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

*Essais de mesurage de la “réaction au feu” des matériaux de
bâtiment — Leur élaboration et leur application*



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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 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 on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 92, *Fire safety*, Subcommittee SC 1, *Fire initiation and growth*.

This first edition cancels and replaces ISO/TR 3814:1989, which has been technically revised.

Introduction

A fire can constitute a hazard to both the structure, e.g. building, transport, and to its occupants, because of the heat generated and the production of smoke and gaseous products of combustion. Consequently, early codes and regulations for fire safety were designed to prevent rapid fire development and spread within individual structures and also from one structure to another. These codes have since developed into more complex laws governing public safety. Formerly, a distinction was made between the protection of persons from fire and the protection of property, with more importance being placed upon the latter. However, this distinction becomes somewhat difficult to make when considering modern, large-area, high-rise structures, where protection of the occupants in-place needs to be substituted for rapid evacuation. Restrictions on the use of combustible materials, compartmentalization, early fire detection, and suppression are key factors for in-place protection of occupants and are also important for minimizing property loss.

Real-scale fire tests are the ideal way to quantify the fire hazard of products. However, such tests are impractical in the vast majority of cases. The reaction-to-fire tests developed by ISO/TC 92/SC 1 seek to quantify aspects of the fire hazard that may result from the use of particular products in particular applications in a meaningful, cost-effective, and reproducible way.

This Technical Specification describes the work being carried out by ISO/TC 92/SC 1 on the development of tests and guidance for the “reaction-to-fire” of products and discusses the role and limitation of these tests in reducing fire danger.

Standard tests for measuring reaction-to-fire of products and materials — Their development and application

1 Scope

This Technical Specification describes the relevance of, and how to apply, the fire tests developed by ISO/TC 92/SC 1 so that they can be used effectively to reduce the hazard of fire. Each reaction-to-fire test is related to the different phases of a developing fire in buildings and transport and has to be seen in its relation to the fire scenario and phase of the fire it represents. Some reaction-to-fire tests are proposed to assess the fire hazard in those different phases.

Although this Technical Specification does not address smouldering combustion, this does not mean that smouldering is not important in some fire development situations. However, there are no tests in Subcommittee 1 (SC 1) which currently address this phenomenon.

This Technical Specification is aimed at indicating those ISO tests which produce relevant and useful data for fire safety engineering and those which do not. This Technical Specification is also of use to regulators, people who are performing reaction-to-fire tests including manufacturers and all people who are responsible to create, control, and assess fire safety concepts.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies

ISO 5657, *Reaction to fire tests — Ignitability of building products using a radiant heat source*

ISO/TS 5658-1, *Reaction to fire tests — Spread of flame — Part 1: Guidance on flame spread*

ISO 5658-2, *Reaction to fire tests — Spread of flame — Part 2: Lateral spread on building and transport products in vertical configuration*

ISO 5658-4, *Reaction to fire tests — Spread of flame — Part 4: Intermediate-scale test of vertical spread of flame with vertically oriented specimen*

ISO 5660-1, *Reaction-to-fire tests — Heat release, smoke production and mass loss rate — Part 1: Heat release rate (cone calorimeter method) and smoke production rate (dynamic measurement)*

ISO 9239-1, *Reaction to fire tests for floorings — Part 1: Determination of the burning behaviour using a radiant heat source*

ISO 9239-2, *Reaction to fire tests for floorings — Part 2: Determination of flame spread at a heat flux level of 25 kW/m²*

ISO 9705-1, *Reaction to fire tests — Room corner test for wall and ceiling lining products — Part 1: Test method for a small room configuration*

ISO/TR 9705-2, *Reaction-to-fire tests — Full-scale room tests for surface products — Part 2: Technical background and guidance*

ISO/TR 11925-1, *Reaction to fire tests — Ignitability of building products subjected to direct impingement of flame — Part 1: Guidance on ignitability*

ISO 11925-2, *Reaction to fire tests — Ignitability of products subjected to direct impingement of flame — Part 2: Single-flame source test*

ISO 11925-3, *Reaction to fire tests — Ignitability of building products subjected to direct impingement of flame — Part 3: Multi-source test*

ISO 12136, *Reaction to fire tests — Measurement of material properties using a fire propagation apparatus*

ISO/TR 13387-1, *Fire safety engineering — Part 1: Application of fire performance concepts to design objectives*

ISO/TR 13387-2, *Fire safety engineering — Part 2: Design fire scenarios and design fires*

ISO/TR 13387-3, *Fire safety engineering — Part 3: Assessment and verification of mathematical fire models*

ISO 13784-1, *Reaction to fire test for sandwich panel building systems — Part 1: Small room test*

ISO 13784-2, *Reaction-to-fire tests for sandwich panel building systems — Part 2: Test method for large rooms*

ISO 13785-1, *Reaction-to-fire tests for façades — Part 1: Intermediate-scale test*

ISO 13785-2, *Reaction-to-fire tests for façades — Part 2: Large-scale test*

ISO 13943, *Fire safety — Vocabulary*

ISO 14696, *Reaction-to-fire tests — Determination of fire and thermal parameters of materials, products and assemblies using an intermediate-scale calorimeter (ICAL)*

ISO 14934-1, *Fire tests — Calibration and use of heat flux meters — Part 1: General principles*

ISO 14934-2, *Fire tests — Calibration and use of heat flux meters — Part 2: Primary calibration methods*

ISO 14934-3, *Fire tests — Calibration and use of heat flux meters — Part 3: Secondary calibration method*

ISO 14934-4, *Fire tests — Calibration and use of heat flux meters — Part 4: Guidance on the use of heat flux meters in fire tests*

ISO/TS 16732, *Fire Safety Engineering — Guidance on fire risk assessment*

ISO/TR 17252, *Fire tests — Applicability of reaction to fire tests to fire modelling and fire safety engineering*

ISO/TS 17431, *Fire tests — Reduced-scale model box test*

ISO 20632, *Reaction-to-fire tests — Small room test for pipe insulation products or systems*

ISO/TS 22269, *Reaction to fire tests — Fire growth — Full-scale test for stairs and stair coverings*

ISO 24473, *Fire tests — Open calorimetry — Measurement of the rate of production of heat and combustion products for fires of up to 40 MW*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 13943 apply.

NOTE ISO 13943 defines reaction-to-fire as the response of a product (material) in contributing by its own decomposition to a fire to which it is exposed, under specified conditions.

4 Development of reaction to fire tests

Authorities responsible for fire safety in many countries have been concerned over the years about the safe use of materials in the construction environment. A number of national test methods have, therefore, been developed to provide the data necessary to identify the important characteristics of