
UP
MAGAZINE
EDUCATION 02
FURAL
METALIT
DIPLING

Sustainability is the new standard

» What is preventing building professionals from making sustainability the new standard?
It's remarkable the creativity with which people are still looking for
reasons are still being sought as to why something is once again not possible ... «

(Dr. Christine Lemaitre from School construction 02-2019)

Why metal ceilings?

- The components already have a **finished surface** at the time of delivery.
- Delivery and assembly are **dust-free**.
- Both the ceilings and the substructures stand out due to their **durability**.
- Thanks to their continuous paint surface, metal ceilings are **especially hygienic**.
- The paint surfaces can be **easily cleaned, dry or wet**.
- For school rooms and sports venues, our ceilings can be designed to be **ball-proof**.
- Our metal ceiling systems can be easily **serviced**.
- There is a possibility of **simple dismantling**.
- Our products are winners owing to their **reusability**.
- All our components allow mono-material recycling.
- We have a **large portfolio** of possible perforations.
- The **integration** of technical elements can be done **easily and precisely**.
- Our metal ceiling systems offer **optimal conditions for the combination** with heating and cooling elements.
- We manufacture precise and **aesthetic** products.
- Modular pre-production **allows for a short construction time.**

Acoustics

Heating and cooling

Fire protection

Hygiene

Design

Sustainability

Parzifal®

Baffle

Metal ceilings with hygiene

Hygiene is a very high priority in educational buildings. The metal ceiling systems from Fural Metalit Dipling help you to achieve your goals in many ways. Thanks to their high-quality coating, our products have a perfectly smooth surface that can be easily cleaned with standard cleaning agents or even dry-cleaned. An optional antibacterial coating offers you even more hygienic safety.

Dust-free

Dust is a so-called "dry" carrier of infections, in which viruses and bacteria spread. Dust can also be deposited in mucous membranes and the respiratory tract. This is why it is vital to avoid dust.

Fibre-free

Fibres are also "dry" carriers of infection. Since fibres can enter the body through the respiratory tract and skin, it is essential to avoid fibres – and not only those of a risky type.

Mould-free

Mould fungi evolve in a humid and warm environment. They secrete substances that can be harmful to humans, either indirectly through the air or by direct contact. Mould must be avoided.

Disinfection

In sensitive environments such as hospitals, doctor's offices, schools and public institutions, hazardous environments can be created through use and operation. It must be possible to disinfect surfaces in such buildings.

No moisture absorption

Components that can absorb moisture often turn into a breeding ground for microorganisms when heated. Subsequently, the surfaces are hard to disinfect and dry. Metal ceilings by contrast are especially easy to clean and do not absorb moisture.

Hygienic heating and cooling

Thanks to the high level of thermal conductivity of metal, our ceilings are excellently suited for heating and cooling. Since our systems work via radiation instead of air transport, they are also especially hygienic.

Serviceability

Our ceilings can be quickly and easily opened nearly everywhere. This guarantees easy and thorough servicing not only of the ceiling itself but of the ceiling cavity and the built-in components in it as well.

Wet cleaning

With water as a solvent and surfactants, dirt can be removed far easier than by dry cleaning. Important here is that the surfaces can be rinsed with clean water – metal ceiling systems allow for this, too.

Interior air quality

Our metal ceiling systems do not release any relevant quantities of VOCs, even taking into account the paints and adhesives (LCI values, evaluation according to AgBB evaluation scheme). Independent testing institutes have certified this.

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We think about healthy learning environment.

Learning in a whispering culture

Hearing is used for communication, spatial orientation and the qualitative perception of the environment. As we spend most of our time indoors, room acoustics are an important factor in our daily lives.

Schools thrive on linguistic exchange. If the room acoustics are not right and it is difficult to understand what is being said in the classroom, pupils and teachers often experience cognitive and health problems. The well-being of the individual and the group is negatively affected and teaching, learning and working together is disrupted.

In rooms with good acoustics, active listening is possible over longer periods of time because acoustic disturbances are reduced.

With metal ceiling systems from Fural Metalit Dipling, the room acoustics can be substantially influenced in classrooms and offices as well as in circulation areas. School thus becomes an acoustically relaxed place.

UP

Silence

»Action takes place in a certain amount of noise.
Work takes place in silence.«
(Peter Bamm, 1897–1975)

Akustik

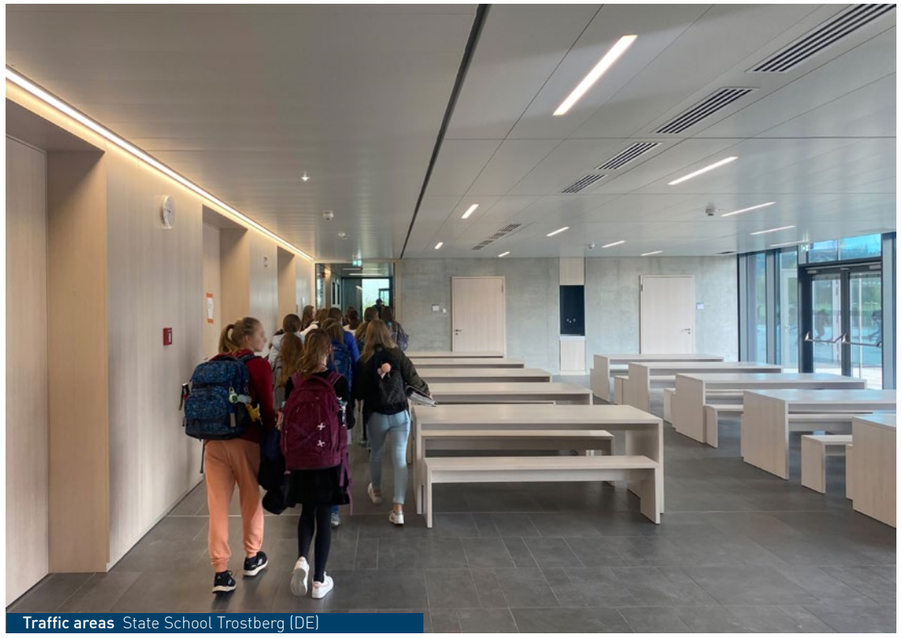
Romping around, playing, doing sport - but also concentrated listening: Optimizing the acoustics in the individual school rooms, which are used in very different ways, is essential. Reverberation should be minimized, especially in rooms with a greater height, such as the gymnasium. Here too, metal ceilings provide excellent services: Equipped with acoustic fleece or an acoustic overlay, the noise level is significantly reduced. After all, good acoustic room conditions have a noticeable effect on well-being and the working atmosphere in schools and should therefore be given special attention.

State School Trostberg

Architecture	Spreen Architekten
Gross floor area	3.200 m²
Ceiling system	SWING F0
Material	Galvanized sheet steel
Surface	Parzifal: bright white

Perforation

	Fural
Perforation Ø	Rg 0,7 - 4 %
Percentage of holes	0,7 mm
Perforation width max	4 %
Ref. according to DIN	1.197 mm
24041	Rg 0,70 - 3,00
Distance horizontal	3,00 mm →
Distance vertical	3,00 mm ↓
Distance diagonal	4,24 mm ↘
Perforation direction	→



Traffic areas State School Trostberg (DE)

Learning locations State School Trostberg (DE)

Rest areas State School Trostberg (DE)

UP

We think from the perspective of the students and teachers.

Climate and indoor air quality, room acoustic, room optics and hygienic comfort.

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.

Speech intelligibility

Speech intelligibility is of particular importance in schools: oral teaching only works if children can listen with concentration and the teacher's voice is not unduly strained. It is not only the reverberation that needs to be taken into account, but also background noises caused by moving chairs, whispering or clearing the throat. While adults are able to block out these disturbing factors, adolescents are much more easily distracted by them. Speech intelligibility is therefore a fundamental factor for learning success. And here too, metal ceiling solutions from Fural Metalit Dipling can be relied upon. We have various specific ceiling solutions in our range for the special requirements of school buildings.

Room air quality

Room air quality is significantly influenced by the building products used.

Construction projects are monitored from a construction ecology perspective during the planning and construction phase in order to select the construction materials and construction chemicals used according to ecological criteria and to avoid the introduction of materials that are hazardous to health.

Particular attention is paid to solvents and allergenic building materials.

Building products as possible sources of pollutants are fibers, radon (granite), and VOCs (solvents in paints, glue, and varnishes, biocides in wood preservatives and carpets, PAHs in parquet adhesives, and formaldehyde-containing adhesives in wood-based materials).

Our metal ceilings and walls take the hygiene aspect into account. Our fire protection ceilings additionally ensure safety, because they achieve the required fire resistance - and without inserts made of artificial mineral fibers.

