BRITISH STANDARD

BS 6706:1986

Specification for

Disposable glass serological pipettes

Confirmed
November 2011

UDC 542.3:531.732:666.172.7

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Laboratory Apparatus Standards Committee (LBC/-) to Technical Committee LBC/27 upon which the following bodies were represented:

Association of Clinical Biochemists
British Laboratory Ware Association
British Lampblown Scientific Glassware Manufacturers' Association Ltd
Department of Health and Social Security
Department of Trade and Industry (Laboratory of the Government Chemist)
Department of Trade and Industry (National Weights and Measures Laboratory)
Glass Manufacturers' Federation
Institute of Medical Laboratory Sciences
Medical Sterile Products Association
Ministry of Defence
Society of Chemical Industry
South Western Regional Health Authority

This British Standard, having been prepared under the direction of the Laboratory Apparatus Standards Committee, was published under the authority of the Board of BSI and comes into effect on 31 October 1986

The following BSI references relate to the work on this standard:
Committee reference LBC/27
Draft for comment 82/52908 DC

ISBN 0 580 15161 1

Amendments issued since publication

Amd. No.	Date of issue	Comments

Contents

Foreword

This British Standard has been prepared under the direction of the Laboratory Apparatus Standards Committee.

This British Standard is related to ISO 7713:1985 published by the International Organization for Standardization (ISO), differing from its technical requirements in the following respects:

a) the external diameter of the 0.5 mL and 1.0 mL pipettes is 4.0 mm to 4.75 mm instead of 4.25 mm to 4.75 mm;

b) the external diameter of the 5 mL pipette is 6.5 mm to 8.25 mm instead of 7.0 mm to 8.25 mm;

c) the minimum wall thickness of the 0.5 mL, 1 mL, 2 mL and 5 mL pipettes is 0.5 mm instead of 0.6 mm;

d) the blow-out type may, in addition or as an alternative to being inscribed with a white band, be inscribed with the wording “Blow-out”.

Purchasers ordering to this standard are advised to specify in their purchasing contract that the supplier operates a quality system in compliance with BS 5750-3 to ensure that products claimed to comply with BS 6706 consistently achieve the required level of quality.

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 4, 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

This British Standard specifies the dimensions and construction of a range of disposable serological pipettes suitable for general laboratory purposes. A method for determining volumetric performance of the pipettes is included.

Two types (flow-out and blow-out) are specified.

NOTE 1 The requirements specified in this standard are in accordance with the principles described in ISO 8417 and the pipettes specified in this standard are related to those specified in ISO 7713 (see foreword). ISO 8417 is in preparation but it is expected to be published as a dual-numbered British Standard.
NOTE 2 The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this British Standard the following definitions apply.

2.1
disposable serological pipette

a serological pipette intended to be used once only and then discarded

NOTE Such pipettes will only be expected to provide their specified performance during the original operation.

2.2
standard reference temperature

the temperature at which the serological pipette is intended to deliver its nominal volume (nominal capacity)

2.3
delivered capacity of flow-out pipettes

the volume, in millilitres, of water corresponding to any graduation line, delivered by the pipette, at the standard reference temperature, when emptied from the zero line to that graduation line; the outflow is unrestricted until making the final setting of the meniscus on the graduation line and no period is allowed for drainage of liquid adhering to the wall before making the final setting

2.4
delivered capacity of blow-out pipettes

the volume, in millilitres, of water corresponding to any graduation line, delivered by the pipette, at the standard reference temperature, when emptied from the graduation line to the jet; the outflow is unrestricted until the meniscus has come to rest in the jet but delivery is completed by expelling the last drop by blowing

NOTE It should be borne in mind that the delivered volume is the complement of that indicated, e.g. if the indication on a 10 mL pipette is 4 mL, the delivered volume is 6 mL.

2.5
delivery time

the time taken for the descent of the water meniscus, at the standard reference temperature, from the zero graduation line to the point at which it appears to come to rest in the jet

2.6
accuracy

the closeness of agreement between the nominal volume and the mean volume, obtained by applying the test procedure specified in clause **7**. It is quantified by the inaccuracy of the mean

2.7
repeatability

the closeness of agreement between the individual volumes obtained by applying the test procedure specified in clause **7**. It is quantified by imprecision

NOTE The definitions for accuracy and repeatability apply only in cases where the distributions are gaussian.

3 Classification

The disposable serological pipettes shall be of the types described in a) or b) as follows:

a) flow-out type, in which the delivered capacity is obtained without expelling the final drop by blowing;

b) blow-out type, in which the delivered capacity is obtained by expelling the final drop by blowing.

