

Abridged version of the research project: Uncertainty budget for installation noise according to DIN 4109

The German standard DIN 4109 about sound insulation in buildings is currently under revision. One major topic here is the adequate consideration of uncertainties which are of major importance for measurement results from laboratories, predicted values and in-situ measurements in buildings, e.g. for checking the compliance with legal or other requirements. Such a concept for the handling of uncertainties in airborne and impact noise had been developed by PTB and was introduced into standardisation. With the research project now finished, this approach has been extended to installation noise for the first time.

A major part of the investigation was dedicated to the in-situ measurements. In addition to the determination of uncertainty the special question arose about whether measurements according to the new standard DIN EN ISO 10052 yield the same results as the old measurement standard DIN 52219. This was initially investigated by a comprehensive measurement programme. Six different teams with different equipment measured the installation noise from six different installation noise sources in two different receiving rooms according to both the old and the new standards. Averaging the participants' results revealed installation noise levels which are about 0 – 3 dB larger with the new standard. To understand the reasons for these deviations, Monte Carlo simulations were performed. It became obvious that the introduction of a microphone position in a corner is essential. Sound pressure levels at low frequencies are larger there than at positions far away from the walls by about 10 dB, which leads to an increase of the A-levels of predominantly low frequency noises. Furthermore, a background noise correction is feasible, according to the new standard, only up to a signal-to-noise ratio of 6 dB whereas the old standard allowed a correction up to signal-to-noise ratios of 3 dB. Discussions about whether the requirement according to DIN 4109 should be increased have already been held within the standardisation committee responsible.

Based on the experimental findings, an uncertainty of 1.5 dB is proposed for the in-situ installation noise measurements when the installation noise level is above 35 dB. The uncertainty increases towards lower installation noise levels by 0.1 dB per dB according to the proposal developed. The uncertainty at the current requirement of 30 dB is thus 2.0 dB.

Besides this, the uncertainties of laboratory measurements of installation noise sources were investigated. For the reception plate method according to DIN EN 15657-1, an interlaboratory test with major contributions from PTB revealed an uncertainty of 2.8 dB for the A-weighted levels. The uncertainty of the appliance sound pressure level according to DIN EN ISO 3822 turned out to be 1 – 2 dB for a mixing valve depending on the mixer position and 2.7 dB for a low noise flow resistance. For other laboratory measurements of installation noise sources no uncertainties can be quoted today, in particular as the measurement methods are still under development.

In contrast to this, the uncertainties associated with predictions of installation noise levels are widely unknown, since the only available prediction method according to DIN EN 12354-5 is not yet applied in practice. Despite this, the requirement of DIN 4109 has to be met which clearly demonstrates the need for further research.