I. VISUAL QUALITY OF INSULATING GLASS

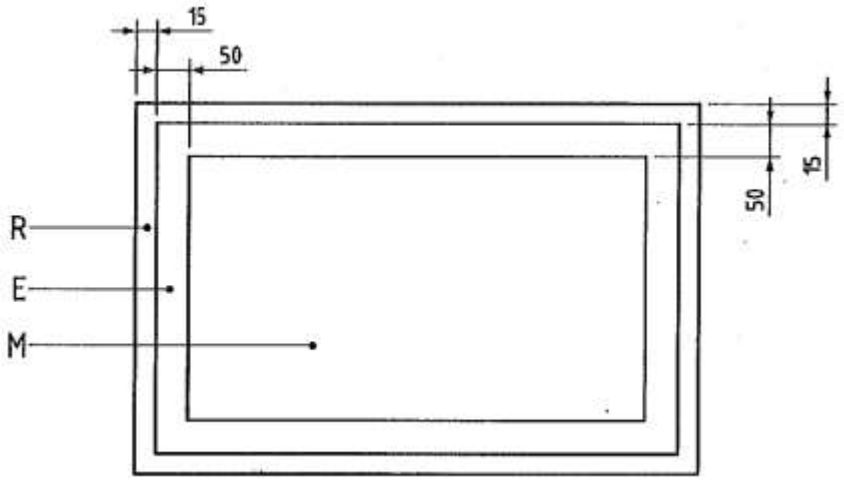
In accordance standard LST EN 1279-1 there are described optical and visual quality requirements for inuslating glass units (IGU).

1. Observations conditions

The panes shall be examined in transmission and not in reflection. The discrepancies shall not be marked on the pane. The insulating glass units shall be observed at a distance of not less than 3 m from the inside to the outtside and at a viewing angle as perpendicular to the glass surface as possible for up to one minute per m^2. The assessment is carried out under diffuse daylight conditions (e.g. overcast sky), without direct sunlight or artificial lighting.

IGU assessed from the outside shall be examined in installed condition, taking into consideration the usual viewing distance with a minimum of 3m. The viewing ange shall be as perpendicular to the glass surface as possible.
These tables below shall not be used for IGU with at least one component made from patterned glass, wired glass, wired patterned glass, drawn sheet glass, fire resistance laminated glass, etc.

2. IGU observation zones



1 pic.. IGU observation zones

Explanation:
R-15mm zone, usually covered by the frame, or corresponding to the edge seal in case of unframed edge
E-zone at the edge of the visible area, with width of 50mm
M- main zone

3. Alowable defects for IGU made of two panes of monolithic glass

3.1 Spot faults

The maximum number of spots faults is defined in Table 1.

1 Table. Allowable number os spot faults

Zone	Size of fault (excluding halo) (Ø in mm)	Size of the pane S (m2)			
		S ≤1	1<S ≤2	2<S ≤3	3<S
R	All sizes	No limitation			
E	Ø≤1	Accepted if less than 3 in each area of Ø≤ 20 cm			
	1<Ø≤3	4	1 per metre of perimeter		
	Ø>3	Not allowed			
M	Ø≤1	Accepted if less than 3 in each area of Ø≤ 20 cm			
	1< Ø≤2	2	3	5	5+2/m2
	Ø>2	Not allowed			

3.2 Residues

The maximum allowable number of residue spots and stains is defined in Table 2.

2 Table. Allowable number of residue sports and stains

Zone	Dimensions and type (Ø in mm)	Pane area S (m2)	
		S≤1	1<S
R	All	No limitation	
E	Spots Ø ≤1	No limitation	
	Spots 1 mm <Ø≤3	4	1 per m of perimeter
	Stain Ø≤17	1	
	Spots Ø>3 and stain Ø>17	maximum 1	
E	Spots Ø≤1	Maximum 3 in each area of Ø ≤20 cm	
	Spots 1<Ø≤3	Maximum 2 in each area of Ø ≤20 cm	
	Spots Ø>3 and stain Ø>17	Not accepted	

3.3 Linear / extended fault

The maximum number of linear / extended fault is defined in Table 3.
Hairlines scratches are allowed provided that they do not form a cluster.

