British Standard

BRITISH STANDARD

BS EN
1279-1:2004

Glass in building — Insulating glass units —

Part 1: Generalities, dimensional tolerances and rules for the system description

The European Standard EN 1279-1:2004 has the status of a British Standard

ICS 81.040.20

National foreword

This British Standard is the official English language version of EN 1279-1:2004.

The UK participation in its preparation was entrusted by Technical Committee B/520, Glass and glazing in building, to Subcommittee B/520/2, Insulating glass products, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled "International Standards Correspondence Index", or by using the "Search" facility of the *BSI Electronic Catalogue* or of British Standards Online.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 16 June 2004

Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 24, an inside back cover and a back cover.

The BSI copyright notice displayed in this document indicates when the document was last issued.

Amendments issued since publication

Amd. No.	Date	Comments

ISBN 0 580 43944 5

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 1279-1

June 2004

ICS 81.040.20

English version

Glass in Building - Insulating glass units - Part 1: Generalities, dimensional tolerances and rules for the system description

Verre dans la construction - Vitrage isolant préfabriqué et scellé - Partie 1 : Généralités, tolérances dimensionnelles et règles de description du système

Glas im Bauwesen - Mehrscheiben-Isolierglas - Teil 1: Allgemeines, Maßtoleranzen und Vorschriften für die Systembeschreibung

This European Standard was approved by CEN on 2 January 2003.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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

Management Centre: rue de Stassart, 36 B-1050 Brussels

Ref. No. EN 1279-1:2004: E

Contents

Foreword

This document (EN 1279-1: 2004) has been prepared by Technical Committee CEN /TC 129, "Glass in building", the secretariat of which is held by IBN.

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 December 2004, and conflicting national standards shall be withdrawn at the latest by December 2004.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative annex Z, which is an integral part of this document.

This European Standard "*Glass in Building - Insulating glass units*" consists of the following Parts

– *Part 1: Generalities, dimensional tolerances and rules for the system description.*

– *Part 2: Long term test method and requirements for moisture penetration.*

– *Part 3: Long term test method and requirements for gas leakage rate and for gas concentration tolerances.*

– *Part 4: Methods of test for the physical attributes of edge seals.*

– *Part 5: Evaluation of Conformity.*

– *Part 6: Factory production control and periodic tests.*

The annexes A and B are normative, and annex C is informative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

1 Scope

This European Standard is the product standard for insulating glass units, which defines insulating glass units, and ensures by means of the evaluation of conformity to this standard that over time:

– energy savings are made because the U-value and solar factor do not change significantly;

– health is preserved because sound reduction and vision do not change significantly;

– safety is provided because mechanical resistance does not change significantly.

It covers characteristics that are of importance for trade. Marking conditions are included.

NOTE 1: For glass products with electrical wiring or connections for, e.g. alarm or heating purposes, other directives, e.g. Low Voltage Directive, may apply.

The main intended uses of the insulating glass units are installations in windows, doors, curtain walling, roofs and partitions where there exists protection against direct ultraviolet radiation at the edges.

NOTE 2: In cases where there is no protection against direct ultraviolet radiation at the edges, such as structural sealant glazing systems, additional European technical specifications should be followed.

Units that are intended for artistic purposes are excluded from this standard.

This Part of this European standard, which is inextricably bound up with the other Parts of the standard, covers the materials, the rules for the system description, the optical and visual quality and the dimensional tolerances for insulating glass units.

2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated by amendment or revision. For undated references, the latest edition of the publication referred to applies.

EN 572 *Glass in Building - Basic soda lime silicate glass products -*

Parts 1: Definitions and general physical and mechanical properties

Part 2: Float glass

Part 3: Polished wired glass

Part 4: Drawn sheet glass

Part 5: Patterned glass

Part 6: Wired patterned glass I

Part 8: Supplied and final cut sizes

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

EN 1279-2 *Glass in Building - Insulating glass units - Part 2: Long term test method and requirements for moisture penetration*

EN 1279-3 *Glass in Building - Insulating glass units - Part 3: Long term test method and requirements for gas leakage rate and for gas concentration tolerances*

EN 1279-4 *Glass in Building - Insulating glass units - Part 4: Methods of test for the physical attributes of edge seals*

EN 1279-6 *Glass in Building - Insulating glass units - Part 6 Factory production control and periodic tests*

EN 1748-1-1 *Glass in Building - Special Basic products - Part 1-1: Borosilicate glasses*

EN 1748-2-1 *Glass in Building - Special Basic products - Part 2-1: Glass ceramics - Definition and description*

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 ISO 12543 *Glass in Building - Laminated glass and laminated safety glass*

Part 1: Definition and description of component parts (ISO 12543-1:1998)

Part 2: Laminated safety glass (ISO 12543-2:1998)

Part 3: Laminated glass (ISO 12543-3:1998)

Part 6: Appearance (ISO 12543-6:1998)

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

prEN 14178-1 *Glass in Building - Basic alkaline earth silicate glass products - Part 1: Float glass*

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

prEN 14321-1 *Glass in Building - Thermally toughened alkaline earth silicate safety glass - Part 1: Definition and description*

3 Definitions

For the purpose of this standard, the following definitions apply.

