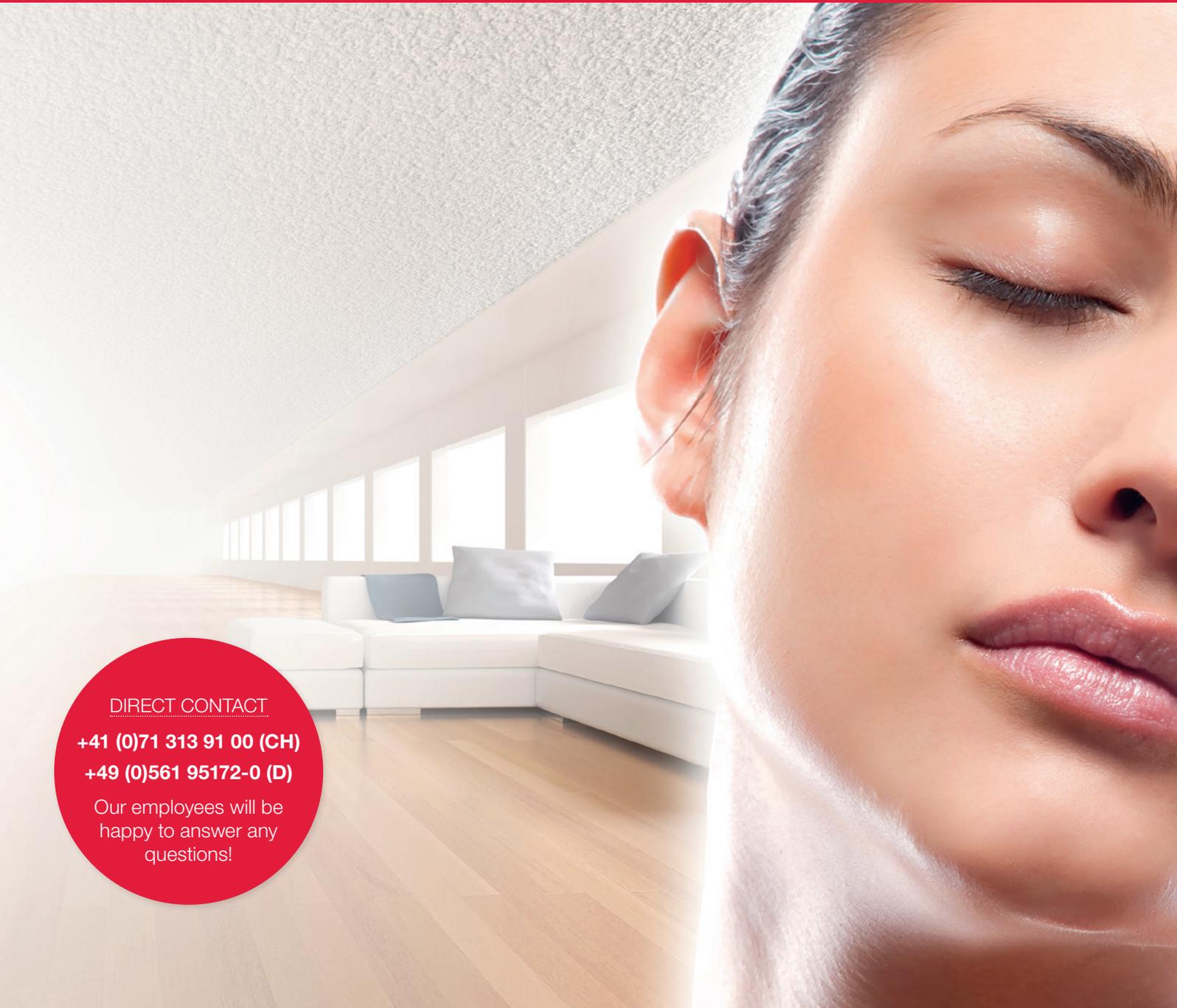


# ISOFLOC SILENCIO

The innovative cellulose acoustic coating

- Good-looking, uniform and joint-free surface texture
- Outstanding sound absorption values even at 15 mm thickness
- Unlimited individual design options



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Our employees will be  
happy to answer any  
questions!

