
Polimerni materiali - Določanje gorljivosti s kisikovim indeksom - 2. del: Preskus pri sobni temperaturi (ISO/DIS 4589-2:2016)

Plastics - Determination of burning behaviour by oxygen index - Part 2: Ambient-temperature test (ISO/DIS 4589-2:2016)

Kunststoffe - Bestimmung des Brennverhaltens durch den Sauerstoff-Index - Teil 2: Prüfung bei Umgebungstemperatur (ISO/DIS 4589-2:2016)

Plastiques - Détermination du comportement au feu au moyen de l'indice d'oxygène - Partie 2: Essai à la température ambiante (ISO/DIS 4589-2:2016)

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83.080.01	Polimerni materiali na splošno	Plastics in general

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Plastics — Determination of burning behaviour by oxygen index —

Part 2: Ambient-temperature test

*Plastiques — Détermination du comportement au feu au moyen de l'indice d'oxygène —
Partie 2: Essai à la température ambiante*

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This draft has been developed within the International Organization for Standardization (ISO), and processed under the **ISO lead** mode of collaboration as defined in the Vienna Agreement.

This draft is hereby submitted to the ISO member bodies and to the CEN member bodies for a parallel five month enquiry.

Should this draft be accepted, a final draft, established on the basis of comments received, will be submitted to a parallel two-month approval vote in ISO and formal vote in CEN.

To expedite distribution, this document is circulated as received from the committee secretariat. ISO Central Secretariat work of editing and text composition will be undertaken at publication stage.

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60 Foreword

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

67 International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

68 The main task of technical committees is to prepare International Standards. Draft International Standards
69 adopted by the technical committees are circulated to the member bodies for voting. Publication as an
70 International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

73 ISO 4589-2 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 4, *Burning*
74 *behaviour*.

75 This second edition cancels and replaces the first edition (ISO 4589-2:1996) and Amendment 1 (2005), which
76 have been technically revised.

77 ISO 4589 consists of the following parts, under the general title *Plastics — Determination of burning behaviour*
78 *by oxygen index*:

79 — *Part 1: Guidance:*

80 — *Part 2: Ambient-temperature test*

81 — *Part 3: Elevated-temperature test*

82 Annexes A and B form an integral part of this part of ISO 4589. Annexes C and D are for information only.

83

84 **Introduction**

85 This part of ISO4589 defines specifications of apparatus and preparation method of samples for determining
86 Oxygen index at ambient temperature. In addition, procedures for determining Oxygen index using the
87 apparatus and the samples is also defined.

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88 **Plastics — Determination of burning behaviour by oxygen** 89 **index — Part 2: Ambient-temperature test**

90 **1 Scope**

91 This part of ISO 4589 specifies methods for determining the minimum volume fraction of oxygen, in admixture
92 with nitrogen, that will support combustion of small vertical test specimens under specified test conditions. The
93 results are defined as oxygen index values.

94 Methods are provided for testing materials that are self-supporting in the form of vertical bars or sheet up to
95 10,5 mm thick. These methods are suitable for solid, laminated or cellular materials characterized by an
96 apparent density 100 kg/m³ or greater. The methods may also be applicable to some cellular materials having
97 an apparent density of less than 100 kg/m³. A method is provided for testing flexible sheet or film materials
98 while supported vertically.

99 For comparative purposes, a procedure is provided for determining whether or not the oxygen index of a
100 material lies above some specified minimum value.

101 Oxygen index results obtained using the methods described in this part of ISO 4589 can provide a sensitive
102 measure of the burning characteristics of materials under certain controlled laboratory conditions, and hence
103 may be useful for quality control purposes. The results obtained are dependent upon the shape, orientation
104 and isolation of the test specimen and the conditions of ignition. For particular materials or applications, it may
105 be necessary or appropriate to specify different test conditions. Results obtained from test specimens of
106 differing thickness or by using different ignition procedures may not be comparable and no correlation with
107 flammability behaviour under other fire conditions is implied.

108 Results obtained in accordance with this part of ISO 4589 is not applicable to describe or appraise the fire
109 hazard presented by a particular material or shape under actual fire conditions, unless used as one element of
110 a fire risk assessment that takes into account all of the factors pertinent to the assessment of the fire hazard of
111 a particular application for the material.

112 NOTE 1 It may not be possible to apply these methods satisfactorily to materials that exhibit high levels of shrinkage
113 when heated, e.g. highly oriented thin film.

