PILKINGTON

NSG GROUP

Glazing and Handling Guidelines for Fire-resistant Glazing Pilkington **Pyrostop®** Pilkington **Pyrodur®**

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These Handling and Glazing Guidelines for fire-resistant Glazing using Pilkington **Pyrostop®** and Pilkington **Pyrodur®** replaces any other such guideline.

1.0 General Product information

Pilkington **Pyrostop®** is a fire-resistant glass designed for use in buildings and construction works for the fire resistance classes EI 30 to EI 180 according to EN 13501-2. Pilkington **Pyrodur®** meets the requirements for E/EW 30 or E/EW 60 classifications to EN 13501-2. Pilkington's fire–resistant glass product lines consist of CE-compliant construction products in accordance with EU Construction Products Regulation, or CPR, no. 305/2011 and are marked accordingly for quick and easy identification.
In accordance with the requirements of the system of AVCP (Assessment and Verification of Constancy and Performance) the production of fire-resistant products is verified by documented, permanent internal controls and by external audits. Pilkington **Pyrostop®** and Pilkington **Pyrodur®** are monolithic glasses in accordance with EN 14449 for internal applications and as insulating glass in accordance with EN 1279-5 for internal and external use as construction products. They are suitable for vertical, inclined or horizontal installation. Typical applications are fire-resistant doors, fixed partition walls, curtain walls or façades, and overhead glazing.

Pilkington **Pyrostop®** and Pilkington **Pyrodur®** are clear, multi-layer intumescent fire-resistant glasses, consisting of sheets of annealed float glass and a special glassy interlayer which intumesces on exposure to fire. This effectively prevents the passage of flames, smoke and hot gases, referred to as integrity (E) performance. Pilkington **Pyrostop®** in addition provides thermal insulation to keep the temperature increase on the outer surface of the pane facing away from the fire below the maximum levels defined in the relevant fire test standards, referred to as insulation performance (I). The degree of energy transmission to the protection area of the fire screen is reduced and the framing structures are effectively cooled by the foaming of the interlayer into the glass rebate area.
Pilkington **Pyrodur®** meets - in addition to being compliant to the integrity criteria - the requirements for fire resistance classes EW for up to 60 minutes according to EN 13501-2, limiting the maximum level of radiation in case of fire.

A special, circumferentially applied edge protection tape is an essential component applied to the high-quality glass compositions of the product lines Pilkington **Pyrostop®** and Pilkington **Pyrodur®**. In order for Pilkington **Pyrostop®** and Pilkington **Pyrodur®** to perform reliably and consistently they must only be installed in a suitable and tested glazing system. It is important that the following glazing and handling guidelines for Fire-resistant glazing Pilkington **Pyrostop®** and Pilkington **Pyrodur®** glass are carefully observed and followed. In the event of modifications, an appropriate assessment of an approved and certified test authority will have to be obtained. In principle, all relevant legal regulations, directives, codes and standards of the respective countries/states must strictly be followed.

These glazing and handling guidelines are applicable solely to Pilkington **Pyrostop®** and Pilkington **Pyrodur®** fire-resistant glass, fully framed along all its edges.

2.0 Installation specification

It has to be noted that any glazing detail is relevant to the fire-protection performance of the glazing system. The glazing must be done in accordance with the relevant fire-protection certification (e.g. general fire test evidence or approval, approval or expertise for individual project related applications or classification reports) as well as in accordance with the relevant and applicable installation guidelines of the system manufacturer or supplier.

For the insulating glass guarantee and the fire-resistant glass guarantee to remain valid, it is an unconditional prerequisite that the products are protected from any damaging conditions or circumstances and complacency with this glazing guideline must be demonstrated. This is applicable once the product leaves the factory during storage, transport, assembly and installation.

Damaging conditions or circumstances include:

- moisture in the glazing rebate area (e. g. sustained water impact)
- UV radiation
- mechanical stresses
- incompatible glazing materials (e.g. acids and alkalis)
- temperatures outside the range of - 40 ° C and + 50 ° C

The suitability of a fire protection/façade system is the responsibility of the system manufacturer or processor, taking into account building law and the state of the art as well as the technical rules and regulations. In addition, the minimum requirement level of these installation recommendations for the protection of the edge composite or the edge protection tape must be observed.