Ceiling outlets flush-mounted integration

Copenhagen International School (DK)

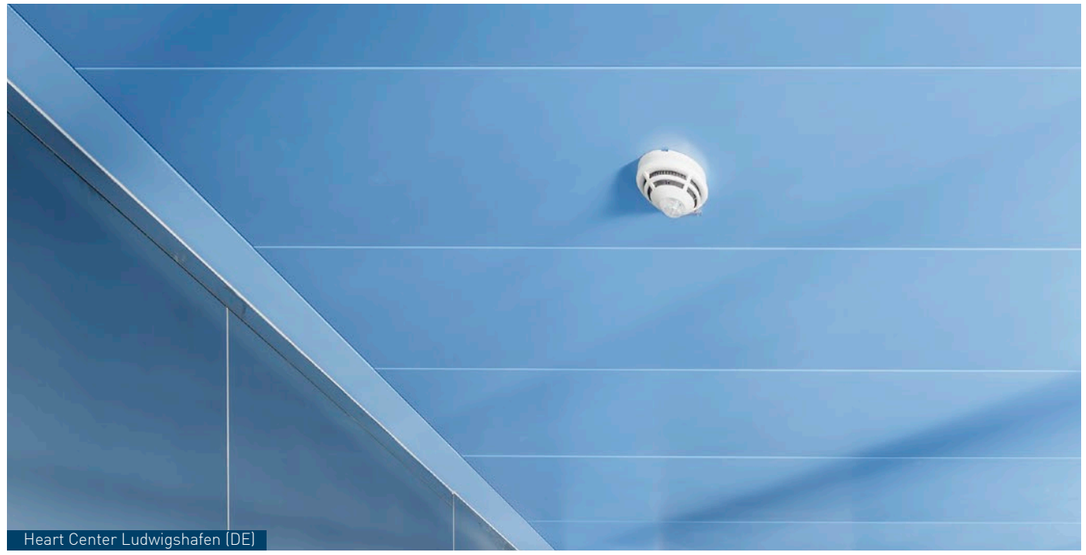
Colors and room optical comfort

It is no secret that colors have an unconscious influence on people and is part of psychological research. Each shade has a different effect and can be calming or stimulating, invigorating or relaxing, concentration-enhancing or distracting. Color accents in school buildings also help with orientation and at the same time create a feel-good atmosphere.

It's a good thing that metal ceilings from Fural Metalit Dipling can be manufactured in all RAL shades and can therefore be completely adapted to the architectural ideas. This turns a school into a place where people enjoy spending time - in rooms that are perfectly designed in terms of shape and color for the respective purpose.

The room appearance of educational buildings is also influenced by the choice of furniture in the room and the type of windows, floor coverings, walls and ceilings.

Eckenberg-Gymnasium, Adelsheim (DE)



Heart Center Ludwigshafen (DE)

EMBL, Heidelberg (DE)

We are acoustic ceilings. We are acoustic walls.

Acoustic comfort

School demands both concentration and communication from pupils. Both can be significantly impaired by acoustic disturbance factors within the classroom, in circulation areas and corridors and in open spaces. This can lead to physical and psychological damage.

From the ceiling to the wall

Acoustic walls from Fural Metalit Dipling not only control the room acoustics, they also optimize the design of the entire classroom.

Thanks to their specific structure, the wall elements act as broadband absorbers and are therefore ideal for regulating reverberation time and speech intelligibility.

The benefits of metal ceilings as acoustic ceilings

Our systems combine outstanding acoustic properties and a high-quality appearance with functionality and durability. This combination creates a pleasant room atmosphere that impresses developers and users alike. Architects and installers hold us in high regard for our easily installed, perfected acoustic metal ceiling systems and our service-oriented project handling.

Our acoustic ceilings can also be fitted with additional functions, such as air conditioning (cooling, heating, ventilation) or lighting. Likewise, the product properties can be enhanced in terms of fire protection, hygiene (hospitals and laboratories) or resistance to ball impact (kindergartens, schools and sports halls). Ceiling components are manufactured on state-of-the-art production systems, which can produce everything from individual pieces to high volumes with maximum precision.
The metal ceilings are delivered with finished surfaces to the construction site, thereby ensuring quick and simple processing and short construction processes.

Our products are sustainable, because they consist of easily processed materials that can either be reused or straightforwardly recycled.

Park Innovaare, Villigen (CH)

Ball-proof

The equipment of rooms in school sports halls is particularly exposed to ball sports, which is why high demands are also placed on the ceiling solutions. Various movement and acceleration forces act on the material in and on the rooms, which must be taken into account. For this purpose, Fural Metalit Dipling offers carefully designed and tested systems that meet the highest safety class in accordance with DIN specifications. The best room acoustics are combined with optimum safety in the ball-proof metal tile ceilings - regardless of whether the handball or soccer team is training.

Copenhagen International School (DK)

Acoustics and aesthetics: metal ceilings for colleges and universities

With almost 50,000 students, the Technical University of Munich is one of the largest universities in Europe. TUM also has the status of "University of Excellence". It is part of the Bavarian Elite Network, which promotes the elite in the higher education sector. The Garching research campus, located north of Munich, is TUM's largest.

Since its expansion in 2017, it has received a huge boost. Numerous new areas and rooms have been created on the three floors of the elongated building complex, which covers around 10,000 m².

An atrium in the interior allows the surrounding areas to come into their own. The light-colored expanded metal of the balustrade is inviting and friendly. The ceiling area perfectly accentuates the technical theme. The suspended expanded metal ceiling offers sufficient space in the ceiling void, e.g. for lighting systems and IT solutions. Visually undisturbed, the open-pored exposed concrete in the foyer and the wooden slats in the lecture theatres are shown to their best advantage.

TUM Garching, Munich (DE)

TUM Garching, Munich (DE)

Gym Secondary school Munich Moosach (DE)

Multifunctional metal ceilings and wall cladding

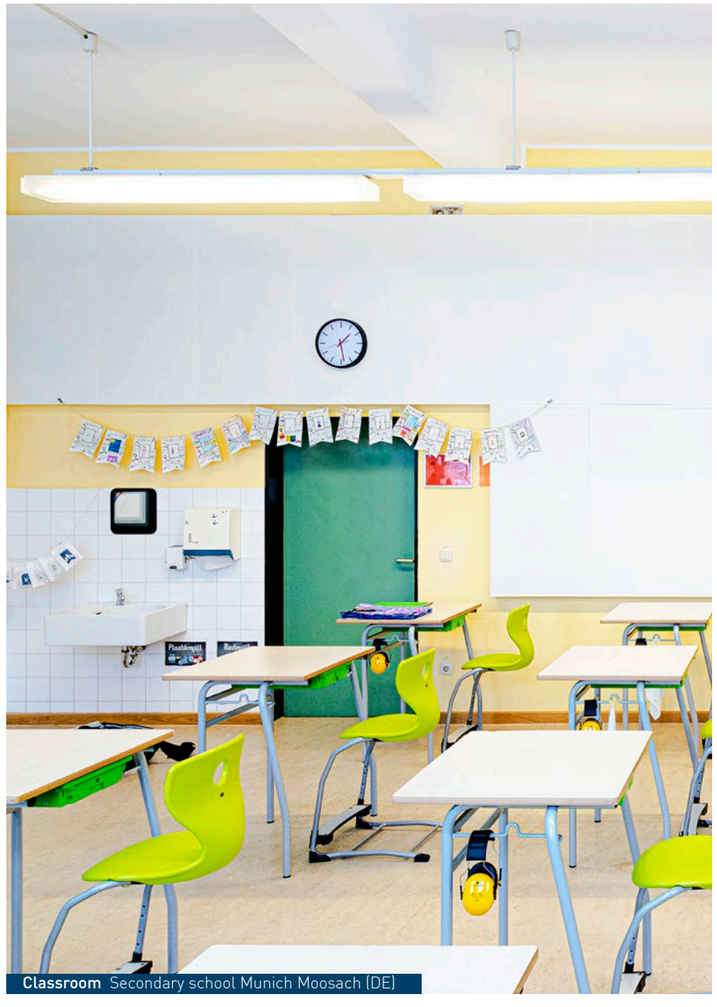
The secondary school in Munich Moosach won the i.s.i. school prize as the best secondary school in Bavaria. The project was carefully planned by Sturm + Viermet Architekten.

The metal walls and ceilings from Fural Metalit Dipling were installed over an area of more than 1,700 m² and, in addition to their aesthetics, impress with excellent solutions for acoustics and ball - proof.

Acoustically effective wall panels ensure perfect room acoustics in the school's classrooms. These can also be used as magnetic walls, providing plenty of space for important teaching content and colorful decorative elements.

The wall panels are also used in the corridors. In existing buildings, acoustically effective wall panels are ideal for retrofitting to improve room acoustics.

High noise levels during sports lessons are not uncommon. Ceiling sails are therefore also used at the Munich Moosach secondary school. These are secured against unintentional unhinging. They improve the room acoustics and make sports lessons more pleasant.



Classroom Secondary school Munich Moosach (DE)

Serviceability

Responsibility of the operator

The operator is responsible for maintaining the function and hygiene of the technical equipment, extensions and installation in a hospital.

