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Laboratory plastic ware — Volumetric flasks

Matériel en plastique de laboratoire — Fioles jaugées

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 48, *Laboratory equipment*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Volumetric flasks together with analytical balances are the fundamental tools for the preparation of volumetric standard solutions – the basis of chemical analysis. The design of class A volumetric flasks has been optimized to achieve the fewest possible acceptable errors.

Class A volumetric flasks are used for the production of standard solutions and where necessary, a suitable quantity is poured into an intermediate vessel into which a pipette tip may be introduced.

In accordance with good laboratory practice, only class A volumetric flasks conforming to this document should be used for precise analytical purposes.

Laboratory plastic ware — Volumetric flasks

1 Scope

This document sets out requirements for the construction of general laboratory volumetric flasks made of plastic material.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC Guide 99, *International vocabulary of metrology — Basic and general concepts and associated terms (VIM)*

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

ISO 384:2015, *Laboratory glass and plastics ware — Principles of design and construction of volumetric instruments*

ISO 1043-1, *Plastics — Symbols and abbreviated terms — Part 1: Basic polymers and their special characteristics*

ISO 4787, *Laboratory glass and plastic ware — Volumetric instruments — Methods for testing of capacity and for use*

DIN 168-1, *Knuckle threads — Part 1: Especially for glass containers; thread sizes*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC Guide 99 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Volume and reference temperature

4.1 Unit of volume

The unit of volume shall be the millilitre (ml), which is equivalent to the cubic centimetre (cm^3).

4.2 Reference temperature

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

When the volumetric flask is required for use in a country which has adopted a standard reference temperature of 27 °C, this value shall be substituted for 20 °C.

5 Classes of accuracy

Two classes of accuracy are specified:

— class A for the higher grade of accuracy;

— class B for the lower grade of accuracy.

6 Series of capacities

The series of nominal capacities of volumetric flasks is as follows (in millilitres):

10 – 25 – 50 – 100 – 250 – 500 – 1 000

All these flasks may be finished with a thread or may include a stopper.

If volumetric flasks of capacities other than those listed above are required, it is recommended that they conform, as far as possible, to the essential requirements of this document. A cross-check with ISO 384 is recommended since, in particular, error limits depend on the inner neck diameter.

7 Definition of capacity

The capacity of a volumetric flask is defined as the volume of water at 20 °C, expressed in millilitres, contained by the flask at 20 °C, when filled to the graduation line.

When the volumetric flask is required for use in a country which has adopted a standard reference temperature of 27 °C, this value shall be substituted for 20 °C.

Setting the meniscus shall be performed according to ISO 4787. In case of a concave meniscus, the meniscus shall be 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 case of a convex or even flat meniscus, the meniscus shall be set so that the plane of the upper edge of the graduation line is horizontally tangential to the highest point of the meniscus, the line of sight being in the same plane.

8 Accuracy and testing of volume

The capacity of the flasks shall not differ from the nominal capacity, by more than the maximum permitted errors shown in Table A.1 when tested in accordance with ISO 4787.

When the flasks are used at temperatures which differ from the standard reference temperature the capacity of the flask will change. Corrections for other temperatures in use shall be applied according to ISO 4787.

The uncertainty calculation can be performed according to ISO/TR 20461 following the procedure specified in ISO/IEC Guide 98-3. Alternatively, EURAMET Calibration Guide No. 19[2] is available.

9 Construction

9.1 Material

Volumetric flasks shall be constructed of generally non-brittle translucent or transparent plastic material of suitable chemical and thermal properties.

The plastic material of the volumetric flask shall be reasonably free from visible defects and internal stresses, which would impair the performance of the flasks.

NOTE For construction of class A volumetric flasks perfluoroalkoxy-copolymer (PFA) or polymethylpentene (PMP) is typically used. In addition to both those materials, for class B volumetric flasks, polypropylene (PP) is also used.

In addition to selecting an accuracy class A or B, the user shall consider the chemical resistance of the plastic materials in relation to the intended application.

9.2 Wall thickness

Volumetric flasks shall be sufficiently robust in construction to withstand normal usage and the wall thickness shall show no gross departures from uniformity.

9.3 Shape

The body of the flask may be pear-shaped or conical, as shown in Figure A.1, so as to provide a large base on which the flask shall stand with its axis vertical without rocking or spinning. Other shapes of flasks are also permissible. Flasks of capacity 25 ml and larger shall not topple when placed empty (without thread or stopper) on a surface inclined at an angle of 15° to the horizontal. Flasks of capacity below 25 ml shall not topple, when similarly tested at an angle of 10° to the horizontal. Details about the dimensions in Figure A.1 are given in Table A.1.

NOTE The internal neck diameter and the distance of the graduation line from any point of change of diameter are essential dimensions for the accuracy of the flasks. The recommended dimensions in Table A.1 have been found suitable for particular use and size.

9.4 Neck

The neck of the flask, excluding the socket and bulge, if present, shall be approximately cylindrical and there shall be no undue variation in internal diameter or wall thickness. The axis of the neck shall be perpendicular to the plane of the base of the flask.

