



Standard Specification for Glazing and Glazing Systems Subject to Airblast Loadings¹

This standard is issued under the fixed designation F2912; 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.

1. Scope

1.1 This specification covers exterior windows, glazed curtain walls, glazing panels in doors and other glazed protective systems used in buildings that may be subjected to intentional or accidental explosions.

1.2 This specification addresses only glazing and glazing systems. This specification does not address the structural integrity and functionality of door assemblies. It assumes that the designer has verified that other structural elements have been adequately designed to resist the anticipated airblast pressures.

1.3 This specification is designed for 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 organic coated glass.

1.4 This specification does not determine the assessment of a facility nor acceptable hazard ratings. Threat and risk assessment shall have already been performed and the acceptable hazard rating defined.

1.5 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 [IEEE/ASTM SI 10](#).

1.6 *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.*

2. Referenced Documents

2.1 ASTM Standards:²

[E631 Terminology of Building Constructions](#)

¹ This specification 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.

Current edition approved July 1, 2011. Published August 2011. DOI: 10.1520/F2912-11.

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.

[F1642 Test Method for Glazing and Glazing Systems Subject to Airblast Loadings](#)
[IEEE/ASTM SI 10 American National Standard for Metric Practice](#)

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:* Not included in Terminology [E631](#).

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

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

3.1.3 *hazard level*—rating assigned to the performance of the glazing system based on the amount and location of integral materials expelled from the system under specific blast conditions of the test.

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

3.1.5 *positive phase impulse (i)*—the integral, over time, of the measured positive phase reflected airblast pressure history, kPa-ms (psi-ms).

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

4. Classification

4.1 The classification of airblast resistant glazing is determined by the defined blast load and the performance of the glass or glazing system when subjected to blast testing in accordance with Test Method [F1642](#).

4.1.1 *Hazard Levels*—The hazard levels are identified and described in [Table 1](#).

4.1.2 *Specification*—Specification shall take into account the specified blast loads as defined by pressure (P) and impulse (i) and the corresponding hazard level (H1 through H4) as determined from [Table 1](#).

TABLE 1 Hazard Levels and Descriptions

Hazard Rating Description	Description of Fenestration Glazing Response	Hazard Level
No Break	The glazing is observed not to fracture and there is no visible damage to the glazing system.	H1
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.	H1
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 the interior face of the specimen and there are fragments with a sum total united dimension of 25 cm (10 in.) or less on the floor between 0m to 1 m from the interior face of the specimen. Glazing dust and slivers are not accounted for in the rating. Fragments are defined as any particle with a united dimension of 2.5 cm (1 in.) or greater. The united dimension of a glass particle is determined by adding its width, length, and thickness. Glazing dust and slivers are all other smaller particles.	H2
Very Low Hazard	The glazing is observed to fracture and is located within 1 m (40 in.) of the original location. 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 the interior face of the specimen and there are fragments with a sum total united dimension of 25 cm (10 in.) or less on the floor between 1 m (40 in.) and 3 m (120 in.) from the interior face of the specimen. Glazing dust and slivers are not accounted for in the rating.	H3
Low Hazard	The glazing is observed to fracture, but glazing fragments generally fall between 1 m (40 in.) of the interior face of the specimen and 50 cm (20 in.) or less above the floor of a vertical witness panel located 3 m (120 in.) from the interior face of the specimen. Also, there are ten or fewer perforations in the area of a vertical witness panel located 3 m (120 in.) from the interior face of the specimen and higher than 50 cm (20 in.) above the floor and none of the perforations penetrate through the full thickness of the foil backed insulation board layer of the witness panel as defined in Test Method F1642-04, section 8.7.5.	H4
High Hazard	Glazing is observed to fracture and there are more than ten perforations in the area of a vertical witness panel located 3 m (120 in.) from the interior face of the specimen and higher than 50 cm (20 in.) above the floor or there are one or more perforations in the same witness panel area with fragment penetration through the first layer and into the second layer of the witness panel.	N/A

5. Performance Requirements

5.1 The performance requirements of glazing or glazing systems are found in [Table 2](#).

5.1.1 *Pre-Defined Blast Load*—Specification format for blast loads that are defined with a pressure and impulse value in [Table 2](#), the following text shall be inserted into the glass and

glazing specification under a security glazing header:

Glazing system shall meet a minimum Specification Level (____(insert specification level from [Table 2](#) ex: K3)) in accordance with ASTM F2912.

5.1.2 *User Defined Blast Load-Specification format*—For blast loads defined by the user, the following text shall be inserted into the glass and glazing specification under a security glazing header:

Glazing system shall meet a minimum Specification Level (____(insert level Z1 through Z4)) with the following blast loads: P(____) kPa (psi), i(____) kPa-ms (psi-ms)) in accordance with ASTM F2912.

Where:

P = indicates blast pressure

kPa = unit of measure or blast load (may also be indicated as psi)

TABLE 2 Specification Levels

Blast Load (<i>P</i> and <i>i</i>)	Hazard Levels			
	H1	H2	H3	H4
	Specification Levels			
28 kPa @ 193 kPa-ms (4 psi @ 28 psi-ms)	A1	A2	A3	A4
41 kPa @ 290 kPa-ms (6 psi @ 42 psi-ms)	C1	C2	C3	C4
69 kPa @ 614 kPa-ms (10 psi @ 89 psi-ms)	E1	E2	E3	E4
90 kPa @ 538 kPa-ms (13 psi @ 78 psi-ms)	F1	F2	F3	F4
234 kPa @ 558 kPa-ms (34 psi @ 81 psi-ms)	J1	J2	J3	J4
290 kPa @ 2055 kPa-ms (42 psi @ 298 psi-ms)	K1	K2	K3	K4
827 kPa @ 1531 kPa-ms (120 psi @ 222 psi-ms)	N1	N2	N3	N4
User Defined	Z1	Z2	Z3	Z4