INTERNATIONAL STANDARD

ISO 18639-3

First edition
2018-01

PPE ensembles for firefighters undertaking specific rescue activities —

Part 3: **Clothing**

Équipements de protection personnelle pour pompiers entreprenant des activités de sauvetage particulières —

Partie 3: Vêtements

Reference number
ISO 18639-3:2018(E)

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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.

ISO 18639-3 was prepared by Technical Committee ISO/TC 94, *Personal Safety — Protective Clothing and equipment*, Subcommittee SC 14, *Firefighters Personal Equipment*.

A list of all the parts in the ISO 18639 series can be found on the ISO website.

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Introduction

ISO 18639 is a standard for personal protective equipment (PPE) for firefighters when engaged in specific rescue activities. It is not possible to provide a standard for PPE to cover all of the diverse range of rescue scenarios that firefighters are likely to encounter so it is important that risk assessments be undertaken to determine if the PPE covered by ISO 18639 is suitable for its intended use and the expected exposure to hazards. For complete protection against exposures, the risk assessment should include protection of the whole body including the torso, arms and legs, head, face, hands and feet.

For certain rescue activities, safety ropes and harnesses can be required. For certain rescue situations, special PPE for use in and on water may be required. In some cases, appropriate respiratory protection may also be identified as being necessary.

The performance requirements in this document take account of accidental exposure to heat and flame, but do not cover PPE for Firefighting. While this standard takes account of accidental exposure to some common chemicals, it is not intended that PPE to this standard should be considered as providing chemical protection as a primary function. It does not cover PPE to protect against biological, electrical or radiation hazards. The risk assessment should determine whether PPE complying to this standard or to the requirements of any other relevant standard is more suitable.

Firefighters should be trained in the use, care and maintenance of the PPE covered by this document, including an understanding of its limitations.

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PPE ensembles for firefighters undertaking specific rescue activities —

Part 3: Clothing

1 Scope

This document specifies test methods and minimum performance requirements for protective clothing for firefighters while engaged in rescue activities.

Clothing related to specific rescue activities are documented in individual subclauses, see 6.2.1 or 6.2.2.

NOTE For further guidance see ISO 18639-1.

Subclauses of this document cover general clothing design, the minimum performance level of the materials used and the methods of test for determining this performance level.

This document does not cover special clothing for use in other high risk situations such as firefighting.

It does not cover protection for the head, hands and feet or protection against other hazards, e.g. chemical, biological, radiation and electrical hazards, except for limited, accidental exposure to some chemicals and contaminated blood or other body fluids.

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 1421, *Rubber- or plastics-coated fabrics — Determination of tensile strength and elongation at break*

ISO 3175-1, *Textiles – Professional care, dry cleaning and wet cleaning of fabrics and garments – Part 1: Assessment of performance after cleaning and finishing*

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

ISO 4920, *Textile fabrics — Determination of resistance to surface wetting (spray test)*

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

ISO 6330, *Textiles — Domestic washing and drying procedures for textile 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 11092, *Textiles — Physiological effects — Measurement of thermal and water-vapour resistance under steady-state conditions (sweating guarded-hotplate test)*

ISO/TS 11999-2, *PPE for firefighters — Test methods and requirements for PPE used by firefighters who are at risk of exposure to high levels of heat and/or flame while fighting fires occurring in structures — Part 2: Compatibility*

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ISO 12127-1, *Clothing for protection against heat and flame — Determination of contact heat transmission through protective clothing or constituent materials — Part 1: Contact heat produced by heating cylinder*

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 14116, *Protective clothing — Protection against flame — Limited flame spread materials, material assemblies and clothing*

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

ISO 16604, *Clothing for protection against contact with blood and body fluids — Determination of resistance of protective clothing materials to penetration by blood-borne pathogens — Test method using Phi-X 174 bacteriophage*

ISO 18639-1, *PPE for firefighters undertaking specific rescue activities*

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

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

EN 1149-5, *Protective clothing — Electrostatic properties. Material performance and design 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
anti-wicking barrier
material used to prevent the transfer of liquid from outside the garment to inside the garment, usually in addition to or replacing part of the moisture barrier at the edge(s)

3.2
clothing assembly
levels of performance specified in this document achieved by the use of a garment or a clothing assembly, which may contain multilayer materials, material combinations in single layers, or a series of separate garments

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3.3
cleaning
process by which a PPE is made again serviceable and/or hygienically wearable by removing any dirt or contamination

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

3.4
closure system
method of fastening 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 of a multi-layer garment presented exactly as the finished garment construction

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

3.7
drain mesh material
permeable material designed to allow drainage of water between the moisture barrier and innermost lining

3.8
garment
single item of clothing which may consist of single or multiple layers

3.9
hardware
non-fabric items used in protective clothing including those made of metal or plastic, e.g. touch and close fasteners, buttons, zippers, embroideries, braces

3.10
high visibility trim
material exhibiting separate performance or combined performance of retroreflective and fluorescent properties

Note 1 to entry: Retroreflective materials enhance night time visibility and fluorescent materials improve daytime visibility.

