



BSI Standards Publication

# Plastics — Determination of burning behaviour by oxygen index

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Part 1: General requirements

## National foreword

This British Standard is the UK implementation of EN ISO 4589-1:2017. It supersedes BS EN ISO 4589-1:2000, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PRI/26, Burning behaviour of plastics and rubbers.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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## Plastics - Determination of burning behaviour by oxygen index - Part 1: General requirements (ISO 4589-1:2017)

Plastiques - Détermination du comportement au feu au moyen de l'indice d'oxygène - Partie 1: Exigences générales (ISO 4589-1:2017)

Kunststoffe - Bestimmung des Brennverhaltens durch den Sauerstoff-Index - Teil 1: Allgemeine Anforderungen (ISO 4589-1:2017)

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COMITÉ EUROPÉEN DE NORMALISATION  
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## **European foreword**

This document (EN ISO 4589-1:2017) has been prepared by Technical Committee ISO/TC 61 "Plastics" in collaboration with Technical Committee CEN/TC 249 "Plastics" the secretariat of which is held by NBN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2017 and conflicting national standards shall be withdrawn at the latest by November 2017.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN ISO 4589-1:1999.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

### **Endorsement notice**

The text of ISO 4589-1:2017 has been approved by CEN as EN ISO 4589-1:2017 without any modification.

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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)).

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

For an explanation on 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 the following URL: [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 4, *Burning behaviour*.

This second edition cancels and replaces the first edition (ISO 4589-1:1996), which has been technically revised.

A list of all parts in the ISO 4589 series can be found on the ISO website.

## Introduction

The oxygen index (OI) test at ambient temperature was first described by Fenimore and Martin<sup>[3]</sup> in 1966. The first use of the method in standards was ASTM D2863:1970<sup>[2]</sup> and it has since been published in a wide range of national and international standards. It was published as ISO 4589 in 1984 and has now been revised as ISO 4589-2. The OI test at elevated temperatures is described in ISO 4589-3.

In the period since ASTM D2863 became a standard, a considerable number of papers have been published about this test. An example is the review in Reference <sup>[6]</sup> relating to the relevance of the test to real fire situations. Other papers have suggested empirical formulae relating OI to the amounts of added fire retardant, or describe practical investigations on the equipment performance (see Reference <sup>[7]</sup>). A clear consensus on the value of the two variants of the test has emerged, however, and it is the purpose of this document to discuss the use of the equipment and the applicability of both test methods.





# Plastics — Determination of burning behaviour by oxygen index —

## Part 1: General requirements

### 1 Scope

This document specifies the general requirements for the oxygen index (OI) test which are further described in ISO 4589-2 and ISO 4589-3 as follows:

- ISO 4589-2 describes a method for determining the minimum volume fraction of oxygen in a mixture of oxygen and nitrogen introduced at  $23\text{ °C} \pm 2\text{ °C}$  that will just support combustion of a material under specified test conditions;
- ISO 4589-3 describes methods of carrying out the same determination over a range of temperatures typically between  $25\text{ °C}$  and  $150\text{ °C}$  (although temperatures up to  $400\text{ °C}$  can be used).

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

ISO 4589-3:2017, *Plastics — Determination of burning behaviour by oxygen index — Part 3: Elevated-temperature test*

ISO 13943, *Fire safety — Vocabulary*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 13943 and the following apply.

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

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

#### 3.1

**oxygen index**

**OI**

**limiting oxygen index**

**LOI**

minimum volume fraction of oxygen in a mixture of oxygen and nitrogen, at  $23\text{ °C} \pm 2\text{ °C}$ , that just supports flaming combustion of a material under specified test conditions

Note 1 to entry: It is expressed as a percentage, e.g. OI = 34,6 %.

[SOURCE: ISO 13943:2008, 4.248, modified — Note 1 to entry has been revised.]