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## Laboratory glassware — Borosilicate glass tubing

*Verrerie de laboratoire — Tubes en verre borosilicaté*

ICS: 71.040.20

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 48, *Laboratory equipment*.

This second edition cancels and replaces the first edition (ISO 4803:1978), which has been technically revised.

The main changes compared to the previous edition are as follows:

- Update of the dimensions and tolerances.
- Inclusion of a comprehensive and precise definition of the mentioned quality characteristics and inspection methods.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

## Introduction

Borosilicate glass is a class of glasses, which is classified in ISO 12775 (Guidelines on types of glass of normal bulk-production composition and their test methods). Borosilicate glasses at all show properties as a very high hydrolytic resistance, a very high acid resistance and a medium alkali resistance. There are borosilicate glasses containing alkali earths and being free of alkali earths. The alkali-earth free borosilicate glasses have a very low coefficient of mean linear thermal expansion  $\alpha$  of  $3,3 \times 10^{-6} \text{ K}^{-1}$  (20 °C; 300 °C). They were first developed 1887 and constitute since then an industrial standard, which is reflected by the standardization of the composition, chemical and physical properties of the material in the ISO 3585.

These special characteristics make this glass preferable for technical purposes with high chemical and thermo shock resistance. The field of application is especially laboratories for chemical, pharmaceutical and food industries as well as other technical applications where these properties are needed.

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# Laboratory glassware — Borosilicate glass tubing

## 1 Scope

This International Standard specifies requirements for borosilicate 3.3 glass tubing in accordance with ISO 3585 for laboratory apparatus in a diameter range from 4 mm to 300 mm. This standard defines dimensions, material, denomination, designation, requirements and inspection methods.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

ISO 3585, *Borosilicate glass 3.3 — Properties*

## 3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

## 4 Designation

Tubing shall be designated by type of glass, external diameter, wall thickness and name of manufacturer. The three categories of wall thickness specified shall be denoted as light, medium and heavy.

## 5 Material

### 5.1 General

Tubing shall be made from borosilicate glass complying with the requirements of ISO 3585. It shall be free from harmful tensions and their applicability shall neither be impaired by striae nor other glass defects.

### 5.2 Hydrolytic resistance

The amount of alkali extracted from the glass, tested in accordance with ISO 719, shall not be greater than 31 µg of Na<sub>2</sub>O g<sup>-1</sup>.

### 5.3 Thermal coefficient of expansion

The glass shall have a thermal coefficient of expansion of  $(3,3 \pm 0,1) \times 10^{-6} \text{ K}^{-1}$  over a temperature range of 20 °C to 300 °C.

## 6 Range of sizes and tolerances

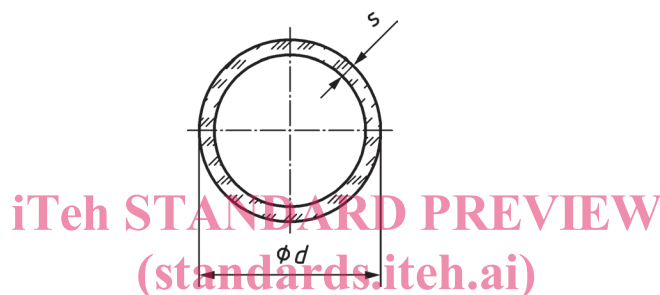
### 6.1 Diameter and wall thickness

The tube outer diameter “ $d$ ” (see [Figure 1](#)) shall be measured as the largest distance of two points on the tube surface in a plane perpendicular to the tube longitudinal axis. The tubes shall comply in all points with the dimensions and tolerances given in [Table 1](#).

Testing method: The outer diameter of the tube can be determined, for example, between two parallel cutting edges perpendicular to the tube’s longitudinal axis.

The wall thickness “ $s$ ” is, the shortest connecting distance between the inner and outer tube’s surfaces in a plane vertically to the tube’s longitudinal axis. The tubes must comply with the dimensions set out in [Table 1](#) at each measuring point on the tube.

Testing method: The measurement of the wall thickness can be carried out, for example, between two hemispherical measuring points, where the radius of the inner measuring point must be smaller than the inner radius of the tube.



