



## **Technical Data Sheet - Stopray**

**10/2023**

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# 1 INTRODUCTION

This Technical Datasheet gives information about the range of coated glass Stopray Ultraselect 70/33, Ultraselect 60/27, Ultraselect 60/28, Ultraselect 50/23, Vision 70/35 & Vision 70/35T, Vision 62/33 & Vision 62/33T, Neutral 60/33 & Neutral 60/33T, Vision 52/27 & Vision 52/27T, Neutral 50/27 & Neutral 50/27T, Vision 40/21 & Vision 40/21T, Silver 44/27S, Stopray Silver 47/29, Stopray Silver 25/17, Grey 34/21T, Smart 51/33, Smart 30/20, Lamismart 24.

These information's are related to stock sizes.

## 2 NORMATIVE REFERENCES

Stopray products conform to:

- EN 1096-1 – Glass in building – Coated glass – Part 1: Definitions and classification
- EN 1096-3 - Glass in building – Coated glass – Part 3: Requirements and test methods for class C and D coatings
- EN 1096-4 - Glass in building – Coated glass – Part 4: Evaluation of conformity/Product standard

All Stopray products are CE-marked following EN 1096-4; CE-Marking declarations are available from the [AGC Glass Configurator](#).

All Stopray are produced in factories being ISO 9001 certified.

## 3 COMPOSITION AND PROPERTIES OF THE FLOAT GLASS

The composition and main properties of the float glass are listed hereunder.

### 3.1 CHEMICAL COMPOSITION

The EN 572-1 defines the magnitude of the proportions by mass of the principal constituents of float glass is as follows.

Constituents	Proportion by mass of element
Silicon (Si)	32 % - 35 %
Calcium (Ca)	3,5 % - 10,1 %
Sodium (Na)	7,4 % - 11,9 %
Magnesium (Mg)	0 % - 3,7 %
Aluminium (Al)	0 % - 1,6 %
Others <sup>a</sup>	< 5 %
<sup>a</sup> properties other than photometric characteristics shall not be significantly altered by these other components	

### 3.2 MECHANICAL PROPERTIES FOR SODA LIME SILICATE GLASS

- Density (at 18°C):  $\rho = 2\,500 \text{ kg/m}^3$
- Hardness (Knoop):  $HK_{0,1/20} 6 \text{ GPa}^a$
- Young's Modulus (modulus of Elasticity):  $E = 70\,000 \text{ N/mm}^2 (7 \times 10^{10} \text{ Pa})$
- Poisson Ratio:  $\mu = 0,2$
- Shear Modulus:  $G = E / [2 (1+\nu)] \approx 29\,166 \text{ N/mm}^2$
- Hardness (Mohs): 5-6
- Characteristic bending strength:  $f_{g,kk} 45 \text{ N/mm}^2$
- Resistance against temperature differential and sudden temperature change  $40K^b$

<sup>a</sup> Knoop Hardness in accordance with ISO 9385

<sup>b</sup> Generally accepted value that is influenced by edge quality and glass type

### 3.3 THERMAL PROPERTIES

- Softening temperature  $T_{so}: \approx 725 \text{ }^\circ\text{C}$
- Working temperature  $T_w: \approx 1030 \text{ }^\circ\text{C}$
- Fusion temperature  $T_f \approx 1300 \text{ }^\circ\text{C}$  to  $1600 \text{ }^\circ\text{C}$
- Linear expansion coefficient:  $\alpha = 9 \cdot 10^{-6} / \text{K}$  (between  $20^\circ$  and  $300^\circ$ )
- Specific heat capacity:  $C_p = 720 \text{ J/(kg.K)}$
- Emissivity of glass without coating:
  - Normal emissivity  $\varepsilon_n = 0,89$
  - Corrected emissivity  $\varepsilon = 0,837$

### 3.4 OPTICAL PROPERTIES

- Refractive index  $N$  to visible radiation (380 to 780 nm):
  - air/glass: 0,67
  - glass/air: 1,50 at 589,3 nm

### 3.5 ELECTRICAL PROPERTIES

- Specific resistance:  $5 \cdot 10^7 \text{ } \Omega \cdot \text{m}$  at 1 000 Hz and  $25^\circ\text{C}$
- Dielectric constant: 7,6 at 1 000 Hz and  $25^\circ\text{C}$

