

# GUIDELINE FOR QUALITATIVE EVALUATION OF POLFLAM FIRE-RESISTANT GLASS



## GUIDELINE FOR QUALITATIVE EVALUATION – Table of Contents

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## 1. Visual inspection of monolithic POLFLAM fire-resistant glass pane acc. to EN 12543-6

### 1.1 Test method

Monolithic POLFLAM fire-resistant glass subjected to visual assessment should be positioned vertically, opposite and parallel to a grey matte screen and lit with dispersed light.

Monolithic POLFLAM fire-resistant glass should be viewed from a perpendicular angle from a minimum observation distance of 2 m from the glass surface with the grey matte screen located on the opposite side of the pane.

Any visible defects disturbing the transparency should be marked.

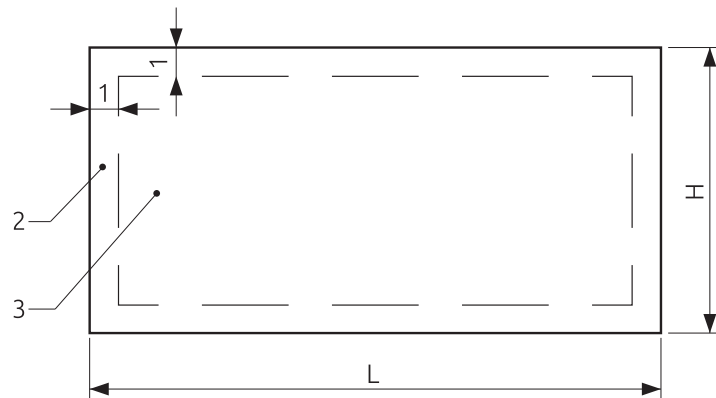


Fig. 1. Zones to be inspected in precisely sized panes ready for glazing

- 1 – Width of the edge zone
- 2 – Edge zone
- 3 – Vision zone
- L – Width of pane
- H – Height of pane

*NOTE: Edge zone (1) – perimeter area of the pane, generally covered by the glazing system  
For panes smaller than 5 m<sup>2</sup> in area, the edge zone width, as shown in Fig. 1, is 15 mm.  
For panes larger than 5 m<sup>2</sup> in area the edge zone width is increased to 20 mm.*

# Visual inspection of monolithic POLFLAM fire-resistant glass

## 1.2 Types of defects

- defects in the edge zone for framed edges, of up to 5 mm in diameter or up to 5% of the edge zone are acceptable
- vents, i.e. sharp-tipped fissures or cracks running into the pane from the edge are not allowed
- creases and streaks, i.e. distortions introduced into the interlayer as defects visible after production are not allowed in the vision zone

**Acceptability of point defects** (spot defects, bubbles and inclusions) is conditional upon:

- size of the defect
- frequency of occurrence of the defect
- size of the POLFLAM fire-resistant glass
- number of glass panes comprising the monolithic POLFLAM fire-resistant glass

The permissible number of defects in a pane are given in Table 1 below.

Defects smaller than 0.5 mm should be ignored.

Flaws larger than 3 mm should be considered unacceptable.

*NOTE: Acceptability of point defects in monolithic POLFLAM fire-resistant glass does not depend on the thickness of the constituent panes.*

**Table 1 – Permissible point defects in the vision zone**

Defect dimension d [mm]		0.5 < d < 1.0	1.0 < d < 3.0			
		any	A ≤ 1	1 < A ≤ 2	2 < A ≤ 8	A > 8
Defect size A [m <sup>2</sup> ]	2-pane	unlimited	1	2	1/m <sup>2</sup>	1.2/m <sup>2</sup>
	3-pane	unless	2	3	1.5/m <sup>2</sup>	1.8/m <sup>2</sup>
	4-pane	occurring in	3	4	2/m <sup>2</sup>	2.4/m <sup>2</sup>
	≥ 5-pane	clusters	4	5	2.5/m <sup>2</sup>	3/m <sup>2</sup>

NOTE: A cluster occurs when at least four defects are located less than 200 mm from each other. This distance is decreased to 180 mm for 3-pane glass, to 150 mm for 4-pane glass and to 100 mm for glass composed of five or more panes.