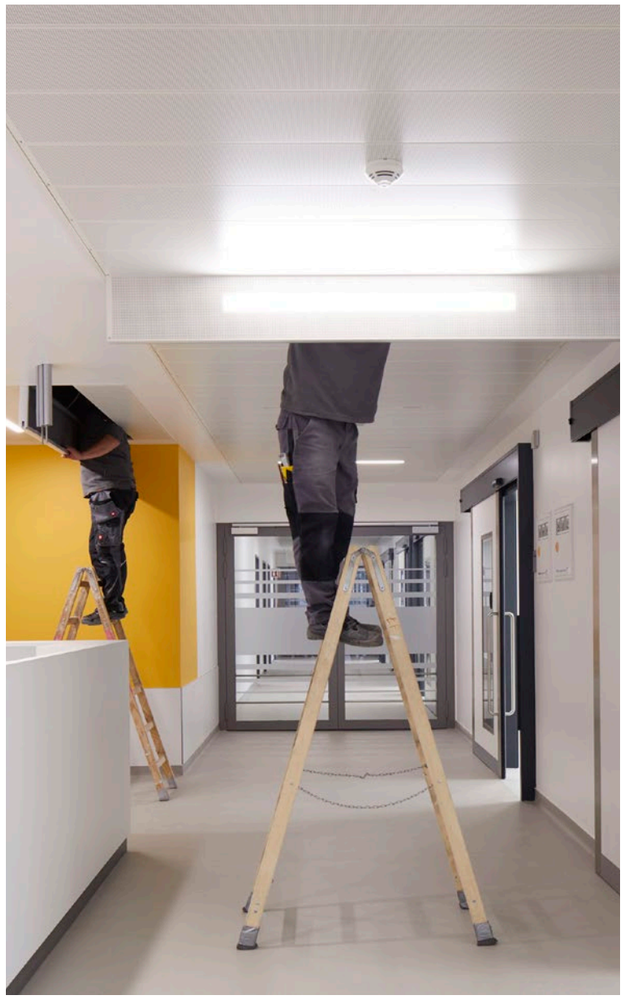
This means that the planners of a hospital are not only responsible to the investor regarding the initial costs; they are also responsible to the later operator regarding the service costs.

Service cycles

In Germany, according to VDI 6022, room air control systems with humidifiers must be checked at least every two years; systems without humidifiers at least every three years. Alongside the conducting of adhesive-film tests to determine the concentration of certain microorganisms and the checking of the filters, this includes an inspection and visual check of the entire facility. How can it be carried out correctly with a closed ceiling with a few service openings?

Accessibility

Our metal ceilings guarantee absolute accessibility, more than any other ceiling system, to almost every area of the ceiling cavity, thus constituting an important hygiene component.



Interior air quality

German Sustainable Building Council

The German Sustainable Building Council (Deutsche Gesellschaft für Nachhaltiges Bauen e. V., DGNB) was founded in Stuttgart in 2007. It advocates »... good buildings, liveable quarters, in short: a sustainably built environment«. (www.dgnb.de)

Around 1200 member organisations are networked in the DGNB. The association is also Germany's official representative in the »World Green Building Council«.

It has developed a remarkable catalogue for the certification of new buildings with the following criteria:

- Ecological quality (ENV)
- Economic quality (ECO)
- Socio-cultural and functional quality (SOC)
- Technical quality (TEC)
- Process quality (PRO)
- Site quality (SITE)

Socio-cultural and functional quality

Under SOC 1.2, the DGNB defines the criterion of »interior air quality«. Since people spend an average of 90% of their lives indoors, the interior room air is critical to health and well-being and thus for hygiene.

Achieving air quality

In this context, the DGNB calls for:

- The use of low-emission products,
- An appropriate air exchange ratio and
- Avoidance of VOCs (volatile organic compounds) that usually escape from paints, varnishes and adhesives via solvent evaporation. This kind of air pollution must not exceed 0.3 mg/m3

.

We are tested and certified

Fural Metalit Dipling has had its metal ceiling systems tested and certified according to the AgBB (Committee for Health Evaluation of Building Products) evaluation scheme of the German Federal Environment Agency

Our systems, including all installations and materials, were tested in a test chamber for 28 days. The result showed that all materials and surfaces used by us (steel and aluminium sheets, powder coatings and Parzifal®-wet coatings as well as adhesives) were far below the required limit values. Furthermore, no carcinogenic substances were found.

Other criteria of the DGNB

Other test criteria are of interest in regard to the understanding that building hygiene includes all measures for maintaining and fostering people's health in and around the building. In the area of »socio-cultural and functional quality« the following points are also rated:

- Thermal comfort (SOC1.2)
- Acoustic comfort (SOC1.3)
- Visual comfort (SOC1.4)

We are delighted to be able to make a contribution here as well with our multifunctional metal ceilings!

No moisture absorption

Water-proof from the outside

Metal ceilings from Fural Metalit Dipling have a water-proof paint surface. The surface is applied either in a high-quality powder coating procedure or in a special high-matt and low-reflection Parzifal®-wet coating

This allows our metal ceilings to be cleaned wet and disinfected with liquid agents without the cleaning agent or disinfectant penetrating the material.

Water-proof from the inside

During the operation of building, leaks of water-carrying pipes in the ceiling cavity happen time and again. With ceilings made of plaster board or mineral fibre panels, water retention in the material is almost inevitable.

Since it is also warm in the ceiling cavity, an almost ideal growth environment for microorganisms is created with the use of water-absorbent ceiling materials. Drying out the components entails a huge effort and high expenses and is frequently not possible to a satisfactory degree. Moreover, microorganisms that have once settled on the materials cannot be removed.

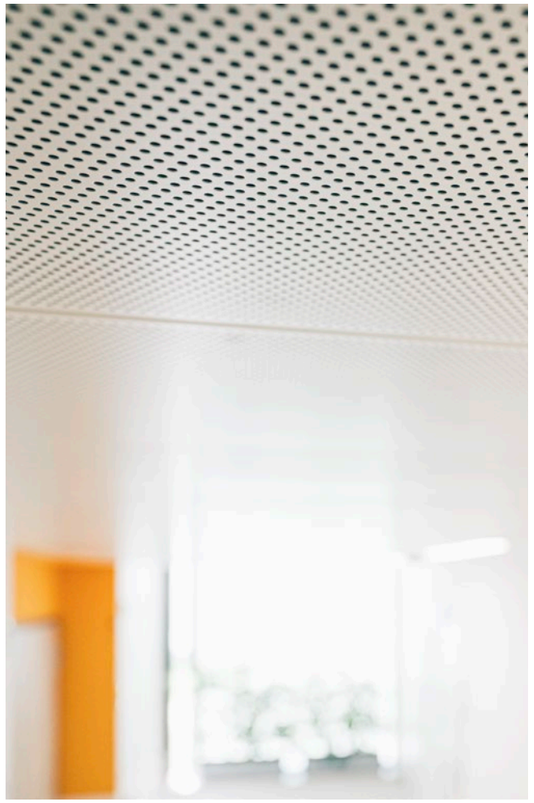
With metal ceilings, such water damage in the ceiling is not problematic: Surface drying is easily possible (mechanically or through evaporation), and no moisture penetrates the material. In addition, no white rust is formed on smooth surfaces. We are water-proof.

Waterproof drops on a coated metal surface

Multifunctionality

Metal ceilings from Fural can be equipped with functions in many ways. Our products combine the following features:

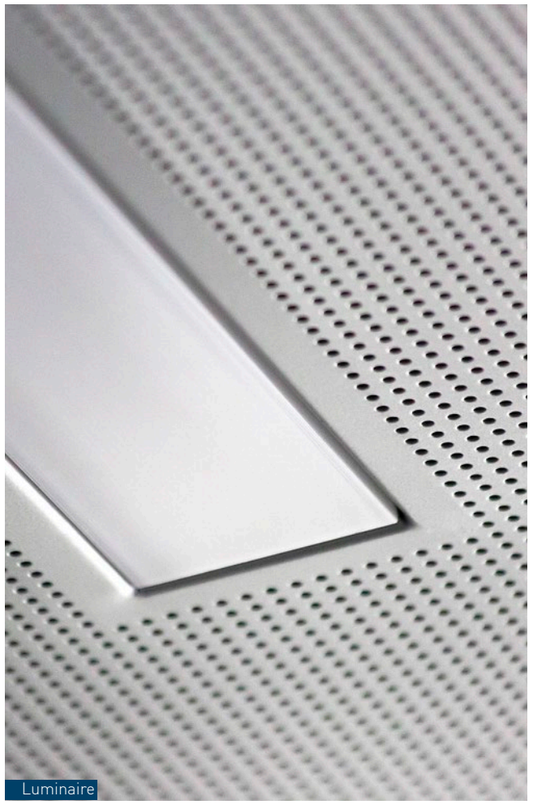
- Fire protection
- Acoustics
- Heating, cooling and ventilation
- Integration possibility of fixtures
- Each tile can be hinged-down
- Simple maintenance
- easy replacement of ceiling components
- easy revision of the ceiling void
- 100 % separable by type
- Recyclability



Clinic, Meinkofen (DE)

