INTERNATIONAL STANDARD

ISO 23932-1

First edition
2018-09

Fire safety engineering — General principles —

Part 1: General

Ingénierie de la sécurité incendie — Principes généraux —

Partie 1: Généralités

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CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

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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).

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For an explanation on 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 the following URL: www.iso.org/iso/foreword.html.

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This document was prepared by Technical Committee ISO/TC 92, *Fire safety*, Subcommittee SC 4, *Fire safety engineering*.

This first edition of ISO 23932-1 cancels and replaces ISO 23932:2009, which has been technically revised.

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

— a clarification of the FSE process (Figure 1) has been added and the document has been restructured subsequently in accordance with the performed changes;

— an expanded discussion of the types of risk analysis approaches commonly used for FSE has been added;

— references to relevant FSE standards have been added;

— examples to illustrate the FSE process have been added.

A list of all parts in the ISO 23932 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.

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Introduction

Fire safety designs often rely on prescriptive specifications set in national, regional or local regulations. It is possible that various engineering approaches also be allowed by these regulations. In addition to prescriptive design, regulations can also allow the use of performance-based design, i.e. the reliance on engineering methods to determine whether a given design meets stated performance objectives. Fire safety can be evaluated through engineering approaches based on the quantification of the behaviour of fire and people, and based on the knowledge of the consequences of such behaviour on life, property, operations, environment and heritage.

Fire safety engineering (FSE) is used in support of performance-based fire safety design. The FSE process not only involves fire safety design, but also extends to the implementation of fire safety design plans and fire safety management.

The difference between prescriptive and performance-based fire safety design is highlighted in this document by requiring fire safety objectives (FSO), functional requirements (FR) and performance criteria (PC) to be explicitly stated in performance-based fire safety design.

This document sets forth the general principles and requirements for a performance-based fire safety design and the implementation of fire safety design plans and fire safety management. Hence, it is important that this document be viewed as an outline of the FSE process, and not as a detailed design methodology. This document provides the process (necessary steps) and essential elements that are needed to design, implement and maintain a robust performance-based fire safety programme.

A set of ISO documents on FSE is available, which provides methods and data supporting the steps in a FSE design, as defined in the ISO 23932 series. This coherent set of ISO documents ensures an effective and correct application of FSE, which includes performance-based fire safety design, implementation of fire safety design plans and fire safety management.

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Fire safety engineering — General principles —

Part 1: General

1 Scope

This document provides general principles and requirements for FSE, and is intended to be used by professionals involved in

1) performance-based fire safety design (of both new and existing built environments),

2) implementation for fire safety design plans, and

3) fire safety management.

This document is not intended as a detailed technical design guide, but does provide the key elements necessary for addressing the different steps and their linkages in the fire safety design process. This document also provides key elements linked to the implementation of fire safety design plans and fire safety management. This document is intended not only to be used on its own, but also in conjunction with a consistent set of FSE documents covering methods in performance-based fire safety design, implementation and management.

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FSOs covered by this document include:

— safety of life;

— property protection;

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— continuity of operations;

— protection of the environment;

— preservation of heritage.

The general principles and requirements of FSE can be applied to all configurations of the built environment, i.e. buildings or other structures (e.g. off-shore platforms; civil engineering works, such as tunnels, bridges and mines; and means of transportation, such as motor vehicles and marine vessels), but may not be applicable for construction sites.

Because prescriptive regulations covering fire safety design commonly co-exist with performance-based design, this document acknowledges that fire safety designs conforming to prescriptive regulations can become the basis for comparison of engineered designs of built environments.

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 13943, *Fire safety — Vocabulary*

3 Terms and definitions

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

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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 http://www.electropedia.org/

3.1
affected party
party that is impacted by a fire safety design, including property owners and other property stakeholders, or authority having jurisdiction or in charge of public safety, health and welfare

3.2
deterministic analysis
risk analysis approach (3.10) in which the fire safety design is evaluated using a set of worst credible case scenarios

3.3
engineering judgement
process exercised by a professional or a team of professionals who is qualified by way of education, experience and recognized skills to complement, supplement, accept or reject elements of an engineering analysis

3.4
fire safety engineering
FSE
application of engineering methods based on scientific principles to the development or assessment of designs in the built environment through the analysis of specific fire scenarios or through the quantification of risk for a group of fire scenarios

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3.5
fire safety strategy
specification of design functions used in achieving fire-safety objectives that forms the basis for the design

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3.6
functional requirement
FR
statement of the means to achieve specified FSO, taking into account the features of a built environment

Note 1 to entry: Mandatory functional requirements are required, explicitly or implicitly, by national regulations or building codes; voluntary functional requirements are expressed by other affected parties.

