JÜLLICH GLAS® HOLDING

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TECHNIKAL CONDITIONS

Acceptance criteria for visual inspection of glass products

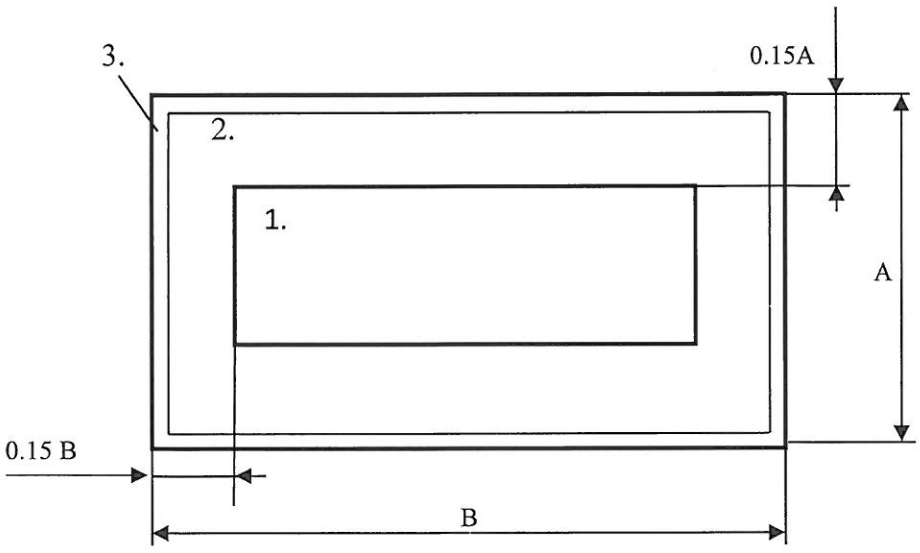
1.1 Visual inspection

The visual inspection is made in diffused daylight, or equivalent illumination (without direct illumination or sunlight) at vertically positioned glass panel. The eyes of the performing inspection are at the same height with the center of the table, approximately 1 meter distance, at a right angle (perpendicularly) and look through the table for about 15 seconds.

1.2 Visual inspection area

The glass panels surface be divided into three zones for control purposes:

- zone 1.: main field of view
- zone 2.: supplementary field of view
- zone 3.: glass panel margin (16 mm)



Type of defect	1. zone	2. zone	3. zone
Rough scratch	not allowed	not allowed	Any error is allowed that not influence the glass function and the edge sealing / frame width is not exceeded.
Fine, scratch perceptible with nail	Allowed: under 1 m²: 2 pcs; above 1 m²: 2 pcs/m² The distance between sratches min. 400 mm. the length of 1 pc scratch max. 15 mm.	Allowed: under 1 m²: 2 pcs; above 1 m²: 2 pcs/m² The distance between sratches min. 400 mm. the length of 1 pc scratch max. 30 mm.	
Hairline scratch, not perceptible with nail	Allowed: under 1 m²: 2 pcs; above 1 m²: 2 pcs/m² The distance between sratches min. 400 mm. the length of 1 pc scratch max. 40 mm	Allowed: under 1 m²: 2 pcs; above 1 m²: 2 pcs/m² The distance between sratches min. 400 mm. the length of 1 pc scratch max. 40 mm	
Bubble, stone and other point defects	Allowed: under 1 m²: 1 pc; above 1 m²: 1 pc/m² The distance between sratches min. 400 mm. the size of 1 defect ≤ Ø 2,0 mm	Allowed: under 1 m²: 2 pcs; above 1 m²: 2 pcs/m² The distance between scratches min. 400 mm. the size of 1 defect ≤ Ø 3,0 mm	
Surface defects from tempering (cratered, orange peel)	Allowed: 1 defect/4 cm2	Allowed: 1 defect/4 cm2	
Laminated glass defects:	<u>Point defects:</u> Ø 0,5-1,1 mm: there are no restrictions however, the defects can not accumulate #. Ø 1,0-3,0 mm: the number of allowable defects depending on the size of the glass sheet (A) and the number of layers of glass: <u>A≤1m² 1m²<A≤2m² 2m²<A≤8m² A>8m²</u> 2 layers 1 pc 2 pcs 3 pcs 4 pcs 3 layers 2 pcs 3 pcs 4 pcs 5 pcs 4 layers 3 pcs 4 pcs 5 pcs 6 pcs ≥5 layers 4 pcs 5 pcs 6 pcs 7 pcs		

	Allowed linear defect: the length of the defect>30 mm<30mm $A \leq 5m^2$ not allowed 1pc $5m^2 < A \leq 8\ m^2$ 1pc 2pcs $A > 8m^2$ 2pcs 3pcs	

The errors can accumulate when four or more errors are <200 mm distance from each other. This distance can reduced to 180 mm with the 3 sheets containing laminated glass, to 150 mm with the 4 sheets containing laminated glass and to 100 with the 5 or more sheets containing laminated glass.