114 NOTE 2 For assessing the flame propagation properties of cellular materials of density < 100 kg/m³, attention is drawn
115 to the method of ISO 3582:2000, *Flexible cellular polymeric materials - Laboratory assessment of horizontal burning*
116 *characteristics of small specimens subjected to a small flame*, for testing horizontal burning characteristics

117 **2 Normative references**

118 The following referenced documents are indispensable for the application of this document. For dated
119 references, only the edition cited applies. For undated references, the latest edition of the referenced
120 document (including any amendments) applies.

121 ISO 291, *Plastics – Standard atmospheres for conditioning and testing*.

122 ISO 2859-1, *Sampling procedures for inspection by attributes - Part 1: Sampling schemes indexed by*
123 *acceptable quality limit (AQL) for lot-by-lot inspection*.

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- 124 ISO 2859-2, *Sampling procedures for inspection by attributes -- Part 2: Sampling plans indexed by limiting*
 125 *quality (LQ) for isolated lot inspection.*
- 126 ISO 7823-1, *Poly(methyl methacrylate) sheets - Types, dimensions and characteristics - Part 1: Cast sheets.*
- 127 ISO 13943, *Fire safety — Vocabulary.*

3 Definition

129 For the purposes of this part of ISO 4589, the definitions in ISO 13943 and the following apply.

- 130 **3.1**
 131 **oxygen index**
 132 **OI**
 133 **limiting oxygen index**
 134 **LOI**
 135 minimum volume fraction of oxygen in a mixture of oxygen and nitrogen, at $23\text{ °C} \pm 2\text{ °C}$, that just supports
 136 flaming combustion of a material under specified test conditions

137 NOTE It is usually expressed as a percentage; e.g. "OI = 34,6%".

138 [SOURCE: ISO 13943:2008, 4.248]

4 Principle

139 **4 Principle**

140 A small test specimen is supported vertically in a mixture of oxygen and nitrogen flowing upwards through a
 141 transparent chimney. The upper end of the specimen is ignited and the subsequent burning behavior of the
 142 specimen is observed to compare the period for which burning continues, or the length of specimen burnt,
 143 with specified limits for such burning. By testing a series of specimens in different volume fractions of oxygen,
 144 the oxygen index is estimated (see 8.6).

145 Alternatively, for comparison with a specified oxygen index, three test specimens are tested using the relevant
 146 volume fraction of oxygen, at least two of which are required to give an "O" response (see 8.3) in order to
 147 meet the specified oxygen index.

5 Apparatus**5.1 Test chimney**

150 The test chimney shall consist of a heat-resistant glass tube supported vertically on a base through which
 151 oxygen-containing gas mixtures can be introduced (see Figure 1).

152 The preferred dimensions of the chimney are 450 mm to 500 mm height and 75 mm to 100 mm inside
 153 diameter.

154 The upper outlet shall be restricted as necessary by an overhead cap having an outlet small enough to
 155 produce an exhaust velocity of at least 90 mm/s from that outlet. The flow rate shall be calculated by using the
 156 formula found in A.2 of Annex A.

157 NOTE 1 Measurement of flow rate or flow speed at the specimen position helps for checking gas leaks.

158 NOTE 2 A cap converging to an outlet of 40 mm diameter at a level at least 10 mm above the top of the cylindrical
 159 chimney has been found satisfactory

160 Chimneys of other dimensions, with or without restricted outlets, are suitable for use if shown to give
161 equivalent results. The bottom of the chimney, or the base upon which the chimney is supported, shall
162 incorporate a device for distributing evenly the gas mixture entering the chimney. The preferred device
163 comprises a suitable diffuser and a mixing chamber with metal foil (honeycomb) or glass beads. Other devices,
164 such as radial manifolds are suitable for use, if shown to give equivalent results. The mounting of a porous
165 screen below the level of the specimen holder is helpful to prevent falling combustion debris from fouling the
166 gas entry and distribution paths. One option is to construct the chimney in such a way that it can be divided in
167 half, so as to make the setting of samples and cleaning easier.

168 The use of a levelling device and indicator incorporated within the chimney support will facilitate vertical
169 alignment of the chimney and of a test specimen supported therein. If a dark background is provided this will
170 facilitate the observation of flames within the chimney.

