BRITISH STANDARD

BS 5404-1: 1976

Specification for

Plastics laboratory ware —

Part 1: Beakers

Confirmed November 2011

UDC [542.2:678.5] + 542.231.5

Cooperating organizations

The Laboratory Apparatus Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations:

Agricultural Research Council
Association for Science Education*
Association of Scientific, Technical and Managerial Staffs*
British Laboratory Ware Association*
British Lampblown Scientific Glassware Manufacturers' Association
British Pharmacopoeia Commission
Chemical Industries Association
Chemical Society
Department of Health and Social Security
Department of Industry (Laboratory of the Government Chemist)*
Department of Industry (National Physical Laboratory)
Glass Manufacturers' Federation
Institute of Petroleum
Ministry of Defence
Pharmaceutical Society of Great Britain
Royal Institute of Chemistry
Scientific Instrument Manufacturers' Association*
Society for Analytical Chemistry
Society of Chemical Industry
Society of Glass Technology
Standardization of Tar Products Test Committee

The Government department and scientific and industrial 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:

British Society of Scientific Glassblowers
Consortium of Local Education Authorities for the provision of Science Equipment
Institute of Medical Laboratory Science
Medical Research Council
Individual expert

This British Standard, having been prepared under the direction of the Laboratory Apparatus Standards Committee, was published under the authority of the Executive Board on 29 October 1976

The following BSI references relate to the work on this standard:
Committee reference LBC/28
Draft for comment 75/52388 DC and draft for approval 76/50244

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Amendments issued since publication

Amd. No.	Date of issue	Comments

Contents

Foreword

This British Standard has been prepared under the authority of the Laboratory Apparatus Standards Committee to specify plastics beakers of the type in general use in laboratories. It has been drawn up with reference to a Draft International Standard for laboratory glass beakers (DIS 3819) which, at the time of preparation of this British Standard, was under consideration by Technical Committee ISO/TC 48 "Laboratory glassware and related apparatus" of the International Organization for Standardization.

Differences between this British Standard and the Draft International Standard for glass beakers have been limited, in most instances, to those arising from the differences in physical properties of the respective materials used in their construction. Owing to the relatively low density of some plastics materials, the series specified in this British Standard has a lower height-to-diameter ratio than squat-form glass beakers, giving greater mechanical stability. To enable beakers of a single size to be stored in "stacked" groups, a tapered shape is also permitted. Whilst the shape of the beakers has been specified, it has been found possible to omit (with one exception) mandatory requirements for linear dimensions.

A further difference concerns the series of sizes, i.e. nominal capacities; this British Standard includes a 500 ml size in place of the 400 ml and 600 ml sizes included in DIS 3819. The choice of sizes was determined by the current practice and demand for plastics beakers in the UK and by analogy with other items of laboratory apparatus such as measuring cylinders and flasks. Plastics beakers are also designed to provide greater ullages than those specified for glass beakers in DIS 3819.

This British Standard specifies beakers intended for use with aqueous solutions between 0 °C and 60 °C. **Before using these beakers for strong acids and alkalis, oxidizing agents or non-aqueous liquids, or at temperatures outside this temperature range, users should satisfy themselves that the beakers are suitable for such use**. Plastics beakers complying with the requirements of this British Standard are marked with both a recommended maximum temperature of use and an indication of the material of construction.

Modern manufacturing techniques make it possible for beakers to bear a scale of approximate graduations at little extra cost and, except where beakers are opaque, this has been made mandatory.

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 details of a single series of squat-form plastics beakers for laboratory use, and covers both a tapered form and a non-tapered form. The so-called non-tapered form may, however, have a slight taper to facilitate mould release during manufacture.

2 Reference

The titles of the publications referred to in this standard are listed on the inside back cover.

3 Sizes of beaker

The series of beakers covered by this British Standard and defined by nominal capacity shall be as follows:

25, 50, 100, 250, 500, 1 000, 2 000 and 5 000 ml.

4 Graduation and figuring

Except if the beaker is opaque, it shall be graduated and figured on the outside as follows.

4.1 General. The graduation lines, figuring and inscriptions shall be clearly and durably marked.

4.2 Graduation lines. The graduation lines shall be of uniform thickness and shall lie in a plane perpendicular to the axis of the beaker.

