
**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*

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 160, *Glass in building*.

This second edition cancels and replaces the first edition (ISO 22897:2003), which has been technically revised.

The main changes are as follows:

- the calibration procedure has been removed and reference is now made to ISO 10140-1:2021, Annex D;
- the extension rules have been expanded;
- [Table 1](#) with typical performance data has been extended;
- [Annex A](#) on the characterization of polyvinyl butyral interlayers has been added.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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

1 Scope

This document establishes a method to determine and assess sound insulation performances of all transparent, translucent and opaque glass products, 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 or supplementary characteristic.

This document refers to laboratory measurement method described in ISO 10140-1:2021, 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 or glass products alone. Incorporation of them into windows can cause changes in acoustic performance as a result of other influences, e.g. frame design, frame material, glazing material or method, mounting method, air tightness. Measurements of the sound insulation of complete windows (glass and frame) can 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.

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

ISO 10140-1:2021, *Acoustics — Laboratory measurement of sound insulation of building elements — Part 1: Application rules for specific products*

ISO 10140-2, *Acoustics — Laboratory measurement of sound insulation of building elements — Part 2: Measurement of airborne sound insulation*

ISO 10140-3, *Acoustics — Laboratory measurement of sound insulation of building elements — Part 3: Measurement of impact sound insulation*

ISO 10140-4, *Acoustics — Laboratory measurement of sound insulation of building elements — Part 4: Measurement procedures and requirements*

ISO 10140-5, *Acoustics — Laboratory measurement of sound insulation of building elements — Part 5: Requirements for test facilities and equipment*

3 Terms and definitions

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

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1
glass product

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

3.2
monolithic glass

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

Note 1 to entry: This term excludes *laminated glass* (3.4) and *laminated safety glass* (3.5).

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

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* (3.6)

[SOURCE: ISO 12543-1:2021, 3.1.1, modified — Note 1 to entry has been deleted.]

3.5
laminated safety glass

laminated glass (3.4) classified in accordance with a soft body impact standard where in the case of breakage the *interlayer* (3.6) serves to retain the glass fragments, limits the size of opening, offers residual resistance and reduces the risk of cutting or piercing injuries

Note 1 to entry: In this document, the expression “laminated glass” covers both laminated glass and laminated safety glass.

[SOURCE: ISO 12543-1:2021, 3.1.2, modified — Note 1 to entry has been replaced.]

3.6
interlayer

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

[SOURCE: ISO 12543-1:2021, 3.2.7, modified — “plies” has been replaced with “panes” in the definition and Notes 1 and 2 to entry have been deleted.]

3.7
acoustic interlayer

interlayer (3.6) that increases the sound reduction index of the *laminated glass* (3.4)

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

3.8
loss factor

parameter used to describe the damping characteristic of a *laminated glass* (3.4)

3.9
insert

constituent included in the cavity of an insulating glass unit

EXAMPLE Georgian bars and blinds.

4 Symbols

R	Sound reduction index
R_w	Weighted sound reduction index
R_{Atr}	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

Basic glasses are glass products manufactured from soda lime silicate glass according to ISO 16293-1 and consist of:

— float glass	ISO 16293-2
— polished wired glass	ISO 16293-3
— wired patterned glass	ISO 16293-4
— patterned glass	ISO 16293-5
— glass blocks	ISO 21690

This document is also applicable to basic glass products with other chemical compositions, such as borosilicate glass, glass ceramics, alkaline earth silicate glass and alumino silicate glass.

5.2 Processed glasses

5.2.1 Strengthened glasses

Strengthened glasses are soda lime silicate glasses that have been strengthened by thermal or chemical means and consist of:

— heat strengthened	ISO 22509
— chemically strengthened	

5.2.2 Thermally toughened safety glasses

Thermally toughened safety glasses are glasses that have been toughened by thermal treatment and consist of:

— tempered soda lime silicate safety glass	ISO 12540
— heat soaked tempered soda lime silicate safety glass	ISO 20657

This document is also applicable to thermally toughened safety glass products with other chemical compositions.

5.2.3 Laminated glasses

Laminated glasses are glasses according to ISO 12543-1 and consist of:

- laminated glass ISO 12543-3
- laminated safety glass ISO 12543-2

5.2.4 Coated glasses

Coated glasses are glass panes that have been coated and are according to ISO 11479-1.

NOTE Coated glass can be manufactured from any of the glass types referred to in [5.1](#), [5.2.1](#), [5.2.2](#) or [5.2.3](#).

5.2.5 Insulating glass units

Insulating glass units (IGUs) are hermetically sealed insulating glass units, containing air or other gas, that are according to ISO 20492-1.

NOTE An IGU can be manufactured from any of the glass types or combination of the glass types referred to in [5.1](#), [5.2.1](#), [5.2.2](#), [5.2.3](#) or [5.2.4](#).

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

This type of processed glass are glass products that consist of:

- mirrors ISO 25537
- painted glass
- acid etched glass
- sand blasted glass
- filmed glass

6 Test methods

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

NOTE 1 Uncertainties are defined in ISO 10140-1:2021, Annex D.

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

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. The application of the following rules removes the necessity of further/extra testing according to 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 requirements will ensure that the data used will always be conservative. If more accurate data are required, then the glass product shall be measured.

The requirements described in [8.2](#) to [8.6](#) can be combined.

8.2 Basic and special basic glasses

The requirements for glass product or treatment are as follows:

- there shall be no difference between soda lime silicate glass and other glass chemical compositions;
- there shall be no difference between clear, white or body-tinted glasses;
- processing, i.e. heat strengthening, chemical strengthening, thermal toughening, heat soaking, shall have no effect;
- patterned/cast glass, including patterned wired glass, shall 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 shall be 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 shall have no influence on the acoustic performance.

8.3 Surface treatments and coatings

The requirements for glass treatment are as follows:

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

8.4 Laminated glass and 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, polyvinyl butyral (PVB) and acoustic PVB are not considered as being of the same material type.

Thicknesses of laminated glass and laminated safety glasses are given according to 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 polyvinyl butyral

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 first mode of the beam of both interlayers are equal to or greater than 0,20, when measured according to ISO 16940, see [Annex A](#).

8.4.3 Laminated glass with non-acoustic polyvinyl butyral

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 first mode of the beam is equal to or greater than that of the initial interlayer measured according to ISO 16940.

8.5 Insulating glass units

The following points shall be considered for 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 equal to 12 mm can be used for the same IGU with narrower spacer. This applies only to IGUs with two panes of glass and one cavity.
- i) If a monolithic glass is replaced by a laminated glass or a 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 [Table 1](#), 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 according to [Clause 6](#).
- b) These data refer to float glass or glass products made with float glass.
- c) The data for laminated glasses are for one with an organic interlayer excluding acoustic interlayer. The thickness is the glass thickness only, excluding interlayer thickness.
- d) The data for IGUs refer to air- or argon-filled cavities with a width from 6 mm to 16 mm.
- e) The construction of IGUs is given as follows:
 - 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} can be derived.

Table 1 — Standard acoustic performance data

Glass type and thickness mm		Sound reduction index, R_f at third octave-band frequency dB																R_w C C_{tr}				
		100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 000 Hz	1 250 Hz	1 600 Hz	2 000 Hz	2 500 Hz	3 150 Hz			4 000 Hz	5 000 Hz	
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
	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
Key																						
LAM : laminated glass																						