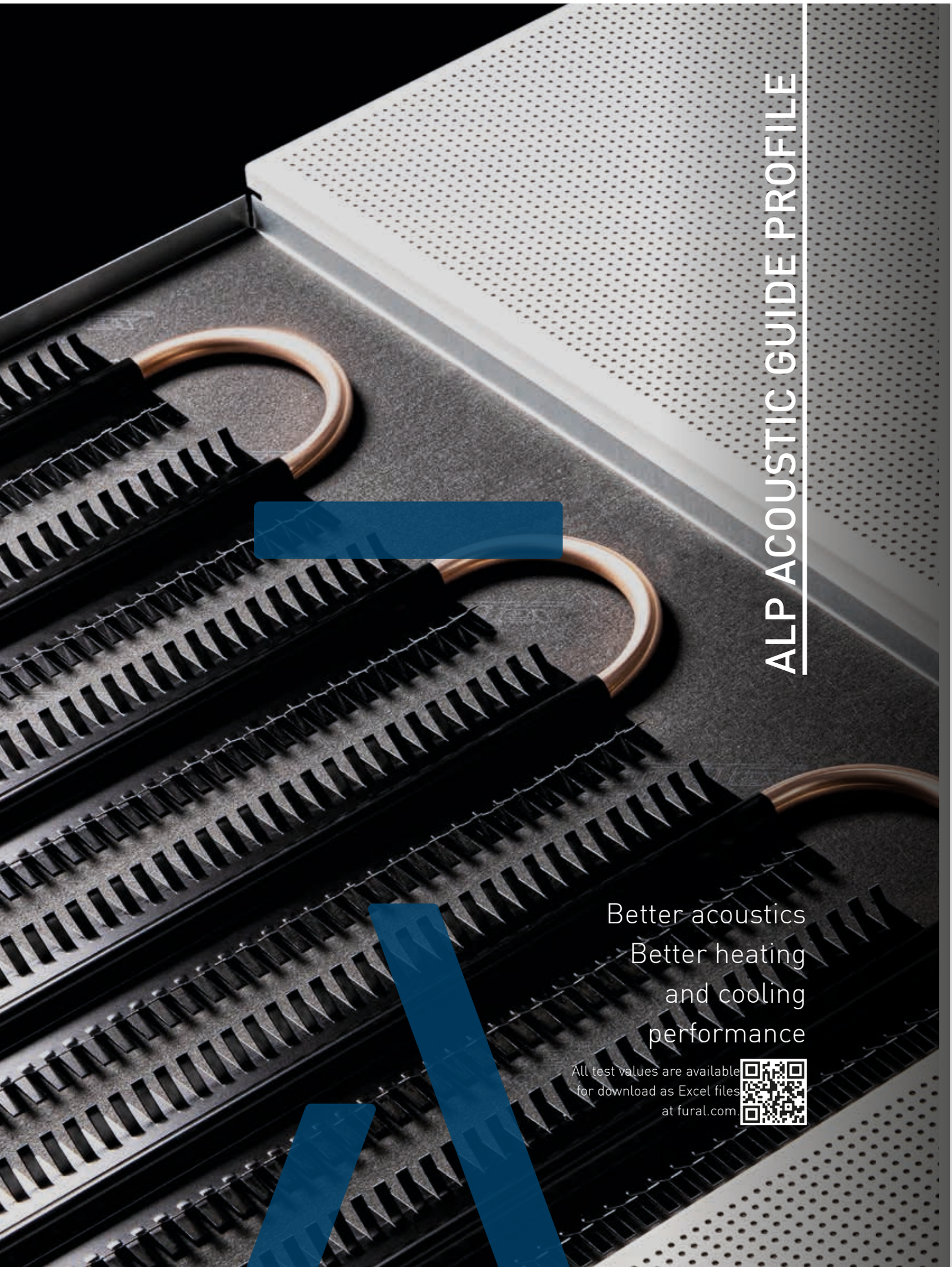


ALP ACOUSTIC GUIDE PROFILE

Better acoustics
Better heating
and cooling
performance

All test values are available
for download as Excel files
at fural.com.

