Guidance notes

GLASS TYPES AND CHARACTERISTICS

This data is provided to ensure a basic understanding of the different types of glass and in particular to detail the characteristics of toughened safety glass.

Annealed glass

This is 'ordinary' glass used in many applications. It is the basic glass product that is processed into laminated and toughened safety glasses. It is not a safety glass and if broken will form a limited number of large pieces with potentially dangerous edges. When glazed on all edges it will tend to remain in its frame. It is commonly used for all types of vertical glazing in non-critical areas.

Laminated safety glass

This is normally two pieces of annealed glass bonded together by a special interlayer. When broken, the glass is retained by the interlayer and if well supported has an increased likelihood of staying in place. Toughened glasses and heat strengthened glasses can also be laminated.

Toughened safety glass

This is annealed glass that has been heat treated after all cutting and other work has been completed. Toughened glass is four to five times stronger than annealed glass of the same thickness and is well suited to most safety critical applications. It is not unbreakable.

Its increased strength enables it to be supported by two or even one edge and allows the safe use of glass in ways not possible with other glass types, all-glass doors being but one example. Its use overhead, at high level and in barriers must be subject to careful consideration.

If broken, the glass will shatter into small relatively harmless pieces that will no longer support a load or act as a barrier. On rare occasions toughened glass has broken in service for no apparent reason. This can be caused by a variety of reasons including damage, impact or inclusions within the glass. One particular type of inclusion, nickel sulphide (NiS), has attracted publicity and it is important that specifiers understand its characteristics and the risk of breakage in service.

NiS is formed naturally within the glass making process but is of concern only in glass that is subsequently toughened. The inclusions are too small to be visually detected by the glass manufacturer and when heated in the toughening process undergo a phase change that reduces their size. Cooling of the glass is far too rapid to allow reversal and this takes place over a period of time. If an inclusion is sufficiently large and is located within the centre of the thickness of the glass it can cause spontaneous breakage.

It is important to appreciate that the risk is very small. Glass manufacturers estimate the incidence at less than 1 in 13,000kg.

Heat-soak testing

This is a destructive test for the presence of nickel sulphide inclusions. It involves placing the toughened glass in an oven and heating it to a temperature of 290^{o}C. The glass is kept at this temperature for a period of time long enough to fracture a large proportion of any panes that might otherwise fail in service. Heat-soak testing achieves a conversion rate of 90% – 95%. Heat soaking will not detect other inclusions such as silica that can also cause breakage.

Heat-soak testing is not a requirement of any British Standard, but is recommended for safety-critical work such as atrium glazing and balustrades that stop people from falling as well as for overhead glazing and highly trafficked areas such as airports and other high-profile areas where breakage would be very emotive.

Toughened glass should be specified only when its inherent characteristics are understood and accepted.

Heat-strengthened glass

This is annealed glass that is heat treated by raising its temperature to approximately 700^{o}C and then cooling it more slowly than toughened glass. It is not a safety glass and breaks in a similar way to ordinary annealed glass. The process adds strength (twice that of annealed glass) and thermal safety.

It is of particular benefit when used to ensure the thermal safety of vertically glazed solar control glasses and cladding panels. There is very little risk of breakage due to nickel sulphide inclusions and if broken it will tend to stay in place and reduce the risk of falling glass.