3.7
mandatory objective
FSO, such as life safety and protection of the environment, which is required by national regulations or building codes

3.8
performance criterium
PC
threshold of performance that forms an agreed basis for assessing the safety of a built environment design

3.9
probabilistic analysis
risk analysis approach (3.10) in which the fire safety design is evaluated using the full range of representative scenarios

3.10
risk analysis approach
method for comparing estimated risk and tolerable risk using some form of risk measure, which includes *qualitative analysis* (3.18), *deterministic analysis* (3.2) and *probabilistic analysis* (3.9)

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3.11
safety factor
multiplicative adjustment applied to calculated values to compensate for *uncertainty* (3.14) in methods, calculations, input data and assumptions

3.12
safety margin
additive adjustment applied to calculated values to compensate for *uncertainty* (3.14) in methods, calculations, input data and assumptions

3.13
trial fire safety design
design chosen for the purpose of making a *fire safety engineering* (3.4) analysis and evaluation

3.14
uncertainty
quantification of the systematic and random error in data, variables, parameters or mathematical relationships, or of a failure to include a relevant element

3.15
validation
process of determining the degree to which a calculation method is an accurate representation of the real world from the perspective of the intended uses of the calculation method, such as confirming the correct assumptions and governing equations implemented in a model when applied to the entire class of problems addressed by the model

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3.16
verification
process of determining that a calculation method implementation accurately represents the developer's conceptual description of the calculation method and the solution to the calculation method

Note 1 to entry: The fundamental strategy of verification of computational models is the identification and quantification of error in the computational model and its solution.

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3.17
voluntary objective
FSO that is required by *affected parties* (3.1) beyond *mandatory objectives* (3.7)

3.18
qualitative analysis
risk analysis approach (3.10) in which areas of increased risk are identified

4 Overview of the FSE process

The FSE process shall be initiated at the earliest stage of a project (that can include, for example, architectural concept design, structural, ventilation, plumbing, electrical designs) for a new built environment, to modify or refurbish an existing built environment or to evaluate compliance with updated regulations. Fire safety design shall be integrated fully with all other engineering design specialities throughout such a project. This is necessary when considering, for example, how the result of acoustic or thermal engineering (introduction of flammable sound/heat absorbing materials) or enhancement of security (limitation of methods of egress) can introduce unintended fire safety design problems.

Figure 1 shows an outline of the FSE process of a built environment, with references to Clauses of this document and references to additional ISO documents which explain the process in more detail. The process involves performance-based fire safety design, implementation of fire safety design plan and fire safety management. In Figure 1, the performance-based fire safety design begins with setting the analysis scope and ends with documentation in final report.

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As shown in Figure 1, the FSE process is iterative. When following the process, the fire safety designer shall explore the answers to key questions posed in decision nodes. The answers to these questions can require that steps of the process be repeated. This procedure is illustrated by the decision nodes (rhombi) and the associated iterative loops (Yes/No arrows) in Figure 1.

The boundaries of the analysis shall be clearly defined in the first part of the FSE process. First, the overall project scope shall be documented. This can include factors such as new building, renovation, expansion, and so forth. Secondly, the scope of the FSE project, within the context of the overall project, shall be identified, agreed and documented. The FSE project scope statement shall contain a description of project relevant information, e.g. characteristics of the built environment, affected parties and external environmental factors, but also a clear definition of what shall be analysed with the performance-based fire safety design.

In subsequent steps, the FSOs and FRs shall be identified. This shall be followed by the selection of the type of risk analysis approach and the subsequent identification of PCs, which are dependent on the chosen risk analysis approach.

The identification of FSOs, FRs and PCs is an essential part of the FSE process. Objectives describe the desired outcome of fires, i.e. they identify what is essential to protect. The FSO for a project should be clearly defined. It should also be documented as to which objectives are to be met by the fire safety analysis and which may be deemed to be met by compliance with prescribed (deemed to satisfy) regulatory measures. FRs translate objectives into required functionality of the fire safety design. Finally, FRs are quantified in terms of PCs, which are used for determining whether or not the FSOs are achieved given the selected risk analysis approach. The risk analysis approach is selected based on the required treatment of uncertainty in the design (see Clause 8). An FSO can be represented by one or more FRs. Similarly, an FR can be quantified by one or more PCs.

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The following questions illustrate the relationship between FSOs, FRs and PCs:

— FSOs (see Clause 6): What are the required/desired outcomes of all foreseeable fires?

— FRs (see Clause 7): How will these outcomes be achieved by design functionality?

— PCs (see Clause 9): How will the adequacy of the design be measured in engineering terms?

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When the boundaries of the analysis are set, a trial fire safety design plan shall be created. This design plan shall then be evaluated using design scenarios and engineering methods. The evaluation shall be performed in relation to the identified PCs. If the criteria are met, the trial design can be considered to have met the objectives. If not, revision of the trial fire safety design is required. It is possible to have more than one trial design that fulfils the objectives.

