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**Fire safety engineering —**

**Part 1:**

Application of fire performance concepts  
to design objectives

*Ingénierie de la sécurité contre l'incendie —*

*Partie 1: Application des concepts de performance aux objectifs de  
conception*



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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:

- type 1, when the required support cannot be obtained for the publication of an International Standard, despite repeated efforts;
- 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;
- 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 Technical Reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.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 13387-1, 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*:

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

Annex D forms a normative part of this part of ISO/TR 13387. Annexes A to C and annexes E and F are for information only.

## Introduction

A fire safety engineering approach may have many benefits over prescriptive approaches (see annex A). It takes into account the totality of the fire safety package and provides a more fundamental and economic solution than traditional approaches to fire safety. It may be the only viable means of achieving a satisfactory level of fire safety in some large and complex buildings. For most buildings prescriptive recommendations may be found to be adequate but the use of a fire safety engineering approach enables the more precise design necessary for the assessment of new and complex projects.

This part of ISO/TR 13387 is intended to be applicable to both new and existing buildings and can be used either to justify minor deviations from traditional/prescriptive codes or to evaluate the building design as a whole.

The interaction of fire, buildings and people gives rise to a large number of possible scenarios. Together with the wide range of building designs and uses, this makes it impractical to establish a single set of calculations and procedures that can be applied directly to all buildings. There are still many gaps in the available knowledge and it is, therefore, not possible to set down simple step-by-step procedures that can be applied to all buildings. This part of ISO/TR 13387 is, therefore, intended to provide a framework for a flexible but formalised approach to fire safety design that can be readily assessed by the statutory authorities.

The current knowledge and ability to model fire processes and the response of people requires the use of engineering judgement to compensate for gaps in, or supplement, knowledge. The approaches and procedures detailed in this part of ISO/TR 13387 should, therefore, only be used by suitably qualified and experienced fire safety professionals. It is also important that account should be taken of statutory requirements, and the appropriate approvals bodies should, where necessary, be consulted before final decisions are made about the fire safety design.

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# Fire safety engineering —

## Part 1:

### Application of fire performance concepts to design objectives

#### 1 Scope

This part of ISO/TR 13387 describes one framework for the provision of an engineered approach to the achievement of fire safety in buildings, based on the quantification of the behaviour of fire and people. The Technical Report is not intended as a detailed technical design guide, but could be used as the basis for development of such a guide. It indicates the interdependence and interactions between various components of the fire safety system and provides an indication of the totality of fire safety design. It is appropriate for various alternative single or multiple design objectives.

The basic principles given in this part of ISO/TR 13387, together with the guidance on detailed aspects of fire safety design given in other parts, may be applied to all types of building and their use. Principally this Part applies to common types of building such as dwellings, office buildings, department stores, schools, hotels, and public-assembly and industrial buildings, new and existing.

The principles, the methodology and many of the calculation tools may be applied to the safe design of many other structures, which may or may not accommodate people, such as tunnels, petrochemical plants, offshore oil/gas installations and transportation systems (railway carriages, aircraft cabins and passenger ships).

This part of ISO/TR 13387 takes into account many factors including building construction, means of escape, human factors, smoke management, detection, alarm and fire suppression and their contribution to the attainment of the fire safety objectives. It provides some alternative approaches to existing codes for fire safety and allows the effect of departures from more prescriptive codes and regulations to be evaluated.

Although the emphasis in this document is on safety of life, the fire safety engineering approach can also be used to assess property loss, business interruption, contamination of the environment and destruction of heritage. It is anticipated that, in the future, this part of ISO/TR 13387 will be broadened to cover, for example, property loss, business interruption, contamination of the environment and destruction of heritage.

#### 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 editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 31-0:1992, *Quantities and units — Part 0: General principles*.

ISO 31-4 1992, *Quantities and units — Part 4: Heat*.

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/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 the following apply.

#### 3.1 acceptance criteria

qualitative and quantitative criteria which have been agreed with the building approval authority and hence form an acceptable basis for assessing the safety of a building design

#### 3.2 alarm time

the time between ignition and alarm

#### 3.3 characterisation

the process of determining design data which are in a form suitable for input to a subsystem

#### 3.4 critical fire load

the fire load required in a compartment to produce a fire of sufficient severity to cause failure of fire-resisting barriers or structural elements

#### 3.5 detection time

the time between ignition of a fire and its detection by an automatic or manual system

#### 3.6 deterministic study

a methodology, based on physical relationships derived from scientific theories and empirical results, that for a given set of initial conditions will always produce the same outcome

#### 3.7 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

#### 3.8 escape/evacuation time

the interval between the time of a warning of fire being transmitted to the occupants and the time at which the occupants of a specified part of a building or all of the building are able to enter a place of safety