

Specification for

Principles of design and construction of volumetric glassware for laboratory use

[ISO title: Laboratory glassware — Principles of design and
construction of volumetric glassware]

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- British Laboratory Ware Association*
- British Lampblown Scientific Glassware Manufacturers' Association Ltd.*
- British Pharmacopoeia Commission
- Chemical Industries Association
- Chemical Society
- Chemical Society, Analytical Division
- Department of Health and Social Security*
- Department of Industry (Laboratory of the Government Chemist)*
- Glass Manufacturers' Federation
- Institute of Petroleum*
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- Pharmaceutical Society of Great Britain
- Scientific Instrument Manufacturers' Association
- Society of Chemical Industry*
- Society of Glass Technology
- Standardization of Tar Products Tests Committee

The organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this British Standard:

- Association of Clinical Biochemists
- Institute of Medical Laboratory Sciences

This British Standard, having been prepared under the direction of the Laboratory Apparatus Standards Committee, was published under the authority of the Executive Board and comes into effect on 29 February 1980

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Contents

	Page
Cooperating organizations	Inside front cover
National foreword	ii
1 Scope and field of application	1
2 References	1
3 Unit of volume, and reference temperature	1
4 Volumetric accuracy	1
5 Methods of verification and use	1
6 Construction	2
7 Linear dimensions	3
8 Graduation lines	3
9 Scales	4
10 Figuring of graduation lines	5
11 Inscriptions	6
12 Visibility of graduation lines, figures and inscriptions	7
13 Colour coding	7
Annex A Limit of volumetric error in relation to capacity	8
Annex B Limit of volumetric error in relation to diameter at the meniscus	10
Annex C The inter-relation between standard deviation, limit of volumetric error and line thickness (also line spacing on articles having a scale)	14
Figure 1 — Length and sequence of graduation lines	5
Figure 2 — Position of graduation lines	6
Figure 3	9
Figure 4	13
Table — Maximum internal diameter of tube at the graduation line appropriate to selected limits of volumetric error	12
Publications referred to	Inside back cover

National foreword

The British Standard is identical with ISO 384:1978 “*Laboratory glassware — Principles of design and construction of volumetric glassware*” published by the International Organization for Standardization (ISO).

Terminology and conventions. The text of the International Standard has been approved as suitable for publication without deviation, as a British Standard. Some terminology and certain conventions are not identical with those used in British Standards; attention is especially drawn to the following.

The comma has been used throughout as a decimal marker. In British Standards it is current practice to use a full point on the baseline as the decimal marker.

Wherever the words “International Standard” appear, referring to this standard, they should be read as “British Standard”.

Cross-references. There are no British Standard equivalents for ISO 383 and ISO 1769. Related British Standards for ISO 383 and ISO 1769 are BS 572 (including amendment no. 1) and BS 3996 respectively.

The references to ISO 4791/II (in preparation) for which there is no corresponding British Standard constitute informative matter only, and since no mandatory requirements are involved the validity of this British Standard is not affected.

Pending the publication of ISO 4791/II the following definitions for the terms referred to in 5.3 may be taken to apply for the purposes of this British Standard.

delivery time. The time in seconds for the delivery of a specified volume of liquid from a burette or pipette by a standard procedure excluding drainage time.

waiting time. Time in seconds before the reading is taken.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 14, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope and field of application

This International Standard sets out principles for drawing up specifications for articles of volumetric glassware.

2 References

ISO 383, *Laboratory glassware — Interchangeable conical ground joints*.

ISO 1769, *Laboratory glassware — Pipettes — Colour coding*.

ISO 4791/II, *Laboratory glassware — Vocabulary — Part II*¹⁾.

3 Unit of volume, and reference temperature

3.1 Unit of volume

The unit of volume shall be the cubic centimetre (cm³) or, in special cases, the cubic decimetre (dm³) or cubic millimetre (mm³).

NOTE The term millilitre (ml) is commonly used as a special name for the cubic centimetre (cm³) and, similarly the litre (l) for the cubic decimetre (dm³) and the microlitre (μl) for the cubic millimetre (mm³), in accordance with the International System of units (SI).

3.2 Reference temperature

The standard reference temperature, i.e. the temperature at which the article of volumetric glassware is intended to contain or deliver its nominal volume (nominal capacity), shall be 20 °C.

NOTE When it is necessary in tropical countries to work at an ambient temperature considerably above 20 °C, and these countries do not wish to use the standard reference temperature of 20 °C, it is recommended that they adopt a temperature of 27 °C.

4 Volumetric accuracy

4.1 In a specification where two classes of accuracy are required,

- the higher grade shall be designated “class A”;
- the lower grade shall be designated “class B”.

4.2 Limits of volumetric error shall be specified for each type of article having regard to the method and purpose of use and the class of accuracy.

4.3 The numerical values of limits of volumetric error for articles of volumetric glassware for general purposes shall be chosen from the series 10 – 12 – 15 – 20 – 25 – 30 – 40 – 50 – 60 – 80, or a suitable decimal multiple thereof.²⁾

4.4 The limits of volumetric error specified for a series of sizes of an article should provide a reasonably uniform progression in relation to capacity when plotted on a logarithmic graph as shown in Annex A. Such a graph should be included as an annex to all specifications in which a series of three or more sizes of an article is specified.

4.5 Where two classes of accuracy are specified, then the limits of volumetric error permitted for class B should, in general, be approximately twice those permitted for class A.

