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Protective clothing for firefighters — Laboratory test methods and performance requirements for wildland firefighting clothing

Habillement de protection pour sapeurs-pompiers — Méthodes d'essai en laboratoire et exigences de performance pour vêtements portés pendant la lutte contre les feux d'espaces naturels

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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.

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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on 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 the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 94, *Personal safety — Protective clothing and equipment*, Subcommittee SC 14, *Fire-fighters' personal equipment*.

This second edition cancels and replaces the first edition of ISO 15384:2003 which has been technically revised.

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Introduction

The purpose of this document is to provide minimum performance requirements for protective clothing designed for use for extended periods during wildland firefighting activities. The minimum performance requirements and methods of test for personal protective equipment (PPE) covering the head, hands, feet, eyes and ears for wildland firefighting are covered in ISO 16073.

Wildland firefighting involves work primarily in summer temperatures, for many hours in which the firefighter can develop high levels of metabolic heat. Loose-fitting clothing is as important as the fire resistance of materials in preventing serious burn injury. Clothing that is tight-fitting poses a danger to the wildland firefighter from radiant heat and heat stress, while, at the same time, diminishing the firefighter's ability to perform. Consequently, the protective clothing needs to be light, flexible and commensurate with the risks to which the firefighter can be exposed in order to be effective without introducing heat stress to the wearer.

Accordingly, a risk assessment (ISO/TR 21808) needs to be undertaken to determine if the clothing covered by this document is suitable for its intended use and the expected exposure. This document does not cover clothing for use in higher risk situations, where clothing complying with ISO 11999-3 or EN 469 (structural firefighting) or even ISO 15538 or EN 1486 (firefighting with reflective outer surface), is more suitable, nor does this document cover clothing to protect against chemical, biological, electrical or radiation hazards. This document does not cover risk related to rescue operations that are covered in ISO 18639 or EN 16689.

The risk assessment needs to include what additional personal protective equipment is necessary for the head, hand and feet. In some situations, respiratory protection may also be required.

Firefighters need to be trained in the use, care and maintenance of the protective clothing covered by this document, including an understanding of its limitation.

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Protective clothing for firefighters — Laboratory test methods and performance requirements for wildland firefighting clothing

1 Scope

This document specifies methods of test and minimum performance requirements for personal protective clothing, designed to protect the wearer's body, except for the head, hands, and feet, that is worn during wildland firefighting and associated activities. This clothing is not intended to provide protection during fire entrapment. This document covers the general design of the garment, the minimum level of performance for the materials employed and the methods of test to determine these levels.

This document is not applicable to clothing for use in situations encountered in structural firefighting (EN 469 or ISO 11999-3), rescue (ISO 18639) or where a high level of infrared radiation is expected (ISO 15538 or EN 1486), nor does this document cover clothing to protect against chemical, biological, electrical or radiation hazards. This document does not provide protection against high mechanical risks such as for protection when using chain saws.

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

ISO 3146, *Plastics — Determination of melting behaviour (melting temperature or melting range) of semi-crystalline polymers by capillary tube and polarizing-microscope methods*

ISO 4674-1, *Rubber- or plastics-coated fabrics — Determination of tear resistance — Part 1: Constant rate of tear methods*

ISO 5077, *Textiles — Determination of dimensional change in washing and drying*

ISO 6942:2002, *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 11092, *Textiles — Physiological effects — Measurement of thermal and water-vapour resistance under steady-state conditions (sweating guarded-hotplate test)*

ISO 12947-2, *Textiles — Determination of the abrasion resistance of fabrics by the Martindale method — Part 2: Determination of specimen breakdown*

ISO 13688, *Protective clothing — General requirements*

ISO 13934-1, *Textiles — Tensile properties of fabrics — Part 1: Determination of maximum force and elongation at maximum force using the strip method*

ISO 13935-2, *Textiles — Seam tensile properties of fabrics and made-up textile articles — Part 2: Determination of maximum force to seam rupture using the grab method*

ISO 13937-2, *Textiles — Tear properties of fabrics — Part 2: Determination of tear force of trouser-shaped test specimens (Single tear method)*

ISO 15025:2016, *Protective clothing — Protection against flame — Method of test for limited flame spread*

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ISO 17493, *Clothing and equipment for protection against heat — Test method for convective heat resistance using a hot air circulating oven*

