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Specification for

Syringe pattern micro-pipette —

Microchemical apparatus —

Group D: volumetric apparatus

Co-operating organizations

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

Admiralty*
 Air Ministry
 Association of British Chemical Manufacturers*
 Association of Scientific Workers
 Board of Trade
 British Association for the Advancement of Science
 British Chemical Ware Manufacturers' Association*
 British Laboratory Ware Association*
 British Lamplown Scientific Glassware Manufacturers' Association*
 British Pharmacopoeia Commission
 British Scientific Instrument Research Association*
 Chemical Society*
 Department of the Government Chemist*
 D.S.I.R. — Chemical Research Laboratory*
 Glass Manufacturers' Federation*
 Institute of Petroleum
 Ministry of Education
 Ministry of Health
 Ministry of Supply*
 National Physical Laboratory*
 Oil Companies Materials Committee
 Pharmaceutical Society of Great Britain*
 Royal Institute of Chemistry*
 Science Masters' Association
 Society of Chemical Industry*
 Society of Glass Technology*
 Society for Analytical Chemistry*
 Standardization of Tar Products Tests Committee

The Government departments 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:—

Biochemical Society
 Brewing Industry Research Foundation
 British Rubber Producers' Research Association
 Glass Delegacy (University of Sheffield)
 Medical Research Council
 Physiological Society
 War Office
 Individual manufacturers

Amendments issued since publication

Amd. No.	Date	Comments

This British Standard, having been approved by the Scientific Glassware and Related Laboratory Apparatus Industry Standards Committee and endorsed by the Chairman of the Chemical Divisional Council, was published under the authority of the General Council on 29 March 1955

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The following BSI references relate to the work on this standard:—
 Committee reference LBC/11
 Draft for comment CR(LBC) 6265

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Foreword

This standard makes reference to the following British Standard:—

BS 1797, *Tables for use in the calibration of volumetric glassware.*

This standard is one of a series which is being prepared at the request of the British Laboratory Ware Association. The whole series is to be published as BS 1428, “*Microchemical apparatus*”, and the parts are being issued separately, in the following provisional groups:—

- A. Combustion trains for the determination of elements.
- B. Apparatus for the determination of elements by other than combustion methods.
- C. Apparatus for the determination of organic groups.
- D. Volumetric apparatus.
- E. General accessory apparatus.
- F. Filtration accessories.
- G. Heating, cooling and drying accessories.
- H. Weighing accessories.
- I. Combustion accessories.
- J. Electrolytic accessories.
- K. Accessories for physical gravimetric methods.
- L. Extraction accessories.

This British Standard forms Part D5 of Group D in the series. Other Parts in Group D have been published as follows:—

- *Part D1: Burettes with pressure-filling device and automatic zero;*
- *Part D2: Washout pipettes;*
- *Part D3: Micro-nitrometer;*
- *Part D4: Capillary pipettes;*
- *Part D6: Micrometer-operated burette.*

The apparatus described in this Part is intended for the precise measurement and delivery of small quantities of liquid such as are required for microchemical work.

The pipette operates in the same way as a syringe: no lubricant is used on the piston and the barrel is completely filled with liquid. The volume of liquid expelled from the jet in operation is therefore the volume of that part of the piston which travels into the barrel when the handle is allowed to fall from the upper to the lower stop.

Numerous designs of syringe pipette have been described in technical journals in recent years, most of them adaptations, by the user, of a hypodermic syringe. Various different arrangements have been used to form end stops to limit the travel of the piston, all of which entail the use of metal parts attached to the barrel of the syringe. The advantages of the design described in this specification are that the pipette consists solely of two glass components which can be sterilized when used for bacteriological work, and that there are no adjustments required by the user.

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 5 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 a form of pipette suitable for the precise measurement and delivery of a predetermined small quantity of liquid.

2 Range of sizes

British Standard syringe pattern micro-pipettes shall be of three sizes: 0.25, 0.5 and 1.0 ml. Each size may be provided with a long or a short delivery tube (see Figure 1).

3 Material

The barrel and piston shall be made of borosilicate glass, as free as possible from visible defects, and shall be reasonably free from internal strain.