## 4 DURABILITY OF STOPRAY COATINGS

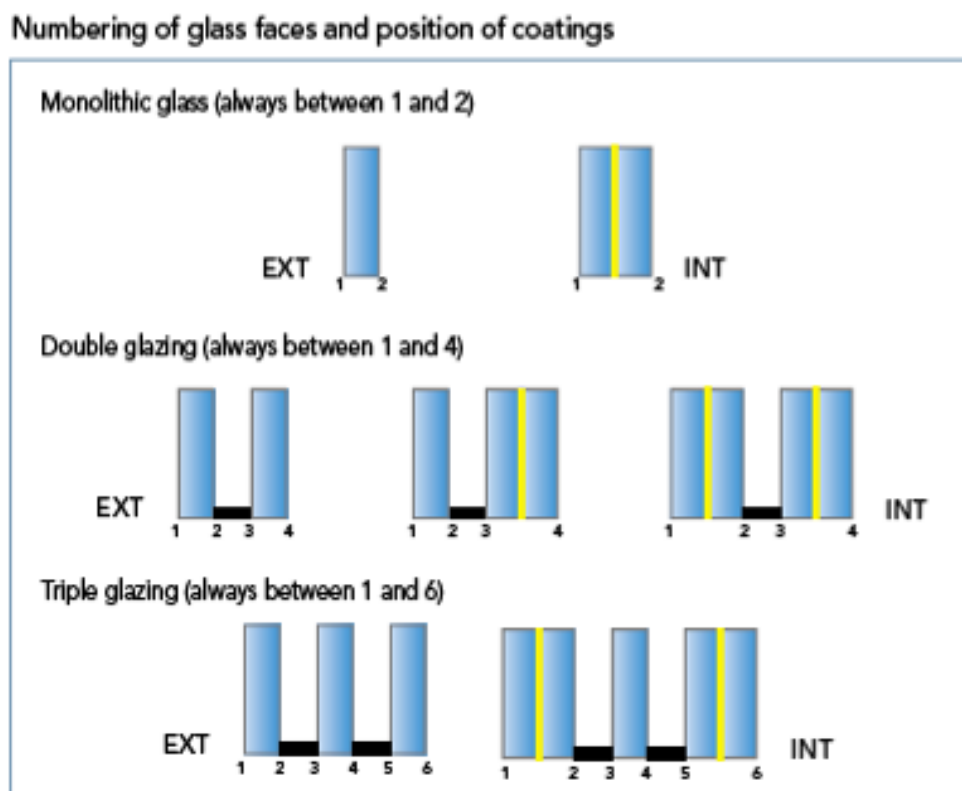
All Stopray coatings (except Stopray LamiSmart 24) are class C following EN 1096-1. They succeed an UV resistance test following EN 1096-3.

Stopray LamiSmart 24 is class B following EN 1096-1. It succeeds an UV resistance test following EN 1096-2.

## 5 LIGHT, SOLAR AND THERMAL PROPERTIES

### 5.1 CONVENTION FOR COATING POSITION

The following conventions are used for the numbering of the glass faces and the position of the coating.



### 5.2 TOLERANCES ON LIGHT AND SOLAR PROPERTIES

The light and solar properties are calculated using spectral measurement that conforms with standards EN 410 and WIS/WINDAT. The following properties are given:

