - 2.12
Horizontal spacing	3.00 mm →
Vertical spacing	1.50 mm ↓
Diagonal spacing	2.12 mm ↘
Perforation direction	→
Overall structure	400 mm
Fleece	Bonded acoustic fleece
Test certificate	17/11/2012 7178-12-2
NRC	0.55
α_w	0.55 (LH)
Absorber class	D (DIN EN 11654)
Acoustic infill	w/o

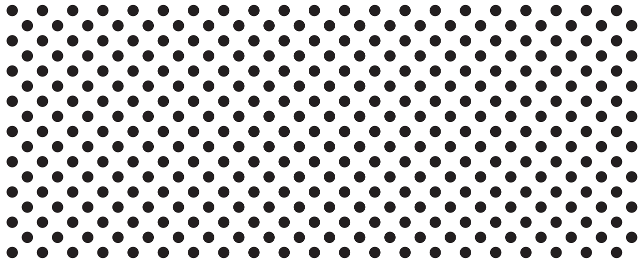
TESTED PERFORATIONS 2



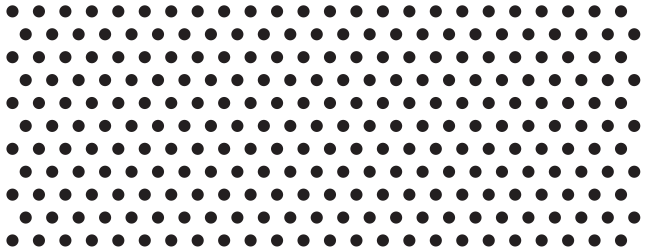
	Fural
	Rg 1.5 - 11 %
Perforation Ø	1.5 mm
Hole content	11 %
Max. perforation width	1,488 mm
Des. acc. to DIN 24041	Rg 1.50 - 4.00
Horizontal spacing	4.00 mm →
Vertical spacing	4.00 mm ↓
Diagonal spacing	5.65 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	07/12/2010 M 61840/6
NRC	0.80
α_w	0.75
Absorber class	C (DIN EN 11654)
Acoustic infill	w/o



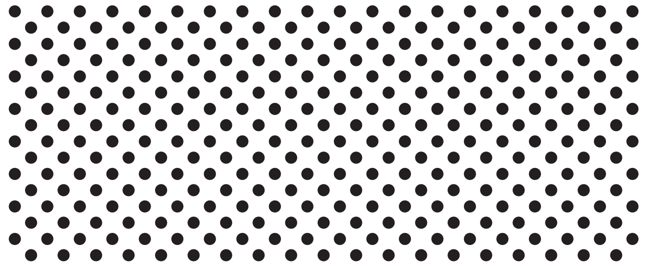
	Fural
	Rd 1.5 - 11 %
Perforation Ø	1.5 mm
Hole content	11 %
Max. perforation width	1,470 mm
Des. acc. to DIN 24041	Rd 1.50 - 4.00
Horizontal spacing	5.66 mm →
Vertical spacing	2.83 mm ↓
Diagonal spacing	4.00 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	07/12/2010 M 61 840/6
NRC	0.80
α_w	0.75
Absorber class	C (DIN EN 11654)
Acoustic infill	w/o



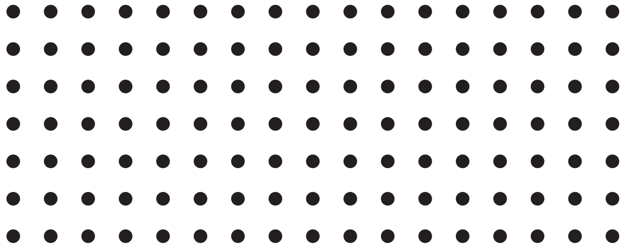
	Fural
	Rd 1.5 - 22 %
Perforation Ø	1.5 mm
Hole content	22 %
Max. perforation width	1,488 mm
Des. acc. to DIN 24041	Rd 1.50 - 2.83
Horizontal spacing	4.00 mm →
Vertical spacing	2.00 mm ↓
Diagonal spacing	2.83 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	07/12/2010 M 61840/5
NRC	0.70
α_w	0.70
Absorber class	C (DIN EN 11654)
Acoustic infill	w/o



