Criteria for quality assessment of glass products manufactured by Pilkington IGP Sp. z o.o.

1. General provisions

Following we present information to explain the correct procedure to control and assess the quality of glass delivered by Pilkington IGP Sp. z o.o. with acceptable tolerances for glass manufacturing and phenomena that may occur while using the products. The collected information shall be useful in answering the questions about the quality of the glass that may arise before, during and after the installation of the glass.

The described principles of assessment result directly from the applicable European standards for types of glass and base on rules used for many years on the European market.

Generally, the quality parameters declared below by Pilkington IGP Sp. z o.o. ensure higher standard of the product compared to the standard and market requirements.

The given amounts, sizes and types of all acceptable defects refer only to standards products of Pilkington IGP Sp. z o.o.

In the case of products for special applications (fireproof, bulletproof, anti-burglary, safe, structural, enamel coated, with additional internal elements such as bars, blinds, etc.) - other assessment criteria may apply, resulting from the characteristics of the product and the materials used.

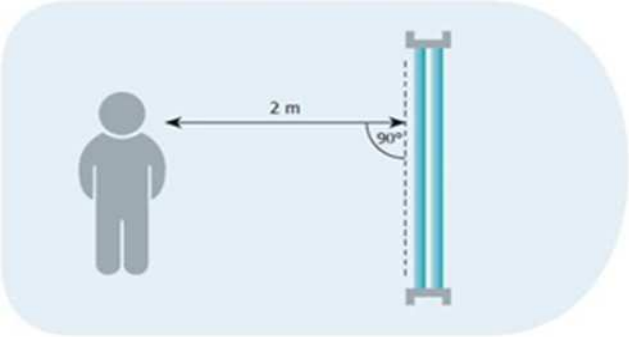
If the quality requirements of the Buyer are different than those specified in these Criteria and in the standards specific to the product, Pilkington IGP Sp. z o.o. shall confirm such deviation before proceeding with the contract.

The presented method of glass assessment is also a basis for evaluation of the justifiability of submitted complaints.

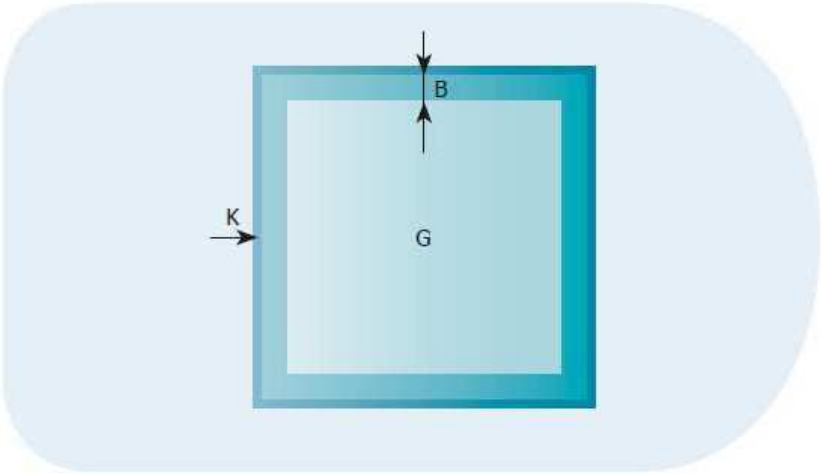
In accordance with the "General Terms and Conditions of Contracts Pilkington IGP Sp. z o.o. " and "General Terms and Conditions of the Standard Warranty for Insulating Glass Units Manufactured by Pilkington IGP Sp. z o.o." the Buyer is obliged to record in the Delivery Acceptance Protocol any observed scratches, breaks or cracks of the insulating glass unit and/or individual glass units. Lack of such remarks in the Delivery Acceptance Protocol may cause rejection by Pilkington IGP Sp. z o.o. of possible complaints and other claims arising from such defects. The Buyer shall test the quality of delivered products within 14 days of their delivery, before further processing.