4 Dimensions

The only mandatory dimension for a British Standard syringe pattern micro-pipette is the diameter of the ground portion of the piston, which shall be 6.0 ± 0.1 mm. The remaining dimensions, given in Table 1 and illustrated in Figure 1 and Figure 2, are recommended for the guidance of manufacturers. These dimensions are not a mandatory part of the specification, but a micro-pipette which, on visual inspection, shows any gross departure from them shall be deemed not to comply with the specification.

5 Piston

The piston shall be made from glass rod. The portion which engages in the barrel shall be ground and lapped to a very fine finish. The departure from circularity of the ground portion, as indicated by the full "throw" of a dial gauge resting on the circumference of the ground portion when it is rotated in a V-block of included angle 120° , shall not be greater than 0.001 mm. The whole of the ground portion shall be straight to 0.002 mm. At the handle end the rod shall be reduced in diameter and bent at right angles sufficiently sharply to ensure that it rests squarely on the stops, as shown in Figure 1.

Table 1 — Recommended dimensions for syringe pattern micro-pipette

Piston	mm
a) Length of ground zone	70
b) Diameter of handle	5
c) Length of handle projecting beyond stop	15
Barrel	
d) Length of ground zone	70
e) External diameter of ground portion, <i>not less than</i>	8.0
f) External diameter of tube from which stops are formed	12.5
g) Length of capillary tube, including jet. Long pattern	75
Short pattern	25
h) External diameter of capillary delivery tube	4
i) Internal diameter of capillary delivery tube	1
j) External diameter of jet at tip	1.0 to 1.5
k) Wall thickness at tip of jet	0.25 to 0.5
l) Internal diameter of jet at tip	0.3 to 0.5
m) Included angle of taper of jet	10° to 25°
n) Included angle of bevel	$45^\circ \pm 3^\circ$

Table 2 — Calculated dimensions for syringe pattern micro-pipette

Piston diameter	Calculated distance between stops ^a		
	Nominal capacity of pipette		
	0.25 ml	0.5 ml	1.0 ml
mm	mm	mm	mm
5.9	9.14	18.29	36.58
6.0	8.84	17.68	35.37
6.1	8.55	17.11	34.22

^a The dimensions in Table 2 are calculated to give the correct capacity when the piston diameter is within the permitted limits of 6.0 ± 0.1 mm. No tolerance is given, as the precise distance is controlled by the tolerance on capacity in clause 10 and the measured diameter of the piston.

6 Barrel

The barrel shall be made from glass tubing which is of uniform circular bore and straight. It shall be lapped or otherwise formed to accept the piston freely without shake. This will ensure that no liquid leaks from or air enters the barrel when used as described in Appendix B.

At the delivery end the barrel shall be smoothly constricted and joined to a capillary tube terminating in a jet.

At the other end the barrel shall be joined to a tube of larger diameter which shall be partly cut away to form the upper and lower end stops for the handle of the piston (see Table 2 for the distance between the stops). All edges shall be ground smooth and the projecting corners chamfered or rounded off. The planes of the two ground faces forming the end stops shall be accurately at right angles to the longitudinal axis of the barrel.

¹⁾ The mark “BS 1428” on the product is an indication by the manufacturer that it purports to comply with the requirements of this British Standard.

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Further particulars of the terms of licence may be obtained from the Director, British Standards Institution, 2 Park Street, London, W.1.

7 Jet

The capillary delivery tube shall terminate at its lower end in a jet, which shall be made with a gradual taper and bevel as shown in Figure 2, without any sudden constriction at the orifice. A slight concavity in the taper shall be permitted. The end of the jet shall be ground smooth and square with the axis and the outer edge slightly bevelled.

8 Dead space

The shape of the joint between the barrel and the capillary delivery tube shall be such that the dead space between the piston and the end of the jet does not exceed 0.25 ml in the closed position.

9 Definition of capacity

The capacity of a British Standard syringe micro-pipette shall be defined as the volume of water at 20 °C, expressed in millilitres, delivered when the pipette is operated as described in Appendix B.

10 Tolerance on capacity

The tolerance on capacity for all sizes of syringe micro-pipette shall be ± 0.002 ml.