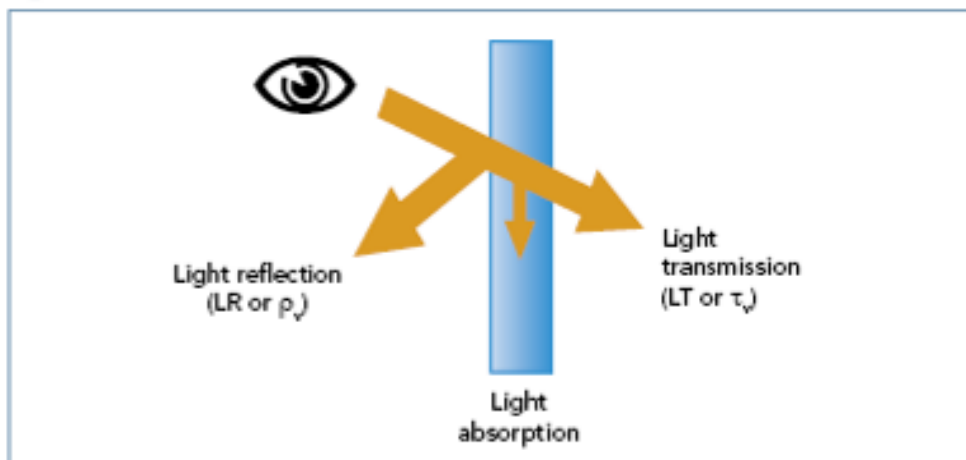
- LT ( $\tau_v$ ): Light transmission

- LR ( $\rho_v$ ): Light reflection on coating side
- LR' ( $\rho'_v$ ): Light reflection on glass side
- DET ( $\tau_e$ ): Direct energy transmission
- ER ( $\rho_e$ ): Energy reflection on coating side
- ER' ( $\rho'_e$ ): Energy reflection on glass side
- EA ( $\alpha_e$ ): Energy absorption
- SF (g): Solar factor
- SC: Shading coefficient

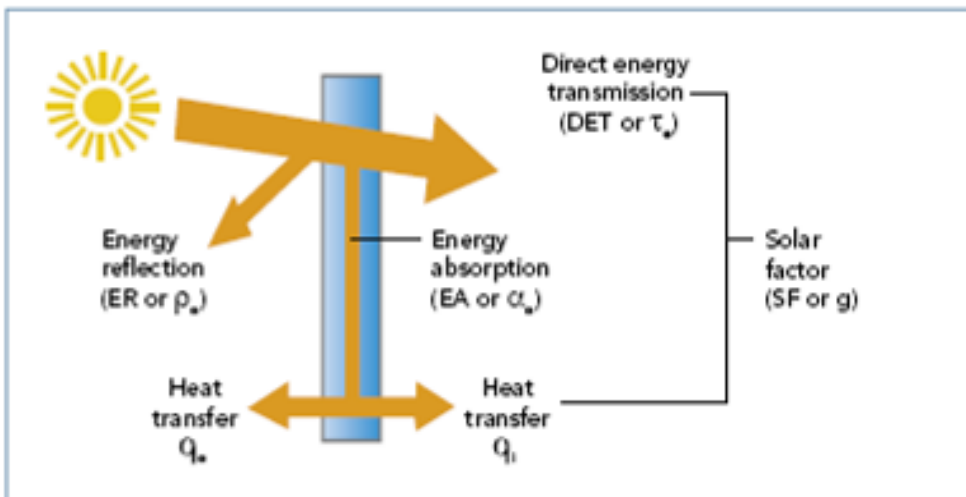
The tolerances on the values LT, LR, LR', DET, ER, ER' are  $\pm 3\%$ .

Notes: there are no direct tolerances on SF, SC and EA as these values are calculated from the previous ones.

### Light Properties



### Energy Properties



### 5.3 TOLERANCES ON THERMAL PROPERTIES

The thermal transmittance  $U_g$  (W/m<sup>2</sup>K) is calculated according EN 673. The emissivity measurement complies with EN 673 and EN 12898.

The tolerance on the values of normal emissivity  $\epsilon_n$  is + 0,01.

### 5.4 PERFORMANCES OF STOPRAY PRODUCTS

The table lists the light, solar and thermal properties of the Stopray products. For other thicknesses, see [www.agc-yourglass.com](http://www.agc-yourglass.com).