Imprint

Publisher	Fural Systeme in Metall GmbH Cumberlandstraße 62 4810 Gmunden Österreich
State	Juli 2023
Photos	stauss processform gmbh (Titel, Seiten 6, 10, 14, 18) Fural (Seite 8) Bruno Klomfar (Seite 4) Architekturfotografie Gempeler (Seite 12) HGEsch Photography (Seite 19)
Concept and design	stauss processform gmbh (Seiten 11, 16 - 19)
Text	Fural
Illustrations	Fural (Seiten 7, 9, 11, 13, 15, 19) stauss processform gmbh, München (Seite 17)
Font	DIN Pro Light und Medium

Fural
Systeme in Metall GmbH
Cumberlandstraße 62
4810 Gmunden
Austria

Business management:
Christian Demmelhuber

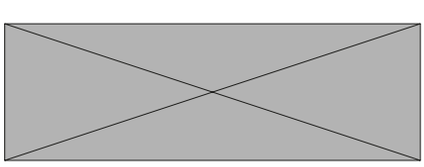
T +43 7612 74 851 0
F +43 7612 74 851 11
E fural@fural.at
W fural.com
Sitz Gmunden
GS Wels
FN 23 57 11
UID ATU 62 76 33 34

Content

Mitglied der DGNB
Deutsche Gesellschaft für Nachhaltiges Bauen
German Sustainable Building Council

PEFC zertifiziert
Dieses Produkt stammt aus nachhaltig bewirtschafteten Wäldern und kontrollierten Quellen
www.pefc.at
PEFC/06-39-16

Stahl



Carbon neutral
Print product
ClimatePartner.com/11293-2310-1005

Bison Offices, Sursee
- Leuenberger Architekten
- Atrium
- Perforation Rd 1,5 - 22 %
- Colour RAL9016 Traffic white
- Hang-in system H28

WE ARE INNOVATIVE

Our drive

Due to their basic materials of sheet steel or aluminium, metal ceilings are excellently suited for supplementing with heat exchangers (cooling coils) made of e.g. copper and aluminium.

High performance values in cooling or heating are achieved with the appropriate occupancy of the ceiling elements. At the same time, there are demanding requirements for the sound absorption of perforated metal ceilings in offices.

The perforation offers the best acoustic values if the holes are not covered by heat-conducting profiles of the heating-cooling elements. For a very good cooling performance, a large area must be covered with heat conducting profiles.

Test values are often available for partial solutions, rarely for the complete construction. This leaves ambiguities or gives rise to discussion points and interpretations. In joint tests, the companies Schmöle (Menden), wg plan (Simmerath) and Fural (Gmunden) have developed a solution that ideally combines cooling capacity and sound absorption.

The result is the ALP acoustic guide profile. The component, for which a patent application has been filed, covers the perforated, acoustically effective area to a much lesser extent than other products. This means that the perforation, the acoustic fleece and the ceiling void can be and the ceiling void can act in the the same way as with metal ceilings.

This brochure

On the following pages, the mode of operation of the ALP is presented on the basis of test values. A distinction is made between closed ceiling systems and floating ceilings. Closed ceilings are full-surface systems that do not have any joints to the room partition walls and the façade. This includes, for example, strip grid sytem.

Floating ceilings are elements that are mounted freely in the room and at a distance from each other. Acoustically, the so-called edge diffraction effect and reflections absorbed by the raw ceiling mean that floating ceilings can have an effect with a larger area than their visible surface. For this reason, the equivalent sound absorption area (A equ.) per frequency and the visible surface area are specified directly for floating ceilings. The diversions via a sound absorption coefficient is saved. The great advantage of acoustic ceilings made of metal is that they already have very good absorption values at the first sound passage - the sound is therefore immediately absorbed in the best possible way, disturbing reflections are reduced. Every hole pattern used in floating ceilings was also tested in parallel as a closed ceiling structure (see examples on page 5).

Note

Other different perforations are possible. For details, please refer to our „ Certified Acoustics“ brochure at www.fural.com/en/downloads.

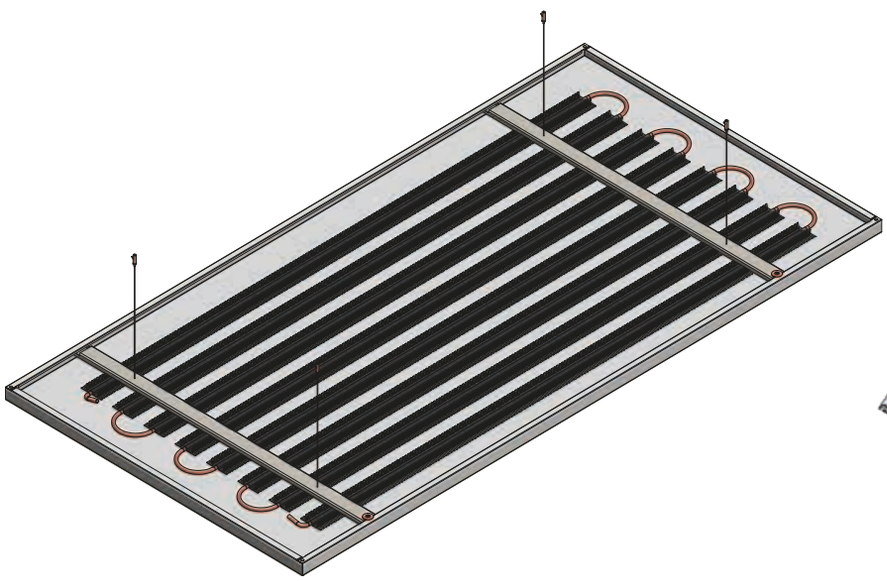
WLB VS. ALP

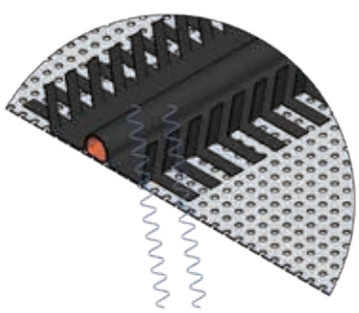
Heat guide plate (WLB) vs. Acoustic guide profile (ALP)