11 Inscriptions

Each pipette shall have permanently and legibly marked on it:

- The nominal capacity, e.g. “0.5 ml”.
- The inscription “D.20 °C” to indicate that the pipette is calibrated for delivery at 20 °C.
- An identification number, to be the same on piston and barrel.
- The maker’s or vendor’s name or mark.
- The number of this British Standard, i.e. “BS 1428”.¹⁾

Appendix A Testing of British Standard syringe pattern micro-pipette

The National Physical Laboratory is prepared to accept micro-pipettes for examination for compliance with the requirements of this British Standard. Certificates of values will be issued for satisfactory pipettes if required. Particulars of the fees charged can be obtained on application to the Director, National Physical Laboratory, Teddington, Middlesex.

Appendix B Determination of capacity

When determining the capacity of a syringe micro-pipette the following procedure shall be observed, the pipette having first been thoroughly cleaned.

The pipette is filled with distilled water by withdrawing the piston beyond the upper stop. The pipette is then inverted to wet the piston and barrel and the piston pushed in a little to expel any air which was trapped by the first filling. The pipette is then again filled to beyond the upper stop and the outside of the delivery jet wiped free from water with a cloth. The piston is then lowered to the upper stop, the surplus water being expelled into a glass vessel and the jet touched on to the side of the vessel, to remove any drop which may be adhering to it.

The contents of the pipette are then delivered into a weighing vessel by holding the pipette in a vertical position and turning the piston so that the handle clears the upper stop. The piston is allowed to fall under its own weight until it reaches the lower stop. When delivery is complete the jet is touched on the side of the receiving vessel to detach any drop adhering to the jet and the drop is caused to unite with the bulk of the water by tilting the vessel until the surface of the water touches the drop. The vessel is then reweighed.

It is recommended that the receiving vessel should contain water and be counterpoised by a similar vessel of the same internal diameter also containing water. The counterpoise vessel should be tilted momentarily in the same way as the receiving vessel, so that equal areas of the surface are wetted. It is unnecessary for the vessels to be covered as the evaporation from the two surfaces will be equal.

All operations shall be carried out at room temperature. The volume of water delivered by the pipette at 20 °C shall be calculated by applying a correction for water temperature (see BS 1797²⁾).

²⁾ BS 1797, "Tables for use in the calibration of volumetric glassware".

