



mance is provided by laboratory testing of a representative test specimen. EN 13830 does not provide any details for the selection of the test specimen. The specified test value is $R_w(C;C_{tr})$. The product standard neither refers to any forecasting methods for calculation nor contains any tabulated values. The product standard does not provide for classification of flanking sound insulation, although the practice in Europe regarding invitations to tenders shows that it must be taken into account.

As a rule, the required flanking sound insulation of curtain walls is usually planned and specified by specialised design offices in the preparatory phase of invitations to tenders. Characteristic quantities are the weighted normalised flanking level difference $D_{n,f,w}$ (laboratory value) or the calculated value of the linear weighted sound reduction index $R_{L,w,R} = D_{n,f,w} - 2$ dB.

3 Airborne sound insulation of curtain walls

2.2 Application in Germany

As regards sound insulation of buildings in Germany, the German standard DIN 4109 : 1989-11 specifies performance characteristics and values for sound insulation against both exterior and interior noise. For sound insulation against exterior noise, the calculated value of the weighted sound reduction index $R_{w,R}$ (deduction of a tolerance of 2 dB) is used. As an alternative means of verification the completed project can be inspected.

Verification of sound insulation of facades as per EN 13830 must be based on laboratory measurements according to EN ISO 140-3. Procedures using tabulated values, calculations or measurements in completed buildings are not suitable for providing evidence of performance. Due to the fact that advance laboratory testing of facades is not always possible, the sound insulation of curtain walls must be forecast. This kind of planning, however, is uncertain due to lack of knowledge or insufficient knowledge of many influencing factors.

DIN 4109 does not contain any specific requirements for the flanking sound insulation of curtain walls, but flanking sound insulation is included in the design and verification of sound insulation of adjacent separating walls and floors.

In order to help the industry deal with this problem, the ift Centre for Acoustics prepared a concept that contains specifications for the „system testing“ of the sound insulation of curtain

Table 1 Characteristic quantities and test standards of airborne sound insulation and flanking sound insulation

		Characteristic	Test standard	Relevant to marking as per product standard EN 13830	Application DIN 4109
Airborne sound insulation	Laboratory testing	Weighted sound reduction index $R_w(C;C_{tr})$	EN ISO 140-3, EN ISO 717-1	yes	Calculated value $R_{w,R} = R_w - 2$ dB
	Testing in insulation completed building	Weighted structure-related sound reduction index $R'_{45^\circ;w}(C;G_r)$	EN ISO 140-5, EN ISO 717-1	no	Requirement $R'_{45^\circ;w} = \text{erf. } R_{w,\text{res}}$
Flanking sound insulation	Laboratory testing	Weighted normalised flanking sound pressure level difference $D_{n,f,w}(C;C_{tr})$	EN ISO 10848-1 and -2, EN ISO 717-1	no	Calculated value $R_{L,w,R} = D_{n,f,w} - 2$ dB

walling which makes it possible to evaluate the sound insulation of these types of facade. The concept is based on a combination of measurements made of selected facade elements, extrapolation rules, and calculations for the integration of variations. The selection of the test specimens and the extrapolation for different

facade variants are based on the parameters relevant to the sound insulation, which are schematically represented in Figure 2.

As an example, the effects of glazing and the dependency on size will be discussed here:

The dimensions of the individual panels or fields are likely to have an influence on the sound insulation of the facade, e.g. as shown in Figure 3. In order to estimate this effect, the extrapolation rules for windows set out in the product standard EN 14351-1, Annex B can be used for the time being.

Infills, i.e. the glazed or panel sections, are essential when it comes to assessing the sound insulation of a facade (see Figure 4). The values can be extrapolated for different infills based on the sound insulation properties of the glass or panel. These can be verified separately by testing or by using the tabulated values.

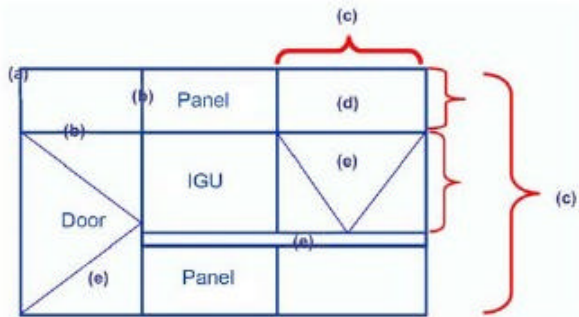


Figure 2 Schematic of a facade construction and the technical details relevant to sound transmission:
a) Type of facade construction, e.g. unitised or stick construction
b) Facade profile sections, i.e. geometry of profiles, material, construction depths, face widths.
c) Dimensions of facade, i.e. field width and heights
d) Facade infills, i.e. IGU, panel field
e) Insert units, e.g. windows, doors, ventilation devices

