



# Standard Specification for Glasses in Laboratory Apparatus<sup>1</sup>

This standard is issued under the fixed designation E438; 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 U.S. Department of Defense.*

## 1. Scope

1.1 This specification covers the glasses commonly used to manufacture laboratory glass apparatus.

1.2 *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:*<sup>2</sup>

**C225** Test Methods for Resistance of Glass Containers to Chemical Attack

**C338** Test Method for Softening Point of Glass

**C598** Test Method for Annealing Point and Strain Point of Glass by Beam Bending

**C729** Test Method for Density of Glass by the Sink-Float Comparator

**E228** Test Method for Linear Thermal Expansion of Solid Materials With a Push-Rod Dilatometer

## 3. Classification

3.1 Three types are included, as follows:

3.1.1 *Type I, Class A*—A low-expansion borosilicate glass.

3.1.2 *Type I, Class B*—An alumino-borosilicate glass.

3.1.3 *Type II*—A soda-lime glass.

## 4. Chemical Requirements

4.1 The Type I, Class A and B glasses shall have the major constituents and comply with the restrictions on trace constituents given in **Table 1**. The major constituents will be varied to maintain the physical requirements as shown.

4.2 Suitable Type II glasses may vary somewhat in chemical composition and still meet essential physical requirements. Two such compositions are shown in **Table 2**; both are readily available and are used for laboratory apparatus.

## 5. Physical Requirements

5.1 The physical requirements for glasses shall be as prescribed in **Table 3**. The tolerances listed in **Table 3** must be on the published values of the manufacturer's specific glass compositions.

## 6. Keywords

6.1 glasses; laboratory

<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 Laboratory Ware and Supplies.

Current edition approved Jan. 1, 2018. Published January 2018. Originally approved in 1971. Last previous edition approved in 2011 as E438 – 92 (2011). DOI: 10.1520/E0438-92R18.

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

**TABLE 1 Chemical Requirements of Type I Glasses**

	Type I, Class A, weight %	Type I, Class B, weight %
Major constituents, approximate:		
SiO <sub>2</sub>	81	73
B <sub>2</sub> O <sub>3</sub>	13	10
Al <sub>2</sub> O <sub>3</sub>	2	7
BaO	see below	0–2
CaO	see below	1
Na <sub>2</sub> O	4	6
K <sub>2</sub> O	see below	1
Trace constituents, max:		
As <sub>2</sub> O <sub>3</sub> plus Sb <sub>2</sub> O <sub>3</sub>	0.005	0.1
PbO	0.1	0.1
MgO	0.1	0.3
ZnO	0.1	0.1
CaO	0.1	see above
K <sub>2</sub> O	0.75 <sup>A</sup>	see above
All other constituents, max	0.2	1.0

<sup>A</sup> Each manufacturer must publish the maximum percentage in his glass because certain limited applications require a level under 0.1 %.

**TABLE 2 Chemical Requirements of Type II Glasses**

	Composition A, weight %	Composition B, weight %
Major constituents, approximate:		
SiO <sub>2</sub>	68	72
B <sub>2</sub> O <sub>3</sub>	2	...
Al <sub>2</sub> O <sub>3</sub>	3	2
BaO	2	...
CaO	5	5
MgO	4	4
Na <sub>2</sub> O	15	16
K <sub>2</sub> O	1	1
Trace constituents, max:		
As <sub>2</sub> O <sub>3</sub> + Sb <sub>2</sub> O <sub>3</sub>	0.1	0.1
Pb O	0.1	0.1
All other constituents, max	1.0	1.0

**TABLE 3 Physical Requirements**

NOTE 1—Values in parentheses are the permissible ranges of nominal values and the tolerances shown are permitted on the nominals published by each manufacturer.

Property	Type I, Class A	Type I, Class B	Type II Glass	ASTM Test Method
Linear coefficient of expansion, 0 to 300°C, cm/cm·°C × 10 <sup>-7</sup>	(32–33) ±1.5	(48–56) ±2	(90–93) ±2	<b>E228</b>
Annealing point, °C	560 ±10	574 ±10	(520–540) ±10	<b>C598</b>
Softening point, °C	(815–820) ±10	(783–799) ±10	(700–720) ±10	<b>C338</b>
Density, annealed, g/cm <sup>3</sup>	(2.23–2.24) ±0.02	(2.33–2.36) ±0.02	(2.47–2.53) ±0.02	<b>C729<sup>A</sup></b>
Chemical durability, titration equivalent of: 0.02N H <sub>2</sub> SO <sub>4</sub> /10 g of glass, max, ml	1.0	1.0	9.5	<b>C225</b> (Method P-W)

<sup>A</sup> See Day, R. K., *Glass Research Methods*, Industrial Publications, Inc., Chicago, IL, 1953, pp. 98–100.



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