3 Table. Allowable number of linear / extended faults

Zone	Individual lenghts (mm)	Total of individual lenghts (mm)
R	No limitation	
E	≤30	≤90
M	≤15	≤45

4. IGU other than made of two monolitic glass panes

The allowable number of discrepancies defined in table No 1 is increased by 25% per additional glass component (in multiple glazing or in a laminated glass component). The number of allowable defects is always rounded up.
EXAMPLE1: Triple glazed unit made of 3 monolithic glass panes: the number of allowable faults of table No 1 is multiplied by 1.25;
EXAMPLE.2:Double glazed unit made of two laminated glass with 2 glass components each: the number of allowable faults of table No. 1 is multiplied by 1.5.

5. IGU containing a tempered glass

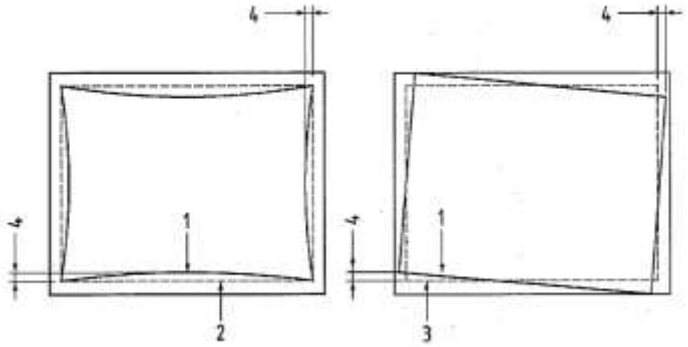
The visual quality of thermally toughened safety (tempered) glass, with or without heat soaking and of heat strengthened glass, when assembled in an IGU or in a laminated glass which is a component of an IGU, shall fulfil the requirements of their respective product standart.
In addition to these requirements, for heat treated float glass, the overall bow relative to the total glass edge lenght may not be greater than 3mm per 1000 mm glass edge length. Greater overall bow may accur for square or near square formats (up to 1:1.5) and for single panes with a nominal thickness <6mm.

6. Edge defects

Allowable edge defects are given in the relevant standard for each glass pane component.
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 are acceptable.
Internal conchoidal fractures without loose shards, which are filled by the sealant, are acceptable.

7. Tolerance on spacer straightness

For double glazing the tolerance on the spacer straightness is:
4 mm up to lenght of <3,5 m;
6mm for longer lengths.
The permissible deviation of the spacer(s) in relation to the parallel straight glass edge or to other spacers (e.g. in triple glazing) is:
3mm up to an edge length 2,5m.
For longer edge lengths, the permissible deviation is 6 mm.
Within the frame area along the entire perimeter, there may be residues of insulating glass unit components, frame cutting remnants, as well as spot or line defects as described in sections 3.2 and 3.3, within the permissible tolerances specified for zone E.



Explanation:
1 – spacer;
2 – theoretical shape of the spacer;
3 – theoretical position of the spacer;
4 – deviation.

2pic. **Tolerance on spacer straightness**

8. IGU with decorative frames, internal muntins

At the customer's request, IGU with decorative frames and internal muntins, taking into account the technical capabilities of the equipment can be produced.
Decorative frames, internal muntins inside IGU can cause the cracking of untempered glass, therefore it is recommended to use tempered glass for such IGU.
Frames, muntins can occasionally cause clattering noises due to environmental influences (e.g. inside can vibrate, rattle or emit other sounds when opening doors or windows in strong winds or other vibrations). Due to the effect of temperature, decorative frames, muntings inside the IGU may be deformed. These possible phenomena are not product defects and the warranty does not apply.
Displacement of decorative frames and muntins is allowed following:
Double glazing 1 - <1.5 mm,
Triple glazing - <3 mm.
Due to the technological process, material cutting chips or slight color variations may be noticeable at the joint areas.

9. Primary sealant

Permissible primary sealant (butyl) overflow into the insulating glass unit interior is < 2 mm along the perimeter or in isolated sections. Over time, due to atmospheric influences (sun, wind, pressure), the butyl overflow may increase to > 2 mm along the entire perimeter, and a 'wavy' effect of the butyl may become visible along the entire perimeter, and a 'wavy' effect of the butyl may become visible. This is not considered a defect.

10. Secondary sealant

The color of the secondary sealant (polysulfide or silicone) may vary. If the IGU is sealed with silicone and has offset edges, slight unevenness in the silicone mass and visible grinding marks on the outer coated glass may be noticeable.

11. Spacer connection

A gap in the spacer connection is allowable if ≤ 1mm. Due to the technological production process, more than two spacer joints inside the glass unit are permitted.

