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Standard Specification for Sampling and Testing of Reusable Laboratory Glassware[1]

This standard is issued under the fixed designation E1157; 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 laboratory items for use until they are no longer considered functional for the intended purpose. It is written specifically for reusable items and is not to be confused with disposable (single use) items that are described in other standards.

1.2 This specification covers the sampling inspection and basic testing criteria for the following four types of laboratory glassware: blown and pressed glassware, nongraduated;[2] blown and pressed glassware, graduated;[2] tubular glassware, nongraduated; and tubular glassware, graduated.

1.3 This specification is intended to be used in conjunction with a standard specification for a specific laboratory glassware product.

1.4 The following precautionary statement pertains only to the test method portion, Section 6, of this specification. *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. Referenced Documents

2.1 *ASTM Standards:*[3]

C162 Terminology of Glass and Glass Products

E542 Practice for Calibration of Laboratory Volumetric Apparatus

E671 Specification for Maximum Permissible Thermal Residual Stress in Annealed Glass Laboratory Apparatus

2.2 *Military Standard:*[4]

MIL-STD-105 Sampling Procedures and Tables for Inspection by Attributes

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *lot*—items of the same respective type, class, style, and size offered for acceptance at one time that have been produced by one manufacturer under essentially the same manufacturing conditions.

3.1.2 *inspection*—as both "examination" (such as visual investigation without the use of special laboratory appliances or procedure) and "testing" (determination by technical means of physical and chemical properties) of the item.

4. Performance Requirements

4.1 The product shall be designed to meet test performance requirements specified in Section 6. Testing of individual lots may be obviated when process controls are employed and monitored. Deviation from or changes to established manufacturing procedures that could adversely affect performance of a product shall be cause for performing applicable testing requirements on a specific lot to verify quality acceptance.

4.2 Alternate testing methods, inspection levels, and sample sizes may also be implemented. Any deviation shall not negate responsibility of product from complying with the applicable test performance standards.

4.3 Unless otherwise specified in the contract or purchase order, the supplier shall be responsible for the performance of all designated inspection requirements. Except as otherwise specified in the contract or purchase order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements. The purchaser has the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to ensure supplies conform to prescribed requirements.

[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] As defined in Terminology C162.

[3] 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.

[4] Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, http://www.dodssp.daps.mil.

TABLE 1 Examination

Visual Examination	Inspection Level	Acceptance Quality Level
Major defects	2	2.5
Minor defects	2	4.0
Dimensional Examination	S-3	2.5

TABLE 2 BLOWN OR PRESSED ITEMS (GRADUATED AND NONGRADUATED)
Classification of Defects (Nongraduated)

Major:
101—Not free of cracks, unhealed chips, breaks or sharp edges.
102—Not free of checks and open blisters.
103—Required components missing.
104—Not free of protruding stones.
105—Not free of stones (buried) or knots that exceed dimensions in Table 9.
106—Required glass joints, rubber stoppers, stopcock plugs or closures not as specified.
107—Not within stress limits as defined in Specification E671.
Minor:
201—Identification marking not complete, correct, legible, and permanent, (see 6.2).
202—Not free of blisters (buried) that exceed dimensions in Table 4, Table 8, and Table 5.
203—Not free of wiry cord or deformation that affects intended use or serviceability.
204—Not free of scale that exceeds dimensions in Table 8.

TABLE 3 Classification of Defects (Graduated)

Major:
101—Not free of cracks, unhealed chips, breaks or sharp edges.
102—Not free of checks and open blisters.
103—Required components missing.
104—Not free of protruding stones.
105—Not free of stones (buried) or knots which exceed dimensions in Table 7.
106—Required glass joints, rubber stoppers, stopcock plugs or closures not as specified.
107—Capacity or graduation lines of wrong width, missing or not straight.
108—Not free of skips in graduation lines that exceed ¼ of the line length.
109—On Class "A" items, the "A" or serial number (where specified) is missing.
110—Not free of blemishes in meniscus reading area that interfere with setting the meniscus.
111—Not within stress limits as defined in Specification E671.
Minor:
201—Identification marking not complete, correct, legible or permanent (See 6.2).[A]
202—Not free of skips in the graduation lines less than ¼ of the line length.
203—Not free of blisters (buried) which exceed dimensions in Table 4, Table 8, and Table 5.
204—Not free of wiry cord or deformation that affects intended use or serviceability.
205—Not free of scale that exceeds dimensions in Table 9.

