National Protective Security Authority

LAMINATED GLASS

Recommended PVB Interlayers for Blast Requirements

Introduction

If there is an external blast threat, laminated glass with a PVB (polyvinyl butyral) interlayer should be used on the inner most pane to reduce the glazing hazard to people inside the building. The interlayer holds the broken glass together, reducing the number of hazardous fragments that are projected, and the risk to people inside the building. For more information see NPSA Guidance Note "Introduction to Interlayers".

In response to market demands, PVB manufacturers have been increasing the range of available PVB interlayers. Interlayers have been produced to meet specific project requirements such as improving noise attenuation or increasing strength so that the glass can be used as a structural element e.g. stairs.

This change in the UK market means that the current guidance for specifying PVB for blast applications is no longer accurate or sufficient.

Interim Guidance

This interim guidance note provides the latest information on the blast performance of different PVB interlayers. Research in this field is still ongoing and an updated guidance note will be issued on completion of this research.

Aim of this Guidance Note

This guidance note will aid the selection of a PVB interlayer for laminated glass in new facades and windows. The guidance note is applicable where the following assumptions are true:

- **The glass is exposed to an external blast threat**
- **The glass is yet to be installed in a façade or a window (identification of interlayers in situ is very difficult)**
- **The glass is held in place by structural silicone (performance of laminated glass held in place by gaskets is different, further guidance will be provided once research has been completed)**

Laminated Glass

Laminated glass comprises of two or more layers of glass which are permanently bonded together by an interlayer. The interlayers vary based on two key aspects:

- The interlayer material properties e.g. stiffness
- The adhesive bond of the interlayer to the glass i.e. how well it sticks to the glass.

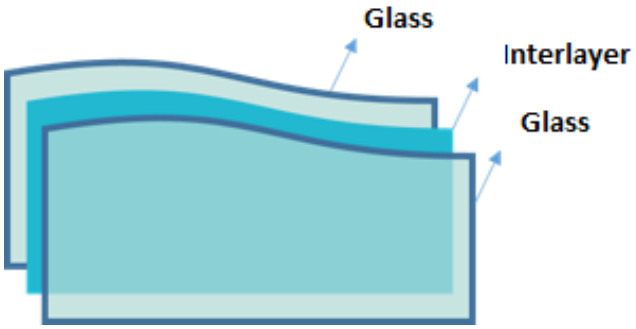

Figure 1: Components of laminated glass

How are PVBs Categorised?

In recently published standards EN 16612 and EN 16613, a simplified method for categorising interlayers into three families with different stiffnesses is provided; Family 0, Family 1 and Family 2. Details of the use of the families is shown in table 1.

PVB Family	PVB Stiffness	Category	Why are they used	Where are they used	Examples
0	Low	Acoustic	Developed for noise reduction	• External windows in residential developments in urban/noisy environments i.e. city or by busy road • External facades in airports	• Kuraray Trosifol S.C. Multilayer – B120 • Kuraray Trosifol S.C. Monolayer
1	Medium	Standard/ Architectural	Original, most commonly used interlayers. The main difference between these interlayers is the adhesion level.	• Car windscreen • Shop fronts in shopping centres • Glass balustrades • Domestic windows • The default interlayer when no specific requirements are given	Ordered from low to high adhesion: • Kuraray Trosifol Clear B100 LR • Everlam Lam51H • Eastman Solutia RB11 (RB41) • Kuraray Trosifol Ultraclear B100 NR
2	High	Structural	Provides greater stiffness and adhesion when compared to other PVB Families	• Large span glass balustrades • Overhead glazing • Glass stairs • Ambitious glazing projects where glass is required to span greater distances	• Eastman Saflex DG41 • Kuraray Trosifol Extra Stiff – B130

Table 1: PVB Categories

Do all interlayers provide the same level of blast protection?

No[1] - the blast performance of laminated glass is highly dependent on the interlayer type that is selected.

Which interlayers should be specified for blast resistant glazing?

For laminated glass fixed to a frame with structural silicone, it is recommended that Family 1 interlayers with a low adhesion level are specified for the inner glass pane where protection from blast is required. It is recommended that the interlayer is at least 1.52mm thick.

Based on initial NPSA testing, the following interlayers provide the best blast performance:

- Everlam Lam54J
- Kuraray Trosifol Clear B100 LR

Other considerations

When specifying the interlayer, blast requirements are not the only consideration. The design must comply with all other project requirements such as imposed loads and the appropriate building regulations. An interlayer that provides good blast performance may not meet other project requirements such as noise reduction.

Interlayer performance is also dependent on correct processing by the glass fabricator. Reputable manufacturers should be able to provide quality control documents to confirm the glass has been correctly processed. See Guidance Note – Factors Effecting the Performance of Glass or Glazing Systems for further information.

[1] Based on tests conducted with 7.5mm laminated glass (with 1.52mm interlayer), pane size - 1.2m x 1.5m, sealant bonded into rigid frames.