



QUALITY CRITERIA FOR INSULATING GLASS UNITS

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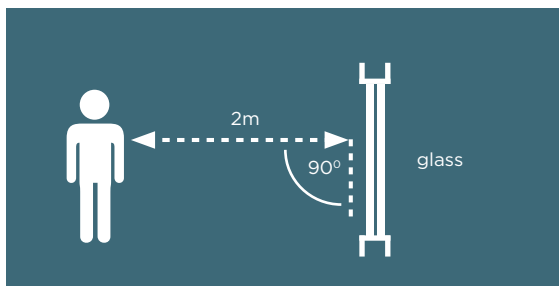
This handbook will show you how to perform the correct visual assessment of glass to check for any manufacturing defects. It provides answers to a number of frequently asked questions that customers may have before, during and after the fitting process.

All GLASSOLUTIONS products are manufactured in accordance with the strictest quality standards, described in EU Standard EN 1279. However, please remember that the natural properties of the material (glass) and many different processes that glass undergoes in order to achieve its desired functionality may impact the appearance of the fitted product. The EU Standard (EN 1279) is the prevailing standard which sets out obligatory requirements and provides criteria for visual assessment of insulating glass units. The European Harmonized Standards (hEN) such as hEN 572 - float glass / hEN 096 - coated glass / hEN 12150 - toughened glass and hEN 12543 /14449 - safety laminated glass, refer to those criteria. That is why we have prepared a simple manual on visual assessment of glass, based on data taken from the EU Standards. It explains the most frequent scenarios and phenomena, as well as situations when you should contact your supplier/ fitter.

Our products are verified by Notified Laboratories and our production facilities undergo external Certification Audits.

Conduct a visual assessment

Look at the glass vertically at the right angle (90°) - this concerns the surface of the glass seen from inside the room. Stand 2m away from the glass. Carry out the assessment in natural daylight, but not in direct sunlight. The glass needs to be completely dry.



During the visual inspection you need to be looking through the glass rather than at the glass. Any glass defects should be noticed within 20 seconds. If a defect is not visible while looking through the glass from the specified distance or if a defect is noticed after 20 seconds, it is considered that the defect is not clearly visible or disturbing to the onlooker. Not all visible defects create a need to replace the glass.

While conducting the assessment you cannot use any magnification devices or sources of strong light (such as halogen lamps or flash lights).

The assessment should not be performed in strong sunlight. All defects should be first identified while standing at least 2m from the glass. If a defect is noticed, it should be measured using the right measurement tool (ruler (mm)/ tape measure) and compared with the table found in this brochure.

Safety glass markings



Example toughened glass marking

The individual panes certified as safety glass are marked accordingly - on the surface or edge of the glass. GLASSOLUTIONS guarantees that all such markings will be found in the same corner of the glass and that they will not overlap in case of insulating glass units.

Image reflection

Due to the fact that insulated glass units consist of more than one pane, the onlooker may notice multiple reflections. The effect is more intense in case of triple insulated units. It does not constitute a defect of the glass.

Distorted reflection

The hermetically sealed space between the glass panels contains a specific volume of air / gas, based on the temperature and atmospheric pressure values at the time of fusing the panels into one unit. Once the unit is fitted, changes in outside temperature and pressure will lead to an increased or decreased volume of air / gas in the space between the glass panels, which causes deflection of the pane, visible as a distorted image reflection. The distortion indicates that the glass panel was fused correctly and does not constitute a defect of the glass.

Light refraction on glass may create a temporary rainbow effect. It appears due to the parallel positioning of high-quality flat glass panels / or different orientation of toughened glass.

Glass manufacturing technology keeps evolving and new glass panels fitted next to old glass panels do not have to match them perfectly. This is not a result of glass defects.

Low-emissivity coating on the glass may cause temporary visual effects. In certain lighting conditions this coating may look like transparent film or may cause a fogging effect on the glass surface. If light, colourful objects, such as net curtains, are placed next to the glass, they may seem slightly darker than they are in reality. Differences in the structure of neighbouring glass units may create acceptable visual effects.