Each beaker shall bear figured graduation lines at intervals of 20 % of the nominal capacity of the beaker. The highest graduation line shall indicate the nominal capacity of the beaker (see clause **5**). The lowest graduation line shall indicate 20 % of the nominal capacity. Shorter, non-figured intermediate graduation lines indicating intervals of 10 % of the nominal capacity of the beaker are permitted.

The figured graduated lines shall extend at least one-fifteenth of the way round the mean circumference of the beaker, but in any case shall be not less than 8 mm long.

The ends of the figured graduation lines shall lie on a line coplanar with the axis of the beaker; this line may be marked.

4.3 Figuring. The position of the figuring shall be such as to enable the value corresponding to each graduation line to be readily identified.

The figures indicating the nominal capacity of the beaker shall be adjacent to the top graduation line, shall be more prominent than the other figures and shall be followed by the inscription “ml”.

4.4 Tolerances. The errors in graduation shall not exceed ± 10 % of the indicated values.

5 Capacity

The brimful capacity of a beaker shall be not less than 1.3 times the nominal capacity of the beaker for sizes up to 500 ml and not less than 1.2 times the nominal capacity for larger sizes.

6 Material

6.1 General. Beakers shall be rigidly constructed of generally non-brittle plastics material of suitable chemical and physical properties and shall be as free as possible from moulding defects and stress.

6.2 Resistance to extraction of ionic material by water at 60 °C. When tested according to the procedure given in Appendix A, the beaker shall give an aqueous extract free of suspended matter and having a conductivity not more than 200 μS/m greater than that of the original water used for the extraction.

NOTE 200 μS/m is equivalent to the conductivity of water containing approximately one part per million of sodium chloride.

7 Details of construction

7.1 Base. The base shall enable the beaker to stand vertically on a plane horizontal surface without any tendency to spin or rock.

7.2 Brim. The diameter of the brim shall be not less than 10 % greater than the average external diameter of the body. The edge of the brim shall be finished in a plane parallel to that of the base. The inside surface of the beaker shall have a smooth contour.

7.3 Spout. The spout shall be so shaped that, when the beaker is filled to its nominal capacity with water, the water may be poured in a regular stream clear of the side of the beaker. The spout shall be at right angles to the radius drawn from the midpoint of the graduation lines and shall be on the left-hand side when the beaker’s graduation lines face the user. The spout shall not extend above the plane of the brim of the beaker.

7.4 Shape. The ratio of overall height to maximum body diameter shall lie between 1.0 and 1.4.

If the sides of the beaker are not parallel, the body shall form a right frustum of a cone, the apex angle of which shall lie below the base of the beaker. This angle (defined as the angle included between the sides) may be the minimum required to ensure mould release in the manufacture of nominally non-tapered beakers, and shall not exceed 10° in the case of tapered beakers.

7.5 Radius at base. The internal radius at the junction between the base and the side of the beaker shall be not less than 3 mm.

7.6 Wall thickness. The wall thickness and brim design shall be such that, when the beaker is tested for flexibility in accordance with the procedure detailed in Appendix B, the outside diameter of the brim shall not decrease by more than 10 %.

Wall thickness shall be uniform, and base thickness shall be not less than wall thickness.

Substantial local irregularities shall be avoided.

8 Inscriptions

The following inscriptions shall be durably and legibly marked on all beakers:

a) the words “approximate volumes” or a suitable abbreviation (on graduated beakers);

b) the maker’s and/or vendor’s name or readily identifiable mark;

c) the name of the material (or its recognized abbreviation as given in BS 3502) from which the beaker is made and the manufacturer’s recommended safe maximum temperature for short-term use (several hours) in contact with materials that do not attack the plastic, e.g. for polypropylene

PP 135 °C max.

NOTE The temperature in the example is merely intended to indicate an inscription and does not represent any particular grade of plastics material.

d) the pictogram shown in Figure 1, or the words “no flame” (the former is preferred);

NOTE The pictogram indicates that the beaker is not suitable for heating by flame or other heat sources (e.g. hot plate) that raise the surface temperature above the manufacturer’s recommended safe temperature for short-term use.

e) the number of this British Standard, i.e. BS 5404.

