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Glass in building — Glazing and airborne sound insulation — Product descriptions, determination of properties and extension rules

bsi.

National foreword

This British Standard is the UK implementation of EN 12758:2019+A1:2023. It supersedes BS EN 12758:2019, which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to CEN text carry the number of the CEN amendment. For example, text altered by CEN amendment A1 is indicated by [A1] [A1].

The UK participation in its preparation was entrusted to Technical Committee B/522, Glass and glazing in building.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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English Version

Glass in building - Glazing and airborne sound insulation - Product descriptions, determination of properties and extension rules

Verre dans la construction - Vitrages et isolation aux bruits aériens - Descriptions de produits, détermination des propriétés et règles d'extension

Glas im Bauwesen - Glas und Luftschalldämmung - Produktbeschreibungen, Bestimmung der Eigenschaften und Erweiterungsregeln

This European Standard was approved by CEN on 5 August 2019 and includes Amendment 1 approved by CEN on 10 April 2023.

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

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

Contents

European foreword

This document (EN 12758:2019+A1:2023) has been prepared by Technical Committee CEN/TC 129 “glass in building”, the secretariat of which is held by NBN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2023, and conflicting national standards shall be withdrawn at the latest by November 2023.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document includes Amendment 1 approved by CEN on 10 April 2023.

This document supersedes ▌A1⟩ EN 12758:2019 ⟨A1▌.

The start and finish of text introduced or altered by amendment is indicated in the text by tags ▌A1⟩ ⟨A1▌.

Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website.

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1 Scope

This document deals with determination and assessment of sound insulation performances of all transparent, translucent and opaque glass products, described in the European Standards for basic, special basic or processed glass products, when intended to be used in glazed assemblies in buildings, and which exhibit properties of acoustic protection, either as a prime intention or as a supplementary characteristic.

This document refers to laboratory measurement method described in EN ISO 10140-1:2016, Annex D and defines extension rules that can be applied without further testing. It also provides typical performance data for a range of common glass products that can be used in the absence of measured data.

All the considerations of this document relate to panes of glass/glass products alone. Incorporation of them into windows may cause changes in acoustic performance as a result of other influences, e.g. frame design, frame material, glazing material/method, mounting method, air tightness, etc. Measurements of the sound insulation of complete windows (glass and frame) may be undertaken to resolve such issues.

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 572-1, *Glass in building — Basic soda lime silicate glass products — Part 1: Definitions and general physical and mechanical properties*

EN 572-2, *Glass in building - Basic soda lime silicate glass products - Part 2: Float glass*

EN 572-3, *Glass in building - Basic soda lime silicate glass products - Part 3: Polished wired glass*

EN 572-4, *Glass in building - Basic soda lime silicate glass products - Part 4: Drawn sheet glass*

EN 572-5, *Glass in building - Basic soda lime silicate glass products - Part 5: Patterned glass*

EN 572-6, *Glass in building - Basic soda lime silicate glass products - Part 6: Wired patterned glass*

EN 572-7, *Glass in building - Basic soda lime silicate glass products - Part 7: Wired or unwired channel shaped glass*

EN 1036-1, *Glass in building - Mirrors from silver-coated float glass for internal use - Part 1: Definitions, requirements and test methods*

EN 1051-1, *Glass in building - Glass blocks and glass pavers - Part 1: Definitions and description*

EN 1096-1, *Glass in building - Coated glass - Part 1: Definitions and classification*

EN 1279-1, *Glass in Building - Insulating glass units - Part 1: Generalities, system description, rules for substitution, tolerances and visual quality*

EN 1748-1-1, *Glass in building - Special basic products -Borosilicate glasses - Part 1-1: Definition and general physical and mechanical properties*

EN 1748-2-1, *Glass in building - Special basic products - Glass ceramics - Part 2-1 Definitions and general physical and mechanical properties*

EN 1863-1, *Glass in building - Heat strengthened soda lime silicate glass - Part 1: Definition and description*

EN 12150-1, *Glass in building - Thermally toughened soda lime silicate safety glass - Part 1: Definition and description*

EN 12337-1, *Glass in building - Chemically strengthened soda lime silicate glass - Part 1: Definition and description*

EN 13024-1, *Glass in building - Thermally toughened borosilicate safety glass - Part 1: Definition and description*