4.6 For all articles having a scale, the maximum permitted volumetric error for either class of accuracy shall not exceed the volume equivalent of the smallest scale division.

4.7 Where two classes of accuracy are specified, the class A limit of volumetric error specified for any article shall not be smaller than that calculated from the maximum permitted diameter at the relevant graduation line by the formulae detailed in Annex B; the corresponding class B limit shall be derived in accordance with 4.5.

Where only one class of accuracy is specified, the limit of volumetric error specified for any article shall be similarly determined, on the basis of a preliminary decision as to whether class A or class B accuracy is appropriate to the article in question.

A nomograph, plotted on a logarithmic scale as shown in Annex B, should be included, as an annex, in all specifications for articles of volumetric glassware.

4.8 The limit of volumetric error specified for any article designed for delivery shall also be not less than four times the standard deviation (RMS) determined experimentally by an experienced operative from a series of at least twenty replicable determinations of delivered capacity on the same article, carried out strictly in accordance with the method specified for that article.

5 Methods of verification and use

5.1 The method of verification should be clearly specified for each article of volumetric glassware.

5.2 Any difference between the method of verification and the method of use shall be clearly indicated.

5.3 Delivery times and, where applicable, waiting times for all articles intended for delivery of a liquid shall be specified.³⁾

¹⁾ In preparation.

²⁾ This is the R” 10 series of preferred numbers and has been adopted because decimal sub-multiples of some of the unrounded numbers, for example 31,5, would appear to imply a degree of precision which is not intended and which could not be measured in practice.

³⁾ See definitions given in ISO 4791/II.

5.4 Setting of the meniscus shall be performed by one of the two methods detailed below. Wherever practicable, the meniscus should descend to the position of setting.

a) The meniscus is set so that the plane of the upper edge of the graduation line is horizontally tangential to the lowest point of the meniscus, the line of sight being in the same plane. In the case of a mercury meniscus, however, the highest point of the meniscus is set to the lower edge of the graduation line.

b) The meniscus is set so that the plane of the centre of the graduation line is horizontally tangential to the lowest point of the meniscus. The eye is raised towards the plane and observes the front and back portions of the line apparently meeting the lowest point simultaneously. In the case of a mercury meniscus, the eye is lowered towards the plane of the centre of the graduation line.

NOTE The difference between meniscus positions resulting from the alternative methods of setting is the volume equivalent to one-half the thickness of the graduation line. In the case of articles where the capacity is read as the difference between two meniscus readings (for example on a burette) then no error results if the article is manufactured using one method and is later used by the other method. Even in most unfavourable cases of single-mark articles (for example large flasks), when working to the highest attainable accuracy, the difference resulting from use of the two methods is unlikely to exceed 30 % of the class A limit of error, and a correction can be calculated where necessary.

5.5 When the article is used with opaque wetting liquids, the horizontal line of sight shall be taken through the upper edge of the meniscus, and where necessary an appropriate correction shall be applied.

6 Construction

6.1 Material

Volumetric glassware shall be constructed of glass of suitable chemical and thermal properties. It shall be as free as possible from visible defects and shall be reasonably free from internal stress.

6.2 Shape

All articles shall be of a shape which will facilitate emptying and drainage, and should preferably be of circular cross-section.

6.3 Capacity

6.3.1 The numerical values of capacity of articles of volumetric glassware for general purposes should preferably be chosen from the series 10 – 20 – 25 – 50, or a decimal multiple or submultiple thereof.

6.3.2 The numerical value of the volume equivalents of the smallest division on articles having a scale shall be chosen from the series 1 – 2 – 5, or a decimal multiple or submultiple thereof.

6.3.3 In the case of a special purpose article of volumetric glassware which is to be graduated for direct reading of capacity when used with a specific liquid other than water, the specification should also indicate the corresponding capacity when used with pure water so that the latter can be used for verification.

6.4 Stability

Vessels provided with a flat base shall stand firmly thereon without rocking when placed on a level surface and, unless specified otherwise, the axis of the graduated portion of the vessel should be vertical. Wherever practicable, vessels shall not topple when placed empty on a surface inclined at an angle to the horizontal to be specified for each article.

Vessels provided with a base which is not circular shall meet this requirement in all directions.

6.5 Delivery jets

6.5.1 Delivery jets should be strongly constructed with a smooth and gradual taper without any sudden constriction at the orifice.⁴⁾

6.5.2 The end of the jet shall be finished by one of the methods listed below in order of preference:

- a) smoothly ground square with the axis, slightly bevelled on the outside and fire-polished;
- b) smoothly ground square with the axis and slightly bevelled on the outside;
- c) cut square with the axis and fire-polished.

A fire-polished finish reduces the danger of chipping in use, but should not result in constriction, as indicated in **6.5.1**, or in undue stress.

6.5.3 The jet should form an integral part of an article intended for class A and should preferably form an integral part of an article intended for class B.

6.6 Stoppers

6.6.1 Glass stoppers should preferably be ground so as to be interchangeable, in which case the ground portions shall comply with ISO 383. If individually fitted, they shall be well ground so as to prevent leakage, preferably with a taper of approximately 1/10.

⁴⁾ A reason for not permitting a sudden constriction at the orifice is that such a shape could conceal the fact that the jet had been damaged, cut back and re-fired. Following such treatment the volume delivered by the article could have been altered beyond the specified limits of volumetric error without any visible evidence of this fact.