

Plastics — Smoke generation —

Part 3: Determination of optical density by a dynamic flow method

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- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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

Cross-references

The British Standards which implement international publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled “International Standards Correspondence Index”, or by using the “Find” facility of the BSI Standards Electronic Catalogue.

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Summary of pages

This document comprises a front cover, an inside front cover, the ISO/TR title page, pages ii to iv, pages 1 to 17 and a back cover.

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Part 3:

**Determination of optical density by a
dynamic-flow method**

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Partie 3: Détermination de la densité optique par une méthode dynamique



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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 main task of technical committees is to prepare International Standards, but in exceptional circumstances a technical committee may propose the publication of a Technical Report of one of the following types:

- $\frac{3}{4}$ type 1, when the required support cannot be obtained for the publication of an International Standard, despite repeated efforts;
- $\frac{3}{4}$ type 2, when the subject is still under technical development or where for any other reason there is the future but not immediate possibility of an agreement on an International Standard;
- $\frac{3}{4}$ type 3, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example).

Technical Reports of types 1 and 2 are subject to review within three years of publication, to decide whether they can be transformed into International Standards. Technical Reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

ISO/TR 5659-3, which is a Technical Report of type 2, was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 4, *Burning behaviour*.

ISO 5659 consists of the following parts, under the general title *Plastics — Smoke generation*:

- $\frac{3}{4}$ *Part 1: Guidance on optical-density testing*
- $\frac{3}{4}$ *Part 2: Determination of optical density by a single-chamber test*
- $\frac{3}{4}$ *Part 3: Determination of optical density by a dynamic-flow method*
[Technical Report]

Annex A forms a normative part of this part of ISO 5659.

It was decided to publish this document in the form of a Technical Report (type 2) in order to make the test method described available for use whilst data relating to precision is obtained by means of a programme of collaborative testing. It is envisaged that, when those data are available, this document will be reviewed and a precision statement included, and that it will eventually be reissued as an International Standard.

Introduction

Fire is a complex phenomenon: its behaviour and its effects depend upon a number of interrelated factors. The behaviour of materials and products depends upon the characteristics of the fire, the method of use of the materials and the environment in which they are exposed.

A test such as is specified in this part of ISO 5659 deals only with a simple representation of a particular aspect of the potential fire situation, typified by a radiant heat source, and it cannot alone provide any direct guidance on behaviour or safety in fire. A test of this type may, however, be used for comparative purposes or to ensure the existence of a certain quality of performance (in this case smoke production) considered to have a bearing on fire behaviour generally. It would be wrong to attach any other meaning to results from this test.

The term "smoke" is defined in ISO 13943 as a visible suspension of solid and/or liquid particles in gases resulting from incomplete combustion. It is one of the first response characteristics to be manifested and should almost always be taken into account in any assessment of fire hazard as it represents one of the greatest threats to occupants of a building on fire.

The attention of all users of this test is drawn to the warnings which immediately precede the "Scope" clause.

Plastics — Smoke generation —

Part 3:

Determination of optical density by a dynamic-flow method

WARNING

1 Avoidance of misleading inferences

This standard method of test should be used solely to measure and describe the properties of materials, products or systems in response to heat or flame under controlled laboratory conditions, and should not be considered or used by itself for describing or appraising the fire hazard of materials, products or systems under actual fire conditions or as the sole source on which regulations pertaining to smoke production can be based.

2 Avoidance of danger to test operators

So that suitable precautions to safeguard health are taken, the attention of all concerned in fire tests is drawn to the fact that harmful gases are evolved in combustion of test specimens. Care must also be taken during cleaning operations on the apparatus to avoid inhalation of fumes or skin-contact with smoke deposits.

Attention is drawn to the hazards due to the high temperatures involved and the electric shock hazard.

1 Scope

1.1 This part of ISO 5659 specifies a method of measuring smoke production from the exposed surface of specimens of essentially flat materials, composites or assemblies not exceeding 25 mm in thickness, when placed in a horizontal orientation and subjected to specified levels of thermal irradiance under forced ventilation conditions, with or without the application of a pilot flame. This method of test is applicable to plastics and may also be used for the evaluation of other materials (e.g. rubbers, textile coverings, painted surfaces, wood and other building materials).

1.2 Values of optical density determined by this test are specific to the specimen or assembly material in the form and thickness tested and are not to be considered inherent, fundamental properties.

1.3 The test is intended for use in research and development and not primarily as a basis for ratings for building codes or other purposes. No basis is provided for predicting the density of smoke which may be generated by the materials upon exposure to heat and flame under other exposure conditions, such as end-use conditions, nor has any correlation been established with measurements derived from other test methods.

1.4 It is emphasized that smoke production from a material varies according to the ventilation conditions and the irradiance level to which the specimen is exposed. In making use of the results of this method, it should be borne in mind that the results are based on exposure to the specific irradiance levels of 25 kW/m² and of 50 kW/m² under specific ventilation conditions.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 5659. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 5659 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 291:1997, *Plastics — Standard atmospheres for conditioning and testing*.

ISO 5659-1:1996, *Plastics — Smoke generation — Part 1: Guidance on optical-density testing*.

ISO 5659-2:1994, *Plastics — Smoke generation — Part 2: Determination of optical density by a single-chamber test*.

ISO 13943:—¹⁾, *Fire safety — Vocabulary*.

3 Terms and definitions

For the purposes of this part of ISO 5659, the terms and definitions in ISO 13943 apply, plus the following:

**3.1
assembly**
a mechanical fabrication of materials and/or composites, for example sandwich panels

An assembly may include an air gap.

**3.2
composite**
a bonded combination of materials which are generally recognized as discrete entities, e.g. coated or laminated materials

**3.3
essentially flat surface**
a surface in which irregularity from a plane does not exceed 1 mm

**3.4
exposed surface**
that surface of the product subjected to the heating conditions of the test

**3.5
irradiance (at a point on a surface)**
ratio of the radiant flux incident on an infinitesimal element of the surface containing the point and the area of that element

**3.6
material**
a basic single substance or uniformly dispersed mixture, for example timber, concrete, mineral fibre, polymer

**3.7
optical density of smoke**
D
a measure of the degree of opacity of smoke, expressed as the negative common logarithm of the relative transmission of light

**3.8
product**
a material, composite or assembly about which information is required

**3.9
specimen**
a representative piece of the product which is to be tested together with any substrate or treatment

A specimen may include an air gap.

1) To be published.