SLOVENSKI STANDARD
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Steklo v gradbeništvu - Zasteklitev in zvočna izolacija - Postopek potrjevanja računskih orodij

Glass in building - Glazing and airborne sound insulation - Validation procedure for calculation tools

Glas in Bauwesen - Glas und Luftschalldämmung - Validierungsverfahren für Berechnungsprogramme

Verre dans la construction - Vitrages et isolation acoustique - Procédure de validation des outils de calcul

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81.040.20	Steklo v gradbeništvu	Glass in building
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Glass in building - Glazing and airborne sound insulation - Validation procedure for calculation tools

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Glas in Bauwesen - Glas und Luftschalldämmung - Validierungsverfahren für Berechnungsprogramme

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

This document (prEN 17839:2022) has been prepared by Technical Committee CEN/TC 129 “Glass in building”, the secretariat of which is held by NBN.

This document is currently submitted to the CEN Enquiry.

Introduction

The standard EN ISO 10140 specifies test requirements for building elements and products, including glazing units. EN 12758:2019 outlines a test procedure for the measurement in laboratory of sound insulation for a range of glass configurations.

Considering the number of possible glazing configurations, it is impractical to measure the acoustic characteristics for all of them.

The last few years have seen the development of acoustic calculation tools based on simulation and/or interpolation. The aim of this document is to provide a methodology and reference values for the assessment of such calculation tools.

As there is neither a reference calculation tool nor a standardized calculation method, the assessment is undertaken first by a comparison with reference values selected from EN 12758:2019. These values have been calculated on the basis of data collected from several European laboratories. The assessment is completed by a comparison of the calculated values for other glass compositions with measurements already performed by the validator according to EN ISO 10140-1 or another possible validator.

1 Scope

This document provides a procedure to validate a calculation tool based on simulation, analytical calculation and/or interpolation of airborne sound insulation characteristics of glass products.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 12758:2019, *Glass in building - Glazing and airborne sound insulation - Product descriptions, determination of properties and extension rules*

EN ISO 10140-1, *Acoustics - Laboratory measurement of sound insulation of building elements - Part 1: Application rules for specific products (ISO 10140-1)*

EN ISO 10140-2:2021, *Acoustics - Laboratory measurement of sound insulation of building elements - Part 2: Measurement of airborne sound insulation (ISO 10140-2:2021)*

EN ISO 717-1, *Acoustics - Rating of sound insulation in buildings and of building elements - Part 1: Airborne sound insulation (ISO 717-1)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 12758:2019 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at https://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

3.1
calculation tool
software that provides Sound Reduction Index (SRI) of glazing configurations, aiming at giving results as close as possible to those that would have been obtained by measurement according to EN ISO 10140

3.2
applicant
party that provides the calculation tool for validation, owns the rights of the calculation tool, and was involved in its development process

3.3
validator
party that validates the calculation tool in accordance with this standard

Note 1 to entry: Within the framework of the EU Regulation 305/2011, the validator is a notified body.

3.4
user
person who uses the calculation tool

4 Software validation procedure

4.1 General outline

The applicant shall provide the validator with access to the calculation tool.

The validation procedure is undertaken in three consecutive steps, for each category as defined in 4.2:

— Step 1: Results obtained with the calculation tool to be validated shall be compared by the validator to a range of maximal values for defined reference glazing products as defined in Annex A (see 4.4).

— Step 2: If the result of this first evaluation is positive, a second evaluation is undertaken by comparing calculated values for configurations selected by the validator with values obtained by measurement (see 4.5).

— Step 3: When the result of the second evaluation is positive, the given limits of the calculation tool for thicknesses of monolithic glass, laminated glass, interlayer and cavity widths are validated by comparison to measurement results (see 4.6).

All comparisons shall be undertaken with an accuracy of 0,1 dB.

4.2 Coverage of the validation

The evaluation of a calculation tool is done for one or several categories hereunder:

— Category A: single monolithic glass;

— Category B: single laminated glass;

— Category C: double glazing units with monolithic glass components only;

— Category D: double glazing units with one monolithic and one laminated glass components;

— Category E: triple glazing units with only monolithic glass components;

— Category F: triple glazing units with two monolithic and one laminated glass components;

— Category G: triple glazing units with one monolithic (mid-pane) and two laminated glass components.

NOTE 1 Laminated glass refers only to standard PVB interlayer (non-acoustics).

The validator shall perform an evaluation for each category for which the calculation tool is able to perform a calculation. The validator shall state for each evaluated category if the calculation tool passed or not.

The applicant defines the limits of glass thicknesses, cavity widths and interlayer thicknesses by restricting user inputs, e.g. only glass thicknesses from 3 mm to 15 mm can be chosen by the user.

