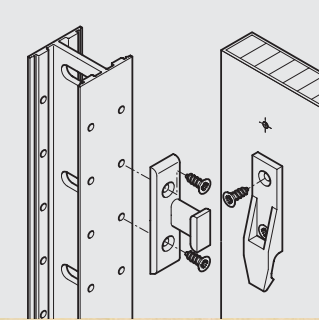


RESOPAL[®]-A2coustic

Installation Instructions



Decor 4370 Display Maple

Everything's possible.

RESOPAL®-A2coustic

Intallation Instructions

This information describes the RESOPAL®-A2coustic board and provides information on handling, installation and use..

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1. RESOPAL®-A2coustic

The quiet board for excellent sound

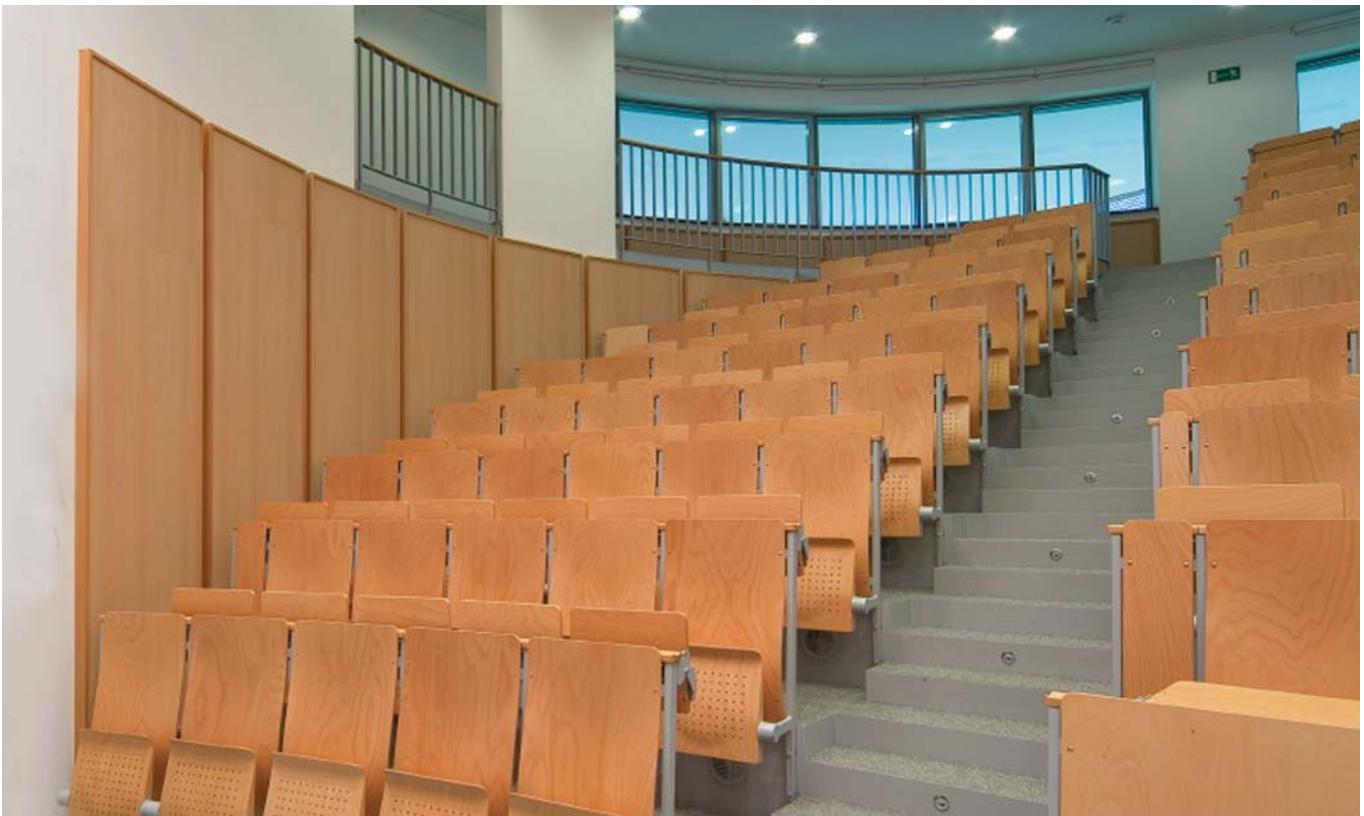
The acoustic board RESOPAL®-A2coustic gives you a heightened sound experience. It dampens noise, improves acoustic hearing and gives an excellent sound quality at the same time, a sound which is neither too muffled nor too strident but clear and strong. RESOPAL®-A2coustic optimises spatial acoustics.

But RESOPAL®-A2coustic is not only characterised technically by an excellent mean sound absorption of 70% across all frequencies. For RESOPAL®-A2coustic you also can select from the entire colour and material diversity of the RESOPAL® standard and trend collections with far more than 200 current plain colours and material effects (see our current collection books). This makes RESOPAL®-A2coustic a universal spatial design element. After all, noise is absorbed less and less by the white ceiling. As the ceiling increasingly has to deal with thermal tasks, more and more other spatial elements must take over acoustic sound absorption, and these elements must meet the most stringent design requirements at the same time.

