

The new StoSilent A-Tec Panel suspended ceiling system

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Problem definition

Materials with surfaces such as metal, glass, marble and wood remain highly popular in modern architecture. The use of these reverberative materials often results in a high level of reverberance in buildings. This sound reaches the listener both directly and via reflection, resulting in delayed and diffusely superimposed sound waves.

If the reverberation time is too long, the sound will be unclear and the spoken word will often be incomprehensible. Defined reverberation times are thus required in accordance with the type and size of room and its mode of use.

The solution

The solution is provided by the Sto acoustic programme which has been in successful use for many years now, ranging from plasters through wallpapers to the StoSilent panel in its different variants. The latest addition to this range of established systems is the new StoSilent A-Tec Panel, which complies with building materials class A2. Its carrier medium, Reapor, is a joint development by the Fraunhofer Institut für Bauphysik, Stuttgart, and the Liapor company. A fine glass powder is produced from ground recycled glass. An expansion and sintering agent is added to this material in the production process, and the acoustic panels are subsequently produced in a special process [1].

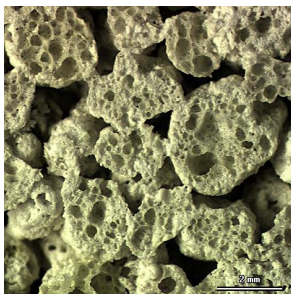


Figure 1: Basic material Reapor

Owing to the panel's inorganic structure, moisture- and temperature-induced changes are minimal. Thermal expansion stands at no more than 8.3×10^{-6} m/mK, for example. This enables the seamless installation of ceiling surfaces of up to 200 m² or side lengths of up to 20 m [2] - without the slightest risk of cracking. In contrast, wood-based ceilings are limited to 100 m², while plaster-based ceilings permit seamless installation over only 150 m². This represents a clear competitive advantage for the approved StoSilent A-Tec system, comprising carrier board, bonding agent, filler and final coating.

As the panel consists of glass and complies with building materials class A2, no volatile organic components can be released in the event of fire, in addition to which there is absolutely no risk of smouldering fires.

Installation

The StoSilent A-Tec panel is provided with fibre matting on both sides and measures 1200 x 625 x 25 mm. The panel is installed on site by fitting it to a rigid, aligned and concordant metal sub-construction, using phosphatised quick-assembly screws. It can be used both in the ceiling area and in wall areas which are not subject to a danger of shock. In order to ensure the necessary exchange of air between the ceiling cavity and the used room, the wall connection should always take the form of an open, surrounding joint.

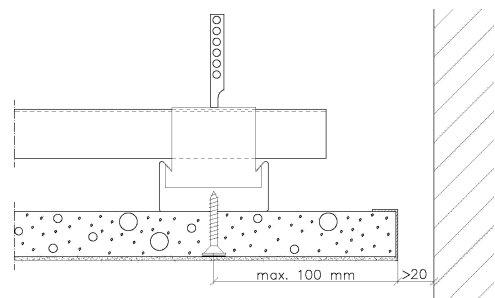


Figure 2: Wall connection

The panels are bonded at the joints using StoColl KM. Following drying of the bonding agent and the removal of excess bonding agent, the joints and screw heads are surfaced with StoSilent Plan. The surfacing should then be sanded until absolutely level. After checking the evenness the final coating of StoSilent Superfine can be applied in at least four layers. The final coating produces a monolithic surface structure which looks like a very fine plaster surface - but incorporating additional acoustic properties.

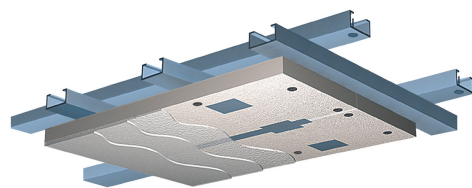


Figure 3: System structure

The final coating of StoSilent Superfine can be tinted in over 460 different shades from the Sto Color system, in accordance with the design requirements of the planner or building owner.

The same tools can be used as are employed in standard dry construction - from keyhole saws through cutters to handsaws. Integrating functional elements such as lamps, loudspeakers or sprinklers thus poses no problem whatsoever. Installation and use are also facilitated by the system weight of only approx. 11.4 kg in fully installed state, including sub-construction and final coating.