## Visual inspection of monolithic POLFLAM fire-resistant glass

The number of permissible defects as per Table 1 should be increased by one for each individual interlayer thicker than 2 mm.

**Linear defects** (inclusions, surface scratches or scuffs) are acceptable as per Table 2 below.

**Table 2 – Number of permissible defects in the vision zone**

Pane area [m <sup>2</sup> ]	Number of acceptable defects longer than 30 mm <sup>a</sup>
≤ 5	unacceptable
5 to 8	1
> 8	2

<sup>a</sup> Linear defects shorter than 30 mm are permissible.

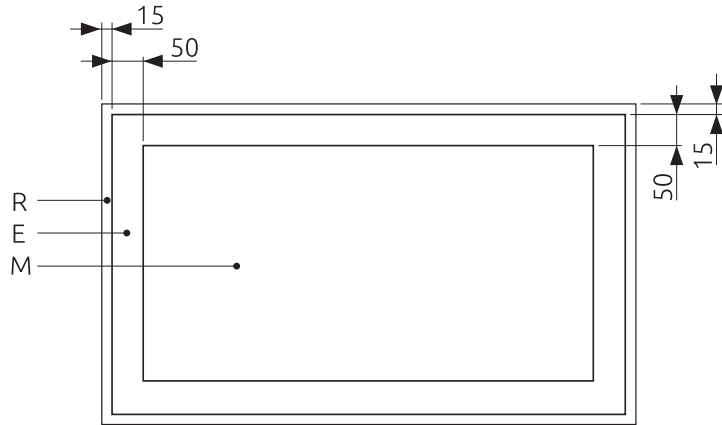
### **Defects in the vision zone for POLFLAM BR fire-resistant glass**

Monolithic POLFLAM fire-resistant glass is generally framed. For butt-jointed glass applications, the following edge finishes for POLFLAM BR fire-resistant glass are acceptable, as per EN ISO 12543-5:

- ground edge
- polished edge
- bevelled edge
- arrised edge

Chips and small bubbles, tested according to the method described in this section are acceptable unless they are visually disturbing. Interlayer defects, i.e. extrusions and retractions, are permissible.

Laminated safety glass panes may exhibit slight visual distortion when viewed at an angle or from a greater distance, which is inherent to the product.



**Fig. 2. Zones to be inspected in precisely sized panes ready for glazing**

R – Width of edge zone  
 E – Edge zone  
 M – Main zone

## 2. Visual inspection of POLFLAM IGU fire-resistant glass acc. to EN 1279-1

### 2.1 Test method

Monolithic POLFLAM fire-resistant glass panes assembled into an Insulated Glass Unit (IGU) should be evaluated acc. to chapter 1.

The IGUs manufactured by **POLFLAM** should be viewed from a perpendicular angle from a minimum observation distance of 3 m from the glass surface. Subjected to visual assessment should be positioned vertically and observed with a naked eye in daylight without direct sunlight (e.g. with overcast sky). Visible defects disturbing the transparency should not be marked on the glass.

### 2.2 Point defects

The maximum numbers of point defects are given in Table 3 below.

**Table 3 – Number of permissible point defects**

Observation zone	Defect size (excluding halo) diameter (d) [mm]	Size of the pane S [m <sup>2</sup> ]			
		S ≤ 1	1 < S ≤ 2	2 < S ≤ 3	3 > S
<b>R</b>	for any dimension	No limitation			
<b>E</b>	d ≤ 1	Permissible if less than 4 within a diameter of ≤ 20 cm			
	1 < d ≤ 3	6	1 per 1 m of perimeter		
	d > 3	Not allowed			
<b>M</b>	d ≤ 1	Permissible if less than 4 within a diameter of ≤ 20 cm			
	1 < d ≤ 2	3	4	7	9 per m <sup>2</sup>
	d > 2	Not allowed			

## 2.3 Inclusion type defects

The maximum numbers of inclusions are given in Table 4 below.