12. Adsorben

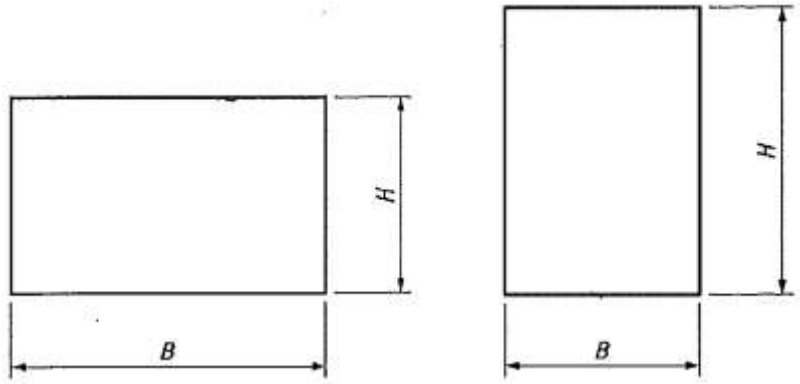
A small amount of desiccant residue inside the IGU may occur as a result of the production process.

13. Removing the coating from the glass

The standard coating removal width is 10mm, with a tolerance of ±2mm. Non-standard removal areas must be agreed upon with the manufacturer. IGUs with coated glass may show signs of corrosion on the polished coating over time.

II. IGU DIMENSIONAL TOLERANCES

When IGU dimensions are quote for rectangular panes, the first dimension shall be the width, B, and the second dimension the height, H, as fown in figure belkow.



1. IGU dimensional tolerances

4 table. IGU width and height, misalignment

Double/ Triple IGU	Tolerances on B and H	Misalignment
All panes ≤6 mm and (B and H) ≤2000 mm	±2 mm	≤2mm
6 mm < thickest pane ≤12 mm or 2000 mm <(B or H) ≤3500 mm	±3mm	≤3mm
3500 mm < (B or H) ≤ 5000 mm and thickest pane ≤12 mm	±4mm	≤4mm
1 pane > 12 mm , or (B or H) >5000 mm	±5mm	≤5mm
Thicknesses are nominal thickness		

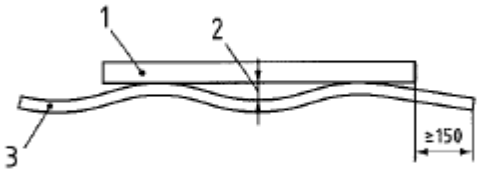
5 table. IGU Thickness tolerance

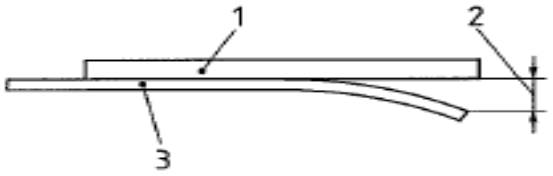
IGU	Pane	IGU Thickness tolerance*
Double glazing	All panes are annealed float glass	±1,0mm
	At least one pane is laminated, patterned or not annealed float glass	±1,5mm
Triple glazing	All panes are annealed float glass	±1,4mm
	At least one pane is laminated, patterned or not annealed float glass	+2,8mm/-1,4mm
[a] If one glass component has a nominal thickness greater than 12 mm in the case of annealed or toughened glass, or 20 mm in the case of laminated glass, the IGU manufacturer should be consulted.		

III. TEMPERED, ENAMELED, SCREEN PRINTED, LAMINATED AND OTHER GLASS

1. *Tempered Glass

The description of visual quality, tolerances, phenomena, and other requirements for tempered glass are specified in the EN12150 standard.
Due to the specifics of the tempering process, a slight waviness effect may occur, depending on the overall and local curvature of the glass.
Additionally, certain phenomena resulting from the physical properties of the glass are not considered defects, such as: anisotropy, interference phenomena, optical interference, spontaneous breakage.
These characteristics are inherent to tempered glass and are considered normal.

Maximum allowable values of overall bow and roller wave distortion for horizontaly toughened glass		
	Maximum allowable value for distortion	
	Overall bow, mm/m	**Roller Wave, mm**
Glass Type		
Uncoated float glass in accordance EN572-1 and EN572-2	3,0	0,3/in 300 mm
Others[a]	4,0	0,5
[a]For enamelled glass which is not covered over the whole surface the manufacturer should be consulted.		

Maximum allowable values for edge lift for horizontal toughening		
		
Type of Glass	**Thickness of glass, mm**	**Maximum allowable values, mm**
Uncoated float glass in accordance with EN572-1 and EN572-2	3	0,5
	4-5	0,4
	6-25	0,3
Others[a]	3-19	0,5
[a]For enamelled glass which is not covered over the whole surface the manufacturer should be consulted.		