EN 14178-1, *Glass in building - Basic alkaline earth silicate glass products - Part 1: Float glass*

EN 14179-1, *Glass in building - Heat soaked thermally toughened soda lime silicate safety glass - Part 1: Definition and description*

EN 14321-1, *Glass in building - Thermally toughened alkaline earth silicate safety glass - Part 1: Definition and description*

EN 15681-1, *Glass in building - Basic alumino silicate glass products - Part 1: Definitions and general physical and mechanical properties*

EN 15682-1, *Glass in building - Heat soaked thermally toughened alkaline earth silicate safety glass - Part 1: Definition and description*

EN 15683-1, *Glass in building - Thermally toughened soda lime silicate channel shaped safety glass - Part 1: Definition and description*

EN 15755-1, *Glass in building - Adhesive backed polymeric filmed glass - Part 1: Definitions and requirements*

EN 16477-1, *Glass in building - Painted glass for internal use - Part 1: Requirements*

EN 17257-1:2018,[1] *Glass in building - Acid etched glass - Part 1: Definitions and description*

EN 17258-1:2018,[2] *Glass in building - Sand blasted glass - Part 1: Definition and description*

EN ISO 10140 (all parts), *Acoustics — Laboratory measurement of sound insulation of building elements (ISO 10140, all parts)*

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

EN ISO 12543-1, *Glass in building - Laminated glass and laminated safety glass - Part 1: Definitions and description of component parts (ISO 12543-1)*

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[1] Under preparation. Stage at the time of publication: prEN 17257-1:2018

[2] Under preparation. Stage at the time of publication: prEN 17258-1:2018

EN ISO 12543-2, *Glass in building - Laminated glass and laminated safety glass - Part 2: Laminated safety glass (ISO 12543-2)*

EN ISO 12543-3, *Glass in building - Laminated glass and laminated safety glass - Part 3: Laminated glass (ISO 12543-3)*

EN ISO 12543-5, *Glass in building - Laminated glass and laminated safety glass - Part 5: Dimensions and edge finishing (ISO 12543-5)*

ISO 16940, *Glass in building — Glazing and airborne sound insulation — Measurement of the mechanical impedance of laminated glass*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 10140 (all parts), EN ISO 717-1 and the following apply.

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

• IEC Electropedia: available at http://www.electropedia.org/

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

3.1
glass product
product manufactured from glass, i.e. basic glass, special basic glass, processed glass, for use in buildings/constructions

Note 1 to entry: See Clause 5.

3.2
monolithic glass
single pane of glass, that includes annealed, strengthened/toughened (by heat or chemical treatment), and coated glasses

Note 1 to entry: The term “monolithic” excludes laminated glass and laminated safety glass

3.3
insulating glass unit
IGU
assembly consisting of at least two panes of glass, separated by one or more spacers, hermetically sealed along the periphery, mechanically stable and durable

3.4
laminated glass/laminated safety glass
assembly consisting of one sheet of glass with one or more sheets of glass and/or plastics glazing sheet material joined together with one or more interlayers

3.5
interlayer
one or more layer or material acting as an adhesive and separator between panes of glass and/or plastics glazing sheet material

3.6
acoustic interlayer
interlayer that increases the Sound Reduction Index of the laminated glass

Note 1 to entry: The interlayer may be evaluated in accordance to ISO 16940.

3.7
loss factor
parameter used to describe the damping characteristic of a laminated glass

3.8
insert
constituent included in the cavity of an IGU

Note 1 to entry: Examples of inserts include Georgian bars and blinds.

4 Symbols

R	Sound Reduction Index
R_{w}	Weighted Sound Reduction Index
$R_{A,\mathrm{tr}}$	Sound Reduction Index for A weighted urban traffic noise
C	Spectrum Adaptation Term for A weighted pink noise
C_{tr}	Spectrum Adaptation Term for A weighted urban traffic noise

NOTE A weighted pink noise is used to describe living activities

5 Glass products

5.1 Basic glasses

These are glass products manufactured from soda lime silicate glass in accordance with EN 572-1 and consist of the following:

- Float glass EN 572-2
- Polished wired glass EN 572-3
- Drawn sheet glass EN 572-4
- Patterned glass EN 572-5
- Wired patterned glass EN 572-6
- Wired and unwired channel shaped glass EN 572-7
- Glass blocks and paver units EN 1051-1

