



Designation: F1642 – 04

Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings¹

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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. These risks increase in direct proportion to the amount of glazing used on the building facade. This test method addresses only glazing and glazing systems. It assumes that the designer has verified that other structural elements have been adequately designed to resist the anticipated airblast pressures.

1. Scope

1.1 This test method sets forth procedures for the evaluation of hazards of glazing or glazing systems against airblast loadings. The specifying authority shall provide the airblast loading parameters.

1.2 This test method allows for glazing to be tested and rated with or without framing systems.

1.3 This test method is designed to test and rate all glazing, glazing systems, and glazing retrofit systems including, but not limited to, those fabricated from glass, plastic, glass-clad plastics, laminated glass, glass/plastic glazing materials, and film-backed glass.

1.4 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, see [SI 10](#).

1.5 *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 and health practices and determine the applicability of regulatory limitations prior to use.* See Section 9 for specific hazards statements.

2. Referenced Documents

2.1 ASTM Standards:²

¹ This test method 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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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.

[E997 Test Method for Structural Performance of Glass in Exterior Windows, Curtain Walls, and Doors Under the Influence of Uniform Static Loads by Destructive Methods](#)
[SI 10 American National Standard for Use of the International System of Units \(SI\): The Modern Metric System²](#)

3. Terminology

3.1 Definitions:

3.1.1 *ambient temperature*— $24 \pm 11^{\circ}\text{C}$ ($75 \pm 20^{\circ}\text{F}$).

3.1.2 *blast mat*—a steel or concrete pad upon which high explosive may be detonated to reduce the incidence of ejecta.

3.1.3 *effective positive phase duration (T)*—the duration of an idealized triangular positive phase reflected airblast pressure history, having an instantaneous rise to the measured P , with a linear decay to ambient, such that the impulse of the idealized pressure history equals i of the measured positive phase reflected airblast history.

3.1.3.1 *Discussion*—The idealized triangular airblast wave is considered to provide a reliable standard measure of the positive phase airblast intensity.

3.1.4 *glazing*—transparent materials used for windows, doors, or other panels.

3.1.5 *glazing system*—the assembly comprised of the glazing, its framing system, and anchorage devices.

3.1.6 *peak positive pressure (P)*—the maximum measured positive phase airblast pressure, kPa.

3.1.7 *positive phase impulse (i)*—the integral of the measured positive phase reflected airblast pressure history, kPa-ms (psi-ms) (more correctly called the *specific positive phase impulse*).

3.1.8 *reflected airblast pressure*—the pressure increase that a surface, oriented other than parallel to the line from the detonation point to the surface, experiences due to the detonation of a high explosive charge.

3.1.8.1 *Discussion*—The reflected airblast pressure history, whether reflected or otherwise, as measured at a point on the surface, consists of two separate phases. The positive phase is characterized by a nearly instantaneous rise to a maximum pressure followed by an exponential decay to ambient pressure. In the negative phase, which follows immediately the positive phase, the pressure decreases below ambient for a period of time before returning to ambient.

3.1.9 *simply supported glazing*—glazing supported in accordance with Test Method E997 with the edges of the glass extending a minimum of 3-mm (0.125-in.) beyond the neoprene supports.

3.1.10 *test director*—the individual identified by the independent testing laboratory as being responsible to complete the specified tests as required and to document the results, in accordance with this test method.

4. Summary of Test Method

4.1 This test method prescribes the required apparatus, procedures, specimens, and other requirements necessary to determine the hazard rating of a glazing or glazing system subjected to an airblast loading.

5. Significance and Use

5.1 This test method provides a structured procedure to establish the hazard rating of glazing and glazing systems subjected to an airblast loading. Knowing the hazard rating provides the ability to assess the risk of personal injury and facility damage.

5.2 The hazard rating for a glazing or glazing material does not imply that a single specimen will resist the specific airblast for which it is rated with a probability of 1.0. The probability that a single glazing or glazing construction specimen will resist the specific airblast for which it is rated increases

proportionally with the number of test specimens that successfully resist the given level of airblast to the hazard level for which it is rated.

