



Standard Test Methods for Deglazing Force of Fenestration Products¹

This standard is issued under the fixed designation E987; 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 These test methods measure the resistance of elements of fenestration products such as operating (or removable) window sashes, storm sashes, and sliding glass door panels (hereafter referred to as sash members) to forces tending to deglaze the construction.

1.2 These test methods utilize concentrated loads applied to the interior side of a sash member in a manner simulating normal opening and closing forces. Removable sashes are loaded to simulate handling for removal and cleaning.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 *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](#)

3. Terminology

3.1 *Definitions*—For definitions of terms used in these test methods, refer to Terminology E631.

3.2 *Descriptions of Terms Specific to This Standard:*

3.2.1 *bite*—the distance from the edge of the glazing material to the sight line.

3.2.2 *deglazing*—the movement of a sash member from its original position in relation to the glazing material. Deglazing is expressed as a percentage of the original (before testing) glazing “bite.”

¹ These test methods are under the jurisdiction of ASTM Committee E06 on Performance of Buildings and are the direct responsibility of Subcommittee E06.51 on Performance of Windows, Doors, Skylights and Curtain Walls.

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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.

3.2.3 *deglazing force*—the force required to obtain the deglazing measured.

4. Significance and Use

4.1 Under normal usage, deglazing loads are generally applied parallel to the plane of the glazing material and eccentric to the sash element when it is opened, closed, or lifted out of the frame. When operating hardware is present, torsional forces may be increased. Opening and closing forces are normally applied from the interior side only. Sliding glass door panels are activated from both sides.

4.2 The ability of fenestration products to resist deglazing forces may vary with a number of factors. These factors should be considered when selecting test specimens or when interpreting test results. Bedding compounds in newly assembled sashes may not reach full strength until they have been allowed to cure for several days or weeks. Some sash materials are subject to shrinkage at low temperatures and increased elasticity at high temperatures. Therefore, a sash containing these materials may exhibit a range of deglazing resistance due to varying temperature conditions. Normal manufacturing tolerances and clearances in sash members and glazing materials may also affect deglazing resistance. Further, although fenestration products are designed to operate within certain force limits, improper installation, wear, and abuse may increase the forces necessary for sash operation.

4.3 When determining which members of a given sash shall be tested for deglazing resistance, consideration must be given to the manner in which the sash may be operated when normally installed. Handles and lift devices are usually located on the sash for the convenience of the operator and therefore dictate the normal direction of operation.

4.4 Test Method A presents a technique for actual measurement of the deglazing forces of an individual sash member.

4.5 Test Method B presents a technique for measuring the deglazing force of two opposite members. This test method is intended for quality control measurements.

5. Apparatus

5.1 *Hydraulic or Pneumatic Ram*, or an equivalent capable of producing at least a 100-lbf (445-N) force when connected to a hydraulic pump or compressed air supply, or an equivalent of suitable capacity. The ram piston extension can be fitted to



allow the addition of extensions to accommodate the width or length of the specimen to be tested.

5.1.1 *Sliding Contact Shoe*, to be fitted on either end of the ram, as shown in Fig. 1.

5.1.1.1 For Test Method A, only one shoe is required, since the opposing force will be dissipated against a stationary support.

5.1.1.2 For Test Method B, two contact shoes are required to generate the opposing forces against opposite sash members.

5.1.2 *Force Gage*, capable of measuring force to an accuracy of ±1.0 lbf (±4.5 N).

5.1.2.1 The apparatus, including the gage system, shall be calibrated and a calibration curve prepared every 6 months correlating gage readings to pounds-force generated.

5.2 *Extensometers*, capable of being read to an accuracy of 0.01 in. (0.25 mm), required to measure the deflection of the

members under test. One extensometer is required for Test Method A and two extensometers are required for Test Method B.

6. Test Specimen

6.1 Submit the test specimen glazed in accordance with the manufacturer’s standard practices for the window sash or the door panel to be tested. The test specimen shall be of the maximum width and maximum height for which the test data is to be determined.

