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# 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*

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# Foreword

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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).

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For an explanation of 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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 94, *Personal safety — Personal protective equipment*, Subcommittee SC 13, *Protective clothing*.

This second edition cancels and replaces the first edition (ISO 17492:2003), which has been technically revised. It also incorporates the Technical Corrigendum ISO 17492:2003/Cor.1:2004. The main changes compared with the previous edition are as follows:

— technical modifications and rewording have been made to all clauses, including to Annexes A and B;

— Clauses 5 to 12 have been renumbered;

— modifications have been made to Figures 1, 2 and 3.

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.

 

# Introduction

The measurement of the thermal energy transferred from the exterior of a material to the interior when exposed to a thermal hazard can be a significant factor in determining 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 affect 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 skin burn injury to the wearer. The performance of a product can be determined by comparing the total exposure energy to that which is transferred through the protective material to a known point where the thermal exposure would produce a burn injury in human tissue. The total exposure energy required to cause the onset of a second-degree burn in human tissue is identified as the thermal protection index (TPI). In the TPI analysis of the data, the specimen is exposed to steady heat until the energy transferred through the specimen is equivalent to the energy that would cause the onset of a second-degree burn injury (e.g. a blister).

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

Unlike what is described in ISO 6942 or ISO 9151, the heat source in this test method is approximately 50 % radiant heat and 50 % convective heat. This equalized radiant/convective output is set to a thermal energy exposure having a heat flux of 84 kW/m$^2$. The magnitude 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 exist in actual fire situations. The level of this heat flux represents a moderately high industrial or emergency fire-fighting exposure that requires the use of a protective material.

This document can be used to measure and describe the properties of materials, products or assemblies in response to both convective and radiant heat under controlled laboratory conditions. It is not recommended to use this document to describe or appraise a fire hazard or fire risk of materials, products or assemblies under actual fire conditions. However, the results of this test method can be used as elements of a fire-risk assessment that takes into account all of the factors pertinent to an assessment of the fire hazard of a particular end use.

NOTE 1 This test method does not necessarily correlate to the heat-insulation performance of vertically oriented flame-resistant textile materials when exposed to convective and radiant heat or used in actual clothing configurations.

NOTE 2 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 TPI and the HTI measure the accumulated thermal energy received by a sensor, which is an indication of the ability of the material to inhibit the transfer of heat.

NOTE 3 A human tissue burn (blister) is predicted to result when the total thermal energy transmitted by the material reaches the second-degree burn threshold identified by the Stoll curve.

NOTE 4 The TPI or the HTI for flame-resistant materials can be used to establish anticipated thermal performance levels for single layer or multilayer constructions or assemblies.

NOTE 5 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 characteristic of the sample and represents the way in which the material is used in the end-use application.

NOTE 6 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 an actual fire exposure. This mounting condition gives a measure of the insulation performance and thermal capacity of the specimen and air gap as a combination.

NOTE 7 The contact configuration, with the sensor in contact with the specimen, gives a measure of the insulation performance and thermal capacity of the specimen and reflects applications in which the textile is in contact with the protected surface.

 