

Sound Absorption

The acoustical value of suspended ceilings is very important. Sound absorption plays an important role for a great comfort.

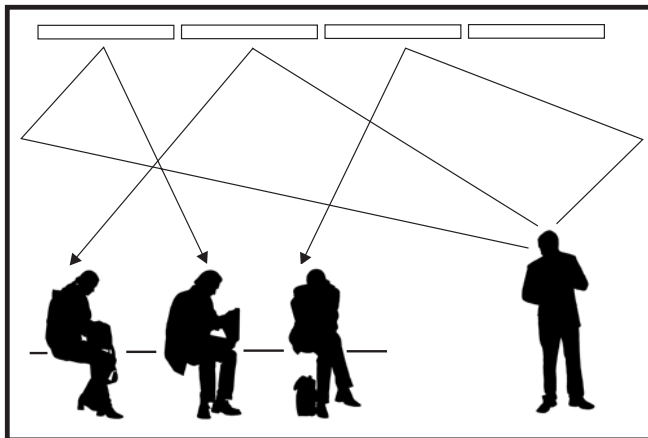
All Lindner metal ceilings are available as highly absorbent acoustic ceilings.

The absorbent behavior of metal ceilings is determined essentially by:

- Type of backing
- Thickness of backing
- Flow resistance
- Open area
- Ceiling plenum
- Perforation

The overall sound absorption of a material when used in an enclosed space is measured by the **Noise Reduction Coefficient (NRC)**

- Average of the mid-frequency sound absorption coefficients (250, 500, 1000 and 2000 Hertz rounded to the nearest 5%)
- Single number rating between 0 - 1.00
- Typical values may range from 0.40 to 0.90
- The higher the coefficient, the more absorptive is the material
- An NRC of 0.75 means that the ceiling absorbs 75% of the incident sound energy
- Measured in accordance with ASTM C 423



Furthermore the overall sound absorption of a material when used in an enclosed space can be measured by the **Sound Absorption Average (SAA)**

- Average of the sound absorption Coefficients α_s for the twelve one-thirds octave bands from 200 Hz through 2500 Hz, rounded to the nearest 1%
- Single number rating between 0 - 1.00
- Typical values may range from 0.40 to 0.90
- The higher the coefficient, the more absorptive is the material
- Measured in accordance with ASTM C 423

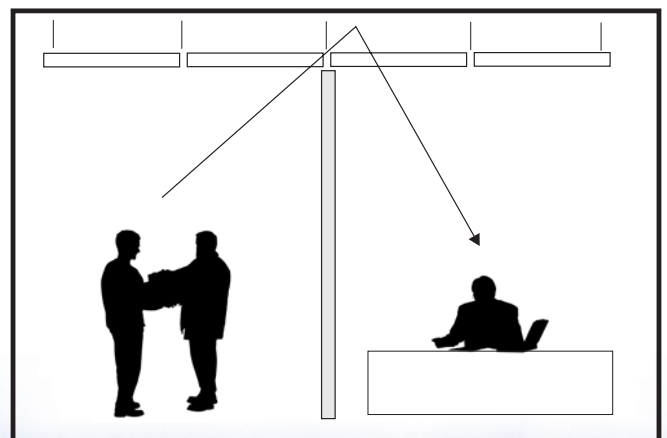
Sound Reduction

To assure sound reduction between adjacent rooms and therefore **acoustic privacy**, the suspended ceiling must provide sufficient resistance to acoustic transmission.

Lindner metal ceilings can perfectly help to fulfill these requirements.

The **Ceiling Attenuation Class (CAC)** rates a structure's efficiency as a barrier to airborne sound transmission between two closed rooms through a common ceiling plenum.

- A CAC < 25 is considered low performance, whereas a CAC > 35 is high performance
- A CAC < 25 is acceptable in open plan offices
- A CAC > 35 is preferred for closed offices
- Testing Method according to ASTM E 1414
- Classification in accordance with ASTM E 413



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Backings for Sound Absorption and Sound Reduction

