

QUALITY CRITERIA

FOR INSULATING GLASS UNITS



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 EN1279:2018. 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.

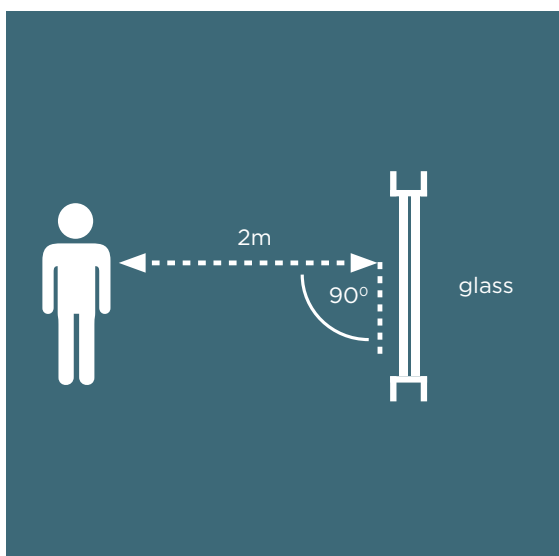
The EU Standard (EN 1279:2018) is the prevailing standard which sets out obligatory requirements and provides criteria for visual assessment of insulating glass units. The European Harmonized Standards (hEN) such as hEN 572 - float glass / hEN 096 - coated glass / hEN 12150 - toughened glass and hEN 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. Criteria inside this booklet are the same or better than these defined in EN1279:2018.

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

Conduct visual assessment according to EN1279:2018

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



During the visual inspection you need to be looking through the glass rather than at the glass. If a defect is not visible while looking through the glass from the specified distance, 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.
We look through the glass, not at 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 2 m 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.



Example toughened glass marking.

Safety glass marking

The individual panes certified as safety glass are marked accordingly - on the surface or edge of the glass. GLASSOLUTIONS do not guarantee 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.

Concavity and convexity Insulating Glass Unit

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. Such behavior is described in EN1279-1: G.5

In case insulating glass units are mounted in the location over 700 meters above the sea level or if the difference between Glassolutions production site and location where insulating glass unit is mounted is above 500meter, it is strongly advised to make pressure compensation. It will limit an effect of concavity and convexity and also will limit risk of glass breaking.

Toughened (Toughened = Tempered) glass may also present some optical and color distortion in the reflection, much more visible than on the Insulating Glass Units which possess only annealed glass. Such distortion are natural phenomenon and cannot be assessed as defect.

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 an 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, colorful 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 neighboring glass units may create acceptable visual effects.

If laminated glass is used within Insulating Glass Unit, there is possible appearance of Moire Effect which is kind of optical waving effect, which cannot be assessed as defect.

Optical assessment of glass should be performed according to EN572-2

Roller imprint. (only in case of toughened glass). Toughening (tempering) process is always linked to usage of tempering furnace where glass is placed on the rollers. It can results with the slight imprints, much more visible on the thicker types of glass. Such effect is natural.

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.

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 considered as a defect of the glass.

Anisotropy. Insulating glass units which contains toughened (tempered) glass can present effect of anisotropy. Effect is described in EN12150-1, EN1836-1.

Colour differences. Colour differences between neighboring glass panels in a unit are acceptable provided that they meet the ISO 11479-2 which relate to measuring and assessing the colour of coated glass used in buildings.

Georgian Bars

Due to the 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 qualify 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 discolorations 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 and knocking sound. Georgian bars and muntins need to be manufactured with positioning tolerance of +/-2mm with regards to the Insulating Glass Unit frame.