[A] Disregard minor smears, smudges or skips in letters or numbers that do not destroy legibility.

5. Sampling and Inspection

5.1 Sampling shall be conducted in accordance with MIL-STD-105 with the levels of inspection and examination and acceptable quality levels as noted in Tables 1-13 unless otherwise agreed upon by purchaser and vendor. Where applicable, distilled water and reagent grade chemicals shall be used throughout the tests. Inspection shall be conducted in accordance with applicable section and individual specifications.

6. Test Methods

6.1 *Leakage Test*—The item shall be filled to nominal capacity with distilled water at 25 ± 5°C, normally capped or stoppered and laid on side for 60 s. No leakage shall result.

6.2 *Permanency of Marking:*

6.2.1 *Alkali Test*—A representative piece of each sample shall be completely immersed in 1 *N* sodium hydroxide solution at room temperature, covered, boiled for 30 min, and allowed to stand in the alkali for an additional hour. The piece shall then be removed, thoroughly rinsed with distilled water, and dried by rubbing vigorously with a cloth. No appreciable change in decoration appearance shall result. Loss of gloss shall not be considered a defect.

6.2.2 *Acid Test*—A representative piece of each sample shall be completely immersed in concentrated sulfuric acid at room temperature and allowed to stand 1 h. The piece shall then be removed, thoroughly rinsed with distilled water, and dried by rubbing vigorously with a cloth. No appreciable change in decoration appearance shall result. Loss of gloss shall not be considered a defect.

6.3 *Capacity:*

6.3.1 *Blown or Pressed Items (Nongraduated) and Tubular Glassware (Nongraduated)*—A volume of distilled water equal to the capacity specified for the size shall be added to the item. The water level shall be between the shoulder and the neck of the item or at the approximate point indicated in the specific standard for the item. The test shall be conducted at room temperature (25 ± 5°C).

6.3.2 *Blown or Pressed Items (Graduated) and Tubular Glassware (Graduated)*—Accuracy shall be as defined in appropriate item standard. Testing shall be conducted in accordance with procedures in Practice E542.

6.4 *Autoclaving*—Items with respective cap or cover secured shall be subject to three consecutive autoclaving cycles at 15 psi for 30 min. Capped items shall be removed after each autoclaving cycle and allowed to cool for 30 min before repeating the heating cycle. Autoclaved items with cap or cover shall be subjected to leakage test. Temperature shall be 121°C.

6.5 *Pour Test*—Fill the item to normal capacity with distilled water. Tilt at an angle of 45° and pour approximately one fourth of the water from the item at such a rate that the water flows in a continuous stream and falls freely from the spout. Stream of water should not cling to the outside of the item and flow off the bottom.

6.6 *Centrifuge Test*—The centrifuge may be any type or model commercially available or normally employed in laboratories and capable of speeds (RPM) recommended for the item. Item shall be filled with tap water to appropriate capacity and placed in centrifuge in balance positions. The centrifuge shall be brought slowly up to recommended speed and run for 30 min. The centrifuge shall then be shut off and allowed to stop without use of the hand brake. There shall be no breakage of the item.

7. Keywords

7.1 glassware; laboratory; sampling; testing

TABLE 4 Buried Blisters in Beakers, Flasks, and Funnels[A]

Blister Diameter, mm (in.)[B]	mL, max	up to 250[C]	251 to 1500	1501 to 3500	3501 to 9500	9501 to 13 500	13 501 to 19 000	19 001 to 45 500
	gal, max	up to 0.066	>0.066 to 0.396	>0.396 to 0.925	>0.925 to 2.51	>2.51 to 3.57	>3.57 to 5.02	>5.02 to 12.0
0.79 to 1.59 (1/32 to 1/16)		2	3	4	6	8	10	16
>1.59 to 3.18 (>1/16 to 1/8)		1	1	1	1	1	1	1
>3.18 to 6.35 (>1/8 to 1/4)		0	1	1	1	1	1	1
>6.35 to 7.94 (>1/4 to 5/16)		0	0	0	1	1	1	1
Combined number, max		2	3	4	6	8	10	16
Per side, max, (180°)		1	2	2	3	4	5	8

[A] For buried seeds under 0.812 mm (0.032 in.) in diameter or equivalent, allow no more than 12 per 25.4 mm (1 in.) diameter circle.
[B] Equivalent diameter = (length + width)/2.
[C] None allowed below maximum outer diameter of Kjeldahl flasks, distilling flasks having sidearms or filter flasks.