2. *Enamelled or screeen printed glass

Type of defect:	Main Zone M: (entire plane of the glass except for the border zone)	Border Zone*: (15 mm R zone + 50 mm E zone of the glass surface length and width)
Enamelling defects	≤ 2 if diametre ≤ 3 mm^2 Length sum of all defects ≤ 9 mm^2 Defects not concentrated	Width ≤ 2 mm, length ≤ 15 mm Length sum ≤ 45 mm Defects not concentrated
Hair-type scratches (visible only at change of lightning)	Length ≤ 30 mm Scratches not concentrated	Allowable
Types of spots	Not permitted	Allowable
Water spots	Not permitted	Allowable
Edge paint surplus	–	Glass mounted to a frame: allowable Not allowable if edges were not covered
Enamel surface unevenness	Surface may thicken at enamel-crossing zones and the internal perimetre (not visible viewing from the glass side which was not painted) in perimetre-painted glass.	
Edge enamel leakage	Leakage allowed where the painted surface and the side cross (where they are not visible viewing from the unpainted side of the glass).	
Partly enamelled glass enamel width allowed deviation	Area of enamel ≤200 mm	± 1,0 mm
	Area of enamel >200 mm	± 2,0 mm

3. Screen printed glass

***Allowable deffects for screeen printed glass**

Defekto tipas:	Main Zone M: (entire plane of the glass except for the border zone)		Border Zone*: (15 mm R zone + 50 mm E zone of the glass surface length and width
Leistinas geometrinės formos nuokrypis *Priklausomai nuo šilkografijos kraštinės ilgio*	Edge length, mm:	Deviation, mm:	Allowable
	≤ 30	±0,8	
	> 30 ÷ ≤ 100	±1,0	
	> 100 ÷ ≤ 500	±1,2	
	> 500 ÷ ≤ 1500	±2,0	
	> 1500 ÷ ≤ 3000	±2,5	
	>3000	±2,5	
Piešinio defektai	Defects named in page 1 allowed if they are at least 300 mm apart		Allowable
Piešinio pozicijos leistinas nuokrypis	Screen printing ≤2000	±2,0	–
	Screen printing >2000	±3,0	

Other tolerances, requirements, and recommendations:

- ≤0,5 mm defects are not examined (including area optically affected by them).
- Color shades of the glass painted at the same time may slightly differ due to lightning, viewing circumstances and glass color shades.
- The shade of enamelled/screen printed glass printed at the same time may differ from glass printed at another time so it is recommended to order all glass that will be visible at the same time. If a project is undertaken where all glasses must be painted identically, it is recommended to contact the glass producers about the parameters and requirements.
- It is recommended to inquire about enamel examples (the client receives one, the producer retains another) before ordering the order.
- Moire effect may occur in very small paintings (mesh ≤5 mm). It is recommended to consult the producer when ordering.
- Enamelled or screen printed glass defects must be visible 3 metres away from the surface being observed, 90° point of view, under either indirect sunlight or artificial light.
- If not noted otherwise defects are only examined on the transparent/non-painted side of the glass.
- If examination of the enamelled glass is to be undertaken on its both sides, it must be arranged with the producer prior to ordering.

NOTE:** ***Manufacturers of tempered, enameled, or silk-screen printed glass may have specific requirements, tolerances, and other considerations (inquire separately).

4. Laminated glass

Dimensional tolerances, visual defects, and other requirements for laminated glass are specified in standards EN 14449 and EN ISO 12543.

Stability of laminated glass edges

Exposing laminated glass edges to sealants, chemical or physical factors may deteriorate its quality (e.g. discoloration, reduced adhesion between the glass and the interlayer, delamination).

Any materials in direct contact with laminated glass must be compatible with its components. Special attention should be paid to the presence of moisture in direct contact with laminated glass edges. Water vapor condensation or direct exposure to water has a negative impact on the laminated glass characteristics.

Laminated glass made of tempered / heat strengthened glass

Due to roller wave distortion, overall bow and anisotropy, laminated glass quality will be different than the quality of annealed laminated glass. Subsequent glass layers can strengthen the visual perception of anisotropy and lenses.

Laminated glass with colored or matt interlayers

Colored or matt interlayers can change its color with time due to weather conditions, e.g. UV radiation. Variations in the color impression are possible also due to the iron oxide content of the glass, the coating process, the coating itself, variation in the glass thickness and the laminated glass construction and cannot be avoided. Due to the aforementioned characteristics, some minor differences in the color of the same glass type from different production batches are also possible. Every interlayer has a slight degree of haze. If the number of interlayer increases, the haze may be more visible. Additional optical effects such as spots, stripes, streaks may be visible.