Georgian Bars

Due to changing weather conditions, georgian bars may deflect and turn aside from a straight line, may seem discoloured or may tap on the glass. None of the above cases qualifies as a defect. The effects increase with the size of the glass unit. When temperature goes back to normal, the bars return to their original position. All visible discolourations on the georgian bars are caused by the use of coated glass. The tapping of the bars on the glass may only be apparent in specific weather conditions, when the insulating glass unit is exposed to strong external vibration, such as strong wind. The use of so-called bumpons protects the glass against damage, but does not eliminate vibration. Georgian bars and muntins need to be manufactured with positioning tolerance of +/-2mm.

Contamination in the inter-pane space

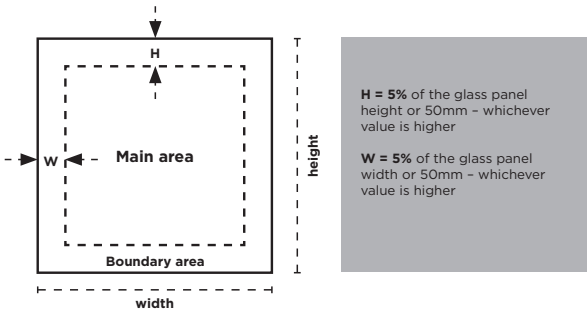
If too much loose material is visible in the inter-pane space, it should be classified as a spot defect and assessed properly. Such a defect may also include leakage of the drying agent from the spacer bar, insects, acrylic glass or wood chips left after cutting the slats.

Defects in the coating

Contamination and punctures in glass coating should be measured and treated as a spot defect.

Spot defects

Such defects include air bubbles (gas inclusions), stones and grains, and should be assessed by determining the quantity and size of the inclusions. The acceptable limits are provided in the table below:



Area	Allowable defects inside the unit in case of float glass and coated glass
Edge	Damage and flaking/ dents on the edges which do not affect the strength of the glass nor the airtightness of the glass along the edge, or butyl flash (max. 5 mm) - not affecting the functionality of the insulating glass unit.
	Internal flaking or dents/ flash without loose chips which have been filled with a sealant/ butyl.
	Flat, spot contaminants and scratches on the surface.
Boundary area	Inclusions, bubbles, flaws, stains: Sheet surface > 1 m ² : max. 4 defects < Ø3 Sheet surface ≤ 1 m ² : max. 1 defect < Ø3 / running meters of the edge
	Flat contaminants: black/ white-grey or transparent - max. 1 defect ≤ 3 cm ²
Main area	Spot defects (spots, punctuations, bubbles, embedded elements, pitting, flaws etc.) > 3mm - unacceptable > 2 and ≤ 3 mm - acceptable if not exceeding 1/m ² > 0.5 and ≤ 2 mm - acceptable if not exceeding 2/m ²
	Scratches, cracks > 75 mm - unacceptable < 75 mm - acceptable provided that their concentration in one area does not create a visual distraction
	Width / Thickness of the crack 0.15 mm or less - hairline crack - does not undergo assessment More than 0.15 mm - should be assessed

Spacer bars and glazing bars	Butyl flash (max. 2 mm) - not affecting the functionality of the insulated glass unit - also butyl surface undulation
	Single contaminants - allowed up to 3 mm
	Groups of defects smaller than 3 mm - not allowed
	Molecular sieve grains should be considered spot contaminants
	Contaminants, stains, streaks on the spacer bar not visible from the distance of 2 m are allowed
	Defects below 0.5 mm are not subject to assessment and are not considered

Allowable defects inside the unit in case of laminated glass						
Size of the defect d[mm]	Number of laminated glass panels	0,5<d≤1,0	1,0<d≤3,0			
Size of glass panel A [m ²]	-	All sizes	A≤1	1<A≤2	2<A≤8	A>8
Liczba dopuszczalnych wad	2 panels	No limitation, but can be in groups	1	2	1/m ²	1,2/m ²
	3 panels		2	3	1,5/m ²	1,8/m ²
	4 panels		3	4	2/m ²	2,4/m ²
	≥5 panels		4	5	2,5/m ²	3/m ²

Defects smaller than 0.5 mm are taken into consideration and assessed during the Visual Assessment of Insulating Glass Unit

During the Visual Assessment of Insulating Glass Unit, contamination in the inter-pane space of a glass unit is considered a spot/ linear defect.

Other residue from the production process - should be considered a spot/ linear defect.

Defects on the outside of the unit which may be created after the glass unit has been delivered may not be reported as a complaint under warranty. External scratches are scratches detectable under the nails.

