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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



DRAFT International Standard

ISO/DIS 10840

Plastics — Guidance for the use of standard fire tests

*Plastiques — Lignes directrices pour l'utilisation d'essais au feu
normalisés*

ICS: 13.220.40; 83.080.01

ISO/TC 61/SC 4

Secretariat: **BSI**

Voting begins on:
2025-08-25

Voting terminates on:
2025-11-17

This document is circulated as received from the committee secretariat.

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Contents

Page

Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Enclosure fire scenarios	2
4.1 General	2
4.2 Initiation and early growth of fire	3
4.3 Development of fire	3
4.4 Fully developed fire	3
4.5 Decay	3
5 Categories of fire tests	4
5.1 Material characterisation tests	4
5.1.1 Tests done on behalf of customers undertaking no further reaction-to-fire testing	4
5.1.2 Tests done on behalf of customers seeking compliance with reaction-to-fire tests on a finished product	4
5.2 Quality-control tests	4
5.3 Pre-selection tests	5
5.4 End-product tests	5
5.5 Fire test based on the fire scenario	6
5.6 Use of Fire safety engineering (FSE)	6
5.6.1 basics of fire safety engineering	6
5.6.2 Fire tests for fire safety engineering on plastic products	6
6 Important considerations in the fire testing of plastics materials and products	8
6.1 Influence of the chemical or physical nature of the test specimen	8
6.2 Sample and test specimen preparation and conditioning	8
6.3 Influence of test procedures	8
6.3.1 Test apparatus	8
6.3.2 Burning effluence	9
6.4 burning behaviours of specimens	9
6.5 Operation of tests	9
6.6 Other critical factors	10
6.7 Characteristics of ignition sources	10
6.8 Operating procedures in the event of specimen collapse or deformation	10
6.9 Debris of specimen	11
7 Advantages and disadvantages of scale in fire tests	11
8 Potentially problematical specimen behaviour	13
8.1 Test developed for materials other than plastics	13
8.2 Shrinking	14
8.3 Bubbling	14
8.4 Intumescence	14
8.5 Extinguishing of pilot flames by highly flame retarded plastics	14
8.6 Slumping of thermoplastic sheets	15
8.7 Detection of flaming drips	15
8.8 Edge effects	15
8.9 Profiles products	15
Annex A (Informative) End-user relevant preparation of test specimens	16
Annex B (informative) Environmental-impact Assessment	25
Bibliography	27

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).

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).

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

For an explanation of 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 www.iso.org/iso/foreword.html.

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

This third edition cancels and replaces the second edition (ISO 10840:2008), which has been technically revised.

The main changes compared to the previous edition are as follows:

- reference documents are reviewed and collected
- Terms and definitions are reviewed and collected
- Clause for fire safety engineering is added

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Many of the current reaction-to-fire tests were developed, prior to the widespread use of synthetic polymers, to assess products incorporating materials such as wood (in the building industry), paper (in electrical wires and cables), and naturally occurring fibres such as cotton, wool and horsehair (in many textile, furniture and electrical applications). The reaction-to-fire characteristics of these so-called traditional materials are often very different from those of synthetic materials, especially thermoplastics.

ISO/TC 61/SC4 recognises the need for guidance for users of fire-test standards commonly applied to materials and products made of, or incorporating, plastics. In 2003, the first edition of ISO 10840 was published, based on the now withdrawn ISO TR 10840:1993; *Plastics – Burning behaviour – Guidance for development and use of fire test*, which listed a series of potential problems associated with the reaction-to-fire testing of plastics materials and products. TR 10840, however, provided users of the test methods with no practical assistance on how to cope with the listed difficulties.

Although the first edition of ISO 10840 discussed the provision of such assistance, the general guidance that it gives on the mounting and fixing of test specimens as found in many cases to be insufficient. More specific guidance, relevant to the various end-use conditions of plastic products, was required. This second edition of ISO 10840 includes a new annex that provides more detail information about how to conduct standard fire tests which are more relatable to the real conditions of plastics products in a variety of applications.

With more concerns expressed about the environmental impact of fires involving plastics, additional guidance has been included in this second edition. This information is general at present but it is proposed to provide further guidance as the technology develops.

Particular attention is given to the provision of guidance for inexperienced users who may need to assess the fire performance of materials or products made of, or incorporating, plastics. This International Standard also provides answers to frequently asked questions concerning fire tests; these cover factors such as cost, duration, complexity, required operator skills, quality of the data produced, relevance to fire hazard assessment as well as test repeatability and reproducibility. This International Standard contains a bibliography of the most frequently used fire tests applied to the materials and products within the scope of ISO/TC61/SC4.

The main focus of this International Standard is on reaction-to-fire testing. Fire resistance testing has also been considered, in particular for the use of plastic construction of small ships, to take account of the widespread use of advanced polymer composites and related materials with superior thermo-mechanical stability which may be used in applications where there is a demand for some degree of fire resistance.

This International Standard also provides guidance on some standard fire tests which give data that is applicable for assessment of the potentially adverse environmental impact of combustion products that may be generated in large-scale fires involving plastics materials and products (see [ANNEX B](#)).

