INTERNATIONAL STANDARD

ISO 17492

First edition
2003-05-01

Clothing for protection against heat and flame — Determination of heat transmission on exposure to both flame and radiant heat

Vêtements de protection contre la chaleur et la flamme — Détermination de la transmission de chaleur lors de l'exposition simultanée à une flamme et à une source de chaleur radiante

Reference number
ISO 17492:2003(E)

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Published in Switzerland

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 17492 was prepared by Technical Committee ISO/TC 94, *Personal safety — Protective clothing and equipment*, Subcommittee SC 13, *Protective clothing*. It is based on Section 6-10 of NFPA 1971:2000 [2].

Introduction

The transfer of heat from the exterior of a material to the interior can be a significant factor in the level of protection or insulation provided by an assembly. While full-scale test methods are a better means of determining how an assembly performs, small scale tests such as those described in ISO 6942 and ISO 9151 can be used in establishing benchmarks of performance for the materials from which these assemblies are made. These tests enable the user of a material to anticipate how the properties of a particular material could impact the performance of the assembly when exposed to a high heat flux.

The purpose of an assembly for thermal protection is to prevent or reduce the potential for burn injury to the wearer. The performance of a product is determined by comparing the heat-transferred through the protective material to a known point where the thermal exposure would produce a burn injury. The total energy transferred that would cause a second-degree burn in human tissue is determined as the thermal protection index (TPI). In the TPI analysis of the data, the specimen is stressed by exposure to heat until the energy transferred through the specimen is equivalent to the energy that could cause a second-degree burn.

Other uses may require comparison of the insulation from a high-temperature exposure in terms other than the response of human tissue to heat. For these uses, an alternate method of evaluating the heat-transfer is provided. The total energy transferred that would cause the temperature rise of the copper sensor of 12 °C and 24 °C is determined as the heat-transfer index (HTI). In the HTI analysis of the data, the specimen is stressed by exposure to heat until the energy causes a specified amount of heat-transfer. This is a measure of the insulation performance of the specimen.

Unlike what is described in ISO 6942 or ISO 9151, the heat source in this test method is produced by 50 % radiant energy and 50 % convective energy. This equalized output is set to a thermal energy exposure having a heat flux of 80 kW/m^2. The intensity of this heat flux is intended to determine the performance of the specimen when exposed to both the high temperature radiation and hot gases that may exist in actual fire situations. The intensity level of this heat flux represents a moderately high industrial or emergency fire-fighting exposure that requires the use of a protective material, and thus, measures the performance of the specimen under realistic conditions relatively close to a realistic exposure intensity.

NOTE 1 The performance of materials made of flame-resistant fibres can be determined by the amount of heat energy transferred through the specimen and by observing any changes affected by the exposure on the specimen. The thermal protection index and the heat-transfer index measure the accumulated heat energy received which is an indication of the ability of the material to inhibit the transfer of heat.

NOTE 2 A human tissue burn will result when the total thermal energy transmitted by the material reaches the second-degree burn threshold.

NOTE 3 The thermal protection index or the heat-transfer index for flame-resistant materials can be used to establish anticipated performance levels of thermal resistance for single layer or multilayer constructions or assemblies.

NOTE 4 Different specimen-mounting conditions, which are determined by the number of layers of material in the test specimen, are provided in this method. Each condition emphasizes a different thermal property of the sample and represents the way in which the material is used in the end-use application.

NOTE 5 The spaced configuration, with a spacer placed between the back surface of the specimen and the sensor, reflects applications in which there is an air space or gap between the specimen and the protected surface. This spaced configuration also eliminates the cooling effect which occurs due to specimen contact with the sensor and allows the specimen to heat to a temperature during the test the same as that which might occur in actual exposure during a flash fire. This mounting condition measures the thermal resistance of the specimen plus the air gap and barrier performance of the specimen.

NOTE 6 The contact configuration, with the sensor in contact with the specimen, measures the insulation property of the specimen and reflects applications in which the textile is in contact with the protected surface.

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1 Scope

This International Standard specifies a test method for measuring the heat-transfer of horizontally mounted flame-resistant textile materials when exposed to a combination of convective and radiant energy.

NOTE This test method may not correlate to the heat-insulative performance of vertically oriented flame-resistant textile materials when exposed to convective and radiant heat energy or used in actual clothing configurations.

This test method can be used for any type of sheet material used either as a single layer or in a multilayer construction when all structures or sub-assemblies are made of flame-resistant materials. It is not intended to be used on materials that are not flame resistant.

This test method is not intended for evaluating materials exposed to any other type of thermal-energy sources, such as radiant heat only or flame contact only. Use ISO 6942 when evaluating heat-transfer through materials due to radiant heat only and use ISO 9151 when evaluating heat-transfer through materials due to flame contact only.

This test method may not identify textile materials that can ignite and continue to burn after exposure to convective and radiant energy.

This International Standard should be used to measure and describe the properties of materials, products or assemblies in response to both convective and radiant energy under controlled laboratory conditions and should not be used to describe or appraise the fire hazard or fire risk of materials, products or assemblies under actual fire conditions. However, the results of this test method may be used as elements of a fire-risk assessment which takes into account all of the factors which are pertinent to an assessment of the fire hazard of a particular end-use.

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 139, *Textiles — Standard atmospheres for conditioning and testing*

ISO 6942, *Protective clothing — Protection against heat and fire — Method of test: Evaluation of materials and material assemblies when exposed to a source of radiant heat*

ISO 9151, *Protective clothing against heat and flame — Determination of heat transmission on exposure to flame*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
break-open
formation of a hole in the material during thermal exposure