When using the ALP, much less acoustically effective area is covered than when using thermal baffles. The incident sound energy can be absorbed, but the thermal energy is still transferred to the water-bearing pipes. No material is wasted due to the partial bending up of the lamellas.

Advantages of ALP over WLB

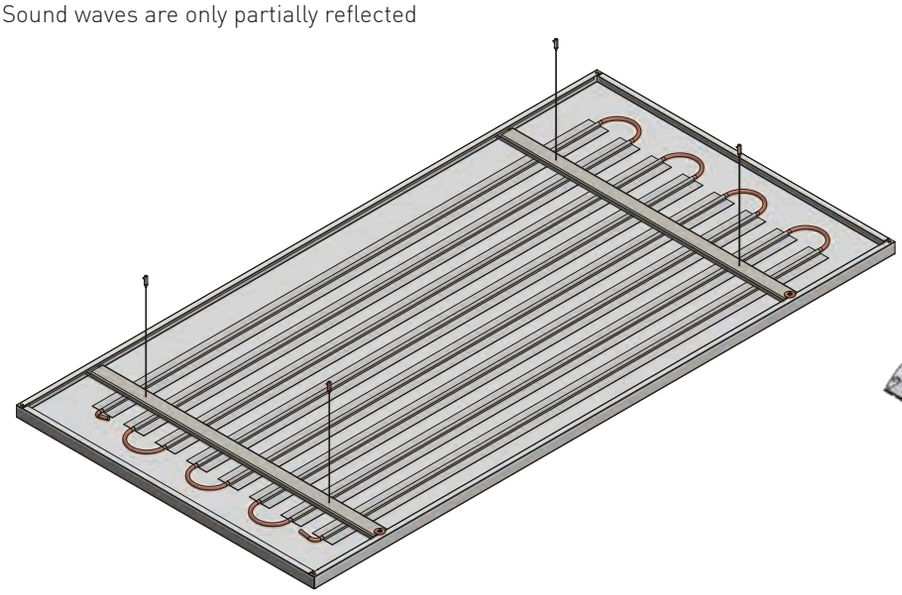
- better sound absorption
- better heating and cooling performance with floating ceilings and closed ceilings

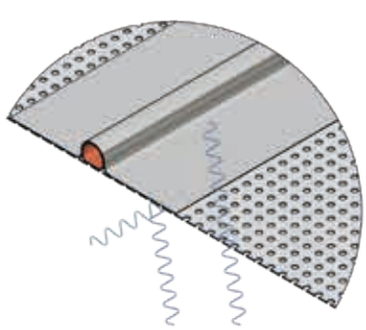




Innovative acoustic guide profile - ALP
Sound waves are only partially reflected

Note: Acoustic fleece not shown





Conventional heat guiding plate
Sound waves are completely reflected by the heat guiding plate

Note: Acoustic fleece not shown

Showroom

WLB VS. ALP

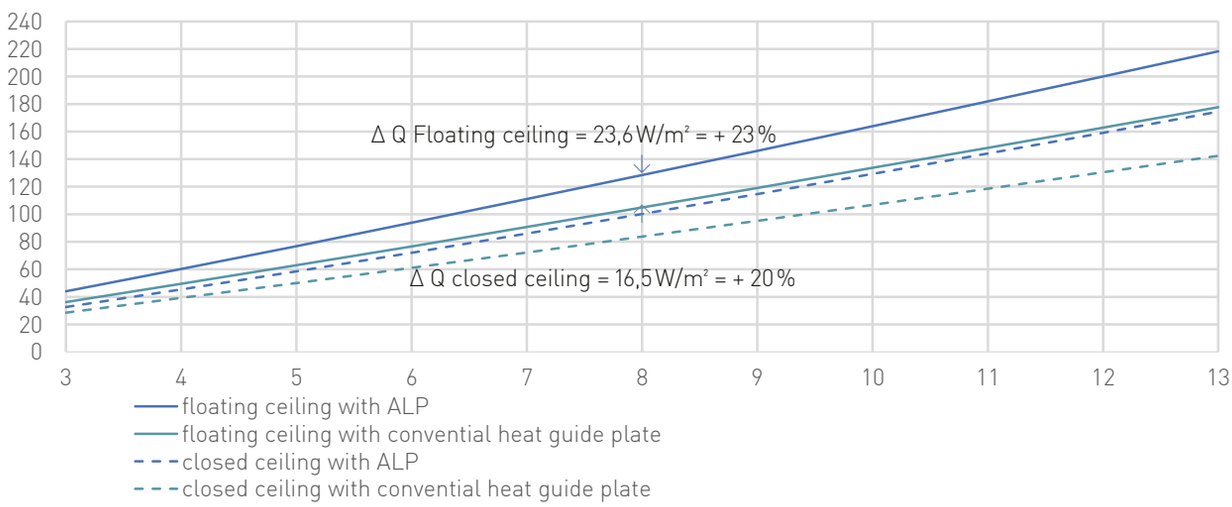
Heat guide plate (WLB) vs. Acoustic guide profile (ALP)

