

TEROSON®

THE WINDOW CONNECTION

A CRITICAL POINT FOR

**SOUND
INSULATION**

WHITE
PAPER



Noise: a problem of our time

Noise pollution makes people ill. It can not only lead to hearing damage, but also triggers a physical stress situation that has a negative effect on the entire organism. Exposure to aircraft noise at a continuous sound level of 40 dB already significantly increases the risk of cardiovascular disease. **This makes noise the most stressful emission for humans.**

The worrying thing: People are being exposed to more and more noise pollution. Precisely because we spend 90% of our time indoors, good sound insulation is important and crucial. Buildings in cities are becoming increasingly dense. Residential buildings near motorways or office buildings near airports are no exception these days. In addition, office buildings, for example, often have window areas of more than 60 % - and large glass elements in the façade of residential buildings are also becoming increasingly popular. The sound insulation of the entire façade is largely determined by the window, even with a proportion of 10 to 20 %.

Window connection joints must significantly reduce the ingress of airborne sound into the interior. This is a complex task, as even the smallest cracks in the seal can severely impair the soundproofing properties. Another challenge is measurability: Values and different materials can never be understood and considered additively.

Sound sources - examples:

The level of sound sources is given in decibels (dB). In the human hearing range, this is between 0 and 120 dB.



Quiet bedroom
at night **30 dB**



Vacuum Cleaner
at 1m distance **70 dB**



Chainsaw at 1m
distance **110 dB**



Pain threshold
130 dB



Windows: weak point for sound insulation

As one of the main penetrations in the building envelope, windows play an important role in the sound insulation of buildings. They can allow airborne sound, which usually emanates from sound sources outside, to pass through unattenuated or even amplify it if they are not fitted with adequate sound insulation.

However, any sound-insulating window is only as good as its connection seal. Improper installation or inadequate sealing can significantly impair sound insulation. Even small holes or hairline gaps in the connection joint can reduce the sound insulation performance by more than 10 dB. The consequences are serious: **a deterioration of 10 dB in sound insulation performance leads to a doubling of the perceived noise pollution for people.**



The following therefore applies:

Only an airtight window connection is an acoustically tight connection.

Insulation materials support joint sound insulation through their absorbent properties. Sealing foils and sealants do this through their different material properties and mass. Both therefore also seal the window connection acoustically!



The sound insulation value of building components

The sound insulation value (**R_w value**) is a measure of the sound insulation of a component, such as a wall, window, or door. It indicates how effective the component is at blocking sound waves from one side to the other. The higher the R_w value, the better the sound insulation of the component. The R_w value is measured in decibels.

Overview of requirements and regulations

The following regulations are used to derive requirements for the sound insulation of building connection joints:

- DIN 4109 - Parts 1, 2 and 35, 2016-07 - „Sound insulation in building construction“
- - DIN 18005-1 „Sound insulation in urban development“
- VDI guideline 2719 „Sound insulation of windows and their additional equipment“
- DIN EN 12354 - Parts 1 and 3 - „Building acoustics“

VDI Guideline 2719 specifies sound insulation classes (SSK) for the sound insulation of windows, which are graded from SSK 1 to 6.

Important to know

Sound insulation requirements are placed on the entire external component when installed. In addition to the window, this applies to accessories such as roller shutter boxes and ventilators as well as the external wall including building connections. Joints must therefore be planned and executed in such a way that the sound insulation value R_w of the components themselves is maintained!

However, the exact requirements of **DIN 4109** depend on various factors, including the type of building, the utilisation of the rooms and the sound insulation class. Minimum requirements are defined, which are binding for new construction projects in Germany. However, higher standards are often common in building practice.

Schallschutz- klasse (SSK)	Verkehrsdichte	Entfernung des Hauses	Schalldämm-Maß des Fensters
1	Wohnstraße 10–15 Autos pro Stunde 	 > 35 Meter	25–29 dB
2	Wohnstraße 10–15 Autos pro Stunde 	 25 - 35 Meter	30–34 dB
3	Wohnstraße 50–200 Autos pro Stunde 	 25 - 35 Meter	35–39 dB
4	Hauptstraße 1000–3000 Autos pro Stunde 	 100 - 300 Meter	40–44 dB
5	Hauptstraße 1000–3000 Autos pro Stunde 	 30 - 100 Meter	45–49 dB
6	Schnellstraße 3000–5000 Autos pro Stunde 	 < 100 Meter	≥ 50 dB

The sound insulation classes describe the sound insulation of windows according to VDI guideline 2719.

The challenge of the front installation position

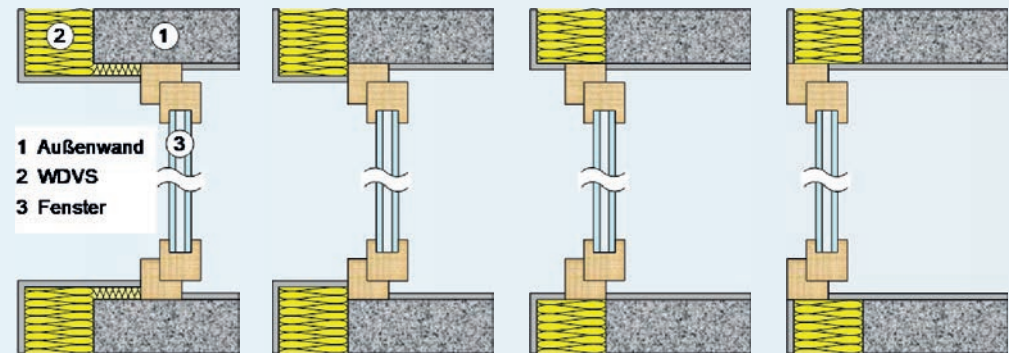
Existing standards and guidelines refer to the classic installation method in which the window is positioned in the central area of the masonry reveal.