In case of shaped glasses or the glasses produced based on the templates received, the tolerance can increase to 10mm

In case if Triple glazing and Georgian bars presence in both chambers position between them can be with tolerance of $\pm 4\text{ mm}$

In case of Georgian bars mounted with inclination (example 30o) due to hand-made character tolerance can be up to $\pm 5\text{ mm}$

Frame Positioning

In triple glass unit, frame position tolerance between both frames can be up to $\pm 2\text{ mm}$. In case of shaped glasses or the glasses produced based on the templates received where the hand-made moulding of frames is used, tolerances for such are increased to $\pm 5\text{ mm}$

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:

Defects definition according to EN1279:2018

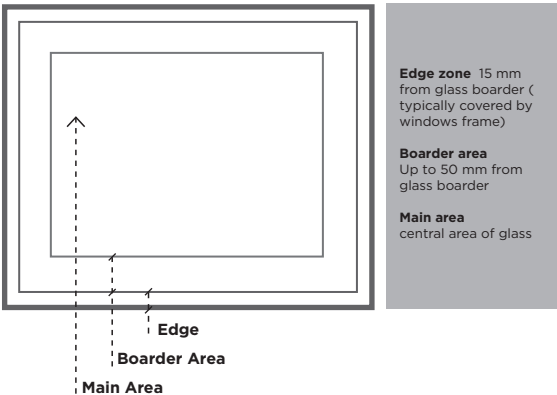
Attention !!! Defect not visible from 2 meters is not considered as defect.

Point defects – spherical, hemi-spherical distortion, visible during looking through the glass. It can be defect in form of solid body, bubbles, lack of coating or defect on laminated glass.

Inner dirt – foreign material present on the glass surface, for of point defect or patch, also inside Insulating Glass Unit.

Spot / Stains – defect bigger than point defect and inner dirt, typically with irregular shape and blur surface (example: fingerprint).

Line defect - defect where one of the dimensions is much bigger than other dimension. Example of line defect is: scratch.



ALLOWED POINT DEFECTS AND BUBBLES					
Size of the pane S (m2)					
Zone	Defect size (excluding halo) (Ø mm)	S ≤ 1	1 < S ≤ 2	2 < S ≤ 3	S > 3
Edge	All sizes	No limitation			
Boarder area	Ø ≤ 1	Accepted if less than 3 in each area Ø ≤ 20 cm			
	1 < Ø ≤ 3	4	1 per meter of perimeter		
	Ø > 3	Not allowed			
Main area	Ø ≤ 1	Accepted if less than 3 in each area Ø ≤ 20 cm			
	1 < Ø ≤ 2	2	3	5	5 +2/m2
	Ø > 2	Not allowed			

ALLOWED NUMBER OF SPOTS AND STAINS			
Pane area S (m2)			
Zone	Defect size (excluding halo) (Ø mm)	S ≤ 1	S > 1
Edge zone	All	No	No
Boarder area	Spot Ø ≤ 1	No	No
	Spot 1 < Ø ≤ 3	4	1 per m of parimeter
	Stain Ø ≤ 17	1	
	Spot Ø > 3 Stain Ø > 17	Maximum 1	
Main area	Spots Ø ≤ 1	Maximum 3 in each area of Ø ≤ 20 cm	
	Spots 1 < Ø ≤ 3	Maximum 2 in each area of Ø ≤ 20 cm	
	ZSpots Ø > 3 Stains Ø > 17	Not accepted	

EN 1279-1:2018

Area	Allowed defects
Glass Edge	Damage and chips/ dents on the edges which do not affect the strength of the glass (EN1279- 1:2018 F.6).
	Internal chips or dents / flash without loose chips which have been filled with a sealant/ butyl.
	Spot , internal defects and inner scratches.
Scratches and line defects	Hairline scratch (scratch with ≤ 0,2 mm), normally not seen during inspection predicted in EN1279:2018 are allowed if not in clusters.
	<ul style="list-style-type: none"> Cluster – more than 3 defects in the circle of the diameter of 20 cm. Scratches and line defect on the width from 0,2mm to 1mm should be assessed as follow.. Scratches with the width above 1mm are assessed as point defects. Main area – single scratch / line defect – max 15 mm; sum of scratches / line defect in IGU - max 45 mm. Board area – single scratch / line defect – max 30 mm; sum of scratches / line defect in IGU - max 90 mm.