**isofloc**<sup>®</sup>



# «Said is not yet heard, heard is not yet understood.»

Konrad Lorenz

isofloc cellulose fibres in roofs and walls have, for over 30 years, been protecting residents successfully from cold, heat and noise. For a high level of well-being and outstanding performance, however, optimal room acoustics are also necessary. Today's building designs have generous floor plans, open designs of spaces and sound-reflecting surfaces, giving an increased need for attention to the acoustics. Since cellulose fibres are very good at absorbing sound, isofloc has developed the isofloc silencio acoustic system. Whether it's in offices, living rooms, galleries, industrial workshops, commercial premises, restaurants, classrooms or staircases - thanks to the flexibility of isofloc silencio, there are no limits to application and imagination.

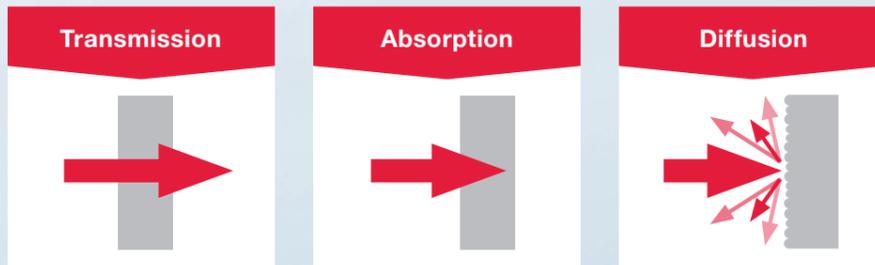
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Sources used for this brochure: SIA 181, DIN 18 041 and wikipedia.org



# WE UNDERSTAND ROOM ACOUSTICS



**Acoustics is the science of sound and its propagation. It is a very complex area that often makes use of knowledge from other specialisms such as physics or materials science. For a basic understanding of room acoustics we have compiled for you simplified explanations of the fundamental terms.**

**Room acoustics** is concerned with the audibility of speech and music in rooms and with their acoustic design. This is a matter of the effects of the constructional features of a room and the sound events that occur in it. In this area, the excellent sound-insulation properties of isofloc silencio come in useful.

**Sound** is the general term for the noise, sounds, tone or bang that can be perceived by human hearing. Sound is mechanical vibrations and waves in an elastic medium (e.g. air).

The louder a noise, sound, tone or bang, the greater is the variation of air pressure and the higher the **sound pressure**. Loudness or sound pressure is usually expressed as **sound pressure level** in the units of decibels (dB) or in A-weighted decibels dB(A) frequency-weighted to correspond to human hearing. The decibel scale is a logarithmic scale. A doubling of the perceived loudness corresponds to a level increase of 10 dB.

The **frequency** of a sound wave is the number of oscillations per second. The unit of measurement is the Hertz (Hz). The greater the Hertz number, the higher the frequency of the sound. The range of human hearing is from about 20 to about 20,000 Hz.

**Reverberation** is the reduction of sound energy in a closed room after the sound source stops. **Reverberation time** is understood as the time period in which the sound pressure in a room falls to one thousandth of the

starting value after the sound source suddenly stops, which is a level reduction of 60 dB.

**Sound insulation** is a measure of the extent to which a medium is transparent to waves such as sound waves. If a wave moving through the medium A (e.g. air) encounters the medium B (e.g. a wall), it will be partly reflected at the boundary surfaces and partly or wholly absorbed on passing through, depending on the material properties of the obstacle. The remainder is carried

through the medium B and exits again at the opposite side of medium B. The less the sound that is transmitted right through, the greater is the sound insulation.