Product	Thick	LT	LR	LR'	DET	ER	ER'	$\epsilon_n$
Stopray Ultraselect 70/33 on Clearvision	6	76	3	5	35	44	41	0,01
Stopray Ultraselect 60/27	6	66	8	8	28	49	35	0,01
Stopray Ultraselect 60/28	6	66	8	9	29	48	34	0,01
Stopray Ultraselect 50/23 on Clearvision	6	54	7	16	24	47	45	0,01
Stopray Vision 70/35 & Vision 70/35T*	6	77	8	10	37	49	39	0,01
Stopray Vision 62/33 & Vision 62/33T*	6	67	4	12	34	42	34	0,01
Stopray Neutral 60/33 & Neutral 60/33T*	6	66	3	10	35	43	34	0,01
Stopray Vision 52/27 & Vision 52/27T*	6	56	6	14	28	43	36	0,01
Stopray Neutral 50/27 & Neutral 50/27T*	6	55	3	11	28	41	32	0,01
Stopray Vision 40/21 & Vision 40/21T*	6	44	9	18	21	48	41	0,01
Stopray Grey 34/21T*	6	38	6	5	20	43	14	0,01
Stopray Silver 25/17	6	27	30	60	17	52	60	0,01
Stopray Silver 44/27S	6	47	45	46	28	60	52	0,01
Stopray Silver 47/29	6	51	26	38	30	50	46	0,01
Stopray Smart 51/33	6	56	12	23	25	37	35	0,03
Stopray Smart 30/20	6	33	9	28	21	31	35	0,03
Stopray Ultraselect 70/33	6	74	3	5	34	44	35	0,01
Stopray Ultraselect 60/27 on CLV	6	67	8	8	29	49	40	0,01
Stopray Ultraselect 60/27 on CLV	6	68	8	9	30	48	45	0,01
Stopray Ultraselect 50/23	6	53	7	15	23	47	39	0,01
Stopray Vision 70/35 & Vision 70/35T on CLV*	6	79	8	10	38	49	45	0,01
Stopray Vision 62/33 & Vision 62/33T on CLV*	6	68	7	12	35	42	40	0,01
Stopray Neutral 60/33 & Neutral 60/33T on CLV*	6	67	3	10	36	43	39	0,01
Stopray Vision 52/27 & Vision 52/27T on CLV*	6	57	6	14	29	43	42	0,01
Stopray Neutral 50/27 & Neutral 50/27T on CLV*	6	56	3	11	29	41	37	0,01
Stopray Lamismart 24	44,1	25	36	28	16	44	33	-

Stopray Smart coatings can be used with or without heat treatment and depending on the type of sealant used, the edge-deletion is not required<sup>1</sup>.

\* Temperable products. Their values are those obtained after the tempering process.

<sup>1</sup> Reference to the prerequisites and the processing guidelines described in the "Magnetron Coatings Processing Guide" and in the "Stopray Smart Sealant Compatibility Guide".

## 6 ACOUSTIC PROPERTIES

The table lists the acoustic properties.

	<b>Rw (C, Ctr)</b>	<b>Rw + C</b>	<b>Rw + Ctr</b>
<b>4</b>	30 (-2, -4)	28	26
<b>5</b>	30 (-1, -2)	29	28
<b>6</b>	31 (-2, -3)	29	28
<b>8</b>	32 (-1, -2)	31	30
<b>10</b>	34 (-2, -3)	32	31

## 7 TOLERANCES ON DIMENSIONS

The same tolerances than for the float used as support of the coating apply. These informations are related to stock sizes.

### 7.1 THICKNESS

The actual thickness shall be the average of for measurements, taken to the nearest 0,01 mm, one taken at the center of each side.

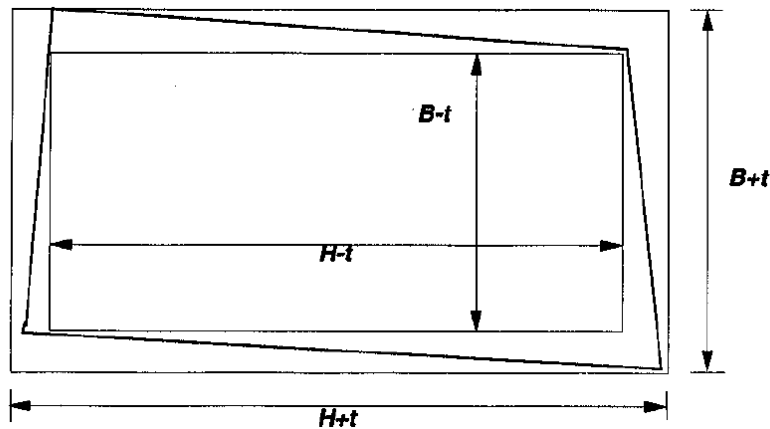
The actual thickness rounded to the nearest 0,1 mm shall not vary from the nominal thickness by more than the tolerances shown in the table.

