




# GLASS QUALITY GUIDELINES

GUIDELINE FOR THE VISUAL ASSESSMENT OF GLASS PRODUCTS



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# TABLE OF CONTENTS

|  |    |
|--|----|
| Term of warranty   | 2  |
| General information  | 2  |
| Inspection methodology   | 3  |
| Visual quality assessment criteria applicable to architectural glass products of Rákosy-Glass Kft. | 4  |
| Visual properties of glass products  | 8  |
| Glossary of terms  | 10 |

## TERM OF WARRANTY

This document provides a guideline for a visual quality assessment of the glass products of Rákosy-Glass Kft. that are intended for architectural use. The assessment must be performed on the basis of the assessment basic principles set forth below, and with the aid of the table located in the chapter titled "Visual quality assessment criteria applicable to the architectural glass products of Rákosy-Glass Kft."

The intended form of use must be stated in writing at the time of submitting the order.

The assessment must be performed in its installed state, applicable to glass surfaces that remain accessible.

In case of specially manufactured glasses, like glass products produced through the use of, for instance, cathedral glass, or in the case of glass products meeting heightened security requirements, the guideline does not always apply. These glass products must be assessed as a function of utilized raw materials and applied manufacturing processes.

## GENERAL INFORMATION

When assessing built-in glass products, it is an important factor that one take into consideration the functional parameters of the glass products, beyond the aspect of visual quality. Those parameters of glass products (e.g. sound and heat insulation, transparency index, etc.) that are proscribed for a given function apply to a tested object defined in the given standard of assessment. Due to other glass sizes, combinations, or effects of installation or exterior forces, given values and visual appearance may vary. In light of the diversity of glass products, this guideline cannot be applied in all cases without limitation. In these cases (e.g. the installation of safety glass), special requirement related characteristics must be assessed as a function of the nature of use and the circumstances of installation. When assessing certain parameters, product specific properties must be considered.

# INSPECTION METHODOLOGY

Over the course of the inspection, the default approach is to make the assessment from the interior side. It is prohibited to separately mark the potentially disputed spots in advance of the inspection.

The inspection of the glass must be conducted from a minimum distance of 1 m, from the interior towards the exterior, and from a vantage point that fits the general function of the room.

The duration of the inspection is 10 seconds.

The inspection must be conducted in daytime light conditions without artificial lighting or direct sunlight.

The inspection of glass installations inside the room must be conducted under normal light conditions and a vantage point that is perpendicular to the surface.

The exterior assessment of glass installations must be conducted at the customary distances for this inspection, under appropriate light conditions.

# VISUAL QUALITY INSPECTION

## CRITERIA APPLICABLE TO THE ARCHITECTURAL GLASS PRODUCTS OF RÁKOSY-GLASS KFT.

### The criteria apply to the following

- float glass
- single layer tempered safety glass (ESG)
- single layer heat-strengthened glass (TVG)
- laminated multi-layered glass(VSG)
- coated glass
- painted glass

### Zones

To perform the inspection, we divide the surface area of the glass panel into three zones. These are as follows:

#### **Frame enclosed area**

With the exception of mechanical type edge damage, there are no limitations that apply to this area

#### **Rim area**

An area equivalent to 10% of exposed width x height, which is subject to less strict scrutiny

#### **Main area**

The area that is subject to the strictest scrutiny

Flaw sites that are smaller than 0.5 mm must be disregarded.

Non-matching patches cannot be larger than 3mm.

For laminated safety glasses (VSG), for all surface sub-areas, the frequency of compliance criteria is to be uniformly increased by 50%.

Ripples appear on the surface of the glass over the course of the heat treatment; these derive from the manufacturing technology. In case of single layer tempered safety glass (ESG), heat-strengthened glass (TVG) and the laminated safety glasses that are produced from them, their localized undulation must not exceed a value of 0.5mm when projected to a 300 mm long segment. Projected to the circumference of the glass, deviations from the plane must not exceed 4mm/lm. Visual appearances that derive from this effect do not justify replacement under the warranty. Other types of deviations must be duly negotiated.

| PERMITTED BY UNIT   | FRAME ENCLOSED AREA   | RIM AREA (18 mm default)  | MAIN AREA   | RIM AREA + MAIN AREA   |
|---|---|---|---|--|
| FLAT, EXTERNAL DAMAGE TO RIM, SHELL-LIKE SHAPES OR INTERNALLY SITUATED SHELL-LIKE SHAPES, WITHOUT BROKEN MISSING SHARDS, FILLED WITH SEALING COMPOUND | Permitted, assuming that it does not impact the mechanical stability of the glass |   |   | The permitted maximum values are identical to the values that are applicable to the rim areas.   |
| SCRATCHES   | Permitted in unlimited numbers  | Maximum total length of scratches is 90 mm, with a maximum individual scratch length of 30 mm   | Maximum total length of scratches is 45 mm, with a maximum individual scratch length of 15 mm   | Inclusions, bubbles, spots, flecks, etc. in the 0.5 mm < 1,0 mm range, without a maximum surface boundary, with the exception of pile-like clumps. |
| HAIRLINE SCRATCHES  |   | Not permitted in clumps   |   |  |
| INCLUSIONS, BUBBLES, FLECKS, POINTS, ETC.   |   | <p>Sheet area &lt;1m<sup>2</sup> max 4 qty, for each &lt; 3 mm Ø</p> <p>Panel area &gt;1m<sup>2</sup> as projected to 1 linear meter is maximum of 1 qty, per each &lt;3 mm Ø</p> | <p>Surface ≤1m<sup>2</sup> max 2 qty, each &lt; 2 mm Ø</p> <p>1 m<sup>2</sup> ≤ surface ≤2m<sup>2</sup> max 3 qty, each &lt; 2 mm Ø</p> | Piling occurs when within a circular area with a diameter of Ø ≤20 cm there are a minimum of 4 inclusions, bubbles, points, stains, etc.           |
| SUPERFICIAL RESIDUE IN THE SPACE BETWEEN THE LAYERS   | Permitted in unlimited numbers  | Pale grey or transparent – max. 1 qty ≤3 cm <sup>2</sup>  |   |  |