1.3 Allowed chipping

Matt edge grinding (C and I):
max. 0.5 mm deep and 2 mm long, maximum 3 pcs per meters, at minimum 200 mm distance from each other.
max. 0.5 mm deep and 1 mm long, maximum 5 pcs per meters, at minimum 200 mm distance from each other.
The two together cannot be more than 4 per meters.
From the verge of the drilled holes to 2 mm is allowed in unlimited quantities. The chipping of the deepness can reach maximum the one third of the glass thickness.

1.4 Color, reflection, light transmission

The minor changes of the color, reflection, and light transmission in front of light background and beyond a 3 meters from the observer are acceptable. The coated glasses have a characteristic color. Its fluctuations are possible because of the iron oxide content of the glass, the coating /the coating formation process, based on the type of coating, such as the thickness of the glass and plate structure and cannot be avoided.
At glasses with solar control coating - especially at single pane safety glasses - optical distortions of the reflected objects are more conspicuous. The allowed tolerances in relation to the plane of the differences can be found in the relevant standards.
If there is no signal from the customer after the order in the coherence of the various units, later the deviations from the base glass colors arriving from different manufacturers cannot be the subject of complain.

1.5 Allowed size tolerances:

- up to 1000 mm ± 1.0 mm
- 1000 - 2000 mm ± 2.0 mm
- over 2000 mm ± 3.0 mm

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2. Insulating glass requirements:

2.1 Dimensions, tolerances:

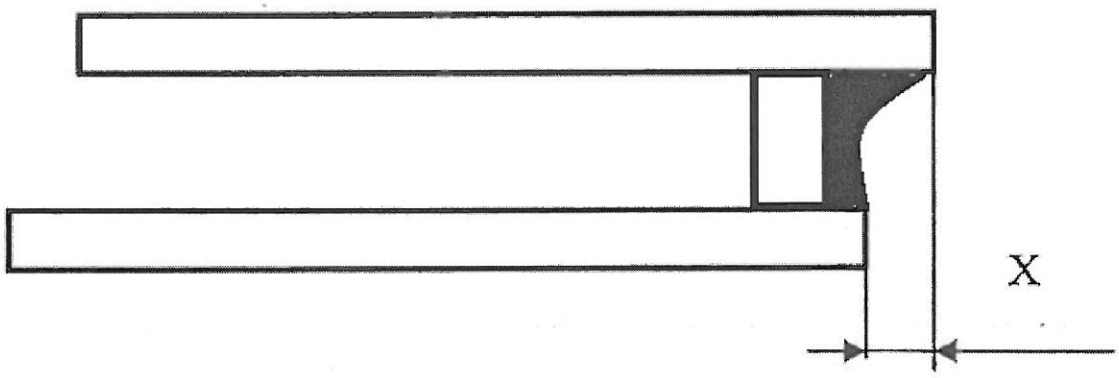
Structural thickness: nominal size ± 1.0 mm.
Edge tortuosity : The allowed edge tortuosity can be 0.3% from examined side length.
deflection from right angle: max. 1 mm/m per side.

Spacer depth:

- In case of continuos „U" duct: : „U" duct height + 6 mm silicone + spacer height = nominal size.
- Within the ranges specified above the spacer is not the base for quality complaints.

The spacer parallelism to the edge of the glass and to the other spacer:
It is allowed maximum 1,5 mm difference in relation to the spacer material and weigh.

The edge deviation of two neighbouring insulating glass (X) perpendicular to the plane of the board
to 2.000 mm: max 2 mm,
above 2.000 mm: max. 4 mm can be.



2.2 Requirements for the primary sealing:

The seal must be continuous all around the outline of the spacer, no tear is allowed. Issued from the technology during the production of insulating glass the even spread of the butyl is unaccomplishable, so in the inner edge of the spacer it can reach over with 0,2mm. Because

the butyl coverage of the whole surface of the spacer is not applicable, the surface of the spacer will not form a homogenous unit.

