BS ISO 29903:2012

BSI Standards Publication

Guidance for comparison of toxic gas data between different physical fire models and scales

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National foreword

This British Standard is the UK implementation of ISO 29903:2012.

The UK participation in its preparation was entrusted to Technical Committee FSH/16, Hazards to life from fire.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Compliance with a British Standard cannot confer immunity from legal obligations.

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INTERNATIONAL STANDARD

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Guidance for comparison of toxic gas data between different physical fire models and scales

Lignes directrices pour la comparaison de données de gaz toxiques entre divers modèles et échelles de feu physiques

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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.

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 29903 was prepared by Technical Committee ISO/TC 92, *Fire Safety*, Subcommittee SC 3, *Fire threat to people and the environment*.

Introduction

The production of toxic gases in fires can be a significant factor in determining whether people escape from a fire or not. Estimation of the time available for escape and the time required for escape each require values of the concentrations of toxic gases along possible escape paths. Typically, the yields of the gases from burning finished products are estimated or measured prior to conducting such calculations. In some rare cases toxic species production can be calculated during modelling of the fire development. Typically spread of the gases and their dilution with air is then simulated using equations or computational models.

The yields of these gases can be measured in a real-scale laboratory test of the entire finished product (e.g. a chair) or in a bench-scale test (using a physical fire model) of a specimen cut from the product or a component of the product. Since there are thousands of different combustibles, routine real-scale testing is both costly and impractical. Thus, there is a need to develop reliable methods to use physical fire models, conducted in less than real-scale, for the estimation of real-scale emissions.

The yields of the gases from the real-scale test are often considered to be the accurate values for the particular test conditions. In tests involving a portion of the finished product in a physical fire model, the specimen characteristics and the combustion conditions differ from those in the real-scale test. In most cases the physical fire model reproduces one part of the entire real-scale scenario, e.g. initial well ventilated conditions or later vitiated conditions. The yields of combustion products in a fire test depend on apparatus conditions such as: the fuel/air equivalence ratio, whether the decomposition is flaming or non-flaming, the persistence of flaming of the sample, the temperature of the specimen and the effluents produced, the stability of the decomposition conditions, and the interaction of the apparatus with the decomposition process, with the effluents and with the flames.

It is, therefore, important to have a standardised methodology for comparing the toxic gas yields generated in tests of different scales to determine the appropriateness of using the data from individual physical fire models in fire hazard and risk assessment. It is also valuable to be able to compare the yield data from different physical fire models to determine whether or when they generate comparable results.

This International Standard concerns the comparison of toxic gas data between small-scale (physical fire models) and large-scale tests and between different small-scale tests, i.e. it covers

a) the comparison of toxic gas data from fire tests of different physical scales and characteristics in terms of a methodology to identify whether the data are comparable and (provided it is comparable) how to make relevant comparisons, and

b) the prediction of large-scale results based on small-scale test data or vice versa.

INTERNATIONAL STANDARD **ISO 29903:2012(E)**

Guidance for comparison of toxic gas data between different physical fire models and scales

1 Scope

This International Standard provides principles for characterizing the measured production of toxic gases from a laboratory fire test and provides bases for comparing the results between different types and scales of such tests. It also includes consideration of the uncertainties in the gas determinations. The combined uncertainty is a key factor in the ability to establish similarity or difference of test results.

The sufficiency of the agreement between a bench-scale test and a real-scale test depends on the precision needed in the fire hazard or risk assessment, which is not covered by ISO 29903:2012.

This International Standard defines the relevance and significance of toxic gas data from measurements in different fire tests. With such a definition it is possible to provide generic guidance on how such data can be compared between different sizes and types of fire tests.

The combustion conditions represented by the fire test, other specific characteristics of the test and the test specimen, the sampling strategy of the fire effluents, and the analysis technique for the toxic gas species are the most important factors when defining the significance of the toxic gas data.

This International Standard is intended to serve as a tool for the

a) definition of the relevance and significance of toxic gas data from fire tests,

b) comparison of toxic gas data from fire tests of different scales and characteristics, and

c) prediction of toxic gas data from a large-scale test based on small-scale data or vice versa.

This International Standard gives general guidance regarding comparison of toxic gas data between physical fire models of different scales, but is principally developed for the gases listed in ISO 13571, i.e. carbon dioxide (CO_2), carbon monoxide (CO), hydrogen halides (HCl, HBr, HF), sulfur dioxide (SO_2), hydrogen cyanide (HCN), nitrogen oxides (NO, NO_2), formaldehyde (CH_2O) and acrolein (C_3H_4O).

This International Standard does not cover characterization and comparisons of the toxicity of the effluents from fire tests.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 5725-1, *Accuracy (trueness and precision) of measurement methods and results — Part 1: General principles and definitions*

ISO 13571, *Life-threatening components of fire — Guidelines for the estimation of time available for escape using fire data*

ISO 13943, *Fire safety — Vocabulary*

ISO 16730, *Fire safety engineering — Assessment, verification and validation of calculation methods*

ISO 19706, *Guidelines for assessing the fire threat to people*