4 Flanking sound insulation of curtain walls

Flanking sound insulation is laboratory testing according to and -2 (formerly DIN 52210-7). only be made by comparing

determined by EN ISO 10848-1 A prediction can the parameters

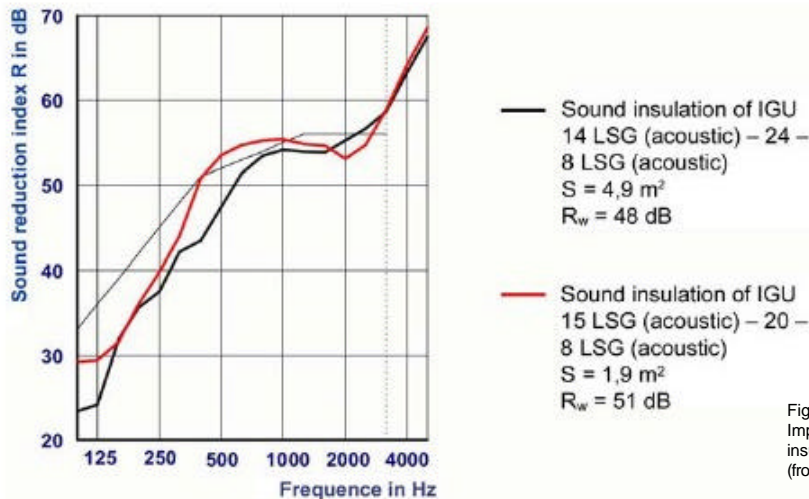


Figure 3 Importance of size and dimensions of insulating glass units of similar configuration (from: archive ift Centre for Acoustics)



relevant to sound insulation with the values provided by literature [1]. These are:

- a) Direction of transmission – horizontal/vertical,
- b) Characteristics of the profiles (material wood/aluminium/steel, geometry, construction depth, construction type (divided/undivided),
- c) Glazing system, in particular the inner pane,
- d) Connection to partitioning wall/ceiling/floor, tightness of wall connection,
- e) Profiles positioned vertically to wall connections and hollow chambers,
- f) Connection to profiles or sheet panels in the case of horizontal sound transmission.

In the special case of horizontal flanking sound insulation of stick constructions, the flanking sound insulation is influenced to a great extent by the sound transmission through the facade mullions. Here, a calculation formula can be used that combines by calculation the sound transmission through the mullions (the weighted

normalised sound level difference $D_{n,e,w}$ with the sound transmission across the remaining facade (influence of glazing, transoms, ...), see e.g. [1] and Figures 5 and 6. In this way, the sound insulation of different mullion/glazing combinations can be assessed in advance.

