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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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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
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Foreword

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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.