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**Glass in building — Basic soda lime  
silicate glass products —**

**Part 5:  
Patterned glass**

*Verre dans la construction — Produits de base: verre de silicate sodocalcique —*

*Partie 5: Verre imprimé*





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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 documents 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](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on 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 the following URL: [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

The committee responsible for this document is ISO/TC 160, *Glass in Building*, Subcommittee SC 1, *Product considerations*.

A list of all parts in the ISO 16293 series can be found on the ISO website.

# Glass in building — Basic soda lime silicate glass products —

## Part 5: Patterned glass

### 1 Scope

This document specifies dimensional and minimum quality requirements (in respect of visual and pattern faults) for patterned glass, as defined in ISO 16293-1, for use in building.

This document applies only to patterned glass supplied in rectangular panes, in stock sizes and in final cut sizes.

### 2 Normative references

There are no normative references in this document.

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 16293-1 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 <http://www.iso.org/obp>

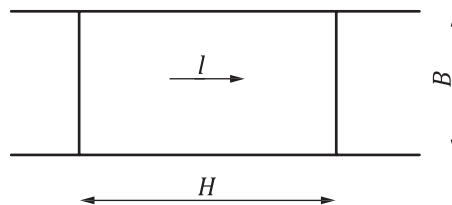
#### 3.1 length

*H*

dimension of the straight edge of the glass parallel to the direction of draw of the glass ribbon

Note 1 to entry: See [Figure 1](#).

[SOURCE: ISO 11485-1:2011, 2.26, modified]



#### Key

- l* direction of draw
- H* length
- B* width

Figure 1 — Relationship between length, width and direction of draw

**3.2**  
**width**

*B*  
dimension of the edge of the glass perpendicular to the direction of the glass ribbon

Note 1 to entry: See [Figure 1](#).

**3.3**  
**stock size**

glass sizes that are intended to be re-cut to obtain final cut sizes

**3.4**  
**final cut size**

pane of glass that has been cut down to the dimensions being required either for installation or processing into a final product, e.g. insulating glass units, thermally toughened safety glass, of those dimensions

Note 1 to entry: The minimum final cut size shall have dimensions *H* or *B* not less than 100 mm and a minimum surface area of not less than 0,05m<sup>2</sup>.

**3.5**  
**visual fault**

fault which alters the visual quality of the glass

Note 1 to entry: They include spot faults, linear/extended faults and pattern faults.

**3.6**  
**spot fault**

fault which can be in or on the glass in the form of gaseous inclusion, solid inclusion, mark or deposit of small size

**3.7**  
**linear/extended fault**

faults which can be on or in the glass, in the form of deposits, marks or scratches which occupy an extended length or area

**3.8**  
**pattern fault**

*deviation of the pattern* ([3.9](#)) relative to a reference, e.g. line or straight edge

**3.9**  
**deviation of the pattern**

deviation, *u*, *v* or *w*, of the pattern

**3.10**  
**edge defect**

defect which can occur on the edge of a glass sheet in the form of entrant and emergent faults and/or bevels

## 4 Dimensional requirements

### 4.1 Thickness

#### 4.1.1 General

The actual thickness shall be the average of four measurements, taken to the nearest 0,01 mm, each one taken at the thickest and closest point to the centre of each side. Measurement shall be by means of an instrument of the plate gauge type with a diameter of 50 mm ± 5 mm.

NOTE The mechanical resistance of patterned glass is a function of the pattern as well as the thickness.

#### 4.1.2 Tolerances

All the four measurements, rounded to the nearest 0,1 mm shall not vary from the nominal thickness by more than the tolerances shown in [Table 1](#).

**Table 1 — Tolerances on nominal thickness**

Nominal thickness (mm)	Tolerances (mm)
2	±0,5
3	±0,5
4	±0,5
5	±0,5
6	±0,5
8	±0,8
10	±1,0
12	±1,5
14	±1,5
15	±1,5
19	±2,0

#### 4.2 Length, width and squareness

##### 4.2.1 Stock sizes

The tolerances,  $t$ , on the nominal dimensions length,  $H$ , and width,  $B$ , are dependent on the thickness of the glass and are shown in [Table 2](#).

**Table 2 — Tolerances,  $t$ , on length,  $H$ , and width,  $B$ , according to the nominal thickness of the glass**

Nominal thickness (mm)	Tolerances, $t$ (mm)
2	±3
3	
4	
5	
6	
8	±4
10	
12	±5
14	
15	
19	

The limits of squareness are described by the difference between diagonals. Limits are given in [Table 3](#).