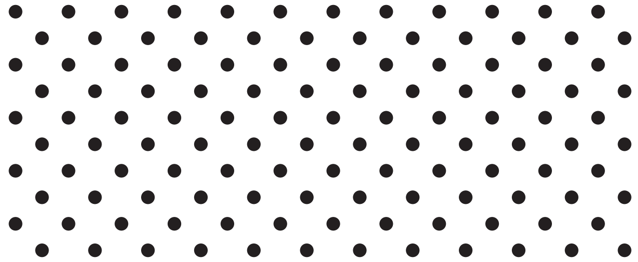
	Fural
	Rv 1.6 - 20 %
Perforation Ø	1.6 mm
Hole content	20 %
Max. perforation width	1,450 mm
Des. acc. to DIN 24041	Rv 1.60 - 3.50
Horizontal spacing	3.50 mm →
Vertical spacing	3.03 mm ↓
Offset spacing 60°	3.50 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	14/12/2006 P-BA 279/2006
NRC	0.74
α_w	0.80
Absorber class	B (DIN EN 11654)
Acoustic infill	w/o



	Fural
	Rd 1.6 - 22 %
Perforation Ø	1.6 mm
Hole content	22 %
Max. perforation width	636.4 mm
Des. acc. to DIN 24041	Rd 1.60 - 3.00
Horizontal spacing	4.30 mm →
Vertical spacing	2.15 mm ↓
Diagonal spacing	3.00 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	09/06/2017 M 105629/19
NRC	0.70
α_w	0.70
Absorber class	C (DIN EN 11654)
Acoustic infill	w/o

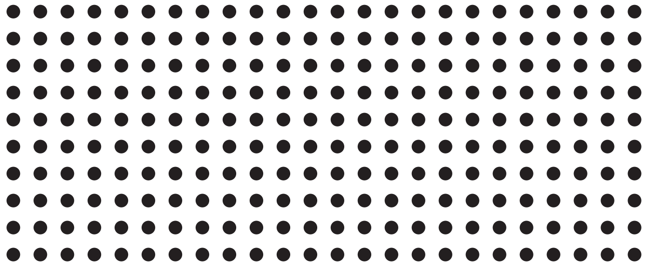


	Fural
	Rg 1.8 - 10 %
Perforation Ø	1.8 mm
Hole content	10 %
Max. perforation width	1,400 mm
Des. acc. to DIN 24041	Rg 1.80 - 4.95
Horizontal spacing	4.95 mm →
Vertical spacing	4.95 mm ↓
Diagonal spacing	7.00 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	07/12/2010 M 61840/4
NRC	0.80
α_w	0.75
Absorber class	C (DIN EN 11654)
Acoustic infill	w/o

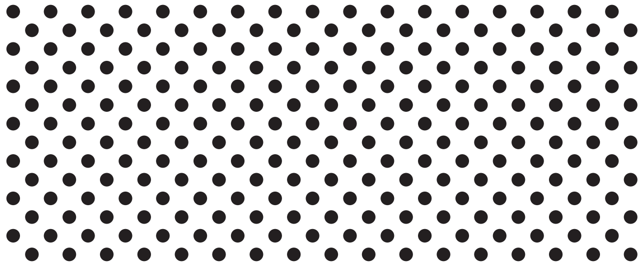


	Fural
	Rd 1.8 - 10 %
Perforation Ø	1.8 mm
Hole content	10 %
Max. perforation width	1.460 mm
Des. acc. to DIN 24041	Rd 1.80 - 4.95
Horizontal spacing	7.00 mm →
Vertical spacing	3.50 mm ↓
Diagonal spacing	4.95 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	07/12/2010 M 61840/4
NRC	0.80
α_w	0.75
Absorber class	C (DIN EN 11654)
Acoustic infill	w/o

