INTERNATIONAL STANDARD

ISO 4142

Second edition
2002-08-15

Laboratory glassware — Test tubes

Verrerie de laboratoire — Tubes à essais

Reference number
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 4142 was prepared by Technical Committee ISO/TC 48, *Laboratory glassware and related apparatus*, Subcommittee SC 2, *General laboratory glassware (other than measuring apparatus)*.

This second edition cancels and replaces the first edition (ISO 4142:1997) by incorporating the following changes:

a) culture tubes have been deleted;

b) the material has been more precisely specified;

c) three types of test tubes have been introduced;

d) additional series and nominal sizes have been added.

Laboratory glassware — Test tubes

1 Scope

This International Standard specifies a range of test tubes, suitable for general laboratory use, fabricated from borosilicate, neutral or soda/lime glass, which are designated Type I, Type II and Type III respectively.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 695, *Glass — Resistance to attack by a boiling aqueous solution of mixed alkali — Method of test and classification*

ISO 719, *Glass — Hydrolytic resistance of glass grains at 98 °C — Method of test and classification*

ISO 1776:1985, *Glass — Resistance to attack by hydrochloric acid at 100 °C — Flame emission or flame atomic absorption spectrometric method*

ISO 3585, *Borosilicate glass 3.3 — Properties*

ISO 4803, *Laboratory glassware — Borosilicate glass tubing*

3 Classification and designation

The following three types of test tubes are specified.

— Type I test tubes (borosilicate glass) are suitable for most usual laboratory applications. They will stand most temperatures commonly used, including boiling of samples. These test tubes are highly chemically resistant.

— Type II test tubes (neutral glass) are suitable for many less demanding applications, and will withstand moderate warming, e. g. in a water bath, and/or moderate temperature change. They should not be taken from the cold and placed directly into the hottest part of the flame without being preheated. Type II test tubes are chemically resistant and are suitable for use with samples which are susceptible to pH changes.

— Type III test tubes (soda/lime glass) are suitable for general mixing and simple laboratory work, and will withstand moderate warming, e. g. in a water bath, and/or moderate temperature change. They should not be placed into naked flames. Their chemical resistance is limited.

These type numbers are specific to this International Standard and should not be confused with similar numbering used in the hydrolytic resistance classification.

If a designation of test tubes is required, this shall be by reference to this International Standard ISO 4142, together with the type designation, the nominal size and the wall thickness of the test tube.

EXAMPLE For a test tube Type I with a nominal size of 10 mm × 75 mm and a medium wall thickness of 1,0 mm, the designation would be as follows:

Test tube ISO 4142-10×75-M

4 Material

4.1 Test tubes shall be of clear glass as free as possible from visible defects and internal stress.

4.2 Type I test tubes shall be manufactured from borosilicate glass in accordance with ISO 3585 and ISO 4803, with coefficient of thermal expansion of $3{,}3 \times 10^{-6}K^{-1}$.

4.3 Type II test tubes shall be manufactured from neutral glass as specified by the manufacturer. Typically the coefficient of thermal expansion will be $5{,}0 \times 10^{-6}K^{-1}$.

4.4 Type III test tubes shall be manufactured from soda/lime glass as specified by the manufacturer. Typically the coefficient of thermal expansion will be $9{,}1 \times 10^{-6}K^{-1}$.

4.5 Water resistance shall be in accordance with ISO 719, alkali resistance in accordance with ISO 695 and acid resistance in accordance with ISO 1776. The resistance classes of the glass types shall comply with Table 1.

Table 1 — Minimum requirements for chemical resistance

Property	Minimum requirement		
	Type I	Type II	Type III
Water resistance	Class HGB 1	Class HGB 1	Class HGB 3
Acid resistance	$\leqslant$ 100 µg Na_2O[a]	$\leqslant$ 100 µg Na_2O[a]	—
Alkali resistance	Class A2	Class A2	Class A2

[a] See clause 9 in ISO 1776:1985.

5 Construction and dimensions

5.1 The top (open end) of each test tube shall be smoothly finished at right angles to the axis, with either a rim or a fire-polished end.

5.2 Dimensions shall be in accordance with the lengths, diameters and tolerances shown in the Table 2 to Table 4.

5.3 The bottom of each test tube shall be essentially hemispherical, with a wall thickness of no less than 67 % and no more than 167 % of the nominal side wall thickness.

6 Marking

6.1 Each Type I test tube shall be marked to clearly indicate that it is manufactured from borosilicate glass with a coefficient of thermal expansion of $3{,}3 \times 10^{-6}K^{-1}$, e.g. “boro 3.3”. The manufacturer's or vendor's name or mark may also be applied to each test tube.