Continuous strip light

Infodisplay


Luminaire

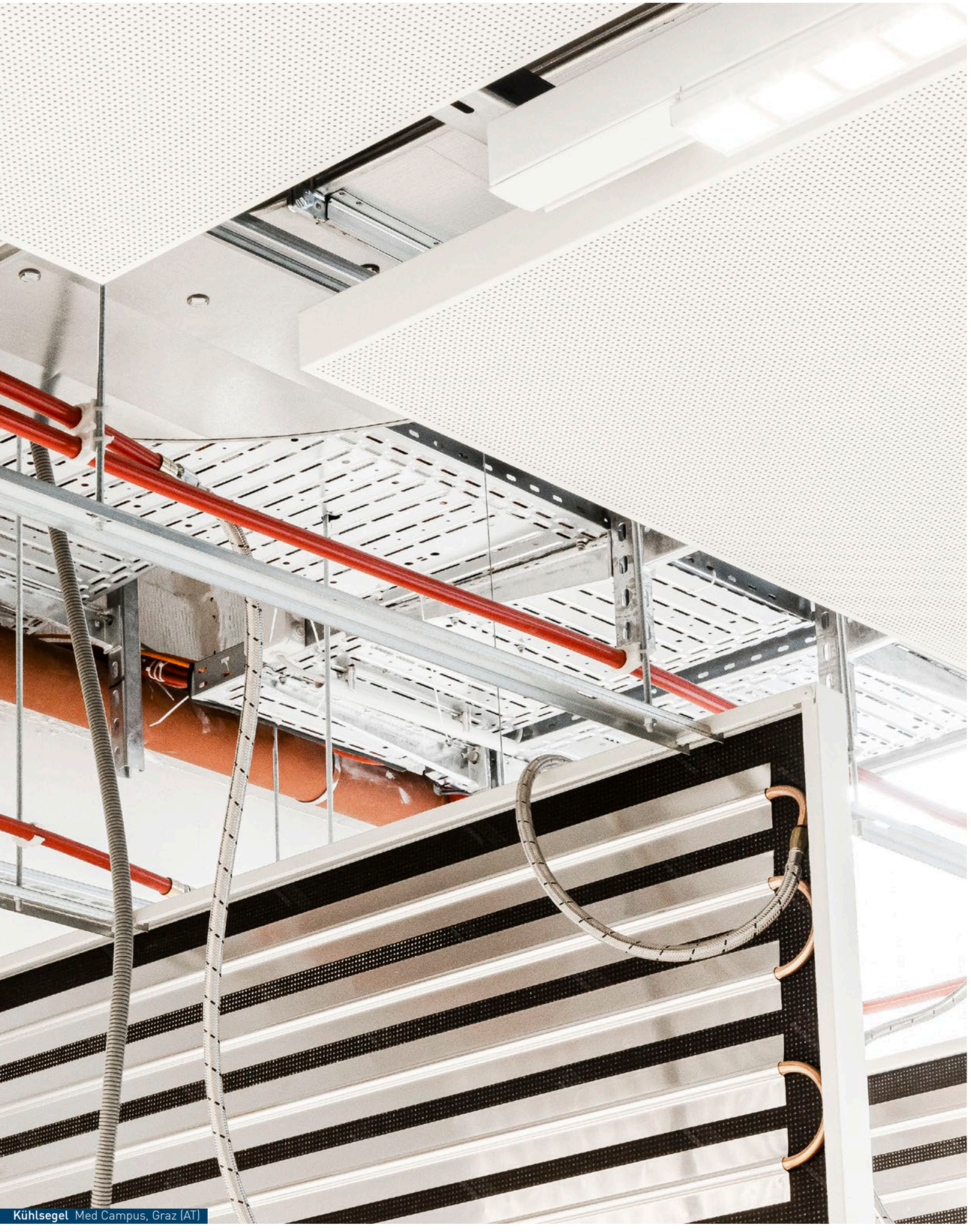

Downlight


Speaker

Integration of technology

It is important to control not only the technical aspects of the building, but also the comfort of patients and staff. For example, the control of temperature and humidity, thermal regulation and lighting appropriate to health conditions, and combine all this with the intended use of the structure (clinical paths and relative coherence of the rooms, flexibility of the parameters of each room).


TUM Garching, Munich (DE)



Kühlsegel Med Campus, Graz (AT)

Heating and cooling

We are a cool company!

One thing in particular is cool for us: our metal ceilings. Because they make it possible to heat and cool rooms in a very simple way. Climate functions can be added and integrated into our metal ceilings according to the modular principle and be combined with other ceiling variants, e.g. acoustic ceilings.

Why use metal for a cooling ceiling?

Metal is ideally suited as a conductive medium for heat and cold. Optimal temperature control is achieved on the basis of the radiation principle.

Since our cooling ceilings work completely without air circulation, dust swirling is prevented and the draft is avoided. During the pollen season, it is particularly important to ensure an agreeable cooling of the room – without being exposed to pollen.

This is particularly relevant to school buildings, since more and more children suffer from allergies due to pollen in the air.

Cooling and heating ceilings with copper/ aluminium or plastic systems can be implemented in various designs. Sustainability is also taken into account: Energy is saved, and costs are reduced.

We test cooling ceilings

The efficiency of our cooling ceilings and walls is no accident. We test your individual projects in our own test laboratory and guarantee custom-tailored solutions for your projects in top quality.

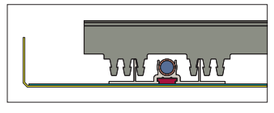
ALP - Acoustic guide profile

In joint tests, Schmöle (Menden), wg plan (Simmerath) and Fural (Gmunden) have developed a solution that ideally combines cooling performance and sound absorption. The result is the ALP acoustic guiding profile. The patented profile opens up large parts of the perforation surface thanks to its raised slats. This allows the perforation, the acoustic fleece and the ceiling cavity to work in the same way as metal ceilings. Tests by independent testing institutes confirm a 20 % higher sound absorption and 20 % higher cooling and heating performance of the ALP compared to conventional WLB (heat conducting sheet). For this increase in performance and the sustainability of the product, the BVF Award 2023 was presented to the ALP by the Bundesverband Flächenheizungen und Flächenkühlungen e.V. (Federal Association for Surface Heating and Cooling).

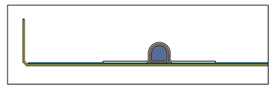
Climate elements

In Austria, the following climate elements are manufactured by long-term and well-experienced partner companies and integrated into our products.

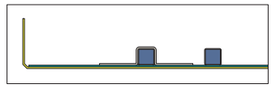
- Copper/aluminium systems with magnetic fixation



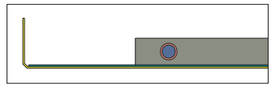
- Copper/aluminium systems with adhesive fixation



- Plastic/aluminium systems with magnetic fixation

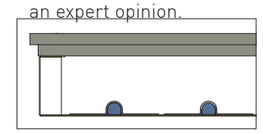


- Copper/graphite systems with adhesive fixation

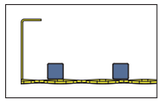


Fire protection ceiling and cooling

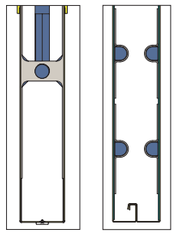
Cooling ceiling systems in the case of fire protection ceilings always require an expert opinion.



Expanded metal ceiling and cooling

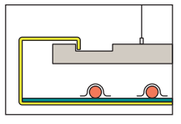


Baffle ceiling and cooling

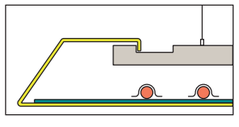


Floated ceiling and cooling

90° angle



55°-angle



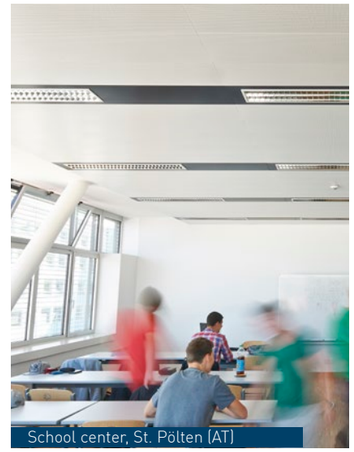
Further information can be found in the »Cooling ceilings« brochure.

Further information can be found in the brochure » ALP – Acoustic guide profile «

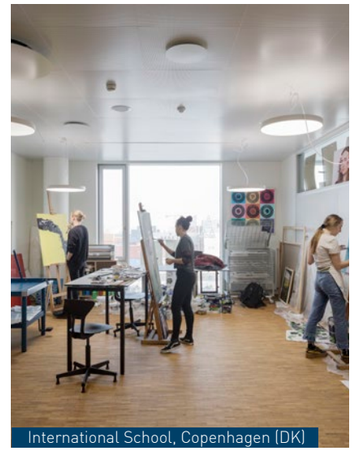

Uni Karl Landstein, Krems (AT)

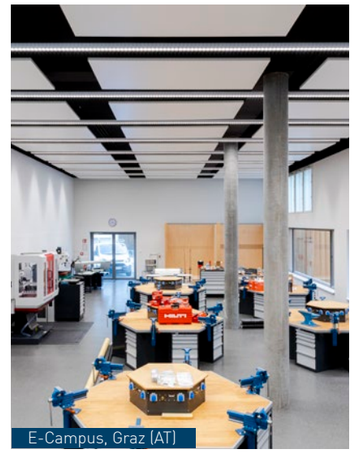
Many classrooms


E-Campus, Graz (AT)


School center, St. Pölten (AT)


International School, Kopenhagen (DK)


International School, Copenhagen (DK)


E-Campus, Graz (AT)

We think in terms of comfortable common rooms.