5. Marking of Safety Glass

Each safety glass must be marked with a permanent logo in accordance with the requirements of applicable glass standards. Unless otherwise specified, standard marking based on the type and processing of the glass is applied before tempering.
Marking may vary (non-standard logo or non-standard distance), or the glass may remain unmarked only in cases where this is agreed upon in advance with the manufacturer and specified in the order.

NOTE: The visual quality requirements, tolerances, safety classes, and other specifications for tempered, enameled, screen-printed, and laminated glass not mentioned above are detailed in the relevant standards and/or manufacturer documentation (inquire separately).

IV. PHYSICAL EFFECTS

Some physical effects can occur that are visible on the glass surface and shall not be taken into account when assesing the visual quality. They are not considered as defects.

Physical effects:

1. Inherent colour
2. Diference in insulating glass unit colour
3. Interference effect
4. Specific effect duea to barometric conditions
5. Multiple reflections
6. Anisotropy (iridescence)
7. Condensation on the external surface of the IGU
8. Wetting of glass surface

Physical effects explanation

1. Inherent colour

Variations in the color impression are possible due to the iron oxide content of the glass, the coating process, the coating itself, variantion in the glass thickenss and the unit construction and cannot be avoided.
All materials used for the manufacture of glazing products have a characteristic colour depending on consumables, which becomes increasingly visible as thickness increases. Glass with special coating is used to comply with energy saving requirements. Coated glass also has its characteristic colour. This colour can vary depending on optical conditions (light conductivity and reflectivity, direction of looking at the glass). Alterations in the intensity of colour are possible due to the level of iron oxide in glass, the coating process, the coating itself, alteration of thickness of glass and the installation point of glass, all of which cannot be avoided. When additional orders for coated glass must be delivered, it is impossible to ensure that the colour will be totally identical for reasons related to the production technology. Such variations in colour should not be treated as basis for a complaint.

2. Difference in IGU colour

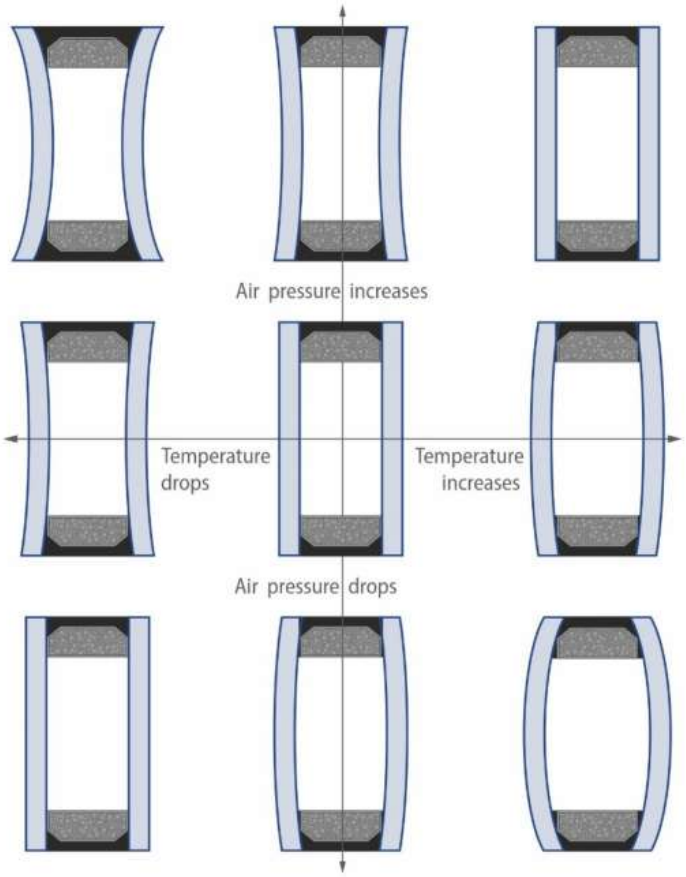
Facades made if IGUs incorporating coated glass can present different shades of the same colour, an effect that can be amplified when observed at an angle. Possible causes of differences in colour include slight variations in the colour of the substrate onto which the coating is applied and slight variations in thickness of the coating itsself.