6.2 In the case of Type II and Type III test tubes, the appropriate information may be on the packaging only.

Table 2 — Type I test tubes, made from borosilicate glass 3.3

Dimensions in millimetres

Nominal size	Length ± 2	External diameter ± 0,5	Wall thickness	
			Medium	Heavy
Series 1				
10 × 75	75	10 ± 0,15	1,0 ± 0,04	1,5 ± 0,1
12 × 75	75	12 ± 0,2	1,0 ± 0,04	1,5 ± 0,1
16 × 125	125	16 ± 0,2	1,2 ± 0,05	1,8 ± 0,1
18 × 150	150	18 ± 0,2	1,2 ± 0,05	1,8 ± 0,1
20 × 150	150	20 ± 0,25	1,2 ± 0,05	1,8 ± 0,1
24 × 150	150	24 ± 0,25	1,2 ± 0,05	1,8 ± 0,1
Series 2				
10 × 100	100	10 ± 0,15	1,0 ± 0,04	1,5 ± 0,1
12 × 100	100	12 ± 0,2	1,0 ± 0,04	1,5 ± 0,1
13 × 100	100	13 ± 0,2	1,0 ± 0,04	1,5 ± 0,1
16 × 100	100	16 ± 0,2	1,2 ± 0,05	—
16 × 150	150	16 ± 0,2	1,2 ± 0,05	1,8 ± 0,1
16 × 160	160	16 ± 0,2	1,2 ± 0,05	—
18 × 180	180	18 ± 0,2	1,2 ± 0,05	—
20 × 180	180	20 ± 0,25	1,2 ± 0,05	1,8 ± 0,1
24 × 200	200	24 ± 0,25	1,2 ± 0,05	1,8 ± 0,1

Table 3 — Type II test tubes, made from neutral glass

Dimensions in millimetres

Nominal size	Length ± 2	External diameter ± 0,5	Wall thickness
Series 1			
10 × 75	75	10	1,0 ± 0,04
12 × 75	75	12	1,0 ± 0,04
16 × 125	125	16	1,2 ± 0,04
18 × 150	150	18	1,2 ± 0,04
20 × 150	150	20	1,2 ± 0,05
24 × 150	150	24	1,2 ± 0,05
Series 2			
10 × 100	100	10	1,0 ± 0,04
12 × 100	100	12	1,0 ± 0,04
13 × 100	100	13	1,0 ± 0,04
16 × 100	100	16	1,2 ± 0,04
16 × 150	150	16	1,2 ± 0,04
16 × 160	160	16	1,2 ± 0,04
18 × 180	180	18	1,2 ± 0,04
20 × 180	180	20	1,2 ± 0,05
24 × 200	200	24	1,2 ± 0,05

Table 4 — Type III test tubes, made from soda lime glass

Dimensions in millimetres

Nominal size	Length	Light wall		Medium wall	
	± 2	External diameter	Wall thickness	External diameter	Wall thickness
Series 1					
10 × 75	75	10 ± 0,2	0,6 ± 0,04	10 ± 0,25	1,0 ± 0,05
12 × 75	75	12 ± 0,2	0,6 ± 0,04	12 ± 0,25	1,0 ± 0,05
16 × 125	125	16 ± 0,2	0,6 ± 0,04	16 ± 0,25	1,0 ± 0,05
18 × 150	150	18 ± 0,2	0,6 ± 0,04	18 ± 0,25	1,0 ± 0,05
20 × 150	150	20 ± 0,3	0,8 ± 0,05	20 ± 0,5	1,2 ± 0,05
24 × 150	150	24 ± 0,3	0,8 ± 0,05	24 ± 0,5	1,2 ± 0,05
Series 2					
10 × 100	100	10 ± 0,2	0,6 ± 0,04	10 ± 0,25	1,0 ± 0,05
12 × 100	100	12 ± 0,2	0,6 ± 0,04	12 ± 0,25	1,0 ± 0,05
13 × 100	100	13 ± 0,2	0,6 ± 0,04	13 ± 0,25	1,0 ± 0,05
16 × 100	100	16 ± 0,2	0,6 ± 0,04[a]	16 ± 0,25	1,0 ± 0,05
16 × 150	150	16 ± 0,2	0,6 ± 0,04	16 ± 0,25	1,0 ± 0,05
16 × 160	160	16 ± 0,2	0,6 ± 0,04[a]	16 ± 0,25	1,0 ± 0,05
20 × 180	180	20 ± 0,3	0,8 ± 0,05	20 ± 0,5	1,2 ± 0,05
24 × 200	200	24 ± 0,3	0,8 ± 0,05	24 ± 0,5	1,2 ± 0,05

[a] Or 0,8 ± 0,05.