In order to improve the acoustic properties, the lamellas are partially bent up as described before. This not only improves the acoustics, but also the thermal properties. Bending up the fins increases the heat exchanger surface in the cassette cavity (e.g. finned heat exchanger). Furthermore, the bent-up fins optimise the convective transfer.

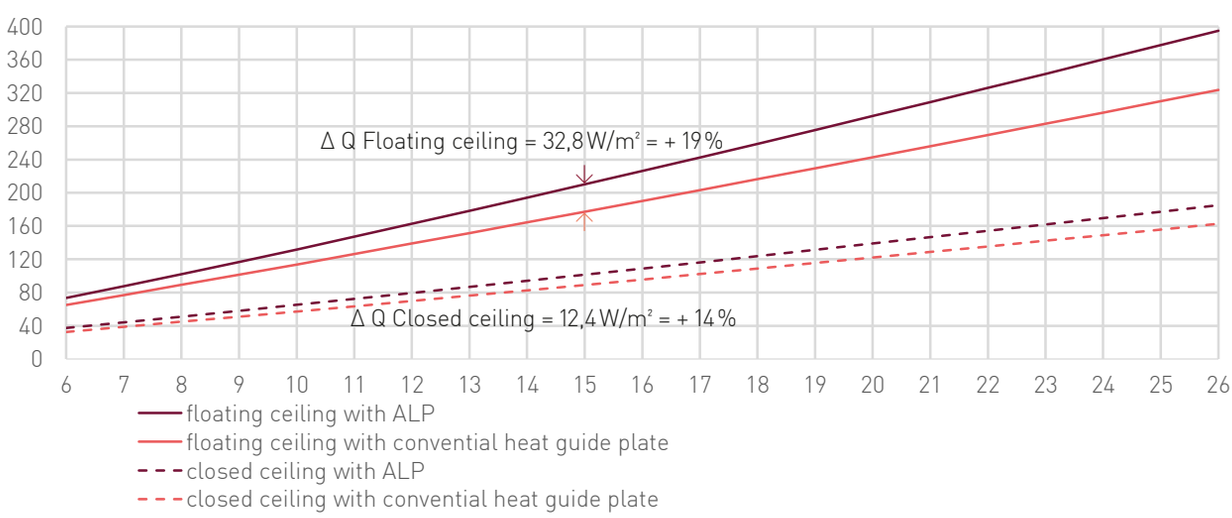
EN 14240 – Heating and cooling:

– The performance is related to the active area according to EN 14240:2004

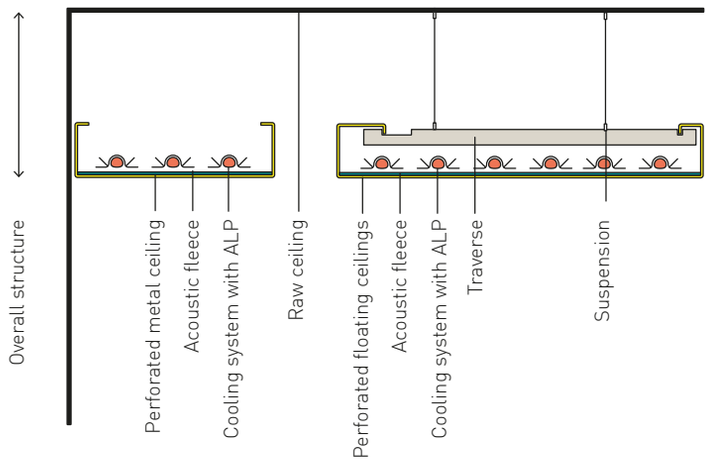
Cooling performance [W/m²] - average excess temperature in K



Heating performance [W/m²] - average excess temperature in K



Akustik- und Designdeckensegel
Mittelschule München Moosach



Comparison of floating ceilings and closed ceiling – first sound transmission

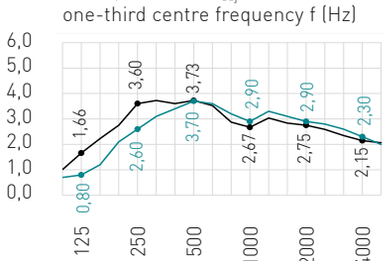
Metal floating ceilings with ALP offer the ideal combination to achieve very good sound absorption values and cooling/heating performance. Even without additional overlays, both closed ceilings and floating ceilings perform very well (see left column).

