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Brandteknisk dimensionering (Fire safety engineering) – Bedömning, verifiering och validering av beräkningsmetoder (ISO 16730:2008, IDT)

Fire Safety Engineering – Assessment, verification and validation of calculation methods (ISO 16730:2008, IDT)

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Den internationella standarden ISO 16730:2008 gäller som svensk standard. Detta dokument innehåller den officiella engelska versionen av ISO 16730:2008.

The International Standard ISO 16730:2008 has the status of a Swedish Standard. This document contains the official English version of ISO 16730:2008.

Upplysningar om sakinnehållet i standarden lämnas av SIS, Swedish Standards Institute, telefon 08-555 520 00.
Standarder kan beställas hos SIS Förlag AB som även lämnar allmänna upplysningar om svensk och utländsk standard.

Information about the content of the standard is available from the Swedish Standards Institute (SIS), tel +46 8 555 520 00.
Standards may be ordered from SIS Förlag AB, who can also provide general information about Swedish and foreign standards.

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 16730 was prepared by Technical Committee ISO/TC 92, *Fire safety*, Subcommittee SC 4, *Fire safety engineering*.

Introduction

The objective of fire safety engineering is to assist in the achievement of an acceptable predicted level of fire safety. Part of this work involves the use of calculation methods to predict the course of events that can potentially occur in case of a fire or as a consequence of a fire. This work involves the use of calculation methods to evaluate the ability of fire protection measures to mitigate the adverse effects of a fire on people, property, the environment and other objects. The main principles that are necessary to establish the credibility of these calculation methods are assessment, verification and validation.

There is a need for a standard as a technical basis to provide the developers and users of calculation methods and third parties with procedures to check whether the calculation method's accuracy for particular applications is sufficient.

This International Standard addresses the assessment, verification and validation of calculation methods for fire-safety engineering in general.

It is necessary that potential users of calculation methods and those who are asked to accept the results be assured that the calculation methods provide sufficiently accurate predictions of the course and consequences of the fire for the specific application planned. To provide this assurance, it is necessary that the calculation methods being considered be verified for mathematical accuracy and validated for capability to reproduce the phenomena.

There is no fixed requirement of accuracy that is applicable to all calculation methods. The accuracy level depends on the purposes for which a calculation method is being used. It is not necessary that all calculation methods demonstrate high accuracy as long as the error, uncertainty and limits of applicability of the calculation methods are known.

This International Standard focuses on the predictive accuracy of calculation methods. However, other factors such as ease of use, relevance, completeness and status of development play an important role in the assessment of the use of the most appropriate method for a particular application. The assessment of the suitability of a calculation method for a special purpose within the field of fire safety engineering is supported by the use of quality-assurance methodology to ensure that the requirements are being fulfilled. Guidance for establishing metrics for measuring attributes of the relevant quality characteristics is outlined in short form in this International Standard.

This International Standard is intended for use by

a) developers of calculation methods (individuals or organizations that perform development activities, including requirements analysis, design and testing of components), to document the usefulness of a particular calculation method, perhaps for specific applications. Part of the calculation method development includes the identification of precision and limits of applicability, and independent testing,

b) developers of calculation methods (individuals or organizations who maintain computer models, supply computer models, and for those who evaluate computer model quality as part of quality assurance and quality control), to document the software development process and assure users that appropriate development techniques are followed to assure quality of the application tools,

c) users of calculation methods (individuals or organizations that use calculation methods to perform an analysis), to assure themselves that they are using an appropriate method for a particular application and that it provides adequate accuracy,

d) developers of performance codes and standards, to determine whether a calculation method is appropriate for a given application,

e) approving bodies/officials (individuals or organizations that review or approve the use of assessment methods and tools), to ensure that the calculation methods submitted show clearly that the calculation method is used within its applicability limits and has an acceptable level of accuracy,

f) educators, to demonstrate the application and acceptability of calculation methods being taught.

It is necessary that users of this International Standard be appropriately qualified and competent in the fields of fire safety engineering and risk assessment. It is important that users understand the parameters within which specific methodologies can be used.