171 **5.2 Test specimen holder**

172 The specimen holder shall be suitable for supporting a specimen vertically in the centre of the chimney.

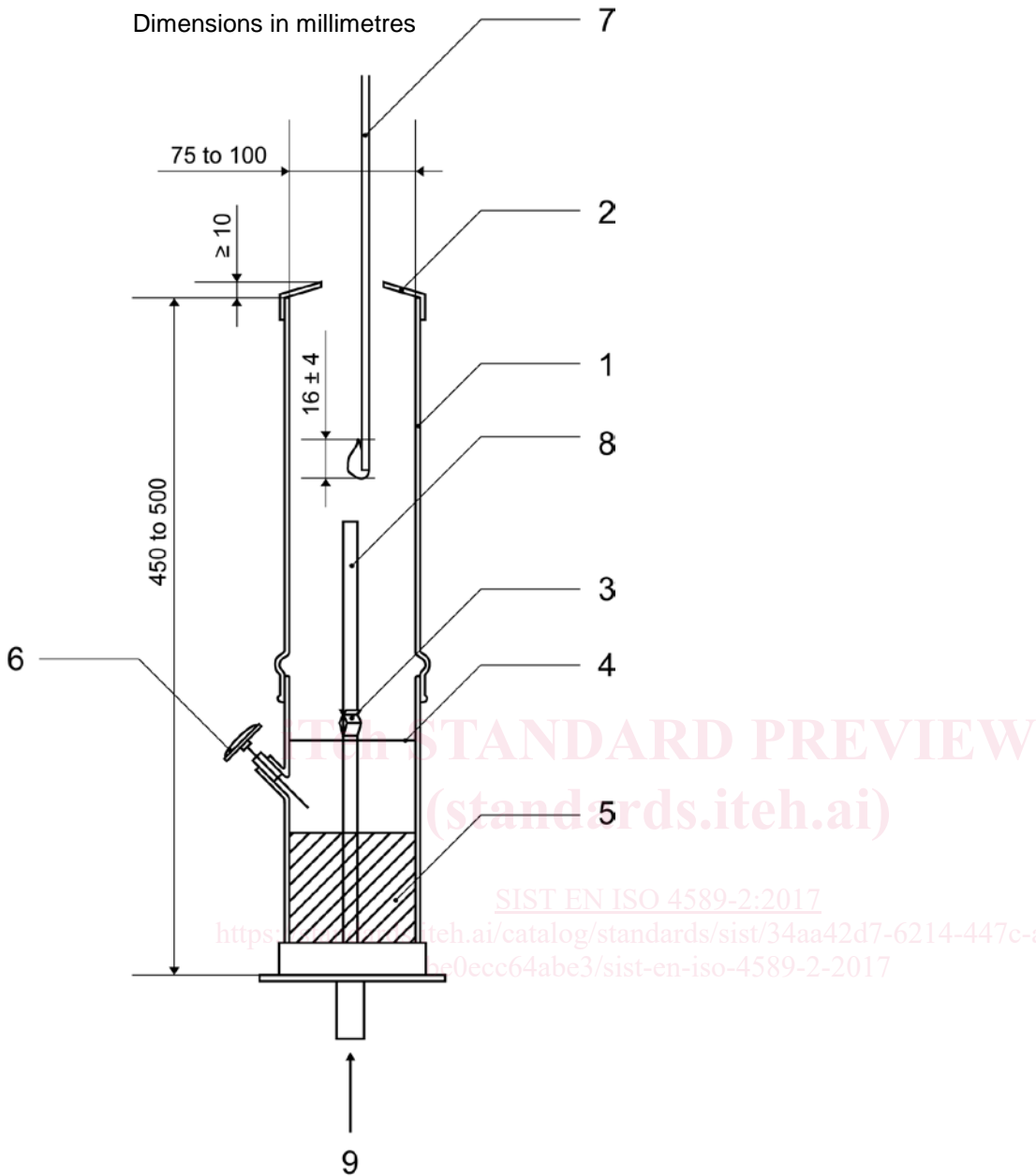
173 For self-supporting materials, the specimen shall be held by a small clamp which is at least 15 mm away from
174 the nearest point at which it is possible that the specimen will burn before the extent-of-burning criterion is
175 exceeded. For supported film or sheet test specimens, the specimen shall be supported by both vertical edges
176 in a frame equivalent to that illustrated by Figure 6, with reference marks at 20 mm and 100 mm below the top
177 of the frame.

178 It is preferable that the profile of the holder and its support be smooth to minimize induction of turbulence in
179 the rising flow gas.

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- | | | |
|-----|--|---------------------------|
| 180 | Key1 chimney | 6 thermometer |
| | 2 chimney cap | 7 tube |
| | 3 specimen holder | 8 test specimen |
| | 4 wire-mesh debris screen | 9 oxygen/nitrogen mixture |
| | 5 suitable diffuser and a mixing chamber | |

181 Figure 1 — Diagram of typical apparatus for determination of oxygen index
182