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INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION
R 385

BURETTES

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BRIEF HISTORY

The ISO Recommendation R 385, *Burettes*, was drawn up by Technical Committee ISO/TC 48, *Laboratory Glassware and Related Apparatus*, the Secretariat of which is held by the British Standards Institution (BSI).

Work on this question by the Technical Committee began in 1952 and led, in 1960, to the adoption of a Draft ISO Recommendation.

In April 1960, this Draft ISO Recommendation (No. 348) was circulated to all the ISO Member Bodies for enquiry. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies:

Australia	Greece	Romania
Austria	India	Spain
Belgium	Israel	Sweden
Canada	Italy	United Kingdom
Chile	Japan	U.S.A.
Colombia	Netherlands	U.S.S.R.
France	New Zealand	
Germany	Poland	

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One Member Body opposed the approval of the Draft:

Czechoslovakia.

The Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided, in September 1964, to accept it as an ISO RECOMMENDATION.

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ISO Recommendation R 385 September 1964

BURETTES

1. SCOPE

This ISO Recommendation is intended to provide details of an internationally acceptable range of burettes, adequate for general laboratory purposes.
The details specified are in conformity with ISO Recommendation R 384, *Principles of Construction and Adjustment of Volumetric Glassware*.

2. BASIS OF ADJUSTMENT

2.1 *Unit of volume*

The unit of volume should be the cubic centimetre (cm^3), for which the name millilitre (ml) may be used,

NOTE. — The term millilitre (ml) is commonly used as a special name for the cubic centimetre (cm^3), in accordance with a decision of the Twelfth Conférence Générale des Poids et Mesures. The term millilitre is acceptable, in general, for references in ISO Recommendations to capacities of volumetric glassware and it is used, in particular, in the present text.

2.2 *Reference temperature*

The standard reference temperature, i.e. the temperature at which the burette is intended to deliver its nominal volume (nominal capacity), should 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 should adopt a temperature of 27 °C.

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3. CLASSES OF ACCURACY

Two classes of accuracy should be specified:

Class A for the higher grade,
Class B for the lower grade,

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in such a way that in neither class does the permissible tolerance exceed the smallest scale division.

4. SERIES OF CAPACITIES

The series of capacities of burettes should be as shown in Table 1.

NOTE. — If other capacities of burettes are required than those listed in Table 1, it is recommended that they should conform, as far as possible, to the essential requirements of this ISO Recommendation.

TABLE 1. — **Range of capacities, divisions and tolerances**

Capacity	Class of accuracy	Smallest scale division	Tolerance
ml		ml	ml
10	A	0.05	± 0.02
10	B	0.05	± 0.05
25	A	0.05	± 0.03
25	B	0.05	± 0.05
25	B	0.1	± 0.1
50	A	0.1	± 0.05
50	B	0.1	± 0.1
100	A	0.2	± 0.1
100	B	0.2	± 0.2

5. DEFINITION OF CAPACITY

The capacity corresponding to any graduation line should be defined as the volume of water at 20 °C expressed in millilitres, delivered by the burette at 20 °C when emptied from the zero line to that graduation line, outflow being unrestricted until making the final setting of the meniscus on the graduation line, and no period being allowed for drainage of liquid adhering to the wall before making the final setting.

NOTE. — Where, exceptionally, the standard reference temperature is 27 °C, this value should be substituted for 20 °C.

Setting of the meniscus should be performed by one of the two methods detailed below. In order to minimize possible errors, the same method of setting should be used for both zero and end readings.

(*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.

(*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.

The burette should be filled to a few millimetres above the zero line and the falling meniscus should be set to the line. Any drop adhering to the jet should be removed by bringing a glass vessel into contact with the tip of the jet. Delivery should then be made into another glass vessel with the jet not in contact with the side. After adjustment of the meniscus to the desired graduation line, the drop of water adhering to the jet should be added to the delivered volume by bringing the inside of the receiving vessel into contact with the tip of the jet.

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6. TOLERANCES ON CAPACITY

Tolerances on capacity of burettes should not exceed the values shown in Table 1, page 5.

The tolerance represents the maximum permissible error at any point and also the maximum permissible difference between the errors at any two points.

7. CONSTRUCTION

7.1 Material

Burettes should be constructed of glass of suitable chemical and thermal properties, should be as free as possible from visible defects and should be reasonably free from internal strain.

7.2 Dimensions

Burettes should comply with the dimensional requirements shown in Table 2, page 7.

7.3 Stopcocks

7.3.1 Stopcocks should be ground to permit easy turning and to prevent a rate of leakage greater than that specified in clause 7.3.3. Grinding to a taper of 1/10 is preferred. Suitable devices for retaining the stopcock key should be permitted when required.

TABLE 2. — **Dimensions**

Capacity	Class of accuracy	Smallest scale division	Scale length		Overall length maximum
			minimum	maximum	
ml		ml	cm	cm	cm
10	A and B	0.05	25	35	57
25	A and B	0.05	50	60	82
25	B	0.1	30	40	62
50	A and B	0.1	50	60	82
100	A and B	0.2	55	65	87

Distance of zero line from top of burette	minimum	5 cm
Distance of lowest graduation line from top of stopcock	,,	5 cm
Length of tube of uniform bore below lowest graduation line . .	,,	2 cm
Distance of end of jet from underside of stopcock	,,	5 cm

7.3.2 Stopcocks should be either single bore or double oblique bore, the diameter of the bore being approximately 2 mm in either case. Stopcock dimensions should comply with the appropriate national or international specification.