3. Interference effect

In IGU made of float glass, interference effects may cause sprectral colours to appear. Optical interference is due to supperposition of two or more light waves at a single point.
The effects are seen as variation in intensity of the coloured zones, which change when pressure is applied to the glass. This physical effect is reinforced by the parallelism of the surface of the glass. Interference effects occur at random and cannot be avoided.

4. Specific effect due to barometric conditions

An IGU includes a volume of air or other gas, hermetically sealed by the edge seal. The state of the glass is essentialy determined by the altitude, the barometric pressure and the air temperature, at the time and place of manufacture. If the IGU is instaled at another altitude, or when the temperature or barometric pressure changes (higher or lower pressure), the panes will deflect inwards or outwards, resulting in optical disortion.



5. Multiple reflections

Multiple reflections can occour in varying intensity at the surfaces of glass units. These reflections can be seen particulary well if the background viewed theough the glazing is dark. This effect is a physical property of all insulating glass units.

6. Anisotropy (iridescence)

IGU that contain a heat – treated glass component may show visual phenomena known as anisotropy, see EN 12150, EN 1863-1. Anisotropy is a physical phenomenon in thermally processed glass which is caused by the distribution of the internal pressure of the glass. Depending on the angle you look from, this is seen in polarized light and/or in observing through polarizing glass as dark circles/stripes. Polarized light occurs usually in daylight. The scope of polarization depends on weather, the altitude of the sun and its direction. The phenomenon is visible from a small angle of looking and in case of glass facades that are set from an angle in comparison to each other.

7. Condensation on the external surface of the IGU

Condensation can occur on the external surface glass when the glass surface is colder then the adjacent air.
The extent of condensation on the external surfaces of a glass pane is determined by the U-value, the air humidity, air movement and the indoor and outdoor temperatures.
When the ambient relative humidity is high and when the surface temperature of the pane falls below the ambient temperature, condensation at the glass surface occurs.


Example: Condensation forming on the glass surface

8. Wetting of glass surfaces

The appearance of the glass surfaces can differ due to the effect of rollers, finger prints, labels, vacuum suction holders, sealant residues, silicone compounds, smoothing agents, lubricants, environmental influences etc. This can become evident when the glass surfaces are wet by condensation, rain or cleaning water.


Example: Marks on the glass surface from vacuum lifters or gaskets

V. THE FOLLOWING RECOMMENDATIONS MUST BE FOLLOWED FOR TRANSPORTATION AND STORAGE OF INSULATING GLASS UNITS (IGU)

1. Special racks and supports should be used for transportation of insulating glass units.
2. In all cases, insulating glass units must be transported and stored exclusively in the vertical position.
3. Insulating glass units should be loaded, uloaded and storaged in right way.
4. Supports should be removed after the delivery of insulating glass units.
5. Insulating glass units should not be placed on one side or one corner, and wooden supports or rubber protection for corners should always be used. Never push or pull a insulating glass unit on the ground.Wood bricks must be used for supports.
6. Insulating glass unit must be placed on two supports, dividing the weight along the thickness of the insulating glass unit.
7. Insulating glass units must be stored only in vertical position.
8. Support bricks and fixing elements which protect insulating glass units from tumbling down should not damage the surface of glass or the sealing edge and must be placed in correct angles with respect to the glass sheet.
9. Separation layers (for example, cork, paper, etc.) should be used for separation of insulating glass units form one another.
10. Insulating glass units must be stored in dry and sufficiently ventilated premises which must be protected against the impact of the atmosphere or suitably covered, for example, covered with tent-cloth in construction areas.
11. Insulating glass units must be protected against direct sunlight. This is especially relevant for glass with films or toned, decorative, sheet or wire-armoured glass as the risk of such glass for thermal breaking is greater.
12. Each insulating glass unit must be checked for possible damage before mounting. Damaged or with defect insulating glass units should not be used or mounted.
13. The sealant of each insulating glass unit edge must be protected from the direct impact of UV rays,rain, snow as otherwise untimely ageing process of the insulating glass unit may start.
14. We do not recommend storing laminated glass outdoors. Humidity and other atmospheric conditions can affect the laminate layer.

VI. GLASS BREAKAGE

The warranty does not cover damages (such as cracks, impacts, or splits) to glass units and individual glass panes that occur after delivery to the customer, especially if caused by increased thermal or dynamic loads. Generally, glass breakage, cracking, or splitting results from external factors, which do not provide a valid basis for a warranty claim.
Glass units that are missing, damaged, or broken during storage, installation, or use due to mechanical or thermal reasons are not covered under the warranty. The warranty only applies to the loss of glass unit tightness if it is due to a manufacturing defect. Liability for damage typically rests with whoever is responsible for the glass at the time of the incident. Therefore, we recommend taking proper precautions to protect the glass units.