The marginless microperforation preserves the material appearance of the RESOPAL® surface. It acts like a soft-focus lens which only gives its damping acoustic function the adequate optical expression. Even at a mean distance the perforation is no longer visible. In this way, the material shown can unfold its synaesthetic force. Finally, the optical conditions also influence the quality of hearing. Hard black and white contrasts sound harder than soft tone-in-tone designs.

The excellent sound quality of RESOPAL®-A2coustic is due to its carrier material, an expanded recycled glass granulate, which has been pressed into a moulded form by means of an inorganic binding agent. Its fine porous structure absorbs any sound in multiple ways. The expanded glass makes the board extremely light and at the same time – just like glass – non-flammable (construction material class A2) as well as giving it a high dimensional stability. In addition, there are all those characteristics of use featured by the high strength surface, for which RESOPAL® has always been known. The perforated plate is just as easy to care for. Deposits in the perforation are simply vacuumed off by means of the vacuum cleaner.

The above-mentioned advantages certainly predestine RESOPAL®-A2coustic for wall linings, complete wall shells, partitions, cabinets and cupboard units, room dividers, and acoustic sails in noise-sensitive environments such as offices, schools, and hospitals or in large halls for sports and culture where excellent acoustics are of prime importance. With its halved module format 1.25 x 1.25 m, RESOPAL®-A2coustic – apart from its diversity of patterns – offers a significantly more generous solution for the ceiling than conventional louvered ceilings. However, for live ends RESOPAL®-Massiv is to be recommended.



Lecture theatre of the Institut für Pathologie at the Berufsgenossenschaftliche Kliniken Bergmannsheil, Bochum: side wall panelling made of RESOPAL®-A2coustic

2. The material system

2.1 Decorative surface material (perforated) RESOPAL®

RESOPAL®-HPL (High Pressure Laminates) are decorative high pressure moulded laminated material boards with a high-strength melamine resin outer layer according to DIN EN 438. They can be produced with different surfaces in accordance with the respective requirements.

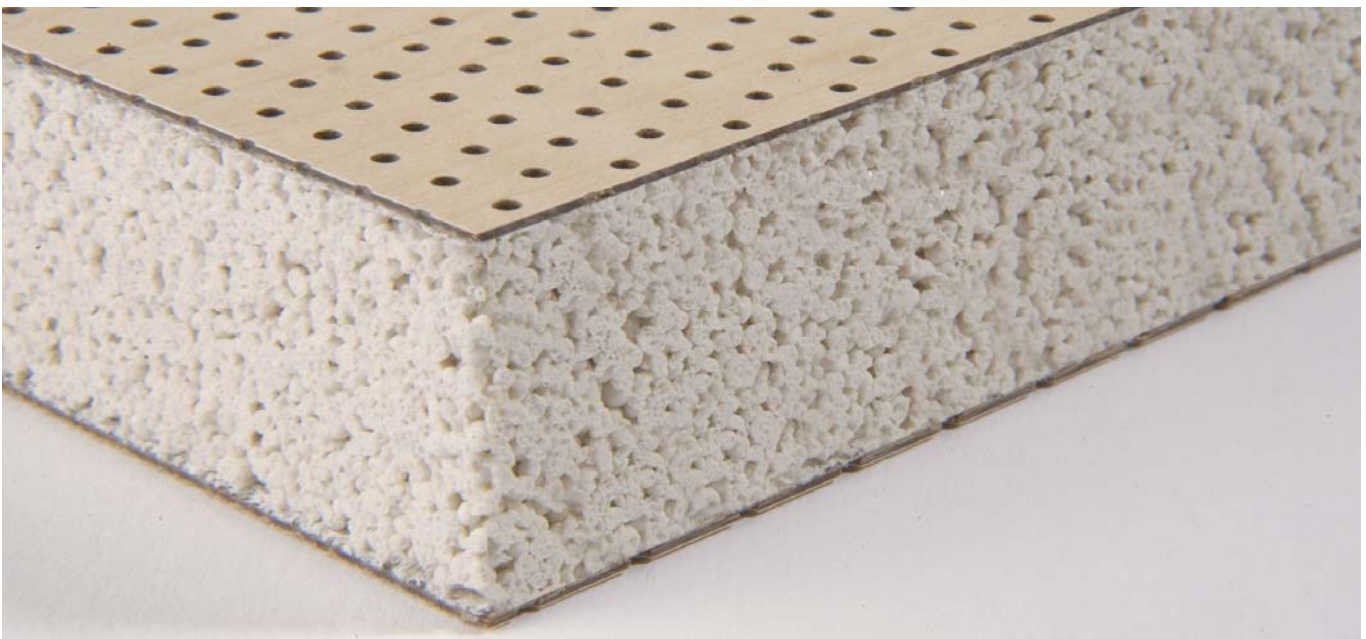
RESOPAL®-HPL comprises several paper lengths that have been impregnated with resin and, under heat and high pressure, are compressed between texturizing steel sheets into a homogeneous board. The paper component in this board, coming from re-growing raw materials, amounts to far more than 60 weight percent. Further details are contained in the product data sheet RESOPAL®-High Pressure Laminated Material-HPL according to DIN EN 438.

