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The Impact of Ceramic Frit on Glass Strength

Ceramic frit applied to a glass surface, also referred to as enameled glass, has been shown to reduce glass strength when compared to non-enameled glass. There are both ASTM and European Standards commonly utilized to calculate glass strength.

The United States' industry standard for determining glass strength is ASTM E1300 Standard Practice for Determining Load Resistance of Glass in Buildings. This standard does not recognize any strength reduction or exclusion for enameled glass. "ASTM E1300 Uniform Load Strength Reduction Factor not Required for Ceramic Enameled Glass" clearly outlines the factors included in the standard and the history behind these factors. The authors conclude, "there is no technically defensible reason to include a strength reduction factor in ASTM E1300 for the design of enamel coated HS glass that is subjected to uniform lateral pressure loads" (Beason, Brackin and Lignell 2017). The European standard for heat strengthened glass, EN1863, and the standard for fully toughened glass, EN14179, both reference a strength reduction of 36-38% when calculating enameled glass strength. It is important to note, however, the European standards do not include the same in-service (weathered glass) factors as ASTM E1300.

In 2015, Viracon provided a variety of freshly manufactured enameled glass for testing to Texas Tech University. The test results corroborate the 36-38% reduction referenced in the European standards. Based on the factors included in ASTM E1300 to account for in-service strength, Viracon's years of fabrication experience, control over our manufacturing processes and history with enameled glass installed throughout the world, we are confident in the ability of the heat treated glass we provide to resist loads calculated according to ASTM E1300.

Regardless of whether the glass has ceramic frit applied or not, Viracon recommends using heat strengthened (HS) glass unless fully tempered (FT) is required by code or to resist applicable loads on the glass. In cases where FT glass is required, heat soaking is recommended to reduce the potential of spontaneous breakage from nickel sulfide inclusions.

For additional information about heat treated glass, see our website at
viracon.com/page/heat-treatment

Beason, W. Lynn, Michael S. Brackin, and A. William Lignell. 2017. "ASTM E 1300 Uniform Load Strength Reduction Factor not Required for Ceramic Enameled Glass." GPD Glass Performance Days 2017. http://www.gpd.fi/GPD2017_proceedings_book/GPD2017_conference_book.pdf