1. Thermal breaks

Mechanical stresses in glass due to heat arise when there is a temperature difference between two points on the glass surface.

If this difference becomes too large, the glass is at risk of thermal cracking along its plane.
For ordinary non-tempered glass up to 12 mm thick, the critical temperature difference is approximately 35°C.

Any conditions or factors that increase this temperature difference also increase the likelihood of thermal cracking. If these risk factors cannot be eliminated, it is recommended to use tempered glass. Tempered glass can withstand temperature differences of up to approximately 200°C, making thermal cracking almost impossible under normal conditions.

Factors influencing temperature differences in glass:

sunlight: The effect of sunlight on glass depends on the orientation of the glazing (North, East, etc.) and the presence of shadows;

indoor conditions: Air conditioning, heating, and heat from equipment can contribute to glass breaks. Space heaters or refrigeration units, for example, should be positioned at least 30 cm away from double-glazed windows. If the inner glass is tempered, this distance can be reduced to 15 cm. Additionally, the heating device should span the full width of the glass unit to ensure even heating. If heaters are closer than recommended, protective shields must be used;

films, paints, internal blinds: Installing absorbent films, paints, or internal blinds on existing glazing can lead to thermal cracks. Consult the manufacturer before making such changes;

paving with asphalt: If asphalt is being poured in areas with glazing, the glass may be heated unevenly from one side. Glass units should be properly protected or removed during this process.

2. Glasses with a higher risk of breakage

Reinforced and heat-absorbing glass, due to their specific physical properties, are more vulnerable to mechanical and thermal stress in glass units.
Tinted glass, in particular, absorbs more solar energy than clear glass, which can lead to thermal stresses caused by:

- Covered areas or shadows
- Hot air pockets due to insufficient air circulation

These stresses can cause the glass to crack, typically starting at the edges. Therefore, for glazing exposed to direct sunlight, the following precautions should be taken:

- The entire glass surface should either be fully in the sun or fully shaded.
- Adequate and consistent ventilation of the inner glass surface is necessary.
- The frame material and glazing blocks should be chosen to match the glass's absorption properties.
- The glass must have room to expand and move; rigid anchoring should be strictly avoided.

If these criteria cannot be met, the increased risk of tinted glass breakage can be mitigated by using tempered glass. Additionally, when the frame thickness exceeds 16 mm or the aspect ratio is unfavorable, it is recommended to toughen the thinner pane in asymmetric glass units.

3. Tempered glass

During use, all types of tempered glass may experience spontaneous cracking due to nickel sulphide inclusions. These fractures can occur even years after installation and are random, not related to the glass unit or the manufacturer. As a result, they cannot be classified as a glass defect, and the warranty does not cover them.

To reduce the risk of spontaneous breakage, the **Heat Soak Test (HST)** can be performed on tempered glass. While this test minimizes the likelihood of spontaneous breakage, it does not eliminate the risk entirely, and the warranty remains void for such occurrences.

Sample. Spontaneous breakage

Additionally, due to the nature of the tempering process, optical distortions and other physical anomalies may be present in tempered glass. These characteristics are detailed in **EN 12150** standards.

VII. INSTALLATION OF IGU, MATERIAL COMPATIBILITY, OPERATION, MAINTENANCE, AND CLEANING

1. Installation of IGU

When installing glass units, it's essential to adhere to approved building regulations, relevant EU norms, internationally recognized standards, and the manufacturer's recommendations. This includes following guidelines outlined in Annex C of **EN 1279-5**, as well as **EN 12488**, **EN 13022-4**, and **EN 15434** standards.

Before installation, inspect the surface, edges, and corners of the glass units to ensure they are free from defects such as cracks, chips, splits, or any other flaws that exceed allowable tolerances or are not permitted.

Glass units must be transported in a vertical position, ensuring their corners and edges are protected from impact. The glass units should not rest directly on their corners or edges, and they must be placed on a stable, solid surface.

During installation and finishing work, care must be taken to protect the glass from mechanical, thermal, and chemical damage, as well as from exposure to construction materials. Only materials that are compatible with the components of the glass unit should be used for installation.

2. Compatibility of materials

The components used in the production of insulating glass units include various types of glass (clear, coated, enamelled, laminated, etc.), primary and secondary sealants, various spacers, connectors, etc., which may contain chemical substances capable of reacting with other materials used during installation. The migration of chemical substances may be influenced by direct or indirect contact between materials, the chemical composition of the materials, the content of volatile substances, ambient temperature, and other factors.