2. Method of assessment the quality of insulating glass and single glass units

The defects are assessed by looking through the glass at a right angle, with the glass in vertical position and bright diffused lighting. The assessment is performed from min. 2 m distance, on a solid grey background or against a cloudy sky. Only product defects, visible in these conditions, are assessed for compliance with the requirements specified by Pilkington IGP Sp. z o.o.



For the purposes of glass quality assessment, the glass surface is divided into three conventional areas: edge (K), border (B) and main (G).



K = 15 mm (zone that in most cases is covered by window frame)
B = 50 mm (edge area)
G = central area of the glass

3. Acceptable tolerances of insulating glass and single glass units

3.1. Acceptable defects visible from 2 m

Defect name	K Edge area (15 mm)	B Border area (50 mm)	G Central area of glass
Hair-scratches	**acceptable, without limits**	**acceptable but not accumulated**	
Scratches		**scratch ≤ 30 mm acceptable, the total length of the scratches ≤ 90 mm**	**scratch ≤ 15 mm acceptable, the total length of the scratches ≤ 15 mm**
Point defects Ø (mm)			
Ø ≤ 0,5	**acceptable, without limits**	**acceptable**	
0,5 < Ø ≤ 1,0		**acceptable, not accumulated**	
1,0 < Ø ≤ 2,0		**1 pc/lm for each side of the glass**	**2 pcs/m² max. 5 items**
> 2,0		**not acceptable**	

3.2. Acceptable tolerances for insulating glass dimensions and thickness

Parameter	Acceptable tolerance
Dimensions	**+2,0 / -1,0 mm**
Thickness	**±1,0 mm (annealed glass)** **±1,5 mm (toughened glass, laminated glass)**
Diagonal difference	**< 2 mm/m**
Glass displacement	**< 2,0 mm**

3.3. Other defects

Glass dirt

Except for the edges area, dirt inside of product visible from a 2 m distance, larger than indicated in the table of defects, is not accepted.

Chipping, dents, edge damages

On not-treated glass edges, damage is allowed up to 2 mm and 20% of the glass thickness, and individual chips are accepted up to 6 mm. Cracks, even small ones - are unacceptable and should be reported on delivery protocol.

Spacer bars faults

The internal surfaces of the spacer bars should be free of stains, spots visible from a 2 m distance. In standard insulating glass, the distance of spacer bar to the edge of the glass shall not exceed 15 mm. The distance of the bars to each other or to the edge of the glass should not vary by more than 2 mm for a given side of the glass length. Deviation from the straightness of the spacer bar shall not exceed 2 mm.

Defects related to Georgian bars / Sprossen

The decorative bars installed inside the insulating glass may show vibrations and sometimes cause noticeable clicking noise. Depending on the type of decorative bar and technical possibilities, small transparent silicone elements are attached in the connection points of the bars, which dampen vibrations and knocking sound. In the case of strong external vibrations transmitted to the glass (e.g. passing a heavy car) or by opening/closing windows and doors, these protections may be insufficient to full eliminate the knocking sound.

Unsealing

Unsealing is a defect of the insulating glass unit consisting in the loss of internal tightness of the insulated glass chamber. Such defect is signalled by visible (permanent or periodic) fogging inside the insulated glass, as well as accumulation of water in the bottom part of the cavity.

The tightness guarantee granted by Pilkington IGP Sp. z o.o. for insulating glass units covers only such cases when the loss of tightness is caused due to defective manufacturing of product or material defects in the delivered insulated glass, if those defects were caused by Pilkington IGP Sp. z o.o.

4. Physical phenomena associated with the using of insulating glass units, which are not caused by the poor quality of the product

Thermal cracks

Cracks caused by thermal stress occur in the event of sudden temperature changes of glass surface. The risk of thermal cracks increases when blinds, adhesive foils are installed, and when radiators or air conditioners are pointing directly at the glass. Thermal cracks can also occur when the glass units are exposed to strong sunlight and high temperatures during transport or storage.

Image distortion in reflected light

After the insulating glass unit is manufactured, natural changes in outside temperature and air pressure increase or decrease the gas pressure inside the unit. The reaction to these changes of internal pressure may be the convex or concavity of the glass surface. Such deflection of glass surface may be notices as distortion of the reflected image.