Necks that are suitable for stoppers shall be manufactured with a socket size complying with the provisions of ISO 383, and shall be selected from the k6 series of ISO 383. Necks that are suitable for screw caps shall be manufactured with the respective knuckle thread (GL) sizes shown in Table A.1. Annex B gives an overview of all recommended dimensions of the threads. Table B.1 gives an overview of all specified dimensions of the volumetric flasks.

There may be a bulge, an enlargement of diameter in the neck below the thread or ground joint, to enable better mixing of liquid.

9.5 Stoppers and threads

Stoppers and threads, if provided, shall fit in the flask neck or on the thread by applying the relevant standards ISO 383 or DIN 168-1.

9.6 Dimensions

Volumetric flasks shall comply with the nominal capacity, internal neck diameter, distance of graduation line and maximum permitted errors given in Table A.1. These dimensions are considered to be essential for accuracy and convenience in use. The information on overall height, bulb diameter, base diameter, wall thickness and closures listed in Table A.1 provide guidance, as they have proved satisfactory in use and are therefore only recommended.

10 Graduation line

The graduation line shall be a clean, permanent and uniform line, of thickness not exceeding 0,4 mm, lying in a plane parallel to the base of the flask and completely encircling its neck in accordance with ISO 384:2015, Clauses 9 and 13. The graduation line shall be placed in the lower two-thirds of the neck of the flask and shall be not less than the stated minimum distance from any point at which the neck begins to change in diameter.

11 Marking and designation

11.1 General

The following shall be permanently marked on each volumetric flask:

a) a number indicating the nominal capacity;

b) the symbol “ml” or “cm^3” to indicate the unit of volume;

c) the inscription “20 °C” or “27 °C” to indicate the standard reference temperature;

d) a suitable abbreviation to indicate that the flask has been adjusted to contain its indicated capacity. In order to obviate language difficulties, it is recommended that the letters “In” are used for this purpose;

e) the letter “A” or “B” to indicate the class of accuracy of the volumetric flask and the tolerance in accordance with Table A.1;

f) the maker's or vendor's name or mark;

g) in the case of a flask with an interchangeable stopper, the size number of the joint shall be marked on the flask or in the case of a flask with a thread the thread size shall be marked on the flask;

h) the plastic material in accordance with 9.1, abbreviated in accordance with ISO 1043-1 (for instance “PMP” for polymethylpentene).

11.2 Identification number

An identification number shall be permanently marked on each class A volumetric flask intended for official verification or certification. For class B an identification number is not necessary.

12 Visibility of graduation line, figures and marking

All figures and marking shall be of such size and form as to be clearly legible under normal conditions of use.

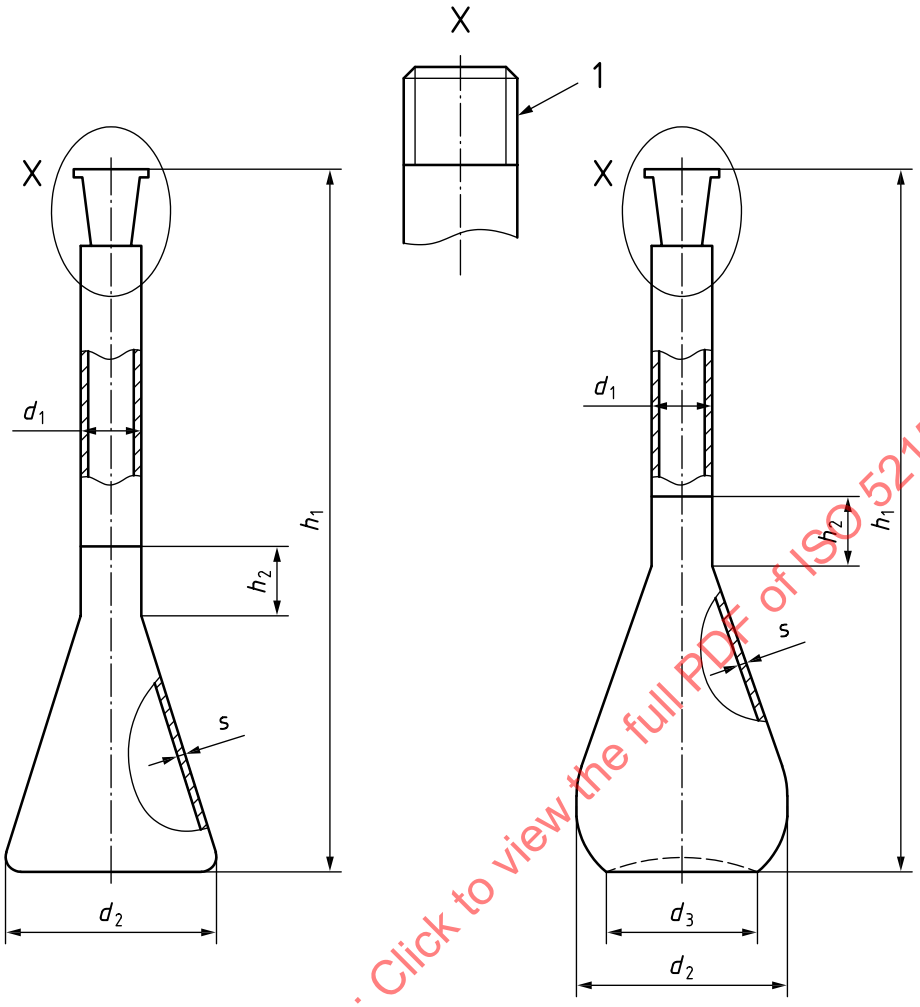
The graduation line, the figures and the marking shall be clearly visible and permanent, under normal conditions of use.

