Use of Saflex® DG in single side supported balustrade systems

Saflex DG was designed as a structural interlayer for applications where high rigidity of the interlayer is a benefit. Saflex DG can be laminated successfully with any glass type –tempered, semi-tempered and float glass - using the recommended conditions and configurations. Saflex DG has been successfully demonstrated in use for single-side supported balustrade systems, meeting the requirements of many applicable codes and norms. Single-side supported balustrade systems can be some of the most demanding applications on the market, as any action on the glass needs to be transferred or dissipated through the single supported edge. Ultimately, the performance of a system as installed has to be considered by the system supplier which not only covers the glass configuration, but also the installation, profile, attachment to the main structure, and other considerations that need to be performed in order to benefit from the properties of Saflex DG structural interlayer. In order to assist the laminator and other users in the value chain in making an appropriate glass choice, a number of considerations are outlined below.

Normative references & glass choice

As Saflex DG is produced by Eastman Chemical Company in Ghent, Belgium, one of the assessments performed was in accordance with the Belgium norm NBN 03-004, Railings of Building. This norm provides a basis for glass choice considerations and evaluation, and a number of configurations were tested based on the principles of this document. The norm is not limited to glass, as any construction material used for a railing/balustrade should be subjected to the testing described.

In the case of glass balustrades in accordance with this norm, only laminated safety glass complying with NBN EN ISO 12543-2 can be used as part of a railing system (paragraph 7.2.1). NBN EN ISO 12543-2 specifies a number of important criteria for glass to be qualified under this norm around impact performance (EN12600) and durability (ISO 12543-4). The minimum classification needs to be attained through EN12600 testing as a laminated safety glass is 3(B)3.

In the case of single-side supported balustrades, structural glass and the allowable deformation and stress permitted to occur are calculated according to national building codes. Glass thickness calculations can be performed either according to prEN 16612 or equivalent national codes. The bending strength of float glass is given as 45 MPa (EN 572), for semi-tempered as 70 MPa (EN 1063) and 120MPa for fully tempered glass (EN 12150). These different strength levels have a large influence on the thickness of glass chosen for the application. Once a specific glass configuration has been selected, it is tested in conjunction with the mounting system and other system components for compliance with applicable code, e.g. NBN 03-004, as used for the specific project. These tests typically constitute static tests and dynamic tests, e.g. an adapted EN 12600 type impact test.

Other considerations

Apart from applicable codes and norms, the breakage patterns of the three glass types in combination with Saflex DG may need to be considered. This is not required by the standard and codes, but as a basis of overall design.

Tempered glass and Saflex DG: Tempered glass is expected to shatter over its entire surface as a result of excessive loads or sometimes due to spontaneous breakage. Structural interlayer Saflex DG tends to

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contain the glass shards to the interlayer and remain upright because of its rigidity when the proper interlayer configuration is used. Tempered glass has been shown to have the highest resistance to breakage during human body impact and simulation, however it can be broken with sharp concentrated impact and results in a loss of structural capability due to the shattering that occurs.

Semi-tempered glass and Saflex DG: Semi-tempered glass does not normally shatter as completely as tempered glass upon failure. It should retain some structural strength from the glass panes adhering to the Saflex DG due to the larger break pattern and benefits from the rigidity of Saflex DG when used in the proper configuration. Panels of heat strengthened glass laminated with Saflex DG are expected to remain upright and stable after breakage by most static or impact loads appropriate for the design purpose. This has been demonstrated in various research and project application tests.

Annealed (Float) glass and Saflex DG: Annealed glass will also break when subjected to impact conditions that exceed its impact strength, but normally does not shatter as does tempered glass. Panels of float glass laminated with Saflex DG are expected to remain upright and stable after breakage by most static or impact loads appropriate for the design purpose. As with any design, excessive sustained or impact load can result in the breakage of the laminate at the point of high stress. This breakage may result in tearing of the interlayer and loss of laminated sections from the system. As such, the glass configuration and thickness of the interlayer used in the design should be dimensioned to deal with the intended and/or anticipated loads, static or dynamic, and should be tested, and not assumed to be appropriate based on engineering calculations alone.

Within the Saflex interlayer product family, Eastman Chemical Company has several configurations and product options available that allow the proper balance between rigidity and impact performance. This option may not be available for other structural interlayer types on the market. Please contact your technical representative in these cases.

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