Quality guideline VETROGARD®

1 INTRODUCTION

This guideline applies for the laminated safety glass VETROGARD® and for insulation glass made using it. VETROGARD® is a product made of several combined components (glass, coatings, plastics) each with type-specific properties, which may deviate in terms of through-view compared with other flat glass products.
VETROGARD® is generally subject to EN ISO 12543, EN ISO 1279 and EN ISO 14449.
Permitted deviations to the relevant product standards are specified in this document.
For special structures, the relevant base standards apply for the panes used, e.g.: Coated glass, EN 1096-1.

2 SCOPE OF APPLICATION

This guideline is used to assess the quality features of VETROGARD®.
The assessment is made in accordance with the testing principles described below.

3 TESTING

In testing, the through-view onto the glazing unit is the generally applicable criterion. The discrepancies may not be specially marked. The glazing units are to be tested in accordance with the table in section 4 from a distance of at least 2 meters, and at a viewing angle which corresponds to the normal usage of the room. The test is carried out under diffuse daylight conditions (e.g. overcast sky), without direct sunlight or artificial light. The glazing units in rooms (indoor glazing) are to be tested in normal (diffuse) illumination intended for the use of the rooms and at the viewing angle that is preferably vertical to the surface. The discrepancies may not be specially marked. Defects ≤ 0.5 mm are not taken into account.
Existing interference fields (corona, glass defects) must not be larger than 3 mm.

4 ALLOWABLE DISCREPANCIES

When evaluating particular characteristics, their specific properties should be noted, e.g.
– Combinations with coated panes, EN 1096
– Material-dependent properties
– Manufacturer- and batch-dependent colour deviations
– Colour differences for patterned glass.
For combinations with toughened safety glass, heat-strengthened glass, patterned glass or plastic panels, the specific characteristics for these products also apply.
However, the manufacturer reserves the right to implement production-related deviations or changes in line with technical advances.

4.1 VETROGARD®

ZONE	The following is allowable:
Rebate zone (R)	R = Rebate zone: The visually concealed area when installed (no limits on discrepancies, with the exception of mechanical damage to the edges) External shallow damage to the edge or conchoidal fractures which do not affect the glass strength and which do not project beyond the width of the edge seal. Internal conchoidal fractures without loose shards, which are filled by the sealant. Unlimited spots or patches of residue or scratches.
Edge zone (E)	The edge zone amounts to 10% of the particular clear width and height dimensions. **Inclusions, bubbles, spots, stains, etc.:** Pane area ≤ 1 m^2: max. 4 cases, each < dia. 3 mm Pane area > 1 m^2: max. 1 case, each < dia. 3 mm per meter of edge length **Residues (spots) in the gas-filled cavity:** Pane area ≤ 1 m^2: max. 4 cases, each < dia. 3 mm Pane area > 1 m^2: max. 1 case, each < dia. 3 mm per meter of edge length **Residues (patches) in the gas-filled cavity:** max. 1 case ≤ 3 cm^2 **Scratches: Total of individual lengths:** max. 90 mm – individual length: max. 30 mm **Hair-line scratches:** Not allowed in higher concentration

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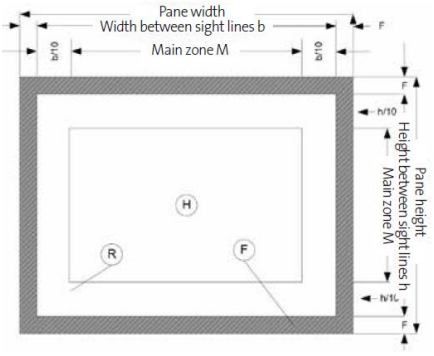
Main zone (M)	**Inclusions, bubbles, spots, stains, etc. :** pane area ≤ 1 m²: max. 1 case, each < 3 mm Ø 1 m² < pane area ≤ 2 m²: max. 2 case, each < 3 mm Ø 2 m² < pane area ≤ 8 m²: max. 1 case, each < 3 mm Ø/m² pane area > 8 m²: max. 1,2 case, each < 3 mm Ø/m² **Lineare fault:** Number of allowable faults ≥ 30mm lenght glass size / number of faults < 5 m² Not allowable 5 – 8 m² 1 case > 8 m² 2 case **Scratches:** sum of the single counts: Max. 60 mm - single lengths: max. 20 mm **Hair-line scratches:** Not allowed in higher concentration
E + M (edge zone + main zone)	Max. number of allowable discrepancies as in zone E. Linear faults measuring less than 30 mm in length are allowable, but grooves and streaks are not. Hair-line scratches are allowable on the entire pane surface (but not in high concentration). A “high concentration” of faults means that at least four discrepancies are located within a circle with a diameter of < 200 mm. This distance is limited to 180 mm for three-layer laminated safety glass, to 150 mm for four-layer laminated safety glass and to 100 mm for five-layer laminated safety glass or more.
General:	Comments: Discrepancies of ≤ 0.5 mm will not be taken into consideration. The optically distorted fields they cause (corona) must not be more than 3 mm. The allowable frequency of discrepancies in zones E and M is increased by 50% per additional glass unit over the above-mentioned values. The result is always rounded up. Undulation may occur due to the manufacturing technology (see p. 5 Tolerances). Depending on the pane thickness and the number of intermediate layers used, the colour rendering effect is slightly influenced. This effect can be significantly reduced by using structures made of extra-white DIAMANT®.