Annex A
(normative)

Alternative shapes and closures of volumetric flasks

A.1 Figure of flasks with stoppers or closures

Figure A.1 shows the shapes and closures of volumetric flasks.



Key

d_1	internal neck diameter
d_2	bulb diameter
d_3	base diameter
h_1	overall height
h_2	distance of graduation line
s	wall thickness
1	thread

NOTE The volumetric flask can have one of the following alternative closures: standard ground joint (NS) or knuckle thread (GL) closure. This is illustrated in Figure A.1.

Figure A.1 — Volumetric flasks showing alternative shapes and closures

Table A.1 presents in addition to Figure A.1 the essential dimensions and recommended dimensions for volumetric flasks with alternative shapes and closures. The maximum permitted errors shall not exceed the values given in Table A.1.

Table A.1 — Dimensions and maximum permitted errors

Essential dimensions			Tolerances		Recommended dimensions					
Nominal capacity	**Internal neck diameter**	**Distance of graduation line**[a]	**Maximum permitted errors for volume**		**Overall height**[b]	**Bulb diameter**	**Base diameter**	**Wall thickness**	**Closures**	
	d_1	h_2	Class A	Class B	h_1	d_2	d_3	s	standard ground joint (NS)[c] k6	knuckle thread (GL)[d]
ml	mm	mm min.	ml	ml	±10 mm	mm (approx.)	mm min.	mm min.		
10[e]	9 ± 1	5	±0,040	±0,080	90	30	18	0,3	10/19	18
25	9 ± 1	5	±0,040	±0,080	110	40	25	0,3	10/19	18
50	11 ± 1	10	±0,060	±0,120	140	50	30	0,4	12/21	18
100	12 ± 1,5	10	±0,100	±0,200	165	60	35	0,5	14/23	18
250	13,5 ± 2	10	±0,150	±0,300	225	80	55	0,6	19/26	25
500	15,5 ± 2	15	±0,250	±0,500	265	105	65	0,7	19/26	25
1 000	20 ± 2	15	±0,400	±0,800	300	125	85	0,8	24/29	32

[a] Minimum distance of graduation line from any point of change of diameter.

[b] Overall height without stopper or thread in accordance with Figure A.1

[c] In accordance with ISO 383.

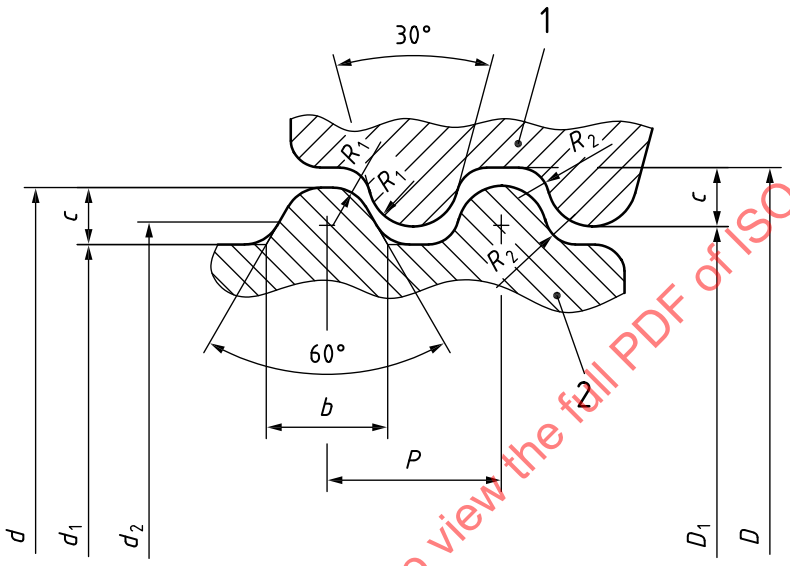
[d] In accordance with DIN 168-1.

[e] Comparable with 10 ml wide neck version made of glass (see ISO 1042).

Annex B
(informative)

Closures — Knuckle threads (GL)

This annex presents the shape (Figure B.1) of the knuckle threads (GL) and the recommended dimensions (Table B.1).



Key

P	thread lead
d, d_1	external thread diameter
D, D_1	internal thread diameter
d_2	screw thread/ effective diameter
R_1	curve
R_2	curve
b	thread profile width
c	thread profile depth
1	inside thread
2	outside thread

Figure B.1 — Dimensions