3.1
insulating glass unit (IGU)
an assembly consisting of at least two panes of glass, separated by one or more spacers, hermetically sealed along the periphery, mechanically stable and durable (see 5.1).

NOTE: systems are available where the spacer and hermetic seal are included within a single edge sealing system.

3.2
system
a range of insulating glass units with a common edge seal profile, edge seal materials and edge seal components as described in the system description. The range having a similar edge seal performance, e.g. moisture penetration index, gas loss rate.

3.3
system description
description of components and the edge seal of the insulating glass unit in terms relevant to identification, and in terms relevant to edge seal performance, e.g. moisture penetration index, gas loss rate.

3.4
permeation geometry
the geometry of that part of the edge seal of the insulating glass unit through which the vapour and gas transmission takes place. For an example, see figure 1.

NOTE: For TPS-type systems the permeation is through the body of the system rather than around the spacer and through the sealant.

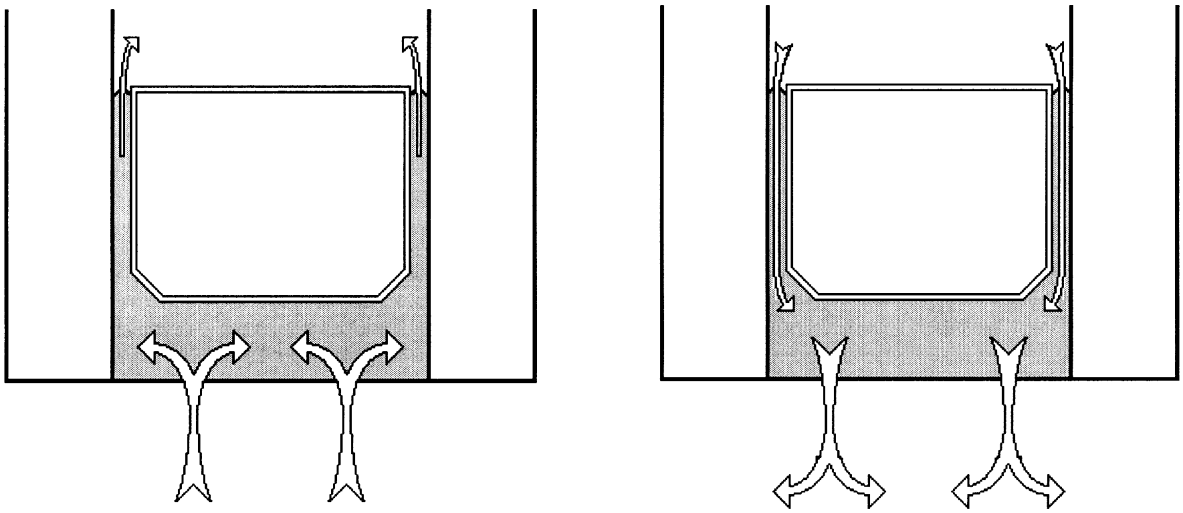

Figure 1 — Example of a permeation geometry

3.5
cavity (cavities)
the gap(s) between the panes of an insulating glass unit.

3.6
channel
a profile covering and protecting the edges and/or making it possible to install the unit in frames originally designed for single glass.

3.7
corner piece
a joint piece that acts as a corner of the spacer frame.

3.8
dehydrated air or gas
air or other gas with a low water vapour partial pressure which, when introduced into the cavity, eliminates the risk of condensation.

3.9
desiccant
a product designed to lower the water vapour partial pressure inside the insulating glass unit.

3.10
desiccant cartridge
a metal or plastic section, containing a desiccant, placed somewhere in the cavity.

3.11
edge seal
the processed edge of an insulating glass unit, designed to ensure that moisture and gas transmissions between the inside and outside of the unit are limited, designed with a certain mechanical strength, and designed with a certain physical and chemical stability.

3.12
glass pane (also referred to as glass component)
one sheet of glass.

3.13
inner sealant
a sealant which, when applied, is in contact with the cavity of the insulating glass units.[1]

3.14
joint piece
a piece that connects parts of a spacer.

3.15
outer sealant
a sealant which, when applied, is in contact with the environment outside the insulating glass units[2].

3.16
sealant
organic material that, after application, has sufficient mechanical properties of cohesion and of adhesion to glass and/or spacer for use in edge seals. For the purpose of this standard, silicone sealant is considered to be organic.

3.17
spacer
a component used to separate the panes and control the width of the gap at the edge of the unit.

3.18
external condensation
condensation appearing on the glass panes of an insulating glass unit either on the room side surface or on the external surface.

3.19
internal condensation
condensation appearing on the glass panes within the cavity of an insulating glass unit.