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:

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

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.

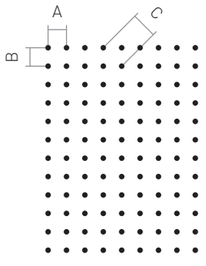
The cavity that this creates between raw ceiling and suspended ceiling acts as a sound transmission path which must be compensated for with longitudinal sound insulation.

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

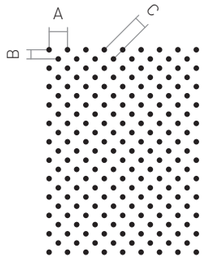
The longitudinal sound insulation is determined according to EN ISO 717-1 and specified as a weighted normalised flanking sound level difference **$D_{n,f,w}$** in **dB** units.

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.

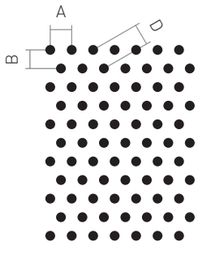
The reference curve is not shown in the test report diagrams.



Rg



Rd



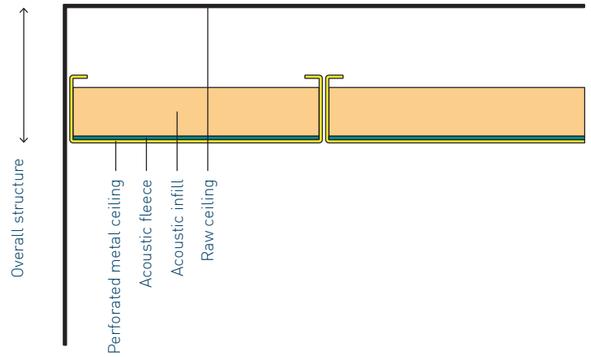
Rv

Perforation sizing

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

Effect of acoustic infills

University of Education, Thurgau(CH)



Different acoustic infills (absorber types)

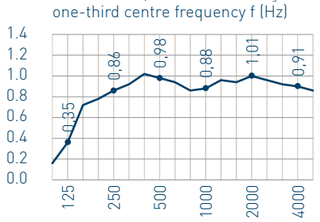
The sound absorption coefficient is greatly affected by the acoustic infills used, which can consist of mineral wool, mineral wool sealed in PE film, foam or polyester wool.

These acoustic infills are also available in different volumetric weights (kg/m³).

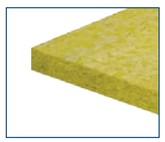
	Fural
	Rg 2.5 - 16 %
Perforation Ø	2.5 mm
Hole content	16 %
Max. perforation width	1,460 mm
Des. acc. to DIN 24041	Rg 2.50 - 5.50
Horizontal spacing	5.50 mm →
Vertical spacing	5.50 mm ↓
Diagonal spacing	7.78 mm ↘
Perforation direction	→

Sound absorption

Sound absorption coefficient α_s at one-third centre frequency f (Hz)



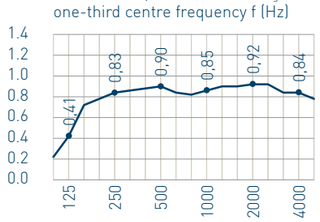
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	P-BA 279/2006 Figure 14
NRC	0.95
α_w	0.95
Absorber class	A (DIN EN 11654)
Acoustic infill	**30 mm mineral wool 45 kg/m³**



	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 2.5 - 5.50
Horizontal spacing	5.50 mm →
Vertical spacing	5.50 mm ↓
Diagonal spacing	7.78 mm ↘
Perforation direction	→

Sound absorption

Sound absorption coefficient α_s at one-third centre frequency f (Hz)

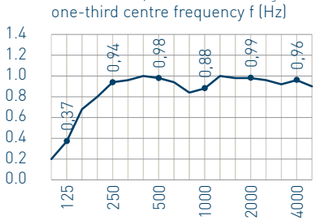


Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	P-BA 279/2006 Figure 17
NRC	0.85
α_w	0.90
Absorber class	A (DIN EN 11654)
Acoustic infill	**30 mm mineral wool 45 kg/m³ in PE film**

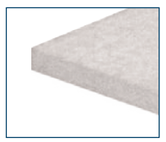
	Fural
	Rg 2.5 - 16 %
Perforation Ø	2.5 mm
Hole content	16 %
Max. perforation width	1,460 mm
Des. acc. to DIN 24041	Rg 2.50 - 5.50
Horizontal spacing	5.50 mm →
Vertical spacing	5.50 mm ↓
Diagonal spacing	7.78 mm ↘
Perforation direction	→

Sound absorption

Sound absorption coefficient α_s at one-third centre frequency f (Hz)



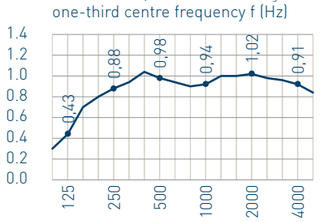
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	P-BA 279/2006 Figure 18
NRC	0.95
α_w	0.95
Absorber class	A (DIN EN 11654)
Acoustic infill	**30 mm foam 9 kg/m³**



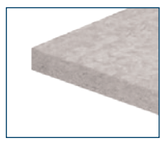
	Fural
	Rg 2.5 – 16 %
Perforation Ø	2.5 mm
Hole content	16 %
Max. perforation width	1,460 mm
Des. acc. to DIN 24041	Rg 2.50 – 5.50
Horizontal spacing	5.50 mm →
Vertical spacing	5.50 mm ↓
Diagonal spacing	7.78 mm ↘
Perforation direction	→

Sound absorption

Sound absorption coefficient α_s at one-third centre frequency f (Hz)



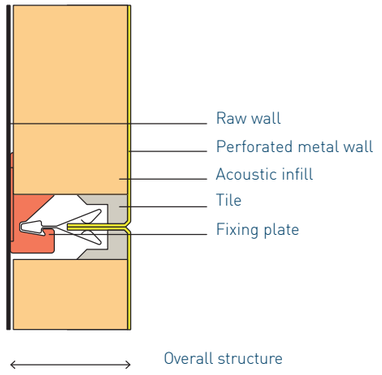
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	P-BA 279/2006 Figure 19
NRC	0.95
α_w	0.95
Absorber class	A (DIN EN 11654)
Acoustic infill	**30 mm polyester wool 48 g/m³**



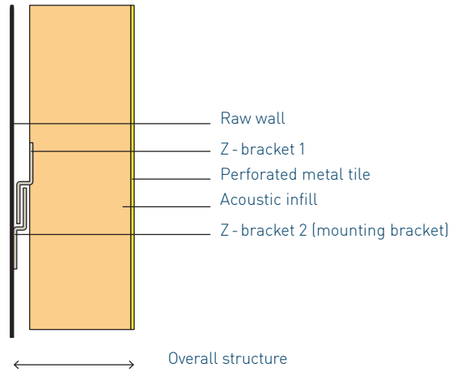
Acoustic walls

EMBL, Heidelberg (DE)

Clip-in system



Hang-in system

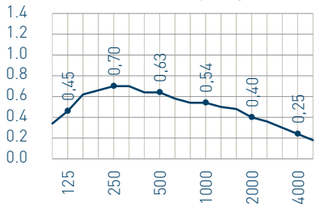


Fural
Rg 0.7 - 1 %

Perforation Ø	0.7 mm
Hole content	1 %
Max. perforation width	1,140 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	→

Sound absorption

Sound absorption coefficient α_s at one-third centre frequency f (Hz)



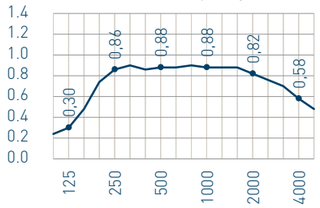
Overall structure	50 mm
Fleece	Bonded acoustic fleece
Test certificate	07.12.2010 M 61840/27
NRC	0.55
α_w	0.40 (L)
Absorber class	D (DIN EN 11654)
Acoustic infill	**50 mm mineral wool 100 kg/m³ in PE film**

Fural
Rg 0.7 - 4 %

Perforation Ø	0.7 mm
Hole content	4 %
Max. perforation width	1,140 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	→

Sound absorption

Sound absorption coefficient α_s at one-third centre frequency f (Hz)