2.3 Requirements for the secondary sealing:
The seal must be continuous, holes, poles, gaps seen with the naked eyes cannot be allowed, and material lack cannot occur. Roughness resulting from sticking again - if it does not affect the airtight - cannot be objectionable. On the edge of the glass the sealant can overreach max 2 mm.

2.4 Insulating glass with Georgian bars
The climatic impacts, vibrations, and the generated mechanical shocks could effect the vibration of the Georgian bars and they are not the basis for quality complaints.
The visible cut marks and large colour detachments which are not bigger than 1 mm on the cut surface can be deemde technological facility.
The effects of thermal expansion of the Georgian bars cannot be avoided. An example for this can be the bending of the Georgian bar (max. 2mm/1m) which can not the basis for quality complaints.

3. Requirements for painted glasses:

3.1 Quality control, allowed defects on the painted glass surface:
The covered edge width can be ignored while the glass sheet functions are not affected. The control take place for max. 15 seconds during daylight against a dark background, at vertical glass from 1 meter test distance. The roughness of the painted glass surface or possibly patterns can not be base for the quality complaints.

3.2 Color effects and transmission
The color effect is evaluated on the basis of the reference model accepted and signed by both parties.
If the glasses are is not ordered in whole quantity for a facade/ project, because of the number of more production batches (glass, color) can arise color deviation. In such case the responsibility lies with the Customer.

3.3 Allowable failures

3.3.1 General requirements

- The 0,5 - 1,0 mm paint traces on the unglazed part are allowed at min. 200 mm from each other.
- Defects are not allowed at under hand control.
- The not enamelled surface is allowed to max. 3 mm from the edge of the glasss as well as grinding and drilling holes.
- The screen printing can be contoured at the edge of the glass. If it does not reach the edge of the glass the edge of the painting must be regular, can not be wavy or dashed, ect.

- The asymmetry of the screen printing must be within 1 mm from the edges.
- The paint is not allowed to flow into the drilling holes or to flow through it.
- The absence of the painting is allowed under 0,3m2 point.
- Dirt under the painting is allowed on a surface smaller than 0,3 mm2.

3.3.2 Painting of the whole surface
The parapet glasses building is not recommended in transmitted light. We can accept as a claim the absence of painting or color inhomogeneity just if it is visible at dark background. Other glasses as well as continuous and running-out dot-raster glasses:

Defect of the surface ≤ 0,5 mm2	- cannot be evaluated
0,5 mm2 < defect of the surface ≤ 1,0 mm2	- max. 6 dots or line-shaped defect are allowed on 1 m2 surface at min. 50 mm from each other's
1,0 mm2 < defect of the surface	- max. 4 dots or line-shaped defect are allowed at min. 50 mm from each other

3.3.3 Raster painting
a) The coherent dots among the first half series of dots and the first full series of dots are not considered defects.
b) Not complettly pressed dots can be considered full dots if they can be seen in intensity and form min. 50%.

Missing dots:

Ø 0,5 mm	- we cannot evaluated, inevitable owing to producibleness
Ø 0,6 - 1 mm	- on a section of 50 mm 5 dots can miss coherent or dispersed
Ø 1 - 1,5 mm	- from the one by one dots max. 4 dots can miss in a distance of 50 mm from each other
Ø 1,5 - 2 m	- max 1 defect can be in a line of 50mm

3.3.4 Decor painting
It is allowed max. 5 % paint lack if does not disturb the nature of the pattern.

3.3.5 Repair
Is allowed the repair of the painting if the diameter of the defect is not bigger than 3 mm or after the glass building the defect cannot seen and the painting layer meets the requirements.

3.3.6
Logo
The logo must have a definite contour. The tolerance of position of the logo according to the concerning drawing, in other cases ±3, 0 mm.

4. Physical phenomena

These phenomena are independent from the basic glass and processing, therefore are not basis of any complaints in case of insulating glass.

4.1 The Doppelscheiben (insulating glass)effect

The insulating glass acts as a membrane because of the hermetically sealed air gap and the gluing along the edges. The air pressure and temperature changes occurs changes in volume. The glass sheets of the structure bend or bulges which can be seen by the distortion of mirror image. Its extent depends from the size of the glass plant and from the width of the air gap. This physically cannot be prevented thus cannot be base for the quality complaints.