---

[1] In the case of single seal insulating glass units, the inner sealant is the same as the outer sealant.

[2] In the case of single seal insulating glass units, the outer sealant is the same as the inner sealant

3.20
absolute limit
a value of a parameter, defined in the system description (annex A), which when exceeded requires:

– remedial action in manufacturing, and

– removal of products from production for repair or destruction.

3.21
action limit
a value of a parameter, defined in the system description (annex A), which when exceeded requires:

– remedial action in manufacturing.

4 Insulating glass unit systems

4.1 General

The great number of possible different insulating glass units allows a distinction to be made between systems, based on common edge seal profiles, edge seal materials and other edge components. The possibility of substitution of different edge seal materials and other edge components are given in annex B table B.1and B2 and in EN 1279-4, and change of desiccant is given in annex B, table B.3.

For conformity control purposes, the manufacturer shall describe his system in a system description, which will be a part of the factory production control documentation, or of the quality assurance system, whichever is applied. See also EN 1279-6.

Disclosure of the system description is entirely at the discretion of the insulating glass unit manufacturer or his agent.

The rules for the system description are given in annex A. It contains mainly a list of the applied edge seal materials and components, the nominal edge seal dimensions of the finished product, the action limits (see 3.21) and the absolute limits (see 3.20).

Insulating glass unit systems can vary in the materials listed below, the limits in height, width, cavity width, glass thickness and number of cavities. These lists are not exhaustive.

4.2 The glass panes/components

The glass pane(s)/component(s) shall be one of the following:

a) basic glass products according to EN 572-1:

- float glass according to EN 572-2
- polished wired glass according to EN 572-3
- drawn sheet glass according to EN 572-4
- patterned glass according to EN 572-5
- wired patterned glass according to EN 572-6

b) special basic glass products:

- borosilicate glass according to EN 1748-1-1
- glass ceramics according to EN 1748-2-1
- alkaline earth silicate glass according to prEN 14178-1

c) processed glasses:

- heat strengthened soda lime silicate glass according to EN 1863-1
- thermally toughened soda lime silicate safety glass according to EN 12150-1
- heat soaked thermally toughened soda lime silicate safety glass according to prEN 14179-1
- chemically strengthened soda lime silicate glass according to EN 12337-1
- thermally toughened borosilicate safety glass according to EN 13024-1
- thermally toughened alkaline earth silicate safety glass according to prEN 14321-1
- laminated glass and laminated safety glass according to EN ISO 12543 Parts 1, 2, 3
- coated glass according to EN 1096-1
- surface worked glass (e.g. sand blasted, acid etched)

d) or other processed glasses, e.g. glass/plastic composites, consisting of one or more of the above basic or processed glasses and one or more layers of sheet plastics glazing material,

e) or other glasses covered, or not, by European specifications.

The glass panes, processed or unprocessed, may be:

- transparent, translucent or opaque
- clear or coloured

4.3 Cavity fillings

The cavity between two panes may be filled with air and/or other gases.

4.4 Cavity inserts

The cavity may contain inserts, such as a grid for aesthetic purposes, which shall meet the volatile content or the fogging test in EN 1279-6.

4.5 Shapes

The panes may have any shape, e.g. rectangular, trapezium, triangular, circular, etc.

4.6 Curved insulating glass units

Units with a bending radius greater than 1 metre comply with this standard without having to undergo the additional tests on curved test pieces.

Units with a bending radius equal to or less than 1 metre comply with this standard if in addition curved test pieces with the same or smaller bending radius meet the moisture penetration requirements of EN 1279-2. The test specimens should be curved with the curving axis parallel with the longest side.

5 Requirements

5.1 Conformity with the definition of insulating glass units

Products intended to belong to the insulating glass system shall conform to the definition of insulating glass units. Durability being ensured by the following:

— the moisture penetration index, the *I*-value, being satisfied in accordance with EN 1279-2;

— the edge seal strength complying with EN 1279-4;

— the manufacturing process respecting EN 1279-6;

— the recommendations of clause 4.4 and Annex B of prEN 1279-5 being followed;

— and in the case of gas-filled insulating glass units, the requirement of the gas leakage rate according to EN 1279-3 being satisfied

Seal properties, validation methods and requirements are summarised in table 1 and table 2.

Substitution of materials and of components shall maintain the conformity of the system with the definition of insulating glass units. The relevant seal properties and the related derived requirements are summarised in annex B, tables B1 and B2, together with the validation methods. When meeting the requirements, the substituting materials and components shall be added to the system description.

Changes within components shall also comply with the above requirements. The requirements for the changes in the quantity of desiccant are given in annex B, table B3. When meeting the requirements, the change within the component shall be added to the system description.