TABLE 5 Buried Blisters in Bottom Zone of Bottles, Jars, and Kettles[A]

Blister Diameter, mm (in.)[B]	mL, max	Up to 250[C]	250 to 1500	1501 to 3500	3501 to 9500	9501 to 13 500	13 501 to 19 000	19 001 to 45 500
	gal, max	Up to 0.066	>0.066 to 0.396	>0.396 to 0.925	>0.925 to 2.51	>2.51 to 3.57	>3.57 to 5.02	>5.02 to 12.0
0.79 to 1.59 (1/32 to 1/16)		1	1	2	4	5	7	12
>1.59 to 3.18 (>1/16 to >1/8)		0	1	2	3	4	5	6
>3.18 to 6.35 (>1/8 to 1/4)		0	0	1	1	1	1	1
>6.35 to 9.52 (>1/4 to 3/8)		0	0	0	0	1	1	1
>9.52 to 12.7 (>3/8 to 1/2)		0	0	0	0	0	1	1
Combined number, max		1	2	4	6	8	11	15
Per side, max, (180°)		1	1	2	4	5	6	8

[A] For buried seeds under 0.812 mm (0.032 in.) in diameter or equivalent, allow no more than 12 per 25.4 mm (1 in.) diameter circle.
[B] Equivalent diameter = (length + width)/2.
[C] Above lower radius.

TABLE 6 Testing for Blown or Pressed Items, Graduated and Nongraduated

Characteristics	Test Procedures	Inspection Level	Acceptable Quality Level
Leakage	6.1	S-3	2.5
Permanency of Marking	6.2	S-1	2.5
Alkali Test	6.2.1	...	...
Acid	6.2.2	...	...
Capacity Fill	6.3	S-3	2.5
Autoclaving	6.4	S-2	...[A]
Pour Test	6.5	S-2	2.5
Centrifuge Test	6.6	S-2	...[A]

[A] Acceptance number shall be zero.

TABLE 7 TUBULAR GLASSWARE (GRADUATED AND NON-GRADUATED)
Classification of Defects, Nongraduated

Major:
101—Not free of cracks, unhealed chips, breaks or sharp edges.
102—Not free of checks and open airlines (elongated blisters) on heated parts or inside surface.
103—Required components missing.
104—Not free of protruding stones.
105—Not free of stones (buried) or knots that exceed dimensions in Table 11.
106—Required glass joints, rubber stoppers, stopcock plugs, or closures not as arts specified.
107—Not within stress limits as defined in Specification E671.
Minor:
201—Identification markings not complete, correct, legible and permanent, (see arts Section 6).
202—Not free of airlines (elongated blisters) that exceed dimensions in Table 9.
203—Not free of wiry cord or deformation that affects intended use orarts serviceability.
204—Vertical section (neck, cylinder, etc.) not perpendicular to base within 1½ °.

TABLE 8 Buried Blisters Above Bottom Zone-Bottles, Jars, and Kettles[A]

Blister Diameter, mm (in.)[B]	mL, max	Up to 250[C]	251 to 1500	1501 to 3500	3501 to 9500	9501 to 13 500	13 501 to 19 000	19 001 to 45 500
	gal, max	Up to 0.066	>0.066 to 0.396	>0.396 to 0.925	>0.925 to 2.51	>2.51 to 3.57	>3.57 to 5.02	>5.02 to 12.0
0.79 to 1.59 (1/32 to 1/16)		2	3	4	8	10	12	20
>1.59 to 3.18 (>1/16 to 1/8)		1	3	4	6	8	10	16
>3.18 to 6.35 (>1/8 to 1/4)		0	1	1	1	2	3	4
>6.35 to 9.52 (>1/4 to 3/8)		0	0	1	1	1	1	2
>9.52 to 12.7 (>3/8 to 1/2)		0	0	0	1	1	1	1
>12.7 to 15.88 (>1/2 to 5/8)		0	0	0	0	1	1	1
Combined number, max		3	5	7	12	16	20	31
Per side, max, (180°)		2	3	4	7	9	11	16

[A] For buried seeds under 0.812 mm (0.032 in.) in diameter or equivalent, allow no more than 12 per 25.4 mm (1 in.) diameter circle.
[B] Equivalent diameter = (length + width)/2.
[C] Above lower radius.