4.2 Interference

The float glass is optimally plane parallel. Used in insulating glass structures shows characteristic optical effect. The phenomenon appears patchy, band or ring-shaped (newton ring), under pressure changes its position. The interference is clearly defined physically fraction which only makes a difference if more float glass sheets are put behind each other. It depends on the local light conditions and the angle of incidence of light. It can be shown From the co-existence of several factors and defined angles. Therefore the interference is a physical phenomenon which is the optical effect of the high-quality float glass thus can not be base for the quality complaints.

4.3 Anisotropy

The glass during the toughening process goes through thermal process thus becomes "tempered" this manufacturing process creates tension zones which under polarized light results dual refraction. These polarized fields can be shown in patchy forms. This is characteristics of tempered glass thus cannot be base for the quality complaints.

4.4 Condensate subsidence on the inner or outer surface of the glass

The temperature of the air where the relative humidity is 100%, is called dew dot. At constant humidity when the temperature decrease vapor condensation are formed. Dew dots can occur in each of the following locations:

- in the interspace between glass sheets of insulating glass:

  The dew dot in an air gap at the unit of the insulating glass must be under 60 °C, which provides the long life of the structure. This rarely occurs, because the interspace of the insulating glass is hermetically closed and filled with dried gas.

- on the surface of the insulating glazing inside of the buildings
  The formation of condensate can lead to the following conditions:
  1) the warm air cools down suddenly on the colder interior glass surface
  2) relatively cold, at high humidity content air the fogging is caused by condensation occurring on the cold surface.

The rate of condensation can be reduced significantly using better Ug-value glass structures and with proper ventilation of the room.

- on the surface of the insulating glazing outside of the building
  In case of heat protective coated glass in certain circumstances can occur condensate formations, - for example early morning due to the higher thermal barrier caused by stronger cooling of the outer surface of the insulating glass.

The condensate is rapidly removed by the first rays of the sun.

4.5 Spontaneous breakage

All float glasses contains in different amounts nickel sulphide (NiS). This compound is stable at both low and high temperature so the date of use of the glass is independent of the production of it.

During the tempering process the nickel sulphide warms up together with the glass, and then cools down suddenly in the quenching section. Due to the rapid temperature change not visible nickel sulphide inclusions can be formed which „freezing" into the glass in a high temperature crystal modification. Later due to an increase in temperature (strong solar radiation on the facade) can "explodes" the glass. This process is called spontaneous breakage, because it happens without any intervention. The spontaneous breakage of the tempered glass can be reduced at around 1 % with a special test named Heat Soak. The spontaneous breakage cannot be base for the quality complaints.

5. Complaint handling

The handling of complaints between the customers and the manufacturer are based on the followings:

- the product shall be considered as been accepted without reservation if the customer does not make complaint within 7 calendar days from the receive of the product. An exception to this is the breakage of the glass and the mechanical damage in the outer region (external scratch, shell). The manufacturer can accept objections immediately signed up on the delivery note or within 24 hours of receipt of the goods.
- the manufacturer undertakes 5-year warranty, for the condensation of the insulating glass.
- the manufacturer accepts any quality complaint only in writing.
- the customer is obligated in any cases to credibly substantiate the complaint (supported with photographs that clearly shows the errors).
- the customer should treat the complaint glass to avoid further injury, after the submission of the complaint until it is closed; the manufacturer does not accept any complaint regarding the improperly treated - otherwise rightly complained - glass.
- the manufacturer does not accept any complaint in the case where the conditions for use of the product does not conform to the professional standards.
- the already processed or built in product or the spontaneous breakage cannot be base for the quality complaints.

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- In case of accepted complaint Jüllich Glas Co. only undertake the exchange charge, additional needs, additional costs cannot be paid.
  In case of rejected complaint the total cost of the investigation lies with the customer.

6. General rules for packaging, transport, storage, cleaning, maintenance and installation of glass

- The customer responsibility to know and use the industrial standards and installation knowledge for the packaging, transportation, cleaning, maintenance and glass installation.

Hereby not discussed conditions and quality issues are according to the concerning european standards as: MSZ EN ISO 12543, MSZ EN 572, MSZ EN 12150, MSZ EN 1863, MSZ EN 1279, MSZ EN 14449, MSZ EN 1096, MSZ EN 14179.

Csaba Lakatos
CEO

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