If glass panes are used which are not covered by European specifications, it shall be demonstrated that those glasses have a chemical and mechanical stability over time comparable with:

— soda lime silicate glass according to EN 572-1,

— or borosilicate glass according to EN 1748-1-1,

— or glass ceramics according to EN 1748-2-1,

— or alkaline earth silicate glass according to prEN 14178-1

Table 1 — Seal performance, validation method and requirements for IGUs

Applicable to:	Seal performance:	Validation method: (Demonstration by means of available test report or by testing)	Requirement:
All systems of IGU	Moisture vapour penetration	EN 1279-2	refer to EN 1279-2
	Adhesion sealant-glass	EN 1279-4	refer to EN 1279-4
NOTE: Tests can be carried out by different test laboratories			

Table 2 — Seal performance, supplementary validation methods and supplementary requirements for gas-filled insulating glass units and units with coated glass

Applicable to:	Seal performance:	Validation method: (Demonstration by means of available test report or by testing)	Requirement:
Gas-filled IGU: Type of gas	Gas leakage rate	EN 1279-3	refer to EN 1279-3
Gas filled units: Gas concentration		Subject of factory production control in accordance with EN 1279-6	refer to EN 1279-6, annex A.3
IGU incorporating coated glass: Bonding to the coating	Adhesion: - sealant/coating - interlayers of coating	EN 1279-4, annex D	refer to EN 1279-4
NOTE: Tests can be performed by different test laboratories			

5.2 Optical and visual quality of the glazed unit

Optical and visual quality requirements for single glazing are described in the appropriate European Standards:

– EN 572 Parts 2 to 6 and 8 Glass in Building - Basic soda lime silicate glass products

– EN 1096-1 Glass in Building - Coated glass

– EN 1748-1-1 Glass in Building - Special basic products - Borosilicate glass

– EN 1748-2-1 Glass in Building - Special basic products - Glass ceramics

– EN 1863-1 Glass in Building - Heat strengthened soda lime silicate glass

– EN 12150-1 Glass in Building - Thermally toughened soda lime silicate safety glass

– EN 12337-1 Glass in Building - Chemically strengthened soda lime silicate glass

– EN 12543-6 Glass in Building - Laminated glass and laminated safety glass

– EN 13024-1 Glass in Building - Thermally toughened borosilicate safety glass

– prEN 14178-1 Glass in Building - Basic alkaline earth silicate glass

– prEN 14179-1 Glass in Building - Heat soaked thermally toughened soda lime silicate safety glass

– prEN 14321-1 Glass in Building - Thermally toughened earth alkaline silicate safety glass

NOTE 1: Visual and quality aspects of single panes are at such a level that the probability of exceeding the maximum allowable faults in the insulating glass unit may be considered as nil, so that no additional provisions have to be considered. Nevertheless a higher level of acceptance could be a subject of a quality contract between purchaser and insulating glass manufacturer, or could be according to the quality policy of the manufacturer.

NOTE 2: In course of time, and due to unintended causes, the surfaces outside the insulating glass units can be weathered so that vision can be influenced.

For information on a number of optical and visual phenomena inherent in the product insulating glass unit and/or are due to physical behaviour, see annex C.

5.3 Dimensions and dimensional tolerances

5.3.1 General

The following tolerances are based on the tolerances for single panes of glass given in the European standards listed in 4.2, and offer the worst-case situations. Narrowing these tolerances can be a subject of contractual agreement between the insulating glass unit manufacturer and his glass supplier and/or his customer, or be in common usage in a local market. Where narrower tolerances are adopted, they shall be quoted in the insulating glass unit system description and/or in the manufacturer's quality manual, or in specific cases, cross-referenced to the particular contract details.

5.3.2 Height and width of the unit

When insulating glass unit dimensions are quoted for rectangular panes, the first dimension shall be the width, *B*, and the second dimension the height, *H*, as shown in figure 2. It shall be made clear which dimension is the width, *B*, and which is the height, *H*, when related to its installed position.

For maximum and minimum sizes, the manufacturer should be consulted.

NOTE 1: For insulating glass units containing patterned glass panes, the direction of the pattern should be specified relative to one of the dimensions.

The insulating glass unit shall not be larger than a prescribed rectangle resulting from the given nominal dimensions, expressed in whole millimetres, increased by the permissible plus tolerance, or not smaller than a prescribed rectangle reduced by the permissible minus tolerance. The sides of the prescribed rectangles shall be parallel to one another and these rectangles shall have a common centre (see figure 3). The limits of the squareness shall also be prescribed by these rectangles.

The dimensional tolerances will be subject to agreement between the insulating glass unit manufacturer and purchaser. The working tolerances shall be part of the system description and subject to the relevant clauses of EN 1279-6.

NOTE 2: Limits on the exceeding of tolerances during manufacture are laid down in EN 1279-6.