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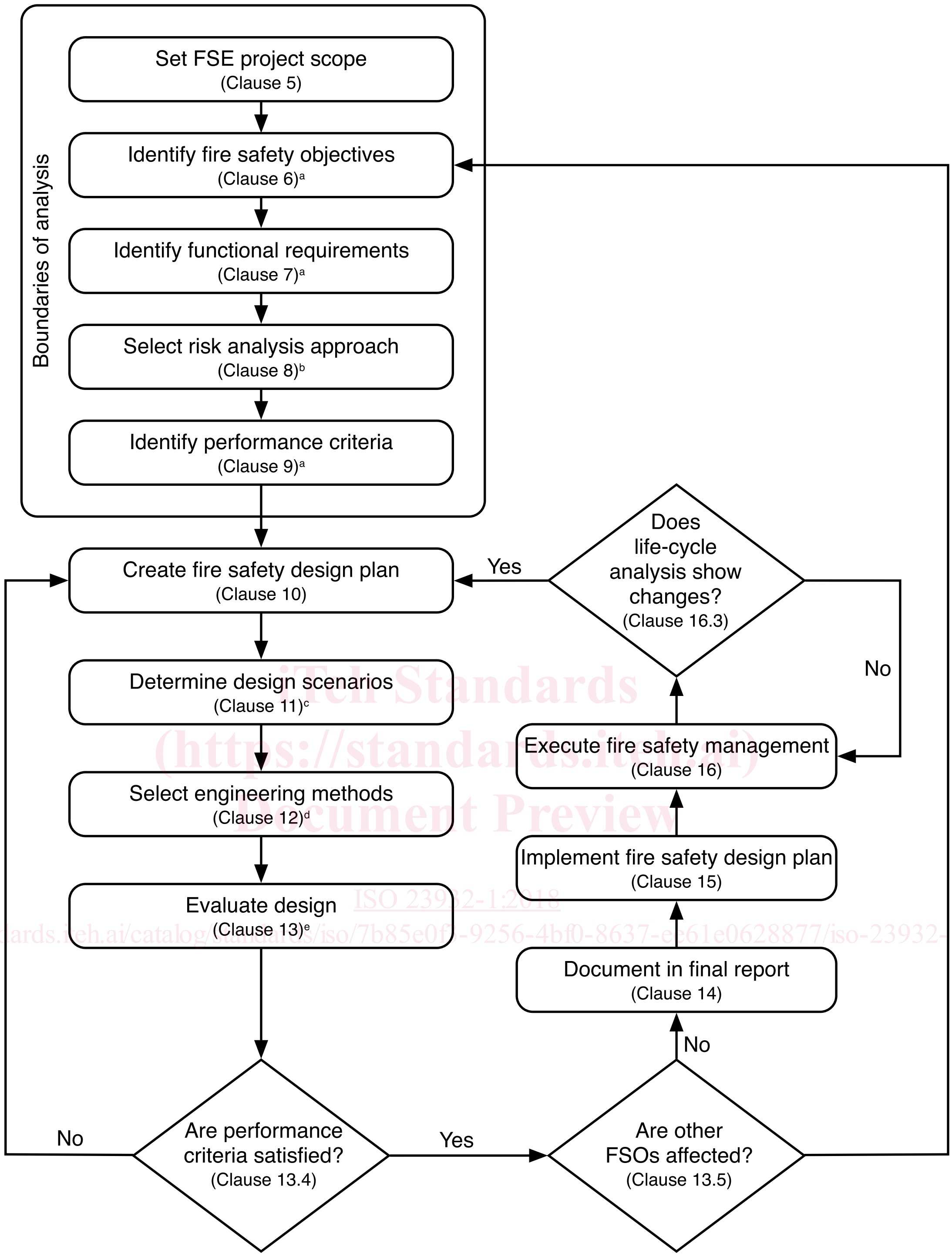

a See also ISO/TR 16576 (Examples).

b See also ISO 16732-1, ISO 16733-1, ISO/TS 29761.

c See also ISO 16732-1, ISO 16733-1, ISO/TS 29761.

d See also ISO/TS 13447, ISO 16730-1, ISO/TR 16730-2 to 5 (Examples), ISO 16734, ISO 16735, ISO 16736, ISO 16737, ISO/TR 16738, ISO 24678-6.

e See also ISO/TR 16738, ISO 16733-1.

NOTE Documents linked to large parts of the FSE process: ISO 16732-1, ISO 16733-1, ISO/TS 24679, ISO/TS 29761, ISO/TR 16732-2 to 3 (Examples), ISO/TR 24679-2 to 4 and 6 (Examples).

Figure 1 — FSE process — Design, implementation and management

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