ISO 20471:2013, *High visibility clothing — Test methods and requirements*

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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 http://www.electropedia.org/

3.1
ageing
changing of the product performance over time during use or storage

Note 1 to entry: Ageing is caused by a combination of several factors, such as:

— cleaning, maintenance, or disinfecting processes;

— exposure to visible and/or ultraviolet radiation;

— exposure to high or low temperatures or to changing temperatures;

— exposure to chemicals including humidity;

— exposure to biological agents such as bacteria, fungi, insects, or other pests;

— exposure to mechanical action such as abrasion, flexing, pressure, and strain;

— exposure to contaminants such as dirt, oil, splashes of molten metal, etc.;

— exposure to wear and tear.

3.2
cleaning
process by which a Personal Protective Equipment, (PPE), is made again serviceable and/or hygienically wearable by removing any dirt or contamination

3.3
cleaning cycle
washing and a drying cycle or dry-cleaning cycle

Note 1 to entry: A cleaning cycle is typically a washing and drying cycle or a dry-cleaning cycle followed, if required, by ironing or other finishing.

3.4
closure system
method of fastening/unfastening the openings in the garment, including combinations of more than one method of achieving a secure closure

Note 1 to entry: This term does not cover seams.

3.5
component assembly
combination of all materials and hardware of a multi-layer garment presented exactly as the finished garment construction

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3.6
conditioning
keeping the samples under standard conditions of temperature and relative humidity for a minimum period of time

3.7
hardware
non-fabric items used in protective clothing including those made of metal or plastic

3.8
main seam
seam which is essential to the integrity of the garment

3.9
material combination
material produced from a series of separate layers, combined prior to the garment manufacturing stage

EXAMPLE A quilted fabric.

3.10
outer material
outermost material of which the protective clothing is made

3.11
pre-treatment
standard way of preparing the samples before testing

Note 1 to entry: This can include subjecting the sample to a specific number of cleaning cycles; to heat, mechanical action or other relevant exposure followed by conditioning of the sample.

3.12
personal protective equipment
PPE
device or appliance designed to be worn or held by an individual for protection against one or more health and safety hazards

3.13
personal protective clothing
PPC
garment designed and configured to provide protection to the torso, neck, arms, and legs, excluding the head, hands, and feet

3.14
protective coverall
one-piece garment designed and configured to provide protection to the torso, neck, arms and legs, excluding the head, hands and feet

3.15
protective garment
clothing which consists of either single or multi-layers

3.16
protective suit
two-piece garment consisting of an upper and lower garment worn together, designed and configured to provide protection to the torso, neck, arms and legs

EXAMPLE Protective coat, protective trouser, or protective coverall.

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3.17
rank markings
means of identifying the firefighter

EXAMPLE Badges, patches or embroideries.

3.18
seam
permanent junction between two or more pieces of textile material created by sewing, welding, or other methods

3.19
wildland firefighting
suppression action involving a fire in vegetative fuels such as forest, crops, plantations, grass or farmland

Note 1 to entry: Suppression actions can include back-burning involving a fire in vegetative fuels such as forest, crops, plantations, grass or farmland.

4 Clothing design

4.1 General

Personal protective garments for firefighters capable of satisfying the levels of performance specified in this document shall protect the wearer's body, except the head, hands, and feet. It may be comprised of

— a coverall,

— a protective suit provided with an interface overlap area, or

— a number of inner and/or outer garments designed to be worn together.

General requirements which are not specifically covered in this document shall be in accordance with ISO 13688.

Personal protective garments shall not restrict the wearer in any of the movements expected to be made during wildland firefighting, for example bending, reaching, twisting, and crouching.

Closure systems, label accessories, touch and close fasteners, retro-reflective and/or fluorescent materials etc. attached to the personal protective clothing shall be designed to not adversely affect the clothing's performance.

All closure systems shall be designed to prevent the entry of burning debris.

Conformity shall be assessed by visual inspection and practical testing, such as to check sizing and correct fit by donning and doffing of the garment.

NOTE For more information, see ISO/TS 11999-2.

4.2 Collar

All protective clothing shall have a collar that encircles and protects the neck and have a closure system to keep the collar closed up the outer edge.

Conformity shall be assessed by visual inspection.

4.3 Protective coverall or protective suit

The protective coverall or protective suit shall not have turn-ups or cuffs.

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