



Designation: C338 – 93(Reapproved 2008)

## Standard Test Method for Softening Point of Glass<sup>1</sup>

This standard is issued under the fixed designation C338; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

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

### 1. Scope

1.1 This test method covers the determination of the softening point of a glass by determining the temperature at which a round fiber of the glass, nominally 0.65 mm in diameter and 235 mm long with specified tolerances, elongates under its own weight at a rate of 1 mm/min when the upper 100 mm of its length is heated in a specified furnace at the rate of  $5 \pm 1^\circ\text{C}/\text{min}$ .

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.3 *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. Significance and Use

2.1 This test method is useful to determine approximately the temperature below which the glass behaves as a rigid solid in glass-forming operations and for a control test to indicate changes in composition. It has been found useful for specification acceptance and for providing information in research and development work with glass.

### 3. Apparatus

3.1 The apparatus for determining the softening point of glass shall consist essentially of an electrically heated resistance furnace, a furnace stand, a device for controlling the heating rate of the furnace, equipment for measuring the temperature of the furnace, and equipment for measuring the elongation rate of a fiber of glass suspended in the furnace.

3.1.1 *Furnace*—The furnace shall conform in all essential respects to the requirements shown in Fig. 1.

3.1.2 *Furnace Stand*—A means shall be provided for supporting the furnace so that the fiber hangs below it. This stand must be provided with a leveling device such as three screws. The stand shown in Fig. 1 is convenient when used with either a cathetometer or a telescope and scale.

3.1.3 *Heating Rate Controller*—Suitable controls shall be provided for maintaining the furnace heating rate at  $5 \pm 1^\circ\text{C}/\text{min}$ .

NOTE 1—A continually adjustable transformer has proved effective for controlling the heating rate.

3.1.4 *Temperature-Measuring Equipment*—The furnace temperature shall be measured with a calibrated Type R or S thermocouple and a calibrated potentiometer capable of measuring the true temperature of the furnace within  $\pm 0.2^\circ\text{C}$ . The cold junction shall be maintained at  $0^\circ\text{C}$  by means of an ice bath. An alternative acceptable means of temperature measurement is the use of a potentiometer to oppose the thermocouple electromotive force. This potentiometer shall be set at a standard setting for the type of glass being measured, and galvanometer deflection shall serve as a means of obtaining relative temperatures, the deflection of the galvanometer having been calibrated. Also acceptable for temperature measurement is a solid-state digital thermometer that is capable of the accuracy specified.

3.1.5 *Fiber-Elongation Measurement Equipment*—The fiber elongation shall be measured by a device capable of measuring the position of the end of the fiber within 0.02 mm throughout the entire elongation period.

NOTE 2—Suitable devices that have proved effective for measuring the elongation are cathetometers, projection magnifiers, and telescope and scale combinations.

3.1.6 *Timer*—A timing device with a least count and accuracy of 1 s shall be used.

### 4. Preparation of Test Specimens

4.1 The fiber specimen used for the test shall meet the following requirements:

4.1.1 It shall be round.

4.1.2 It shall be smooth and shall contain no void spots or foreign matter.

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee C14 on Glass and Glass Products and is the direct responsibility of Subcommittee C14.04 on Physical and Mechanical Properties.

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