DLW FLOORING

DLW Flooring GmbH
Product Information
Stuttgarter Str. 75

D-74321 Bietigheim-Bissingen

e-mail: service_germany@dlwflooring.com

Technical Information

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Sound Insulation, Impact Sound Absorption and Noise Reduction by floor coverings

1 General

The main function of sound insulation is to protect us from the ever-increasing exposure to noise regarding the propagation of noise from outside, sound from our own and external homes and workplaces as well as from sound transmitted from stairwells, lifts or other specific sources of noise. This achieved by means of sound insulation and noise reduction. The requirements and necessary verifications for sound insulation are specified in individual ordinances issued in Germany by the construction authorities and in DIN 4109 "Sound Insulation in Buildings". As regards verifications for sound insulation in a construction project in Germany elastic floor coverings may not be taken into account due to the possibility of their replacement and wear.

2 Sound transmission

Noise can greatly impair our well-being and is transmitted from one room to another by various means. Here we distinguish between airborne, structure-borne and impact sound.

3 Terms and definitions

Airborne sound: Noise is propagated in the air in the form of sound waves. If airborne sound waves encounter spatial limits such as walls or ceilings, they will cause them to vibrate. The airborne sound is transformed into structure-borne sound and is then transmitted further to adjacent rooms as attenuated airborne sound. Airborne sound can penetrate openings, joints and cracks in walls unhindered.

The transmission of airborne sound can be reduced by the use of heavy solid building materials and tightly closing doors and windows. Textile floor coverings and furnishings/fittings such as upholstered furniture and window decorations act as absorption areas and also absorb airborne sound.

Structure-borne sound: Structure-borne sound is produced through direct action, e.g. knocking or striking solid bodies/objects. Some of the sound waves are propagated to neighbouring rooms but a greater part is transmitted to adjacent building structures. Errors in building design, so-called acoustic bridges such as continuous concrete slabs in terraced housing, encourage structure-borne sound.

Impact sound: Impact sound is a type of structure-borne sound which occurs when walking or when furniture is moved. It is propagated on the one hand to the rooms underneath as airborne sound and on the other, to the rooms underneath via the parts of the building. Floating screed can be used to counteract impact sound.
Resilient floor coverings with an insulating underlay and in particular textile floor coverings can reduce the sound of feet.

Noise reduction: Sound absorption (noise reduction) is the ability of surfaces and building parts to absorb sound energy. This is achieved by the use of porous materials, perforated building parts with back lining or

building parts with appropriate surface structures. The aim of such measures is to reduce the level of noise in a room as quickly as possible.
Without noise reduction sound waves are repeatedly reflected and may be superimposed with new sound waves. Such a room would be noisy, and in extreme cases it would be virtually impossible to make oneself understood.

Noise reduction is only possible with textile floor coverings.

Resilient floor coverings, parquet or ceramic etc. do not absorb sound energy. There is not a great deal of difference in the levels of noise reduction offered by textile floor coverings. As the reverberation time in a room is never influenced by the floor covering alone (other building parts, furniture or curtains are always involved), knowledge of the approximate noise reduction levels is sufficient in most cases.

There are no official requirements on the noise reduction levels of building materials / parts.
The requirements in terms of the acoustics of a room depend on the type of usage involved and the resulting demands of the client. Acousticians then use suitable materials to achieve the desired reduction in the reverberation time for a room.

Noise reduction levels are specified for the relevant measuring frequencies in Hertz (Hz). Noise reduction is limited at the lower end of the scale. It is important at approx. 1000 Hz as it is here that the maximum energy of the human voice is to be found.

4 Test methods

4.1 Measurement of impact sound absorption

Impact sound absorption is measured in a frequency range between 50Hz and 5000 Hz using one third octave bands.
In the source room the floor slab is excited at various points with a standardised tapping machine (according to EN ISO 140, part 6), consisting of 5 hammers which strike the floor from a specified height of fall at specific intervals. In the receiving room underneath the resulting sound level for every hammer position is measured via the capacitor microphone with the sound level meter also being positioned at different points of the room.
The third octave band filter connected between the capacitor microphone and the sound level meter allows the sound level to be measured using one third octave bands in the above frequency range.
The impact sound level (Ln,w) is used to evaluate impact sound absorption. This is the result of deducing the impact sound reduction ΔL_w of the covering from the equivalent standard impact sound level Ln,w,eq (bare floor without covering) .
The unit of measurement is decibel (dB) in both cases. The German standard DIN 4109 specifies minimum impact sound insulation values which must be observed to ensure adequate impact sound insulation for slabs.

The impact sound reduction values of different layers in the construction structure may not be added together. If two coverings are used simultaneously, e.g. floating screed, insulating underlay and floor covering, only the higher value, either that of the floating screed or elastic underlay may be taken into account for the impact sound reduction ΔL_w .

4.2 Measurement of impact sound reduction

The impact sound reduction value is the difference between the evaluated standard impact sound levels of the reference slab without and with floor covering (e.g. soft floor covering).
The impact sound reduction evaluated is indicated by ΔL_w. As the impact sound reduction value is determined using test rigs, this is indicated by the index P: $\Delta L_{W,P}$.
To calculate impact sound levels in buildings, this value has to be reduced by 2 dB. This allows us to obtain

the characteristic value for the impact sound reduction, which is indicated by an R: $\Delta_{LW,R}$.

4.3 Measurement of airborne sound

Airborne sound can be measured regardless of its source. The sound level / acoustic pressure measured is specified in dB. Measurement of the sound level / acoustic pressure is not linear but logarithmic so that an increase of just 10 dB represents doubling of the sound level / acoustic pressure. This is also the reason why the human ear is normally unable to perceive sound differences of less than 2 to 3 dB.

4.4 Measurement of noise reduction

Measurement of the reverberation time and calculation of the resulting noise reduction levels is performed according to EN ISO 354 or EN 20354.

For measurement a sound level is generated in a room and the time measured from switch-off of the acoustic source until the sound level is reduced by 60 dB (reverberation time). The reverberation time is used to calculate the noise reduction level α_S (alpha sabine). This is a measure of how much sound energy is absorbed by an area of material in

comparison with an area of identical size that is 100% absorbent. A comparison for a 100% noise reduction is e.g. a window opening onto an unobstructed landscape. The sound that escapes here is not reflected.
A floor covering with an α_S of 0.50 is thus half as effective as an open window of identical size.

5 Impact sound reduction of DLW floor coverings

The following overviews show the ranges of attainable impact sound reduction according to measurements made at the test laboratory. The individual values can be found in the relevant product data sheets.

5.1 Textile floor coverings

Type of flooring	$\Delta L_{W,P}$ in dB
Fibrebonded sheet flooring	16 - 22
Fibrebonded tiles	approx. 19

5.2 Resilient floor coverings

5.2.1 Floor coverings without carrier

Type of flooring	$\Delta L_{W,P}$ in dB
Vinyl homogeneous / heterogeneous	approx. 3
Linoleum 2.0 – 4.0 mm	3 - 6

5.2.2 Coverings with carrier (composite floor coverings)

Type of flooring	$\Delta L_{W,P}$ in dB
Vinyl Acoustic (foam backing)	17
Linoleum Acoustic (corkment)	approx. 14
Linoleum Acoustic (foam backing)	18

5.2.3 Separate installation on corkment

Type of flooring	$\Delta L_{W,P}$ in dB
Vinyl homogeneous on corkment spezial 2,0 mm	14
Linoleum on corkment 2.0 mm	14
Linoleum on corkment 3.2 mm	15