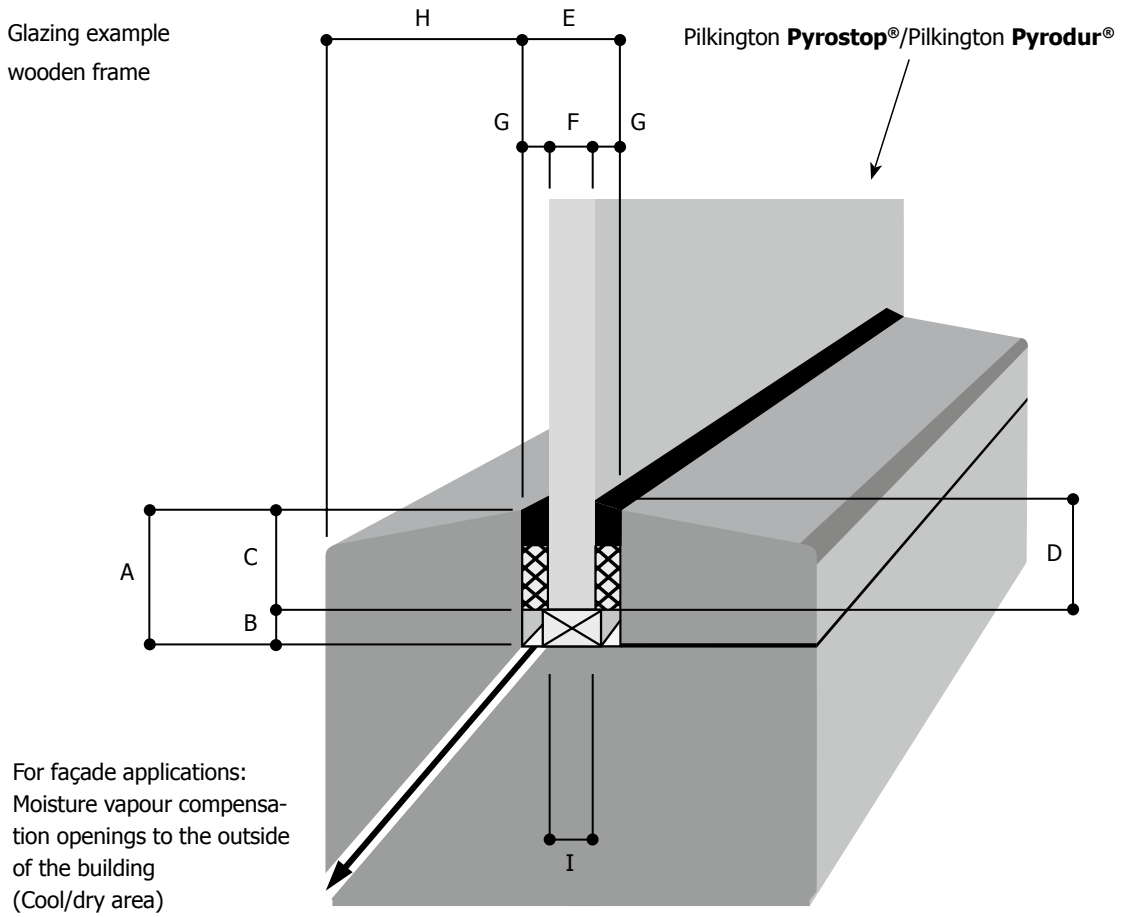
3.0 Installation recommendations

3.1 Glazing Example / Principle

In general, glazing systems are installed with their rebates free of sealant and openings for the moisture vapour compensation on the outer side (weather side) for sufficient drainage and ventilation. In any case, the fire-resistant glass must be framed on all sides, and held in place elastically by means of glazing profiles or glass retainers using suitable, preformed gaskets or glazing tapes with silicone capping. The edge of the glass or the IGU-edge seal system must be adequately covered on all sides. The correct fixing and bedding of the fire-resistant glass is essential for ensuring reliable and long term performance of a fire protection system.

The suitable setting blocks should be be chosen and positioned between the bottom edge of the frame and the glass in such a way that the glass is supported and a safe transmission of its dead loads is possible. Their use must be compliant to the fire resistance requirements. Where fire resistant IGUs are concerned, a sufficient glass edge covering is to be planned, in order to ensure longevity in normal use.