If overlays such as mineral wool strips are used, the physical properties of the floating ceilings (e.g. edge diffraction effect) have a stronger effect (right column).

	Fural Metalit Dipling
	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)

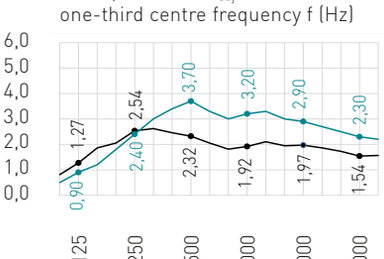


Overall Structure	200 mm
Fleece	Bonded acoustic fleece
Type	**closed ceiling*; Floating ceiling**
Test certificate	B105629_64; B105629_77
equiv. sound absorp.	(500 Hz) 3,73 m²; 3,70 m²
Visible surface area	4,05 m²
Acoustic infill	without
Acoustic occ. level	62 % cooling register with ALP

	Fural Metalit Dipling
	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
Type	**closed ceiling**; Floating ceiling**
Test certificate	B105629_73; B105629_80
equiv. sound absorp.	(500 Hz) 2,32 m²; 3,70 m²
Visible surface area	2,70 m²
Acoustic infill	33 % with 50 x 50 mm Mineralwool 57 kg/m³ in PE film between ALP
Acoustic occ. level	62 % cooling register with ALP

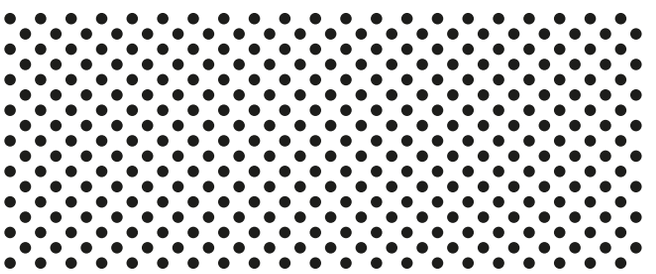
* The sound absorption coefficient α_s of the closed ceiling was converted to the visible surface area (4,05 m²) of the floating ceiling A_{Ob}.

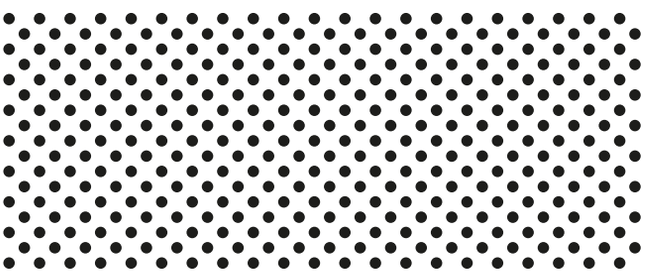
** The sound absorption coefficient α_s of the closed ceiling was converted to the visible surface area (2,70 m²) of the floating ceiling A_{Ob}.

FURAL METALIT DIPLING

FLOATING CEILING WITH ALP

Hospital, Solothurn (CH)

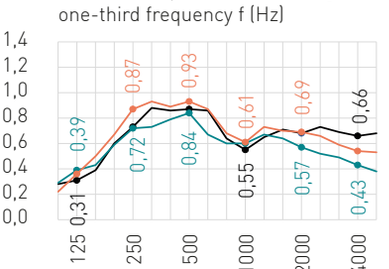




	Fural Metalit Dipling
	Rd 1,5 - 22 %
Perforation Ø	1,5 mm
Hole content	22 %
Max. perforation width	1.488 mm
Des. acc. to DIN 24041	Rd 1,50 - 2,83
Horizontal spacing	4,00 mm →
Vertical spacing	2,00 mm ↓
Diagonal spacing	2,83 mm ↘
Perforation direction	→

Sound absorption

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

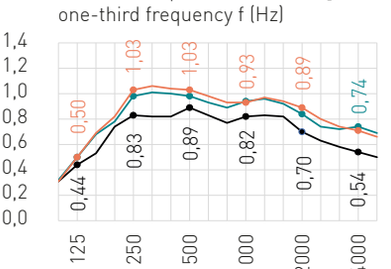


Overall Structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	M 61840/5; DE22ASRF 001 5; B105629/63
NRC	0,70; 0,70; 0,80
α_w	0,70; 0,60; 0,70 (L)
Absorber class,	C, C, C (DIN EN 11654)
Acoustic infill	without
Acoustic occ. level	**ohne;** **66 % cooling register with WLB;** **62 % cooling register with ALP**

