

Guideline to Assess the Visible Quality of Enamelled or Screen-printed Glass, produced by company Pilkington IGP Poland

1. Scope

These guidelines apply to assess of visual quality of completely or partially enamelled or screen-printed glasses, produced by Pilkington IGP.

Both enamelled and screen-printed glasses are produced by burning inorganic colours on glass surface on temperature 620 – 650°C.

Pilkington IGP offers two main types of enamelled or screen-printed glass:

- toughened safety glass, with or without “heat soak” test
- heat-strengthened glass

General, **enamelled glass is intended to use as cladding, to cover walls or facades, and is observed only in reflection light.**

Screen-printed glass is intended to use both as cladding, and as typical glazing, with viewing of both sides of glass.

The enamelled or screen-printed side of glass must always be the side turned away from the weathering and cleaning /position # 2 or higher/.

Exceptions are permissible only after prior consultation with the manufacturer.

Applications, with viewing of both **sides must always be agreed with the manufacturer**, since enamelled glass is generally **not** suitable for backlit applications.

2. Testing

The visual quality of enamelled glass is checked at a distance of at least 3 meters, in front of an opaque background.

Screen-printed glass is checked in transmitted light at a distance of at least 3 meters, if intended use is viewing from both sides of pane.

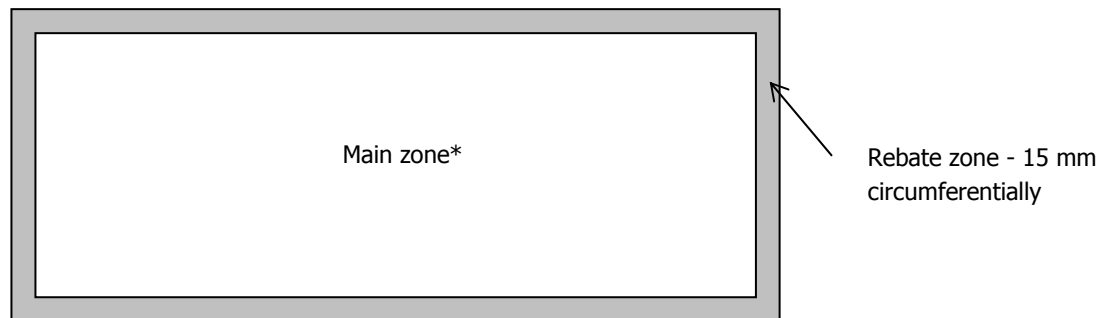
Position of observer should be perpendicular to glass surface, with tolerance +/- 30°.

The test is carried out under diffuse daylight conditions (e.g. overcast sky), without direct sunlight or artificial lighting shining directly on the glass or background.

The glazing units in rooms (indoor glazing) are to be inspected with normal (diffuse) illumination intended for the use of the rooms and at a viewing angle that is preferably vertical to the surface.

Viewing should always be done through the untreated glass side onto the enamelled, screen-printed pane.

3. Allowable Discrepancies for the Visible Quality of Enamelled or Screen-printed Glass Products



* - If information, that glass edges are visible, is placed in order - the rebate zone is omitted and the main zone extends to the edge of the pane.

The requirements to visual quality are given in the following table 1

Table 1

Allowable Discrepancies for the Visible Quality of Enamelled or Screen-printed Glass Products		
Kind of Defect	The following are allowable per unit:	
	Main zone	Rebate zone
Point defects*	max 3 pcs, total surface < 25 mm ²	Width: max. 3 mm, exceptionally 5 mm Length: no limit
Hair-line scratches	to 10 mm in length	permissible / no limitation
Clouds, water spots	not allowable	permissible / no limitation
Rests of enamel on the glass edges	-	<ul style="list-style-type: none"> • permissible with framed panes • not allowable with visible edges

* point defects < 0.5 mm /"pin holes"/ are permissible and are generally not taken into consideration.

Note: Correction of defects in enamel before the tempering process or with organic enamel varnish after the tempering process is permissible. The corrected defects should be not visible from a distance of 3 meters during test according point 2. However,

organic enamel varnish may **not** be used if the glass is further processed into insulation glass and the defect is in the area of the insulation glass sealing edge.

4. Assessing the colour impression

Colour deviations cannot in principle be excluded, since they can occur due to several unavoidable factors:

Type of light in which the object is viewed

The light conditions are constantly different depending on the season, time of day and the prevailing weather. This means that the spectral colours of the light are present in varying degrees in the range of the visible spectrum. The colour of enamel could appear a little different, according to the light source.

Viewers and type of viewing

The human eye reacts very differently to different colours. While a very slight colour difference seriously stands out with blue tones, colour differences with green colours are noticed less.

Other factors are:

- the viewing angle,
- the size of the object
- how closely two objects to be compared are placed to one another
- colour of background and distance to glass surface.

Please note, even if you prepare enamelled glass and screen-printed glass on a base of the same enamel – you could observe deviation of colour impression both glasses, due differ thickness of enamel layer's on glass surface,

5. General comments

- The other characteristics of the products /for example: tolerance of dimension, flatness, mechanical strength/ are conform with the respective European standards:
 - EN 12150-1 for toughened safety glass
 - EN 1863-1 for heat-strengthened glass
 - EN 14179-1 for toughened safety glass with HST.
- Applications enamelled or screen-printed glass **as a part of laminated safety glass** must be checked with the manufacturer. That applies in particular to use of etching tone enamels, since during laminating the optical density of the etching tone can be severely reduced and the effect of the etching tone is preserved only with use on position 1 or 4.

- Special colors, e.g., metallic effect, anti-slip coatings or combinations of several colors can be produced on request. The respective special characteristics or the appearance of the product are to be clarified with the manufacturer.
- Enamelled or screen-printed glass can only be manufactured as toughened safety glass or heat-strengthened glass.

Any further mechanical treatment of enamelled or screen-printed glass is not permissible, for example: grinding, polishing of edges; drilling holes.

- Enamelled or screen-printed glass can be used as monolithic pane or as a part of insulating glass unit. In this case, the respective provisions, standards and guidelines are to be taken into consideration by the user.
- Enamelled or screen-printed glass can be heat-soak tested /HST/ to reduce risk of glass self-breaking. The respective necessity of the heat-soak test is to be checked by the user and disclosed to the manufacturer by putting the order.
- The static parameters of enamelled or screen-glass are lower at non-printed or non-enamelled equivalent glass.

Note: a document has been prepared on a base of "Richtlinie zur Beurteilung der visuellen Qualität von emaillierten und siebbedruckten Gläsern" done by Bundesverband Flachglas Grosshandel, Isolierglasherstellung, Veredlung e.V., Fachverband Konstruktiver Glasbau e.V.; March 2002

March, 2011

Krzysztof Skarbiński

Quality Manager Pilkington IGP Poland
mob. +48 601 50 60 51
e-mail: Krzysztof.Skarbinski@pl.nsg.com