4 Basis of adjustment

4.1 Unit of volume

The unit of volume shall be either the millilitre or the cubic centimetre.

NOTE The millilitre is commonly used as a name for the cubic centimetre, in accordance with the International System of Units (SI).

4.2 Standard reference temperature

The standard reference temperature shall be 20 °C, except when the serological pipette is required for use in a country that has adopted a standard reference temperature of 27 °C, in which case 27 °C shall be the standard reference temperature.

NOTE 27 °C is the alternative standard reference temperature recommended in BS 5898 for tropical use.

5 Construction

5.1 Material

Disposable serological pipettes shall be manufactured from soda-lime-silica, neutral or borosilicate glass complying with the requirements of class 3 or better of BS 3473-2.

NOTE The pipettes should be as free as possible from visible defects and free from any internal stress that would impair the performance of the pipette.

5.2 Dimensions

The dimensions shall comply with the requirements shown in Table 1.

5.3 Straightness

The pipettes shall be straight.

5.4 Ovality

At any cross section of a pipette, taken in a plane perpendicular to the longitudinal axis, the maximum and minimum external diameters shall not differ by more than 2 %.

5.5 Delivery jet

The lower end of the pipette shall terminate in a delivery jet having a smooth and gradual taper without any sudden constriction at the orifice which could give rise to turbulent outflow.

The length of the tapered portion shall be:

a) 10 mm to 25 mm for capacities up to 2 mL inclusive;

b) 15 mm to 30 mm for the 5 mL and 10 mL capacities.

The jet end shall be either fire-polished, without run-in, or clean cut, without appreciable toe nail or chip that affects the bore.

5.6 Suction end

All suction ends shall be fire-polished.

NOTE All suction ends should be reasonably perpendicular to the longitudinal axis of the pipette.

The suction end of the 10 mL pipette shall be either of unreduced diameter or of reduced external diameter of 7 mm to 9 mm and an overall length from 15 mm to 25 mm.

The 5 mL pipettes and the 10 mL pipettes of unreduced diameter shall have a constriction located between 15 mm and 25 mm from the top.

The suction end shall be dimensionally suitable for plugging with filtering material.

5.7 Workmanship

The pipettes shall be free from foreign matter, loose or embedded lint, chips that affect the bore and stains when viewed under normal room lighting.

6 Delivery time

The delivery time, when determined with the pipette unplugged and using water complying with BS 3978, shall be within the limits specified in Table 1.

7 Volumetric performance

The volumetric performance shall be determined for either a single pipette or a minimum of 30 pipettes.

The delivered capacity shall be determined in accordance with BS 6696 supplemented by Appendix A.

The volumetric accuracy and repeatability shall be determined in accordance with Appendix B.

The accuracy and repeatability of the delivered capacity shall be within the limits stated by the manufacturer.

8 Graduation and figuring

The pipettes shall be graduated in accordance with the graduation pattern III of BS 5898:1980, and figured accordingly.

NOTE When a British Standard corresponding to ISO 8417 (see note 1 to clause **1**) is published, this clause will be amended to make reference to that standard rather than BS 5898.

Graduation and figuring shall be durable until the pipette has been used.

The pipette shall be graduated from zero at the top down to the lowest graduation line according to Table 1. The distance between the top of the pipette and zero line shall be at least 90 mm.

Table 1 — Capacity, subdivision, dimensions and delivery time

Nominal capacity	Smallest scale division	Lowest graduation line	External diameter[a]	Minimum wall thickness	Delivery times	
					Minimum	Maximum
mL	mL	mL	mm	mm	s	s
0.1	0.01	0.09	3.5 to 4	1	0.5	3
0.2	0.01	0.18	3.5 to 4.5	1	0.5	3
0.5	0.01	0.45	4.0 to 4.75	0.5	0.5	3
1	0.01	0.9	4.0 to 4.75	0.5	0.5	5
1	0.1	0.9	4.0 to 4.75	0.5	0.5	5
2	0.01	1.9	5 to 6	0.5	0.5	5
5	0.1	4.5	6.5 to 8.25	0.5	3	10
10	0.1	9	9.5 to 11.25	0.6	4.5	15

[a] Graduated part.

9 Inscriptions

9.1 The following inscriptions shall be marked on all disposable serological pipettes:

a) a number indicating the nominal capacity and, adjacent or subjacent to this number, either the symbol "cm^3" or the symbol "mL" to indicate the unit of graduation (see note to **4.1**);

b) the inscription "20 °C" or "27 °C" to indicate the standard reference temperature (see **4.2**);

c) the letters "Ex" to indicate that the pipette has been adjusted to deliver its indicated capacity;

d) the maker's and/or vendor's name or mark.

