

# TECHNICAL TERMS & CONDITIONS OF DELIVERY BG-NFT.

## INTENTION

Overview of the quality requirements and specifications for etched glass products of Berliner Glas Herbert Kubatz GmbH & Co. KG Syrgenstein (in the following Berliner Glas).

Determination of the exact criteria for the definition, classification and evaluation of quality characteristics associated with etched glass products.

## SCOPE

The following technical terms and conditions of delivery apply to single- and double-sided etched glass products of the brand **BG-NFT**.

## DEFINITIONS

### Surface defects

Surface defects are local defects which change the visual quality of the glass. These are point and linear/elongated defects.

Surface defects are for example scratches, chips, chafe marks and punctiform etching defects.

The designation for the number and size of surface defects is specified according to ISO 10110-7.

### Etching defects

Etching defects are areas with a modified etching structure unlike the actual etching.

Etching defects are for example bright (black) and dark (white) bands, unetched (blank) areas/points and defects due to acid inlets.

### Glass defects

Glass defects are defects that result from the manufacturing process of the float glass.

Glass defects are local defects such as bubbles, inclusions and tin spots as well as linear or elongated defects like drawmarks/-scratches and tin lines/-stains on the float side.

The conditions for evaluation of number and size of allowable glass defects are specified within DIN EN 572-2.

## Defect sizes

The definition of defect sizes according to DIN ISO 10110-7 is: defect size [mm] = square root (defect length [mm] x defect width [mm]).

For example, defect size 0.40 mm corresponds to a square with an edge length of 0.40 mm or a circle with a diameter of 0.45 mm.

## Stock sheets and customized sizes

Stock sheets are dimensions which are cut from (split) ribbon sizes for further processing at Berliner Glas.

Pre-cut sizes are dimensions that are cut from (split) ribbon sizes or already further processed products on customer's request.

## GEOMETRY

### Maximum length and width

Glass thickness (mm)	Maximum dimension (mm)	
	single-side etching	double-side etching
1.0–1.3	800x600	
1.6	1,600x640	800x640
2.0–2.6	1,600x1,070	1,600x640
3.0–6.0	1,600x1,070	1,600x1,070

### Tolerances for length and width dimension

Glass product	Thickness (mm)	Edge length (mm)	Tolerance (mm)
Pre-cut	1.0–3.15	≤ 1,000	±0.5
Pre-cut	1.0–3.15	> 1,000	±1.0
Pre-cut	4.0–6.0	all	±1.0
Stock sheet	1.0–6.0	all	±5.0

Further length and width tolerance requirements have to be agreed on in each case.

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## Tolerances for glass thickness

Thickness (mm)	Tolerance (mm)	Thickness (mm)	Tolerance (mm)
1.0	+0.05/-0.15	2.6	+0.1/-0.2
1.1	+0.1/-0.2	3.0	+0.0/-0.3
1.3	+0.1/-0.2	3.15	+0.05/-0.15
1.6	+0.1/-0.2	4.0	+0.2/-0.3
2.0	+0.0/-0.3	5.0	+0.2/-0.3
2.3	+0.1/-0.2	6.0	+0.2/-0.3
2.5	+0.1/-0.2		

## Angular tolerance for pre-cut sizes

Maximum angular deviation:  $\pm 0.10^\circ$

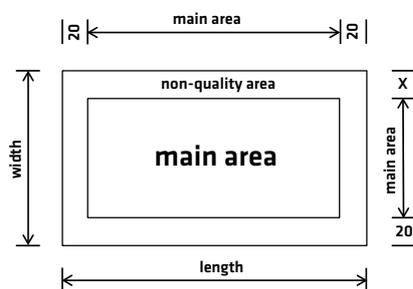
## Measuring equipment geometry

Characteristic	Measuring device
Length/width	Calliper
Thickness	Micrometer
Angle	Angulometer

## QUALITY

### Edge zone for stock sheets

For stock sheets, surface and glass defects (with exception of fracture causing edge defects) as well as deviations of optical properties within a circumferential edge zone (=non-quality area) are unrestricted admissible. The width of the edge zone is 20 mm on the lower edge and on the sides, on the upper edge it depends on the height of the panel.