Other defects

Disturbed homogeneity of the surface and staining, such as scratches, large cracks, lines, residue, prints, marks and contaminants on the frame etc. are only allowed if they do not disturb visual perception (looking through the glass).

Water condensation

1. Inside rooms. Condensation on the surface of the glass inside a room is caused by the presence of warm, moist air locked inside the building. This indicates a problem in the structure of the building itself and a need to ensure better ventilation - condensation on the glass is a sign of the problem, not a defect.

2. Condensation between glass panels. Presence of condensation between glass panels indicates that the glass unit is not airtight; it is a defect of the glass unit.

3. Condensation outside. Condensation on the external side of the glass is a positive indication of the insulating properties of the glass unit. It is not a defect of the glass unit.

4. Condensation patterns. Patterns appearing on the glass surface as a result of condensation/ humidity are known as “condensation patterns” and do not indicate a defect of the glass. They are created due to the presence of microscopic silicone residue on the glass surface, which breaks down over time.

If a new glass unit is fitted next to an old unit, the age of glass surfaces in the unit will be different, so condensation/ humidity may create different patterns of their surfaces.

Roller imprint (only in case of toughened glass). The rollers in the furnace may also create a slightly uneven surface of the glass. According to the EN 572 standard, the maximum deflection (undulation) may amount to 0.3 mm/ 300 mm.

Rollers wave (only in case of toughened glass). The rollers in the furnace may also create a slightly uneven surface of the glass. According to the EN 572 standard, the maximum deflection (undulation) may amount to 0.3 mm/ 300 mm.

Glass mismatch for single-chamber units max. 2 mm, for two-chamber units max. 4 mm.

Unit thickness tolerance

Product type	Thickness tolerance
2-pane unit (annealed float glass)	± 1,0 mm
2-pane unit with at least one heat-treated or laminated panel	± 1,5 mm
3-pane unit	± 2,0 mm

Cracked glass. / External defects / Dents / Cracks and chemical defects on the external surface of the product which may be created and appear outside the manufacturing facility - are not covered by the warranty and such complaints are not accepted.

Thermal cracking. Cracks caused by thermal tensions which appear in case of sudden changes of temperature of the glass. The risk of thermal cracking increases if the glass is fitted in partially shaded areas, if the glass serves as a support structure (for posters, furniture), if curtains are fitted, if plastic film is applied or if heaters of air conditioning units are directed straight at the glass. Thermal cracking may also appear if glass delivered on racks is subjected to strong sunlight - such cases are not covered by the warranty.

Glass panels which have not been fitted in the windows yet (resting on racks) cannot be stored in direct sunlight.

IMPORTANT!!! Glass is protected with security strips only while in transport. After unloading the glass, loosen the security strips.

Fogging. In certain lighting conditions and when looking from certain angles some coating or laminated products may create a fogging effect (unclear, somewhat dusty appearance). It is not a defect of the glass.

Colour differences. Colour differences between neighbouring glass panels in a unit are acceptable provided that they meet the GEPN/P criteria (www.glas-sforeurope.com) which relate to measuring and assessing the colour of coated glass used in buildings.

Recommended cleaning practices. Use gentle, non-abrasive glass cleaning agents. Apply the solution evenly onto the glass surface using a sprayer bottle, a clean brush, a non-abrasive cloth or a non-abrasive sponge.

Wipe off the cleaning solution from the glass surface with circular movements, applying light to moderate pressure. Immediately rinse the glass with plenty of clean water and remove the entire cleaning agent from the glass surface.

Dry the glass surface using a clean, non-fraying cloth or a window squeegee.

Exercise extreme care not to allow any contact between the glass surface and metal components of glass cleaning tools, such as blades, and ensure that there are no abrasive particles between the cleaning tools and the glass surface.

If residue is still present on the glass, repeat the steps above.

Do not use abrasive cleaning agents, scrubbers or any other sharp materials to clean the windows and the areas around the frames.

Complaints:

Minimum requirements for submitting a complaint:

- Completed complaint form,
- Photo of the whole unit,
- Photo of the defect /preferably also showing a ruler/measuring tape (this is obligatory for spot defects)/,
- Photo of the label or description on the frame (if the required details are not included in the complaint).

More information can be found in “General T&Cs of Sale” available on glassolutions.pl or you can contact our Technical Advisor/ Sales Agent.

NOTES



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More information can be
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and Conditions of Sale
available on
www.glassolutions.pl