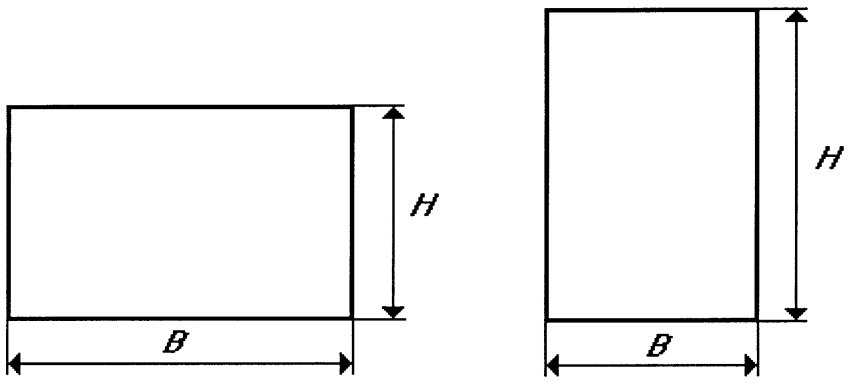

Figure 2 — Examples of width and height relative to the pane shape

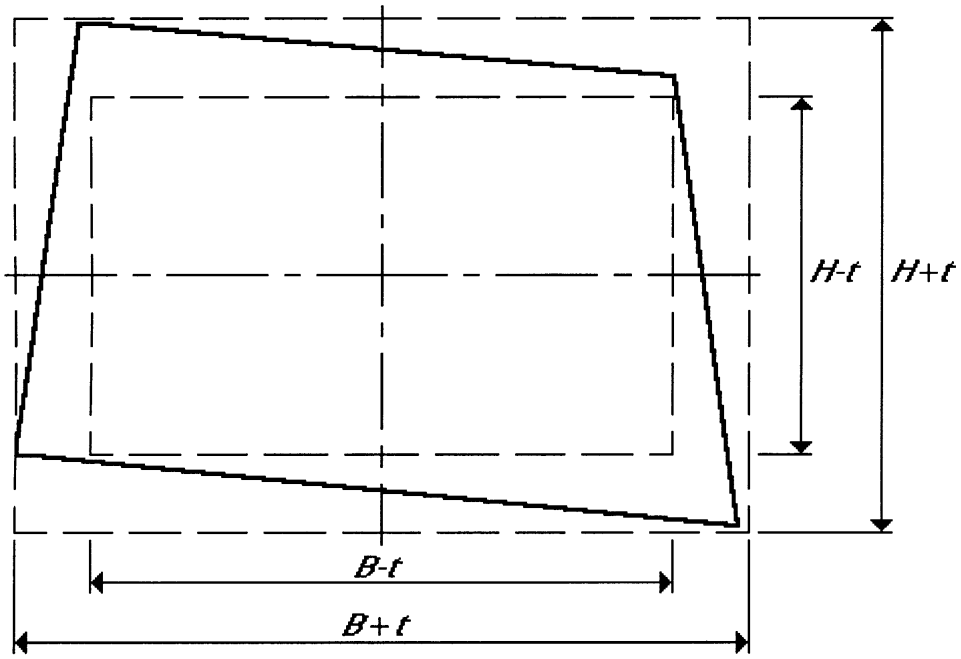

Figure 3 — Nominal height and width and tolerances.

5.3.3 Thickness tolerances along the periphery of the unit

The actual thickness shall be measured between the outside glass surfaces of the unit, at each corner and at the approximate centre points of the edges. The values shall be measured to the nearest 0,1mm. The measured thicknesses shall not vary from the nominal thickness given by the manufacturer of the insulating glass units by more than the tolerances shown in table 3.

The thickness tolerances of multi-cavity insulating glass units are obtained by using the following rules:

a) determine the tolerance of each composition glass/cavity/glass in accordance with table 3;

b) calculate the squares of those values;

c) sum all those square values;

d) calculate the square root of that sum.

NOTE 1 Limits on the exceeding of tolerances during manufacture are laid down in EN 1279-6.

NOTE 2 Narrowing the tolerances can be a subject for a quality contract between purchaser and insulating glass unit manufacturer, or can be a part of the quality policy of the insulating glass manufacturer, or can be in common usage in the local market.

Table 3 — Thickness tolerances on the insulating glass units (IGU) when float glasses are used

	First pane (note 1 of this table)	Second pane (note 1 of this table)	IGU thickness tolerance
A	Annealed glass	Annealed glass	±1,0 mm
B	Annealed glass	Toughened or strengthened glass (note 2 of this table)	±1,5 mm
C	Annealed glass	Folio laminated glass (note 3 of this table)	
	thickness ≤ 6 mm and total thickness ≤ 12 mm		±1,0 mm
	In other cases		±1,5 mm
d	Annealed glass	Patterned glass	±1,5 mm
e	Toughened or strengthened glass	Toughened or strengthened glass	±1,5 mm
f	Toughened or strengthened glass	Glass/plastics composites (note 4 of this table)	±1,5 mm
g	Toughened or strengthened glass	Patterned glass	±1,5 mm
h	Glass/plastic composites	Glass/plastics composites	±1,5 mm
i	Glass/plastics composites	Patterned glass	±1,5 mm

NOTE 1 Pane thicknesses are expressed as nominal values.