In extreme cases, too high pressure inside the insulating glass may result in self-breakage of the component glass. In order to prevent such problems, it is crucial to select the proper glass structure and type of glass used for the anticipated dimensions of the glass and operating conditions.

Moisture condensation / fogging of the outside surface of glass

Moisture condensation / fogging on the outside surface of the glass is a natural phenomenon associated with the position of the glass and very good thermal insulation parameters of the unit (U-value).

The occurrence of such phenomenon confirms the parameters and is not deemed as a defect of the insulating glass. Similar, in such conditions may occur traces of stickers, distance elements which disappear when the glass is dry.

Moisture condensation / fogging of inside surface of the glass

The effect of fogging the inside surface of the glass is caused by too high humidity inside the room and is not deemed as a defect of the insulating glass unit.

Anisotropy / Leopard spots

The anisotropy effect can be observed in toughened glass and in insulating glass units with the toughened glass. During the toughening process, areas with different stresses are generated on glass pane. The stress areas produce the effect of birefringence in glass, visible in polarized light. When observed in polarized light, areas with different stress appear as coloured zones, sometimes called "leopard spots". The effect could be visible for human eyes because lLight polarization may occur also in normal daylight, and the degree of polarization of light depends on the weather conditions and angle of sunlight. The birefringence effect increases when observed at an angle or through polarized glasses. Anisotropy is not a defect but is a visible effect of the glass toughening process.

Fine colour differences of insulating glass units

The facades made of glass units with coatings may present fine, different shades of the same colour. This effect may be strengthened when observing the glass at an angle. Such small differences may by caused by tiny changes in the colour of the ground glass on which the coating is applied and by slight differences in the thickness of the coating itself. The shade difference can be objective assessed based on measurements in accordance with ISO 11479-2.

5. List of reference standards for the quality assessment of glass products manufactured by Pilkington IGP Sp. z o.o.

- For insulating glass: EN 1279-1 "Glass in building. Insulating glass units. Part 1: Generalities, system description, rules for substitution, tolerances and visual quality."
- For toughened glass units: EN 12150-1 "Glass in building. Thermally toughened soda lime silicate safety glass. Part 1: Definition and description."
- For float glass units: EN 572-8 "Glass in building. Basic soda-lime silicate glass products. Supplied and final cut sizes."
- For coated glass units: EN 1096-1 "Glass in building. Coated glass. Part 1: Definitions and classification."
- For laminated glass units: EN ISO 12543-6 "Glass in building. Laminated glass and laminated safety glass. Appearance."
- For heat strengthened glass units: EN 1863-1 "Glass in building. Heat strengthened soda lime silicate glass. Part 1: Definition and description."
- For heat soaked thermally toughened glass units: EN 14179-1 "Glass in building. Heat soaked thermally toughened soda lime silicate safety glass. Part 1: Definition and description."

6. CE marking and Declarations of Performance for glass products manufactured by Pilkington IGP Sp. z o.o.

Each product of Pilkington IGP Sp. z o.o. has a label with the CE marking, identification data, identification number and declared parameters. The product Declaration of Performance shall be downloaded from www.pilkington.com/CE by entering the identification number from the label.

The "Transport, storage, installation, use and maintenance instruction for glass products" is available at www.pilkington.pl.

7. Final provisions

The main intended use of glass products produced by Pilkington IGP Sp. z o.o. is their installation in windows, doors, walls, glued glazing for doors, windows, and walls, in roofs and partitions. Responsibility of Pilkington IGP Sp. z o.o. is limited to delivering the product in accordance with the order, of agreed quality and parameters. Pilkington IGP Sp. z o.o. does not guarantee that the product acquired by the Buyer will be suitable for specific purposes assumed by the Buyer or for use in specific conditions and place, even in a situation where such purpose or conditions may be known or disclosed to Pilkington IGP Sp. z o.o.

16 June 2020

Krzysztof Skarbiński
Quality Director
Pilkington IGP Sp. z o.o.
phone.: +48 601 50 60 51
e-mail: Krzysztof.Skarbinski@pl.nsg.com