The glass edge area, which is completely covered by a special edge protection tape as an integral part of our fire resistant glass, must be permanently protected against exposure to incompatible materials such as acids and alkalis as well as prolonged moisture or humidity.



A = Glass rebate depth	**Min. 20 mm**
B = Glass edge clearance (~ setting block thickness)	**Min. 5 mm**
C = Bite	**15 mm to 25 mm**
D = Glass edge cover	**Max. 25 mm**
E = Glass rebate width	**F + 2 x G**
F = Pane thickness	
G = Face (front/back) clearance	**Approx. 4 mm**
H = Glass bead width	**Depending on material and fire-resistance class**
I = Setting block width	**pane thickness F + 2 mm**

3.2 Applications

All fire-resistant glazing systems, both for internal and external/façade applications, must provide at least the required integrity (E-Class) in the event of a fire, where performance levels of EW classes are required, reduce the heat radiation to a defined level and additionally have thermally insulating properties for compliance to the EI class requirements. Certified and approved systems – such as fixed glazing in compartmentation or partition walls or mullion and transom construction or openable fire-resistant elements such as fire-resistant barriers - are usually made of wood, steel or aluminium and combinations thereof. In general, the system components must be dimensioned in such a way that the deflection of the frame under full load in the area of a pane edge is limited to 1/200 of the pane's edge.

Additional normative or object-specific requirements are to be considered. Likewise, selecting the glass thickness and verification whether the selected glass pane is appropriate for the respective application are the responsibility of the user.

3.2.1 Façades

All façade-glazing systems installed in moderate Central European climate zones must have a rebate free from any loose material or debris which is ventilated to the outside through openings at the base of the rebate to prevent water from collecting. The whole system must be able to dispose of moisture and condensate generated in the rebate directly and reliably to the outside (colder/drier ambient conditions).

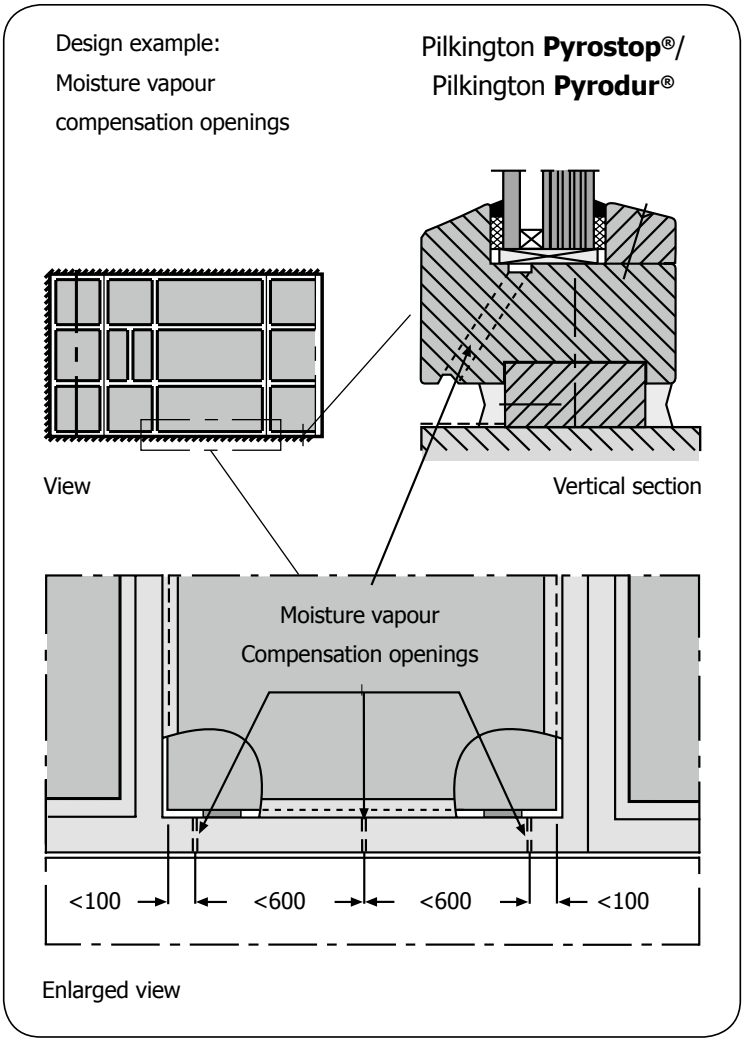
The openings, which must be designed so that no rain water can penetrate into the rebate space, can be designed as follows:

a) round holes with a minimum diameter of 8 mm,
b) quadratic holes:
   Minimum dimensions 8 mm x 8 mm,
c) oblong holes /slots:
   Minimum dimensions 5 mm x 15 mm.