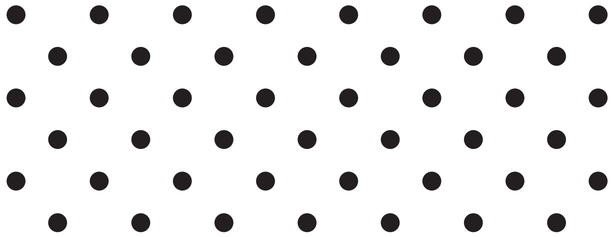
TESTED PERFORATIONS 3



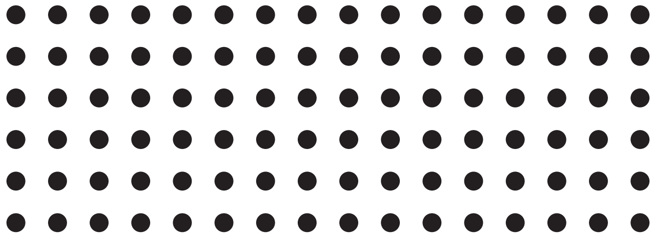
	Fural
	Rg 1.8 - 20 %
Perforation Ø	1.8 mm
Hole content	20 %
Max. perforation width	1.460 mm
Des. acc. to DIN 24041	Rg 1.80 - 3.50
Horizontal spacing	3.50 mm →
Vertical spacing	3.50 mm ↓
Diagonal spacing	4.95 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	P-BA 220/2007 Figure 2
NRC	0.75
α_w	0.75
Absorber class	C (DIN EN 11654)
Acoustic infill	w/o



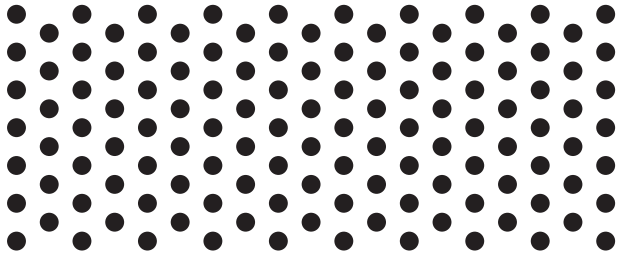
	Fural
	Rd 1.8 - 21 %
Perforation Ø	1.8 mm
Hole content	21 %
Max. perforation width	1,400 mm
Des. acc. to DIN 24041	Rd 1.80 - 3.50
Horizontal spacing	4.96 mm →
Vertical spacing	2.48 mm ↓
Diagonal spacing	3.50 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	31/08/2007 P-BA 220/2007 Figure 2
NRC	0.75
α_w	0.75
Absorber class	C (DIN EN 11654)
Acoustic infill	w/o



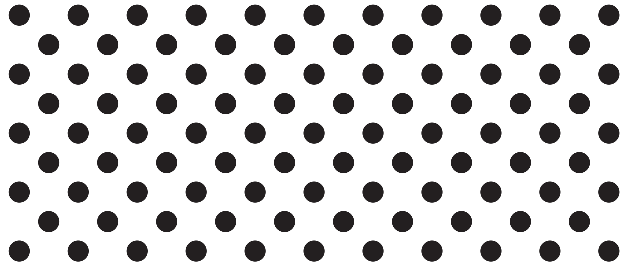
	Fural
	Rd 2.5 - 8 %
Perforation Ø	2.5 mm
Hole content	8 %
Max. perforation width	1,460 mm
Des. acc. to DIN 24041	Rd 2.50 - 7.80
Horizontal spacing	11.0 mm →
Vertical spacing	5.50 mm ↓
Diagonal spacing	7.78 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	14/12/2006 P-BA 279/2006 Figure 5
NRC	0.80
α_w	0.75
Absorber class	C (DIN EN 11654)
Acoustic infill	w/o



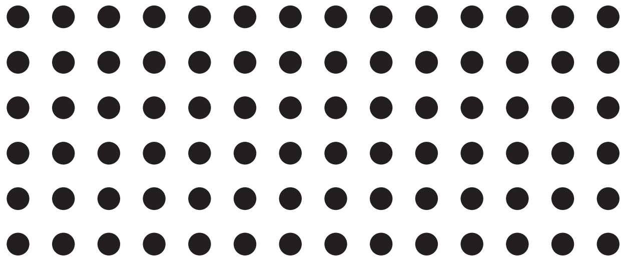
	Fural
	Rg 2.5 - 16 %
Perforation Ø	2.5 mm
Hole content	16 %
Max. perforation width	1,460 mm
Des. acc. to DIN 24041	Rg 2.50 - 5.50
Horizontal spacing	5.50 mm →
Vertical spacing	5.50 mm ↓
Diagonal spacing	7.78 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	14/12/2006 P-BA 279/2006 Figure 1
NRC	0.80
α_w	0.80
Absorber class	B (DIN EN 11654)
Acoustic infill	w/o