Currently, there is great pressure to make buildings as energy efficient as possible. However, measures to improve thermal properties do not always have a positive effect on sound insulation. For example, the increasing use of external thermal insulation composite systems (ETICS) and the resulting installation position of the window in front has a critical effect on sound insulation due to hydrothermal advantages.

This is because: window frame profiles today generally measure at least 70 mm and therefore slide more and more into the insulation level, at the expense of the available depth of the window insulation foam between the masonry and the profile.

Testing with the Fraunhofer IBP

The study „Sound insulation of windows in front installation position“ by the Fraunhofer Institute for Building Physics (IBP), Stuttgart, shows how great the influence of the front installation position is on sound insulation. Sealing and insulating materials from TEROSON Bautechnik, among others, were used in the study and in the test procedure subsequently developed to test the influence of sealing foams in the joint.



Installation positions and connection to the thermal insulation of the windows within the wall opening with external thermal insulation composite system (ETICS). From left to right: Position -90, 0, 90, 160

The following measurements were part of the test:

- four different installation positions (shown using a picture)
- four different windows with a weighted sound reduction index of 37 to 47 dB corresponding to sound insulation classes (SSK) 2, 3, 4 and 5 in accordance with VDI 2719
- three different pre-wall fastening systems (insulating frame, brackets, metal frame)*
- Various types of sealing (combinations of: Foil, compressible sealing tape (multifunctional tape), installation foam and sprayable sealants)
- Different joint widths between window frame and building (15 mm and 30 mm all round)

* Mounting frame system, window mounting bracket, classic steel frame

The Fraunhofer Institute test in detail

The assumption

It was assumed that the metal frame would perform best in the comparison and the bracket system would perform worst.

The procedure

The measurements were carried out in a building acoustics wall test stand with equipment in accordance with the requirements of DIN EN ISO 10140-4 and 5 and the same for all systems. The test started with the reference installation, installation position „-90“. This procedure was then repeated for the installation positions „0“, „90“ and „160“, whereby the measurements for the last two positions were carried out once each with the mounting frame system, with the bracket system and with the metal frame.

The result

Contrary to the initial assumption, the bracket system performed best and the metal frame worst in terms of sound insulation properties. The tests also showed that the installation of windows in the front installation position in walls with external ETICS leads to a change in sound insulation compared to the reference position in the central area of the reveal. The frequency curve showed negative influences in the range from 63 to 100 Hz, particularly with metal frames and bracket systems. For windows with high sound insulation (from SSK 3), these effects can lead to a significant deterioration in sound insulation, especially when installed with unspecified metal frames.



“The bracket system with sealing film insert may only be slightly superior to other systems in terms of sound insulation, but ultimately its price-performance ratio is unbeatable! The susceptibility to faults is also clearly lower.”

Vito Henning, Head of Curtain Walling
at Henkel Adhesive Technologies

Our systems for effective noise and sound insulation

Testing by the Fraunhofer IBP has proven this: Our sealing film systems for window connections have excellent sound-insulating properties.

We rely on a 3-level model consisting of:

- **TEROSON EF 537:**
A flexible 1-component gun foam for thermal and acoustic insulation of window connection joints to the building structure
- **TEROSON FO 3 / 2 SK:**
A water-impermeable, but diffusion-open elastic sealing film system for the cold component side
- **TEROSON FO 150 FOIL-TACK M+S:**
A fully self-adhesive, vapour-tight sealing foil for the warm component side

The combination of these three components achieves SSK 6 (>50 dB) with a joint depth of just 40 mm. The TEROSON EF 537 window installation foam is so compact that it fulfils SSK 4 with a joint depth of just 20 mm.

More information at
<https://profiguide.terason-bautechnik.com/technikblog/schallschutz-mit-system/>

Alexander Bauer, Technical Manager at TEROSON Bautechnik, explains:

"The TEROSON EF 537 window installation foam achieves such high sound insulation properties because the extremely fine foam cell structure of the material gives it a particularly high level of impermeability and thus effectively absorbs noise. TEROSON EF 537 is also certified as flame-retardant in accordance with DIN 4102-1 (fire protection class B1). Having been awarded the EMICO-DE EC 1Plus seal of approval, it is categorised as very low emission. Processing is possible at air temperatures of up to -10 °C."



The advantages of TEROSON Bautechnik sealing foil systems in the 3-level model:

- ✓ Very good price-performance ratio
- ✓ Easy to use and therefore minimises potential installation errors
- ✓ Preservation of the sound insulation value with front installation position



About TEROSON Bautechnik

TEROSON Bautechnik offers comprehensive product and consulting expertise for sealing and adhesive solutions for façades and windows. As part of the Düsseldorf-based Henkel Group, the company supplies sealing films and tapes, adhesives, joint sealants, specialty sealants and other system components to metal and window manufacturers. Customers can rely on more than 30 years of experience in international and national projects.

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Do you have any questions on the subject of „Soundproof window connection“? Then please do not hesitate to contact us.

