



# **Solaris Standards for single glazing**

**Solaris Bus & Coach sp. z o.o.  
(hereinafter “Solaris”)**

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with its registered seat in Bolechowo-Osiedle, at 46 Obornicka Street, 62-005 Owińska, entered in the Register of Entrepreneurs of the National Court Register by the District Court Poznań Nowe Miasto and Wilda in Poznań VIII Economic Department of the National Court Register under the KRS number 0000236619, NIP 524-00-15-630, share capital 160 169 580,00 PLN, fully paid up

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## Table of contents

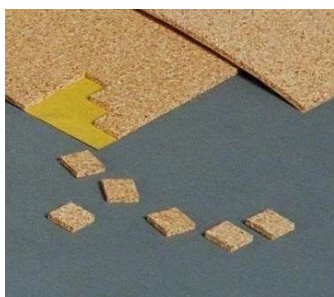
1. General Guidelines .....	2
2. Criteria for acceptance of quality defects .....	4

## 1. General Guidelines

The purpose of this presentation is to define, in the simplest and clearest way possible, the standards for the visual evaluation of insulating glass units supplied to Solaris Bus & Coach sp. z o.o.

### 1.1. General principles

- All workpieces should be properly protected for transportation
  - glazing should be placed on racks or should be packed in crates; all parts of the rack or crate that come in contact with the glazing should be lined with rubber or other shock-absorbing material.
- Each glass should be translated with flexible shims , for example: cork spacers 20-30 cm apart.



- All workpieces should be traceable, the label containing the index, supplier number according to SAP, delivery date and batch
- Each batch of glazing should be marked by the manufacturer with a quality certificate (a sticker on the glazing containing confirmation of the release of the batch for transport).
- Dimensional and radius tolerances in accordance with the specifications of the technical documentation.

## 1.2. Visual evaluation of glazing

- Examination of the appearance is done with the naked eye, the glass is placed in a horizontal position looking at it from different angles of incidence, on both sides of at a distance of 0.9m with minimum lighting of 1000 lx for all criteria.
  - Lighting bright daylight not sunlight, and artificial light.
- Inspection time (does not include glass washing time):
- 30s for glass with dimension  $\leq 1.5\text{m}^2$ ;
  - 60s for glass with dimension  $> 1.5\text{m}^2$ .

Evaluation of the defect found is done beyond this time by verifying the glass in the vertical mounting position.

- Evaluation of the quality of the glass is carried out after a thorough prior cleaning of the glass with chemicals such as cleaning foam, degreasers.
- In the case of enamel-coated glass, the quality is assessed from the non-enamel side.
- A maximum of 5 defects per pane is permitted. The distance between individual assessed features must be no less than 200 mm.

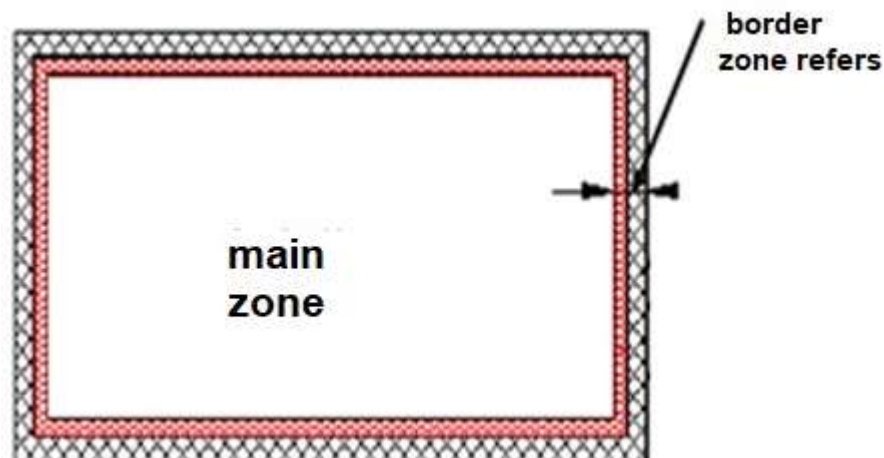
**Any additional detailed arrangements for individual indexes take precedence over these standards.**

## 1.3. Glass grading fields:

- the entire visible surface of the glass is the main field of view with silk screen and spot raster

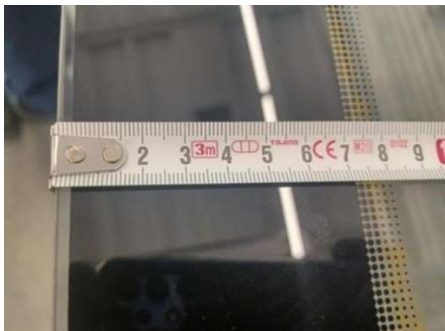
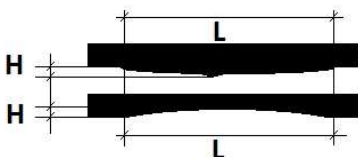

In special cases, it is permissible to divide the main zone and the edge zone of the shaft:

- main zone refers to the transparent surface
- border zone refers to the printed surface (full and dot print)