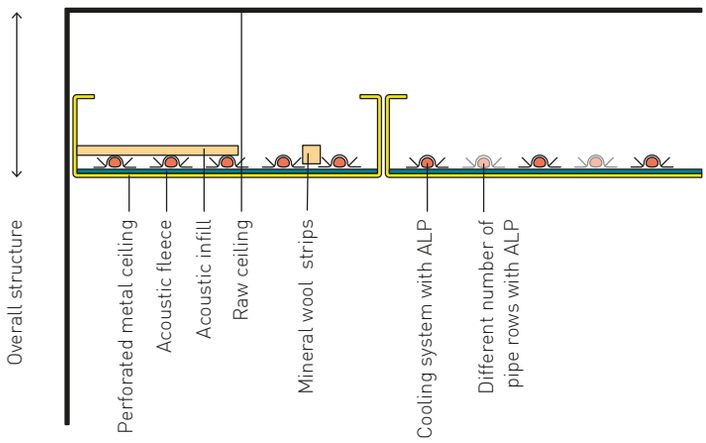
	Fural Metalit Dipling
	Rd 1,5 - 22 %
Perforation Ø	1,5 mm
Hole content	22 %
Max. perforation width	1.488 mm
Des. acc. to DIN 24041	Rd 1,50 - 2,83
Horizontal spacing	4,00 mm →
Vertical spacing	2,00 mm ↓
Diagonal spacing	2,83 mm ↘
Perforation direction	→

Sound absorption

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



Overall Structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	DE22ASRF 001 6; B105629_74; B105629_69
NRC	0,80; 0,95; 0,95
α_w	0,70 (L); 0,85 (L); 0,90 (L)
Absorber class	C; B; A (DIN EN 11654)
Acoustic infill	**30 mm Mineral wool 45 kg/m³ in PE Film;** **30 mm Mineralwool 45 kg/m³ in PE Film;** **40 mm Polyester wool 20 kg/m³**
Acoustic occ. level	**66 % cooling register with WLB;** **62 % cooling register with ALP;** **62 % cooling register with ALP**



Different overlay/absorber thicknesses

The layer thickness influences the sound absorption coefficient just as much as the layer type and the height of the air cavity. All these 3 factors play an important role in the acoustic behaviour of the metal ceiling.

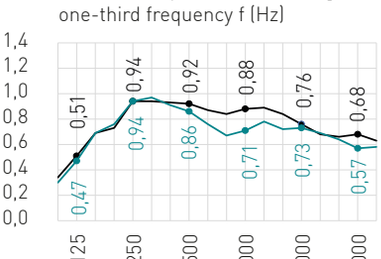
Acoustic occupancy level

Metal ceilings are ideally suited for combination with water-bearing heat exchangers for room temperature control. The use of cooling coils leads to a change in the acoustic properties of the ceiling tiles because previously continuous holes are covered by profiles. For this reason, the „acoustic occupancy rate" is given in the tables. This refers to the proportion of the surface that is covered by heat-conducting profiles.

	Fural Metalit Dipling
	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 frequency f (Hz)

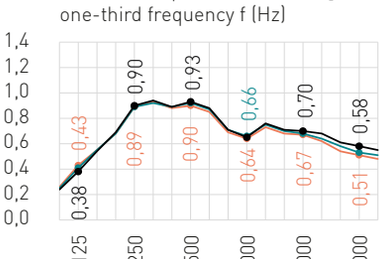


Overall Structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	B105629_75; B105629_73
NRC	0,90; 0,80
α_w	0,80 (L); 0,70 (L)
Absorber class	B; C (DIN EN 11654)
Acoustic infill	**30 mm Mineral wool 45 kg/m³ in PE Film; 33 % with 50x50 mm MiWo57 kg/m³ PE**
Acoustic occ. level	62 % cooling register with ALP

	Fural Metalit Dipling
	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 frequency f (Hz)



Overall Structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	B105629_65; B105629_64; B105629_66
NRC	0,80; 0,80; 0,80
α_w	0,70 (L); 0,70 (L); 0,65 (LM)
Absorber class	C; C; C (DIN EN 11654)
Acoustic infill	without
Acoustic occ. level	**46 % cooling register with ALP; 62 % cooling register with ALP; 77 % cooling register with ALP**

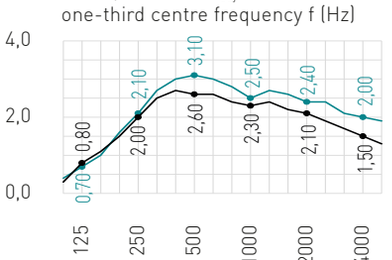
FLOATING CEILING WITH ALP

E-Campus, Graz (AT)