Frames and Georgian Bars

Typically such defects are present on the area covered by the Windows frame and should not be assessed according to EN1279:2018

Butyl creep – max size 5mm above frame face level (including waviness) . Butyl creep does not affect the strength of the glass nor the airtightness of the glass along the edge

Spot / point defects visible on the frames and visible parts of Georgian bars – max size 3mm.

Molecular sieve grains on the frame cannot be in cluster. Cluster is more than 4 balls on the 20 cm distance.

Slight scratches and abrasion on aluminum frames are allowed .

Other types of defects on frames like: scratches/ marks / stains / spots / fingerprints / roller marks / butyl marks etc. – not visible from 2 meters with the inspection predicted in EN1279:2018 are allowed.

Defects smaller than 0.5 mm are not taken into consideration and assessed during the Visual Assessment of Insulating Glass Unit.

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

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.

Visual assessment of IGU containing special glasses, ornament glasses as well as tempered / toughened glass as well as other aspects of such glasses should be performed taking into consideration respective to these products norms.

Other defects

Water condensation

External condensation from room or environment side can be detected by whipping out glass surface by dry cloth.

- 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

Thickness tolerances for IGU EN1279-1:2018

IGU Type	Thickness tolerances
IGU with 2 glasses (DGU) 2x annealed float	$\pm 1,0$ mm
IGU with 2 glasses (DGU) at least one glass tempered or laminated	$\pm 1,5$ mm
IGU with 3 glasses (TGU) 3x annealed float	$\pm 1,4$ mm (annealed float)
IGU with 3 glasses (TGU) at least one glass tempered or laminated	+ 2,8 mm / -1,4 mm

Dimension tolerances EN1279-1:2018

According to EN1279-1:2018 point 6.3.2

Single or double chamber IGU (insulating glass units)	Width and height tolerance of IGU	Tolerance of mismatch
All IGU where glass thickness is below 6mm and width and height is smaller than 2000mm	± 2	≤ 2
All IGU where thickness glass has from 6 to 12 mm or the width and height is between 2000 and 3500mm	± 3	≤ 3
IGU where width or height is between 3500 and 5000 mm and thickest glass is below 12mm	± 4	≤ 4
IGU where width or height is at least 5000mm or thickness glass is above 12mm	± 5	≤ 5

For the shaped glasses tolerance is ± 5 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.

Spontaneous cracking of tempered glass. Naturally in each glass, the contamination of nickel sulphide contamination it is present. It is harmless when using annealed glass. Nickel sulphide in glass is extremely rare, but in some cases it can lead to spontaneous cracking of tempered glass during its use. To reduce the risk of such a crack, it is recommended that the tempered glass be treated with an additional HST process (Heat- -Soak-Test), which tests the glass for the presence of nickel sulphide

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 motion , 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 awindow 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

ECLAZ

SOURCE OF LIGHT AND WELLBEING



ECLAZ is the new generation of Saint-Gobain Low-E glass for high end Glazing Units. Produced by an industrial breakthrough technology, ECLAZ comes on top of highly recognized Saint-Gobain Planitherm® range.

BUILDING GLASS POLSKA

UNDERSTAND THE DRIVERS OF COMFORT AND ENERGY EFFICIENCY

The energy efficiency of a window is not only defined in terms of thermal insulation, it also includes solar gains. Such a balance determines the energy efficiency of a window, but also contributes to occupants wellbeing.

■ Natural light

Recent studies show key contributions of natural light in mood, productivity and even the quality of sleep.

■ Thermal insulation

Management of heat loss, through efficient windows, allows up to 20% saving on energy bill while reducing cold wall sensation.

■ Solar gains

Heat transmission from the sun represents a free energy source. It also contributes to winter comfort of the occupant.



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