Fire safety engineering — Assessment, verification and validation of calculation methods

1 Scope

This International Standard provides a framework for assessment, verification and validation of all types of calculation methods used as tools for fire safety engineering. It does not address specific fire models, but is intended to be applicable to both analytical models and complex numerical models that are addressed as calculation methods in the context of this International Standard. It is not a step-by-step procedure, but does describe techniques for detecting errors and finding limitations in a calculation method.

This International Standard includes

— a process to ensure that the equations and calculation methods are implemented correctly (verification) and that the calculation method being considered is solving the appropriate problem (validation),

— requirements for documentation to demonstrate the adequacy of the scientific and technical basis of a calculation method,

— requirements for data against which a calculation method's predicted results shall be checked,

— guidance on use of this International Standard by developers and/or users of calculation methods, and by those assessing the results obtained by using calculation methods.

2 Normative references

The following referenced documents are indispensable for the application 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/TR 13387-1, *Fire safety engineering — Part 1: Application of fire performance concepts to design objectives*

ISO 13943, *Fire safety — Vocabulary*

3 Terms and definitions

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

NOTE Some of the definitions have been updated to illustrate the current understanding of the meaning of the terms in the field of fire-safety engineering.

3.1
accuracy
degree of exactness actually possessed by an approximation, measurement, etc.

NOTE In the context of this International Standard, the numerical (or mathematical) accuracy is part of the verification process for calculation methods, where a computer fire model may be such a calculation method. The accuracy may be expressed by indicating the uncertainty of a calculation or solution(s) of a model.

3.2
assessment
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 and the degree to which a calculation method implementation accurately represents the developer's conceptual description of the calculation method and the solution to the calculation method

NOTE Key processes in the assessment of suitability of a calculation method are verification and validation.

3.3
calculation method
mathematical procedure used to predict fire-related phenomena

NOTE Calculation methods may address behaviour of people as well as objects or fire; may be probabilistic as well as deterministic in form; and may be algebraic formulae as well as complex computer models.

3.4
calibration
〈of a model〉 process of adjusting modelling parameters in a computational model for the purpose of improving agreement with experimental data

3.5
computer(ized) model
operational computer program that implements a conceptual model

3.6
conceptual model
description composed of all the information, mathematical modelling data and mathematical equations that describe the (physical) system or process of interest

3.7
default value
standard setting or state to be taken by the program if no alternate setting or state is initiated by the system or the user

3.8
deterministic model
calculation method that uses science-based mathematical expressions to produce the same result each time the method is exercised with the same set of input data values

3.9
engineering judgment
process exercised by a professional who is qualified by way of education, experience and recognized skills to complement, supplement, accept or reject elements of a quantitative analysis

3.10
error
recognizable deficiency in any phase or activity of calculation that is not due to lack of knowledge

3.11
fire model
representation of a system or process related to fire development, including fire dynamics and fire impacts

3.12
mathematical model
sets of equations that describe the behaviour of a physical system

3.13
measure
variable to which a value is assigned as the result of measurement

3.14
measurement
set of operations having the object of determining a value of a measure

3.15
metric
measure, quantitative or qualitative, of relative achievement of a desired quality characteristic

3.16
modelling
process of construction or modification of a model

3.17
numerical model
numerical representation of a physical (fire) model

3.18
physical model
model that attempts to reproduce fire phenomena in a simplified physical situation, e.g. scale models

3.19
probabilistic model
model that treats phenomena as a series of sequential events or states, with mathematical rules to govern the transition from one event to another, e.g. from ignition to established burning, and probabilities assigned to each transfer point

3.20
simulation
exercise or use of a calculation method

3.21
simulation model
model that treats the dynamic relationships that are assumed to exist in the real situation as a series of elementary operations on the appropriate variables

3.22
uncertainty
potential deficiency in any phase or activity of the modelling process that is due to lack of knowledge

3.23
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

3.24
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 The fundamental strategy of verification of computational models is the identification and quantification of error in the computational model and its solution.