FINAL
DRAFT

INTERNATIONAL
STANDARD

**ISO/FDIS
7249**

ISO/TC **38**/SC **23**

Secretariat: **KATS**

Voting begins on:
2023-11-08

Voting terminates on:
2024-01-03

Textiles — Fibres — Determination of burning behaviour by oxygen index

Textiles — Fibres — Détermination du comportement au feu au moyen de l'indice d'oxygène

Reference number
ISO/FDIS 7249:2023(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

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 document 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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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.

This document was prepared by Technical Committee ISO/TC 38, *Textiles*, Subcommittee SC 23, *Fibres and yarn*.

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.

Textiles — Fibres — Determination of burning behaviour by oxygen index

WARNING — The use of this document can involve hazardous materials, operations and equipment. It does not purport to address all of the safety or environmental problems associated with its use. It is the responsibility of users of this document to take appropriate measures to ensure the safety and health of personnel and the environment prior to application of the document.

1 Scope

This document specifies a test method for the determination of burning behaviour of textile fibres by oxygen index.

This document is only used for the purpose of testing burning behaviour of textile fibres under conditions of this test, controlling quality of the products, or studying the factors causing the fire of some particular textile fibres. It is not used for assessing fire risk in their actual use.

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 139, *Textiles — Standard atmospheres for conditioning and testing*

ISO 2060, *Textiles — Yarn from packages — Determination of linear density (mass per unit length) by the skein method*

ISO 2061, *Textiles — Determination of twist in yarns — Direct counting method*

ISO 4589-1, *Plastics — Determination of burning behaviour by oxygen index — Part 1: General requirements*

ISO 4589-2:2017, *Plastics — Determination of burning behaviour by oxygen index — Part 2: Ambient-temperature test*

ISO 4880, *Burning behaviour of textiles and textile products — Vocabulary*

ISO 6741-3:1987, *Textiles — Fibres and yarns — Determination of commercial mass of consignments — Part 3: Specimen cleaning procedures*

3 Terms and definitions

For the purpose of this document, the terms and definitions given in ISO 4589-1 and ISO 4880 apply.

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/ui

— IEC Electropedia: available at https://www.electropedia.org/

4 Principle

A test specimen is fixed vertically in a transparent chimney with upward flowing oxygen mixture gas. The top end of the test specimen is ignited and its burning behaviour is observed. The burning length or burning duration is compared with the given criterion.

The minimum oxygen concentration is estimated by a series of experiments at different volume fractions of oxygen.

5 Apparatus

The usual laboratory apparatus and, in particular, the following shall be used.

5.1 Test chimney, as specified in ISO 4589-2:2017, 5.1.

5.2 Test specimen holder, to support a test specimen vertically, which is fixed on the axial central position of the test chimney.

The clamping position is at least 15 mm away from the nearest point where the test specimen can burn.

It is recommended that the frame of the test specimen holder is smooth to minimize induction of turbulence in the rising flow gas.

5.3 Gas supplies, shall comprise pressurized sources of oxygen and nitrogen or other gases mixed with oxygen.

When using gas flow meter to control the oxygen concentration (volume fraction), gas supplies shall comprise pressurized sources of oxygen and nitrogen, both with a purity not less than 99,99 %.

When using oxygen analyser to control the oxygen concentration (volume fraction), gas supplies shall comprise pressurized sources of oxygen and/or nitrogen not less than 98 % (mass fraction) pure and/or clean air [containing 20,9 % (volume fraction) oxygen], as appropriate.

5.4 Gas control devices, with a suitable gas flow meter or oxygen analyser measures the oxygen concentration (volume fraction) in the gas mixture with an accuracy of ±0,5 %.

When the gas flow rate within the test chimney is (40 ± 2) mm/s at temperature [10 °C, 30 °C], the precision of concentration adjustment is ±0,1 %.

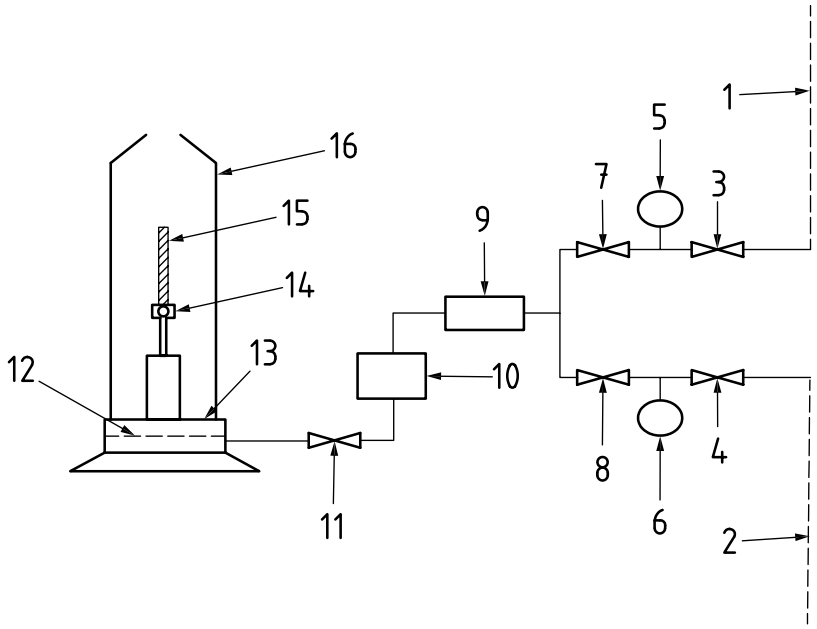
There are needle valves, calibrated orifices, gas pressure regulators, pressure gauges, flow meters on every gas supply line.