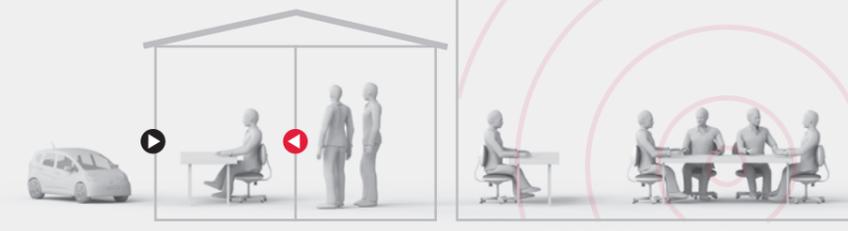
Die **Sound absorption** is the process of reduction of sound energy when a sound wave encounters a material. "Absorb" means the same as "swallow" and "soak up". The level of absorption indicates what part of the power of an incident wave (e.g. sound) is absorbed ( $\alpha = 0$ : minimum,  $\alpha = 1$ : maximum absorption).

**Sound diffusion** (sound scattering) is a general description of the extent of distribution of the sound in a room when it is reflected from a surface with a texture.

## BUILDING ACOUSTICS VS. ROOM ACOUSTICS

**Building acoustics:** Transmission of sound between rooms or between room interiors and the outside world

**Room acoustics:** Audibility within a room, acoustic design of rooms





# QUIET GIVES STRENGTH

Noise and long uncontrolled reverberation interfere with communication. This is particularly hard on people with hearing difficulties or other problems in understanding (e.g. different native language). But, even for people with normal hearing, the limit is soon reached above which what is said cannot be understood.

### Stress and illness due to noise

Noise is often a nuisance; it annoys us. At the workplace, noise leads to reduced performance, stress and tiredness. Even with noises that we don't perceive as annoying, such as background conversations that we don't understand, these effects can be demonstrated. In classrooms, the success in learning is greatly reduced by noise and reverberation, the lessons are very wearing for pupils and teachers, leading to tiredness, headaches and sore throats, and can lead in the worst cases to long-lasting illness.

### Acoustic effects of different materials

The acoustics in a room are to a great extent dependent on the acoustic quality of the surfaces. This results in the question of how different materials affect the acoustics or, more specifically, how strongly they absorb sound. Concrete, masonry, solid wood or glass absorb practically no sound. In the low-frequency range, light panels of wood or plaster (all filled with a porous absorber such as isofloc silencio) are absorbent. In the middle- and high-frequency ranges, porous absorber

materials such as isofloc silencio achieve good absorption values.

### Acoustic solutions for contemporary buildings

Nowadays architects and building contractors often plan and construct buildings with generous floor plans, open and voluminous spatial concepts and sound-reflecting surfaces. Whether they are for living or working – these visually very attractive rooms increasingly demand acoustic solutions, so that the occupants or users can feel well in them and give of their best.

#### BAD ACOUSTICS

- many sound-reflecting surfaces and materials
- large volume

#### LONG REVERBERATION

- poor understanding of speech
- noisy

#### GOOD ACOUSTICS

- many sound-absorbing surfaces and materials
- small volume

#### SHORT REVERBERATION

- good understanding of speech
- quieter

#### EXAMPLE

On the isofloc website there are examples that give you a good picture of the acoustic effects of reverberation in various surroundings and situations.

# UNLIMITED DESIGN CHOICES

isofloc silencio is a highly sound-absorbing cellulose-based spray coating. Since the manufacture of isofloc silencio uses only light-fast paper, the ceiling does not need any further covering after the spraying is finished. The regular surface texture is both plain and decorative. The basic colours are white, gray and black; further colours are possible by means of post-treatment with a special, acoustically-open paint.

## How does isofloc silencio work?

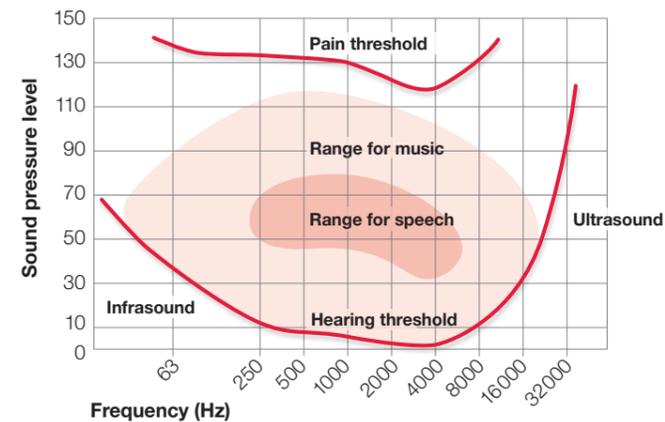
Sound-absorbing materials such as isofloc silencio reduce the reflection of incident sound. Sound absorption by isofloc occurs through the conversion of sound energy into heat energy. The friction occurring between the molecules converts the sound into heat. An acoustic coating of cellulose has a high degree of porosity, providing a lot of friction and thereby achieving an excellent level of absorption.