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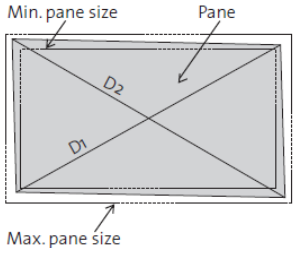
5.1 Measurement and offset

	Tolerances in width or height Element thickness		
Measurement	≤ 26	≤ 40	> 40
≤ *1000 mm*	± 2 mm	± 3 mm	± 4 mm
≤ *2000 mm*	± 3 mm	± 4 mm	± 5 mm
>2000 mm	± 4 mm	± 5 mm	± 6 mm

The individual panes may slide against one another for manufacturing reasons.
The tolerances are within the deviation stated in the abovementioned table.

5.2 Rectangulary

A pane that must be rectangular must be enclosed by a rectangle, whose sides comply with the largest and smallest permissible dimensions.



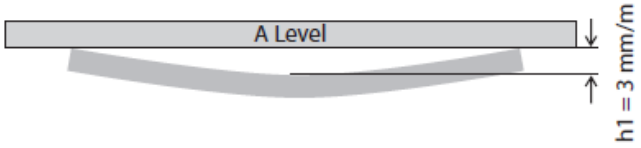
D1 - D2 = max. 2 mm

The rectangularity is verified by measuring diagonals D1 and D2. The absolute difference must not exceed 2 mm.

5.3 General warping

Linearity with reference to the glass edge length (general warping)

Deviations across the levels: Up to 2 mm/linear meter edge length; for square shapes: Up to 3 mm/linear meter edge length.
Measurements with an aspect ratio of ≤ 1:1.3 are regarded as square shapes.



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5.4 Element thickness tolerance

Element thickness	Mono	IGU
≤ 26 mm	+/- 1,0 mm	+/- 1,5 mm
> 26 und ≤ 40 mm	+/- 2,0 mm	+/- 2,0 mm
> 40 mm	+/- 3,0 mm	+/- 3.0 mm

6 EVALUATION OF THE VISIBLE AREA OF THE INSULATION GLASS DEGE SEAL

For insulation glass, features determined by the manufacturing process may be visible on glass and spacer frames in the visible area of the edge seal, and therefore outside the clear glass surface. These features may be visible if the insulation glass edge seal is not covered on one or more sides for design reasons. The permissible parallelism deviation for the spacer(s) to the straight glass edge or to further spacers (e.g. on triple heat-insulating glass) is 4 mm in total for limit edge lengths of up to 2.5 m; for longer edge lengths, the deviation is 6 mm in total. For double-pane insulation glass, the spacer tolerance is 4 mm for limit edge lengths of up to 3.5 m; for longer edge lengths, the deviation is 6 mm. If the insulation glass edge seal is not covered for design reasons, common edge seal features may be visible, which are not related to the guideline's purpose and are to be agreed on a case-by-case basis. Particular frame constructions and edge seal designs for insulation glass require an agreement on the relevant glazing system.

7 GERNERAL INFORMATION

This guideline applies to the assessment of the visible quality of architectural glass units. When evaluating an installed glass product, it is assumed that, in addition to the visual quality, the glass product's features for fulfilling its function are also taken into consideration.
Property values for glass products, such as noise-reduction values, heat-insulation values and light-transmission values, etc., which are specified for the corresponding function, refer to the test panes in accordance with the corresponding test standard to be used. The specified values and optical impressions may change for other pane formats and combinations, or as a result of the installation or other influences.

7.1 Physical characteristics

A range of inevitable physical phenomena that may be noticeable in the clear glass surface is excluded from the evaluation of the visual quality, such as:
– Interference phenomena
– Insulation glass effect
– Anisotropisms
– Condensation on the outer pane surface (condensation formation)
– Wettability of glass surfaces

7.1.1 Definitions of terms

7.1.1.1 Interferenc phenomena

For insulation glass made of float glass, spectral-colour interferences may occur. Optical interference is observed when two or more light waves are superposed when meeting at one point. It can be observed through more or less brightly coloured areas, which change when pressure is applied to the pane.
This physical effect is enhanced by the plane parallelism of the glass surfaces. This plane parallelism ensures through-view without distortion. Interference phenomena occur randomly and cannot be influenced.

