Annex 20: Visual deviations in quality in insulated glass units

Quality assessment

As the European Standard for Insulated Glass Units, EN 1279-1, has not stipulated rules for evaluating deviations in the quality of insulated glass units, the following requirements and exemptions apply to glazing unit manufacturers supplying glazing units to DVV-certified window manufacturers.

Requirements to purity and quality of glass

Glass is an industrial product which, among other things, consists of lime, silica, and soda. Despite careful purification of the raw materials, minor impurities and scratches will – in rare cases - occur in the glass on the inside of the glazing unit (cf. table page 3).
Butyl from double sealing is permitted max.. 2 mm into the unit from the spacer profile..
Complaints concerning impurities in glass will be evaluated according to the below procedure on the basis of which it will be decided if they are immaterial i.e. inherent in the material and as such not covered under the warranty – or if they are so material as to qualify for a replacement of the glazing unit.

Assessment criteria

Glazing units, cf. Annex 21, must be assessed from the inside at a min. distance of 2 m in diffuse daylight (e.g. a cloudy sky) with no direct sunlight or artificial light. Irregularities that are not visible from a distance of 2 m are not considered as defects.
When checking reflection the distance from the outside must be at least 5 m..

Glazing units with coated glass

Coated glass may contain pinholes (small round spot with no coating) which is a phenomenon that may occur from manufacturing.
The assessment criteria for pinholes is shown in the table on p. 3.
Assessment critieria in connection with reflection: shades, differences in nuances, and distortion of reflection are accepted.

Patterned and wire glass

Distortions in the pattern are considered acceptable deviations. Deviations in wire parallism may appear in wire glass.

Colour shades in glass

Standard window glass as used in glazing units is commonly perceived as being completely clear, but it is actually green. The very own colour of the glass reduces the light transmittance.
Two pieces of glass of the same type but of different thickness may therefore be perceived as having different shades of colour.
With coated or body-tinted glass this becomes even more clear.
The fast development in new types of glass may, however, make it difficult to obtain glass of a quality similar to that of existing glazing units.
Even with coated or body-tinted glass produced by the same manufacturer and to the same specifications but at different plants, there may be minor differences in nuances.

The below do not qualify for a complaint:

- interference phenomena (Brewster Stripes)
- double glazing effect
- anisotropies
- condensation on external glass pane areas
- formation of marks on glass surfaces
- misting

Interference phenomena (Brewster Stripes)

Appear as irregular rainbow-coloured stripes. Usually they are visible only when looking out the window at an oblique angle. Another characteristic feature is that the stripes may ”wander” when a slight pressure is applied to the glass pane. The phenomenon appears in glass panes manufactured in floatglas due to the extremely good flatness of the glass.
Daylight is composed of a large number of colours, which may be shown by transmitting a beam of light through a prism which will cause the light to split into the spectral colours.
When beams of light pass through glass, irregularities in the glass will result in either a shorter or a longer time of passage of the light. The phenomenon is seen only in insulated glass units with floatglass and can be ascribed to the extreme flatness of the glass, which is on a scale of the wavelength of light and that daylight is ”split” into the spectral colours of blue, red, and green.

Double glazing effect

Because of the edge seal, insulated glass units hold an amount of contained air/gas the state of which is essentially determined by the barometric air pressure and the air temperature at the production site. Installation of insulated glass units at other altitudes and at changes in temperature and variations in the barometric air pressure (high and low pressure) will inevitably cause concave or convex deflections in individual glazing panes and with that also optical distortions.
Multi-glass reflections may appear at different strenghts on the surfaces of insulated glass units. These reflections may be intensified e.g. with a dark background of the glazing unit or in coated glass panes. This phenomenon is a physical law which applies to all insulated glass units.

Anisotropies

Anisotropies is a physical effect in heat-treated glasses caused by the internal stress distribution. Depending on the visual angle, it is perceived as dark, coloured rings and stripes at polarizing light and/or viewing through polarizing glass. Polarized light is present at normal daylight. The extent of the polarization depends on the weather and the solar altitude/angle.
The phenomenon is visible primarily at a low visual angle or at glass facades forming an angle with each other.

Condensation on glazing areas

Inside: Occasionally, formation of mist on insulated glass units is seen on the side facing the room. This may be due to excessive humidity, a poorly insulating glazing unit, or an unheated room. Energy-efficient glazing units offer a higher internal surface temperature and minimized misting.
Outside: Due to their good insulating properties, energy-efficient glazing units have a lower temperature on the external glass surface. At special weather conditions this may cause mist on the external side of this type of glazing unit.

Formation of marks on glazing surfaces

The moisturization on the exterior glazing surface of insulated glass units may be uneven due to different sources leaving their imprints such as rollers, fingers, labels, vacuum suction apparatus, sealants, glazing materials, gliding materials, or environmental impacts.

Misting

Misting is seen as a greyish surface resulting from chemical influence arising from incorrect storage in a damp environment.
In concrete buildings, chemical influence may occur as a result of alcaline washout of substances which get in contact with the glass surface.

Definitions of rebate, edge, and inner zone for glazing units and glass

When assessing optical quality the entire visible glass surface must be viewed.
Assessment of visual quality must be made on the basis of the above division in zones.

Permissible visible irregularities in glass

How to interpret the below table:
As practically all insulated glass units are basically constructed from clear glass, they are rated on the basis of the criteria in the marked boxes along with the criteria mentioned for other types of glass which may have been used for constructing the unit.

	CLEAR INSULATED GLAZING	**WITH COATED GLASS**
REBATE ZONE	Outer crushed edges or chippings. Inner chippings filled with joint sealant. Residue and numerous scratches.	
EDGE ZONE	**Pores, spots, discolouration etc.:** Pane area: <1 m^2 max. 4 of <3 mm Ø. Pane area: >1 m^2 max. 1 of <3 mm Ø per running metre edge length. **Scratches:** Max. 30 mm x 2 mm per individual length. The sum of individual lengths max. 90 mm. **Hairline scratches:** No limit, however not piled up.	**Pinholes:** Ø 1 mm – 1.5 mm 5 pinholes/200 mm Ø >1.5 mm not permitted.
INNER ZONE	**Pores, spots, discolouration etc.:** Pane area: <1 m^2 max. 2 of <2 mm Ø. Pane area: >1 m^2 and <2 m^2 max. 3 of <2 mm Ø. Pane area: >2 m^2 max. 5 of <2 mm Ø. **Scratches and hairline scratches:** As for edge zone.	**Pinholes:** Ø 1 mm – 1.5 mm 2 pinholes/m^2 Ø >1.5 mm not permitted.
	LAMINATED GLASS	**COATED LAMINATED GLASS**
EDGE ZONE AND INNER ZONE	1. The frequency of permissible visible defects in edge zone and inner zone is increased by 50 % per additional layer of glass. 2. Cast laminated glass units may show waves resulting from the production.	Cf. box for coated glass.
	HEAT-TREATED GLASS	**COATED HEAT-TREATED GLASS**
EDGE ZONE AND INNER ZONE	Cf. EN 12150	Cf. box for coated glass.