2.2 Carrier material Mikropor® G

Mikropor® G are inorganically bonded carrier boards whose base material consists of recycled glass material. They correspond to construction material class A2 (non-flammable according to DIN 4102-1; approval number: Z-56.426-882).

The board core carries an acoustic fleece on both sides. This gives the board a homogeneous surface without direction. The Mikropor® G carrier board is resistant against air humidity and extremely dimensionally stable.

Mikropor® G is a patented product and registered trademark of Wilhelmi Werke AG Lahnau.



RESOPAL®-A2acoustic: Perforated RESOPAL®-HPL on expanded glass carrier Mikropor® G

3. Recommended areas of use

With its decorative and functional characteristics, RESOPAL®-A2acoustic is predestined for the completion of the interior, where demanding optical appearance and ease of care, low weight, fire protection and economic finishing are required. Classical areas of use are noise absorbing wall and ceiling coverings in building construction and shipbuilding. It is recommended to use RESOPAL®-A2acoustic boards only in interior areas with a normal room climate (15-25°C / 30-70% r.h.).

4. The fundamentals of acoustics

One of the most important parameters in room acoustics is the reverberation time. It is defined as the interaction of the sound source and the surrounding room by bringing the time factor into play and indicating the length of time until an acoustic signal being emitted by a transmitter only has one millionth of its original intensity (drop of the noise pressure by 60 dB). With other words: The reverberation time expresses numerically for how long one still hears the sound of a tone reverberating in the room, although the source of sound has already fallen silent. The longer the reverberation time, the longer we hear the tone sound in the room. If this reverberation time is too long, the room is too "live" and we do not hear the tone clearly enough.

The hearability of small to medium size rooms is regulated by DIN 18041. For each room, an optimum reverberation time can be determined in accordance with the utilization of the room, and the type, size, and arrangement of the necessary absorption surfaces calculated. In principle, the following holds: Livened rooms (long reverberation time) as well as overdampened rooms (short reverberation time) must be avoided as they have a negative effect on speech intelligibility (hearability).

The reverberation time (T), in addition to the sound absorption factor (α) of the boundary surfaces (S), also depends on the room volume (V) and the room type.

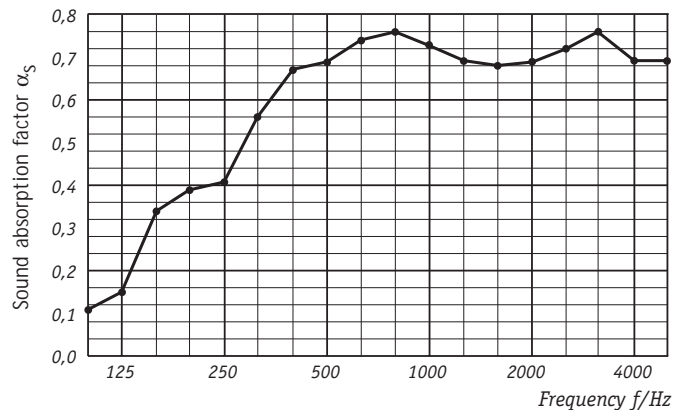
A calculation of the reverberation time to be expected can be effected by means of the Sabine formula:

$$T = 0,163 \cdot V / \sum S \cdot \alpha$$

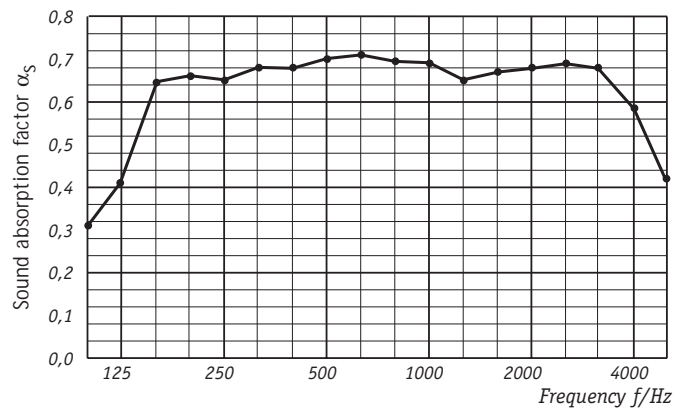
The sound absorption factor (α) defines the ratio of reflected sound energy relative to absorbed sound energy. A value of 0 would correspond to complete reflexion, a value of 1 would correspond to complete absorption. That is, for a building material which features an (α_s) of 0.75, 75% of the impacting sound energy are absorbed and converted into heat due to internal friction within the building material, whilst 25% of the sound are reflected.

The sound absorption capacity of building materials depends on frequencies and is determined by measuring in a standardized reverberation room (see example curves RESOPAL®-A2coustic). The human ear is capable to perceive frequencies from 16-20,000 Hz (oscillations per second). The frequency range with significance for language lies between 125 and 4000 Hz.

Depending on the structure of the absorption system, curves with higher peak values or a more even distribution across the frequency spectrum can be achieved, depending on the requirement and construction options - as is shown by the two examples.



Sound absorption factor of RESOPAL®-A2coustic via an undamped 50mm cavity according to ISO 354. Evaluated sound absorption factor 0.7 according to ISO 11654.