5.2 Special basic glasses

These are glass products manufactured from a variety of compositions, which are in accordance with appropriate European standards, and consist of the following:

- Borosilicate glass EN 1748-1-1
- Glass ceramics EN 1748-2-1
- Alkaline earth silicate glass EN 14178-1
- Alumino silicate glass EN 15681-1

5.3 Processed glasses

5.3.1 Strengthened glasses

These are soda lime silicate glasses that have been strengthened by thermal or chemical means and are as follows:

- Heat strengthened EN 1863-1
- Chemically strengthened EN 12337-1

5.3.2 Thermally toughened safety glasses

These are glasses that have been toughened by thermal treatment and are as follows:

- Thermally toughened soda lime silicate safety glass EN 12150-1
- Thermally toughened borosilicate safety glass EN 13024-1
- Heat soaked thermally toughened soda lime silicate safety glass EN 14179-1
- Thermally toughened alkaline earth silicate safety glass EN 14321-1
- Heat soaked thermally toughened alkaline earth silicate safety glass EN 15682-1
- Thermally toughened soda lime silicate channel shaped safety glass EN 15683-1

5.3.3 Laminated glasses

These are glasses that are in accordance with EN ISO 12543-1 and consist of the following:

- Laminated glass EN ISO 12543-3
- Laminated safety glass EN ISO 12543-2

5.3.4 Coated glasses

These are glass panes that have been coated and are in accordance with EN 1096-1.

NOTE Coated glass can be manufactured from any of the glass types referred to in 5.1, 5.2, 5.3.1, 5.3.2 or 5.3.3.

5.3.5 Insulating glass units (IGU)

These are hermetically sealed insulating glass units, containing air or other gas, that are in accordance with EN 1279-1.

NOTE An IGU can be manufactured from any of the glass types or combination of the glass types referred to in 5.1, 5.2, 5.3.1, 5.3.2, 5.3.3 or 5.3.4.

5.3.6 Mirrors, painted glass, filmed glass, acid etched glass and sand blasted glass

These are glass products produced in accordance with the following:

- Mirrors EN 1036-1
- Painted glass EN 16477-1
- Adhesive backed polymeric filmed glass EN 15755-1
- Acid etched glass EN 17257-1:2018—[3]
- Sand blasted glass EN 17258-1:2018—[4]

6 Test methods

Acoustic performance data shall be obtained under the conditions specified by EN ISO 10140-1 and EN ISO 717-1.

7 Sound insulation rating and classification

7.1 Sound insulation rating

The octave band values may be derived from third-octave-band data.

The procedures for deriving the values of R, R_w, C and C_{tr} are specified in EN ISO 717-1 and EN ISO 10140.

7.2 Statement of acoustic performance of glass

The R_w Index and corresponding spectrum adaptation terms, C and C_{tr} shall be stated, in accordance with EN ISO 10140-1 and EN ISO 717-1.

NOTE 1 Uncertainties are defined in EN ISO 10140-1:2016, Annex D.

NOTE 2 Low frequency data (50 Hz, 63 Hz, 80 Hz) are generally not relevant for glazing applications.

[3] Under preparation. Stage at the time of publication: prEN 17257-1:2018

[4] Under preparation. Stage at the time of publication: prEN 17258-1:2018

7.3 Specification of glazing requirements

Performance requirements may be in terms of the R_W Index alone or as the sum of the R_W and the relevant spectrum adaptation term, the latter specification resulting in a closer indication of the required acoustic performance for particular applications.

EXAMPLE For A weighed urban traffic noise, $R_{A,tr} = R_w + C_{tr}$.

The $R_{A,tr}$ for 12 mm monolithic glass determined from the data in Table 1 is: 34 + (−2) = 32 dB.

8 Extension rules

8.1 General

The measured acoustic performance of glass products may be assumed to be unaffected when subjected to specific changes. Application of the following rules removes the necessity of further/extra testing in accordance with EN ISO 10140-1.

These extension rules in 8.2, 8.3, 8.5 a) to e) and 8.6 may be applied to single number values i.e. R_w (C; C_{tr}) and single frequency data.

These extension rules in 8.4 and 8.5 f) to i) may only be applied to single number values i.e. R_w (C; C_{tr}) and shall not be used for single frequency data.