NOTE 2 Thermally toughened safety glass, heat strengthened glass or chemically strengthened glass

NOTE 3 Laminated glass or laminated safety glass, consisting of two annealed float glass sheets (maximum thickness 12 mm each) and plastic sheet interlayer. For different assemblies of laminated glass or laminated safety glass, see EN ISO 12543-5, and apply subsequently the calculation rule as given in 5.3.3.

NOTE 4 Glass/plastics composites are a form of laminated glass incorporation at least one pane of plastics glazing sheet material; see EN ISO 12543 –1

Annex A
(normative)

System description of insulating glass units

A.1 General content of the system description

The system description shall contain at least a normative part. The system description may also contain an informative part, when the manufacturer foresees further development of the product. The system description shall be prepared under the responsibility of the insulating glass manufacturer or his agent.

The unit components and edge seals in the system description can be adapted by the means listed in annex B, tables B.1 and B.2.

A.2 The normative part of the system description

A.2.1 Normative sub parts of the system description

The normative part of the system description shall consist of two sub parts:

– the component descriptions (see A.2.2 for guidance);

– the processed edge seal description(s) (see A.2.3 for guidance).

A.2.2 The component descriptions

The component descriptions may consist of:

a) a drawing of a cross section of the sealed edge of the insulating glass unit to scale, with each component numbered. When not all components appear in the drawing, additional drawings should be made.

b) a list of cavity fillings and inserts

c) a list with the name of the components according to the numbering of the detailed drawing(s), and in accordance with the relevant annex of EN 1279-6.

— a record for each of the components (more records per component are possible, e.g. when more suppliers for one component are involved), numbered in accordance with the detailed drawing(s). Each component record should contain:

— number and functional name of the component,

— the name and supplier or manufacturer of the component,

— the general description of the material(s) used for the component (e.g. desiccant), and where appropriate followed by some more detailed information (e.g. molecular sieve 3 Å),

— a drawing with relevant dimensions related to the permeation geometry of the component, except for those components which will be subjected to clause A.2.3: "The processed seal description", i.e. those components obtaining its shape during the sealing process, e.g. sealants, solder, desiccants.

A.2.3 The processed edge seal description

This description may consist of:

a) Detailed drawings of relevant areas on the sealed edge, e.g.:

— the relevant section(s) of the continuous sealed edge;

— the relevant section(s) of the edge where a joint piece is applied;

— the relevant section(s) of a corner;

— indication of the gas fill process, e.g. description of:

- position and dimensions of the filling holes;
- gas filling equipment;
- filling holes closing method, which includes sealing and list of used materials;

indicating the relevant dimensions of the sealing (including, if appropriate, the width of the coating to be stripped), and the relevant quantities of those components which are introduced during the sealing process such as sealant, solder, gas and desiccant. The relevant dimensions and quantities shall be numbered.

b) A list of the relevant dimensions and quantities mentioned under the previous paragraph, which may contain:

— the numbering according to the drawing(s),

— the average values, and the action limits on which the production of insulating glass units will be based,

— the absolute limits, e.g. per m edge seal or per insulating glass unit, which may occur during production without affecting the economically reasonable lifetime. Among others, they may relate to:

- air inclusions between inner and outer seal,
- a length of interruption of inner seal,

If the list does not contain the absolute limits, the action limits serve as absolute limits.

c) A list of absolute limits, indicating which ones appear combined with others in insulating glass units.

In the course of time, tolerances, action limits and absolute limits in the quality manual can be narrower than those in the system description.

A.3 The informative part of the system description

The informative part may contain all information that the manufacturer or agent considers as relevant, and is of importance and is needed for change of materials and components. The information can be descriptions of materials and components, as well as test reports from independent testing laboratories, concerning material properties, such as sealant stress/strain curves, sealant moisture vapour and/or gas permeation numbers.

A.4 Test samples representative of the system description.

Test samples shall be representative of the system description.

NOTE This means that those reasonable deviations from perfection, when foreseen by the system description, shall be included in the testing specimens. When no deviation from perfection is foreseen, units for sale with the slightest deviation should not be shipped.

Annex B
(normative)

Tables of possibilities to substitute materials and components, and of possible changes within components