Materials used during installation (e.g., glazing blocks, various sealants, etc.) must be compatible with the components of the insulating glass unit. If incompatible materials are used, chemical migration into the insulating glass unit may occur, resulting in deposits or stains on the glass surfaces, potential loss of unit hermeticity, delamination of laminated glass, softening and leakage of butyl into the unit, and other visual defects. In such cases, the warranty is void. The buyer of the insulating glass units is responsible for the correct selection of compatible materials

Sample. Incompatible materials were used

3. Operation of IGU

The recommended operating temperature range for glass units is between -40°C and +60°C.

Exceeding temperatures above +60°C can accelerate chemical evaporation and the migration of materials within the glass unit and its surrounding cladding. Special attention should be given to glass units with enamelled glass, which must be adequately ventilated to avoid exceeding the permissible temperature.

When the operating temperature is exceeded, chemicals may migrate into the unit, leading to deposits or stains of various colors on the glass surface. This can result in the glass unit losing its seal or experiencing other issues.

It's important to note that the manufacturer of the insulated glass units cannot control the customer's choice of installation materials and is not responsible for any defects caused by excessive temperature, material incompatibility, or similar factors. In such cases, warranties are void.

Sample. Exceeding temperatures accelerate chemical evaporation and the migration of materials inside IGU

4. Damage to the glass surface

4.1 Corrosion from alkaline substances

Alkaline substances, such as those washed from concrete surfaces or accumulated lime and cement mortar, can corrode glass. It is essential to protect installed glass surfaces from such substances during construction. Fresh lime and cement mortar stains can be washed off with water. However, damage caused by these substances may only be removable with special cleaning products under favorable conditions, and often, pre-existing damage cannot be fully repaired.

4.2 Welding droplets or sparks from grinding and cutting discs

When welding or grinding work is done near glazed surfaces, hot welding droplets or grinding particles can become embedded in the glass. Even after cleaning, microcracks or burn marks can remain on the surface, permanently affecting the appearance and integrity of the glass.

4.3 Factors affecting facade cleaning

During construction, facades, especially those of brick buildings, often become dirty or splattered. Cleaning these surfaces with products containing hydrofluoric acid can severely damage the glass. This type of damage can be avoided by protecting the windows with a protective film during construction. It is the responsibility of the building contractor to prevent such damage.

Due to the wide range of possible damages to glass surfaces, it is not feasible to list all protective measures. Each case should be assessed individually, and appropriate precautions should be taken.

5. Maintenance

Construction materials, such as window frames, paint, sealant connectors or bands, are the objects of natural ageing process.
In order to maintain the term of guarantee in effect and extend the term of operation of insulating glass units, it is necessary to carry out regular tests of functioning. All maintenance works, such as window frames, leakage test for seal between the glass and window frame, inspection of ventilation and steam pressure equalization holes have to be carried out regularly and at appropriate intervals.

6. Glass cleaning

The construction contractor is responsible for cleaning of glass units in mounted windows as well as removal of remainders of labels and seals using mild cleaners.
Grease which cannot be removed from a glass using ordinary cleaning with water or spray-cleaners available for purchase can be removed using a sponge or household cleaners.
Tolls which can leave scratches as well as razors and scrapers should be avoided as they can leave scratches on the glass surface.
It is especially important that mortar and alkaline substances of construction materials were removed immediately; otherwise the glass surface can be damaged and look like frosted.
If sealing materials fall on the glass, they should be cleaned immediately.
Special cleaning instructions are given for glass coated with metal-oxides:
ordinary grease can be removed as described above without using abrasive cleaners;
resistant grease, i. e. spots of paint or pitch, sticky scrap should be dissolved in certain solvents, i. e. methanol, acetone or cleaning liquid, and them washed. When solvents are used for cleaning, they should be used with care, avoiding damage of the sealed edge, sealer or other organic parts of the insulating glass unit.

7. Unsuitable cleaners

Glass must never be cleaned with strong alkaline solutions or acids, especially hydrofluoric acid or other cleaners containing fluoride. Such solutions can damage the glass and its coating, thus causing irreparable damage.

Avoid using abrasive tools, razor blades, scrapers, metal blades, or other sharp objects to clean the glass, as they may scratch the surface.

Improper cleaning of the glass can cause irreparable damage and negatively affect both the optical and functional properties of the glass coating.