3.2.2 Frame systems

The following minimum requirements have been established for the moisture vapour compensation openings in fixed glazed frame systems:

- In the lower glass rebate, there are at least one opening to the right and left, whose distance from the frame corner is not more than 100 mm and does not exceed 600 mm.
- To optimise the ventilation and drainage, we recommend that you also provide an opening in the upper rebate corner areas.
- Only setting and location blocks may be placed in the rebate as required.
- The setting blocks must not obstruct the moisture vapour compensation and the drainage. If necessary, special glazing supports must be used.
- The openings must be placed at the lowest point of the glass rebate. Profile undercuts or ridges must be made through the opening area. The openings are to be burr-free in the glass rebate.
- The openings for the moisture vapour compensation (drainage/ventilation) should not lead directly into the glass rebate from the outside. For frames with channelled profiles, the openings should preferably pass through a channel with an offset of 50 mm. The use of rain protection covers is recommended.



3.2.3 Curtain wall systems

Where stick-built systems (mullion/transom construction) are concerned, moisture vapour compensation and ventilation by means of lateral, sufficiently large openings of the bottom and top transom rebates into the mullion rebate channels and from there to the outside have proved to work reliably, provided the distance between the mullions is not more than 1,250 mm. For larger mullion spans, we recommend providing an additionally moisture vapour compensation opening in the centre of the transom, ensuring effective ventilation and drainage of the transom rebate. The mullions should also be provided with adequate ventilation/ drainage openings.

Additional openings should be provided for each floor depending on the façade system and the size of the free mullion areas, but should not exceed a free span of 6 m.

In order to ensure the permanent function of the moisture vapour compensation and the ventilation/drainage, effective air and vapour tightness for the mullion/transom system is necessary, especially on the internal side (the warmer/more humid side).

3.2.4 Special internal applications

In the case where internal applications are having to be designed to withstand loading requirements beyond normal levels, a fire-resistant glass specialist from Pilkington Deutschland AG should be consulted in beforehand.

Examples of special applications include high-humidity areas (swimming pools, etc.), an extreme risk of heating due to proximity to high power, heat generating artificial light or heat sources, or use near a façade with restricted ventilation.

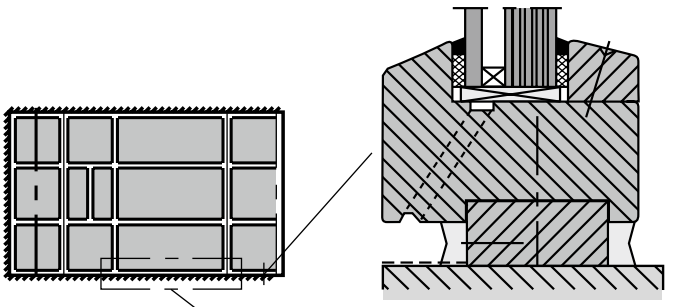
3.3 Setting blocks

In addition to supporting the glass by transferring the dead load of the unit's weight, the use of setting blocks of the fire-resistant glasses has the following essential task:
It is intended to create an unobstructed rebate able to maintain the moisture vapour compensation and the ventilation/drainage.

The setting blocks must consist of a material which is **fire-resistant** and resistant to moisture and to humidity; they must be compatible with the adjacent glazing materials and have sufficient compressive strength. They should not cause any damage to the edge protection tape or splintering of the glass.