Changes not covered in these extension rules are not permitted and shall be measured. The use of these rules will ensure that the data used will always be conservative. If more accurate data are required, then the glass product shall be measured.

The rules described below can be combined.

8.2 Basic and special basic glasses

- No difference between soda lime silicate glass and other glass chemical compositions;
- No difference between clear, white or body-tinted glasses;
- Processing, i.e. heat strengthening, chemical strengthening, thermal toughening, heat soaking has no effect;
- Patterned/cast glass, including patterned wired glass, can be assumed to be equivalent to the next lowest thickness of float glass, i.e. 6 mm patterned glass is described acoustically by the data for 5 mm monolithic float glass;
- Polished wired glass is treated as a monolithic float glass of the same thickness or, if not available, of the next lowest thickness.
- The wire mesh within wired glass has no influence on the acoustic performance.

8.3 Surface treatments and coatings

- Surface treatment, i.e. sand blasting, acid etching, has no effect as long as the glass thickness stays within the allowable tolerance for the specific product;
- The application of a coating will have no effect on the acoustic performance of the glass substrate from which it was manufactured.

8.4 Laminated glass/laminated safety glass

8.4.1 All types of laminated glass

Laminated glass using an inorganic or organic interlayer can be described acoustically by the data for a monolithic glass of the same overall thickness. (i.e. the sum of the thicknesses of the glass components) If data for a monolithic glass of the same thickness is not available then use the data for the next available lower thickness.

Data for a glass product including any type of laminated glass may be adopted for the same glass product including laminated glass using the same or increased thickness of interlayer of the same material type.

NOTE In this case, PVB and acoustic PVB are not considered as being of the same material type

Thicknesses of laminated glass/laminated safety glasses are given in accordance with EN ISO 12543-5.

With laminated glass incorporating monolithic glass of different thicknesses, there is no preferred way round, i.e. acoustic benefit is not dependent on which glass is outermost.

8.4.2 Laminated glass with acoustic PVB

Data for a glass product including laminated glass using acoustic PVB interlayer may be adopted for the same glass product including laminated glass using another acoustic PVB interlayer as long as the measured loss factor of the 1st mode of the beam of both interlayers are equal to or greater than 0,20, when measured in accordance with ISO 16940.

8.4.3 Laminated glass with non-acoustic PVB

Data for a glass product including laminated glass using a non-acoustic PVB interlayer may be taken for a glass product including laminated glass using another non-acoustic PVB interlayer as long as the measured loss factor of the 1st mode of the beam is equal to or greater than that of the initial interlayer measured in accordance with ISO 16940.

8.5 Insulating glass units

a) Data for an air-filled or argon-filled IGU can apply to all IGUs, irrespective of being air-filled or argon-filled, for the same glass composition.

b) Whatever the composition of the IGU, with or without laminated glass, the acoustic performance does not depend on the direction of installation of the IGU.

c) The influence of insert in the cavity that does not touch the glass panes is negligible.

d) Data for IGUs including organic sealants can be adopted for the same IGU with any other edge seal.

e) Data for IGUs including one spacer type can be adopted for the same IGU with any other spacer type.

f) Data for an air-filled or argon-filled IGU can be used for krypton-filled IGU or a mixture (Kr-Ar-air), for the same glass composition.

g) Data for IGUs with spacer ≥ 12 mm can be used for the same IGU with wider spacer.

h) Data for IGUs with spacer = 12 mm can be used for the same IGU with narrower spacer. A1 This applies only to IGUs with two panes of glass and one cavity. A1

i) If a monolithic glass is replaced by a laminated glass/laminated safety glass of at least the same thickness, the sound insulation is not reduced.

8.6 Mirrors, painted glass, enamelled glass and filmed glass

The application of a silver layer, paint, enamel or thin film will have no effect on the acoustic performance of the glass substrate from which it was manufactured.

9 Typical performance data

In the absence of specific measured performance data from which to calculate R_W, C and C_{tr} generally accepted values are given.

Table 1 states the generally accepted values of R_W, C and C_{tr} as well as 1/3 octave data for a range of glass products. When required octave band values shall be derived from third-octave band data.