	<b>Minimum (mm)</b>	<b>Maximum (mm)</b>
<b>3,15</b>	3,0	3,2
<b>4</b>	3,8	4,2
<b>5</b>	4,8	5,2
<b>6</b>	5,8	6,2
<b>8</b>	7,7	8,3
<b>10</b>	9,7	10,3
<b>12</b>	11,7	12,3

### 7.2 LENGTH AND WIDTH

The tolerances on nominal dimensions length H and width B are respectively  $\pm 3$  mm and  $\pm 2$  mm.





The limit of squareness is described by the difference between diagonals. The difference is maximum 5 mm.

## 8 QUALITY REQUIREMENTS

### 8.1 INTRODUCTION

The defect affecting appearances are:

- Specific from the float glass: see the Technical Datasheet "Planibel"
- Specific to the coating: see hereunder.

If a defect specific to the glass substrate is more visible because of the coating, it will be treated as a coating defect.

### 8.2 DEFINITIONS OF DEFECTS

The following definitions apply:

- **Uniformity defect:** Slight visible variation in color, in transmission or reflection, within a coated glass pane or from pane to pane.
- **Stain:** Defect in the coating larger than punctual defect, often irregularly shaped, partially of mottled structure.
- **Punctual defect:** Punctual disturbance of the visual transparence looking through the glass and of the visual reflectance looking at the glass.  
Note: Spot, pinhole and scratch are types of punctual defect.
- **Spot:** Defect that commonly looks dark against the surrounding coating, when viewed in transmission.
- **Pinhole:** Punctual void in the coating with partial or total absence of coating and normally contrasts clear relative to the coating, when viewed in transmission
- **Scratch:** Variety of linear mark, whose visibility depends on their length, depth, width, position and arrangement
- **Cluster:** Accumulation of very small defects giving the impression of stain.

## **8.3 DETECTION OF DEFECTS**

### **8.3.1 GENERAL**

The defects are detected visually by an observation of the coated glass in transmission and/or reflection. An artificial sky or daylight may be used as the source of illumination.

### **8.3.2 ARTIFICIAL SKY**

The artificial sky is a plane emitting diffuse light with a uniform brightness and a general coloring index Ra higher than 70.

It is obtained by using a light source whose correlated color temperature is in the range between 4000 K and 6000 K. In front of the arrangement of light sources is a light scattering panel, without spectral selectivity. The illuminance level, on the glass surface shall be between 400 lx and 20000 lx.