It is equipped with a calibrated flow meter to indicate the flow rate of gas through the test chimney is within the required limits.

Equipment shall be regularly calibrated in accordance with ISO 4589-2:2017, Annex A.

A typical test system for oxygen index is shown in Figure 1 or Figure 2.

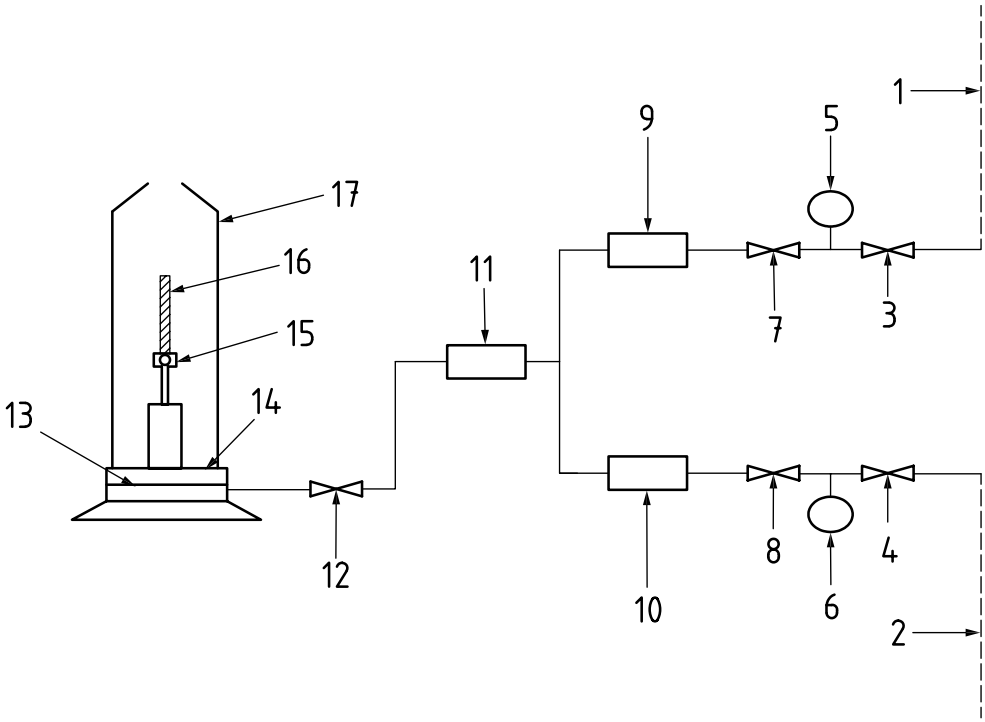
Other apparatus specified in ISO 4589-2:2017, 5.4, may be used for the test provided that equivalent results are obtained.



Key

1	nitrogen supply	9	calibrated mass flow meter
2	oxygen supply	10	oxygen analyser
3	gas pressure regulator of nitrogen	11	calibrated mass flow controller of mixture gas
4	gas pressure regulator of oxygen	12	diffuser
5	gas pressure gauge of nitrogen	13	wire-mesh debris screen
6	gas pressure gauge of oxygen	14	test specimen holder
7	calibrated mass flow controller of nitrogen	15	test specimen
8	calibrated mass flow controller of oxygen	16	test chimney

Figure 1 — A typical apparatus for determination of oxygen index with one calibrated mass flow meter for nitrogen supply and oxygen supply



Key

1	nitrogen supply	6	gas pressure gauge of oxygen	11	calibrated mass flow meter of mixture gas	16	test specimen
2	oxygen supply	7	calibrated mass flow controller of nitrogen	12	calibrated mass flow controller	17	test chimney
3	gas pressure regulator of nitrogen	8	calibrated mass flow controller of oxygen	13	diffuser		
4	gas pressure regulator of oxygen	9	calibrated mass flow meter of nitrogen	14	wire-mesh debris screen		
5	gas pressure gauge of nitrogen	10	calibrated mass flow meter of oxygen	15	test specimen holder		

Figure 2 — A typical apparatus for determination of oxygen index with separate calibrated mass flow meters for nitrogen supply and oxygen supply

5.5 Flame igniter, as specified in ISO 4589-2:2017, 5.6.

5.6 Fume extraction system, as specified in ISO 4589-2:2017, 5.8.

5.7 Raw cotton analyser or carding machine for staple fibres, for loosening and carding the staple fibres.

Other method or device may be used to achieve the purpose of loosening and carding.