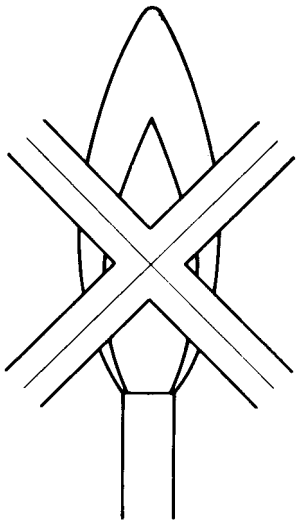

Figure 1 — Pictogram to be inscribed on the beaker

Appendix A Test for ionic material extracted by water at 60 °C

A.1 Apparatus and solutions required

The following items are required.

A.1.1 *Clock glasses*, made of borosilicate glass, sizes appropriate to the beakers under test.

A.1.2 *Water bath*, maintained at 60 ± 2 °C.

A.1.3 *Conductivity meter*, suitable for measurement of the electrical conductivity of water.

A.1.4 *De-ionized water*, complying with the requirements of BS 3978 except that the conductivity shall be less than 200 μS/m.

A.1.5 ***Detergent solution***

A.2 Procedure

Thoroughly wash each beaker under test with hot water and detergent solution, then rinse well with hot water followed by cold water and finally with liberal quantities of de-ionized water. Fill each beaker to its nominal capacity with de-ionized water and place in the water bath maintained at 60 ± 2 °C to the depth of the water level in the beaker. Cover each beaker with a clean clock glass and allow it to stand for 3 h.

Remove each beaker from the water bath and allow the contents to cool to 20 °C. Measure the electrical conductivity of each extract by the procedure detailed in method 6 of BS 2690-9:1970, and deduct from the value obtained the conductivity of the original water (also measured at 20 °C) used to prepare the extract. Note the difference in conductivity in microsiemens.

Appendix B Flexibility test for plastics beakers

B.1 Apparatus

The general arrangement of the apparatus is shown in Figure 2. The following items are required.

B.1.1 *Square blocks of wood*, up to 15 in number, each 19 mm thick, having a square with up to 110 mm sides cut from one corner and not exceeding one-quarter of the original block.

B.1.2 *A test finger III*, complying with the requirements of BS 3042.

B.1.3 *A guide for the test finger*, consisting of a stout plate with a 13 mm hole, suitably mounted so that it is adjustable in distance (from 65 mm to 275 mm) from the inside corner of the blocks and adjustable in height (from 25 mm to 220 mm).

B.1.4 *Thermometer*, reading from 0 °C to 100 °C and graduated at each degree Celsius (e.g. GP 105C/1.0 of BS 1704).

B.1.5 *Outside calipers*, opening up to 250 mm.

B.1.6 ***G-clamp***

B.2 Procedure

B.2.1 Stack sufficient of the wooden blocks to bring the highest one just below the brim of the beaker to be tested. Adjust the blocks so that each touches the beaker at two points and clamp the stack to the working surface. Adjust the brackets bearing the guide such that the test finger, when inserted through the hole, will touch the beaker at a height equal to three-quarters of the total height of the beaker. Further adjust the brackets bearing the guide such that the guide is perpendicular to the plane of the axis of the beaker and the inside corners of the blocks and is fixed 20 mm from the beaker.

B.2.2 Using the calipers, measure the outside diameter (d_1 mm) of the brim of the beaker in the direction the force is to be applied by the test finger.

B.2.3 Fill the beaker to its nominal capacity with water at 60 ± 2 °C. Insert the test finger through the guide and apply a steady force of 30 N, as shown by the force indicator of the test finger, horizontally and towards the axis of the beaker.

Approximately 1 min after applying the force and while still maintaining it, remeasure the outside diameter (d_2 mm) as described in **B.2.2**. Remove the test finger. Check the temperature of the water; if it is different from 60 ± 2 °C, reject the readings and repeat from **B.2.2**.

B.2.4 Rotate the beaker 90° and repeat from **B.2.2**.

B.3 Expression of result

Express the result as the percentage change in the diameter

$$= (1 - \frac{d_2}{d_1}) \times 100$$

and report the higher of the two values derived before and after rotation of the beaker.