Sound absorption factor of RESOPAL®-A2coustic via a damped 50 mm cavity with 50mm mineral wool according to ISO 354. Evaluated sound absorption factor 0.7 according to ISO 11654.

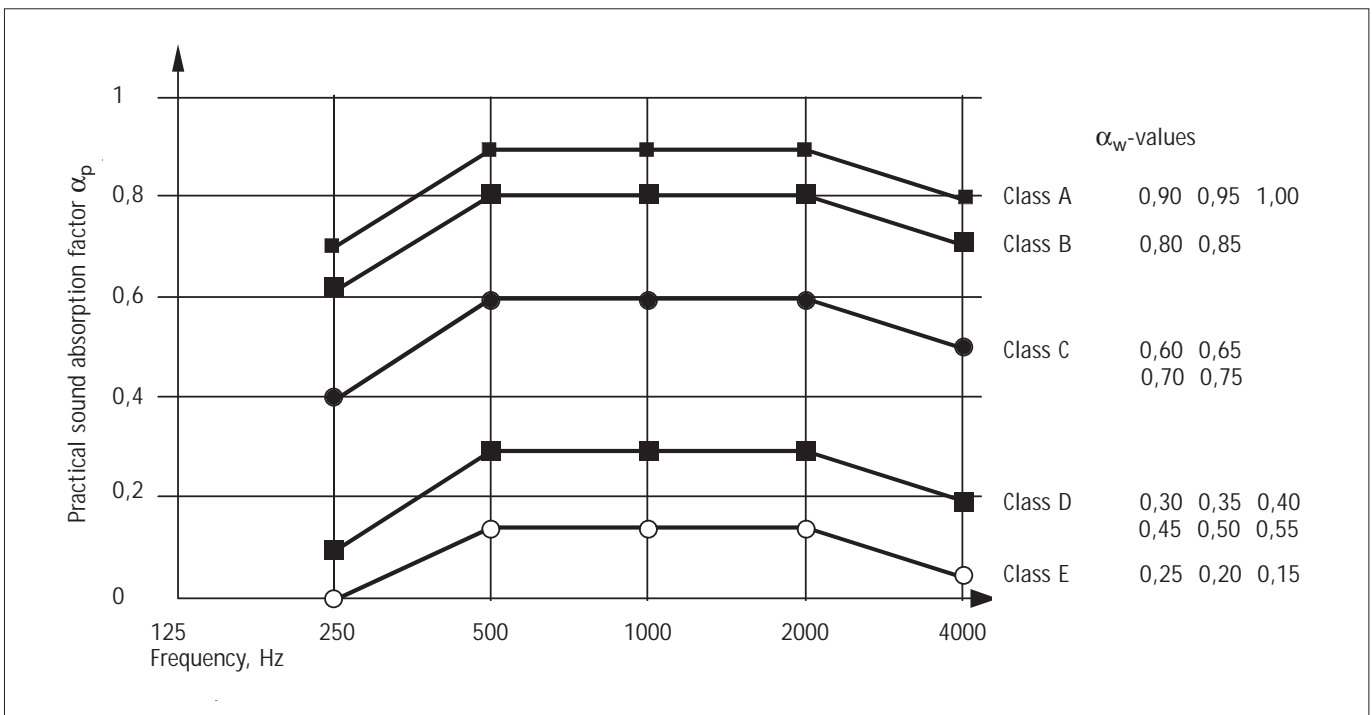
Test reports for all relevant installation types on request.

5. Recommendations for an acoustic room design

For the wellbeing and personal performance capability in interior spaces, room acoustics play a largely underestimated role. On the one hand this is due to the fact that the synaesthetic effect of the room acoustics on the overall design with materials, colours, and light is hardly known; and on the other hand, however, this is also above all due to the fact that there were hardly any planning aids, acoustics seemed a matter of feeling or could only be simulated and planned at a high cost.

Ways to audio aesthetics: Planning diversity and planning reliability by acoustic computer simulations

For "audio aesthetics", a computer-supported planning element has recently become available which finally "demystifies" acoustics. This uses the classification of room surface materials according to EN ISO 11654 from A to E. Pursuant to the latter, for example, it is necessary to use a larger quantity of a product of class D, in order to reach the same acoustic performance of a product of class C. Effect, performance and costs will thus become manageable for the planner and designer.

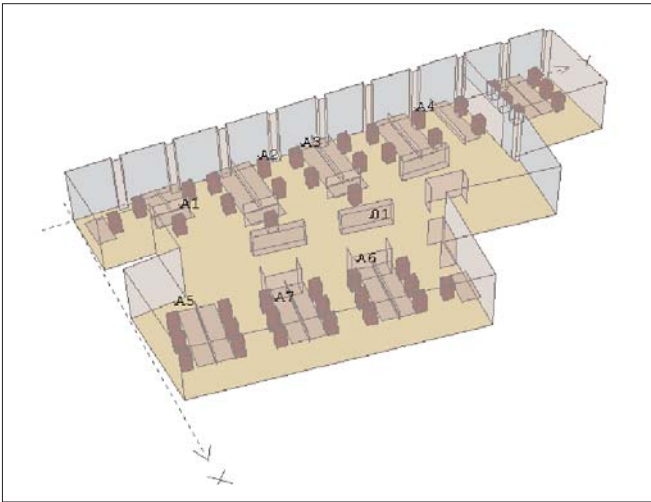


Sound absorption factor of classified products

For determining the necessary acoustic measures, please request our acoustics questionnaire.