Fig. 260 Mineral wool backing

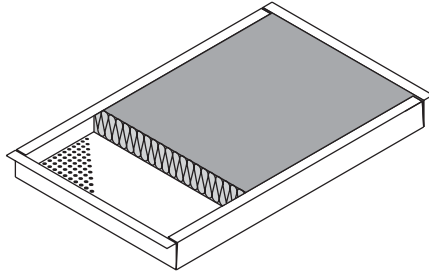
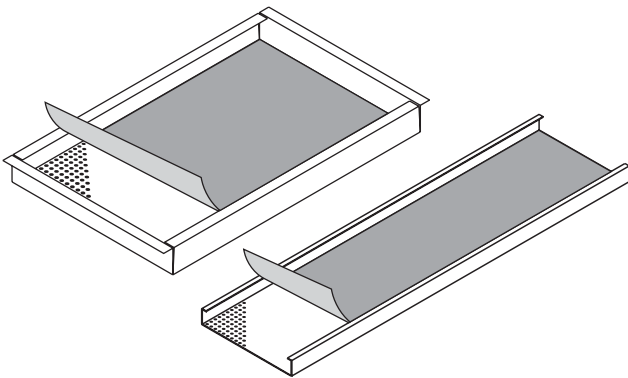


Fig. 261 Acoustical fleece backing



- Metal ceiling panel with mineral wool backing A1 and A2 in accordance with DIN 4102 for sound absorption and horizontal sound reduction
- Black acoustical fleece on visible side, applied onto mineral wool
- Alternatively, the mineral wool is also available encapsulated in a black acoustical plastic foil
- Available upon request as an element (mineral wool, incl. foil) in Building-Materials Class B1 in accordance with DIN 4102. ¹⁾

1) Additional backings are possible with plasterboard or steel sheet panels, increasing the effectiveness, especially for horizontal sound reduction.

- Metal ceiling panels and linear panels (galvanized steel or aluminum) with acoustical fleece glued in
- Standard color of acoustical fleece is black
- Building Material Class B1 in accordance with DIN 4102-1

Alternative:

- Metal ceiling panels made of galvanized steel sheet
- With acoustical fleece glued in
- With powder/coil coating surface
- In accordance with Building Material Class A2 acc. to DIN 4102 and/or A2s1d0 acc. to EN 13 501-1 and/or Class A as per ASTM E 84

Sound-Deadening Coating

By means of special backings or by applying special coatings to the reverse side, Lindner metal ceilings achieve a substantial reduction in structure-borne noise characteristics.

Our specially developed “sound-deadening” coating serves this purpose. Building Materials Class A2s1d0 acc. to EN 13 501-1, Damping loss factor measurement based on DIN EN ISO 6721-3

Fig. 262 Damping loss factor

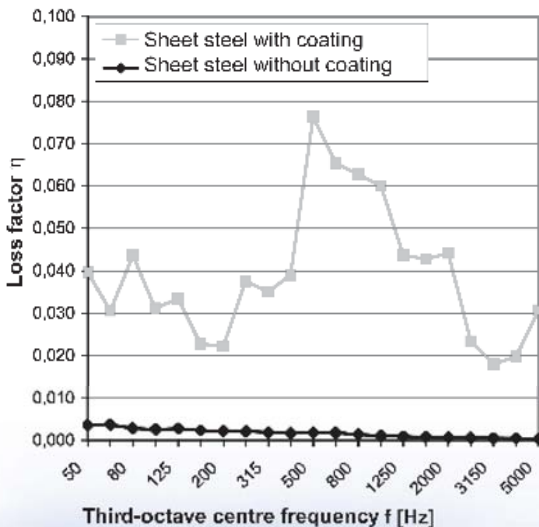
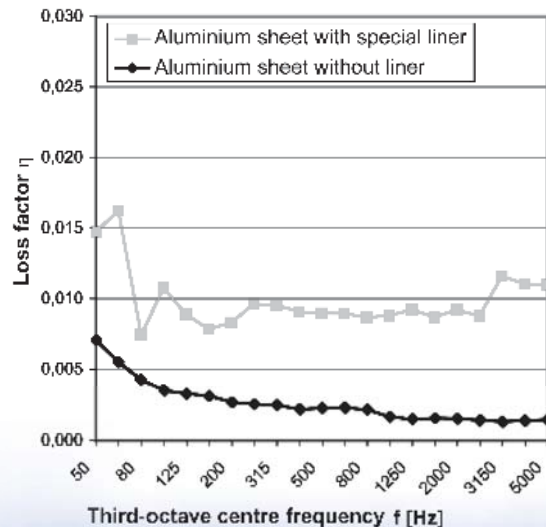