**Table 3 — Limit on the difference between diagonals**

Dimensions in millimetres

Nominal glass thickness	Limit on the difference between diagonals		
	Stock sizes		
	$(H, B) \leq 1\,500$	$1\,500 < (H, B) \leq 3\,000$	$(H, B) > 3\,000$
2, 3, 4, 5, 6	3	4	5
8, 10, 12	4	5	6
14, 15, 19	5	6	8

**4.2.2 Final cut sizes**

The tolerances,  $t$ , on nominal dimensions length,  $H$ , and width,  $B$ , for final cut sizes are given in [Table 4](#).

The limits of squareness are described by the difference between diagonals. Limits are given in [Table 5](#).

**Table 4 — Tolerance,  $t$ , on the nominal dimensions length and width for patterned glass**

Dimensions in millimetres

Thickness	Tolerance, $t$		
	$(H, B) \leq 1\,500$	$1\,500 < (H, B) \leq 3\,000$	$(H, B) > 3\,000$
all thicknesses	$\pm 2$	$\pm 3$	$\pm 4$

**Table 5 — Limit on the difference between diagonals for patterned glass**

Dimensions in millimetres

Nominal glass thickness	Limit on the difference between diagonals		
	Supplied and final cut sizes		
	$(H, B) \leq 1\,500$	$1\,500 < (H, B) \leq 3\,000$	$(H, B) > 3\,000$
2, 3, 4, 5, 6	3	4	5
8, 10, 12	4	5	6
14, 15, 19	5	6	8

**5 Quality requirements**

**5.1 General**

One quality level is considered in this document. This is determined by evaluation of the visual faults.

There are three different types of pattern faults considered which may occur simultaneously. They are shown in [Figure 2](#) and are as follows:

- out of square;
- waviness;
- bow.



## 5.2 Methods of observation and measurement

### 5.2.1 Visual faults

#### 5.2.1.1 Spot and linear/extended faults

The glass pane to be examined is illuminated in conditions approximating to diffuse daylight and is observed in front of a matt grey screen.

Place the pane of glass to be examined vertically 3 m in front of the parallel to the screen. Arrange the point of observation 1,5 m from the glass, keeping the direction of observation normal to the glass surface.

View the pane of glass, and note the presence of visually disturbing faults.

#### a) Spot faults

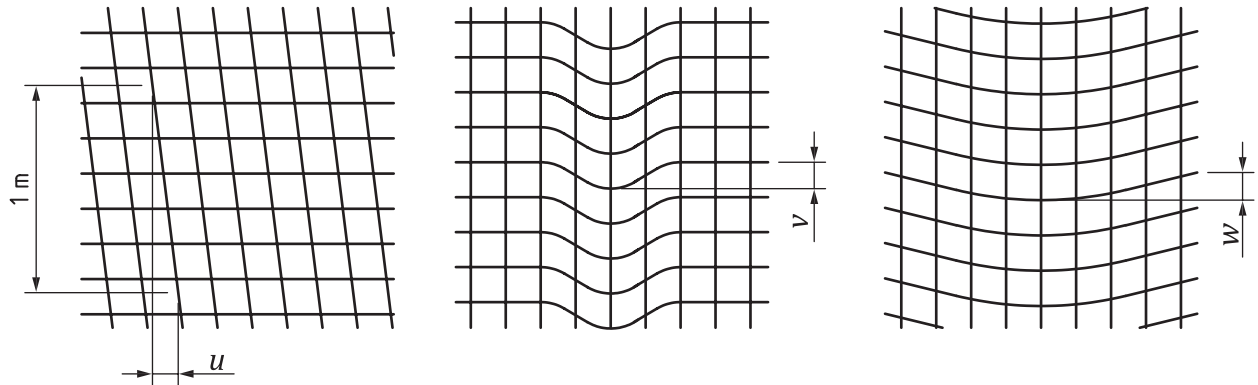
Measure the dimensions of these faults with a micrometre with graduations in tenths of a millimetre. Note the number, dimensions and concentration of the spot faults.

#### b) Linear/extended faults

Note the number of these faults.

#### 5.2.1.2 Pattern faults

A reference, e.g. line or straight edge, is placed on the glass as shown in [Figure 2](#). The deviations,  $u$ ,  $v$  or  $w$  of the pattern in relation to this reference are measured.



**Figure 2 — Representations of the type of pattern faults**

NOTE 1 The scale of these drawings is exaggerated to be explicit.