Glass height (mm)	Width of edge zone x (mm)
> 800 to 1,070	70
> 640 to 800	40
up to 640	20

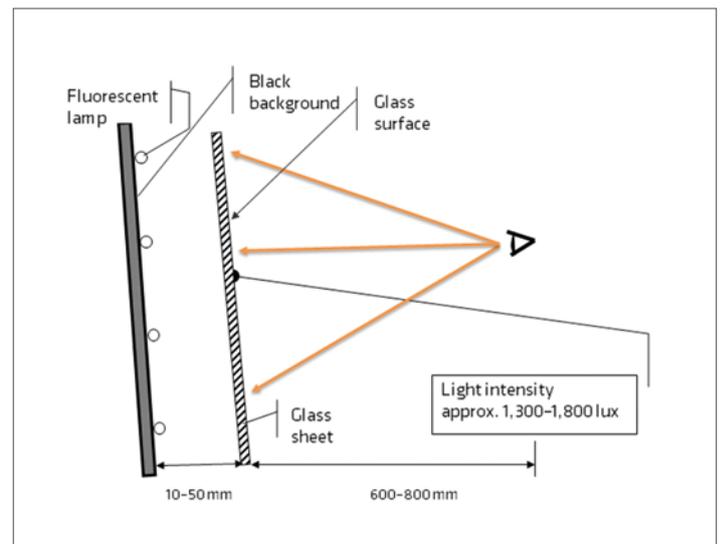
## Conditions of evaluation

The inspection for surface and glass defects is performed under the following conditions:

	Description
Inspection equipment	naked eye
Inspection in	Transmission
Lighting	Rear illumination with four fluorescent lamps with a length of 1,200 mm, arranged one above the other at a distance of 350 mm in front of a black background at the washing machine outlet.
Light intensity	Intensity of illumination 1,300-1,800 lux
Incidence angle of light	85-90° to the evaluating area
Evaluation side	blank or etched side
Evaluation angle	40-90° to the evaluating surface
Evaluation time	The inspection time for the entire area is about ten seconds.
Evaluation distance	600-800 mm from the glass surface

Basically the following applies: all errors and discrepancies which are not identified according to the given conditions and within the given time will be ignored.

## Schematic test assembly



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## Surface defects

Area up to m <sup>2</sup>	Permissible point defects max. number x max. defect size (mm)	Permissible scratches max. number x max. scratch width (mm)/ cumulated length (mm)
0.04	1 x 0.63	2 x 0.063/5
0.16	2 x 0.63	2 x 0.10/10
0.36	3 x 0.63	3 x 0.10/15
0.64	4 x 0.63	4 x 0.10/20

The following numbers and sizes of surface defects are permitted in the main area of stock sheets and on the whole area for pre-cut sizes:

- ▶ Defect sizes  $\leq 0.25$  mm will not be regarded
- ▶ Point defects and scratches are cumulative, i. e. point defects and scratches are allowed together
- ▶ No accumulation of surface defects allowed, definition according to ISO 10110-7
- ▶ Removable residues (dust, paper marks etc.) will not be considered as a defect

Further demands on surface quality have to be agreed on in each case.

## Edge defects

For pre-cut sizes, edge damages of a maximum length x width x depth of 2 mm x 1 mm x  $\frac{1}{3}$  glass thickness are permitted.

Fracture causing edge defects are not permitted.

## PROPERTIES

### Gloss measurement

For the measurement of the gloss values, Berliner Glas uses only measurement devices of the type BYK micro-TRI-gloss of the production series 4430 i. e. 4446. The measurement can be performed under an angle of 20°, 60° or 85° (measurement device geometry).<sup>1</sup>

For the gloss measurement, the glass sheet has to be placed on a black, non-reflectant background (black felt is used at Berliner Glas) with the etched side facing frontwards. The measurement device is placed on the glass at an angle of 45° to the outer edges inside the main area.

<sup>1</sup> If using other measurement devices, there can be distinct deviations in the measured gloss values

## Tolerances gloss values

Product	Tolerance GL 60° in main area
NFT GL 70–135 single-sided etched	±5
NFT GL 60–110 double-sided etched	±5

Further demands on gloss values and their tolerances have to be agreed on in each case and can lead to an enlarging of the edge zone.

## Further optical characteristics

Besides the gloss values, further optical and mechanical parameters (like roughness, haze, clarity, transmission, sparkling) can be determined on customer's demand.

Based on the raw materials, glass products have characteristic colors, these become more evident with increasing glass thickness. Therefore different color appearance is possible for the same products.

## WARRANTY

In terms of warranty, please pay attention to our delivery and payment conditions – point 11.

## Return of rejected goods

For the assessment of complaints, Berliner Glas can request the entire disputed goods from the customer.

The redelivery costs go at the expense of Berliner Glas. The customer has to ensure proper packaging so that the goods may not be damaged on the backhaul. Unauthorized complaints will be returned to the customer and partial transportation and sorting costs will be invoiced.

## Storage conditions

The storage of refined glass products has to be done properly, as is common in the glass industry. This includes in particular the prevention of moisture and temperature changes. Berliner Glas is not liable for damages caused by improper storage.