When using this table, it is essential to understand the following:

a) These tabulated values are derived from the mean value minus one standard deviation of typical measured data. As such, they represent conservative values which may be adopted in the absence of specific data measured in accordance with Clause 6.

b) These data refer to float glass or glass products made with float glass.

c) LAM means laminated glass.

d) The data for laminated glasses is for one with an organic interlayer excluding acoustic interlayer. The thickness is the glass thickness only, excluding interlayer thickness.

e) The data for IGUs refer to air-, or argon-filled cavities with a width from 6 mm to 16 mm.

f) The construction of IGUs is given as follow:

   — for double glazing: glass type and thickness / cavity width / glass type and thickness,

   — for triple glazing: glass type and thickness / cavity width / glass type and thickness / cavity width / glass type and thickness.

For products not covered by Table 1, extension rules of Clause 8 may be used. When these rules are not applicable, relevant test data shall be made available from which the corresponding values of R_w, C and C_{tr} may be derived.

Table 1 — Table of standard acoustic performance data

Glass type and thickness (mm)	Sound Reduction Index R (dB), at third octave-band frequency (Hz)																	Indices and adaptation terms		
	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	R_w	C	C_{tr}
Monolithic glass:																					
3	15	12	15	18	19	21	24	25	26	28	29	31	33	33	34	30	26	23	28	−1	−4
4	17	18	16	19	20	22	25	27	28	30	32	33	34	34	31	24	26	29	29	−2	−3
5	17	21	22	20	22	25	28	30	30	32	33	34	34	32	26	28	31	36	30	−1	−2
6	16	19	20	22	24	25	28	30	32	34	35	35	32	26	27	30	33	34	31	−2	−3
8	19	21	21	21	25	28	29	28	32	34	35	33	27	30	33	35	38	39	32	−2	−3
10	24	21	25	23	28	28	31	33	34	33	31	29	30	33	36	37	40	42	33	−2	−3
12	23	29	30	29	29	31	30	33	32	32	31	32	35	38	42	45	47	50	34	−1	−2
15	27	28	30	30	32	33	33	33	34	33	32	35	39	42	45	47	50	51	36	−1	−2
19	24	23	30	31	32	32	32	34	33	33	35	40	43	45	47	48	51	51	38	−2	−4
Laminated glass:																					
6 LAM	21	20	21	21	24	25	27	29	32	34	34	35	34	31	31	35	39	42	32	−1	−3
8 LAM	17	27	22	22	25	27	28	31	32	35	35	34	32	33	36	40	43	45	33	−1	−3
10 LAM	24	24	24	25	27	29	31	33	35	35	33	31	32	36	39	42	46	47	34	−1	−3
12 LAM	27	28	32	29	30	32	33	35	35	35	34	32	26	40	43	46	49	51	36	−1	−2
Insulating glass units:																					
4/(6 to 16)/4	21	21	20	18	15	19	22	25	29	33	36	38	40	39	34	28	31	35	29	−1	−4
6/(6 to 16)/4	18	23	23	18	21	23	25	24	32	36	39	41	40	36	36	37	40	42	32	−2	−4

Glass type and thickness (mm)	Sound Reduction Index R (dB) at third octave-band frequency (Hz)																		Indices and adaptation terms		
	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	R_w	C	C_{tr}
6/(6 to 16)/6	18	23	20	15	18	23	26	29	33	37	39	39	37	33	32	36	40	42	31	−1	−4
8/(6 to 16)/4	22	25	22	20	22	24	27	30	34	37	40	39	39	41	44	42	45	47	34	−2	−4
8/(6 to 16)/6	21	20	19	19	23	27	29	35	38	40	40	39	36	35	38	43	48	53	35	−3	−6
8/(6 to 16)/8	20	21	16	16	22	27	25	32	34	37	38	32	31	35	41	47	50	54	32	−2	−5
10/(6 to 16)/4	24	24	25	19	22	25	30	32	35	36	37	39	40	44	45	41	42	45	35	−2	−5
10/(6 to 16)/6	26	26	21	23	28	30	31	34	36	39	39	38	37	35	36	40	46	49	36	−2	−4
4/(6 to 16)/6 LAM	22	24	20	17	21	23	25	28	31	35	39	41	41	38	37	35	38	42	33	−1	−5
6/(6 to 16)/6 LAM	18	24	21	18	18	23	27	31	34	38	40	40	39	35	37	44	48	49	33	−2	−5
6/(6 to 16)/8 LAM	25	24	19	19	24	27	30	35	39	42	43	42	40	39	42	46	52	54	36	−2	−5
6/(6 to 16)/10 LAM	27	24	23	24	30	30	32	35	37	40	41	40	40	40	43	47	52	55	38	−1	−5
4/(6 to 16)/4/(6 to 16)/4	22	16	15	14	19	21	24	28	32	37	42	45	47	47	42	33	39	45	30	−1	−5
6/(6 to 16)/4/(6 to 16)/4	21	16	19	18	24	26	28	31	35	40	45	47	46	44	42	40	45	50	34	−2	−5
8/(6 to 16)/4/(6 to 16)/6	21	15	19	24	27	30	33	36	39	43	43	40	40	37	40	46	51	54	37	−3	−7
8/(6 to 16)/6/(6 to 16)/6	20	17	18	23	23	30	33	35	38	40	40	34	36	35	39	46	53	57	35	−2	−5
10/(6 to 16)/6/(6 to 16)/8	27	25	26	24	33	32	37	39	42	44	42	37	37	44	49	54	59	58	40	−2	−5
4/(6 to 16)/4/(6 to 16)/6 LAM	18	13	19	20	24	25	28	31	34	39	43	47	48	47	45	43	50	57	34	−2	−6