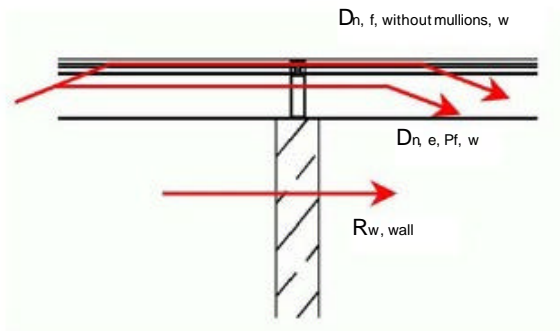


Figure 5 Sound transmission paths of stick construction

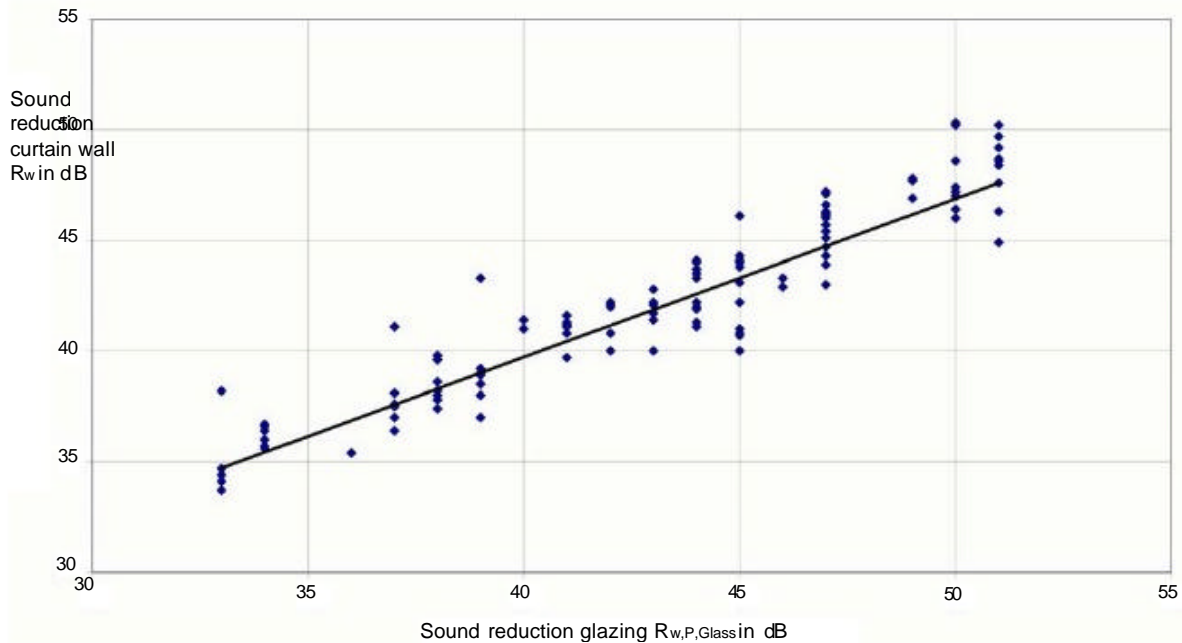


Figure 4 Sound insulation of curtain walls featuring fixed lights for sound reduction $R_{w,P,Glass}$ of the glazing (from: Archive ift Centre for Acoustics)

Due to the fact that the sound transmission paths cannot be clearly separated, there is no equivalent calculation method for vertical flanking sound insulation.

Literature

- [1] Final report research project „Überprüfung des Einflusses von Stoßstellen bei Fassaden “ ift Rosenheim, 2000

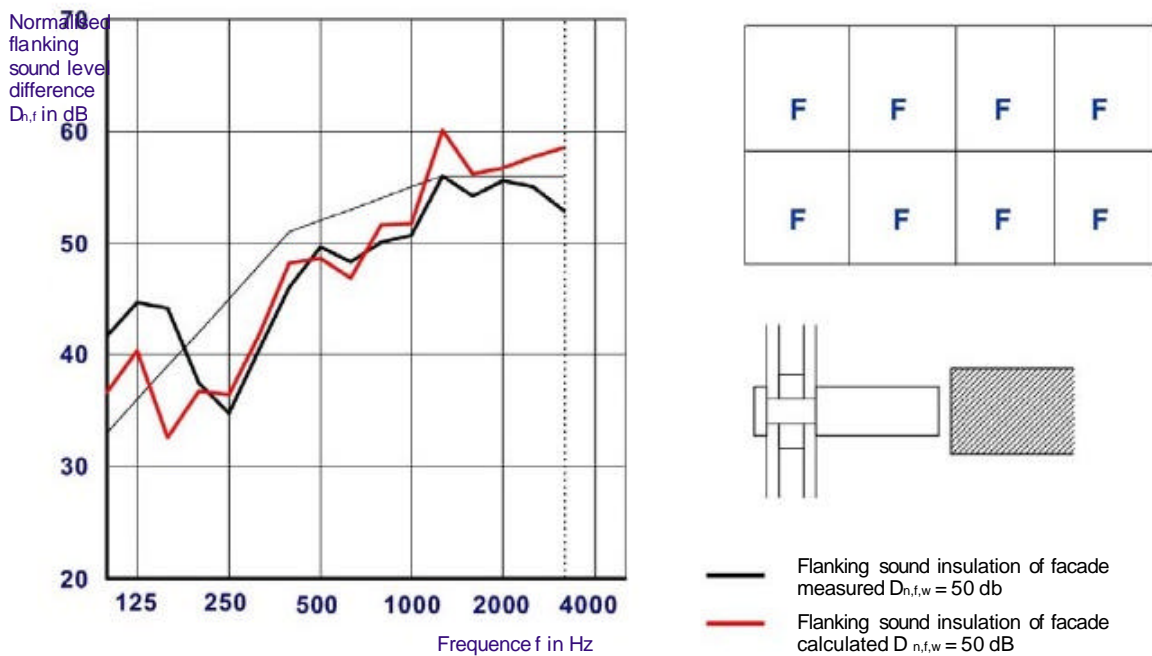


Figure 6 Comparison of measured and calculated flanking sound insulation for aluminium stick construction (from: Archive ift Centre for Acoustics)



Useful information in brief

Which basic rules should be observed for verification of the sound insulation of curtain walls?

- 1 For CE marking, the product standard EN 13830 applies;
the airborne sound insulation of curtain walls is determined by laboratory testing of a representative test specimen.
- 2 In Germany, the requirements for sound insulation and their verification are laid down in DIN 4109. In addition to airborne sound insulation, the flanking sound insulation of the curtain walling should also be taken into account. For verification purposes, the values of the sound reduction index and of the linear sound reduction index (tolerance of 2 dB) are determined by calculation.
- 3 There are no procedures for determining the sound insulation in advance. In order to evaluate the sound insulation of curtain walling systems, a series of measurements are carried out on curtain walling elements of the original size. These measurements can be applied to the requested system variants if properly designed and planned.
- 4 A forecast for linear sound insulation may be based on previously tested constructions. Horizontal flanking sound insulation of stick constructions of simple design can be determined up to an average sound reduction level by separating the sound transmission paths via mullions and the remaining curtain walling.



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