NOTE 2 Deviation measurement is not possible for all kinds of patterns.

### 5.2.2 Edge defects for final cut sizes

#### 5.2.2.1 Entrant and emergent faults

These faults are shown in [Figures 3](#) and [4](#). The dimensions  $h_1$ ,  $h_2$  and  $p$  and the glass thickness,  $e$ , are measured.

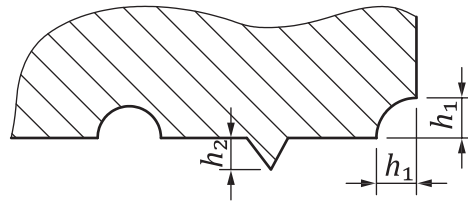


Figure 3 — Entrant and emergent faults (surface view)

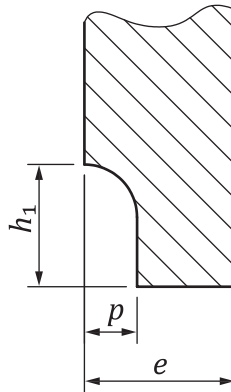


Figure 4 — Entrant faults (edge view)

### 5.2.2.2 Bevel

This fault is shown in [Figure 5](#). The dimension,  $d$ , and the glass thickness,  $e$ , are measured.



Figure 5 — Bevel (edge view)

## 5.3 Acceptance levels

### 5.3.1 Spot faults

#### 5.3.1.1 Stock sizes

The allowable numbers for each size of spot faults for stock sizes and supplied sizes are shown in [Table 6](#).

**Table 6 — Spot faults**

Width of fault [mm]	Length of fault [mm]	Maximum in any pane [per m <sup>2</sup> ]
≤2,0	≤4,0	Any number
	>4,0 and ≤25,0	Sum of length ≤ 100 mm
	>25,0	0
>2,0	≤2,0	Any number
	>2,0 and ≤5,0	6
	>5,0 and ≤10,0	3
	10,0<	0

### 5.3.1.2 Final cut sizes

The allowable numbers for each size of spot faults are shown in [Table 7](#).

**Table 7 — Spot faults**

Width of fault [mm]	Length of fault [mm]	Maximum in any pane [per m <sup>2</sup> ]
≤2,0	≤4,0	Any number
	>4,0 and ≤25,0	Sum of length ≤ 80 mm
	>25,0	0
>2,0	≤2,0	Any number
	>2,0 and ≤5,0	6
	>5,0 and ≤10,0	3
	10,0<	0

## 5.3.2 Linear/extended faults

### 5.3.2.1 Stock sizes

The allowable number of faults is an average of 0,05 faults in 20 m<sup>2</sup> of glass related to at least 20 tonnes.

### 5.3.2.2 Final cut sizes

When examined by the method in [5.2](#), no linear/extended faults are allowed.

### 5.3.3 Pattern faults

The deviation,  $u$ , (see [Figure 2](#)) shall not exceed 12 mm per metre for the out of square.

The deviations,  $v$  and  $w$ , (see [Figure 2](#)) shall not exceed 12 mm for the waviness and bow, respectively.

### 5.3.4 Edge defects for final cut sizes

The limitations on entrant and emergent faults and bevel are given in [Table 8](#).

Table 8 — Limitations on edge defects

Edge defect	Limitations
Entrant fault	$h_1 < e$ mm $P < (0,8 \times e)$ mm, but shall not exceed 10 mm
Emergent fault	$h_2 < e$ mm, but shall not exceed 10 mm
Bevel	The ratio $(d/e)$ shall be less than 0,8, but $d$ shall not exceed 10 mm
The limitations only apply when there is no risk of breakage resulting from thermal stress. In applications where thermal stress breakage may apply, the manufacturers' recommendations on edge quality should be followed.	

## 6 Designation

Patterned glass in compliance with this document shall be designated respectively by the following:

- the type;
- a reference to this document, i.e. ISO 16293-5;
- the nominal thickness in mm;
- the nominal length,  $H$ , and width,  $B$ , in mm.

EXAMPLE Patterned glass, intended for use in buildings, thickness 4 mm, length 2,438 m, width 1,829 m is designated as follows:

Patterned glass – ISO 16293-5 – 4 mm, 2 438 mm × 1 829 mm

## Bibliography

- [1] ISO 16293-1, *Glass in building — Basic soda lime silicate glass products — Part 1: Definitions and general physical and mechanical properties*