**Table 4 – Number of permissible inclusions**

Observation zone	Defect size (excluding halo) diameter (d) [mm]	Surface area of pane S [m <sup>2</sup> ]	
		S ≤ 1	S > 1
<b>R</b>	for any dimension	No limitation	
<b>E</b>	dots of d ≤ 1	No limitation	
	dots 1 < d ≤ 3	6	1 per 1 m of perimeter
	spots of d ≤ 17	1	
	dots of d > 3 and spots of d > 17	max. 1	
<b>M</b>	dots of d ≤ 1	max. 4 within a diameter of ≤ 20 cm	
	dots of 1 < d ≤ 3	max. 2 within a diameter of ≤ 20 cm	
	dots of d > 3 and spots of d > 17	Not allowed	

## 2.4 Linear defects

The maximum numbers of linear defects are given in Table 5 below. Hairline scratches are permissible unless occurring in clusters.

**Table 5 – Number of permissible linear defects**

Observation zone	Length of a single defect [mm]	Total length of a single defects [mm]
<b>R</b>	No limitation	
<b>E</b>	≤ 40	≤ 125
<b>M</b>	≤ 20	≤ 63

### 3. POLFLAM fire-resistant glass width and height tolerances

The dimensions of POLFLAM fire-resistant glass should be checked with a dimensional measuring tool appropriate to the measured dimension. The width and height are measured with a tape measure and thickness is measured with calipers.

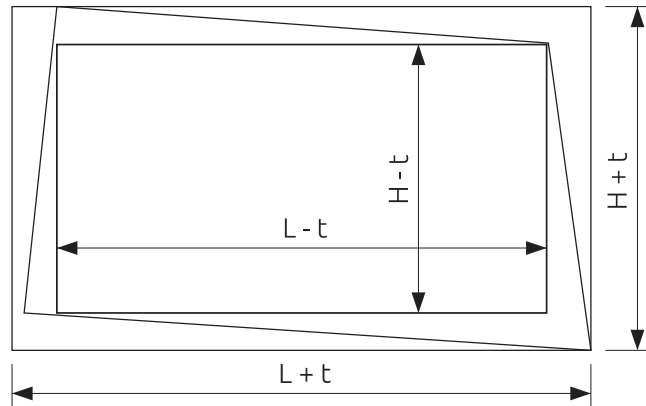


Fig. 3. POLFLAM fire-resistant glass width and height measurement diagram

L – Width of pane  
 H – Height of pane  
 t – Tolerance

Table 6 – Permissible tolerances of the width and height of monolithic POLFLAM fire-resistant glass

Nominal dimension L or H [mm]	Monolithic POLFLAM nominal thickness of $\geq 20$ mm	
	Each single glass pane of nominal thickness of $< 10$ mm [mm]	Each single glass pane of nominal thickness of $> 10$ mm [mm]
$\leq 2\ 000$	+3.5 -2.0	+5.0 -3.5
$\leq 3\ 000$	+5.0 -3.0	+6.0 -4.0
$> 3\ 000$	+6.0 -4.0	+7.0 -5.0

Table 7 – Permissible tolerances of POLFLAM IGU fire-resistant glass diagonals

Dimension	POLFLAM DGU		POLFLAM TGU	
	L and H $\leq 3000$ mm	L or H $> 3000$ mm	L and H $\leq 3000$ mm	L or H $> 3000$ mm
Deviations in width (L) and height (H)	$\pm 2$	$\pm 3$	$\pm 3$	$\pm 4$
Difference in diagonal dimensions	$\leq 1.5$ mm/m		$\leq 2$ mm/m	
Spacer shift	$\leq 3$ mm		$\leq 3$ mm	



#### 4. Tolerances for the displacement of POLFLAM IGU fire-resistant glass

The maximum displacement  $d$  is specified in Table 8.

Table 8 – Maximum permissible displacement of POLFLAM IGU fire-resistant glass

Nominal size L or H [mm]	Maximum permissible displacement $d$ [mm]
$L, H \leq 1\,000$	2.0
$1\,000 < L, H \leq 2\,000$	3.0
$2\,000 < L, H \leq 4\,000$	4.0
$L, H > 4\,000$	6.0