	Fural Metalit Dipling
	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}/m^2 at one-third centre frequency f (Hz)

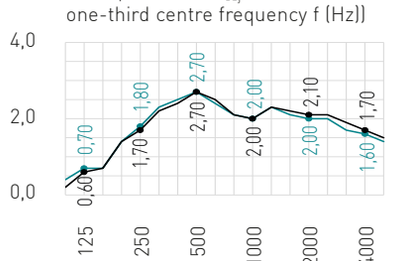


Overall Structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	B105629_84; B105629_83
equiv. sound absorp.	(500 Hz) 2,60 m^2; 3,10 m^2
Visible surface area	3,45 m^2; 3,45 m^2
Acoustic infill	without
Acoustic occ. level	**72 % cooling register with WLB;** 72 % cooling register with ALP

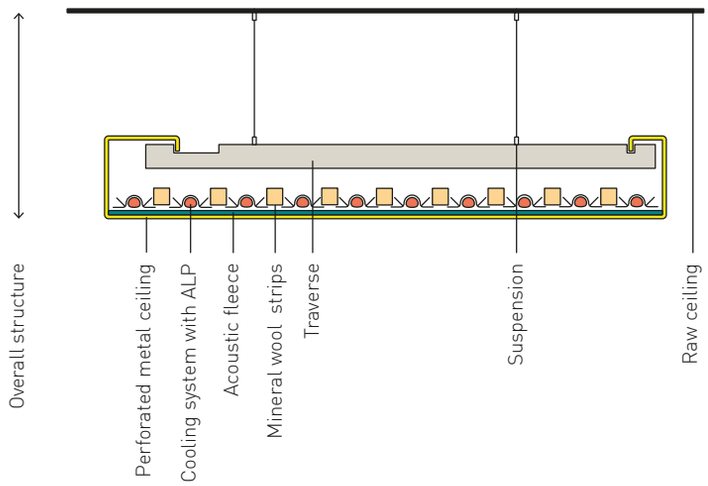
	Fural Metalit Dipling
	Rg 2,5 - 16 %
Perforation Ø	2,5 mm
Hole content	16 %
Max. perforation width	1.460 mm
Des. acc. to DIN 24041	Rg 2,50 - 5,50
Horizontal spacing	5,50 mm →
Vertical spacing	5,50 mm ↓
Diagonal spacing	7,78 mm ↘
Perforation direction	→

Sound absorption

Absorption area A_{Obj}/m^2 at one-third centre frequency f (Hz))



Overall Structure	200 mm
Fleece	Bonded acoustic fleece
Test certificate	B105629_81; B105629_82
equiv. sound absorp.	(500 Hz) 2,70 m^2; 2,70 m^2
Visible surface area	2,70 m^2; 2,70 m^2
Acoustic infill	without
Acoustic occ. level	**46 % cooling register with ALP;** 77 % cooling register with ALP



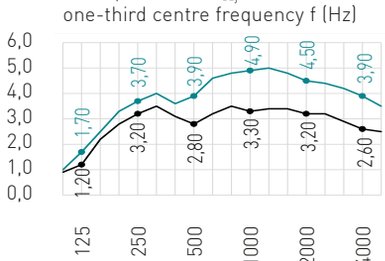
Floating ceiling

Floating ceilings can be used both as individual elements and as multi-part, composite units. With floating ceilings, the edge diffraction and the ratio of perimeter to surface area result in better sound absorption than with closed ceilings. For this reason, the equivalent sound absorption area and not the sound absorption coefficient is given for individual absorbers. To achieve the same acoustic effect in a room, significantly less surface area is required when using floating ceilings. The additional physical damping effects can result in material savings of up to 30%.

	Fural Metalit Dipling
	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}/m^2 at one-third centre frequency f (Hz)

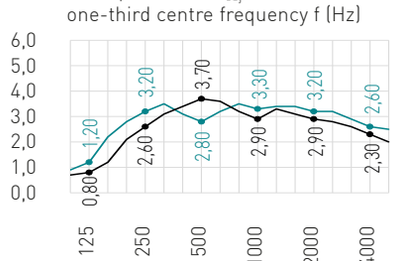


Overall Structure	400 mm
Fleece	Bonded acoustic fleece
Test certificate	B105629_78; B105629_79
equiv. sound absorp.	(500 Hz) 2,80 m^2; 3,90 m^2
Visible surface area	4,05 m^2; 4,05 m^2
Acoustic infill	**without; 33 % with 50 x 50 mm Mineralwool 57 kg/m³ in PE film between ALP**
Acoustic occ. level	62 % cooling register with ALP

	Fural Metalit Dipling
	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}/m^2 at one-third centre frequency f (Hz)