6.2 The sash or panel members to be included in this test are those having integral pull provisions, and those having no integral pull provisions, but fitted with handles, latches, or other means that might be used to operate the window or door. Removable window sashes, because of their inherent capability of being lifted by any sash surround, shall be tested on all four sash surround members.

6.2.1 Test sliding glass door panels from both the interior and exterior side on the stile containing the locking mechanism, necessitating the submission of at least two panels for each door tested.

6.3 Acclimate the test specimen to the ambient conditions under which the test shall be conducted.

7. Procedures

7.1 Test Method A:

7.1.1 Provide a reaction fixture capable of withstanding at least the anticipated maximum deglazing load to be achieved. The fixture shall be designed so that when the ram is attached, the ram will be perpendicular to the member under test at the center point of the member, and parallel to the plane of glazing.

7.1.2 Support the test specimen, with the side to which manual force is normally applied to operate the sash facing upward, on (at least) two 2 by 4-in. (51 by 102-mm) wooden supports located under the glass or other glazing material. Two of the wooden supports shall be located within 1 in. (25.4 mm) of each of the parallel sash members and be of sufficient length to extend within 1 in. of each perpendicular sash member.

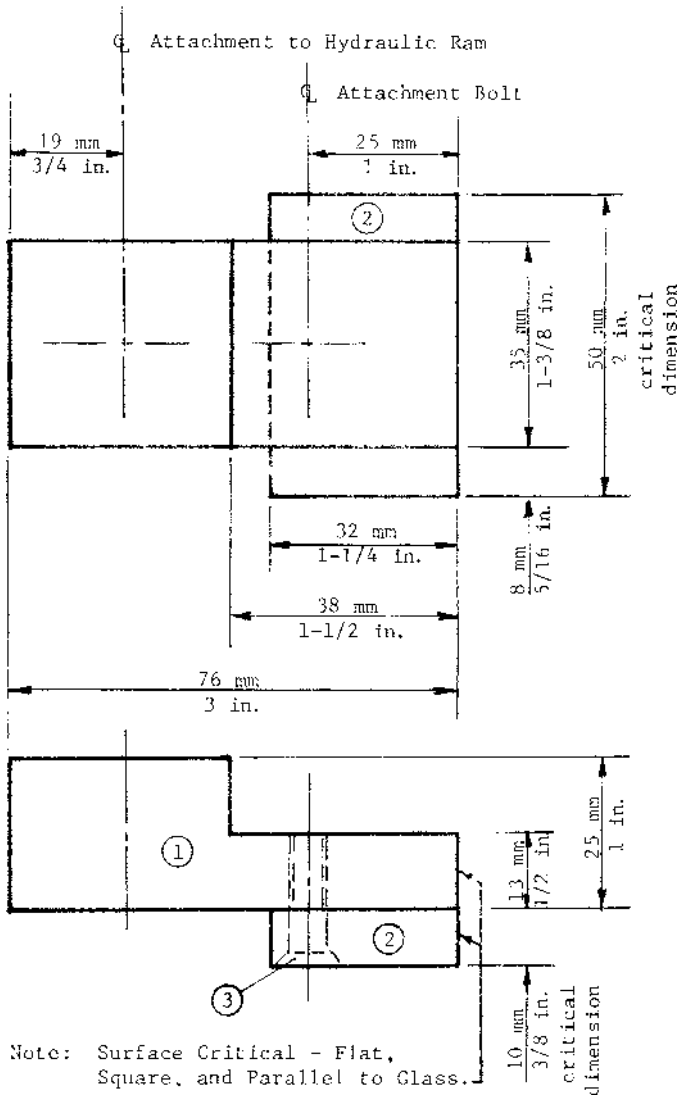
7.1.3 Provide a mechanical stop at each corner of the test specimen to prevent movement of the test specimen in the direction of loading. The mechanical stops shall not engage the test specimen for more than ½ in. (12.7 mm) from the corner of the specimen.

