

Fire hazard testing —

Part 6-2: Smoke obscuration — Summary and relevance of test methods

ICS 13.220.99; 29.020

National foreword

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According to the replies received by the end of the review period, the responsible BSI Committee will decide whether to support the conversion into an international standard, to extend the life of the Technical Specification for another 3 years or to withdraw it. Comments should be sent in writing to the Secretary of BSI Technical Committee GEL/89, Fire hazard testing, at British Standards House, 389 Chiswick High Road, London W4 4AL, giving the document reference and clause number and proposing, where possible, an appropriate revision of the text.

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 Catalogue* under the section entitled “International Standards Correspondence Index”, or by using the “Search” facility of the *BSI Electronic Catalogue* or of British Standards Online.

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Summary of pages

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Part 6-2:

Smoke obscuration –

Summary and relevance of test methods



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INTRODUCTION

The risk of fire needs to be considered in any electrical circuit, and the objective of component, circuit and equipment design, and the choice of materials, is to reduce the likelihood of fire, even in the event of foreseeable abnormal use, malfunction or failure.

Electrotechnical products, primarily as victims of fire, may nevertheless contribute to the fire. One of the contributing hazards is the release of smoke, which may cause loss of vision and/or disorientation which could impede escape from the building, or fire fighting.

This technical specification describes smoke test methods in common use to assess the smoke release from electrotechnical products, or from materials used in electrotechnical products. It forms part of the IEC 60695-6 series which gives guidance to product committees wishing to incorporate test methods for smoke obscuration in product standards.

FIRE HAZARD TESTING –

Part 6-2: Smoke obscuration – Summary and relevance of test methods

1 Scope

This technical specification gives a summary of the test methods that are used in the assessment of smoke obscuration. It presents a brief summary of static and dynamic test methods in common use, either as international standards or national or industry standards. It includes special observations on their relevance to electrotechnical products and their materials and to fire scenarios, and it gives recommendations on their use.

One of the responsibilities of a technical committee is, wherever applicable, to make use of basic safety publications in the preparation of its publications.

2 Normative references

The following referenced documents are indispensable for the application 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.

IEC 60695-4:2005, *Fire hazard testing – Part 4: Terminology concerning fire tests*

IEC 60695-6-1, *Fire hazard testing – Part 6-1: Smoke obscuration – General guidance*

IEC 61034-1, *Measurement of smoke density of cables burning under defined conditions – Part 1: Test apparatus*

IEC Guide 104, *The preparation of safety publications and the use of basic safety publications and group safety publications*

ISO/IEC 13943:2000, *Fire safety – Vocabulary*

ISO/IEC Guide 51, *Safety aspects – Guidelines for their inclusion in standards*

ISO 5725-2, *Accuracy (trueness and precision) of measurement methods and results – Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method*

ISO/TR 9122-1:1989, *Toxicity testing of fire effluents – Part 1: General*¹

NF C20-902-1, *Fire hazard testing – Test methods – Determination of smoke opacity without air change – Part 1: Methodology and test devices*

¹ This document has been withdrawn.

NF C20-902-2, *Fire hazard testing – Test methods – Determination of smoke opacity without air change – Part 2: Test methods for materials used in electric cables and in optical fibre cables*

3 Terms and definitions

For the purposes of this document the following definitions apply, some of which are taken from ISO/IEC 13943 and IEC 60695-4.

3.1

combustion

exothermic reaction of a substance with an oxidiser

NOTE Combustion generally emits effluent accompanied by flames and/or visible light.

[ISO/IEC 13943, definition 23]

3.2

extinction area of smoke

product of the extinction coefficient and the volume occupied by the smoke

NOTE It is a measure of the amount of smoke.

[IEC 60695-4, definition 3.17]

3.3

extinction coefficient of smoke

natural logarithm of the opacity of smoke divided by the path length of the light used to measure the smoke opacity

[IEC 60695-4, definition 3.18]

3.4

fire

- a) process of combustion characterized by the emission of heat and effluent accompanied by smoke, and/or flame, and/or glowing;
- b) rapid combustion spreading uncontrolled in time and space

[IEC 60695-4, definition 3.19]

3.5

fire effluent

the total gaseous, particulate or aerosol effluent from combustion or pyrolysis

[IEC 60695-4, definition 3.23]

3.6

fire hazard

potential for injury or loss of life and/or damage to property from fire

[IEC 60695-4, definition 3.26]

3.7

fire model

procedure or process intended to represent, predict or reproduce one or more phases of a fire, or the transition between phases

[ISO/IEC 13943, definition 51]

3.8

fire scenario

detailed description of conditions, including environmental, of one or more stages from before ignition to after completion of combustion in an actual fire at a specific location or in a real-scale simulation

[ISO/IEC 13943, definition 58]

3.9

heat flux

amount of thermal energy emitted, transmitted or received per unit area and unit time

NOTE It is expressed in watts per square metre.

[ISO/IEC 13943, definition 85]

3.10

ignition

initiation of combustion

NOTE The term "ignition" in French has a very different meaning [state of body combustion].

[ISO/IEC 13943, definition 96]

3.11

mass optical density of smoke

optical density multiplied by a factor, $V / (L \cdot m)$, where V is the volume of the test chamber, m is the mass loss of the test specimen and L is the light path length

3.12

optical density of smoke

common logarithm of the opacity of smoke ($\lg(I/T)$) (see also *specific optical density*)

[IEC 60695-4, definition 3.68]

3.13

real-scale test

test which simulates an end-use situation in both size and surroundings

[IEC 60695-4, definition 3.73]

3.14

small-scale test

test which may be made on a typical laboratory bench

[IEC 60695-4, definition 3.77]

3.15**smoke**

visible suspension of solid and/or liquid particles in gases resulting from combustion or pyrolysis

[IEC 60695-4, definition 3.79]

3.16**smoke obscuration**

reduction in visibility due to smoke

[IEC 60695-4, definition 3.80]

3.17**smoke production rate**

extinction area of smoke produced, per unit time, by the combustion of a material under specified test conditions

3.18**smoke release rate**

see "smoke production rate"

3.19**specific extinction area of smoke**

extinction area of smoke divided by the mass loss of the test specimen

[IEC 60695-4, definition 3.83]

3.20**specific optical density of smoke**

optical density multiplied by a geometric factor V/AL , where V is the volume of the test chamber, A is the exposed surface area of the test specimen and L is the light path length.

NOTE The use of the term 'specific' does not, in this case, denote 'per unit mass' but rather denotes a dimensionless quantity associated with a particular test apparatus and exposed surface area of the test specimen.

3.21**visibility**

maximum distance at which an object of defined size, brightness and contrast can be seen and recognized

4 Classification of test methods**4.1 General**

The classification of the test method is characterised by whether it is static or dynamic and/or the type of test specimen.

4.2 Fire model

The amount and rate of smoke released from a given material or product is not an inherent property of that material or product, but is critically dependant on the conditions under which that material or product is burnt. Decomposition temperature and amount of ventilation are the main variables which affect the composition of fire effluent, and hence the amount and rate of smoke release.