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Fire safety engineering — Performance of structures in fire —

Part 1: General

Ingénierie de la sécurité incendie — Performances des structures en situation d'incendie —

Partie 1: Généralités

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Contents

Page

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 ISO/TC 92, *Fire safety,* Subcommittee SC 4, *Fire safety engineering*.

This first edition of ISO 24679-1 cancels and replaces ISO/TS 24679:2011, which has been technically revised.

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

— The document has been updated to properly structure as a normative document.

A list of all parts in the ISO 24679 series can be found on the ISO website.

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

Fire is an extreme loading condition for structures, which can lead to significant effects on people, property and the environment. Part of the fire safety design of a built environment arises out of the need to provide design strategies that minimize the occurrence and spread of fire and its impact on life, property and the environment. Fire safety of structures is one important component of an overall fire safety design strategy. The role of fire safety of structures is to ensure that elements of a structure, (separating and structural elements) within a built environment, are capable of preventing or delaying fire spread and structural failure, so that the fire safety objectives, such as safety of life (for occupants and firefighters), conservation of property, continuity of operations, preservation of heritage and protection of the environment, are not compromised.

Traditionally, most designs for the fire safety of structures have been based on prescriptive requirements set by building regulations, building codes and associated standards. In prescriptive regulations, this is also known as *fire resistance*. The evaluation of fire resistance of construction elements is mainly determined by fire tests that involve:

— a single fire represented by a standard time-temperature curve (such as that given in ISO 834-1); and

— isolated elements or assemblies with defined boundary conditions and sizes.

In standard fire resistance tests, the thermal fire action continues to increase for the duration of the test according to standardized time-temperature fire curves. These thermal actions do not take into account the real conditions such as real fuel load, enclosure size, ventilation conditions, thermal properties of enclosure boundaries, active fire protection systems and firefighting actions. At the same time, from a mechanical point of view, these tests do not take into account the realistic boundary conditions and, consequently, the mechanical loads are not realistic. For example, possible redistribution of loads to other elements in a structure is not evaluated, since only single elements are tested. In addition, most test furnace facilities cannot take into account of the effect of restraint conditions that the tested element may undergo within a structure in real situation.

Such an assessment method is only able to provide a comparative rating of the construction products and cannot provide all the information required to perform a structural fire analysis of a given built environment.

With the recent advances in fire safety engineering and the opportunity for designers to take advantage of an engineering approach when evaluating the performance of structures in fire, it is becoming necessary to:

— refine the philosophy covered by the fire safety of structures, in the case of real fires, with respect to the whole structure;

— move beyond the sole consideration of individual elements and include the behaviour of the entire structural system;

— consider realistic thermal and mechanical load conditions; and

— include the cooling phase of the fire.

In the approach used in this document, solutions are based on engineering principles founded on a quantification of fire development, heat transfer and thermo-mechanical behaviour, on experts' judgement and on practicability.

An engineering approach offers many benefits, including:

— the provisions for better and more reliable fire safety in the built environment;

— potential cost-effective fire safety measures, and more options with regard to the choice of these measures; and

— better communication with other professionals involved in the design, construction process and approval process.

ISO 24679-1 is intended for use by fire safety practitioners who employ performance-based design methods. It is expected that users of this document be appropriately qualified and competent in the fields of fire safety and structural engineering. It is particularly important that users understand the limitations of any methodology used.

Each ISO standard supporting the global fire safety engineering analysis and information system includes language in the introduction to tie this document to the steps in the fire safety engineering design process outlined in ISO 23932-1.

ISO 23932-1 provides a performance-based methodology for engineers to assess the level of fire safety for new or existing built environments. Fire safety is evaluated through an engineered approach based on the quantification of the behaviour of fire and based on knowledge of the consequences of such behaviour on life safety, property and the environment.

ISO 24679-1 "Performance of structures in fire" standard form part of compliance with ISO 23932-1, and all the requirements of ISO 23932-1 (see Figure 1) apply to any application of this International Standard. For example, section "Selection of engineering methods and preliminary report" of ISO 23932-1 describes the procedure to select engineering methods used to assess the fire behaviour of structure, and section "Scenario-based evaluation of trial design" of ISO 23932-1 describes the procedure of quantification of the performance of structures in fire.

Fire safety engineering — Performance of structures in fire —

Part 1: General

1 Scope

This document provides a methodology for assessing the performance of structures in the built environment when exposed to a real fire.

This document, which follows the principles outlined in ISO 23932-1, provides a performance-based methodology for engineers to assess the level of fire safety of new or existing structures.

NOTE The fire safety of structures is evaluated through an engineering approach based on the quantification of the behaviour of a structure for the purpose of meeting fire safety objectives and can cover the entire time history of a real fire (including the cooling phase), and its consequences related to fire safety objectives such as life safety, property protection and/or environmental protection.

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 834-1:1999, *Fire-resistance tests — Elements of building construction — Part 1: General requirements*

ISO 13943, *Fire safety — Vocabulary*

ISO/TR 16576, *Fire safety engineering — Examples of fire safety objectives, functional requirements and safety criteria*

ISO/TS 16733-2, *Fire safety engineering — Selection of design fire scenarios and design fires — Part 2: Design fires*

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

3 Terms and definitions

For the purpose of this document, the terms and definitions given in ISO 13943, ISO 23932-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

3.1
building element
integral part of a built environment

Note 1 to entry: This includes floors, walls, beams, columns, doors, and penetrations, but does not include contents.