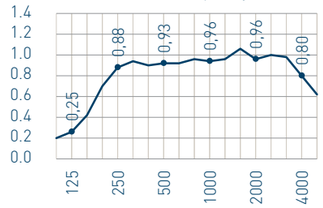
Overall structure	50 mm
Fleece	Bonded acoustic fleece
Test certificate	07.12.2010 M 61840/26
NRC	0.85
α_w	0.80 (L)
Absorber class	B (DIN EN 11654)
Acoustic infill	**50 mm mineral wool 100 kg/m³ in PE film**

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	→

Sound absorption

Sound absorption coefficient α_s at one-third centre frequency f (Hz)



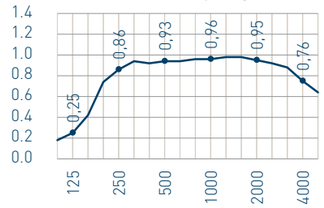
Overall structure	50 mm
Fleece	Bonded acoustic fleece
Test certificate	07.12.2010 M 61840/22
NRC	0.95
α_w	0.95
Absorber class	A (DIN EN 11654)
Acoustic infill	**50 mm mineral wool 100 kg/m³ in PE film**

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	→

Sound absorption

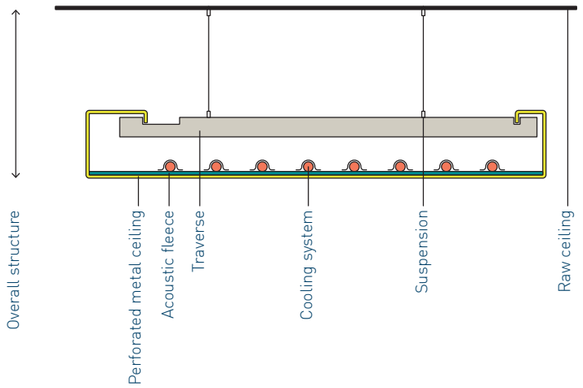
Sound absorption coefficient α_s at one-third centre frequency f (Hz)



Overall structure	50 mm
Fleece	Bonded acoustic fleece
Test certificate	07.12.2010 M 61840/25
NRC	0.95
α_w	0.95
Absorber class	A (DIN EN 11654)
Acoustic infill	**50 mm mineral wool 100 kg/m³ in PE film**

Cooling floating ceiling

MED Campus, Graz (AT)



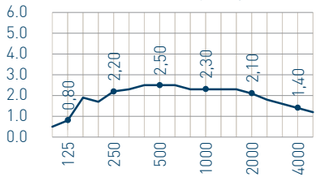
Room temperature control by floating ceiling

Floating ceilings are particularly suitable for combination with water-bearing heat exchangers for room temperature control. Fitting with cooling systems changes the acoustic properties of the floating ceilings, because the previously continuous holes of profiles are covered. Therefore the "acoustic occupancy level" is specified in the tables. This means the proportion of the area covered by the heat conducting profile.

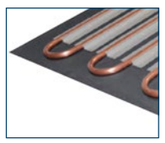
	Fural
	Rg 2.5 - 16 %
Perforation Ø	2.5 mm
Hole content	16 %
Max. perforation width	1,460 mm
Des. acc. to DIN 24041	Rg 2.50 - 5.50
Horizontal spacing	5.50 mm →
Vertical spacing	5.50 mm ↓
Diagonal spacing	7.78 mm ↘
Perforation direction	→

Sound absorption

Absorption area A_{Obj}/m² at one-third centre frequency f (Hz)



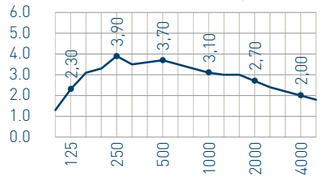
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	28.06.2019 M 105629/37
Equiv. sound absorp.	(500 Hz) 2.50 m²
Visible surface area	3.45 m²
Acoustic infill	**Cooling system**
Acoustic occ. level	73 % (cooling system with 12 heat conducting profiles)



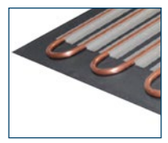
	Fural
	Rg 2.5 - 16 %
Perforation Ø	2.5 mm
Hole content	16 %
Max. perforation width	1,460 mm
Des. acc. to DIN 24041	Rg 2.50 - 5.50
Horizontal spacing	5.50 mm →
Vertical spacing	5.50 mm ↓
Diagonal spacing	7.78 mm ↘
Perforation direction	→

Sound absorption

Absorption area A_{Obj}/m² at one-third centre frequency f (Hz)



Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	28.06.2019 M 105629/38
Equiv. sound absorp.	(500 Hz) 3.70 m²
Visible surface area	3.45 m²
Acoustic infill	**50 mm mineral wool 100 kg/m³ in PE film + cooling system**
Acoustic occ. level	73 % (cooling system with 12 heat conducting profiles)



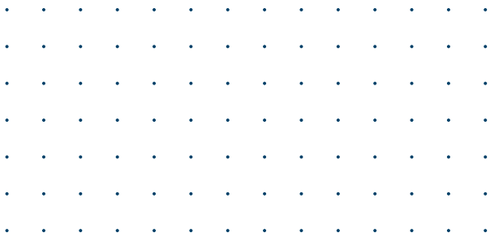
Edge formation of floating ceilings

The edge formation of floating ceilings can be implemented with internal angles of 90°, 60° or 45°. While internal angles of 90° create a voluminous impression, the versions with internal angles of 60° and 45° have a more two-dimensional effect.

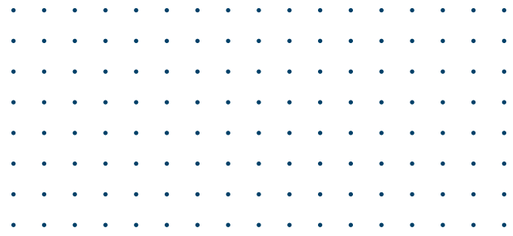
Ball-proof in sports

UP

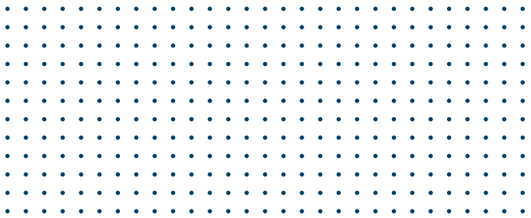
Tested perforations 1



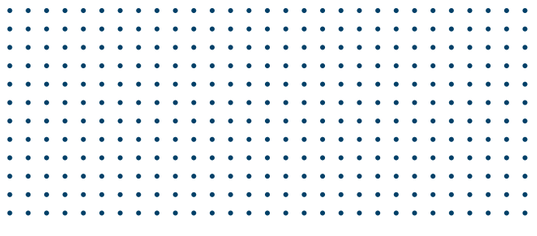
	Fural
	Rg 0.7 - 1 %
Perforation Ø	0.7 mm
Hole content	1 %
Max. perforation width	1,197 mm
Des. acc. to DIN 24041	Rg 0.70 - 6.00
Horizontal spacing	6.00 mm →
Vertical spacing	6.00 mm ↓
Diagonal spacing	8.48 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	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



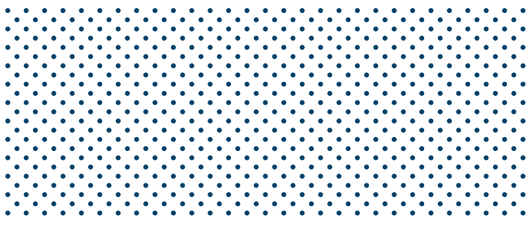
	Fural
	Rg 0.7 - 1.5 %
Perforation Ø	0.7 mm
Hole content	1.5 %
Max. perforation width	1,400 mm
Des. acc. to DIN 24041	Rg 0.70 - 5.00
Horizontal spacing	5.00 mm →
Vertical spacing	5.00 mm ↓
Diagonal spacing	7.07 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate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



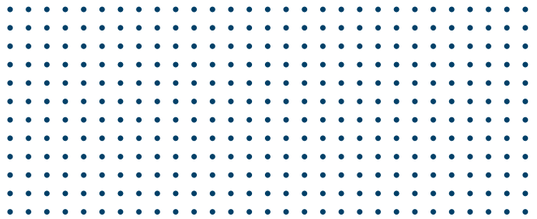
	Fural
	Rg 0.7 - 4 %
Perforation Ø	0.7 mm
Hole content	4 %
Max. perforation width	1,197 mm
Des. acc. to DIN 24041	Rg 0.70 - 3.00
Horizontal spacing	3.00 mm →
Vertical spacing	3.00 mm ↓
Diagonal spacing	4.24 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	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



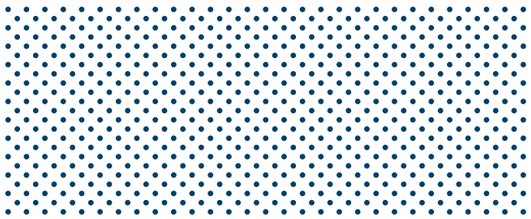
	Fural
	Rg 0.8 - 6 %
Perforation Ø	0.8 mm
Hole content	6 %
Max. perforation width	1,400 mm
Des. acc. to DIN 24041	Rg 0.80 - 3.00
Horizontal spacing	3.00 mm →
Vertical spacing	3.00 mm ↓
Diagonal spacing	4.24 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	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