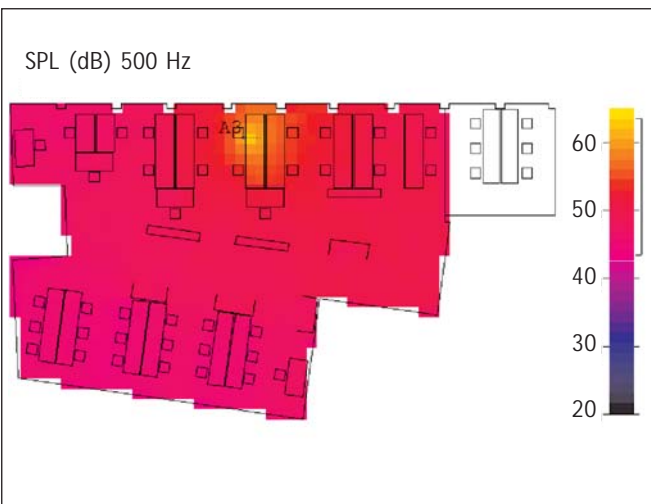
For specialist acoustic plannings, measurements, analysis of actual situations and their improvement as well as computer simulations with regard to acoustics, we recommend our partner:

SoundComfort GmbH
 Joachimstaler Straße 17
 10719 Berlin / Germany
 Tel. +49 30 590 03 42 30
 Fax +49 30 590 03 42 35
 info@soundcomfort.de
 www.soundcomfort.de



Computer model of an open plan office

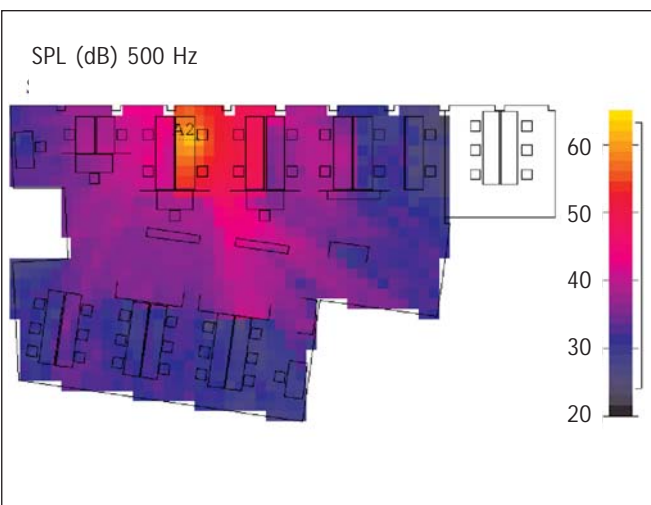
The computer simulation provides for a far-reaching freedom of design and planning and ensures planning reliability with regard to the measures selected even before their implementation. From the existing CAD planning data, a 3D computer model is prepared for the simulation of diverse room situations.



Poor acoustic room climate

A person (marked by a yellow colour in the diagram) talks with approximately 68 dB (see bar). In the direct environment, up to the right-hand wall, between 50 and 55 dB still reach the colleagues, in the left-hand room half these values are nevertheless still between 45 and 50 dB. The consequences for office workers are stress and, in the long term, sick days.

Fault accumulations and the consequential costs resulting therefrom lead to unsatisfied customers and economic damage for the company



Improved acoustic room climate

Following implementation of acoustic conditioning, the talking employee can only be heard within his direct surrounding area, his own working group with the same work contents. But only 30 and 40 dB reach the other workplaces. This ensures undisturbed working.

The computer simulation was carried out with RESOPAL®-A2coustic products (sound absorption class C).

6. Storage and transportation

Storage and transportation should be carried out in accordance with our recommendations.

Storage is effected across a full surface on even and flat base. If RESOPAL®-A2coustic boards are not stored flat during an extended period of time, irreversible deformations will result.

RESOPAL®-A2coustic boards must be stored in enclosed store-rooms under normal interior ambient conditions (18–25° C and 50–65% relative humidity). Within the meaning of transport

regulations, RESOPAL®-A2coustic boards are not classified as hazardous materials; there is no need for any special marking therefore.

During transportation of RESOPAL®-A2coustic boards with different types of transport vehicles, sufficiently large, flat, and stable pallets must be used. The board must be placed in a flat position and secured against sliding; the edges should be sufficiently protected against any impacts.

7. Work Recommendations

Due to possible sharp edges, protective gloves must always be worn when handling RESOPAL®-A2coustic.

RESOPAL®-A2coustic can be processed using wood processing machines. Here, it must be ensured that suitable tools are used, and safety rules and processing principles are complied with.

The processing of RESOPAL®-A2coustic leads to glass dust which, together with other organic components, may lead to skin and respiratory irritations. No detrimental long term effects were found if the dust content of breathing air at workplaces was within the statutorily prescribed limits.

Precautionary measures are limited to the regular checking of the workplace. Workplaces must be well ventilated. Loose dust must be removed regularly by means of a vacuum cleaner. Compressed air must not be used for dust removal. In a dust-laden atmosphere, suitable respiratory protection masks should be worn for reducing the amount of dust breathed in.