## Where is isofloc silencio effective?

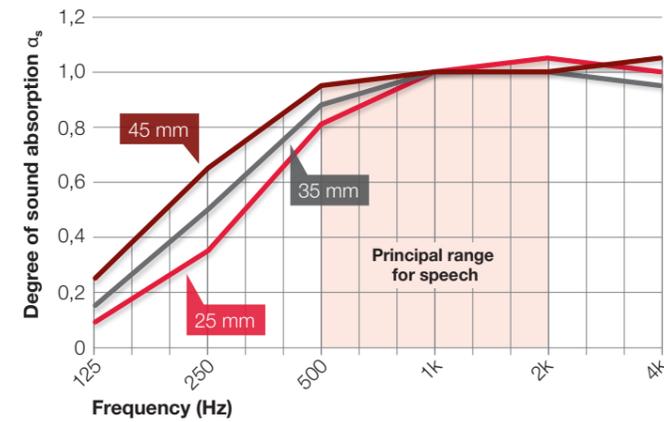
The range of hearing is the range of frequencies and sound pressure level that is perceived by human hearing. The range of hearing is determined at the low end by the threshold of hearing and at the upper end by the pain threshold. On the left, the hearing range is bounded by the lowest humanly audible frequency of about 20 Hz, and on the right by the highest audible frequency of about 20,000 Hz.

The frequency range of speech is mainly between 500 and 2000 Hz. Porous absorbers like isofloc are very effective in just this range. The measurement graph of the degree of sound absorption  $\alpha_s$  shown below, shows that isofloc silencio has an excellent absorption of sound in the frequency range of speech. This improves the intelligibility of speech in a room and makes things quieter overall. With increasing layer thickness, the sound

FROM THE THRESHOLD OF HEARING TO THE PAIN THRESHOLD



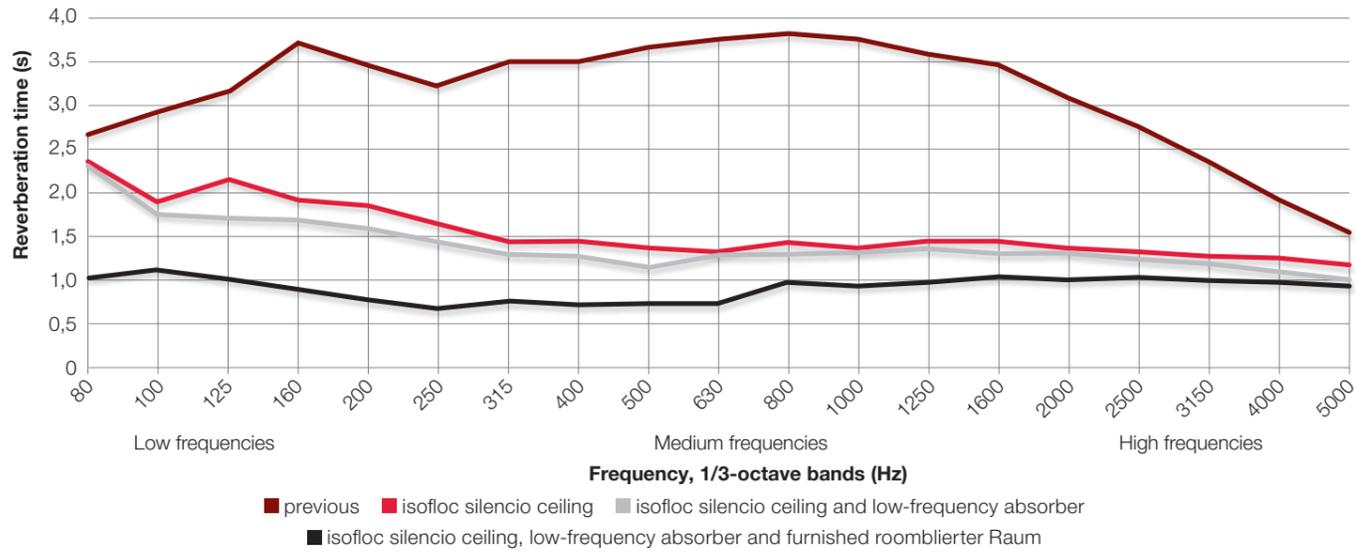
ISOFLOC SILENCIO, DEGREE OF SOUND ABSORPTION