7.1.1.2 Insulation glass effect

Insulation glass has an air/gas volume that is enclosed by the edge seal, whose state is essentially determined by the barometric air pressure, the altitude of the production site above sea level and the air temperature at the manufacturing time and place. Installing insulation glass at different altitudes, with temperature differences and fluctuations in the barometric air pressure (high and low pressure) results in inevitable concave or convex curvatures in the individual panes and also optical distortions. Furthermore, multiple reflections may appear on glass surfaces at different intensities. These reflections may be more noticeable if the glazing unit background is dark, for example. This phenomenon is a physical law.

7.1.1.3 Anisotropisms

Anisotropisms are a physical effect on heat-treated glass, resulting from internal stress distribution. Depending on the viewing angle, it is possible that fuscous rings or streaks are perceived in polarised light and/or when viewed through polarised panes. Polarised light present in normal daylight. The polarization level is dependent on the weather and the position of the sun. Double refraction is more noticeable at flat viewing angles or when glass surfaces are positioned next to one another in a corner.

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7.1.1.4 Condensation on the outer pane surface (condensation formation)

Condensation may form on the outer glass surfaces if the glass surface is colder than the surrounding air (e.g. fogged vehicle windscreens).
Condensation formation on the outer surfaces of a glass pane is determined by the U-value, the humidity, the air current, and the interior and exterior temperature.
Condensation forms on the room-side pane surface when the air circulation is restricted, e.g. due to deep soffits, curtains, flower pots, window boxes, blinds, radiators being poorly positioned or a lack of ventilation, among other issues.

On insulation glass with a high level of heat insulation, condensation may form temporarily on the weather-side glass surface if the outside humidity (outside relative humidity) is high and the air temperature is higher than the temperature of the pane surface.

7.1.1.5 Wettability of glass surfaces

The wettability of glass surfaces may be different due to imprints from rollers, fingers, labels, paper residues, suction pads, sealant residues, silicone components, smoothing agents, lubricants or environmental influences. If the glass surface is damp due to condensation, rain or cleaning water, the different levels of wettability may be visible.

7.2 Visual properties of glass products

7.2.1 Inherent colour

All materials used for glass products have raw-material-dependent inherent colours, which may become more apparent the thicker the glass is. For functional reasons, coated panes are used. Coated panes also have an inherent colour. This inherent colour may be noticeable to different degrees in the through-view and/or top view. The colour impression may fluctuate due to the pane's iron oxide content, the coating process, the coating, and changes to the glass thickness and pane structure, and this cannot be prevented.

7.2.2 Colour differences for coatings

An objective evaluation of the colour differences for coatings requires the colour difference to be measured and tested under conditions that have previously been defined exactly (type of glass, colour, type of light). This particular evaluation cannot be the purpose of this guideline. (Further information can be found in the information sheet published by Verband der Fenster- und Fassadenhersteller [German Association of Window and Façade Manufacturers] entitled "Farbgleichheittransparenter Gläser im Bauwesen" ["Colour uniformity of transparent glass for construction"].)

7.2.3. Special optical characteristics when TG is used

As the glass is placed on rollers in the furnace during the toughening process, slight surface changes may occasionally occur. This wave pattern is caused by physical processes; it is not always avoidable and in certain cases can lead to changes of the reflection pattern. Because of the thermal toughening process, chemical and mechanical changes of the surface characteristics may occur, such as the formation of spots and roller impressions.

7.3 Exterior surface damage

The cause must be determined if mechanical or chemical exterior surface damage, which is noticed after glazing, occurs. These complaints can also be evaluated in accordance with section 3.
In addition, the following standards and guidelines apply:
- Technical guidelines issued by Glaserhandwerk (German Glazing Trade)
- VOB/C ATV DIN 18 361 "Glazing works"
- Product standards for the glass products considered
- Information sheet on glass cleaning, published by Bundesverband Flachglas e. V. [German Federal Association of Flat Glass], among others
- The elements must be padded in such a way that the load is transferred across the entire element.

8 IDENTIFICATION

8.1 Stamp

VETROGARD® – glazing units are permanently marked in the bottom right on the protection side (inside).
It is possible to have multiple markings upon consultation.

8.2. Stickers/shipping documents

Furthermore, CE-relevant information is supplied with every glass delivery. Further information about CE markings can be found under www.vetrotech.com/ce.
Additional inspection marks can be applied in accordance with national requirements.

8.3 Positioning of the blocking edge

On each VETROGARD® the blocking edge is marked with a sticker. Please respect the sticker for the Installation.