



Designation: F2927 – 21

Standard Test Method for Door Systems Subject to Airblast Loadings¹

This standard is issued under the fixed designation F2927; 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 test method identifies the standard procedures that shall be followed when utilizing either an air blast simulator, shock tube, or a controlled open-air explosion to evaluate the blast capacity of a door system. This test method is designed for all types of swinging doors, including single and double doors construction. This method is used to test complete door assemblies. The door panel(s) may also contain one or more integral vision lites (part of the glazing system). The door assembly shall be arranged so that the initial blast force either acts to seat the door panel(s) into the frame or unseat the door panel(s) from the frame to simulate the blast threat. When the initial blast force acts to unseat the door(s) from the frame, the force is concentrated on the restraining hardware (that is, the latching mechanism, the hinges, and the frame connection). The results gathered from this method can be used for door installations in non-rigid wall openings. The test method may be adapted to horizontal sliding and vertical-lift doors.

1.2 When testing with an explosive charge, a charge in-contact with the test specimen or any charge resulting in high localized loading is not covered by this method. When testing with an explosive charge to this standard, to avoid brittle modes of response from the blast, the scaled range of the charge shall be $(1.19 \text{ m/kg})^{1/3}$ ($3 \text{ ft/lb})^{1/3}$ or greater from the test specimen, with an absolute minimum of 1 m (39 in.) standoff of the charge from the test specimen.

1.3 Swinging doors that may be required to resist or mitigate the effects of a blast shall have restraining hardware (latching mechanisms and hinges). The performance of these items is critical in determining the blast resisting or mitigating properties of a door assembly. A door assembly may also contain ancillary hardware. Although many of these critical restraining and ancillary items are mounted on what is deemed the “safe side” of the door system, the test director must verify whether these items stay affixed to the assembly or become dislodged from the assembly. Hardware items that dislodge from the door or frame during the test and become a flying

debris hazard shall be assigned a door response damage category as defined in [Table 1](#). When the test results of a door system do not include ancillary hardware as specified by the specifier, it shall be the responsibility of the test sponsor or vendor/manufacture to determine the risk of an ancillary component becoming a flying debris hazard to the satisfaction of the specifier.

1.4 Unless otherwise specified by end user, this test method and the resulting data are valid for the door size tested, and for smaller doors of identical construction (including any ancillary hardware) with a similar ($\pm 20\%$) aspect ratio up to 25 % smaller. Acceptance criteria are divided into five door response damage categories (Categories I, II, III, IV, and V). Damage Category III has two subcategories: III/U that permits an unsecured door after the loading event and III/S that requires a secured door after the loading event. Refer to [7.1](#) and [Table 1](#) for a description of each category.

1.5 A door assembly may also contain ancillary hardware. Although these hardware components may not influence blast resistance performance, the specifier may wish to verify that these items do not dislodge from the door or frame during a test and become a flying debris hazard.

1.6 For doors equipped with a vision lite, the door shall be evaluated using the door response damage categories in [Table 1](#), and the glazing and glazing system of the vision lite shall also be evaluated using the glazing hazard levels in [Table 2](#) (see also [7.5](#)).

1.7 This method is intended to test the blast capacity of a door assembly from a shock wave. It does not attempt to address all testing required of door assemblies. These tests may include, but are not limited to, charge-in-contact blast resistance, forced entry resistance, ballistic resistance, fire resistance, sound attenuation, and gas or water leakage. These types of tests are not covered by this test method.

1.8 This test method does not verify the blast performance of the wall that a tested door will be placed in.

1.9 The values stated in SI units (International System of Units) are to be regarded as the standard. The values given in parentheses are provided for information only.

1.10 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the*

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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TABLE 1 Door Response Damage Categories and Descriptions

Damage Rating	Description of Door/Frame Response	Damage Level Category
Undamaged	The door specimen is substantially unchanged after the airblast loading and is fully operable. Any permanent deformation shall be within 3 mm ($\frac{1}{8}$ in.) of the pre-test condition. The door must be checked that it is operable by unlatching and swinging the door open and then closed and latched. The door can be locked. The external portion of the frame, frame anchorage, latches, and hinges shall not show any visible damage.	I
Damaged but Openable	The door panel, the frame, or the hardware, or combinations thereof, have acceptable permanent deformation or damage; however, the door remains openable. The door must be checked that it is openable by unlatching and swinging the door open far enough to allow ingress/egress. Acceptable permanent deformation or damage and degree of opening to permit ingress/egress is determined by the specifier based on the end use of the door.	II
Non-catastrophic Failure Security or Secured Application	The door shall remain shut and secure both during and after the loading event. The door panel(s) may get lodged into the frame from the blast force to hinder ingress/egress. After the loading event, the door system shall be non-openable from the threat side, nor shall a man-passable* opening be allowed or created using the force of a single person without tools, from the threat side. End user may elect to specify additional limitation, such as permanent deformation or hardware detachment, as required based upon intended end use of the door system.	III/S
Non-catastrophic Failure Unsecure Application	The door need not remain secure after the loading event – a door panel is openable or man-passable, or both, by means other than operation of the manufacturer's supplied hardware, or by using the force of one person without tools. Acceptable permanent deformation or damage is determined by the specifier based on the end use of the door. The door hardware components, including ancillary hardware, are permitted to detach from the door panel or frame and come to rest on the floor of the witness area within the 3-m (120-in.) distance to the witness panel. No flying debris can strike the witness panel. The frame and frame anchorage must remain an integral system and attached to the test structure wall. The door panel may swing open during the rebound phase of the loading event. Should the door panel swing open it must remain affixed to the frame by the door hinges.	III/U
Limited Hazard Failure	A door leaf becomes separated from frame or the frame anchorage fails and the entire door leaf and frame assembly become separated from the test structure wall and are thrown into the test structure witness area. The dislodged door leaf or assembly must remain within the 3-m (120-in.) finish floor as shown in Fig. 1. There shall be no evidence of any dislodged hardware component striking the witness panel mounted on the back wall of the test structure. Note: A door assembly equal to or exceeding 3 m (120 in.) in height cannot obtain a "Limited Hazard Failure – Category IV Rating" due to the size limitation of the test structure witness area and thus shall be given a damage rating category of V.	IV
High Hazard Failure	A door leaf becomes separated from frame or the frame anchorage fails and the entire door leaf and frame assembly become separated from the test structure wall and are thrown into the test structure witness area and strike the witness panel above the "High Hazard Threshold" shown in Fig. 1. There shall be no evidence of any dislodged hardware component striking the witness panel above the High Hazard Threshold. Note: A door assembly equal to or exceeding 3 m (120 in.) in height can only be assigned a damage category of V.	V

responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.

1.11 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

E699 Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components

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

F2912 Specification for Glazing and Glazing Systems Subject to Airblast Loadings

F3038 Test Method for Timed Evaluation of Forced-Entry-Resistant Systems

2.2 Other Standards:³

ISO/IEC International Standard 17025:2017 General Requirements for the Competence of Testing and Calibration Laboratories

3. Terminology

3.1 Definitions:

3.1.1 *airblast load*—either an air blast simulator, shock tube or a high explosive charge used to generate the desired peak pressure and positive phase impulse on the test specimen; if an

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.