NOTE The term, 'adverse environmental impact', covers undesirable direct effects on the environment as well as indirect effects on people of ISO 10840 through environmental exposure.

Plastics — Guidance for the use of standard fire tests

1 Scope

This document covers the following aspects of fire testing of plastics materials and products: -

- Selection of appropriate tests that reflect realistic end-use conditions
- Grouping of the reaction-to-fire characteristics that any given test or tests can measure
- Assessment of tests as to their relevance in areas such as material characterisation, quality control, pre-selection, end-product testing, environmental profiling and DfE (Design for the Environment)
- Definition of potential problems that may arise when plastics are tested in standard fire tests

This document does not include specification for development or design of new fire-tests for plastics. However, the flexibility of approach that is indicated with respect to the mounting and fixing of test specimens is valuable when fire testing laboratories and certification bodies are considering how to evaluate ranges of plastics that are used in different ways.

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/TS 3814, *Standard tests for measuring reaction-to-fire of products and materials — Their development and application*

ISO 10093, *Plastics — Fire tests — Standard ignition sources*

ISO 13943, *Fire safety — Vocabulary*

ISO 23932-1, *Fire safety engineering — General principles — Part 1: General*

ISO 23948, *Plastics — Intumescence properties of PVC materials and products — Test method for the measurement of expansion with the cone calorimeter*

ISO 29473, *Fire tests — Uncertainty of measurements in fire tests*

IEC 60695-1-11, *Fire hazard testing - Part 1-11: Guidance for assessing the fire hazard of electrotechnical products - Fire hazard assessment*

IEC 60695-1-12, *Fire hazard testing - Part 1-12: Guidance for assessing the fire hazard of electrotechnical products - fire safety engineering*

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:

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

3.1**End-product test**

Fire hazard assessment test on a complete product, piece, part component or sub-assembly

3.2**pre-selection test**

combustion characteristic test made on a standardized shape, for the process of assessing and choosing candidate materials, components or subassemblies for making an end product

Note 1 to entry: IEC 60695-4 3.2.15 defines “preselection”

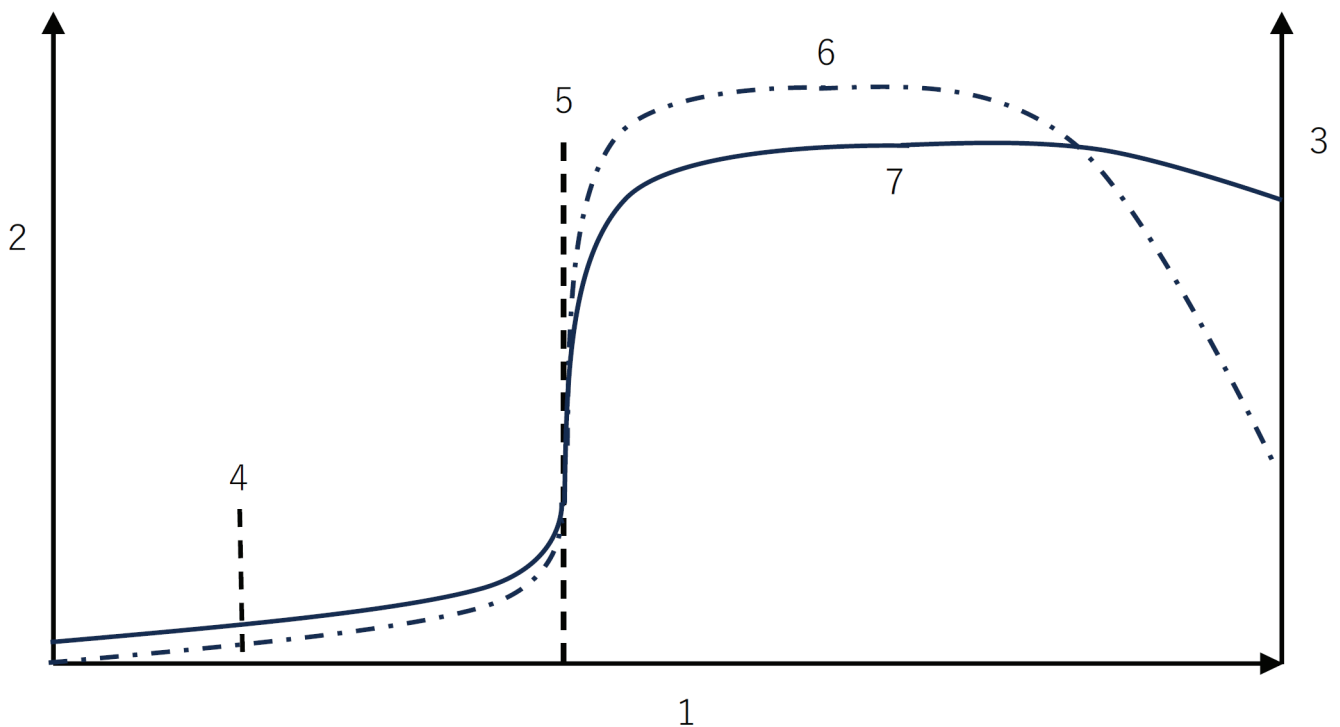
3.3**spalling**

the breaking off of fragments or solid articles from a heated surface

4 Enclosure fire scenarios**4.1 General**

A number of fire parameters influence the development of a fire and, moreover, the fire parameters measured during the pre-flashover and the post-flashover conditions differ greatly.