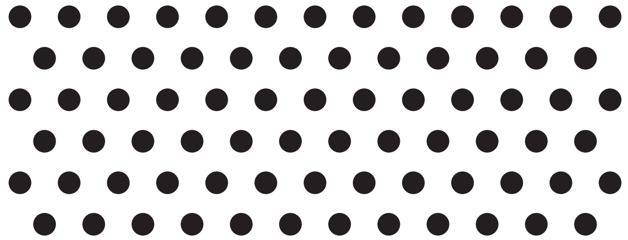
	Fural
	Rv 2.5 - 23 %
Perforation Ø	2.5 mm
Hole content	23 %
Max. perforation width	1,467 mm
Des. acc. to DIN 24041	Rv 2.50 - 5.00
Horizontal spacing	8.66 mm →
Vertical spacing	2.50 mm ↓
Offset spacing 60°	5.00 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	07/12/2010 M 61 840/7
NRC	0.75
α_w	0.75 (L)
Absorber class	C (DIN EN 11654)
Acoustic infill	w/o



	Fural
	Rd 2.8 - 20 %
Perforation Ø	2.8 mm
Hole content	20 %
Max. perforation width	627.9 mm
Des. acc. to DIN 24041	Rd 2.80 - 5.50
Horizontal spacing	7.80 mm →
Vertical spacing	3.90 mm ↓
Diagonal spacing	5.50 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	09/06/2017 M 105629/20
NRC	0.75
α_w	0.75
Absorber class	C (DIN EN 11654)
Acoustic infill	w/o

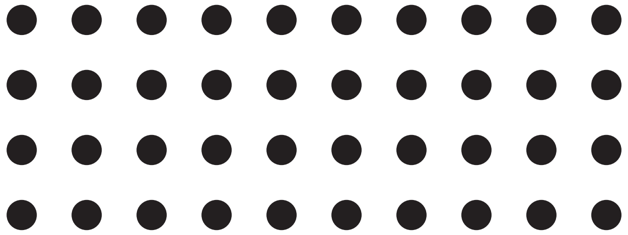


	Fural
	Rg 3.0 - 20 %
Perforation Ø	3.0 mm
Hole content	20 %
Max. perforation width	1,434 mm
Des. acc. to DIN 24041	Rg 3.00 - 6.00
Horizontal spacing	6.0 mm →
Vertical spacing	6.0 mm ↓
Diagonal spacing	8.48 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	P-BA 221/2007 Figure 2
NRC	0.80
α_w	0.75 (L)
Absorber class	C (DIN EN 11654)
Acoustic infill	w/o

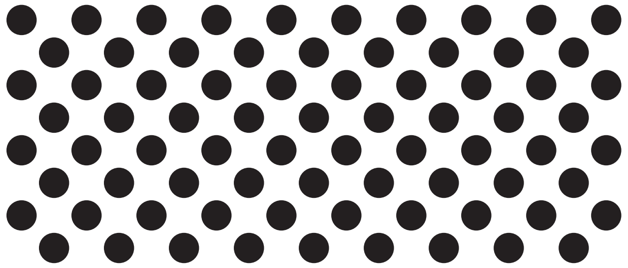


	Fural
	Rv 3.0 - 20 %
Perforation Ø	3.0 mm
Hole content	20 %
Max. perforation width	1,402 mm
Des. acc. to DIN 24041	Rv 3.00 – 6.35
Horizontal spacing	6.50 mm →
Vertical spacing	5.50 mm ↓
Offset spacing 60°	6.39 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	P-BA 221/2007 Figure 2
NRC	0.80
α_w	0.75 (L)
Absorber class	C (DIN EN 11654)
Acoustic infill	w/o

