



Standard Specification for Glasses in Laboratory Apparatus¹

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 (ϵ) 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 the glasses commonly used to manufacture laboratory glass apparatus.

2. Referenced Documents

2.1 *ASTM Standards:*²

[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](#)

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

Current edition approved Dec. 1, 2011. Published December 2011. Originally approved in 1971. Last previous edition approved in 2006 as E438 – 92 (2006). DOI: 10.1520/E0438-92R11.

²For 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. 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



TABLE 1 Chemical Requirements of Type I Glasses

	Type I, Class A, weight %	Type I, Class B, weight %
Major constituents, approximate:		
SiO ₂	81	73
B ₂ O ₃	13	10
Al ₂ O ₃	2	7
BaO	see below	0–2
CaO	see below	1
Na ₂ O	4	6
K ₂ O	see below	1
Trace constituents, max:		
As ₂ O ₃ plus Sb ₂ O ₃	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 ₂ O	0.75 ^A	see above
All other constituents, max	0.2	1.0

^A 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 ₂	68	72
B ₂ O ₃	2	...
Al ₂ O ₃	3	2
BaO	2	...
CaO	5	5
MgO	4	4
Na ₂ O	15	16
K ₂ O	1	1
Trace constituents, max:		
As ₂ O ₃ + Sb ₂ O ₃	0.1	0.1
PbO	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 ⁻⁷	(32–33) ±1.5	(48–56) ±2	(90–93) ±2	E228
Annealing point, °C	560 ±10	574 ±10	(520–540) ±10	C598
Softening point, °C	(815–820) ±10	(783–799) ±10	(700–720) ±10	C338
Density, annealed, g/cm ³	(2.23–2.24) ±0.02	(2.33–2.36) ±0.02	(2.47–2.53) ±0.02	C729 ^A
Chemical durability, titration equivalent of: 0.02N H ₂ SO ₄ /10 g of glass, max, ml	1.0	1.0	9.5	C225 (Method P-W)

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

 **E438 – 92 (2011)**

ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.

This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org). Permission rights to photocopy the standard may also be secured from the ASTM website (www.astm.org/COPYRIGHT/).