Absorption

The StoSilent A-Tec panel is also ahead of the competition with regard to its absorptive properties. The acoustic system is effective over a very broad frequency spectrum. Depending on the suspension height, weighted sound absorption coefficients, α_w , of up to 0.85 are possible. The absorption curve shows a particularly well-balanced course at the suspension height of approx. 230 cm which is customary in dry construction:

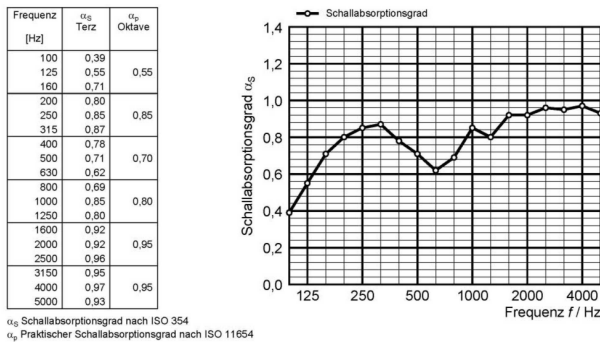


Figure 4: Absorption curve for StoSilent A-Tec Panel

In contrast to virtually all rival products, the panel is able to absorb 55% of incoming sound at 125 Hz. This means optimum acoustics and fatigue-free working in rooms in which communication plays a major role.

Scope of application

In accordance with DIN 18041, the reverberation time in a standard office room with a volume of approx. 70 m³ should be within the parameters presented in Figure 5. Theoretical calculation of the reverberation time for this room without acoustic measures results in a mean value of 1.40 seconds, which is totally unacceptable. When the entire ceiling surface is covered with the StoSilent A-Tec Panel system, the acoustic requirements for the room are fulfilled in impressive style.

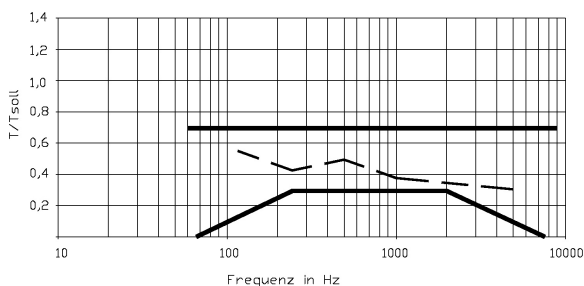


Figure 5: Application in the office

The panel's compliance with building materials class A2 means that it is also predestined for all areas in which non-combustibility is required, e.g. in meeting halls, public buildings, schools and over escape routes.

Acoustics has recently been a topic of great interest in schools. Numerous problems apply here in the absence of acoustic measures:

- Damaged hearing
- Lack of concentration and high incidence of errors
- Increased energy consumption
- Reduction in work output
- Increased aggressiveness

- High risk of tinnitus and rise in blood pressure
- Inadequate regeneration during breaks
- Adverse effects on the deep sleep phase

Long reverberation times render it difficult in particular to distinguish between consonants, whereby these are crucial to understanding the spoken word. When pupils are required to make a great effort to understand what the teacher is saying, this leaves little energy and concentration for the actual subject matter, which places weaker pupils at a particular disadvantage.

DIN 18041 recommends installing the necessary absorbers if possible in the rear upper wall area of the classroom and in the side area of the ceiling (in a U shape which is open towards the front). In the middle area of the room it is recommended to use a reflective mirror. The ideal reverberation time for a classroom of approx. 300 m³ volume is 0.6 seconds. All parameters are within the specified tolerance range when StoSilent A-Tec Panel is installed in accordance with the DIN recommendations.

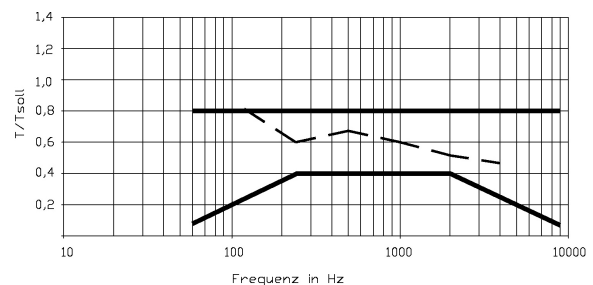


Figure 6: Application in the classroom

In conclusion, it can be said that StoSilent A-Tec Panel combines all the merits which are required of a modern ceiling system - particularly in high-demand communication rooms:

- General test certificate issued by the building inspectorate
- Building materials class A2 in accordance with DIN 4120
- Outstanding acoustic effect throughout a broad frequency range, α_w of up to 0.85
- Recycled material - no negative impact on the environment
- Seamless appearance over an area of up to 200 m² in more than 460 colours

Sources

- [1] Prof. Dr.-Ing. Helmut Fuchs, Dipl.-Ing. Gerhard Babuke and Dipl.-Phys. Norbert König: Akustik ohne Fugen in Trockenbau-Akustik, 12/03
- [2] Technical documentation of Sto AG