



Designation: E 1094 – 98 (Reapproved 2003)

## Standard Specification for Pharmaceutical Glass Graduates<sup>1</sup>

This standard is issued under the fixed designation E 1094; 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 specification covers glass graduates suitable for laboratory, pharmaceutical, and other uses, in both conical and cylindrical shapes.

### 2. Referenced Documents

#### 2.1 ASTM Standards:

- E 438 Specification for Glasses in Laboratory Apparatus<sup>2</sup>
- E 671 Specification for Maximum Permissible Thermal Residual Stress in Annealed Glass Laboratory Apparatus<sup>2</sup>
- E 694 Specification for Laboratory Glass Volumetric Apparatus<sup>2</sup>
- E 920 Specification for Commercially Packaged Laboratory Apparatus<sup>2</sup>
- E 921 Specification for Export Packaged Laboratory Apparatus<sup>2</sup>
- E 1133 Practice for Performance Testing of Packaged Laboratory Apparatus for United States Government Procurements<sup>2</sup>
- E 1157 Specification for the Sampling and Testing of Reusable Laboratory Glassware<sup>2</sup>

#### 2.2 Other Document:

- NIST Handbook 44, Section 4.44 Graduates<sup>3</sup>

### 3. Classification

3.1 Graduates shall be in the following types and sizes:

3.1.1 *Type 1*—Graduated in metric scale only.

3.1.1.1 *Sizes*—5, 10, 25, 50, 100, 250, 500, and 1000 mL.

3.1.2 *Type 2*—Graduated in both metric and inch-pound scales.

3.1.2.1 *Sizes*—5 mL and 60 minims, 10 mL and 120 minims, 15 mL and 4 fluid drams, 25 mL and 8 fluid drams, 50 mL and 2 fluid oz, 100 mL and 4 fluid oz, 250 mL and 8 fluid oz, 500 mL and 16 fluid oz, and 1000 mL and 32 fluid oz.

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee E41 on Laboratory Apparatus and is the direct responsibility of Subcommittee E41.01 on Apparatus.

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 14.04.

<sup>3</sup> Available from National Institute of Standards and Technology (NIST), Gaithersburg, MD 20899.

NOTE 1—The term millilitre (mL) is commonly used as a special name for the cubic centimetre (cm<sup>3</sup>) in accordance with the International System of Units (SI). (The inch-pound fluid ounce is equivalent to 29.5735 mL, hence, the fluid dram is equivalent to 3.6967 mL and the minim is equivalent to 0.0616 mL).

### 4. Material and Annealing

4.1 Graduates shall be made of borosilicate glass conforming to the requirements of Type 1, Class A of Specification E 438.

4.2 Maximum residual thermal stress shall be such as to conform to Specification E 671.

### 5. Design

5.1 *Style*—Graduates having a capacity of more than 15 mL (4 fluid drams) may be either conical or cylindrical. Those having a capacity of 15 mL or less shall be cylindrical.

5.2 *Dimensions*—The inside measurement from the bottom of the graduate to the top capacity graduation shall be not less than five times the inside diameter on a cylindrical graduate and two times on a conical graduate. The inside measurement from the bottom of the graduate to the point representing one fourth of the capacity shall not be less than the inside diameter at that point.

5.3 *Pour-Out Spout*—All graduates shall have a pour-out spout that ensures delivery of an unbroken stream of liquid without wetting the outside wall of the graduate.

5.4 *Base*—The base shall be hexagonal in shape and shall be perpendicular to the vertical axis of the graduate. The base shall be large enough so that the empty graduate will stand on a surface 15° from the horizontal.

### 6. Graduations

6.1 Each graduate shall have clear graduation markings perpendicular to the vertical axis of the graduate and parallel to each other. They shall conform to the requirements of Specification E 694.

6.1.1 No graduation line shall extend less than one fourth the circumference of the graduate. Graduates shall have an initial interval that is not subdivided, equal to not less than one fifth and not more than one fourth of the capacity of the graduate. Except for this interval, the values of all graduated intervals shall be the same. Each main graduation line shall be