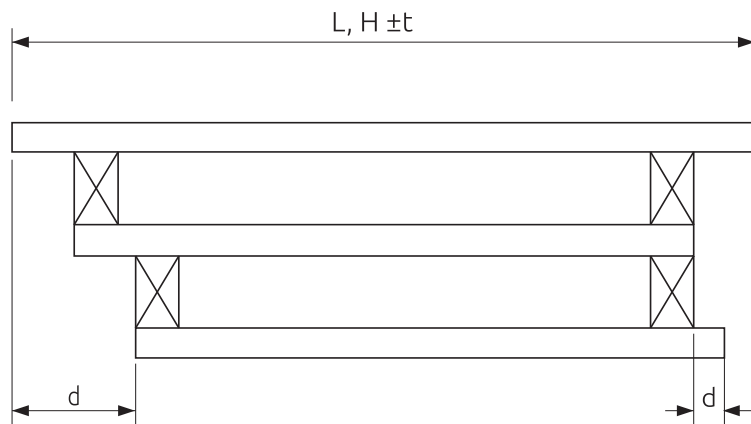


Fig. 4. Displacement measurement diagram of POLFLAM IGU fire-resistant glass

### 5. Roller wave distortion acc. to EN 12150-1

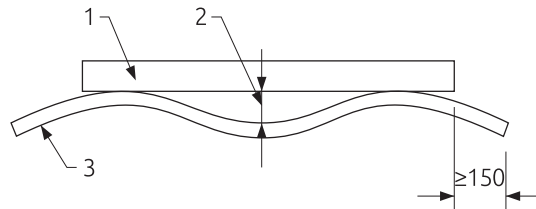
By the very nature of the toughening process, it is not possible to obtain a product as flat as annealed glass. This difference in flatness depends on the type of glass (float / coated) and glass dimensions (nominal thickness, dimensions, ratio between the dimensions).

In the case of thermally toughened glass, roller wave distortion should be measured using a ruler or an equivalent measuring tool between 300 and 400 mm in length so that it joins at least the two closest undulation ends. Then, measure the gap formed between the surface of the glass and the ruler using a feeler gauge. The gauge should allow measurements to be made with an accuracy of up to 0.05 mm.

The maximum permissible undulation values for thermally toughened glass are given in Table 9.

The roller wave distortion is measured:

- on panes with dimensions greater than 600 mm measured perpendicular to the wave distortion
- inside the glass, excluding a 150 mm wide belt running along the periphery



**Fig. 5. Measurement diagram of roller wave distortion**

- 1 – Ruler
- 2 – Roller wave distortion deformations
- 3 – Thermally toughened glass

**Table 9 – Maximum permissible value of roller wave distortions**

Type of glass	Maximum permissible value of roller wave distortions [mm]
Uncoated float glass in accordance with EN 572-1 and EN 572-2	0.3
Other	0.5

The measurement of deformation of the edge lift for thermally toughened glass is made by placing the glass on a flat support. The edge of the glass to be tested should be extended beyond the edge of the support by 50 to 100 mm. The ruler, 300-400 mm long, is placed at the tops of the waves formed from the rollers, and then the distance between the ruler and the glass surface is measured using a feeler gauge. Edge zone minor visual distortions are inherent for the product.

### 6. Glass convexity acc. to EN 12150-1

Rectilinearity measurements are taken from glass placed in a vertical position when its lower edge is supported on two supporting elements. These elements should be spaced one quarter the width of the supported side from its beginning and end. The maximum permissible convexity is specified in Table 10.

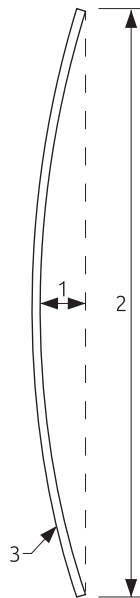


Fig. 6. Diagram of overall bow

- 1 – Deformation for calculating overall bow
- 2 – L or H or the length of the diagonal
- 3 – Thermally toughened glass

Table 10 – Maximum permissible value of overall bow

Type of glass	Maximum permissible value of overall bow in compliance with EN 12150-1 [mm/m]
Uncoated float glass in accordance with EN 572-1 and EN 572-2	3.0
Other	4.0

