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Conspectus's Tech Tips received the national Communications Award from the Construction Specifications Institute.

ABSTRACT:
Laminated glass construction is simple - glue two or more panes of glass together to form a composite single pane. Wait, nothing is ever that simple. What can be used as the glue? What benefits and limitations do the glues have? What considerations might help design teams choose the best construction?

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REFERENCES:
International Building Code, 2009 edition.
16 CFR 1201 - Safety Standard for Architectural Glazing Materials

Laminated Glass

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Background

Laminated glass construction is simple - glue two or more panes of glass together to form a composite single pane. Wait, nothing is ever that simple. What can be used as the glue? What benefits and limitations do the glues have? What considerations might help design teams choose the best construction?

There are three types of glue, typically called interlayers, used to fabricate laminated glass:

- Polyvinyl Butyral (PVB) film
- Ionoplast film or sheet
- Liquid resin (cast in place) and cured

This Tech Tips will focus on the PVB and Ionoplast interlayers as Conspectus's most commonly specified types.

The Uses

Laminated glass may be selected for a variety of reasons. The most distinct advantage is that laminated glass, when broken, remains in the opening. Keeping the glass in the opening improves safety and security.

Hurricane wind-borne debris may shatter the glass, but the interlayer will prevent the glass shards from becoming projectiles and injuring building occupants. Interlayers will deter smash-and-grab thefts by preventing easy building entry. With the right construction, laminated glass will resist ballistic and blast threats.

Laminating glass panes together will allow glass to meet 16 CFR 1201 for Category II to be classified as safety glass without tempering. The interlayer provides improved strength.

Safety rated laminated glass may be substituted for tempered glass at locations subject to human impact as required by code.

Interlayers and the glass panes can be "tuned" to provide improved acoustic performance. Laminated glass will help reduce sound transmission compared to single pane glass. When combined into an insulating glass unit with unbalanced interior and exterior panes, even better performance is possible.

Laminated glass introduces design options that are simply not available with single pane glass. Virtually unlimited colors, patterns, and transparencies are possible. Designers will love it.

The Codes

The IBC does not require laminated glass for any application. (See all the exceptions.) The code permits laminated glass as an option for safety glass at human impact locations and at overhead applications to prevent broken glass from injuring or falling on building occupants. Laminated glass is a convenient way to satisfy the code safety requirements without compromising aesthetics and creating other problems.

PVB Films

Products: DuPont Butacite PVB, Eastman Saflex Dg PVB, and Eastman Vanceva PVB.

Available Thicknesses: 15, 30, 45, 60, and 90 mil. The 15 mil thickness is the standard for Vanceva colored interlayers. The 45 mil thickness is available from DuPont, only.

Available Colors: A variety of standard colors are available in the standard thicknesses. Vanceva offers a color system by combining 4 layers of 15 mil interlayers similar to CMYK color printing. The four-digit code used to specify the color represents each of the four plies of the interlayer for a total 60 mil thickness.

Clarity: PVB films are reported to be slightly yellow, especially in comparison to SGP. When PVB films are used for design effects, the clarity is probably of little concern.

SGP Films

Products: SGP is the acronym for DuPont's trade name SentryGlas®Plus. The product is described as an ionoplast, a specialty product for improved structural performance compared to PVB interlayers. SGP interlayers produce glass with five times the strength of similar construction with PVB.

Available Thicknesses: 35, 60, 90, and 100 mils. The 35 mil film is available in roll form. The others are available in sheet form only. Two layers of 35 mil film will provide the equivalent performance of one layer of 60 mil sheet. Roll form is the most efficient (least costly) for fabricators.

Available Colors: Clear and white, only. Note that white has limited availability for now. Be sure to check with your DuPont representative to confirm availability before specifying white for your project.

Clarity: SGP is reported to have superior clarity compared to PVB interlayers by a factor of 4 to 8. The basis and test to support this claim could not be verified. When selecting low iron glass for improved clarity, get samples. Be certain that interlayers are not clouding the view.

Considerations

PVB and SGP interlayers require the glass fabrication to be autoclaved to achieve the bond between the interlayer and glass while liquid resin interlayers do not. Autoclaving SGP transforms the product from translucent to clear. Specifying PVB and SGP interlayers will preclude fabricators without autoclaves from furnishing the glass.

PVB films, when subject to direct exposure to moisture and certain sealants, may deteriorate. The deterioration will be visible at the glass edge. Depending on the application and glazing method, the deterioration may be concealed by the perimeter framing and therefore not objectionable. SGP is less susceptible to moisture and is preferred for structurally glazed applications where the glass edge is visible.

Heat treated glass, whether heat strengthened or fully tempered, develops roller waves on the glass surface as a result of the heat treatment. This slight irregularity in the glass surface requires laminating interlayers to be a minimum 60 mils to assure full adhesion to both glass surfaces.

Conclusion

Select the right interlayer to ensure performance for the life of the installation. When strength, clarity, or exterior exposure is paramount, make it SGP. For color and design options, choose PVB.

Consult the manufacturer's literature for compatible sealants. Each manufacturer has a published list of silicone products that can be used successfully with the interlayers.

Unless the design team determines that heat strengthened or tempered glass is not required for laminated units, consider specifying a minimum 60 mil interlayer to ensure complete adhesion of the glass layers. Heat treatment may be required for the glass sizes.

Let your imagination go wild! Manufacturers already did. They found a way to glue wo layers of not-quite0liquid and not-quite-solid material together to give you unlimited design options. Now, make good use of it!

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