In principle, if nothing is stated to the contrary, the General Work Recommendations for RESOPAL®-HPL apply at all times-Elements.

7.1 Cutting of RESOPAL®-A2coustic boards

7.1.1 Format cutting

The cutting is effected by means of carbide tipped saw blades. The following tooth forms are usual:

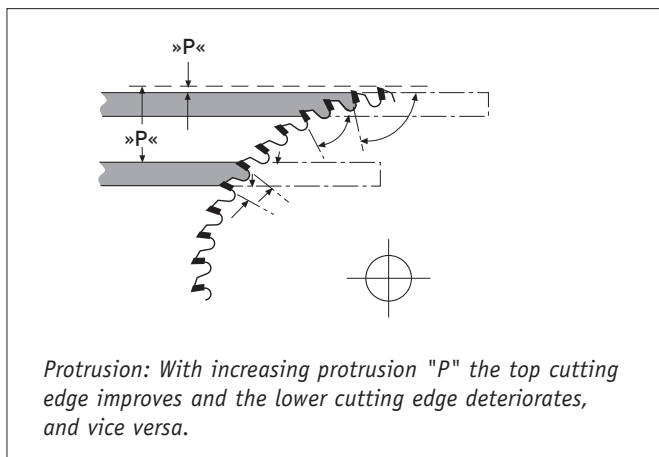
Flat tooth, change tooth, Duplovit tooth, Duplovit tooth complete with chamfer, roof Duplovit tooth, trapezoidal flat tooth.

The quality of the cutting edges depends a.o. from the height adjustment of the saw blade. The most favourable height

adjustment must be determined on a case by case basis. The best results can be achieved by using a pre-cutting saw. Furthermore, the quality of the cutting edge also depends on the following parameters:

Spacing	10 – 15 mm
Speed	3000 – 4000 rpm
Cutting speed	40 – 70 m/s
Advance speed	10 – 20 m/min

Format cutting or edge processing of RESOPAL®-A2coustic boards with double end profilers is not recommended.



Recommended saw blade protrusion

7.1.2 Contour cutting

Contour cuts are achieved by means of table top spindle moulders and manually operated spindle moulders. It is not recommended to use compass saws.

7.2 Edge processing

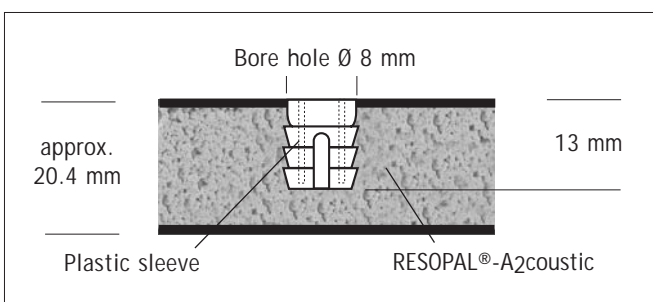
Edge processing of RESOPAL®-A2coustic boards with double end profilers is not recommended. The final format cutting should be effected by means of circular saws.

The selection of the individual edge types depends on the intended use of the edge, internal working methods and available machine facilities. Before processing the edge strips as well as the carrier material must be stored at 18-22°C and 50-60% relative humidity. For gluing or bonding edge materials, special adhesives are available that are used in the furniture industry and in the specialist trade. To this end, the processing guidelines issued by adhesive manufacturers must be complied with and queries should always be raised with the manufacturer of the edges and the manufacturer of the adhesive.

For RESOPAL®-A2coustic boards, processing with hot melt adhesives (EVA or reactive melt adhesives on a polyurethane basis) is recommended. In order to stabilise the edges it is helpful in addition to use a primer suitable for the adhesive applied. The melt adhesives become liquid within a higher temperature range of between 160-200°C and are applied – via an application roller – onto the edges of the workpiece running through. In the case of edges not initially primed it is recommended to apply more adhesive due to the open pores of the narrow side surfaces of the RESOPAL®-A2coustic boards; this is achieved by a reverse run of the application roller. The quality of the bonding is decisively influenced by the following factors: Selection of the adhesive system and machine system; advance speed of the edge bonding machine; roller contact pressure. Therefore, the guidelines issued by the machine manufacturers and adhesive manufacturers must be complied with in all circumstances. It is recommended to carry out a sample bonding.