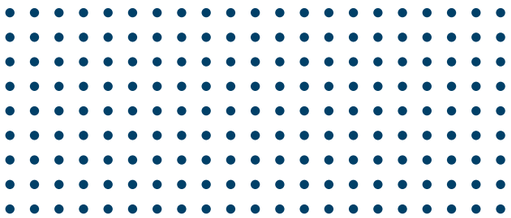


	Fural
	Rg 0.9 - 7 %
Perforation Ø	0.9 mm
Hole content	7 %
Max. perforation width	1,022 mm
Des. acc. to DIN 24041	Rg 0.90 - 3.00
Horizontal spacing	3.00 mm →
Vertical spacing	3.00 mm ↓
Diagonal spacing	4.24 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate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

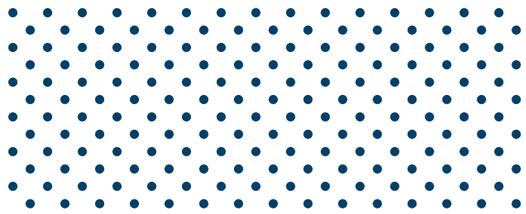


	Fural
	Rd 0.9 - 14 %
Perforation Ø	0.9 mm
Hole content	14 %
Max. perforation width	1,022 mm
Des. acc. to DIN 24041	Rd 0.90 - 2.12
Horizontal spacing	3.00 mm →
Vertical spacing	1.50 mm ↓
Diagonal spacing	2.12 mm ↘
Perforation direction	→
Overall structure	400 mm
Fleece	Bonded acoustic fleece
Test certificate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

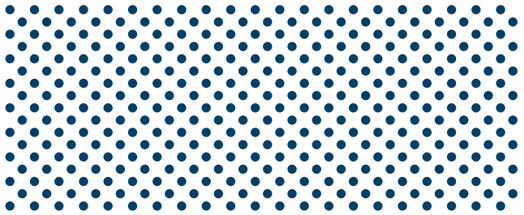
Tested perforations 2



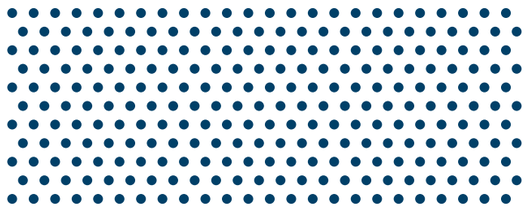
	Fural
	Rg 1.5 - 11 %
Perforation Ø	1.5 mm
Hole content	11 %
Max. perforation width	1,488 mm
Des. acc. to DIN 24041	Rg 1.50 - 4.00
Horizontal spacing	4.00 mm →
Vertical spacing	4.00 mm ↓
Diagonal spacing	5.65 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate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



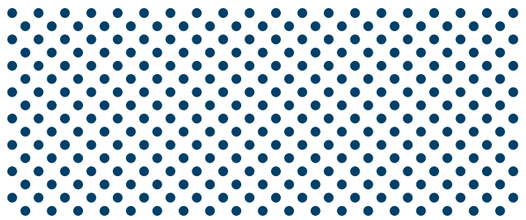
	Fural
	Rd 1.5 - 11 %
Perforation Ø	1.5 mm
Hole content	11 %
Max. perforation width	1,470 mm
Des. acc. to DIN 24041	Rd 1.50 - 4.00
Horizontal spacing	5.66 mm →
Vertical spacing	2.83 mm ↓
Diagonal spacing	4.00 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate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



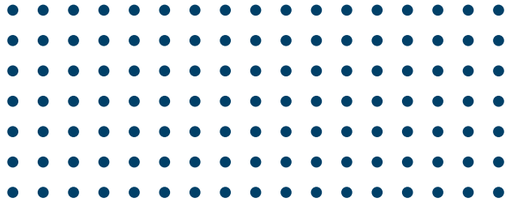
	Fural
	Rd 1.5 - 22 %
Perforation Ø	1.5 mm
Hole content	22 %
Max. perforation width	1,488 mm
Des. acc. to DIN 24041	Rd 1.50 - 2.83
Horizontal spacing	4.00 mm →
Vertical spacing	2.00 mm ↓
Diagonal spacing	2.83 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate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



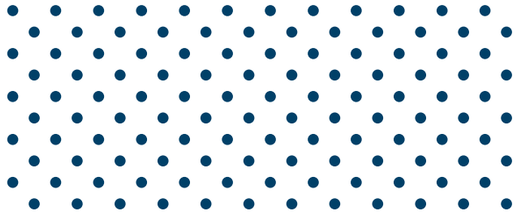
	Fural
	Rv 1.6 - 20 %
Perforation Ø	1.6 mm
Hole content	20 %
Max. perforation width	1,450 mm
Des. acc. to DIN 24041	Rv 1.60 - 3.50
Horizontal spacing	3.50 mm →
Vertical spacing	3.03 mm ↓
Offset spacing 60°	3.50 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	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

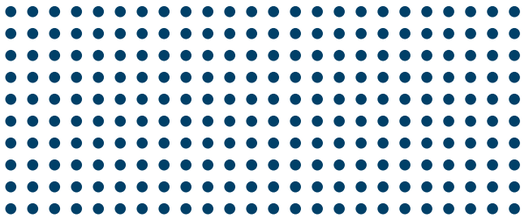


	Fural
	Rg 1.8 - 10 %
Perforation Ø	1.8 mm
Hole content	10 %
Max. perforation width	1,400 mm
Des. acc. to DIN 24041	Rg 1.80 - 4.95
Horizontal spacing	4.95 mm →
Vertical spacing	4.95 mm ↓
Diagonal spacing	7.00 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate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

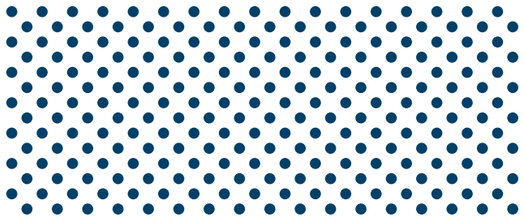


	Fural
	Rd 1.8 - 10 %
Perforation Ø	1.8 mm
Hole content	10 %
Max. perforation width	1.460 mm
Des. acc. to DIN 24041	Rd 1.80 - 4.95
Horizontal spacing	7.00 mm →
Vertical spacing	3.50 mm ↓
Diagonal spacing	4.95 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate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

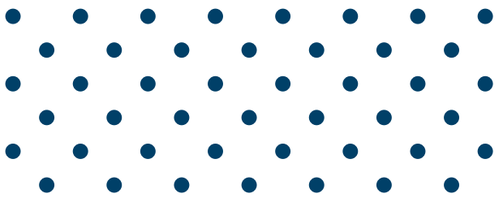
Tested perforations 3



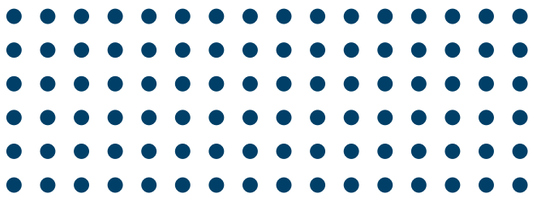
	Fural
	Rg 1.8 - 20 %
Perforation Ø	1.8 mm
Hole content	20 %
Max. perforation width	1.460 mm
Des. acc. to DIN 24041	Rg 1.80 - 3.50
Horizontal spacing	3.50 mm →
Vertical spacing	3.50 mm ↓
Diagonal spacing	4.95 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate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



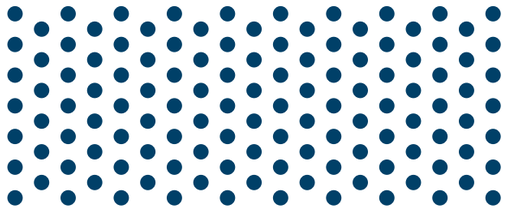
	Fural
	Rd 1.8 - 21 %
Perforation Ø	1.8 mm
Hole content	21 %
Max. perforation width	1,400 mm
Des. acc. to DIN 24041	Rd 1.80 - 3.50
Horizontal spacing	4.96 mm →
Vertical spacing	2.48 mm ↓
Diagonal spacing	3.50 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	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



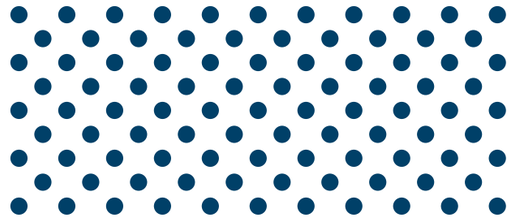
	Fural
	Rd 2.5 - 8 %
Perforation Ø	2.5 mm
Hole content	8 %
Max. perforation width	1,460 mm
Des. acc. to DIN 24041	Rd 2.50 - 7.80
Horizontal spacing	11.0 mm →
Vertical spacing	5.50 mm ↓
Diagonal spacing	7.78 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	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