6. Number of Specimens

6.1 *Number of Specimens*—A minimum of three test specimens representative of a glazing or glazing system, or a glazing retrofit system, shall be tested at a given level of airblast, defined in terms of P and i .

7. Hazard Rating

7.1 The hazard rating of the glazing or glazing system shall be according to the rating criteria definitions provided below and further demonstrated in Fig. 1. The hazard rating that glazing or glazing systems receive is based upon the severity of fragments generated during an airblast test. The fragment severity is determined based upon the number, size and location of fragments observed during post-test data gathering. Fragments to be considered in rating the glazing or glazing system include those generated by the glazing, and any other parts of the glazing system not considered to be part of the test facility. See 8.1 for a definition of the test facility.

7.1.1 *No Break*—The glazing is observed not to fracture and there is no visible damage to the glazing system.

7.1.2 *No Hazard*—The glazing is observed to fracture but is fully retained in the facility test frame or glazing system frame and the rear surface (the side opposite the airblast loaded side of the specimen) is unbroken.

7.1.3 *Minimal Hazard*—The glazing is observed to fracture and the total length of tears in the glazing plus the total length of pullout from the edge of the frame is less than 20 % of the glazing sight perimeter. Also, there are three or less perforations caused by glazing slivers and no fragment indents anywhere in a vertical witness panel located 3 m (120 in.) from

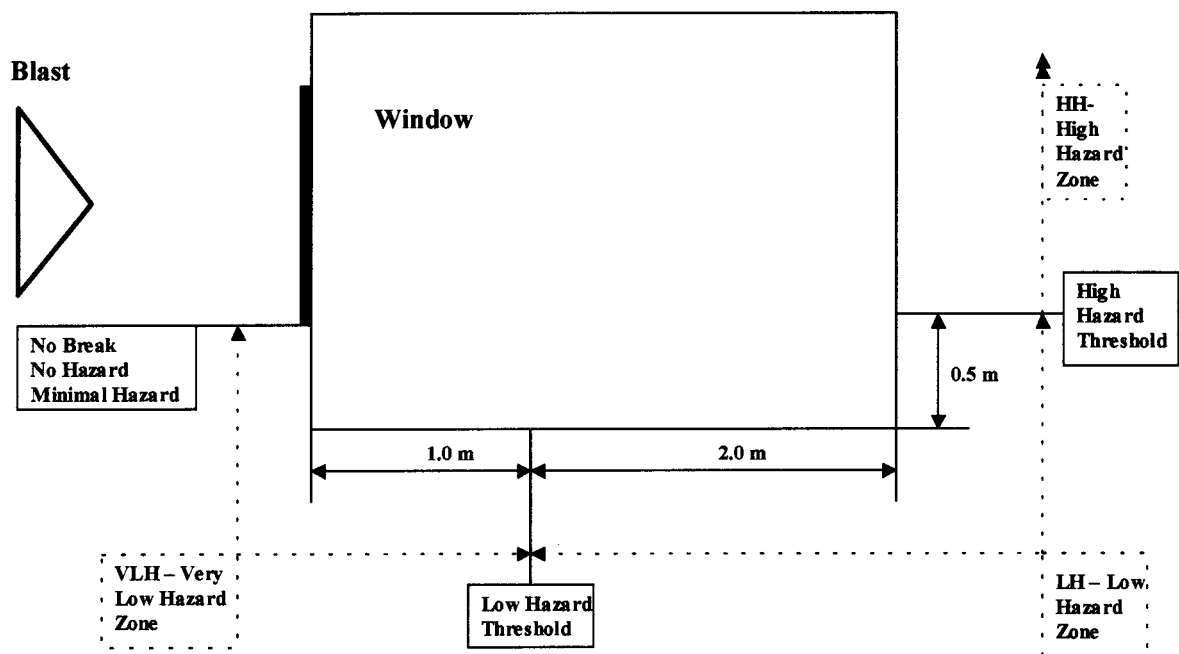


FIG. 1 Cross-section Through Witness Area