
**Standard test method for measuring
the heat release rate of low flammability
mattresses and mattress sets**

*Méthode d'essai normalisée pour mesurer le débit calorifique de
matelas et d'éléments de matelas à inflammabilité réduite*



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Contents

Page

Foreword	v
Introduction	vi
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Summary of test method	2
5 Significance and use	2
6 Apparatus and equipment	2
6.1 Test area	2
6.2 Test frame	5
6.3 Ignition source	6
6.4 Fuel supply and control	10
6.5 Ignition burner gas flow	11
7 Test specimens	12
8 Test preparation	12
8.1 Specimen conditioning	12
8.2 Instrument calibration	13
8.3 Specimen orientation	13
8.4 Burner set-up	13
8.5 Burner alignment procedure	14
8.6 Video recording	17
9 Test procedure	18
9.1 Safety precautions	18
9.2 Burner preparation	18
9.3 Initiation of recording systems	18
9.4 Test initiation	18
9.5 Test conduct	19
10 Test report	19
Annex A (informative) Reducing fire hazards associated with mattress flammability	21
Bibliography	23

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 12949 was prepared by Technical Committee ISO/TC 92, *Fire safety*, Subcommittee SC 1, *Fire initiation and growth*.

Introduction

A typical bed consists of several components, including a mattress, a foundation, and a collection of bedclothes (e.g. mattress pad, sheets, pillows, blankets, quilts and/or comforters). Mattress and bedding fires are a major contributor to residential fire deaths ^[1]. A significant portion of these deaths and injuries results from fires in which the bedclothes are the first items ignited, and those flames ignite the mattress or foundation. In the United States, approximately two-thirds of all deaths from flaming bed fires occur after the room has reached the point of flashover ^[2]. This accounts for nearly all the fatalities that occur outside the room of fire origin and about half of the fatalities that occur within the room of origin.

A burning mattress is generally the primary energy contributor to a fatal bedroom fire. Once the mattress is ignited, the fire develops rapidly. Room flashover occurs at heat release rates near or above 1 000 kW (1 MW) for small-to-medium size bedrooms ^[3]. 1 m wide mattresses, without bedclothes, have been shown to reach peak heat release rates of 2 MW and flash over a room in less than 300 s ^[3]. In addition, a typical set of bedclothes on a 1 m wide bed can lead to a fire whose peak rate of heat release is approximately 100 kW to 200 kW ^[4], with values up to 400 kW possible for the heaviest sets ^[5]. A bed clothes fire can become appreciably more threatening on larger beds ^[6].

It follows that a significant reduction in bed fire fatalities can be achieved by reducing the combined peak heat release rate of a bed, the bedclothes, and other furnishings ignited by the bedclothes to a level well below 1 MW. Current regulation in the United States limits the peak rate of heat release of a mattress and foundation to 200 kW and the total heat release to 15 MJ during the first 10 min of the test ^[7], ^[8]. Combined with the typical heat release rate of the bedclothes, which generally occurs well before the peak heat release from the mattress, the overall heat release rate from the burning bed is substantially below the value that leads to room flashover. Furthermore, as the intensity of the bed fire is decreased this much, there is an accompanying reduction in the spatial extent of the radiant heat from flames. This reduces the likelihood that other bedroom furnishings will be ignited by the bed fire and greatly increases the time available for occupants to recognize and escape the fire.

This International Standard addresses a fire hazard scenario different from one in which a cigarette ignites the bed and threatens people who might be asleep on the bed with their heads near the location of the dropped cigarette. The resulting deaths most often result from inhalation of the toxic fumes from the smouldering fire and are distinct from the deaths that are to be averted by limiting the flaming intensity of the bed fire. In several countries, mattresses are tested for cigarette ignition resistance ^[9], which reduces the likelihood of smouldering fires, but infrequently addresses the fire hazard addressed by this International Standard.

Standard test method for measuring the heat release rate of low flammability mattresses and mattress sets

WARNING — So that suitable precautions can be taken to safeguard health, the attention of all concerned with fire tests is drawn to the possibility that toxic or harmful gases are evolved during combustion of test specimens.

The test procedures involve high temperatures. Hazards can therefore exist for burns and ignition of extraneous objects or clothing. The operators should use protective clothing, helmets, face-shields, and breathing equipment for avoiding exposure to toxic gases.

Laboratory safety procedures should be set up to ensure the safe termination of tests. It is imperative that adequate means of extinguishing such a fire are provided.

1 Scope

This International Standard provides a full-scale test method for determining the heat release rate and total heat release from a mattress or a mattress and foundation. The test specimen is ignited by exposure to a pair of gas burners that simulate burning bedclothes [5]. The measurement capability is designed for mattress sets of low flammability, i.e. having a peak rate of heat release below 300 kW.

This International Standard applies to mattresses and mattress and foundation sets. This International Standard does not apply to mattress pads, pillows, blankets, or other items used on top of a mattress.

This International Standard is a performance standard and does not prescribe the use of any specific components, fire retardant chemicals, or materials, and does not prescribe any design features that might lead to improved or degraded performance of a mattress set.

Annex A describes an analysis that indicates the potential reduction in life loss achievable by limiting the magnitude of the bed fire.

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 9705, *Fire tests — Full-scale room test for surface products*

ISO 13943, *Fire safety — Vocabulary*

ISO 24473, *Fire tests — Open calorimetry — Measurement of the rate of production of heat and combustion products for fires of up to 40 MW*

3 Terms and definitions

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

3.1

foundation

ticking-covered structure used to support a mattress or other sleep surface