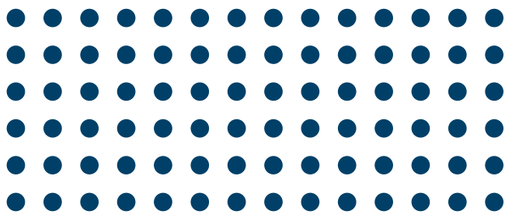
	Fural
	Rg 2.5 - 16 %
Perforation Ø	2.5 mm
Hole content	16 %
Max. perforation width	1,460 mm
Des. acc. to DIN 24041	Rg 2.50 - 5.50
Horizontal spacing	5.50 mm →
Vertical spacing	5.50 mm ↓
Diagonal spacing	7.78 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	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



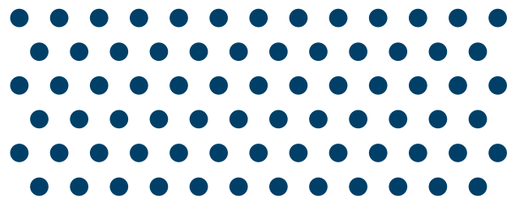
	Fural
	Rv 2.5 - 23 %
Perforation Ø	2.5 mm
Hole content	23 %
Max. perforation width	1,467 mm
Des. acc. to DIN 24041	Rv 2.50 - 5.00
Horizontal spacing	8.66 mm →
Vertical spacing	2.50 mm ↓
Offset spacing 60°	5.00 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	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

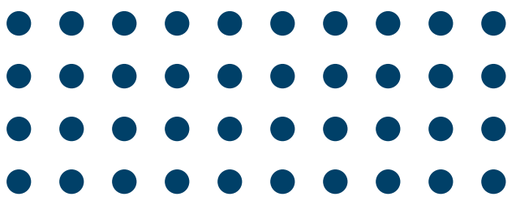


	Fural
	Rg 3.0 - 20 %
Perforation Ø	3.0 mm
Hole content	20 %
Max. perforation width	1,434 mm
Des. acc. to DIN 24041	Rg 3.00 - 6.00
Horizontal spacing	6.0 mm →
Vertical spacing	6.0 mm ↓
Diagonal spacing	8.48 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate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

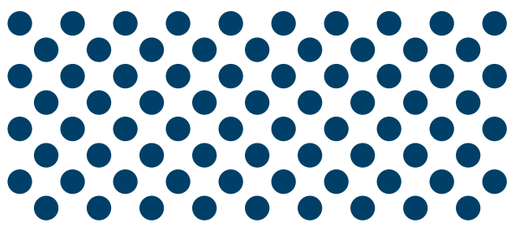


	Fural
	Rv 3.0 - 20 %
Perforation Ø	3.0 mm
Hole content	20 %
Max. perforation width	1,402 mm
Des. acc. to DIN 24041	Rv 3.00 – 6.35
Horizontal spacing	6.50 mm →
Vertical spacing	5.50 mm ↓
Offset spacing 60°	6.39 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate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

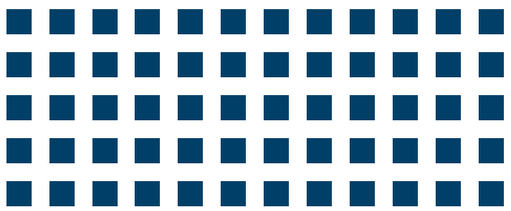
Tested perforations 4



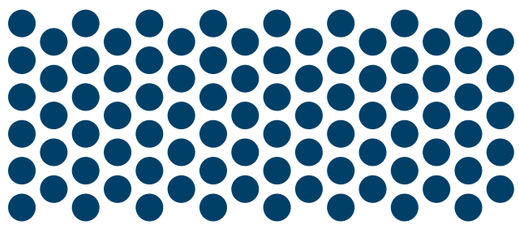
	Fural
	Rg 4.0 - 17 %
Perforation Ø	4.0 mm
Hole content	17 %
Max. perforation width	1,453 mm
Des. acc. to DIN 24041	Rg 4.00 - 8.60
Horizontal spacing	8.60 mm →
Vertical spacing	8.60 mm ↓
Diagonal spacing	12.1 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate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



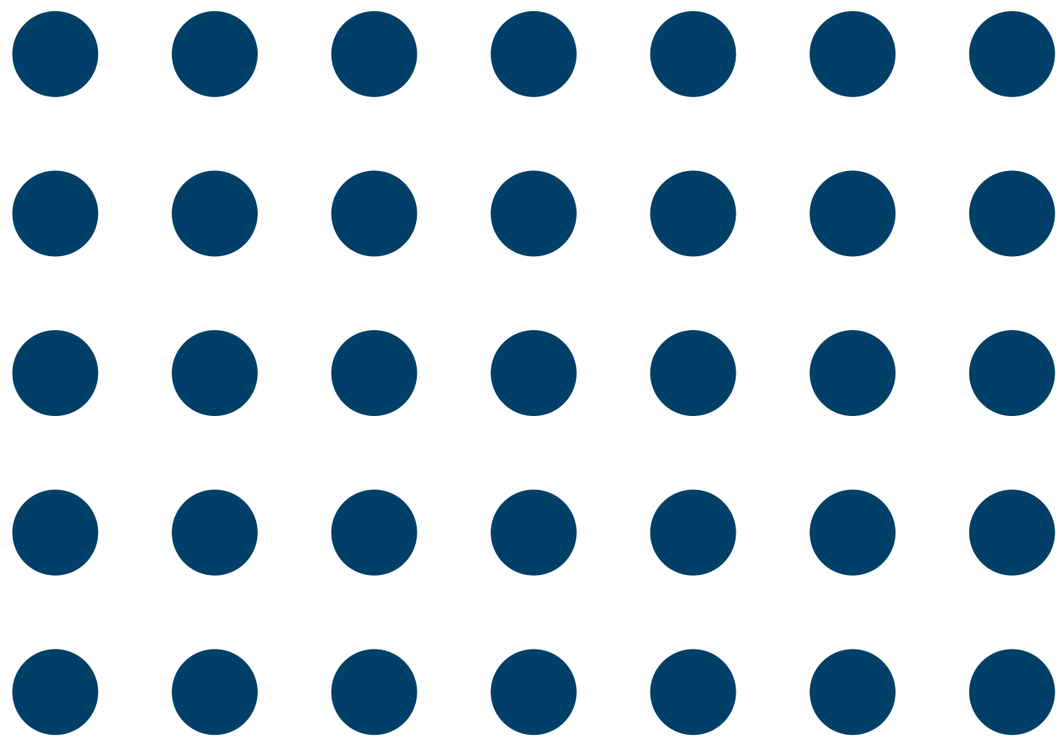
	Fural
	Rd 4.0 - 33 %
Perforation Ø	4.0 mm
Hole content	33 %
Max. perforation width	1,450 mm
Des. acc. to DIN 24041	Rd 4.00 - 6.10
Horizontal spacing	8.60 mm →
Vertical spacing	4.30 mm ↓
Diagonal spacing	6.10 mm ↘
Perforation direction	→
Overall structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	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

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)

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4810 Gmunden
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Photos
Celia Uhalde (main page, pages 8-11)
Stauss Processform GmbH (pages 4–5, 14-15, 18, 22-23, 28-29, 36, 38, 41, 50, 52–53, 63)
Adam Mørk (pages 2, 16-17, 19, 24-25, 41, 42-43)
Peter Kubelka (pages 3, 41)
Herbert Brunnmeier (pages 6-7, 20)
Gunter Bieringer Fotografie (pages 12-13, 26-27, 37)
gerstner + hofmeister architekten (pages 21, 48)
Yannick Wegner (page 21)
Achim Frank Schmidt (pages 30, 34-35)
Daniel Hawelka (page 40)
Michael Egloff (page 46)
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FURAL METALIT DIPLING

Fural
Systeme in Metall GmbH
Cumberlandstraße 62
4810 Gmunden
Austria
T +43 7612 74 851 0
E fural@fural.at
W **fural.com**

Metalit
AG
Murmattenstrasse 7
6233 Büron
Switzerland
T +41 41 925 60 22
E metalit@metalit.ch
W **metalit.ch**

Dipling
Werk GmbH
Königsberger Straße 21
35410 Frankfurt Hungen
Germany
T +49 6402 52 58 0
E dipling@dipling.de
W **dipling.de**

Fural
Bohemia s.r.o.
Průmyslová II/985
383 01 Prachatice
Czech Republic
T +420 732 578 739
E info@fural.cz
W **fural.com**

Fural
Systeme in Metall GmbH
Büro BeNeLux
Corluytstraat 5 GLV
2160 Wommelgem
Belgium
T +32 3 808 53 20
E benelux-france@fural.com
W **fural.com**

Fural
Systeme in Metall GmbH Sp. z o.o.
Oddział w Polsce
ul. Krakowska 25
43-190 Mikołów
Poland
T +48 32 797 70 64
E polska@fural.com
W **fural.com**