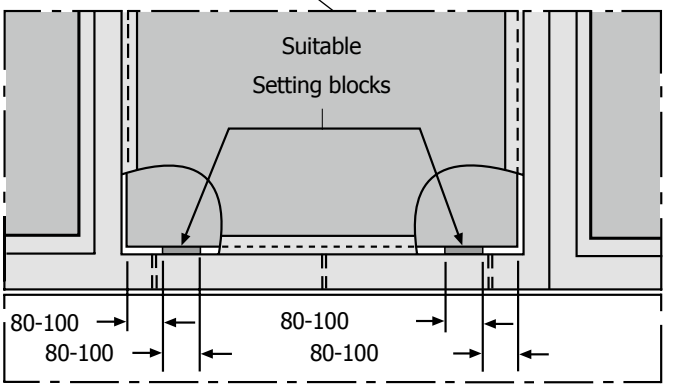
Design example:
Setting blocks

Pilkington **Pyrostop®**/
Pilkington **Pyrodur®**



View

Vertical section



Enlarged view

The setting blocks must not significantly alter their properties during the period of use due to the sealants and adhesives used, or due to moisture, temperatures or other influences. The setting blocks must be dimensioned in length and width so that the intrinsic strength of the glass is not exceeded. Typically, a length of about 80 to 100 mm is sufficient. The setting blocks must be at least wide enough to support the total thickness of the glass unit.
(Recommendation: glass thickness plus 2 mm).

The location of setting blocks directly on the corners of the glass units increases the glass breakage risk. It is recommended that their distance from the corners should be at least approx. one block length.

It is essential that the use of the setting blocks is carried out in a professional manner which ensures that harmful stresses in the glass are avoided.

3.4 Edge protection

Pilkington **Pyrostop®** and Pilkington **Pyrodur®** are supplied with a special edge protection tape which is circumferentially applied around the edges and must not be removed. Care must be exercised when Pilkington **Pyrostop®** and Pilkington **Pyrodur®** is handled, the panes must not be pulled across the ground or over edges or corners to ensure that the edge protection tape must not damage.

No changes or modifications should be made to the edge protection tape. Do not install panes with damaged edge protection tape.

3.5 Glazing pressure

In general it is not necessary to exert an excessive glazing pressure on the glass retaining strips or the glazing beads or glazing tapes to achieve the required fire resistance performance. In order to reduce the risk of the glass being damaged by excessive pressure, the glazing pressure should be as low as necessary and distributed as uniformly as possible. The glazing method should be such that the glass rests on a flexible support/bedding and a perfectly circumferential sealing holds it inside the frame, keeping it effectively sealed, also in the corners during entire period of its intended under normal loading conditions.

Excessive glazing pressure can lead to leakage between the glass unit and the glazing beads and increase the glass breakage risk. Too little glazing pressure, however, does not ensure a sufficient tight weather seal of the fire-resistant glass against rain and cleaning water, or from condensation, moisture or vapour on the room side. Due to the risk of glass breakage, point-by-point pressure glazing is not permitted. A recommendation or choice of the appropriate glazing pressure is the responsibility of the system manufacturer/ supplier/processor.

3.6 Material compatibility

The edge area of our fire-resistant glass, which is covered and thereby protected by the edge protection tape, must not get in contact or be exposed to incompatible materials, such as acids and alkalis. It must be kept dry and not be exposed to moisture, vapour, humidity or be sitting in water. When using fire-resistant IGUs in combination with Pilkington Activ™ coating on surface 1, specific instructions must be considered and taken into account (available on request).

3.7 Product marking

Each Pilkington **Pyrostop®** and Pilkington **Pyrodur®** glass is supplied with permanent product identification mark which is placed at the lower right-hand corner. For those types suitable for external application, it is important to ensure that the product stamp must always facing to the interior/room side. Only then the unit is installed in the right orientation. Its design takes into consideration local, national requirements regarding layout, size of letters digits as well as content of information. The Pilkington **Pyrostop®** and Pilkington **Pyrodur®** product mark may not be covered or altered. It must still be visible after installation of the glass in the surrounding frame.

3.8 Installation conditions

Exposure to UV radiation, e.g. by means of high power artificial lighting or positioning near to transparent roofs which enable UV radiation to enter the building, must be avoided on both sides for all internal use glass types and, where external use types are concerned, on the room side, i. e. the face with the product mark.

For external grade units, it is absolutely necessary to ensure that the installation orientation corresponds to the instructions on the glass label or sticker. An indication for the correct orientation of the glass after the installation is when the product stamp can be read from the room side or is facing inside.