## How long must one shout at a glass of water to make it boil?

For producing even very loud sounds, only very low levels of acoustic energy are required. This calculation shows how small the amounts of physical energy are: Assuming that no energy is lost, one would need to shout at a glass of water for one year to make it boil.

## REVERBERATION TIME AT MEDIUM AND HIGH FREQUENCIES – SEE THE REFERENCE EXAMPLE BOX



absorption improves, including at low frequencies. isofloc silencio can easily be combined with other low-frequency absorbers to give an optimal result in all frequency ranges. Optimal use of isofloc silencio is achieved on large flat areas of a building, such as the ceiling. Detailed parameter values for isofloc silencio can be found in our data sheet. We shall gladly provide you with test certificates and detail drawings.

### How is isofloc silencio applied?

isofloc silencio is sprayed onto the ceiling (or alternatively other absorption surfaces) using a machine specially developed by isofloc and with the addition of a water-soluble glue. The cellulose fibres adhere to the surface and form an even absorption layer there. The thickness can be varied depending on the amount of sound absorption required.

### Where is isofloc silencio applied?

isofloc silencio can be applied to flat, curved and profiled surfaces in the most diverse premises, such as offices, living rooms, galleries, industrial workshops, commercial premises, restaurants, classrooms or staircases. isofloc silencio can be sprayed onto virtually all clean surfaces such as wood, steel, concrete or plaster. Depending on the character of the surface, a primer will be used (e.g. on absorbent substrates). With isofloc silencio you can also spray sections of areas or shapes that can be used as design elements in a room.

- 1 The cellulose fibres are sprayed on with a machine specially developed by isofloc.
- 2 isofloc silencio can be sprayed onto ceilings or optionally other absorption surfaces.
- 3 Whether for a private home or industrial premises - isofloc silencio can be used everywhere.

### REFERENCE EXAMPLE

It was planned to change the use of the former manufacturing area of a spinning mill. However, in their unfinished state, the premises were entirely unsuited to other uses. In a conversation at normal loudness there was reverberation and the noise level was already uncomfortably high for some of the people present. The ceilings were therefore sprayed with 20 mm of isofloc silencio. With isofloc silencio the reverberation time in the medium and high frequency ranges was immediately much better. With an additional low-frequency absorber, the whole frequency range was then very well covered. The average reverberation time for 500/1000 Hz was, in the empty room before spraying, 3.6 seconds. In the furnished room and with the isofloc silencio acoustic coating, the average reverberation time for 500/1000 Hz was now only 0.86 seconds.



# THE SUM OF ALL THE BENEFITS: ISOFLOC SILENCIO



**isofloc silencio has, even at 15 mm, excellent sound-absorption values and they become even better with increasing thickness. Speech comprehensibility in rooms is improved, and the noise level significantly lowered. In addition to these excellent acoustic properties, isofloc silencio brings you many further benefits.**

**Virtually no loss of room height**  
isofloc silencio can be sprayed directly onto existing surfaces. No elaborate substructure is necessary. An unbeatable argument if the room height is already limited.

**Outstanding price-performance ratio**  
Thanks to the possibility of spraying isofloc silencio directly onto existing surfaces without substructures or attachment systems, the system has a very good price-performance ratio. Also, the work involved is very efficient.

**Joint-free surface structure**  
isofloc silencio is sprayed on without joints and fitting precisely. This results in a good-looking, uniform surface that is also simple and decorative.