7.3 Attachment of fittings

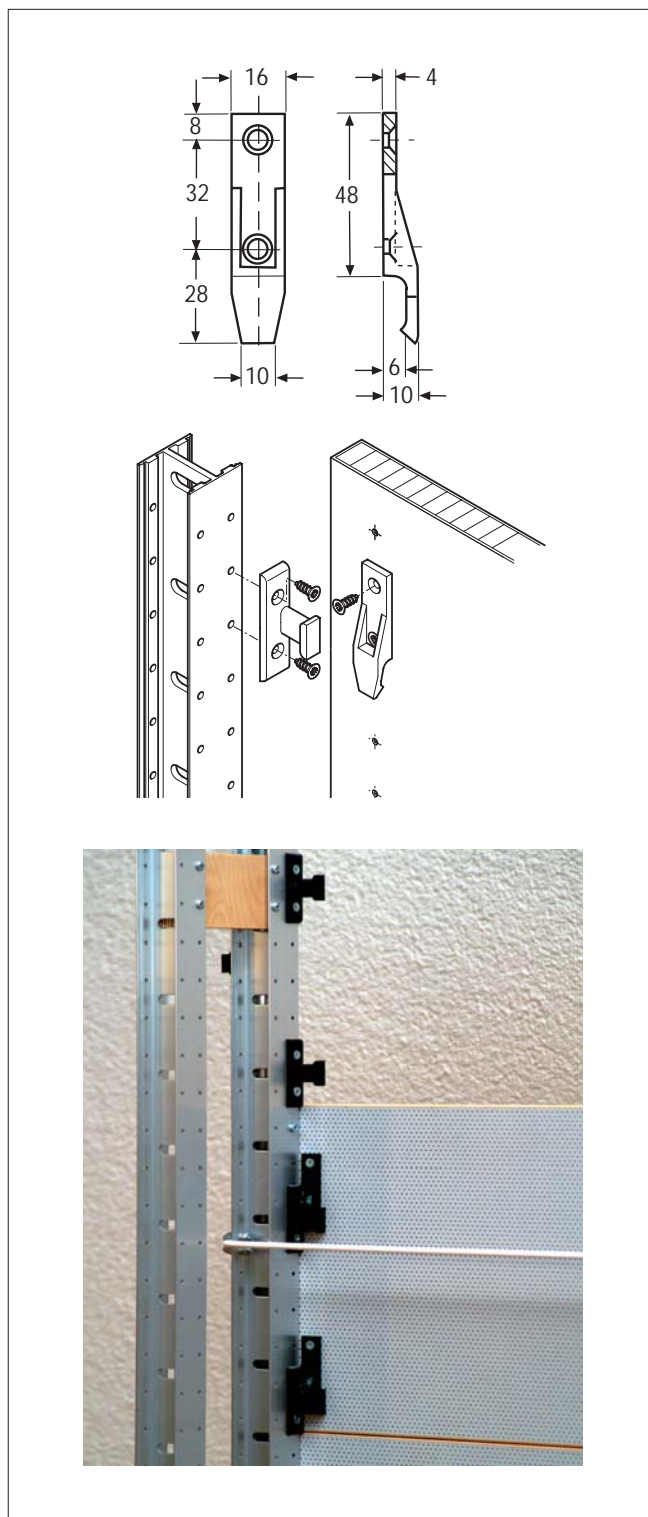
For screwing on fittings it is necessary to glue in plastic sleeves. Bore holes with a diameter of 8 mm must be produced into which subsequently the 8mm plastic sleeves are inserted and glued in with a PU adhesive or a PUR melt adhesive.



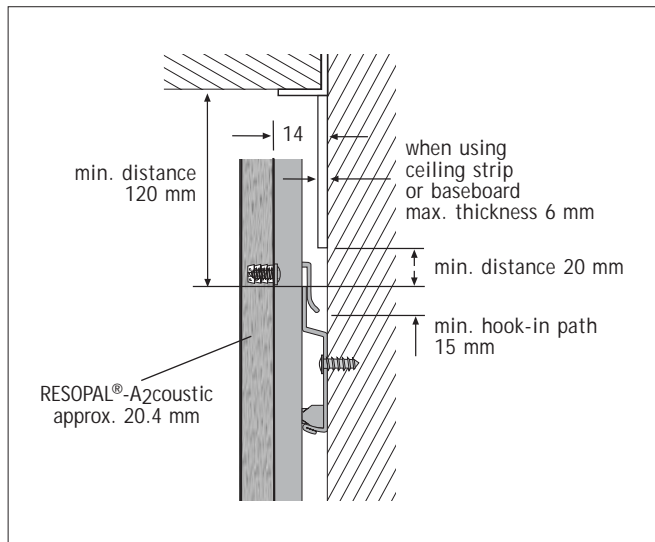
Glued-in / bonded in plastic sleeve for the attachment of fittings

7.4 Mounting systems

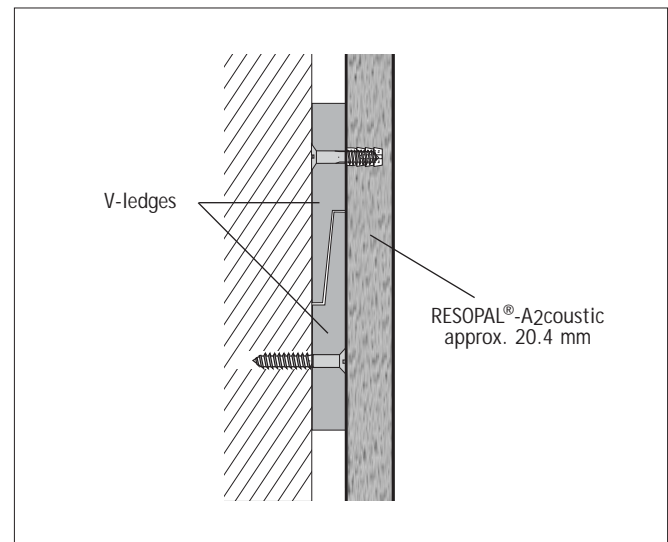
7.4.1 Mounting with Häfele Room System Keku R



7.4.2 Mounting with Häfele Panel Installation System



7.4.3 Mounting with V-ledges



8. Maintenance, environment, fire and disposal

8.1 Maintenance, care and cleaning

RESOPAL® surfaces are neither corrosive nor oxidizing. They do not require any further surface treatment (by lacquer or painting). All decorative RESOPAL®-surfaces can be cleaned by means of mild soapy solutions. Persistent pollutions are usually removed by means of a solvent. Abrasive cleaning aids (e.g. scouring powders) should be avoided.