4.0 Transport, handling and storage

Transport, handling and storage – especially of heavy units such as fire resistant glass – must be done in such a way that each individual pane is supported. A suitable method for handling such glass is to temporarily lift the unit with heavy load vacuum lifters on one side at a time when manipulating and installing.

Only appropriate tools and equipment must be used and procedures be followed in each step of handling phase. Pilkington **Pyrostop®** and Pilkington **Pyrodur®** glass units should be carefully inserted into the frame system without tilting or slipping. Pilkington explicitly advises those responsible for the handling of the units of this fact and requests them to take due care.
The responsibility for applying the correct procedures on the construction site or at the place of installation with appropriate health and safety measures and precautions remains with the persons responsible for handling and/or installing the fire-resistant glazing.

Glass units may only be stored in the appropriate manner, in a vertical position (up to 6 ° from the vertical). The supports and any support against tilting must not cause damage to the glass or the edge seal system, including the edge protection tape. It must be positioned at the right angle to the pane surface. The individual panes must be separated by means of intermediate layers (e. g. self-adhesive cork pads). All fire-resistant glass must be stored in a dry place and must not be exposed to direct sunlight or other sources of heat or UV radiation. This also applies to packaged units.
In case of improper setting down, a twisting of the packaging unit can occur, which can be transmitted to the panes. Each glazing unit must be checked for faults before glazing commences. Damaged or defective units must not be used.

5.0 Replacement glazing, maintenance and cleaning

In case of damage to a fire-resistant glazing unit occurs, such as, for example by glass breakage, any necessary measures and precautions for a maximum level of personal safety and protection of assets must be taken without delay and the required fire resistance performance of the unit maintained.

5.1 Replacement glazing

As a general rule, replacement glazing must be only installed in accordance with the relevant fire test certificate or technical certificate or approval (general building inspection/ control approvals, approvals or expert opinions in individual cases or classification reports) in accordance with the relevant installation manuals of the system manufacturer/supplier and according to Pilkington's actual glazing and handling guidelines for fire resistant glazing. The installation of the replacement must be done in such a manner that the glass is fixed in the frame in the appropriate and approved manner.

5.2 Servicing and maintenance

All components of a glazing system are subject to a natural aging process. We therefore recommend that glazing systems are periodically checked and inspected for functioning and, when necessary, repaired. This applies to the functioning of the moisture vapour compensation and the sealants or gaskets profiles/silicone capping, especially for the edges/corner areas. In addition, the frame and panes must be regularly checked for any visual damage.

5.3 Cleaning of glass panes

Any glass surfaces must be cleaned at regular intervals, depending on the degree of contamination. It is best to use clear water and cleaning additives or spray cleaners and simple soft cloths or sponges. Alkaline detergent solutions, washing liquids or cleaning agents and acids and fluoride-containing agents are not to be used. Grease and sealant residues should be removed using commercially available, non-aggressive, non- corrosive solutions (menthylated spirit, isopropyl alcohol), then rinsed off with plenty of water. Any cleaning with abrasive, i. e. scrubbing or scratching materials (fine steel wool, glass planes, razor blades at a flat angle to the glass or similar) is only permitted to remove individual spots of dirt or residue. The use of such tools to clean entire surfaces, i.e. so-called"blade-scraping", is not appropriate. Pilkington **Pyrostop®** or Pilkington **Pyrodur®** fire-resistant glass, which has been covered by a decorative film, are not to be cleaned at all with abrasive materials.

These rules apply to almost all types of basic and specialty glasses.
For glasses coated on Pos. 1, such as Pilkington **Activ™**, additional, special cleaning instructions (available on request) apply.

5.4 Cleaning on construction sites

Both the cleaning water and the rags or sponges must be free from sand and other foreign particles.
Cement dust and other abrasive residues must not be removed in a dry state! Plenty of water should be used to clean heavily contamined glass.
Due to its corrosive effect, water which has passed over fresh concrete must be kept away from glass surfaces. Likewise, traces of cement sludge or building material discharges must be removed immediately from the glass without residue - such deposits remaining on the glass for any length of time leads to permanent damage (dulling).

In the case of Pilkington **Pyrostop®** and Pilkington **Pyrodur®** fire-resistant glazing, which are provided with a decorative foil, special precautions, e. g. protective measures on the construction site, are to be taken to minimize subsequent cleaning effort.