### **8.3.3 DAYLIGHT ILLUMINATION**

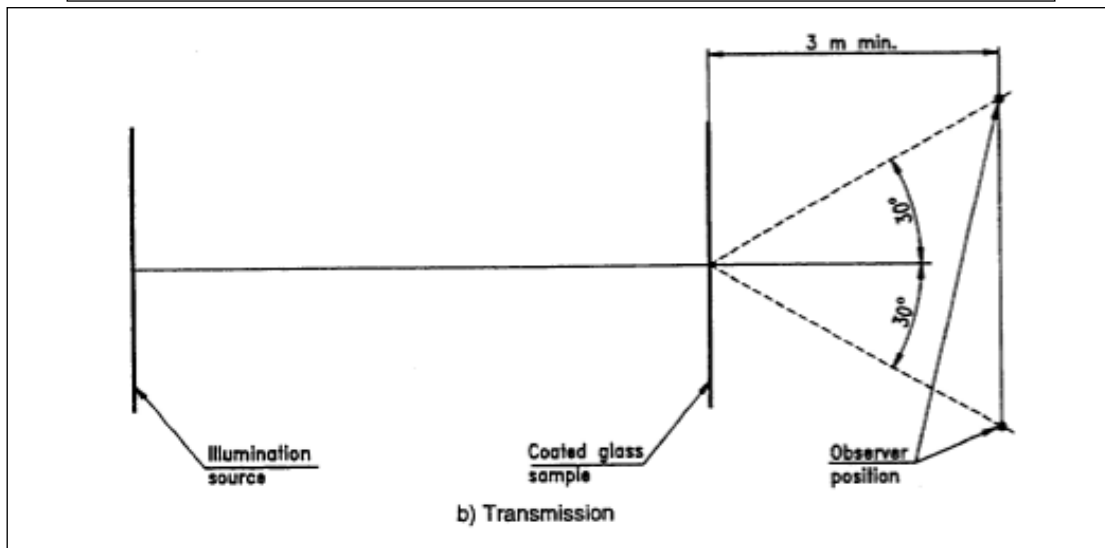
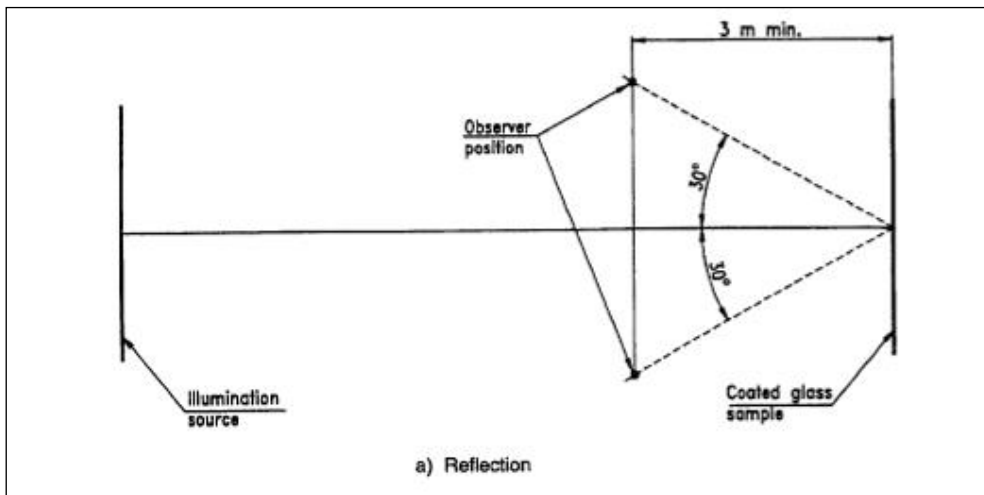
Daylight illumination is a uniform overcast sky, without direct sunlight.

## **8.4 CONDITION OF OBSERVATION OF DEFECTS**

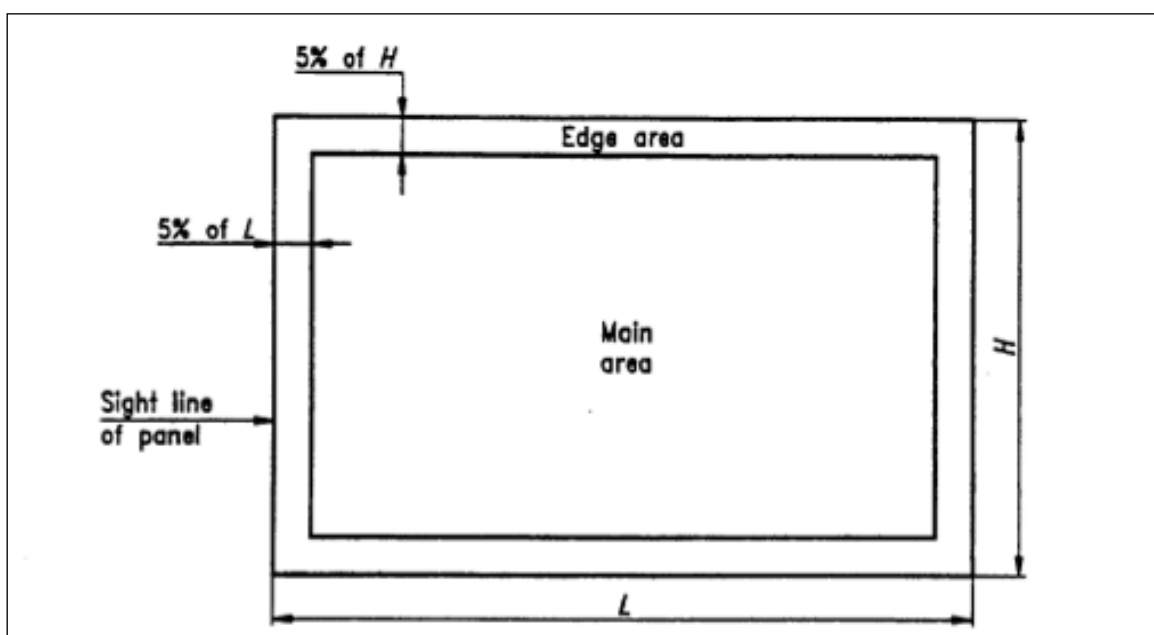
### **8.4.1 GENERAL**

Coated glass may be examined in stock size or in finished sizes ready for installation. The examination may be undertaken in the factory or on site when glazed.