Glass type and thickness (mm)	Sound Reduction Index R (dB) at third octave-band frequency (Hz)																		Indices and adaptation terms
	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	R_w C C_{tr}
4/(6 to 16)/4/(6 to 16)/8 LAM	20	21	20	19	23	27	31	35	38	42	45	46	47	49	49	45	51	58	36 −2 −6
6/(6 to 16)/4/(6 to 16)/8 LAM	15	15	20	26	27	31	35	38	42	45	46	43	41	38	42	48	54	59	38 −2 −8
6/(6 to 16)/6/(6 to 16)/8 LAM	18	20	22	22	26	31	34	39	42	45	47	44	43	40	44	51	58	61	38 −2 −6
6/(6 to 16)/6/(6 to 16)/10 LAM	26	22	27	24	31	32	36	38	40	43	44	43	42	41	43	48	52	51	40 −2 −5
6/(6 to 16)/6/(6 to 16)/12 LAM	25	24	27	26	31	33	34	38	40	42	43	44	42	41	43	49	54	56	40 −2 −4
6 LAM/(6 to 16)/4/(6 to 16)/ 6 LAM	19	14	17	21	26	27	31	35	38	42	44	44	42	39	41	48	55	61	36 −3 - −7
8 LAM/(6 to 16)/4/(6 to 16)/ 6 LAM	21	20	21	25	30	31	35	38	41	44	46	45	44	42	44	50	57	61	40 −3 −7
8 LAM/(6 to 16)/4/(6 to 16)/ 8 LAM	21	21	21	23	27	31	33	34	40	42	43	40	38	41	47	52	58	63	37 −2 −5
8 LAM/(6 to 16)/6/(6 to 16)/ 8 LAM	19	23	22	22	28	32	36	38	41	44	45	42	40	43	48	53	58	60	39 −2 −6
12 LAM/(6 to 16)/4/(6 to 16)/ 8 LAM	23	33	29	34	35	36	40	41	42	42	42	40	40	43	48	55	60	64	42 −2 −4

Annex A
(informative)

Characterization of acoustic PVB interlayers

Acoustic PVB (Polyvinyl Butyral interlayer films) is characterized by its high damping value and stiffness lower than the one of standard PVB. As stiffness and damping of PVB are related, it is not necessary to check both.

ISO 16940 describes a method to compare the acoustic properties of laminated glass interlayers based on the stiffness and the loss factor of the interlayer.

This method consists of fixing a beam of laminated glass on an impedance head, making it vibrate with a shaker, and measuring the transfer function between the force of excitation and the velocity response of the beam. The shape of the transfer function curve allows knowing the frequencies and the damping of the vibration modes, related to the stiffness and the loss modulus of the interlayer. It is then possible to calculate a sound transmission loss curve for comparative means, as well as R_w values. Due to its temperature dependency, the temperature is fixed very precisely.

The loss factor and the equivalent bending rigidity modulus are determined from the measurement of the input impedance of a glass beam sample. The input impedance is the transfer function between the injected force in one point and the velocity. This transfer function has resonances corresponding to a maximum of the response of the system (resonance frequency).

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