The applicant informs the validator about categories which shall not be validated.

The applicant shall clearly indicate for which categories of products the calculation tool has been validated, e.g. by a disclaimer accompanying the validation tool.

At the date of publication of this document, due to insufficient data concerning laminated glass with interlayers other than standard (non-acoustic) PVB interlayers, only this type is considered for the validation method.

NOTE 2 The validation does not cover frequencies below 100 Hz and above 3 150 Hz.

4.3 Requirements for the calculation tool

The calculation tool shall calculate sound reduction index in third octave bands in the range from 100 Hz to 3 150 Hz. Furthermore, the calculation tool shall calculate single-number quantities R_w, R_w+C and R_w+C_{tr} according to EN ISO 717-1.

The version of the calculation tool shall be clearly and unambiguously identified. As an example, the calculation tool may use a unique hash code based on the complete software code source.

The presentation and the report of the calculation results shall contain:

— sound reduction index, in dB, in third octave band in the range from 100 Hz to 3150 Hz and R_w, R_w+C and R_w+C_{tr} according to EN ISO 717-1;

— the composition of the calculated glazing, its corresponding category from 4.2, with a reference to this document;

— a clear note that the results are not derived from measurement;

— name and version number of the calculation tool;

— time and date of calculation.

All results shall be given with an accuracy of 0,1 dB.

An example for a calculation results report is given in Annex B.

4.4 Step 1: validation using the reference values of Table A.1

4.4.1 Reference data

The reference values are given in Table A.1 of Annex A for each reference glazing configuration. All configurations of Table A.1 listed in the categories for which the applicant requests a validation shall be calculated by the validator.

4.4.2 Comparison procedure

The validator shall perform the calculations on glazings as defined in 4.2, using the applicant's calculation tool.

The validator compares the results obtained with the applicant tool with the data in third octave bands and single-number quantity ratings given in Table A.1 and assesses if the criteria defined in 4.4.3 are met.

4.4.3 Validation criteria

The following criteria shall be met for each glazing category defined in 4.2.

a) For the results in third octave band frequencies:

1) For both, reference values of Annex A and calculated values, the sound transmission loss (R_{oct}) for each octave band from 125 Hz to 2 000 Hz is calculated from the third octave band values from 100 Hz to 2 500 Hz according to the Formula 7 of EN ISO 10140-2:2021:

$$R_{oct} = -10 \cdot \log\left(\sum_{n=1}^{3} \frac{10^{-R_{1/3\,oct,n}/10}}{3}\right)$$

2) The deviation, for each octave band, between the reference values of Annex A and the calculated values are calculated;

3) Zero is applied for all negative deviations;

EXAMPLE

Octave bands		250 Hz			2 kHz		
Third octave bands		200 Hz	250 Hz	315 Hz	1 kHz	2 kHz	2,5 kHz
a) 1)	Third octave band values calculated from reference data given in Table A.1	40,4	41,9	39,1	20,5	20,3	21,0
	Third octave band values calculated by the validator	43,4	41,1	38,8	18,6	14,5	21,3
	Octave band values calculated from reference data given in Table A.1	35,5			15,8		
	Octave band values calculated by the validator	35,9			12,5		
a) 2)	Calculation of the deviation, between the reference values and the calculated values in octave band	0,4			-3,4		
a) 3)	Zero is applied for all negative deviations	0,4			0,0		

4) The deviations shall not exceed 3 dB at 125 Hz, 2 dB at 250 Hz and 500 Hz, 2 dB at 1 kHz and 3 dB at 2 kHz;

5) If more than 1 out of 5 (i.e. 20 %) of the calculated octave band deviations exceed the criteria defined in iv), the whole category shall be declared as "not validated" by the validator.

b) For the single-number quantities:

The single-number quantities for airborne sound insulation rating, R_w, R_w+C and R_w+C_{tr}, calculated according to EN ISO 717-1, shall not exceed the single-number quantities given in Table A.1. It is allowed to have 20 % of single-number quantities per category which have a positive deviation below or equal to 1 dB. Otherwise, the category shall be declared as "not validated" by the validator. An example is given in Annex C.

4.5 Step 2: validation using values of random glass configurations

4.5.1 Reference data

The validator randomly selects three glazing configurations per category for which the calculation tool shall be validated. These three configurations shall differ from the ones listed in Table A.1. For each of these random configurations, the validator shall have at least three sets of values obtained from three different measurements of the sound transmission loss according to EN ISO 10140-1 that originate from a notified body. From these three sets of measurement results, the arithmetic average values at third octave band frequencies are calculated by the validator. The average values are the reference data for the following evaluation.

The validator should ensure that the chosen configurations differ sufficiently from each other and from the composition of step 1 (Validation using the reference values of Table A.1).