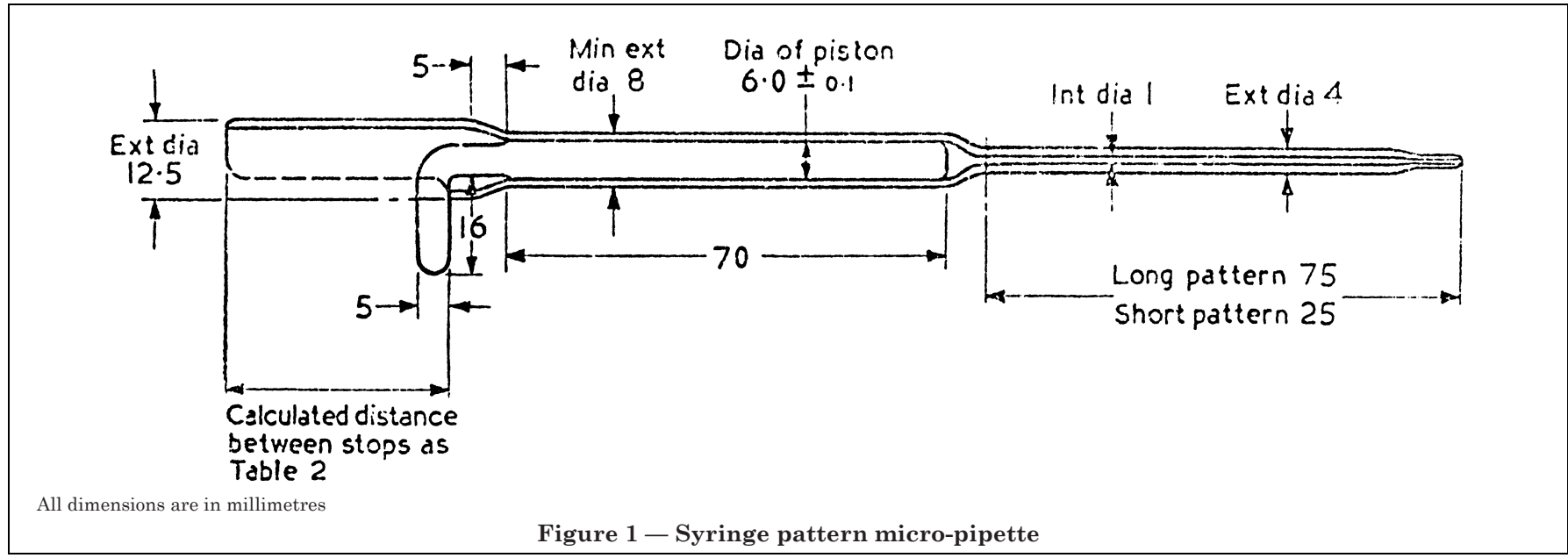
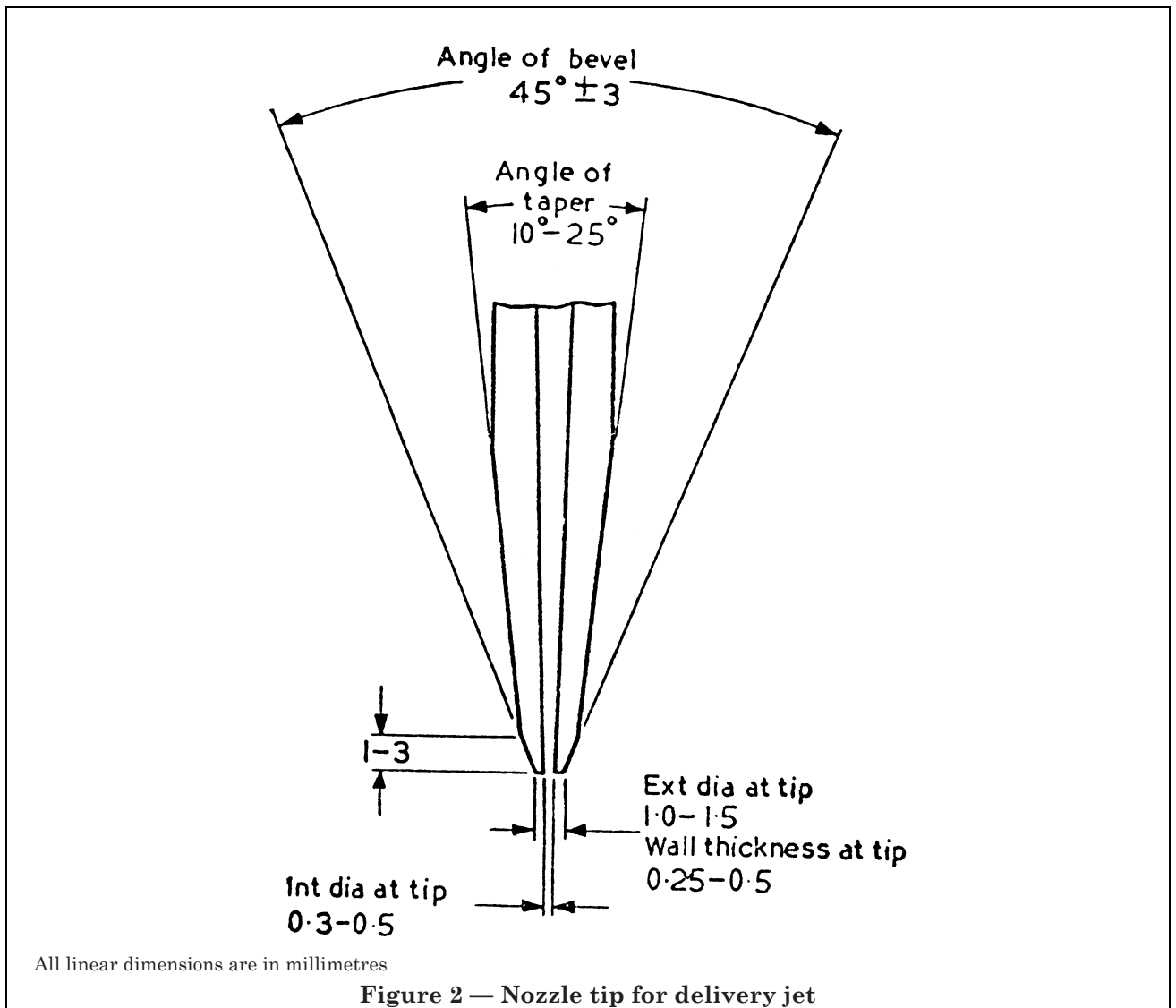


Figure 1 — Syringe pattern micro-pipette



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