**Table 11 – POLFLAM monolithic fire-resistant glass – maximum production thickness tolerances**

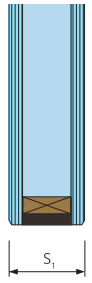
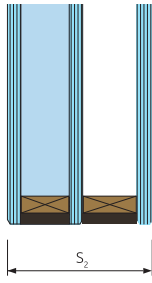
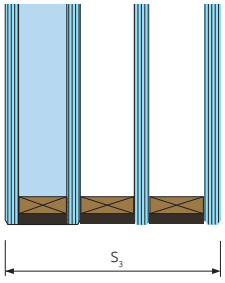
Glass type	Class	Thickness [mm]	Tolerance [mm]
POLFLAM	EI 15	16	+/- 2
	EI 30	20	+/- 2
	EI 60	25 or 28	+/- 2
	EI 90	32 or 35	+/- 3
	EI 120	35 or 40	+/- 3
	EI 180	55	+/- 3
	EW 30	16 or 20	+/- 2
	EW 60	16 or 20	+/- 2
POLFLAM SG	EI 30	20	+/- 2
	EI 60	25	+/- 3
POLFLAM H	REI 30	22	+/- 2
POLFLAM BR	EI 30	30	+/- 2
	EI 60	35	+/- 3
	EI 90	45	+/- 3
	EI 120	50	+/- 3
POLFLAM FR	EI 30	20	+/- 2
	EI 60	25	+/- 3
	EI 90	35	+/- 3
	EI 120	35	+/- 3
	EI 180	55	+/- 2
POLFLAM F	REI 30, 60	62	+/- 3
	REI 30, 60	54	+/- 3
	REI 30, 60	50	+/- 3
	REI 30, 60	46	+/- 3

## 7. Thickness tolerances

Actual thickness should be measured on the outer surfaces of the POLFLAM fire-resistant glass pane, close to the middle points of the edges. The measurement should be carried out with an accuracy of up to 0.1 mm. Permissible deviations of the thickness of the POLFLAM fire-resistant glass are included in Table 12.

The maximum thickness tolerances for POLFLAM IGU according to EN 1279-1 are in Table 12.

**Table 12 – POLFLAM IGU fire-resistant glass – maximum production thickness tolerances**

	Monolithic POLFLAM fire-resistant glass	POLFLAM DGU	POLFLAM TGU
			
<b>POLFLAM EI 30</b> <b>POLFLAM EI 60</b>	$S_1 \pm 2 \text{ mm}$	$S_2 \pm 3.5 \text{ mm}$	$S_3 \pm 4.1 \text{ mm}$
<b>POLFLAM EI 90</b> <b>POLFLAM EI 120</b> <b>POLFLAM EI 180</b>	$S_1 \pm 3 \text{ mm}$	$S_2 \pm 4.5 \text{ mm}$	$S_3 \pm 5.1 \text{ mm}$

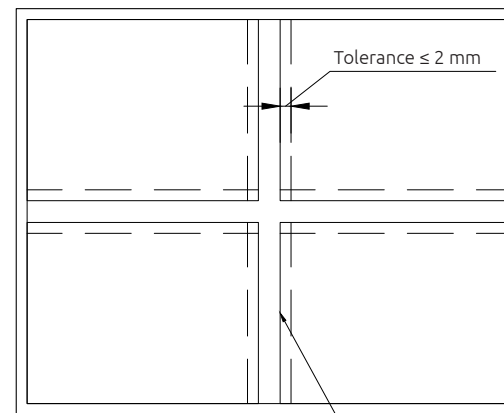
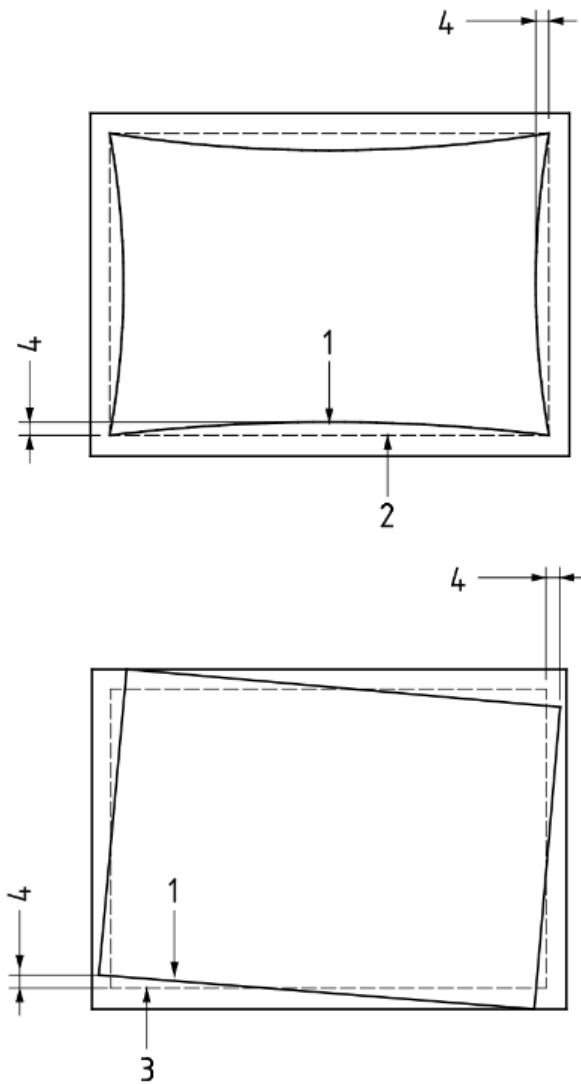
### 8. Tolerances on spacer straightness