Table B1 — Substitution of components: Validation methods and requirements

Substitution of:	Related to edge seal performance:	Validation method:	Derived requirement:
Outer sealant: All systems of IGU	- MVP index *I* - seal strength	Refer to table B4, or when test report(s) is (are) available for the same or (an)other system(s) where the substitute outer sealant is used, then:	
		EN 1279-4: - moisture vapour transmission - stress/strain curve	Refer to EN 1279-4: - moisture vapour transmission is similar to or less than that of initial sealant, - and stress/strain curve is similar to that of the initial outer sealant.
Outer sealant: For gas filled IGUs in addition to all System of IGUs	- gas leakage rate	Refer to table B5, "gas-filled IGUs", or when test report(s) is (are) available for the same or (an)other system(s) where the substitute outer sealant is used, then:	
		EN 1279-4: - gas permeation	Refer to EN 1279-4: - gas permeation is similar to or less than that of initial outer sealant.
Inner sealant: All systems of IGU	- MVP index *I*	refer to table B4, or when test report(s) is (are) available for the same or (an)other system(s) where the substitute inner sealant is used, then:	
		EN 1279-4: - moisture vapour transmission	Refer to EN 1279-4: - moisture vapour transmission is similar to or less than that of initial sealant.
Inner sealant: For gas filled IGUs in addition to all, System of IGUs	- gas leakage rate	refer to table B5, "gas-filled IGUs", or when test report(s) is (are) available for the same or (an)other system(s) where the substitute inner sealant is used, then:	
		EN 1279-4: - gas permeation	Refer to EN 1279-4: - gas permeation is similar to or less than that of initial inner sealant.
Corner or joint piece geometry: All systems of IGU	- MVP index *I*	refer to table B4, or when test report(s) is (are) available for the same or (an)other system(s) where the substitute corner or joint piece is used, then:	
		System description: - compare corner or joint geometry	Refer to system description: - permeation geometry is similar to or better than for the initial corner and joint

Corner or joint piece geometry: For gas-filled IGUs, In addition to all system of IGUs	- gas leakage rate	refer to table B5 "gas-filled IGUs", or when test report(s) is (are) available for the same or (an)other system(s) where the substitute corner or joint piece is used, then:	
		System description: - compare corner or joint geometry	Refer to system description: - permeation geometry is similar to or better than for the initial corner and joint
Corner or joint piece material: All systems of IGU	- adhesion of sealant	refer to table B4, or when test report(s) is (are) available for the same or (an)other system(s) where the substitute corner or joint piece is used, then:	
		Production control documentation: - adhesion strength	Production control documentation: - similar to previous test results

Continued

Table B2 — Substitution of components: Validation methods and requirements (*concluded*)

Substitution of:	Related to edge seal performance:	Validation method:	Derived requirement:
Spacer geometry: All systems of IGU	- MVP index *I*	refer to table B4, or when test report(s) is (are) available for the same or (an)other system(s) where the substitute spacer is used, then:	
		System description: - compare spacer geometry	Refer to system description: - permeation geometry is similar to or better than for the initial spacer
Spacer geometry: For gas-filled IGUs, In addition to all Systems of IGU	- gas leakage rate	refer to table B5 "gas-filled IGUs", or when test report(s) is (are) available for the same or (an)other system(s) where the substitute spacer is used, then:	
		System description: - compare spacer geometry	Refer to system description: - permeation geometry is similar to or better than for the initial spacer
Spacer material (inorganic): All systems of IGU	- adhesion of sealant	refer to table B4, or when test report(s) is (are) available for the same or (an)other system(s) where the substitute spacer is used, then:	
		EN 1279-6, annex A, or production control documentation: - adhesion strength	Refer to EN 1279-6, annex A, or production control documentation: - similar to initial test results
Gas filling holes closing method: For gas filled IGUs	- gas leakage rate	refer to table B5 "gas-filled IGUs", or when test report(s) is (are) available for the same or (an)other system(s) where the substitute closing method is used, then:	
		no further validation needed	
Glass/Plastics composite: sheet by glass sheet All systems of IGU	- adhesion of sealant	refer to table B4, or when test report(s) is (are) available for the same or (an)other system(s) where the substitute glass sheet is used, then:	
		EN 1279-4: - stress/strain curve	Refer to EN 1279-4: - stress/strain curve is similar to that with the initial plastic pane
Glass sheet by glass/plastic composite: All systems of IGU	- MVP index *I* - adhesion to sealant	Refer to table B4	
And additionally to Gas-filled IGUs	- gas leakage rate	Refer to table B5	

Notes relative to tables B1 and B2

NOTE 1 When available test reports are used, the result(s) shall indicate conformance with the specified requirements.

NOTE 2 Tests can be carried out by different test laboratories.

NOTE 3 Similar considerations should be taken into account when substituting inserts.

NOTE 4 Following any substitutions, the fogging requirements in EN 1279-6 should be met.

NOTE 5 Due to lack of experience with spacer materials other than inorganic, substitution with such materials is not allowed.

NOTE 6 For the substitution of sealant, the conditions as described in EN 1279-4 shall be respected.