There are four main stages of fire development within an enclosure, i.e., pre-ignition, fire growth, flash-over and fully developed fire, which are assessed using measurements of temperature and heat release rate in terms of time as shown in [Figure 1](#), which shows the different phases in the development of fires, i.e. pre-ignition phase, fire growth phase, flash-over, fully developed fire and fire decay, within an enclosure space (ISO/TS 3814).



Pre-ignition	Fire growth	Fully developed fire and fire decay
Ignitability	Flame spread	Fire penetration
	Heat development	
Smoke (loss of visibility, generation of gases, toxicity, corrosivity)		

Key

1	time
2	heat release rate (kW)
3	temperature (°C)
4	ignition
5	flash-over
6	heat release rate curve
7	temperature curve

Figure 1 — Development of fire in terms of temperature and heat release rate

NOTE [Figure 1](#) shows fire development in a compartment that goes to flashover. In some cases, fire may not go to flashover due to limited combustibles present or due to the intervention of active firefighting measures (e.g. sprinklers, fire brigades).

4.2 Initiation and early growth of fire

This stage of fire includes the exposure of a product to a heat source, ignition and early development of a fire. Two types of combustion may exist at this stage, smouldering and flaming. Smouldering is a slow, flameless combustion producing very little heat, but having the potential to fill an enclosure with smoke and toxic gases.

After ignition, the development of a flaming fire will depend on the following effects:

- fire growth on first ignited item,
- fire spread to other items,
- the effect of intervention (portable extinguishers, sprinklers, fire brigades).
- the ventilation conditions

4.3 Development of fire

As a fire develops, a hot smoke and gas layer usually builds up below the ceiling. The radiant heat transfer to combustible items accelerates the thermal decomposition of material below the smoke layer, and the rate of fire spread increases.

Flashover, which usually occurs at temperatures around 600 °C, corresponds to an abrupt sudden transition from a localised fire to the ignition of the gas layer and to the sudden subsequent ignition of all exposed flammable surfaces, leading to a fully developed fire. The rate of heat release increases rapidly, and this leads to a rapid temperature rise within the enclosure. However, Temperature at flash-over is not always the maximum temperature in the compartment of the fire. Flashover is uncommon in large enclosures, as the required temperature conditions are not often reached.

4.4 Fully developed fire

A fire is regarded as fully developed when all fuel within an enclosure is burning. This stage usually follows flashover, but some fires may become fully developed without passing through the flashover phase.

4.5 Decay

The decay stage of a fire is reached when the fire load or available air has been consumed, or when the fire is suppressed. In the pre-flashover phase reaction to fire characteristics of products are important, while in the post-flashover phase resistance to fire parameters of complete assemblies apply.

Fire building regulations make a distinction between these two conditions. [Table 1](#) summarises the important fire parameters associated with reaction to fire and resistance to fire.

Table 1 — Phases of fire

Phase	Stage	Parameters
Pre-flashover	Initiation	Ignitability
	Developing fire	Fire growth (ignitability, flame spread, heat-, smoke- and toxic effluent release)
Post-flashover	Developed fire	Resistance to fire (load-bearing, integrity, insulation)

5 Categories of fire tests

5.1 Material characterisation tests

5.1.1 Tests done on behalf of customers undertaking no further reaction-to-fire testing

This type of testing imposes an obligation on the material supplier to assess reaction-to-fire characteristics of the material likely to be of relevance to the application of the customer's product, or foreseeable misuse of the product as may be imposed by product stewardship aspects of Responsible Care programmes, or product liability litigation, or both. The objective should be to provide answers to questions such as:

1. Do the properties of the thermal decomposition products (heat release, smoke density, toxicity or corrosivity) pose a foreseeable problem?
2. Is the thermomechanical response of the material (e.g. melting or retreating from the heat source) likely to constitute a hazard or an advantage in the customer's product application, or in foreseeable misuse scenarios?

5.1.2 Tests done on behalf of customers seeking compliance with reaction-to-fire tests on a finished product

In this case, the test method(s) used by the material manufacturer should provide an indication of the likely influence on the product test result of material characteristics such as melting, dripping, or retreat from heat source.

5.2 Quality-control tests

Quality control fire tests can be conducted at manufacturers of materials and products for the purpose of examining that the quality of the products is maintained.

In order to select a quality control test, it is important to:

- decide which characteristics should be checked by the test;
- select or develop the appropriate test methodology;
- specify the required performance criteria;
- compare test result to ensure that the parameter measured by the quality-control test correlates with the key performance parameter being investigated.

It is necessary to specify:

- the characteristics which have to be checked by test;
- the appropriate test procedure;
- the required pass (acceptance) and fail (rejection) criteria;