#### Key

$d$  tube outer diameter

$s$  wall thickness

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**Figure 1 — Tube with dimensions**

### 6.2 Wall Thickness difference (Siding)

The wall thickness difference shall be measured as the difference between the largest and smallest wall thickness in a cross section. For each tube’s cross-section, the difference between the largest and smallest wall thickness shall not exceed 12 % of the wall thickness as specified in [Table 1](#) without exceeding the wall thickness tolerance.

The wall thickness shall be tested in accordance with [6.1](#).

### 6.3 Length

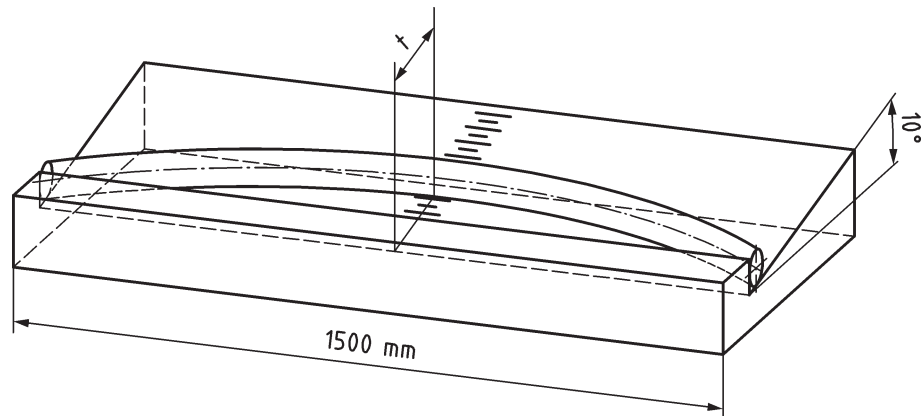
Tubing should be supplied in accordance with the values given in [Table 2](#).

### 6.4 Straightness

The straightness tolerance shall not exceed the values given in [Table 2](#).

For the testing method according to [Figure 2](#), tubes with an outer diameter of 4 mm and 5 mm shall be placed on a flat, smooth surface so that they lie with the ends of the tube on a tarpaulin stop. In the middle of the tube, the straightness tolerance  $t$  as the distance of the tube from the stop shall be measured. The supporting surface shall be inclined about 10° against the horizontal; this allows on the one hand a flush contact of the tube with the stopper, on the other hand it excludes modifications of the pressure-free determined straightness tolerance by the own weight of the tube.

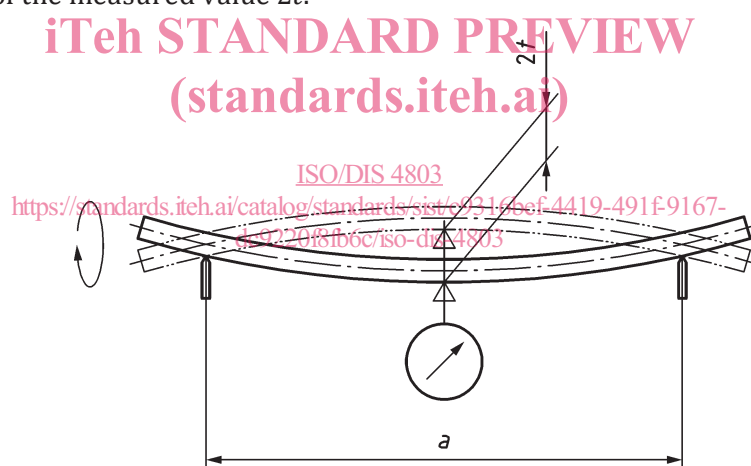


**Key**

t straightness tolerance

**Figure 2 — Determination of straightness for tubes with an outer diameter of 4 mm and 5 mm**

Tubes with an outer diameter of 6 mm or larger shall be placed in the middle on two supports as shown in Figure 3. The contact distance shall be selected according to Table 2. The tube shall be rotated 360° around its longitudinal axis and the sagging can be measured in the middle of the tube. The straightness tolerance  $t$  is half of the measured value  $2t$ .

**Key**

t straightness tolerance

**Figure 3 — Determination of straightness for tubes with outer diameter  $\geq 6$  mm****6.5 Ovality**

The ovality tolerance  $t_o$  (see ISO 1101) in a measuring plane shall not exceed:

- for tubes with an outer diameter of up to 48 mm, 0,7 % of the respective nominal dimension of the outer diameter;
- for tubes with an outer diameter of 50 mm to 300 mm, 1,0 % of the respective nominal dimension of the outer diameter.