6.0 Special advice

6.1 On site conditions

Excessive thermal stress caused by shading or heat build-up due to specific installation conditions, e.g. niches, pre-installed slats and awnings, or heat sources, such as radiators etc., can lead to glass breakage in the form of tension cracks. The application of paint, adhesive films or foils or the application of other materials has such effects and can lead to tension cracks and thermal strain of the intumescent fire-resistant layers (Pilkington **Pyrostop®**/Pilkington **Pyrodur®**) as well as of the insulating glass edge seal system. The same applies to all external fire-resistant glazing installed without sufficient ventilation as cladding or screen to cover building elements (e.g. spandrel or roof covering).

Radiators, radiant heaters and fan heaters must not be able to directly have an effect on the fire-resistant glass. A minimum distance of 10 cm should be maintained between radiators comprising a radiation shield and the glass in order to avoid an excessive temperature load on the glazing unit, which could affect the intumescent interlayer. For radiators without a radiation shield, the distance between the radiator and the glass surface should be at least 30 cm.

The installation of special screed flooring like mastic asphalt in rooms leads to a high temperature load. Fire-resistant glass must be protected from exposure to such heat stresses. For this reason, we generally recommend that the glazing is installed after the flooring work has been completed. When the work schedule does not allow this, the fire-resistant glass must be protected against heat radiation and humidity/moisture by means of a complete, appropriate cover. In case of exterior application where the fire resistant glass is exposed to the solar radiation as well, an additional cover on the weather side is required. This is especially important for units comprising coated glasses.

Sand blasting/welding work in the window area requires effective protection of the glass surface against welding beads, sparks etc.

Irremovable stains on the surfaces of the glass can occur from chemicals contained in building materials and detergents. Such chemicals lead to permanent etching, the longer the contamination remains on the glass surface, the more severe the damage to the surface.

General advice on best practice for protective measures cannot be provided due to the variety of causes. The circumstances have to be assessed and measures taken which are appropriate to each individual case.

Insulating glass at greater heights

When glass units are installed in greater heights, the external pressure is decreasing and the insulating glass unit is affected by deflection, taking on a biconvex shape.

In addition to the optical effects, such as the double-pane effect, the risk of glass breakage increases and the stress on the edge seal system is increased. To limit the bowing effect, insulating glass units which are to installed at an altitude more than 600 m above the production site level can be equipped with pressure compensating valves. This is especially recommended for:

- high-absorptive glasses,
- cavities wider than 6 mm and
- long and narrow insulating glass units,

especially when the shorter edge is smaller than about 50 cm.

The same applies for transports at high altitudes and air freight. This requires a special coordination with the supplier.

6.2 Characteristics of glass products

Performance data which is provided for glass products, such as sound insulation, heat insulation and light transmission etc., are based on data obtained by subjecting test glass units to test methods defined in the relevant product standard. The measured results are generally recorded in test certificates. Those values may change for other unit formats and/or combinations, as well as due to installation, application and external influences.

Intrinsic colour

The raw materials used to manufacture float glass for architectural applications have specific colours, which can become more noticeable with increasing thickness. In order to meet the legal requirements in regard to energy saving, coated glasses have to be used. Coated glasses also have their own intrinsic colour. This intrinsic colour may be different when viewed at different angles. Variations in the colour appearance are a given fact and cannot be avoided, depending on the iron oxide content of the glass, the coating process and the coating substrates, as well as variations in the glass thickness and the composition of the unit.

Interference phenomena

As far as fire-resistant insulating glass is concerned, interferences in the form of spectral colours may occur in very rare cases. Optical interferences are a superposition phenomenon of two or more light waves when they meet at a single point. They are shown through coloured zones of varying strength, which change when the panes are pressed. This physical effect is enhanced by the parallelism of the glass surfaces. This parallelism ensures distortion-free transparency. Interference appearances are random and cannot be influenced.

Insulating glass effect

Fire-resistant insulating glass has an air/gas-filled cavity sealed by the edge seal system, which is essentially influenced by the barometric air pressure, the height of the manufacturing site above normal zero (NN) and the air temperature at the time and at the place of manufacture. When insulating glass is installed in great heights, the changes in temperature and fluctuations in the barometric air pressure (high and low pressure) inevitably cause concave and convex deflections of the individual glass panes which lead to undesired optical distortions.

