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Protective clothing against heat and flame —

Part 2: Skin burn injury prediction — Calculation requirements and test cases

Habillement de protection contre la chaleur et les flammes —

Partie 2: Prédiction de blessure par brûlure de la peau — Exigences de calculs et cas d'essai

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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 document 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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This document was prepared by Technical Committee ISO/TC 94, *Personal safety — Personal protective equipment*, Subcommittee SC 13, *Protective clothing*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 162, *Protective clothing including hand and arm protection and lifejackets,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition of ISO 13506-2, cancels and replaces the first edition (ISO 13506-2:2017), which has been technically revised.

A list of all parts in the ISO 13506 series can be found on the ISO website.

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.

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Introduction

The purpose of heat and flame-resistant protective clothing is to shield the wearer from hazards that can cause skin burn injury. The clothing can be made from one or more materials, which can be made into a garment or protective clothing ensemble for testing on a manikin fire exposure system.

This document is a companion document to ISO 13506-1. The data gathered by tests according to ISO 13506-1 are used as input for this calculation.

In ISO 13506-1, a stationary, upright, adult-sized manikin (male or female) is dressed in a garment or protective clothing ensemble and exposed to a laboratory simulation of a fire with controlled heat flux, duration and flame distribution. The average incident heat flux to the exterior of the garment is 84 kW/m^2. Thermal energy sensors are fitted to the surface of the manikin. The output from the sensors is used to calculate the heat flux variation with time and location on the manikin and to determine the total energy absorbed over the data-gathering period. The data-gathering period is selected to ensure that the total energy transferred will no longer be rising. The information obtained from the calculation of skin burn injury prediction (see Annex B) can be used to assist in evaluating the performance of the garment or protective clothing ensemble under the test conditions. It can also be used as a model-based tool to estimate the extent and nature of potential skin damage resulting from the exposure of the test garment.

Fit of the garment or protective clothing ensemble on the manikin is important. Thus, variations in garment or protective clothing ensemble design and how the manikin is dressed by the operator may influence the test results and skin burn injury prediction. Experience suggests that testing a garment one size larger than the standard can reduce the percentage of predicted body burn by up to 5 %.

ISO 13506-1 uses the calculated skin injury information in the calculation of the thermal manikin performance factor.

The method described in this document as an optional part in the fire fighter standards ISO 11999-3 and EN 469 and as an optional part in the industrial heat and flame protective clothing standard ISO 11612.

The National Fire Protection Association standard NFPA 2112[5] specifies ASTM F1930-18[6], which is a test method similar to the one described in ISO 13506-1 and which contains skin burn injury prediction calculations similar to the one described in this document.

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Protective clothing against heat and flame —

Part 2:
Skin burn injury prediction — Calculation requirements and test cases

1 Scope

This document provides technical details for calculating predicted burn injury to human skin when its surface is subject to a varying heat flux, such as may occur due to energy transmitted through and by a garment or protective clothing ensemble exposed to flames. A series of test cases are provided against which the burn injury prediction calculation method is verified. It also contains requirements for the in situ calibration of the thermal energy sensor — skin injury prediction system for the range of heat fluxes that occur under garments.

The skin burn injury calculation methods as presented in this test method do not include terms for handling short wavelength radiation that may penetrate the skin. The latter include arc flashes, some types of fire exposures with liquid or solid fuels, and nuclear sources.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 11610, *Protective clothing — Vocabulary*

ISO 13506-1, *Protective clothing against heat and flame — Part 1: Test method for complete garments — Measurement of transferred energy using an instrumented manikin*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 13506-1 and ISO 11610 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

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