Overall Structure	**200 mm; 400 mm**
Fleece	Bonded acoustic fleece
Test certificate	B105629_77; B105629_78
equiv. sound absorp.	(500 Hz) 3,70 m^2; 2,80 m^2
Visible surface area	4,05 m^2; 4,05 m^2
Acoustic infill	without
Acoustic occ. level	62 % cooling register with ALP

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:

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

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

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

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“:

$$T = V \div A \cdot 0{,}163$$

„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 αs 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 αw 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)

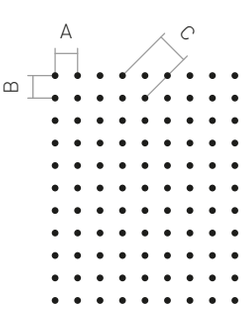
The weighted sound absorption coefficient, αw, can be supplemented with
so-called „shape indicators", expressed by the letters L, M and H (low, mid, high), in which frequency ranges the sound absorption level is particularly high.
L Particularly good absorption
up to 250 Hz
M Particularly good absorption
at 500 Hz to 1000 Hz
H Particularly good absorption
at 2000Hz to 4000Hz

Absorber classes

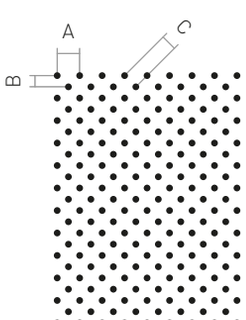
According to DIN EN 11654, acoustic elements are assigned to absorber class A, B, C, D or E based on their sound absorption coefficient.
A Extremely absorbent
αw 0.90–1.00
B Highly absorbent
αw 0.80-0.85
C Very absorbent
αw 0.60-0.75
D Absorbent
αw 0.30-0.55
E Slightly absorbent
αw 0.15-0.25

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

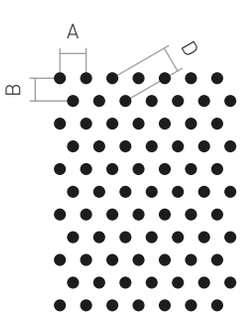
In buildings with a skeleton construction – typically nearly all new office buildings today – the individual rooms are separated by lightweight partition walls. The ceilings are suspended.
The cavity that this creates between raw ceiling and suspended ceiling acts as a sound transmission path
which must 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 Dn,f,w in dB units.
Here „Dn,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°

SUSTAINABILITY

Manufacturing

- The metal used in production consists of 100 % recyclable material. This provides the best possible opportunity for sustainable deconstruction.
- The recycling process of metals has been established for decades. Sheet steel, with a current scrap content of approx. 25 -33%, can be reused indefinitely.
- 90 % of the copper used today already comes from secondary sources.
- 80 % of the steel produced worldwide and 75 % of the aluminium produced is still used today.
- Compared to primary steel production, recycling steel saves about 75% CO2, and recycling copper saves as much as 85%.

Use

- An important factor in the sustainability of metal ceilings is their long service life of more than 50 years.
- This makes metal ceilings perfectly suited for the life cycle of modern buildings.
- Metal ceilings are durable, surface-finished and robust.
- The integration of a variety of functions and properties into the metal ceiling (e.g. revisability, sound absorption and fire resistance), in combination with low and regeneratively generated supply temperatures, ensures economical and environmentally friendly building operation.

Disposal

- The material is returned to the established recycling process via local scrap recyclers. Landfilling, as with other ceiling materials, is not necessary. Metals are recyclable materials.


-75 % CO_2
Raw material →
Manufacturing process
← Recycling
2
3
1
← Collection
← 50 years of low running costs
50 years of perfect form + function →
4
Use phase
5
50+ years

Fundi
Systeme in Metall GmbH
Cumberlandstraße [illegible]
4810 Gmunden
Austria
T +43 7612 [illegible]
E fundi@fundi.at
W fundi.com

Metalit
AG
Wynentalerstrasse 7
4335 Büren
Szwajcaria
T +41 [illegible]
E metalit@metalit.ch
W metalit.ch

Dipling
Werk GmbH
Königsberger Straße [illegible]
[illegible] Frankfurt Hungen
Niemcy
T +49 [illegible]
E dipling@dipling.de
W dipling.de

Fundi
Bohemia s.r.o.
Průmyslová [illegible]
[illegible] Předhradí
Republika Czeska
T +420 [illegible]
E info@fundi.cz
W fundi.com

Fundi
Systeme in Metall GmbH
Büro Belgium
[illegible]
2160 Wommelgem
Belgia
T +32 3 [illegible]
E benelux-trends@fundi.com
W fundi.com

Fundi
Systeme in Metall GmbH Sp. z o.o.
Oddział w Polsce
ul. Krakowska [illegible]
43-190 Mikołów
Polska
T +48 [illegible]
E polska@fundi.com
W fundi.com