

Plastics — Smoke generation —

Part 2. Determination of specific optical density

ICS 13.220.40; 83.080.01

Committees responsible for this British Standard

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Association of Building Component Manufacturers
 British Apparel and Textile Confederation
 British Cable Makers Confederation
 British Electrical Systems Association (BEAMA) Ltd.
 British Plastics Federation
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National foreword

This British Standard reproduces verbatim ISO 5659-2 : 1994 and implements it as the UK national standard.

This British Standard is published under the direction of the Sector Board for Materials and Chemicals whose Technical Committee PRI/26 has the responsibility to:

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

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INTERNATIONAL STANDARD

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Plastics — Smoke generation —

Part 2:

Determination of optical density by a
single-chamber test

Plastiques — Production de fumée —

*Partie 2: Détermination de la densité optique par un essai en enceinte
unique*



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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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 5659-2 including Amendment No.1 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC4, *Burning behaviour*.

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

- *Part 1: Guidance*
- *Part 2: Determination of optical density by a single-chamber test*
- *Part 3: Determination of optical density by dynamic flow*

Annex A forms an integral part of this part of ISO 5659. Annexes B and C are for information only.

Introduction

Fire is a complex phenomenon: its development 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 (see also ISO/TR 3814 and ISO/IEC Guide 52).

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/IEC Guide 52 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 responsibility for the preparation of ISO 5659 was transferred during 1987 from ISO/TC 92 to ISO/TC 61 on the understanding that the scope and applicability of the standard for the testing of materials should not be restricted to plastics but should also be relevant to other materials where possible, including building materials.

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

Plastics — Smoke generation —

Part 2:

Determination of optical density by a single-chamber test

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 smoke chamber to avoid inhalation of fumes or skin-contact with smoke deposits.

Attention is drawn to the hazards arising from the hot radiator cone, and the use of a mains-voltage electricity supply.

A safety blow-out panel, as specified in 7.2.1.1, is essential for the protection of operators from the risk of explosion from sudden pressure surges.

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 in a closed cabinet with or without the application of a pilot flame. This method of test is applicable to all 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, nor has any correlation been established with measurements derived from other test methods.

The fact that this test procedure excludes the effect of irritants on the eye should also be taken into account when applying the test results.

1.4 It is emphasized that smoke production from a material varies according to 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 50 kW/m².

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 5659. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 5659 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 291:1977, *Plastics — Standard atmospheres for conditioning and testing*.

ISO 3261:1975, *Fire tests — Vocabulary*.

ISO/TR 3814:1989, *Tests for measuring "reaction-to-fire" of building materials — Their development and application*.

ISO 5659-1:—¹⁾, *Plastics — Smoke generation — Part 1: Guidance*.

ISO 5725:1986, *Precision of test methods — Determination of repeatability and reproducibility for a standard test method by inter-laboratory tests*.

ISO/IEC Guide 52:1990, *Glossary of fire terms and definitions*.

3 Definitions

For the purposes of this part of ISO 5659, the definitions given in ISO/IEC Guide 52 and the following definitions apply.

3.1 assembly: A fabrication of materials and/or composites, for example sandwich panels. This may include an air gap.

3.2 composite: A combination of materials which are generally recognized in building construction as discrete entities, for example coated or laminated materials.

1) To be published.

3.3 essentially flat surface: A surface in which departure 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): The radiant flux incident on an infinitesimal element of the surface containing the point divided by the area of that element.

3.6 material: A basic single substance or uniformly dispersed mixture, for example metal, stone, timber, concrete, mineral fibre, polymers.

3.7 mass optical density (MOD): A measure of the degree of opacity of smoke in terms of the mass loss of the material under the conditions of the test.

3.8 optical density of smoke (D): A measure of the degree of opacity of smoke; the negative common logarithm of the relative transmission of light.

3.9 product: The material, composite or assembly about which information is required.

3.10 specific optical density (D_s): The optical density multiplied by a factor which is calculated by dividing the volume of the test chamber by the product of the exposed area of the specimen and the path length of the light beam (see 11.1.1).

3.11 specimen: A representative piece of the product which is to be tested together with any substrate or treatment. This may include an air gap.

4 Principles of the test

Specimens of the product are mounted horizontally within a chamber and exposed to thermal radiation on their upper surfaces at selected levels of constant irradiance up to 50 kW/m²; the test may be carried out in the absence or in the presence of a pilot flame.

The preferred conditions are as follows:

- specimens are exposed to an irradiance of 25 kW/m² in the presence or absence of a pilot flame;
- specimens are exposed to an irradiance of 50 kW/m² in the absence of a pilot flame;

NOTE 1 Some materials will not ignite when exposed to the conditions given in a) and b).