8.2 Environmental aspects during application

RESOPAL®-HPL is a cured and thus inert synthetic material. Exhalations from the surface and the edges are so low that they do not show up in instrumental analysis.

The decorative surfaces are resistant against all standard household-type solvents and chemicals; for many years, therefore, this material has been used in areas of application where cleanliness and hygiene are a primary consideration.

8.3 RESOPAL®-A2coustic elements in the event of fire

RESOPAL®-A2coustic consists of Mikropor® G, an inorganic bound carrier material and a coating on both sides made up of approx. 0.6mm thick perforated RESOPAL® moulded laminated material boards.

The Mikropor® G carrier board consists of glass recycling material and corresponds to construction material class A2 (not flammable according to DIN 4102-1; approval number: Z-56.426-882).

The RESOPAL® moulded laminated material boards are hardly inflammable and possess characteristics that delay the spread of flames and thereby would release only relatively low quantities of heat and smoke.

As a rule, from a construction supervision point of view, thin inflammable boards on non-flammable carrier boards (A1, A2) can be tolerated as they do not affect detrimentally the fire behaviour of the carrier board. The thin flammable cover layers increase the actual fire load only slightly. In individual cases, approval by the construction supervision authority must be obtained.

8.4 Disposal

In accordance with the law on recycling management and waste disposal RESOPAL® residues are classed as "other cured synthetic material waste". The glass components can be disposed of as construction waste materials.

9. Technical Data

Properties	Test method	Dimensional unit	Result
Density	ISO 1183 or EN 323	Kg/m ³	approx. 450 - 550
Transverse pull strength	EN 319	MPa	approx. 0.2
Bending strength	EN ISO 178 or EN 310	MPa	3.5 – 4.5
E module	EN ISO 178 or EN 310	MPa	n.d.
Lift-off strength	EN 311	MPa	approx. 0.1 – 0.2
Dimensional changes Mikropor® G in connection with changes in the rel. humidity	EN 318	%	IL85: < 0.01 DL35: < 0.05 IT85: < 0.15 DT35: < 0.10
Abrasive resistance	EN 438-2 / 10	IP: Rev. (IP+FP)/2: Rev.	≥ 150 ≥ 400
Scratch resistance	EN 438-2 / 25	Degrees	3 ¹⁾
Light-fastness	EN 438-2 / 27	Grey scale	4 - 5 ²⁾
Hole diameter	–	mm	approx. 1.5
Hole surface share	–	%	approx. 12
Degree of sound absorption	ISO 11654	α_w	approx. 0.7 ³⁾
Fire behaviour	DIN 4102-1		A2 ⁴⁾
	IMO-Res. MSC. 61(67) FTPC, Annex 1, Part 1		Non-flammable Carrier board ⁵⁾

Explanations

1 MPa = 1 N/mm² n.d. = cannot be determined

¹⁾ corresponds to ≥ 2N

²⁾ corresponds to blue scale ≥ 6

³⁾ Evaluated degree of sound absorption 11654 α_w according to ISO 11654

⁴⁾ Mikropor® G carrier board with general building construction approval no. Z-56.426-882

⁵⁾ EC type approval certificate no. 107.049 (Module B) for Mikropor® G carrier board

IL85 = length increase following climatization at 85% relative humidity

DL35 = length decrease following climatization at 35% relative humidity

IT85 = increase in thickness following climatization at 85% relative humidity

DT35 = decrease in thickness following climatization at 35% relative humidity

10. Product data

Product data	RESOPAL®-A ₂ coustic
Board composition Carrier board Mikropor® G	front and rear perforated RESOPAL® without margin according to DIN EN 438, with the same pattern or white counteractive pattern on the rear
Sound absorption	approx. 70% for 50 mm undampened cavity Test certificate with measurement curves according to ISO 354
Format	2500 x 1250 x approx. 20.4 mm
Mounting pattern	max. 625 mm
Weight	approx. 9.5 kg/m ²
Perforated surface share	11.2% (1.5 mm round perforation in offset rows)
Construction material classes	Expanded glass carrier A2 – non-flammable according to DIN 4102
Processing	as wooden material
Care	standard household care, perforation can be hoovered
Available patterns	all patterns of the current RESOPAL® collections (see current collection books) except Wood in RESOPAL® and Metal on RESOPAL®, if structured
Available surfaces	pattern-specific, each with 20, 60, 90, EM and HW respectively

All details contained in this product data sheet are based on our current technical knowledge but do not represent any warranty or guarantee. It is the personal responsibility of each individual user of the products described in this product data sheet to comply with all existing laws and regulations.

Your specialist dealer:

Date of publication: 01 July 2006 Subject to alteration