For a double glazed unit, the tolerance on spacer straightness is 4 mm up to a length of 3.5 m and 6 mm for longer lengths.

The permissible deviation of the spacer(s) in relation to the parallel straight glass edge or to other spacers (e.g. in triple glazing) is 3 mm up to an edge length of 2.5 m. For longer edge lengths, the permissible deviation is 6 mm.

- 1 - Spacer
- 2 - Theoretical shape of spacer
- 3 - Theoretical position of spacer
- 4 - Deviation

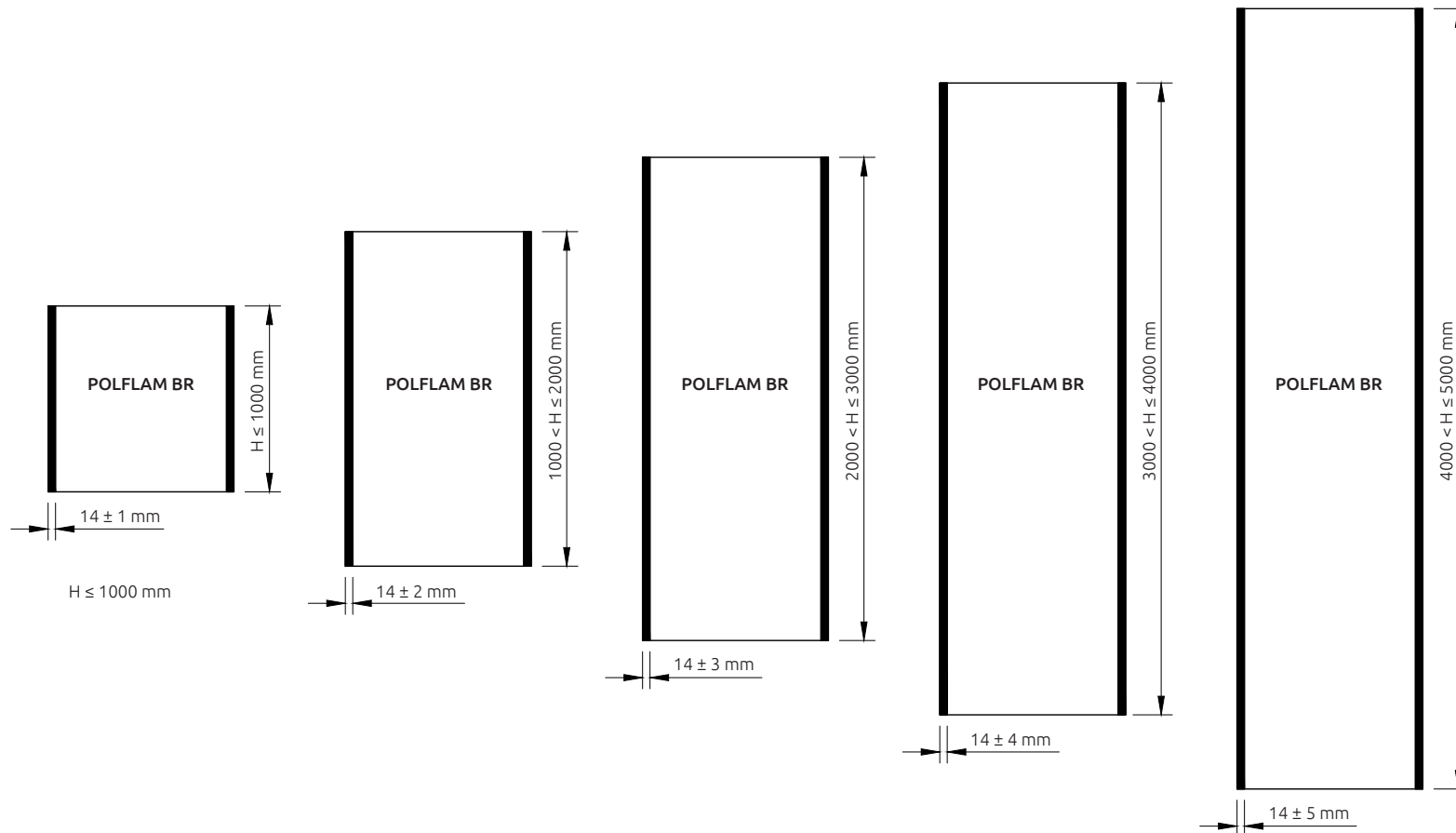
The accuracy of the positioning of Georgian bars is maximum 2 mm from the nominal dimensions.