5.8 Spinning device, for spun yarn with a linear density less than 60 tex.

Simple spinning device may be used, when a small amount of test specimens tested.

A simple spinning device is described in Annex A, whereas other devices with similar functions are also suitable.

5.9 Skein winding reel, having a circumference (1 000 ± 2) mm, as specified in ISO 2060.

Other method or device may be used to obtain the skein of a certain length.

5.10 Yarn twist counter, as specified in ISO 2061.

5.11 Balance, with a resolution of 0,01 g.

5.12 Straight scale, with an accuracy of ±1 mm.

5.13 Timing device, with measuring range at least 5 min, to an accuracy of ±0,2 s.

5.14 Airtight vessel, to store test specimens after conditioning.

6 Preparation of the test specimens

6.1 Test specimens for staple fibres

6.1.1 Card staple fibres by a raw cotton analyser or carding machine for staple fibres (5.7), to open the crimped bundles and for the fibres to be in a single fibre fluffy state.

6.1.2 Take out, randomly and uniformly, 20 g carded fibres as a spinning sample.

6.1.3 Spin the sample by a spinning device (5.8) to spun yarn with a linear density less than 60 tex.

6.1.4 Smoothly reel the spun yarn to a certain length (integer number of turns) on a skein winding reel (5.9) and prepare a skein with mass of (0,30 ± 0,03) g.

When the above test specimen mass is not applicable, test specimen mass will be determined on agreement between the interested parties and shall be stated in the test report.

Remove the skein from the reel. The skein is approximately 500 mm in length and 0,30 g in mass.

6.1.5 Twist the skein by a yarn twister counter (5.10). Twist number is normally between [110, 150] turns.

When the above twist number is not applicable, twist number will be determined on agreement between the interested parties and shall be stated in the test report.

Fold the twisted skein along the middle part into a multifolded yarn and tie two ends together as a test specimen.

Appropriate twist number should be selected to ensuring the multifolded yarn straight and stiff, according to the characteristics of fibres, and number of the twist of single yarn.

6.1.6 Repeat the procedures given in 6.1.1 to 6.1.5, and prepare at least 15 test specimens.

6.1.7 Singeing treatment before conditioning is suggested, when a large amount of hairiness on the surface of test specimens which easily causing flash burning.

6.2 Test specimens for filament yarns

6.2.1 Smoothly reel the spun yarn to a certain length (integer number of turns) on a skein winding reel (5.9) and prepare a skein with mass of (0,30 ± 0,03) g.

When the above test specimen mass is not applicable, test specimen mass will be determined on agreement between the interested parties and shall be stated in the test report.

Remove the skein from the reel. The skein is approximately 500 mm in length and 0,30 g in mass.

6.2.2 Twist the skein by a yarn twister counter (5.10) in same twist direction as the spun yarn. Twist number is normally between [60, 80] turns.

When the above twist number is not applicable, the twist number will be determined on agreement between the interested parties and shall be stated in the test report.

Fold the twisted skein along the middle part into a multifolded yarn and tie two ends together as a test specimen.

The appropriate twist number should be selected to ensuring the multifolded yarn straight and stiff, according to the characteristics of fibres.

6.2.3 Repeat the procedures given in 6.2.1 to 6.2.2, and prepare at least 15 test specimens.

6.2.4 The test specimen is generally not washed. If it is necessary to be washed, it shall be determined on agreement between the interested parties and shall be stated in the test report. Cleaning process is in accordance with ISO 6741-3:1987, Method A1.

6.3 Marking of test specimens

To observe the burning distance of a specimen, mark the test specimen with transverse lines at 50 mm from the ignition end. If wet inks are used, the marks shall be dried before ignition.

7 Preconditioning and conditioning

7.1 Atmosphere for conditioning

The standard atmosphere shall be as specified in ISO 139.

7.2 Pre-conditioning

When the actual moisture regain exceeds the commercial one, the test specimen shall be pre-conditioned as specified in ISO 139.

7.3 Conditioning

Condition the test specimens in standard atmosphere (7.1) for at least 2 h until equilibrium is attained.

Unless otherwise specified, the test specimen should be considered to be in equilibrium when successive weighing, at intervals of 2 h, shows no progressive change in mass greater than 0,25 %.

7.4 Test specimens storage

Seal test specimens in an airtight vessel (5.14) after conditioning.