Fig. 263 Damping loss factor



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Perforation ¹	Ceiling Plenum ²	Sound Absorption Coefficient α_s ³						NRC ⁴	SAA ⁵	α_w ⁶
		125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz			
L 0,7.1	E-200	0,26	0,67	0,83	0,64	0,69	0,64	0,70	0,73	0,75
L 1,6.25	E-300	0,34	0,69	0,69	0,67	0,58	0,61	0,65	0,63	0,65 (L)
L 1,8.5	E-400*	0,58	0,78	0,76	0,60	0,48	0,33	0,65	0,66	0,50
L 1,8.10	E-400*	0,69	0,72	0,64	0,67	0,70	0,74	0,70	0,71	0,70
L 1,8.19	E-400*	0,65	0,80	0,58	0,70	0,78	0,77	0,70	0,74	0,75(L)
L 1,8.20	E-400	0,65	0,80	0,58	0,70	0,78	0,77	0,70	0,74	0,75(L)
L 1,8.21	E-400*	0,65	0,80	0,58	0,70	0,78	0,77	0,70	0,74	0,75(L)
L 2.20	E-400	0,60	0,73	0,48	0,59	0,68	0,71	0,60	0,65	0,65(L)
L 2,3.23	E-400*	0,65	0,80	0,60	0,67	0,70	0,74	0,70	0,71	0,70
L 2,5.4	E-400*	0,58	0,75	0,73	0,58	0,48	0,40	0,65	0,64	0,50
L 2,5.8	E-400*	0,60	0,66	0,54	0,59	0,55	0,47	0,60	0,62	0,55
L 2,5.16	E-200	0,41	0,77	0,93	0,67	0,77	0,68	0,80	0,81	0,80
L2,5.32	E-300	0,62	0,77	0,70	0,76	0,70	0,70	0,75	0,74	0,75
L 3.4	E-400*	0,66	0,71	0,62	0,61	0,53	0,49	0,60	0,64	0,60
L 3.7	E-400*	0,63	0,71	0,59	0,59	0,63	0,50	0,65	0,65	0,65
L 3.17	E-300	0,45	0,82	0,70	0,68	0,65	0,59	0,70	0,69	0,70 (L)
L 3.20	E-300	0,60	0,87	0,73	0,70	0,76	0,75	0,75	0,75	0,75 (L)
L 3.30	E-400*	0,76	0,79	0,59	0,67	0,70	0,79	0,70	0,70	0,70
L 5.35	E-400*	0,79	0,96	0,64	0,67	0,70	0,74	0,75	0,77	0,75
L 6.51	E-400*	0,69	0,86	0,74	0,77	0,69	0,73	0,75	0,77	0,75
L 7.27	E-400*	0,74	0,83	0,74	0,67	0,70	0,75	0,75	0,75	0,75
L 7.30	E-200	0,40	0,69	0,93	0,72	0,79	0,90	0,80	0,81	0,80
L 8.25	E-300	0,62	0,73	0,66	0,69	0,73	0,67	0,70	0,72	0,75
L 12.11	E-400*	0,71	0,96	0,63	0,66	0,64	0,53	0,70	0,74	0,70
L 12.22	E-400*	0,70	0,96	0,64	0,67	0,70	0,73	0,75	0,76	0,70
L 12.44	E-400*	0,69	0,96	0,64	0,67	0,75	0,74	0,75	0,77	0,75
Qg 4.20	E-400*	0,78	0,90	0,68	0,72	0,72	0,76	0,75	0,77	0,75
Qg 6.15	E-400*	0,74	0,91	0,59	0,63	0,65	0,68	0,70	0,71	0,70
Qg 6.30	E-400*	0,79	0,96	0,64	0,67	0,70	0,74	0,75	0,77	0,75
St 20x5.57	E-300	0,25	0,48	0,58	0,60	0,61	0,65	0,60	0,60	0,60 (L)

¹ Stated values for metal ceiling panel with acoustical fleece backing

² E-400* values are evaluated with a simulation program

³ α_s sound absorption coefficient measured in accordance with ISO 354

⁴ NRC Noise Reduction Coefficient evaluated in accordance with ASTM C 423

⁵ SAA Sound Absorption Average evaluated in accordance with ASTM C 423

⁶ α_w weighted sound absorption coefficient evaluated in accordance with ISO 11654

For more information regarding the specified perforation patterns please refer to page A61 et sqq.

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