



Standard Test Methods for Strength of Glass by Flexure (Determination of Modulus of Rupture)¹

This standard is issued under the fixed designation C158; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 These test methods cover the determination of the modulus of rupture in bending of glass and glass-ceramics.

1.2 These test methods are applicable to annealed and prestressed glasses and glass-ceramics available in varied forms. Alternative test methods are described; the test method used shall be determined by the purpose of the test and geometric characteristics of specimens representative of the material.

1.2.1 Test Method A is a test for modulus of rupture of flat glass.

1.2.2 Test Method B is a comparative test for modulus of rupture of glass and glass-ceramics.

1.3 The test methods appear in the following order:

Test Method A
Test Method B

Sections
6 to 9
10 to 15

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.* Specific hazard statements are given in Section 10 and A1.5, A2.3.3, A2.4.3 and A2.5.3.

2. Referenced Documents

2.1 *ASTM Standards:*²

C148 Test Methods for Polariscopic Examination of Glass Containers

E4 Practices for Force Verification of Testing Machines

¹ These test methods are under the jurisdiction of ASTM Committee C14 on Glass and Glass Products and are the direct responsibility of Subcommittee C14.04 on Physical and Mechanical Properties.

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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.

SI10-02 IEEE/ASTM SI 10 American National Standard for Use of the International System of Units (SI): The Modern Metric System

3. Terminology

3.1 *Definitions:*

3.1.1 *glass-ceramics*—solid materials, predominantly crystalline in nature, formed by the controlled crystallization of glasses.

3.1.2 *modulus of rupture in bending*—the value of maximum tensile or compressive stress (whichever causes failure) in the extreme fiber of a beam loaded to failure in bending computed from the flexure formula:

$$S_b = \frac{M c}{I} \quad (1)$$

where:

M = maximum bending moment, computed from the maximum load and the original moment arm,

c = initial distance from the neutral axis to the extreme fiber where failure occurs, and

I = initial moment of inertia of the cross section about the neutral axis.

3.1.3 *prestressed*—material in which a significant and controlled degree of compressive stress has been deliberately produced in the surfaces.

3.1.4 *standard laboratory atmosphere*—an atmosphere having a temperature of $23 \pm 2^\circ\text{C}$ and a relative humidity of $40 \pm 10\%$.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *abraded*—describes a test specimen that has at least a portion of the area of maximum surface tensile stress subjected to an operationally defined procedure for mechanical abrasion. The severity and uniformity of abrasion should be sufficient to ensure origin of failure substantially in the region of maximum stress.

3.2.2 *annealed glass*—describes a specimen that shall not have a temper or degree of residual stress resulting from prior thermal treatment in excess of the following limits when measured polarimetrically (see Annex A1):