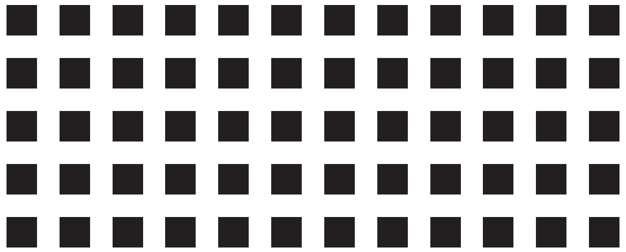
TESTED PERFORATIONS 4



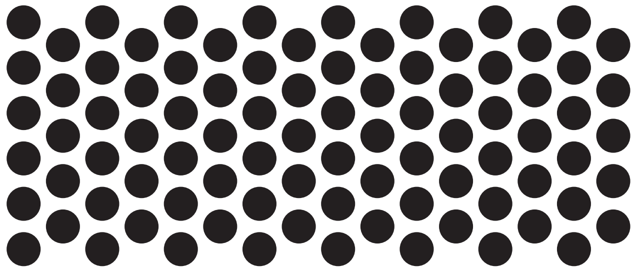
	Fural
	Rg 4.0 - 17 %
Perforation Ø	4.0 mm
Hole content	17 %
Max. perforation width	1,453 mm
Des. acc. to DIN 24041	Rg 4.00 - 8.60
Horizontal spacing	8.60 mm →
Vertical spacing	8.60 mm ↓
Diagonal spacing	12.1 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	P-BA 279/2006 Figure 7
NRC	0.80
α_w	0.80
Absorber class	B (DIN EN 11654)
Acoustic infill	w/o



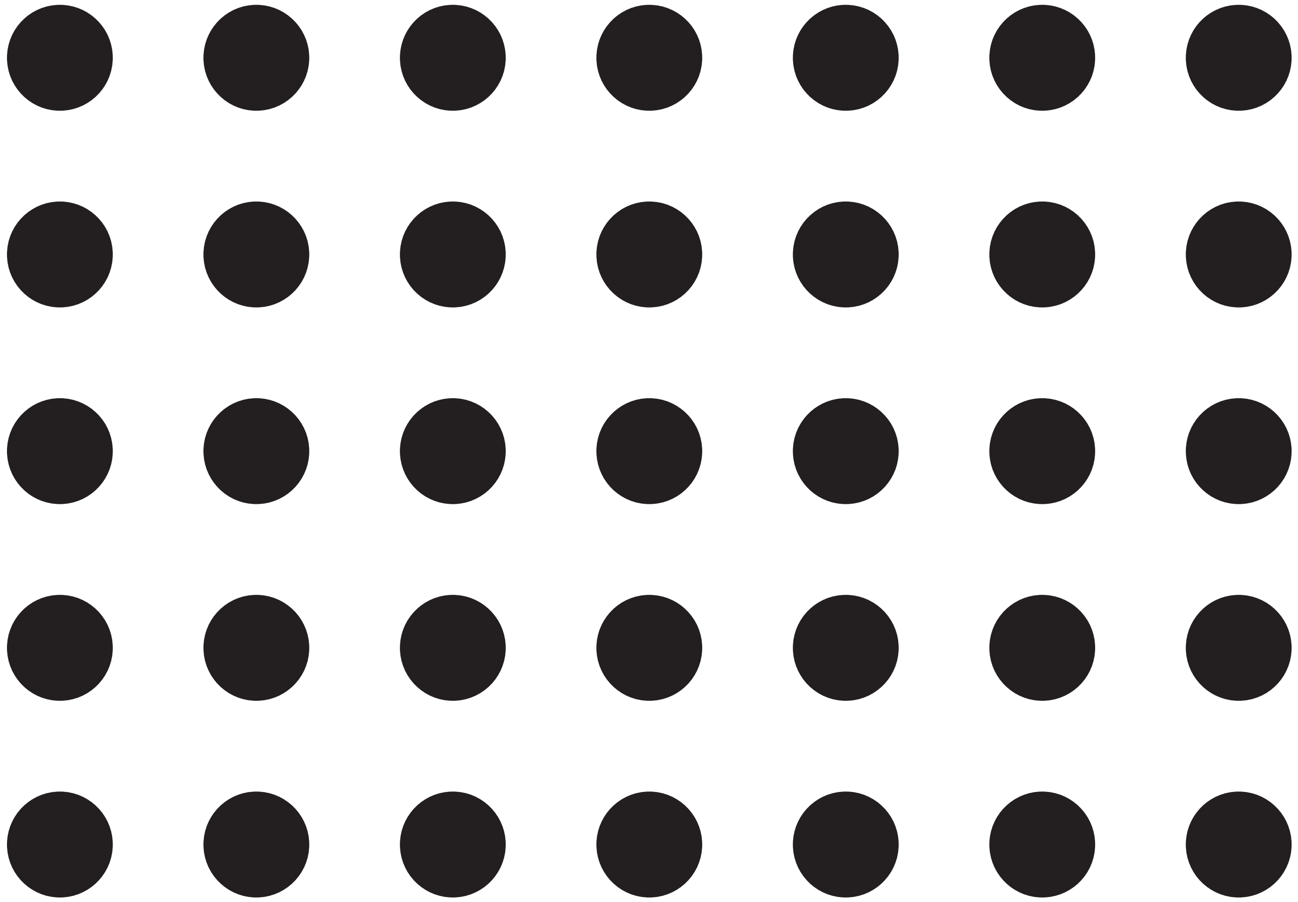
	Fural
	Rd 4.0 - 33 %
Perforation Ø	4.0 mm
Hole content	33 %
Max. perforation width	1,450 mm
Des. acc. to DIN 24041	Rd 4.00 - 6.10
Horizontal spacing	8.60 mm →
Vertical spacing	4.30 mm ↓
Diagonal spacing	6.10 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	P-BA 279/2006 Figure 3
NRC	0.80
α_w	0.80
Absorber class	B (DIN EN 11654)
Acoustic infill	w/o