3.11
interface area
area where two separate and adjacent items of PPE interface function together to provide continuity of protection and performance

3.12
innermost lining
lining on the innermost face of a component assembly which is intended to be nearest to the wearer's skin

Note 1 to entry: Where the innermost lining forms part of a material combination, the material combination is regarded as the innermost lining.

3.13
interlining
layer between the outermost layer and the innermost lining in a multilayer garment

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3.14
material
substances excluding hardware and labels, of which an item of clothing is made

3.15
material assembly
combination of all materials of a multi-layer garment presented exactly as the finished garment construction

3.16
material combination
material produced from a series of separate layers, fixed together during the garment manufacturing stage

3.17
moisture barrier
fabric or membrane used in a component assembly to achieve the properties of hydrostatic resistance with water vapour permeability

Note 1 to entry: Moisture barriers may not prevent the passage of some chemical (except incidentally), biological, or radiological agents. Appropriate PPE should be provided to protect the wearer in such instances.

3.18
multilayer material
material consisting of different layers intimately combined prior to the garment manufacturing stage, e.g. by weaving, quilting, coating or gluing

3.19
outer garment
outermost garment of the clothing that will be exposed to the hazard(s)

3.20
outer material
outermost material (i.e., outer shell) of which the clothing assembly is made, with the exception of trim, hardware, reinforcing materials and wristlet material

3.21
overlapping seam
any seam where all or parts of one or more layers of material cover any other layer or layers

3.22
pre-treatment
standard way of preparing the samples before testing

Note 1 to entry: This may include e.g. a number of cleaning cycles, submitting the sample to heat, mechanical action or any other relevant exposure and is finished by conditioning.

3.23
rank markings
symbol or colour coding system denoting the rank or position within the hierarchy of an organisation or group

EXAMPLE Embroideries, badges, patches, transfers.

3.24
seam
permanent fastening between two or more pieces of material

3.25
structural seam
seam which holds the outer garment together and which if broken would expose the under garments and reduce protection

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3.26
torso
trunk of the human body, i.e. without arms, legs and head

4 Design requirements

4.1 General

The PPE shall provide protection to the wearer against general hazards encountered in rescue activities as well as protection against hazards specific to the individual specific rescue activities covered within sub sections of this document.

Where more than one garment is needed to meet the requirements of this document, each garment shall be labelled to ensure that the correct combination is used.

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

NOTE Consideration is given to the design and material make up of this rescue PPE, to maximize thermal metabolic stability of the rescuer. This is especially critical for International Search & Rescue Advisory Group (INSARAG) member nations whose rescuers can be deployed out of or into sub-zero conditions or extremely hot and high humidity areas and be involved in prolonged rescue incidents.

4.2 Size designation

Size designations shall be in accordance with ISO 13688.

4.3 Type of clothing

The levels of performance specified in this document may be achieved by the use of a garment or a clothing assembly, which may contain multilayer materials, material combinations in single layers, or a series of separate garments.

4.4 Outer two piece suit

Where protection to the requirements of this document is provided by an outer two piece suit, it shall be determined that an overlap between the jacket and trousers shall always be maintained as specified in ISO/TS 11999-2.

4.5 External Pockets

All external pockets and protective flaps shall be made from the same or equivalent material performance as the outer material of the garment. The pockets, except radio pockets shall have a closure system that shall completely cover and overlap the pocket opening.

All pockets shall be able of fastening the pocket closed. The flap shall be at least 20 mm wider than the opening (approximately 10 mm on each side) to prevent the flap from being tucked into the pocket.

Conformity shall be checked by visual inspection and physical measurement.

4.6 Padding

Where the outer garment contains padding, this shall be either permanently fixed to the garment or retained securely inside the garment, either in internally or externally accessible pockets. If externally accessible pockets, the opening shall be at the bottom and completely secured e.g. by touch and close fastener. Padding may be provided to protect the knee, elbow and shoulder areas. Where padding is provided it shall not detract from the performance requirements of the garment.

Conformity shall be checked by visual inspection.

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