9.2 The word "Blow-out" and/or a white enamelled (or etched or sand-blasted) band 3 mm to 5 mm wide shall additionally be inscribed on all blow-out pipettes.

10 Labelling

Each package of serological pipettes shall be clearly labelled with the following information:

a) the maker's and/or vendor's name or mark;

b) the product description, e.g. disposable serological pipettes, 5 mL;

c) the volumetric performance in terms of accuracy and repeatability;

d) the number of pipettes in the package;

e) the batch number or date of manufacture;

f) the number and date of this British Standard, i.e. BS 6706:1986[1)].

11 Colour coding

Colour coding, if used, shall comply with the requirements of BS 3996.

[1)] Marking BS 6706:1986 on or in relation to a product is a claim by the manufacturer that the product has been manufactured to the requirements of the standard. The accuracy of such a claim is therefore solely the manufacturer's responsibility. Enquiries as to the availability of third party certification should be addressed to the appropriate certification body.

Appendix A Determination of delivered capacity

NOTE Appendix A supplements paragraph 3 of **10.5.1** of BS 6696:1986 and describes the method of handing the pipette for the determination of the delivered capacity.

Hold the clean pipette, filled with distilled water to a few millimetres above the zero line, in a vertical position. Set the falling meniscus to the line.

Set the meniscus 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 order that the lowest point of the meniscus may be observed, place a shade of some dark material immediately below and behind the meniscus.

NOTE This renders the profile of the meniscus dark and clearly visible against a light background.

Remove any drop adhering to the jet of the pipette by bringing the surface of a glass vessel in contact with the tip of the jet.

Deliver the water into another glass vessel slightly inclined so that the tip of the jet is in contact with the inside of the vessel, but without movement of one against the other throughout the delivery period.

In case of delivery of the total capacity (to the jet), leave the outflow also unrestricted.

In order to ensure that delivery is complete, observe a waiting time of approximately 3 s before removing the pipette from the receiving vessel. In the case of blow-out pipettes, after the 3 s waiting time, expel the last drops by blowing and then remove the pipette from the receiving vessel.

NOTE The waiting period of 3 s is specified only for the purpose of definition. In use, it is unnecessary to adhere closely to this period; it is sufficient to be certain that the meniscus has come to rest in the jet before either removing the pipette from contact with the receiving vessel or blowing out the pipette, as appropriate.

Appendix B Determination of accuracy and repeatability

B.1 Volumetric capacity deviation (single pipette)

The percentage capacity deviation for a single pipette C shall be calculated from the following equation:

$$C = \frac{(V_1 - V_0)\ 100}{V_0}$$

where

V_0 is the nominal capacity of the pipette;

V_1 is the delivered capacity at the reference temperature.

B.2 Volumetric capacity deviation (number of pipettes)

B.2.1 *Percentage volumetric error*

The percentage volumetric error V for a minimum of 30 pipettes shall be calculated from the following equation:

$$V = \frac{(\overline{V} - V_0)\ 100}{V_0}$$

where

$\overline{V}$ is the mean of the sample measurements at the reference temperature;

V_0 is the nominal capacity of the pipette.

B.2.2 *Percentage coefficient of variation*

The percentage coefficient of variation A shall be calculated from the following equation:

$$A = \frac{s\ 100}{\overline{V}}$$

where

$$s = \sqrt{\left\{\frac{\Sigma\ (V_2 - \overline{V})^2}{n - 1}\right\}}$$

$\overline{V}$ is the mean of the sample measurements at the reference temperature;

V_2 is the individual sample measurement at the reference temperature;

n is the number of pipettes measured.

Publications referred to

BS 3473, *Chemical resistance of glass used in the production of laboratory glassware.*

BS 3473-2, *Method for determination of hydrolytic resistance of glass grains at 98 °C.*

BS 3978, *Specification for water for laboratory use.*

BS 3996, *Specification for colour coding for one-mark and graduated pipettes (including requirements for the service performance of the colour coding enamels).*

BS 5750, *Quality systems*[2)].

BS 5750-3, *Specification for final inspection and test.*

BS 5898, *Specification for principles of design and construction of volumetric glassware for laboratory use.*

BS 6696, *Methods for use and testing capacity of volumetric glassware.*

ISO 7713, *Laboratory glassware — Disposable serological pipettes.*

ISO 8417, *Laboratory volumetric instruments — Disposable volumetric articles — Principles of design and construction*[3)].

[2)] Referred to in the foreword only.

[3)] In preparation.

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