7.1.4 Adjust the ram assembly to the appropriate length with the ram extenders so that the contact shoe is within ½ in. (12.7 mm) of the member to be tested. Install the ram onto the reaction fixture (in accordance with 7.1.1) so that the ram is perpendicular to the member under test and parallel to the plane of glazing. The centerline of the contact shoe must correspond to the centerline of the sash member being tested.

7.1.5 Place an extensometer at the center of the sash member under test to measure the deflection of the member when the load is applied.

7.1.6 Mark the glazing bite at the point where the shoe will make contact with the sash member.

7.1.7 Apply the required specification load for 30 s, measure and record the extensometer reading (L_c), and release the load.



- 1—Hydraulic ram foot. The dimensions are not critical.
- 2—Aluminum block, 1¼ by 2 by ¾ in. (32 by 50 by 10 mm)
- 3—Attachment bolt, ¼ in. (6 mm)

FIG. 1 Sliding Contact Deglazing Shoe



The loading period required to achieve the specified load should not exceed 15 s.

7.1.8 Remove the sash member under the test from the glazing material, being careful not to break the glazing material. Measure the distance from the mark described in 7.1.6 to the edge of the glazing material. Record this measurement as the glazing bite (L_b).

7.2 Test Method B:

7.2.1 Support the test specimen, with the side to which manual force is normally applied to operate the sash facing upward, on (at least) two 2 by 4-in. (51 by 102-mm) wooden supports located under the glazing material and parallel to the sash members under test. Two of the wooden supports shall be located within 1 in. (25.4 mm) of each of the parallel sash members and be of sufficient length to extend within 1 in. of each perpendicular sash member.

7.2.2 Adjust the ram assembly to the appropriate length with the ram extenders so that the contact shoes are within 1.5 in. (38.1 mm) of the members to be tested. Install the ram assembly onto the glass so that the centerline of the contact shoes correspond to the centerlines of the sash members being tested.

7.2.3 Place an extensometer at the center of each sash member under test to measure the deflection of the member when the load is applied.

7.2.4 Mark the glazing at the point where the contact shoes will make contact with the sash members.

7.2.5 Apply the required specification load for 30 s, measure and record the extensometer readings (L_e), and release the load. The loading period required to achieve the specified load should not exceed 15 s.

7.2.6 Remove the sash members under test from the glazing material, being careful not to break the glazing material. Measure the distance from the marks described in 7.2.4 to the edge of the glazing. Record these measurements as the glazing bite (L_b).

8. Calculation

8.1 Calculate the percentage deglazed for the member under test as follows:

$$D_x = \frac{L_e}{L_b} (100) \quad (1)$$

where:

D_x = percent deglazed at load x applied to the sash member,

x = load applied at which L_e is measured, lbf (N),

L_b = original depth of bite on the glazing material, in. (mm),
and

L_e = movement of the sash member under x , lbf (N).

9. Report

9.1 Report the following information:

9.1.1 Manufacturer's name and address of the window sash or door panel.

9.1.2 Name and address of the testing agency.

9.1.3 Type and thickness of the glazing material(s) used in the test specimen.

9.1.4 Drawing or complete description of the sash members tested. Dimensions on drawings shall be verified by the testing agency.

9.1.5 Complete description of the glazing system, including component materials, such as backbedding compound, glazing compound, gasketing, etc. When such a description includes drawings, dimensions shall be verified by the testing agency.

9.1.6 Tabulation of the loads applied, the percentage of deglazing observed under those loads, and the test methods used.

9.1.7 Statement that the tests were performed in accordance with these test methods; or, if any deviation was used, a treatment describing the deviation.

10. Precision and Bias

10.1 The precision and bias of these test methods have not been established. As soon as statistically valid data is compiled, precision and bias will be stated.

11. Keywords

11.1 deglazing loads; deglazing resistance; doors; sliding glass doors; storm sashes; window sashes

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