TABLE 9 Knots, Stones and Scale

Size, mL (gal)	Knots[A]		Scale or Stones[A]	
	Diameter, max mm (in.)	Number, max	Diameter, max mm (in.)	Number, max
Up to 250 (up to 0.066)	1.59 (1/16)	2	0.79 (1/32)	2
251 to 1 500 (0.066 to 0.396)	3.18 (1/8)	3	1.59 (1/16)	3
1 501 to 3 500 (0.396 to 0.925)	3.18 (1/8)	4	1.59 (1/16)	4
3 501 to 9 500 (0.925 to 2.51)	3.18 (1/8)	4	3.18 (1/8)	4
9 501 to 13 500 (2.51 to 3.57)	6.35 (1/4)	4	3.18 (1/8)	5
13 501 to 19 000 (3.57 to 5.02)	6.35 (1/4)	4	3.18 (1/8)	5
19 001 to 45 500 (5.02 to 12.0)	6.35 (1/4)	4	3.18 (1/8)	5

[A] Equivalent diameter = (length + width)/2.

TABLE 10 Classification of Defects, Graduated

Major:
101—Not free of cracks, unhealed chips, breaks or sharp edges.
102—Not free of checks and open blisters.
103—Required components missing.
104—Not free of protruding stones.
105—Not free of stones (buried) or knots that exceed dimensions in Table 9.
106—Required glass joints, rubber stoppers, stopcock plugs, or closures not as specified.
107—Capacity or graduation lines of wrong width, missing or not straight.
108—Not free of skips in graduation lines that exceed one fourth of the line length.
109—On Class "A" items, the "A" or serial number (where specified) is missing.
110—Not free of blemishes in meniscus reading area which interfere with setting the meniscus.
111—Not within stress limits as defined in Specification E671.
Minor:
201—Identification marking not complete, correct, legible or permanent (see 6.2).
202—Not free of skips in the graudation lines less than 1/4 of the line length.
203—Not free of airlines (elongated blisters) that exceed dimensions in Table 9.
204—Not free of wiry cord or deformation that affects intended use or serviceability.
205—Vertical section (neck, cylinder, etc.) not perpendicular to base within 1½ °.

[A] Disregard minor smears, smudges or skips in letters or numbers which do not destroy legibility.

TABLE 11 Stones and Knots

Size, mL (gal)	Stones and Knots	
	Maximum Diameter mm (in.)[A]	Maximum Number
Up to 249 (0.066)	1.59 (1/16)	2
250–1499 (0.066–0.396)	3.18 (1/8)	3
1500–3499 (0.396–0.925)	3.18 (1/8)	4
3500 and Up (0.925 and Up)	3.18 (1/8)	4

[A] Equivalent diameter = (length + diameter)/2.

TABLE 12 Airlines (Buried or Open)

Tubing Wall mm (in.)	Airline Width, max[A]	
	Tubing Outer Diameter (up to and including 31.7 mm (1¼ in.))	Tubing Outer Diameter (over 31.7 mm (1¼ in.))
Up to 0.38 (0.015)	1.27 (0.005)	...
>0.38 to 0.76 (>0.015 to 0.030)	0.178 (0.007)	...
>0.76 to 1.14 (>0.030 to 0.045)	0.229 (0.009)	0.0228 (0.009)
>1.14 to 1.55 (>0.045 to 0.061)	0.254 (0.010)	0.279 (0.011)
>1.55 to 2.39 (>0.061 to 0.094)	0.305 (0.012)	0.330 (0.013)
>2.30 to 3.20 (>0.094 to 0.125)	0.381 (0.015)	0.381 (0.015)
>3.20 to 4.75 (>0.126 to 0.186)	0.508 (0.020)	0.508 (0.020)
>4.75 and up (>0.187 and up)	20 % of nominal wall	20 % of nominal wall

[A] Maximum airline length not to exceed 1 × length of any item.

TABLE 13 Testing for Tubular Glassware, Nongraduated and Graduated

Characteristics	Test Procedures	Inspection Level	Accepted Quality Level
Leakage	6.1	S-3	2.5
Permanency of marking	6.2	S-1	2.5
Alkali test	6.2.1	...	...
Acid	6.2.2	...	...
Capacity (single graduated)	6.3.1	S-3	2.5
Capacity (multiple graduated)	6.3.2	S-3	4.0
Autoclaving	6.4	S-2	[A]
Pour test	6.5	S-2	2.5
Centrifuge test	6.6	S-2	[A]

[A] Acceptance number shall be zero.