In case of painted glass surfaces (painted on entire surface or via screen printing), the criteria for the visual quality inspection of the final product may vary from the foregoing.

The inspection must be performed in accordance with the mandates written in the chapter titled "Inspection Methodology".

Similarly to the foregoing, when inspecting painted glasses, defect sites that are smaller than 0,5 mm must be disregarded.

Performing the installation of glasses that are painted over their entire area is not recommended when the glass is subjected to direct light. If the customer still wishes to employ this setup, it must be coordinated in advance with the manufacturer.

On the solidly painted side of glass panes, pushpin sized gaps in paint coverage, or potentially paint flows are visible, thus a not entirely uniformly covered surface is visible. In these cases, we only and exclusively accept gaps in the paint coverage as a warranty claim if such gap is clearly visible in front of a dark background.

In case of painting performed via screen printing for a decorative purpose, gaps in paint coverage that is not larger than 5% and does not disrupt the nature of the pattern are permitted.

Painted glass originating from different manufacturing batches might have varied colors. This cannot be the subject of the warranty claim.



# VISUAL PROPERTIES OF GLASS PRODUCTS

## The colors of the raw materials

The raw materials that are used over the course of the manufacturing of glass products all possess their own color, which becomes proportionately more and more apparent with the increasing thickness of the glass.

The fluctuations in color depend on changes to many factors; these can include the iron oxide content of the glass, glass thickness, as well as the order of the layers; this cannot be prevented.

Heat insulation glasses and coated glasses that are used for sun protection glass products also possess their own color, which can deviate on the external and interior side alike.

Glasses derived from various manufacturing batches may have varied colors.

## Color deviations on coated glass

To objectively assess color deviations in case of transparent and non-transparent (reflective) coatings, the inspection requires the measurement and inspection of deviations under precisely predefined conditions (glass type, color, nature of light). This type of assessment cannot comprise the subject matter of this guideline.

## The inspection of the visible section of the casing for insulation glass

In the visible section of the casing, meaning excluding uncovered glass surfaces, on the insulating glass products, traces and markings that are derived from the technology can be detected upon the glass of the insulating glass products and on the extended frame.

## External surface damage

Subsequent to installation, for mechanical or chemical based surface damage, the cause of the defect must be assessed. The assessment must be performed in accordance with the above table.

## Physical characteristics

Obviously, the visual quality inspection cannot include unavoidable physical phenomenon that can arise on uncovered glass surfaces. These are independent of the processor, thus they cannot be the basis of a warranty claim in case of any multi-layered heat insulating glass products. These include, for instance:

- Doppelscheiben effect
- interference phenomenon
- anisotropies
- condensation on external glass surfaces
- wet, humid glass surfaces (residual traces derived from the use of the glass)

## Doppelscheiben effect

In multilayered heat insulating glasses, as a result of changes in air pressure and temperature, changes in volume occur. Consequently, the glass panes turn convex or concave. This can be perceived as a distortion in the reflection. Its extent depends on the size of the pane and the width of the airgap.

## Interference phenomena

In glass products made of float glass, interference phenomena may arise. By optical interference, we mean the overlap of two or more light waves in one spot. The phenomenon can be seen as a patchlike, ringed or striped form; its position shifts when pressure is applied. The extent of interference depends on light conditions and the angle of diffraction. It is only visible from a specific angle and in the presence of multiple factors.

## Anisotropies

These are typically those physical phenomena that occur in heat treated glasses, a result of the distribution of internal stresses. In this context, it is possible to detect – depending on vantage point, of a darkened color – rings or stripes in polarized light and/or polarizing glass.

## Condensation on external glass surfaces

Condensation may occur on the surface of the glass structure when the glass surface is more golden than the surrounding air. Condensation on the surface of the glass structure is influenced by Ug value, relative humidity, air currents, and interior and exterior temperature. On interior facing glass surfaces, condensation is assisted when air circulation is inhibited (e.g. the unfavorable placement of recesses, curtains, flowerpots, planters, shutters, and radiators, etc.) On glass with significant heat insulating capacity, on a glass surface that is subjected to outside weather, condensation may occur when external humidity (relative humidity) is high and the temperature of the air is higher than the temperature of the glass surface.

## Wet, humid glass surface (visual phenomena arising from the proper use of the glass)

Imprints of rubber rollers, labels and fingerprints, residual paper, vacuum suction locations, sealant or silicone residue, putty and lubricant residue, but even the traces of environmental factors. We can perceive similar deviations on wet glass surfaces that were subjected to the effect of waste water, rain, or cleaning fluid.