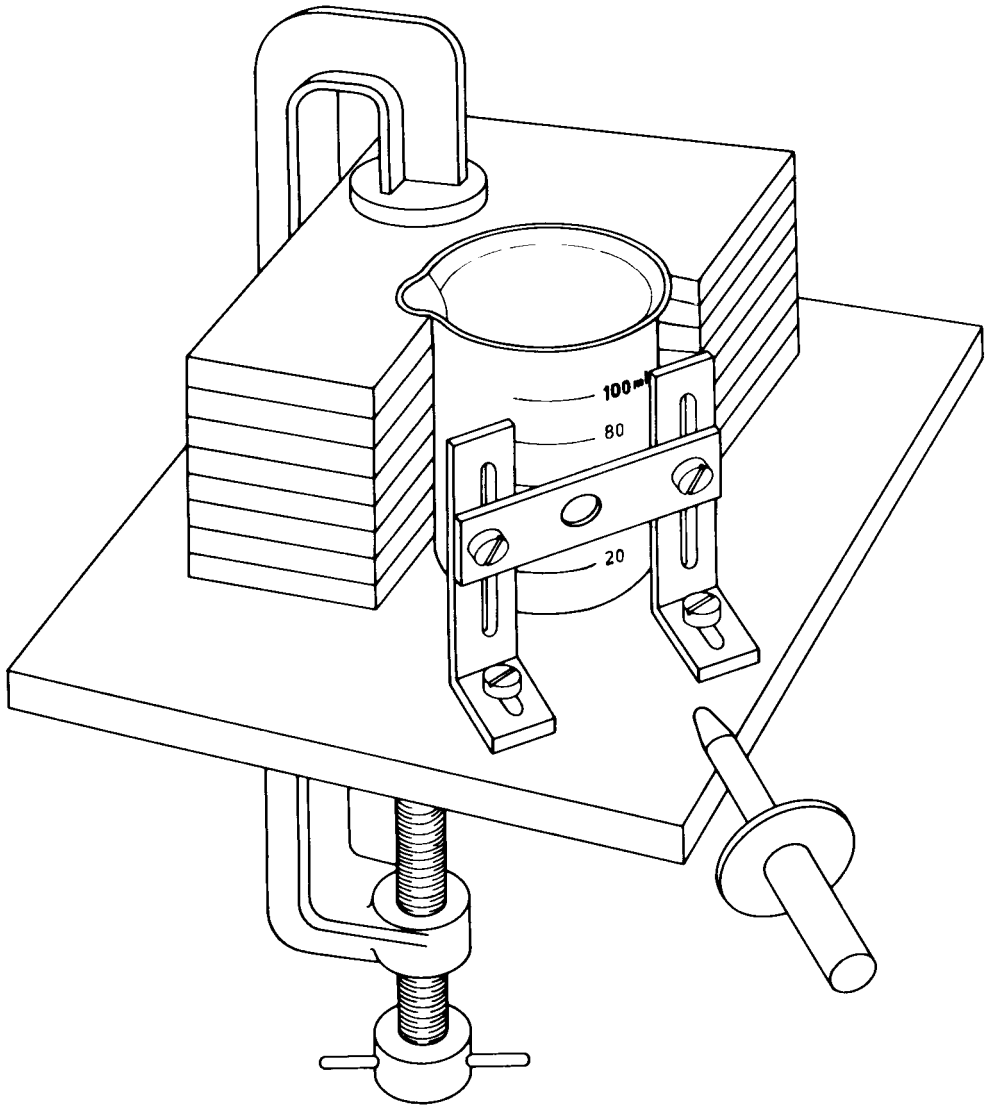

Figure 2 — Apparatus for flexibility test for plastics beakers

Publications referred to

BS 1704, *General purpose thermometers.*

BS 2690, *Methods of testing water used in industry.*

BS 2690-9, *Appearance (colour and turbidity), odour, suspended and dissolved solids and electrical conductivity.*

BS 3042, *Standard test fingers and probes for checking protection against electrical, mechanical and thermal hazard.*

BS 3502, *Schedule of common names and abbreviations for plastics and rubbers.*

BS 3978, *Water for laboratory use.*

ISO/DIS 3819, *Laboratory glass beakers.*

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