Table B3 — Change of desiccants: Validation methods and requirements

Change:	Related to durability:	Validation method:	Derived requirement:
Type of Desiccant: All systems of IGU	- MVP index *I*	refer to table B4, or when test report(s) is (are) available for the same or (an)other system(s) where the substitute desiccant is used, then:	
		EN 1279-2: - determination of adsorption capacity *T*c	Refer to EN 1279-2: - recalculated MVP index *I* complies with EN 1279-2
Type of Desiccant: For gas-filled IGUs, in addition To all systems of IGU	- maintaining the quantity of gas in the cavity	refer to table B5, "gas-filled IGUs", or when test report(s) is (are) available for the same or (an)other system(s) where the substitute type of desiccant is used, then:	
		EN 1279-6: - flatness of IGU after two weeks	Refer to annex A of EN 1279-6: - flatness of IGU in factory production control
Mass of desiccant: All systems of IGU	- MVP index *I*	EN 1279-2: - calculation of MVP index *I*	Refer to EN 1279-2: - recalculated MVP index *I* complies with EN 1279-2
NOTE In the case of decreasing the amount of desiccant so that the recalculated *I*-value is between 0,10 and 0,20 (long term test), the periodic test on moisture vapour penetration in accordance with EN 1279-6 shall be performed and its requirement shall be respected.			

Table B4 — Seal performance, validation method and requirements for IGUs

Applicable to:	Seal performance:	Validation method: (Demonstration by means of available test report or by testing)	Requirement:
All systems of IGU	Moisture vapour penetration	EN 1279-2	refer to EN 1279-2
	Adhesion sealant-glass	EN 1279-4	refer to EN 1279-4
NOTE Tests can be carried out by different test laboratories.			

Table B5 — Seal performance, supplementary validation methods and supplementary requirements for gas-filled insulating glass units and units with coated glass

Applicable to:	Seal performance:	Validation method: (Demonstration by means of available test report or by testing)	Requirement:
Gas-filled IGU: Type of gas	Gas leakage rate	EN 1279-3	refer to EN 1279-3
Gas filled units: gas concentration		Subject of factory production control in accordance with EN 1279-6	refer to EN 1279-6, annex A.3
IGU bonded to the glass coating	Adhesion: - sealant/coating - interlayers of coating	EN 1279-4, annex D	refer to EN 1279-4
NOTE Tests can be performed by different test laboratories.			

Annex C
(informative)

Optical and visual quality of the glazed unit.

C.1 Interference colouration (Brewster's fringes, Newton rings)

C.1.1 Brewster's fringes

When the glass pane surfaces exhibit near perfect parallelism and the surface quality is high; the insulating glass shows interference coloration. These are lines varying in colour as a result of decomposition of the light spectrum. When the sun is the light source, the colours vary from red to blue. This phenomenon is not a failure; it is inherent to the insulating glass unit construction.

C.1.2 Newton rings

This optical effect only occurs in faulty insulating glass units when the two panes of glass are touching or nearly touching in the centre. The optical effect is a series of concentric coloured rings with the centre being in the point of contact/near contact of the two panes. The rings are roughly circular or elliptical.

C.1.3 Others

Some processed glasses also show coloration inherent to the product, e.g. toughened glass, heat strengthened glass. See EN 12150-1 or EN 1863-1.

C.2 Glass deflection due to variations in temperature and barometric pressure

Temperature variations of the space filled with air and/or gas and barometric pressure variations of the atmosphere and altitude will contract or expand the air and/or gas in the cavity and consequently deflections of the glass pane will occur, resulting in distortion of reflected images. These deflections, which cannot be prevented, show variations over time. The magnitude depends partially on the stiffness and size of the glass panes, as well as on the width of the cavity. Small sizes, thick glasses, and/or small cavities reduce these deflections significantly.

C.3 External condensation

External condensation on insulating glass units may occur either inside or outside the building. When it is inside the building, it is principally due to high humidity in the room, together with a low outside temperature. Kitchens, bathrooms, and other high humidity areas are particularly susceptible. When it is outside the building, condensation is principally due to nocturnal heat loss of the outside glass surface by infrared radiation to a clear sky, together with high humidity, but no rain, in the outside atmosphere.

These phenomena do not constitute failures of the insulating glass, but are due to atmospheric conditions.

C.4 Natural colour of clear glass

Clear glass has a very light green appearance, especially at the edges. It becomes more visible when the glass is thicker.

Bibliography

[1] EN ISO 12543-5 Glass in building – Laminated glass and laminated safety glass - Part 5: Dimensions and edge finishing (ISO 12543-5:1998)

blank

BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Tel: +44 (0)20 8996 9000. Fax: +44 (0)20 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: +44 (0)20 8996 9001. Fax: +44 (0)20 8996 7001. Email: orders@bsi-global.com. Standards are also available from the BSI website at http://www.bsi-global.com.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre. Tel: +44 (0)20 8996 7111. Fax: +44 (0)20 8996 7048. Email: info@bsi-global.com.

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration. Tel: +44 (0)20 8996 7002. Fax: +44 (0)20 8996 7001. Email: membership@bsi-global.com.

Information regarding online access to British Standards via British Standards Online can be found at http://www.bsi-global.com/bsonline.

Further information about BSI is available on the BSI website at http://www.bsi-global.com.

Copyright

BSI
389 Chiswick High Road
London
W4 4AL