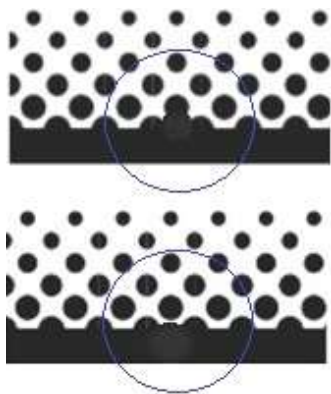


## 2. Criteria for acceptance of quality defects


### 2.1. Underpainting of screen print.

	<p>A defect is allowed if it occurs a maximum of 3 mm from the edge, length without limitation.</p> <p>Screen printing painting should be uniform over the entire surface, lines or highlights of paint are unacceptable</p>
	<p>Uneven edge of screen printing - Acceptable deviation from edge straightness of screen painting 1mm/m</p>
	<p>Underpainting of the screen printing causing clearances is unacceptable.</p> <p>Correction of screen printing on the printed side is allowed, provided that it is not visible from the outside or inside after installation. Screen printing defects can be repaired using a special marker.</p> <p>No transmission of light discernible to the naked eye is allowed when inspecting the glass vertically.</p>


## 2.2. No preservation of the screen printing pattern.

	<p>Defect acceptable if there are a maximum of 2 spot underpainting not more often than every 200 mm, whose dot area does not have a circular shape.</p> <p>Defect unacceptable if there are more than 2 spot underpaintings next to each other and if they occur more often than every 200 mm.</p> <p>A defect may be a lack of pattern (dots) or an error in the shape of the pattern, e.g.: half a dot</p>
	<p>Connected dots (converging dots in screen printing) allowed between two dots of the first row of half dots or between two dots of a row of half dots and a dot of the first row of full dots are allowed under the condition: max. 2 defects / min. 500 mm (measured on the outline of the glass sheet).</p>


## 2.3. Ink outside the screen-printing area

	<p>Unacceptable defect.</p>
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## 2.4. Approval mark

	<p>The windshields should bear the appropriate approval mark and the Solaris logo.</p> <p>Approval mark legible from the outside of the vehicle, intermittent writing not permitted.</p> <p>The design of the approval mark must be approved between the supplier and Solaris Bus &amp; Coach sp. z o.o.</p>
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## 2.5 Irremovable inclusions (glass particles fused on the surface and air bubbles in the glass mass).

	<p>Defect acceptable if it occurs in the edge zone of the glass and if it is a maximum of 1 defect not exceeding <math>\varnothing &lt; 0,8\text{mm}</math>.</p> <p>Defect unacceptable if it occurs in the main zone.</p>
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## 2.6 Glass soiling.

	<p>Unacceptable defect - these are all kinds of dirt from the production process, fingerprints, cork marks on the surface.</p> <p>The glass surface should be clean, free from any contamination or residue from the production process.</p>
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## 2.7 Capillary scratches


	<p>Hairline scratches - all kinds of scratches on the surface not perceptible with a fingernail.</p> <p>Permissible in:</p> <ul style="list-style-type: none"> <li>- main zone max 2 pieces with a maximum length of 15 mm separated from each other by min. 200 mm.</li> <li>- Edge zone max 2 pieces with a maximum length of 15 mm separated from each other by min. 200 mm.</li> </ul>
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## 2.8 Deep scratches


	<p>Deep scratches - all kinds of scratches and abrasions that can be felt with the fingernail.</p> <p>Unacceptable defect.</p>
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## 2.9 Scratches under the screen print.

	<p>Acceptable 1pc max 5mm invisible from 0.9m.</p>
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## 2.10 Rubbing from rollers.

	<p>Unacceptable defect - these are all kinds of irremovable abrasions on the surface of the glass after the production process.</p>
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## 2.11 Chipping

	<p>Defect unacceptable for side and rear windows, the edge of the finished product of which is visible after installation.</p> <p>In other cases, chipping of up to 1.5mm, not clustered, spaced 200mm apart are acceptable – inside the glass, no more than 2 chips on one glass. Chips in drilled holes are unacceptable.</p>
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## 2.12 Water stains after screen printing.

	<p>Unacceptable defect.</p> <p>Before screen printing, the surface of the glass should be clean, without any impurities or residues from the production process.</p>
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## 2.13 Air bubbles

	<p>Defect acceptable in the edge zone, a maximum of 2 pieces with a diameter of 1.5 mm, a minimum of 200 mm apart.</p> <p>Defect unacceptable in the main zone. The defect refers to air bubbles trapped between the glued panes during the lamination process.</p>
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## 2.14 Delamination

	<p>Unacceptable defect</p>
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## 2.15 Pitting

	<p>Permissible unfocused if not visible from 0.9 m.</p> <p>These are any type of glass or plastic particles embedded in the glass surface.</p>
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## 2.16 Edge straightness not maintained.

	<p>A defect is permissible if the deviation of straightness is a maximum of <math>\pm 1</math> mm and if the difference in the lengths of the diagonals is a maximum of 2 mm.</p>
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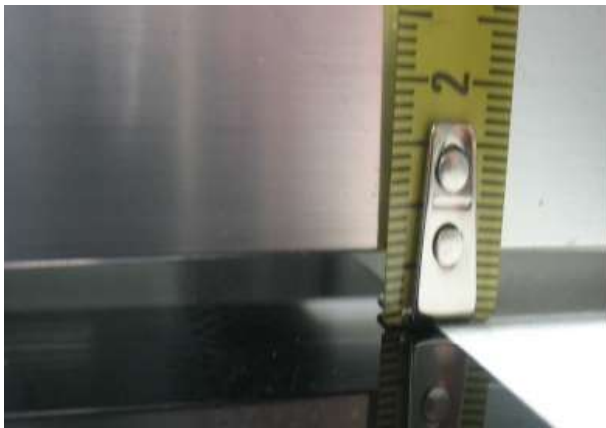
## 2.17 Waviness

	<p>Glazing with a wavy surface is unacceptable.</p>
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## 2.18 Edge cutting

	<p>A defect is permissible if the cut does not exceed 2 mm.</p>
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## 2.19 Flatness

	<p>Permissible defect if total maximum deflection is 0.8 mm for every 305 mm.</p>
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