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ISO/R 385:1964

7.3.3 Stopcocks should be tested for leakage with the burette clamped in a vertical position, the stopcock free from grease, the barrel and key wetted with water and the burette filled initially to the zero line with water. The rate of leakage with the key in either of the fully shut-off positions should not exceed the smallest scale division in 10 minutes.

Double bore stopcocks, in addition to passing this test, should not show a rate of leakage greater than that specified above when tested similarly, with the burette empty, the key of the stopcock in the normal delivery position and the filling tube connected to a suitable graduated tube filled with water to a level 25 cm above the zero line of the burette.

In order to ensure a sufficiently accurate determination, the leakage test should be carried out for a period of at least 30 minutes.

Under conditions of high temperature and low humidity, it may be desirable to have a loose cap over the top of the burette during the test, to minimize evaporation.

NOTE. — The leakage test described above is suitable for purposes of adjustment. For many other purposes, a quicker test may be necessary, in which case a vacuum leakage apparatus is suitable. Such a test is not suitable for specification purposes, owing to the difficulty of standardizing all the conditions. Any particular quick test apparatus can be calibrated by means of several burettes whose leakage rates have been determined by means of the leakage test described above.

7.4 Delivery jet

The jet should be made with a gradual taper without any sudden constriction at the orifice. The end of the jet should preferably be ground smooth and square with the axis and slightly bevelled on the outside. Alternatively, the end may be finished by fire polishing, provided that the requirement in the first sentence of this clause is met.

The jet should be made from thick-walled capillary tubing and, when joined to the stopcock, should have no cavity likely to trap air bubbles.

The jet should form an integral part of all Class A burettes, either by joining to the stopcock barrel (see Fig. 1) or by forming part of the stopcock key (see Fig. 2). Class B burettes should preferably have integral jets, but for special purposes separate jets may be used if adequate precautions against error are taken.

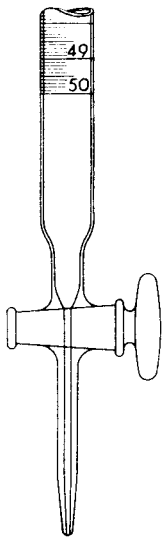

FIG. 1. — **Jet joined to stopcock barrel**

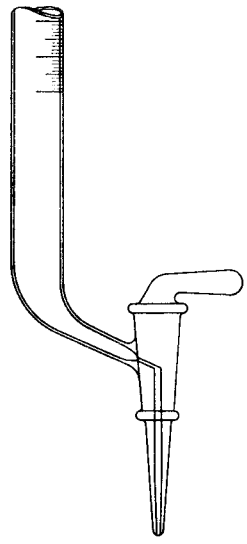

FIG. 2. — **Jet forming part of stopcock key**

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7.5 Delivery time

The delivery time should be defined as the time occupied by the descent of the water meniscus from the zero line to the lowest graduation line. The delivery time should be determined with the stopcock fully open and with the jet not in contact with the side of the receiving vessel.

The delivery time thus determined should be within the limits shown in Table 3. In the case of a detachable jet, the appropriate delivery time should be maintained when the jet is in the position of normal use.

TABLE 3. — **Delivery times**

Capacity	Class of accuracy	Smallest scale division	Delivery time	
			minimum	maximum
ml		ml	seconds	seconds
10	A	0.05	70	100
10	B	0.05	30	60
25	A	0.05	120	170
25	B	0.05	85	170
25	B	0.1	35	70
50	A	0.1	105	150
50	B	0.1	75	150
100	A	0.2	100	150
100	B	0.2	65	130

The delivery time should be marked on all Class A burettes intended for official verification or certification. The observed delivery time and the marked delivery time should both be within the limits given in Table 3 and should not differ by more than 10 per cent of the marked delivery time.

NOTE. — Comparative tests in national standards laboratories have proved that burettes exhibit the best reproducible accuracy when adequate drainage takes place during delivery. The delivery times given in Table 3 have been determined on this basis and no drainage time is required.

8. GRADUATION AND FIGURING

8.1 Graduation lines

8.1.1 Graduation lines should be clean, permanent, uniform lines of thickness not exceeding 0.3 mm.

8.1.2 All graduation lines should lie in planes at right angles to the longitudinal axis of the graduated portion of the burette.

8.2 Spacing of graduation lines

8.2.1 There should be no evident irregularity in the spacing of the graduation lines.

8.2.2 The limits on the spacing of graduation lines should be such as to give scale lengths within the limits allowed in Table 2, page 7.

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8.3 Length of graduation lines

ISO/R 385:1964
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8.3.1 The lengths of the graduation lines should be varied so as to be clearly distinguishable and should be in accordance with the provisions of clause 8.3.2 or 8.3.3.

8.3.2 On Class A burettes,

(*a*) the long lines should extend completely round the circumference of the burette;

(*b*) the length of the medium lines should be approximately two-thirds of the circumference of the burette;

(*c*) the length of the short lines should be approximately, but not less than, one-half of the circumference of the burette;

(*d*) the medium lines should extend symmetrically at each end beyond the ends of the short lines.

8.3.3 On Class B burettes,

(*a*) the length of the long lines should be at least one-quarter of the circumference of the burette;

(*b*) the length of the medium lines should be at least one-sixth of the circumference of the burette;

(*c*) the length of the short lines should be at least one-eighth of the circumference of the burette;

(*d*) the medium and long lines should extend symmetrically at each end beyond the ends of the short lines.