

Salt Fog Exposure of Laminated Glass with Saflex PVB Interlayers

Saflex® and Vanceva® brands of polyvinyl butyral (PVB) interlayer by Eastman Chemical Company are plasticized interlayer films that are laminated between two or more plies of glass. Salt fog testing exposes laminates to a saline fog which is expected to simulate South Florida environmental conditions. Edge stability ratings are performed on laminates exposed with open edges in South Florida. This test protocol is expected to determine the reaction of laminates to this simulated environment and allow conclusions to be reached about their longer term performance and use in marine-like climates.

Laminated glass specimens were produced using standard laboratory practices with Saflex R series PVB interlayers and Saflex DG interlayers. The specimens were exposed in a salt-fog cabinet for 12 weeks and evaluated visually for edge blush and delamination.

The test was run in accordance with ASTM B117-11 Standard Practice for Operating Salt Spray (Fog) Apparatus. The method involves placing specimens in a hot (35°C) environment where the entire specimen (except for the section protected by the holder/frame) is uniformly surrounded by a fog that is created from a 5% saline solution. Sample set consists of 6 laminated specimens for each interlayer type which are constantly exposed to this environment for the selected duration (12 weeks). The exception is the time out of the cabinet to rate samples and chamber maintenance (~ 1hr per week).

Table 1: Laminate Characterization for Salt Fog Testing

| Laminate Configuration (annealed glass) | Pummel Adhesion (PU) | Moisture content (%) | Interlayer thickness (mm) |
|---|-------------------------|-------------------------|------------------------------|
| 2.3 mm clear glass Saflex DG41 2.3 mm clear glass | 4/6 | 0.50% | 0.76 |
| 2.3 mm clear glass Saflex RB41 2.3 mm clear glass | 4/4 | 0.44% | 0.76 |

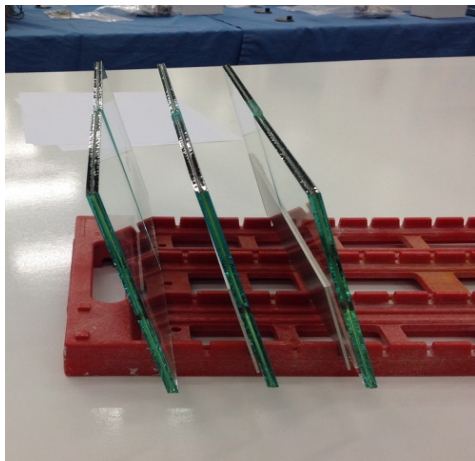


Figure 1: Salt fog specimens in rack (side-view)

The specimens were rated visually for the appearance of edge blush and delamination. Corner edge blush or delamination was recorded diagonally from the corner while depth of blush or delamination from the straight edges was measured perpendicular to the edge. The depth and length of any edge effect was measured, average area and maximum depth are reported for the sample set in Table 2. The samples remained for 60 days at ambient condition and were re-evaluated with results shown in Table 3. Edge blush was no longer visible upon re-evaluation.

The study indicates salt fog testing in accordance with ASTM B117 is capable of generating edge blush and delamination in laminated glass samples in 12 weeks or less.

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Saflex DG41 interlayer performed better than Saflex RB with regard to edge blush development in this study, and laminates with Saflex RB41 and Saflex DG41 PVB interlayers exposed to continuous marine-like climate as simulated by the salt fog testing have good durability as shown by minimal and reversible edge blush development. Saflex DG41 is not as susceptible as Saflex RB41 to the development of minor edge delamination after removal from salt fog exposure.

Table 2: Saflex® PVB interlayers - Salt Fog exposure 12 week exposure summary

| Exposure Rating | Edge Effects ⁽¹⁾ | | | |
|---------------------------------|-----------------------------|--------------|--------------|--------------|
| | Saflex® RB41 | | Saflex® DG41 | |
| | Edge Blush | Delamination | Edge Blush | Delamination |
| Maximum area (mm ²) | 21 | 0 | 6 | 0 |
| Maximum Depth (mm) | 7 | 0 | 3 | 0 |

(1) Blush area calculated as diagonal depth * 3mm as predominately corners.

Table 3: Saflex® PVB interlayers - Salt Fog exposure- 60 Day Post Exposure Rating

| Post Exposure Rating | Edge Effects | | | |
|---------------------------------|-----------------------------|--------------|--------------|--------------|
| | Saflex® RB41 ⁽¹⁾ | | Saflex® DG41 | |
| | Edge Blush | Delamination | Edge Blush | Delamination |
| Maximum area (mm ²) | 0 | 15 | 0 | 0 |
| Maximum Depth (mm) | 0 | <1 | 0 | 0 |

(1) Delamination occurred on top edge < 1mm maximum depth

Keywords: Architectural, Edge Blush, Exposure, Delamination, Laminated glass, Saflex, Salt fog

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