**No limits to your imagination**  
isofloc silencio is very versatile in its uses. Whether it's a rectangular ceiling panel with a frame surround, an acoustic ceiling with cloud shapes or colourful accents on the walls - you can give free rein to your imagination with isofloc silencio. The design possibilities are unlimited.

**Quick to install**  
Depending on the size of the room and the results wanted, the isofloc silencio acoustic ceiling can be completed in one to two days.

**Thermal benefits in addition**  
Even with layers only a few centimetres thick, cellulose performs well, increases the comfort of the room and shortens heating-up times.

**Retain the character of a room?**  
You don't want to change the look of a room, but to maintain its existing character? But it is important to do something to improve the acoustics? Thanks to the flexibility of isofloc

silencio, this acoustic coating is clearly different from other acoustic treatments. isofloc silencio is simple, fits the shape of the substrate and can (depending on the reverberation time wanted) be sprayed on in different thicknesses.

**Natural and easy on the environment**  
Natural materials are the first choice in interior rooms. isofloc silencio meets all requirements for building materials in living and working rooms. In addition, isofloc silencio does not require large amounts of energy to manufacture and is a meaningful contribution to real recycling.

**isofloc silencio:**  
Who can match these advantages?

## MEASURING REVERBERATION TIME

There are several apps available on the market for simple measurement of reverberation time (e.g. RevMeter Pro for the iPhone). This is a quick and easy way to check whether your room needs some acoustic treatment. These apps are, of course, not a complete substitute for professional measurement by an acoustician.

# SURE TO BE THE BEST SOLUTION



## MORE ON THE INTERNET

- Swiss Acoustical Society: [www.sga-ssa.ch](http://www.sga-ssa.ch)
- Suva: [www.suva.ch](http://www.suva.ch)
- Empa: [www.empa.ch/akustik](http://www.empa.ch/akustik)
- German Acoustical Society: [www.dega-akustik.de](http://www.dega-akustik.de)
- Federal Institute for Occupational Safety and Health: [www.baua.de](http://www.baua.de)

**For many types of rooms the requirements and the necessary design actions are relatively easy to understand and implement. The Austrian standard ÖNORM B 8115-3:2005 draws heavily on DIN 18041, and the Swiss standard SIA 181:1996 refers directly to the German standard. DIN 18041 contains details about acoustic requirements and actions in small to medium-sized rooms.**

### DIN 18041 distinguishes two categories of rooms:

**Category A:** Optimal speech communication over medium and longer distances: for example conference, teaching and seminar rooms, lecture theatres, meeting rooms. Rooms in category A require a greater effort for acoustic treatment. Optimal reverberation times are specified dependent on room volume and frequency. Indications are also given concerning volume and shape of the rooms.

**Category B:** Good communication over small distances: for example restaurants, consultation rooms of lawyers and doctors, individual offices, offices for several people, open-plan offices, public areas, pedestrian areas, foyers, exhibition rooms and staircases. In rooms of category B, it is mainly a matter of creating absorbent surfaces to reduce reverberation and therefore the noise level.

A table in the standard states, for four sub-categories of rooms, which ceiling and wall areas, as a multiple of the floor area, must be covered with a material of a rated sound-absorption level. This way, the standard covers a wide range of rooms and uses, noting that special requirements apply for persons with hearing difficulties. The standard does not deal with audibility in rooms with special requirements such as theatres, concert halls, cinemas, sacred spaces and rooms for high-quality recording of music and speech. The recommendations can,

however, be applied to some extent to rooms for general music performance, multi-purpose rooms and rooms of large volumes up to about 30,000 m<sup>3</sup>.

### Are you interested in isofloc silencio?

We shall be pleased to help you towards optimal room acoustics. isofloc knows that the people who make the isofloc system successful are those who are involved. isofloc professionals are taught everything they need to know about acoustic insulation with cellulose, both in theory and in prac-

tice, in the most up-to-date training centres. With their high-quality training, they can always assure you of first-class work and answer your questions competently. For more in-depth questions, isofloc can provide a physicist specialised in buildings. isofloc and its acoustics professionals look forward to soon being able to provide the insulation for your building to your entire satisfaction!

## STEPS TO OPTIMAL ROOM ACOUSTICS