	Fural
	Qg 4.0 - 33 %
Perforation	4.0 mm
Hole content	33 %
Max. perforation width	630 mm
Des. acc. to DIN 24041	Qg 4.00 - 7.00
Horizontal spacing	7.00 mm →
Vertical spacing	7.00 mm ↓
Diagonal spacing	9.89 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	P-BA 279/2006 Figure 4
NRC	0.80
α_w	0.80
Absorber class	B (DIN EN 11654)
Acoustic infill	w/o



	Fural
	Rv 4.5 - 51 %
Perforation Ø	4.5 mm
Hole content	51 %
Max. perforation width	627 mm
Des. acc. to DIN 24041	Rv 4.50 - 6.00
Horizontal spacing	10.4 mm →
Vertical spacing	3.00 mm ↓
Offset spacing 60°	6.00 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	09/06/2017 M 105629/21
NRC	0.65
α_w	0.65 (L)
Absorber class	C (DIN EN 11654)
Acoustic infill	w/o



	Fural
	Rg 14.0 - 23 %
Perforation Ø	14.0 mm
Hole content	23 %
Max. perforation width	598 mm
Des. acc. to DIN 24041	Rg 14.00 - 26.00
Horizontal spacing	26.00 mm →
Vertical spacing	26.00 mm ↓
Diagonal spacing	36.76 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	P-BA 279/2006 Figure 8
NRC	0.75
α_w	0.75 (L)
Absorber class	C (DIN EN 11654)
Acoustic infill	w/o


Top Architecture | International School, Kopenhagen (DK)

Publisher	**Impressum**
	Fural
	Systeme in Metall GmbH
	Cumberlandstraße 66
	4810 Gmunden
Stand	Austria
Photos	Juni 2025
	stauss processform gmbh (pages 16-17, 18, 19, 24-25, 26-27, 29, 31, 36-37, 48-49, 54-55)
	Herbert Brunnmeier (pages 44)
	Erich Spahn (pages 22-23, 52-53)
	Adam Mørk (Titelseite, pages 4-5, 6-7, 12, 13, 50-51, 64)
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	Ruedi Walti (pages 2)
	Celia Uhalde (pages 10-11)
	Franz Rindlisbacher (pages 29)
	Daniel Hawelka (pages 29)
	LENZER.BE (pages 30)
Concept and Design	Team Marketing
Texts	DIN Pro Light und Medium

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Mitglied der DGNB
Deutsche Gesellschaft für Nachhaltiges Bauer
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