Multi-level reflections can also occur, looking differently on each surface of fire-resistant insulating glass unit.

These additional mirror images can be enhanced when, for example, the background of the glazing is dark or when the panes are coated. This cause of this phenomenon is a physical law which applies to all kinds of insulating glass units.

Anisotropies

Anisotropies are a physical effect in heat-treated glasses resulting from the internal stress distribution. A perception of dark-coloured rings and stripes arising in polarized light and/or viewing through polarizing glasses arising as a function of the viewing angle is possible.

Polarized light exists in normal daylight. The size of the polarization is dependent on the weather and the sun's level. The double refraction becomes more visible with a flat angle of view or when the glass façades form a corner.

Condensation forming on the outside surface of the glass (condensation water)

Condensation (condensation water) can appear on the outer glass surfaces when the glass surface is cooler than the adjacent air. The degree of condensation of water on the outer surfaces of the insulating glass units is determined by the thermal transmittance value, the air humidity, the air flow and difference between the internal and external temperature.

The forming of condensation water on the surface of the panes is enhanced when the air circulation is obstructed, e.g. by deep embrasures, curtains, flower pots, flower boxes or internal blinds, as well as by unfavourable location of the radiators or similar heating devices.

Where insulating glass with high thermal insulation is concerned, condensation water can form temporarily on the weather-side of the glass surface when the level of humidity outdoors (relative outdoor air humidity) is high and the outside air temperature exceeds by far the temperature of the window surface.

Wettability of glass surfaces

The outer surfaces of monolithic glazing and insulating glass units can be unevenly wetted, which can be caused by for example imprints of rollers, finger prints, vacuum cleaners, silicone components, smoothing agents and lubricants, labels, jointing compounds remnants or environmental influences. These variations can be made visible on glass surfaces by condensation, rain or cleaning water.

Glass breakage

Being a super cooled liquid, architectural float glass belongs to the class of brittle materials. When a load is applied which is exceeding the elasticity limit, especially close to the glass edge, an excessive tensile stress can build up which leads to spontaneous breakage without prior plastic deformation, as is common with metals.

Whilst glass is able to withstand high levels of compressive stress, its ability to withstand tensile stresses is only about 1/10 of the resistance to compressive stresses. When thermal and/or mechanical stresses occur in the glass exceeding the intrinsic limits of the glass, glass breakage occurs. It has to be pointed out that any type of toughened safety glass, even when being heat soak tested, denoted by an additional H mark on the glass, remains prone to spontaneous breakage caused by a crystal transformation of contained nickel sulphide particles. Toughened safety glass can be tested for critical nickel sulphide inclusions by means of the so-called heat soak test, which has a success rate close to 100% for identifying rejects. Nevertheless, there remains a residual risk of spontaneous breakage.

In view of the high level of today's production quality and the Factory Production Control activities, glass breakage nowadays is only caused by external factors or influences and is therefore, in principle, not a valid reason for a claim or complaint.

Breakage patterns

- Annealed float glass shatters in the event of glass breakage into many sharp-edged fragments, some of which can be large and pointed.
- Thermally toughened safety glass has a safer breakage behaviour compared to annealed float glass. When the high stress ratio, which is in equilibrium, is disturbed by damage to the edges of the glass or the surface, the glass shatters into a number of small glass pieces which are more or less loosely connected. The glass breakage can occur immediately after the damage is done or at a later time.
- Laminated safety glass has a safer breakage behaviour compared to annealed float glass. In the case of glass breakage, the individual panes of the laminated unit have a fracture pattern corresponding to that of annealed float glass. However, the safety layer holds the glass fragments together, limits the opening size and provides a residual strength, thus reducing the risk of cuts and stab injuries.
- Laminated glass has a breakage pattern in the event of breakage which corresponds to that of the individual glass panes that are part of the laminate

This publication provides only a general description of the product. Further, more detailed information may be obtained from your local supplier of Pilkington products. It is the responsibility of the user to ensure that the use of these products is appropriate for any particular application and that such use complies with all relevant legislation, standards, code of practice and other requirements. To the fullest extent permitted by applicable laws, Nippon Sheet Glass Co. Ltd. and its subsidiary companies disclaim all liability for anyerror in or omission from this publication and for all consequences of relying on it.

CE

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