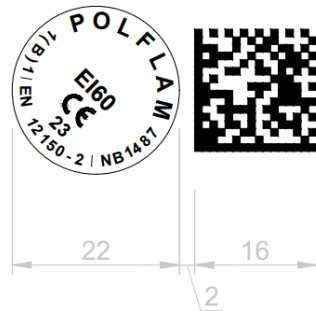


Georgian bar positioning tolerance  $\pm 2$  mm

## 9. Tolerances on edge painting of POLFLAM BR fire-resistant glass

The standard width of edge painting on POLFLAM BR fire-resistant glass is 14mm, with a tolerance of  $\pm 1$  mm per meter of glass height. In example: for a 2m high glass panel, the painted edge can be between 12 mm and 16 mm wide.

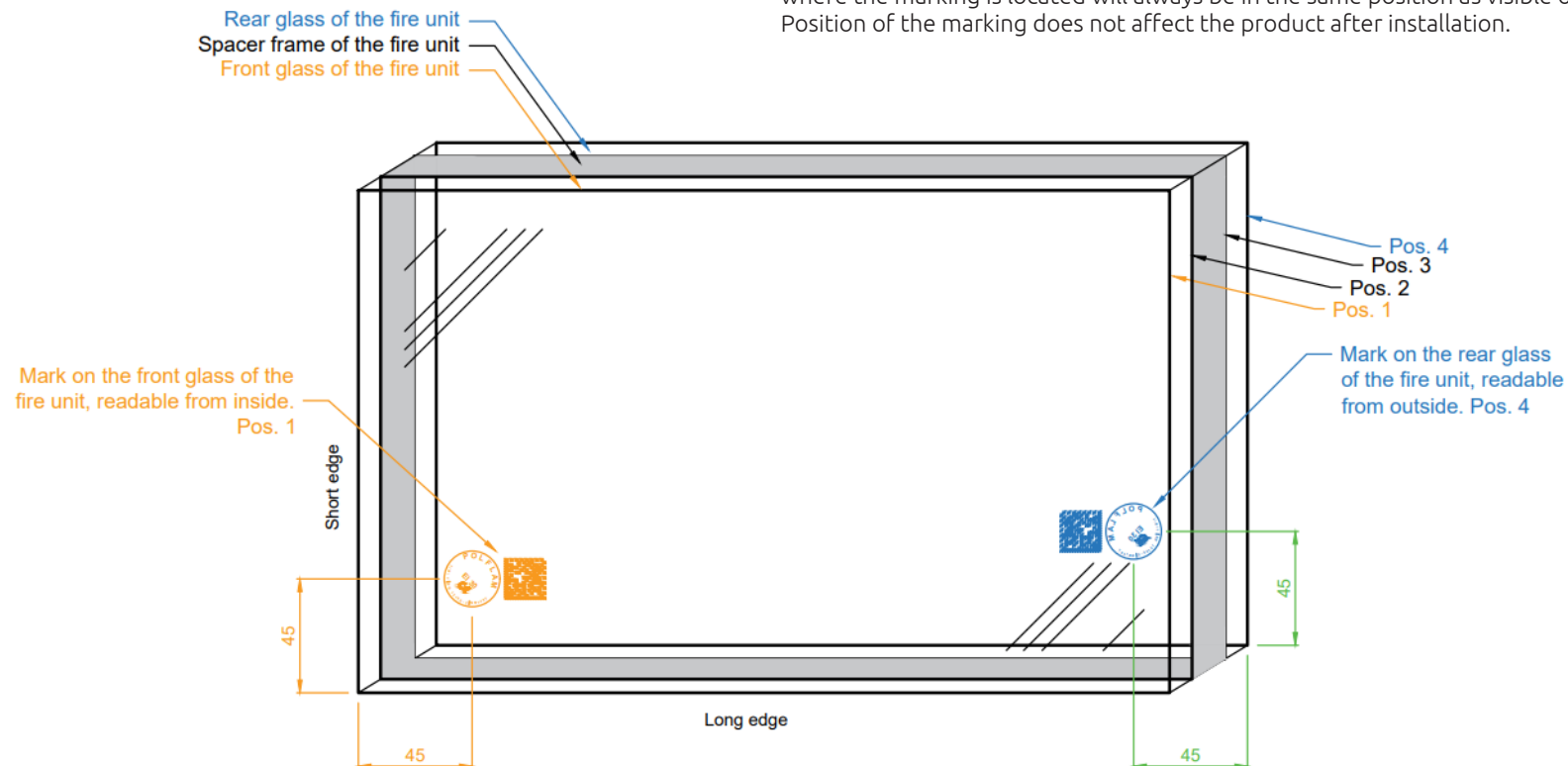




## 10. Marking of POLFLAM fire-resistant glass

Marking design for glass panes, depends on the fire resistance class, as shown on the drawing. Design includes product name („POLFLAM”), fire resistance class appropriate for a given product (example „Ei 60”), „CE” symbol, year production (23), glass class in accordance with PN-EN 12600:2004 („1(B)1”), product standard (toughened glass - „EN 12150-2”, heat soaked safety glass – „EN 14179-2”) and the number of the notified body (NB1487). Other markings like UKCA and UL are optional.

Marking placement shown on the drawing below – POLFLAM does not guarantee that the corner where the marking is located will always be in the same position as visible on the drawing. Position of the marking does not affect the product after installation.



### 11. Normative references

List of reference standards for the quality assessment of glass products manufactured by POLFLAM:

- EN 1279-1 Glass in building – Insulating glass units. Part 1: Generalities, system description, rules for substitution, tolerances and visual quality.
- EN 1096 Glass in building – Coated glass
- EN 572 Glass in building – Basic soda lime silicate glass products
- EN 1863-1 Glass in building – Heat strengthened soda lime silicate glass. Part 1: Definition and description.
- EN 12543-6 Glass in building – Laminated glass and laminated safety glass. Part 6: Appearance
- EN 14179-1 Glass in building – Heat soaked thermally toughened soda lime silicate safety glass. Part 1: Definition and description.
- EN 12150-1 Glass in building – Thermally toughened soda lime silicate safety glass. Part 1: Definition and description.



## 12. Document history

Version	Description	Valid until	Approved by
–	Criteria for qualitative evaluation of POLFLAM products (15 pages) – <b>Withdrawn</b>	10.07.2024	DC – 10.07.2024
072024 INT	Guideline for qualitative evaluation of POLFLAM fire-resistant glass (18 pages) – <b>Complete review and update of the document</b>		DC – 10.07.2024



PARTITIONS



WINDOWS  
AND DOORS



FACADES  
AND ROOFS



FLOORS



SMOKE  
BARRIERS



CE marking confirms that a product complies with the relevant harmonised European Norm.

Technical specification of the products are available at [www.polflam.com](http://www.polflam.com)



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