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Standard Specification for Glasses in Laboratory Apparatus[1]

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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

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

[1] 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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[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.

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_2O_3	13	10
Al_2O_3	2	7
BaO	see below	0–2
CaO	see below	1
Na_2O	4	6
K_2O	see below	1
Trace constituents, max:		
As_2O_2 plus Sb_2O_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_2O	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_2O_3	2	...
Al_2O_3	3	2
BaO	2	...
CaO	5	5
MgO	4	4
Na_2O	15	16
K_2O	1	1
Trace constituents, max:		
$As_2O_3 + Sb_2O_3$	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^{-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: 0.02*N* H_2SO_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.