The pane of coated glass being examined is viewed from a minimum distance of 3 m. The actual distance will be dependent on the defect being considered and which illumination source is being used. The examination of the coated glass in reflection is performed by the observer looking at the side which will be the outside of the glazing. During the examination the angle between the normal to the surface of the coated glass and the light beam proceeding to the eyes of the observer after reflection or transmission by the coated glass shall not exceed 30° (see figure).



For panes of coated glass in finished sizes ready to be installed, both main area and edge area of the pane shall be examined (see figure).



Each examination will take no more than 20 s.

## 8.4.2 UNIFORMITY DEFECTS AND STAINS

Under the condition of examination given in 8.4.1, note any coating variations either within on pane or between neighboring panes which are visually disturbing.

## 8.4.3 PUNCTUAL DEFECTS

Under the conditions of examination given in 8.4.1, note any spots, pinholes and/or scratches that are visually disturbing.

For spots/pinholes, measure the size and note the number relative to the size of the pane. If there are any clusters found, their position relative to the through vision area shall be determined.

For scratches, determine whether they are in the main or edge area. Measure the length of any scratches noted. For scratches  $> 75$  mm long, determine the distance between adjacent scratches. For scratches  $\leq 75$  mm long, note any area where their density produces visual disturbances.

## 8.5 ACCEPTANCE CRITERIA OF COATINGS GLASS DEFECTS

The acceptance criteria for the defects of coating glass are given in the table.

Defects types	Acceptance criteria		
	Pane/Pane	Individual pane	
<b>UNIFORMITY/STAIN</b>	Allowed as long not visually disturbing	Allowed as long not visually disturbing	
<b>PUNCTUAL</b> Spot/pinholes $> 3$ mm  $> 2$ mm and $\leq 3$ mm	Not applicable	<b>Main area</b>	<b>Edge Area</b>
		Not allowed  Max 1 by m <sup>2</sup>	Not allowed  Max 1 by m <sup>2</sup>
Clusters	Not applicable	Not allowed	Allowed as long as not in area of through vision

Scratches > 75 mm	Not applicable	Not allowed	Allowed as long as they are separated by > 50 mm
≤ 75 mm		Allowed as long as local density is not visually disturbing	Allowed as long as local density is not visually disturbing

## 8.6 COLOR DIFFERENCE IN FAÇADES

### 8.6.1 METHOD AND CONDITION OF OBSERVATION

When coated glasses are installed on façades, some variations of color can appear between the panes. The document of Glass for Europe "Code of practice for in-situ measurement and evaluation of the color of coated glass used in façades" (available at <https://glassforeurope.com/wp-content/uploads/2018/04/Measurement-and-Evaluation-of-the-Colour-of-Coated-Glass.pdf>) describes the way to measure and evaluate these differences of color.

### 8.6.2 REQUIREMENTS

The values of  $\Delta L^*$ ,  $\Delta a^*$  and  $\Delta b^*$  determined in accordance with 8.6.1 shall met the following requirement.

$\Delta L^*$	≤ 4,0
$\Delta a^*$	≤ 3,0
$\Delta b^*$	≤ 3,0

## 9 OTHER RELATED DOCUMENTS

Following documents are also available from [www.agc-yourglass.com](http://www.agc-yourglass.com):

- Processing Guide <https://www.agc-yourglass.com/en-BE/document-library>
- Cleaning and Maintenance Guide for Façade glazing <https://www.agc-yourglass.com/en-BE/document-library>
- Glazing Instruction <https://www.agc-yourglass.com/en-BE/document-library>
- CE-Marking and Declaration of Performance at <https://www.agc-yourglass.com/configurator/app/login>