



Designation: **F2248 – 12 F2248 – 19**

Standard Practice for Specifying an Equivalent 3-Second Duration Design Loading for Blast Resistant Glazing Fabricated with Laminated Glass¹

This standard is issued under the fixed designation F2248; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

INTRODUCTION

Historical records show that fragments from glazing that has failed as the result of intentional or accidental explosions present a serious threat of personal injury. Glazing failure also allows blast pressure to enter the interior of buildings thus resulting in additional threat of personal injury and facility damage. This standard practice provides a means for designers to determine equivalent 3-second duration design loadings with which they can size blast resistant glazing comprised of laminated glass or insulating glass fabricated with laminated glass, or both. Blast resistant glazing systems of this genre can reduce the number and size of glass fragments in an explosion as well as reducing greatly or eliminating blast pressure that enters buildings when an explosion occurs.

1. Scope

1.1 This practice sets forth a method to specify an equivalent 3-second design loading suitable to use with Practice E1300 to select the thickness and type of blast resistant glazing fabricated with laminated glass to glaze a fenestration. Glass plies used to construct laminated glass are recommended to be either annealed or heat strengthened glass. This analytical method for glazing should be used with caution for glazing panels larger than 1.8 m by 2.4 m (6 ft by 8 ft) as this size panel exceeds database of testing upon which this standard is based.

1.2 This practice applies to blast resistant glazing fabricated using laminated glass only, including single laminated glass and insulating glass fabricated with laminated glass. As a minimum, insulating glass shall use laminated glass for the inboard (protected side) lite.

1.3 This practice assumes that blast resistant glazing shall be ~~adhered~~attached to its supporting frame using ~~structural silicone sealant or adhesive glazing tape~~. The width of the structural silicone sealant bead shall be at least equal to the larger of 10-mm (a captured bite so that $\frac{3}{16}$ -in.) or the thickness designation of the glass to which it adheres but not larger than two times the thickness designation of the glass to which it adheres. The minimum thickness of the structural silicone bead shall be 5-mm (it does not detach in the event of fracture due to a blast event, $\frac{3}{16}$ -in.). The width of glazing tape shall be at least equal to two times but not more than four times the thickness designation of the glass to which it adheres. The width of silicone or glazing tape is referred to as bite and is shown and discussed in Guide ~~C1564~~.

1.4 This practice assumes that the structural silicone bead or glazing tape is applied to both sides of single lite laminated glass but need only be applied to the inboard side (protected side) of insulating glass.

1.5 This practice assumes the framing members shall restrict deflections of edges of blast resistant glazing they support to $L/60$ under $2.0\times$ the load resistance of the blast resistant glazing for inward loading, where L denotes the length of the supported edge.

1.6 This practice assumes the framing system supporting the blast resistant glazing shall attach mechanically to the structural framing system. The system shall be designed to ensure that the glazing fails prior to the framing system that supports the glazing and its attachment to the structural framing system. The fasteners that attach the framing system that supports the glazing to the structural framing system shall be designed to resist a uniform load acting on the blast resistant glazing that has a magnitude of at least:

¹ This practice is under the jurisdiction of ASTM Committee F12 on Security Systems and Equipment and is the direct responsibility of Subcommittee F12.10 on Systems Products and Services.

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1.6.1 Two (2.0) times the magnitude of the load resistance of the blast resistant glazing if the maximum air blast pressure is greater than one half the magnitude of the load resistance of the blast resistant glazing, or

1.6.2 One (1.0) times the magnitude of the load resistance of the blast resistant glazing if the maximum air blast pressure is less than one half the magnitude of the load resistance of the blast resistant glazing.

1.4 Blast resistant glazing designed using this practice recommends the use of annealed or heat strengthened glass plies for the laminated glass. Blast testing has shown that use of fully tempered glass plies, when fractured during a blast event, have poorer post blast performance than ~~annealed~~annealed or heat strengthened glass plies. Laminated glass fabricated with fully tempered glass plies has a tendency to leave the supporting glazing system frame after fracture whereas laminated glass fabricated with annealed or heat strengthened glass plies will remain in the frame and absorb remaining load through tensile membrane behavior. Use of the annealed or heat strengthened glass plies will also reduce the amount of load transferred into the structure.

1.5 The equivalent 3-second design load as determined herein shall not apply to the design of monolithic glazing, plastic glazing, or security film applied to existing glazing configurations in an attempt to achieve blast resistance.

1.6 The values stated in SI units are to be regarded as the standard. Values given in parentheses are for information only. For conversion of quantities in various systems of measurements to SI units refer to ANSI IEEEE/SI 10.

1.7 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate ~~safety~~safety, health, and ~~health~~environmental practices and determine the applicability of regulatory limitations prior to use.*

1.8 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

[C1036 Specification for Flat Glass](#)

[C1048 Specification for Heat-Strengthened and Fully Tempered Flat Glass](#)

[C1172 Specification for Laminated Architectural Flat Glass](#)

~~E1422~~[C1422/C1422M Specification for Chemically Strengthened Flat Glass](#)

[C1564 Guide for Use of Silicone Sealants for Protective Glazing Systems](#)

[E631 Terminology of Building Constructions](#)

[E1300 Practice for Determining Load Resistance of Glass in Buildings](#)

~~F1642~~[F1642/F1642M Test Method for Glazing and Glazing Systems Subject to Airblast Loadings](#)

[F2912 Specification for Glazing and Glazing Systems Subject to Airblast Loadings](#)

2.2 ANSI Standard:³

[IEEE/SI 10 Use of the International System of Units \(SI\): \(The Modernized Metric System\)](#)²

3. Terminology

3.1 Definitions:

3.1.1 *blast resistant glazing, n*—glazing that provides protection against air blast pressure generated by explosions.

3.1.2 *blast resistant glazing systems, n*—a fenestration product that includes, but is not limited to, blast resistant glazing, framing systems, connections, and materials, when used, to adhere the glazing to the frame and hardware.

3.1.3 *design load, n*—magnitude in kPa (psf) of 3-second duration uniformly distributed lateral pressure.

3.1.4 *equivalent TNT charge mass, n*—mass of TNT placed on the ground in a hemisphere that represents the design explosive threat.

NOTE 1—If a different high explosive material comprises the design threat, tables exist to convert its mass to an equivalent TNT mass. Refer to Test Method ~~F1642~~[F1642/F1642M](#), for example.

3.1.5 *glass breakage, n*—the fracture of any lite or ply in monolithic, laminated, or insulating glass.

3.1.6 glass types:

3.1.6.1 *annealed (AN) glass, n*—a flat, monolithic, glass lite of uniform thickness where the residual surface stresses are nearly zero as defined in Specification [C1036](#).

3.1.6.2 *chemically strengthened glass, n*—glass that has been strengthened by ion-exchange to produce a compressive stress at the treated surface as defined in Specification ~~E1422~~[C1422/C1422M](#).

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.