

Fire safety engineering —

Part 2: Design fire scenarios and design fires

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Summary of pages

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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 ISO 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:

- ¾ type 1, when the required support cannot be obtained for the publication of an International Standard, despite repeated efforts;
- ¾ 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;
- ¾ 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 Technical Reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.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 13387-2, which is a Technical Report of type 2, was prepared by Technical Committee ISO/TC 92, *Fire safety*, Subcommittee SC 4, *Fire safety engineering*.

It is one of eight parts which outlines important aspects which need to be considered in making a fundamental approach to the provision of fire safety in buildings. The approach ignores any constraints which might apply as a consequence of regulations or codes; following the approach will not, therefore, necessarily mean compliance with national regulations.

ISO/TR 13387 consists of the following parts, under the general title *Fire safety engineering*:

- ¾ *Part 1: Application of fire performance concepts to design objectives*
- ¾ *Part 2: Design fire scenarios and design fires*
- ¾ *Part 3: Assessment and verification of mathematical fire models*
- ¾ *Part 4: Initiation and development of fire and generation of fire effluents*
- ¾ *Part 5: Movement of fire effluents*
- ¾ *Part 6: Structural response and fire spread beyond the enclosure of origin*
- ¾ *Part 7: Detection, activation and suppression*
- ¾ *Part 8: Life safety — Occupant behaviour, location and condition*

Annex A of this part of ISO/TR 13387 is for information only.

Introduction

The specification of appropriate design fire scenarios and design fires are a crucial aspect of fire safety design. The assumptions made with regard to these factors have a major impact on all aspects of the design as they represent the input into most of the quantification processes.

A design fire scenario is the description of the course of a particular fire with respect to time and space. It includes the impact on the fire of building features, occupants, fire safety systems and all other factors. It would typically define the ignition source and process, the growth of fire on the first item ignited, the spread of fire, the interaction of the fire with its environment and its decay and extinction. It also includes the interaction of this fire with the building occupants and the interaction with the features and fire safety systems within the building.

ISO/TR 13387-1 provides a framework for the quantitative fire safety engineering assessment of buildings using time-dependent calculations. Fire scenario analysis forms the basis of the method described.

The basis of these calculations is the design fire. A design fire is an idealisation of real fires that may occur in the building. Design fires are described in terms of the variation with time of variables used in the quantitative analysis. These variables typically include heat release rate, fire size, yield of toxic species and yield of soot.

Where the calculation methods used are not able to predict fire growth and spread to other objects within the compartment of origin or beyond, such growth and spread needs to be specified by the analyst as part of the design fire, satisfying the functions of both SS2 and SS3.

Fire safety engineering —

Part 2: Design fire scenarios and design fires

1 Scope

This part of ISO/TR 13387 provides guidance on the identification of appropriate design fire scenarios for consideration in fire safety design. It also provides guidance on the specification of design fires for quantitative analysis in fire safety design of buildings. This approach may be applied to other constructions. It is intended for use in conjunction with the methodology outlined in part 1 of this Technical Report.

The document describes a systematic approach to the identification of significant fire scenarios that need to be considered in fire safety design. Once significant fire scenarios have been identified, the document provides guidance on the selection of "design fire scenarios" for quantitative analysis.

The document provides guidance on the specification of "design fires" to reflect the design fire scenarios that have been identified for analysis. Design fires are specified in terms of important characteristics that form the input data into the quantitative analysis of various subsystems of the fire safety system as described in part 1.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO/TR 13387. 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/TR 13387 are encouraged to investigate the possibility of applying the most recent additions of the normative documents indicated below. For undated references, the latest addition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid international standards.

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

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

ISO/TR 13387-4, *Fire safety engineering — Part 4: Initiation and development of fire and generation of fire effluents*.

ISO/TR 13387-5, *Fire safety engineering — Part 5: Movement of fire effluents*.

ISO/TR 13387-6, *Fire safety engineering — Part 6: Structural response and fire spread beyond the enclosure of origin*.

ISO/TR 13387-7, *Fire safety engineering — Part 7: Detection, activation and suppression*.

ISO/TR 13387-8, *Fire safety engineering — Part 8: Life safety — Occupant behaviour, location and condition*.

ISO 13943, *Fire safety — Vocabulary*.

3 Terms and definitions

For the purposes of this part of ISO/TR 13387, the terms and definitions given in ISO 13943 and ISO/TR 13387-1 and the following apply:

3.1 design fire

a quantitative description of assumed fire characteristics within the design fire scenario

Typically, it is an idealised description of the variation with time of important fire variables such as heat release rate, fire propagation, smoke and toxic species yield and temperature.

3.2 design fire scenario

a specific fire scenario on which an analysis will be conducted

3.3 engineering judgement

the process exercised by a professional who is qualified by way of education, experience and recognised skills to complement, supplement, accept or reject elements of a quantitative analysis

3.4 fire scenario

a qualitative description of the course of a fire with time, identifying key events that characterise the fire and differentiate it from other possible fires

It typically defines the ignition and fire growth process, the fully developed stage and the decay stage, together with the building environment and systems that will impact on the course of the fire.

3.5 relative risk

the relative potential for realisation of an unwanted event

It is the product of the probability of occurrence of a consequence and the magnitude of the consequence based on numbers that are only internally consistent within the set being compared and does not represent the actual risk in absolute values.

4 Symbols and abbreviated terms

A_w	Area of window opening, expressed in m^2
g	Acceleration due to gravity, expressed in m/s^2
h_w	Height of window, expressed in m
$\dot{Q}$	Heat release rate, expressed in MW
$\dot{m}_{air}$	Rate of inflow of air, expressed in kg/s
$\dot{m}_f$	Rate of volatilisation of fuel, expressed in kg/s
R	Burning rate (wood equivalent) , expressed in kg/s
r	Stoichiometric air/fuel ratio
	Density, expressed in kg/m^3